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ENSAFE

FINAL REMEDIAL INVESTIGATION REPORT
SITE 38
NAVAL AIR STATION
PENSACOLA, FLORIDA

VOLUME I
(SECTIONS 1-14)

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Section 10	All	All
Appendix N	None	Fugitive Dust Inhalation Sample Problem

Report Documentation Page

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19. Abstract

A remedial investigation was conducted at Site 38 as part of the Installation Restoration Program. The areas surrounding former Building 71 and Building 604 as well as the segment of the Industrial Wastewater Treatment Plant (IWTP) sewer line between Buildings 71 and 604 were included in the investigation. Past activities at Building 71 included aircraft painting, paint stripping, and metal refinishing between 1935 and the late 1970s. From 1980 to 1989, Building 71 was used to store hazardous waste. Building 604 housed a primary metal plating shop for Naval Aviation Depot (NADEP) from approximately 1960 to the spring of 1996. Historically, paint, solvent, and metal plating waste were discharged from these areas to Pensacola Bay via the storm drainage system. In 1973, these waste streams were diverted to the newly constructed IWTP via the IWTP sewer line.

Soil and groundwater samples were collected from soil borings and monitoring wells installed onsite to evaluate site conditions, determine the nature and extent of contamination, and assess any potential human health and/or ecological risks. The field effort consisted of a multi-phased approach from February 1993 to October 1995 including personnel from E/A&H, U.S. Environmental Protection Agency (USEPA), and the U.S. Navy. As a result of the investigation, the site was divided into two primary study areas, the Building 71 study area and the Building 604 study area.

Contaminants detected above PRGs in surface soil in the Building 71 and 604 study areas included heavy metals, semivolatiles, pesticides, and PCBs. No VOCs were detected above PRGs in surface soil. Subsurface soil contaminants exceeding the leachability-based PRGs included heavy metals, semivolatiles, pesticides, PCBs, and VOCs. The primary areas of soil contamination appeared to be centered beneath Building 71, surrounding the former plating shop at Building 604, and in a few isolated areas along the IWTP line.

Groundwater contaminants detected above PRGs included inorganics, semivolatiles, and VOCs in both study areas. PRG exceedances in the shallow groundwater were consistent with soil exceedances at Building 71. Much of the contamination again appeared to be beneath and downgradient of former Building 71. The VOC and inorganic exceedances in this area were consistent with past painting and paint stripping operations. Only inorganic contaminants exceeded a PRG in intermediate groundwater at Building 71. Heavy metals, including cadmium and chromium, were detected in shallow groundwater above their PRGs surrounding the former plating shop at Building 604 and are likely the result of past plating operations. The area most highly impacted was in the vicinity of the former solvent UST, immediately east of the former plating shop. Naphthalene and several chlorinated solvents, including tetrachloroethene, TCE, and vinyl chloride, exceeded the respective PRGs in this area and in downgradient wells. Two other areas where VOC exceedances occurred were adjacent to Building 636, a former dry cleaners, and along the storm drain north of Building 38. Aluminum and vinyl chloride were the only contaminants detected above PRGs in intermediate groundwater at Building 604.

Potential receptors of contaminants detected at Site 38 include the main producing zone of the Sand-and-Gravel Aquifer and Pensacola Bay. Water from the main producing zone beneath NAS Pensacola is not considered potable because of its naturally occurring high aluminum and iron content, but is used as a supplementary water source for the base. The main producing zone is separated from the surficial zone by a low-permeability clay layer. The potential for migration through this zone is considered to be extremely low. Groundwater from the main producing zone was not sampled as part of the RI. The proximity of Site 38 to Pensacola Bay, coupled with the short travel times calculated for migration of site contaminants, indicates that some impact to the bay may have occurred. This area of the bay is being investigated as part of the Site 2 RI.

The primary ecological risk includes the marine/estuarine receptors in Pensacola Bay due to groundwater to surface water migration from Site 38. Data from the Site 2 RI indicate significant metal contaminants present in bay sediments adjacent to Site 38.

Human health risk was determined using USEPA's acceptable risk range of 1E-6 to 1E-4, and FDEP's risk goal of 1E-6. For the hypothetical exposure pathways included in this report, the site resident and site worker soil risk estimates for Building 71 and Building 604 exceed FDEP's threshold, assuming the soil exposure pathways will be completed. The primary contributor to soil risk is arsenic, while secondary contributors depend upon the sample location. Consequently, chemicals of concern have been identified for the site residents and workers. The cumulative Building 604 trespasser risk estimate exceeded FDEP's threshold, while the cumulative risk estimate for the trespasser at Building 71 was below FDEP's threshold.

At Buildings 71 and 604, soil hazard estimates are less than the USEPA and FDEP threshold of 1.0 for site residents, site workers, and site trespassers. Therefore, chemicals of concern have not been identified for soil based on the hazard index. Soil exposure in general is unlikely because most areas are paved at this site.

The 95th percentile upper confidence limit mean, arithmetic mean, and geometric mean of the arsenic concentrations reported in groundwater did not exceed the MCL or FPDWS. In addition, the Navy will restrict land use at Site 38 to industrial use only and will prevent groundwater use in accordance with the Land Use Restriction Agreement signed August 31, 1998 between the Navy, FDEP, and USEPA. However, this assessment includes exposure pathways and land use scenarios which were developed since 1992 for completeness.

Exposure to groundwater as a drinking water source would be unlikely at this site. Drinking water is supplied by Corry Station, and the water-bearing zone beneath NAS Pensacola would not be expected to be used as a primary drinking water source. Assuming groundwater exposure pathways would be completed, risk estimates for both areas would exceed USEPA and FDEP risk and hazard thresholds. In groundwater near Building 71, arsenic is the primary contributor to risk and hazard estimates, while VOCs and arsenic primarily account for risk and hazard estimates in the area of Building 604.

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Acronyms and Abbreviations

μg/kg	micrograms per kilogram
μg/L	micrograms per liter
μR/hr	micro-REMS (Roentgen equivalent man) per hour
μS/cm	microsiemens per centimeter
%D	percent difference
%RSD	percent relative standard deviation
1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethylene
1,1,1-TCA	1,1,1-Trichloroethane
1,1,2-TCA	1,1,2-Trichloroethane
c-1,2-DCE	cis-1,2-Dichloroethene
t-1,2-DCE	trans-1,2-Dichloroethene
ABF	Absorption Factor
BAP	Benzo(a)pyrene
BEHP	bis(2-ethylhexyl)phthalate
BEQ	Benzo(a)pyrene equivalent
bls	below land surface
BNA	Base-neutral/acid extractable organic compounds
BOD	Biological oxygen demand (five-day)
BRA	Baseline Risk Assessment
BRAC	Base Closure and Realignment
BTEX	Benzene, toluene, ethylbenzene, and xylene
CCl_4	Carbon tetrachloride
CDI	Chronic daily intake
CEC	Cation exchange capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CG	Cleanup Goals
CH_2Cl_2	Methylene chloride
$CHCl_3$	Chloroform
CHIL	Consolidated Hazardous Item List
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
cm/sec	centimeters per second
CNS	Central nervous system
COC	Chemical of Concern
COD	Chemical oxygen demand
COPC	Chemical of Potential Concern
cPAH	Carcinogenic polyaromatic hydrocarbon
CPSS	Chemical Present in site samples
CRQL	Contract Required Quantitation Limit
CSAP	Comprehensive Sampling and Analysis Plan
CSS	Contaminant Source Survey

CT	Central tendency
DCB	Decachlorobiphenyl
DI	De-ionized
DQO	Data Quality Objective
E/A&H	EnSafe/Allen & Hoshall
E&E	Ecology & Environment, Inc.
ECAO	Environmental Criteria and Assessment Office
ECD	Electron Capture Detector
EPC	Exposure Point Concentration
ESAT	Environmental Services Assistance Team
ESD	Environmental Services Division (USEPA)
FASP	Field Analytical Services Program
FDEP	Florida Department of Environmental Protection
FDER	Florida Department of Environmental Regulation
FID	Flame ionization detector
FPDWS	Florida Primary Drinking Water Standards
FS	Feasibility Study
FSA	Full Scan Analysis
FSA/NP	Full Scan Analysis/No Pesticides-PCBs
FSDWS	Florida Secondary Drinking Water Standards
ft/day	feet per day
ft^2/day	feet square per day
GC	Gas Chromatography
GPC	Gel Permeation Chromatography
gpd	gallons per day
gpm	gallons per minute
gpm/ft	gallons per minute per foot
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
HSA	Hollow-stem auger
HWS	Hazardous Waste Section
ICP	Inductively coupled plasma
ICS	Interference Check Sample
ID	Inside diameter
IDL	Instrument Detection Limit
IRP	Installation Restoration Program
IRIS	Integrated Risk Invormation System
ITAS	International Technology Analytical Services
IWTP	Industrial Wastewater Treatment Plant
K_d	Normalized partition coefficient
K_{oc}	Organic carbon/water partitioning coefficient
L/kg	liters per kilogram

LCS	Laboratory Control Sample
LOAEL	Lowest-oberved-adverse-effects level
LWA	Lifetime weighted average
MCL	Maximum Contaminant Level
meq/100g	milliequivalents per 100 grams
mg/day	milligrams per day
mg/kg	milligram per kilogram
mg/L	milligram per liter
MLP	Mobile Laboratory Parameters
MS/MSD	Matrix spike/matrix spike duplicate
msl	mean sea level
MWR	Morale, Welfare, and Recreation
NADEP	Naval Aviation Depot
NAS	Naval Air Station
NCEA	National Center for Environmental Assessment
NEESA	Naval Energy and Environmental Support Activity
NET	National Environmental Testing
NOAEL	No-observed-adverse-effects level
No/g	colonies per gram
NTU	Nephelometric turbidity units
NWFWMD	Northwest Florida Water Management District
OD	Outside diameter
OSWER	Office of Solid Waste and Emergency Response
PAH	Polyaromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
PID	Photoionization detector
PPE	Personal protective equipment
ppb	parts per billion
ppm	parts per million
PRG	Preliminary Remedial Goal
PVC	Polyvinyl chloride
PWC	Public Works Center
QA/QC	Quality Assurance/Quality Control
RAGS	Risk Assessment Guidance for Superfund
RBC	Risk-Based Concentration
RC	Reference Concentration
RCRA	Resource Conservation and Recovery Act
RGO	Remedial Goal Option
R_f	Retardation factor
RfD	Reference Dose
RfDo	Oral Reference Dose
RI	Remedial Investigation
RME	Reasonable maximum exposure

ROD	Record of Decision
RPD	Relative Percent Difference
RRF	Relative response factor
SAP	Sampling and Analysis Plan
SDG	Sample delivery group
SF	Slope Factor
SMCL	Secondary maximum contaminant level
SOP/QAM	Standard Operating Procedure/Quality Assurance Manual
SOP	Standard Operating Procedure
SOW	Statement of Work
SQL	Sample Quantitation Limit
SSL	Soil Screening Level
SVOC	Semivolatile organic compounds
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TCX	tetrachloro-xylene
TEF	Toxicity equivalence factor
TIC	Tentatively Identified Compound
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TRPH	Total Recoverable Petroleum Hydrocarbons
TSCA	Toxic Substances Control Act
TSS	Total Suspended Solids
UCL	Upper Confidence Limit
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	Underground storage tank
VTSR	Verified Time of Sample Receipt
VOA	Volatile organic analysis
VOC	Volatile organic compound

EXECUTIVE SUMMARY

A remedial investigation (RI) was conducted at Site 38 as part of the Installation Restoration Program at Naval Air Station (NAS) Pensacola. The areas surrounding former Building 71 and Building 604 as well as the segment of the Industrial Wastewater Treatment Plant (IWTP) sewer line between Buildings 71 and 604 were included in the investigation. Past activities at Building 71 included aircraft painting, paint stripping and metal refinishing between 1935 and the late 1970s. From 1980 to 1989, Building 71 was used to store hazardous waste. Building 604 housed a primary metal plating shop for the Naval Aviation Depot (NADEP) from approximately 1960 to the spring of 1996. Historically, paint, solvent, and metal plating waste were discharged from these buildings to Pensacola Bay via the storm drainage system. In 1973, these waste streams were diverted to the newly constructed IWTP via the IWTP sewer line.

Soil and groundwater samples were collected from soil borings and monitoring wells installed onsite to evaluate site conditions, determine the nature and extent of contamination, and assess any potential human health and/or ecological risks. The field effort consisted of a multiphased approach from February 1993 to October 1995 including personnel from EnSafe Inc. (formerly EnSafe/Allen & Hoshall [E/A&H]), U.S. Environmental Protection Agency (USEPA), and the U.S. Navy. As a result of the investigation, the site was divided into two primary study areas, the Building 71 study area and the Building 604 study area.

Contaminants detected above Preliminary Remedial Goals (PRGs) in surface soil in the Building 71 and 604 study areas included heavy metals, semivolatiles, pesticides, and polychlorinated biphenyls (PCBs). No volatile organic compounds (VOCs) were detected above PRGs in surface soil. Subsurface soil contaminants exceeding the leachability-based PRGs included heavy metals, semivolatiles, pesticides, PCBs, and VOCs. The primary areas of soil contamination appeared to be centered beneath Building 71, surrounding the former plating shop at Building 604, and in a few isolated areas along the IWTP line.

Groundwater contaminants detected above PRGs included inorganics, semivolatiles, and VOCs in both study areas. PRG exceedances in the shallow groundwater were consistent with soil exceedances at Building 71. Much of the contamination again appeared to be beneath and downgradient of former Building 71. The VOC and inorganic exceedances in this area were consistent with past painting and paint stripping operations. Only inorganic contaminants exceeded a PRG in intermediate groundwater at Building 71. Heavy metals, including cadmium and chromium, were detected in shallow groundwater above their PRGs surrounding the former plating shop at Building 604 and are likely the result of past plating operations. The area most impacted was in the vicinity of the former solvent underground storage tank (UST), immediately east of the former plating shop. Naphthalene and several chlorinated solvents, including tetrachloroethene, trichloroethene, and vinyl chloride, exceeded the respective PRGs in this area and in downgradient wells. Two other areas where VOC exceedances occurred were adjacent to Building 636, a former dry cleaners, and along the storm drain north of Building 38. Aluminum and vinyl chloride were the only contaminants detected above PRGs in intermediate groundwater at Building 604.

Potential receptors of contaminants detected at Site 38 include the main producing zone of the Sand-and-Gravel Aquifer and Pensacola Bay. Water from the main producing zone beneath NAS Pensacola is not considered potable because of its naturally occurring high aluminum and iron content, but is used as a supplementary water source for the base. The main producing zone is separated from the surficial zone by a low-permeability clay layer. The potential for migration through this zone is considered to be extremely low. Groundwater from the main producing zone was not sampled as part of the RI. The proximity of Site 38 to Pensacola Bay, coupled with the short travel times calculated for migration of site contaminants, indicates that some impact to the bay may have occurred. This area of the bay is being investigated as part of the Site 2 RI.

The primary ecological risk includes the marine/estuarine receptors in Pensacola Bay due to groundwater to surface water migration from Site 38. Data from the Site 2 RI indicate significant metal contaminants present in bay sediments adjacent to Site 38.

Human health risk was determined using USEPA's acceptable risk range of 1E-6 to 1E-4, and FDEP's risk goal of 1E-6. For the hypothetical exposure pathways included in this report, the site resident and site worker soil risk estimates for Building 71 and Building 604 exceed FDEP's threshold, assuming the soil exposure pathways will be completed. The primary contributor to soil risk is arsenic, while secondary contributors depend upon the sample location. Consequently, chemicals of concern have been identified for the site residents and workers. The cumulative Building 604 trespasser risk estimate exceeded FDEP's threshold, while the cumulative risk estimate for the trespasser at Building 71 was below FDEP's threshold.

At Buildings 71 and 604, soil hazard estimates are less than the USEPA and FDEP threshold of 1.0 for site residents, site workers, and site trespassers. Therefore, chemicals of concern have not been identified for soil based on the hazard index. Soil exposure in general is unlikely because most areas are paved at this site.

The 95th percentile upper confidence limit mean, arithmetic mean, and geometric mean of the arsenic concentrations reported in groundwater did not exceed the MCL or FPDWS. In addition, the Navy will restrict land use at Site 38 to industrial use only and will prevent groundwater use in accordance with the Land Use Restriction Agreement signed August 31, 1998 between the Navy, FDEP, and USEPA. However, this assessment includes exposure pathways and land use scenarios which were developed since 1992 for completeness.

Exposure to groundwater as a drinking water source would be unlikely at this site. Drinking water is supplied by Corry Station, and the water-bearing zone beneath NAS Pensacola would not be expected to be used as a primary drinking water source. Assuming groundwater exposure pathways would be completed, risk estimates for both areas would exceed USEPA and FDEP risk and hazard thresholds. In groundwater near Building 71, arsenic is the primary contributor to risk and hazard estimates, while VOCs and arsenic primarily account for risk and hazard estimates in the area of Building 604.

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1.0 INTRODUCTION

As part of the U.S. Navy Comprehensive Long-term Environmental Action Navy (CLEAN) program, a Remedial Investigation (RI) was conducted at Site 38 at Naval Air Station (NAS) Pensacola, Florida. Site 38 includes the location of former Building 71 and surrounding area, Building 60, the former plating facility and surrounding area, and the associated industrial wastewater treatment plant (IWTP) sewer line (TL 073/C southwest to the end). This investigation was conducted by EnSafe/Allen & Hoshall (E/A&H) to meet the requirements of the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) program, which administers investigation and cleanup of hazardous waste sites. The investigation of Building 604 was led by the Hazardous Waste Section (HWS) of the Environmental Services Division (ESD), Region IV, U.S. Environmental Protection Agency (USEPA) at request of the NAS Pensacola's Tier I Partnering Team.

Although Building 26, the foundry, was included in the USEPA's investigation, it will not be discussed in this report. At the time of the investigation, the foundry was an active facility; thus, it will be investigated further under the Resource Conservation and Recovery Act (RCRA). Testing indicates contamination in soil which is underlain by concrete. Removal of the soil has been conducted by Public Works Center (PWC).

This RI report summarizes the activities, results, and conclusions of the investigation, including a baseline risk assessment (BRA), and provides the basis for the feasibility study (FS) to be completed onsite. The objectives are outlined below.

RI Objectives

The objectives of the RI conducted at Site 38 were to:

- Determine the source, nature, and, to the degree practical for an acceptable FS, the extent of soil and groundwater contamination.

- Facilitate the evaluation of human health and ecological risk posed by contaminated environmental media onsite through the BRA process.

After the RI is complete, an FS will be conducted to determine appropriate methods of addressing site contamination, based on data generated during the RI process.

1.1 Project Organization

The RI was executed in four parts. First, all available previous investigation reports in the administrative record were reviewed to develop a comprehensive understanding of the site history to develop the Sampling and Analysis Plan (SAP) (E/A&H 1992a/b). Next, a contaminant source survey (CSS) was performed to gain additional information concerning the history of the site and present and past activities which may have contributed to its contamination. The field investigation was performed in two phases; E/A&H conducted Phase I and USEPA conducted Phase II. Phase I included the investigation of former Building 71 and the IWTP sewer line between it and Building 604. Soil borings and permanent monitoring wells were installed and sampled for chemical and physical analyses. Phase II included confirmation sampling at former Building 71 and the investigation of Building 604. Soil borings and temporary and permanent wells were installed and sampled for chemical analyses.

1.2 Purpose of Report

This RI report summarizes the activities, results, and conclusions of all phases of the investigation, and provides the basis for an FS to be completed and, ultimately, a Record of Decision (ROD) for the site. The report also documents the investigation's data collection and analytical methods.

2.0 SITE DESCRIPTION AND HISTORY

Site 38 is in the southeastern portion of NAS Pensacola, as shown on Figure 2-1. This site includes former Building 71 and surrounding areas, Building 604 and surrounding areas, and the associated IWTP sewer line (TL 073/C southwest to the end). The site was divided into two study areas; the Building 71 area and Building 604 area (Figure 2-2). The general area surrounding the site is used for storage, maintenance, and operations support for Morale, Welfare, and Recreation (MWR). Most of the area is paved with asphalt or concrete with exposed soil only along the road or in parking lot medians. The southern part of the site is adjacent to Pensacola Bay. The immediate offshore area was investigated in the Site 2 RI (E/A&H, 1995). Port operations and the main ship docks are to the east.

2.1 Building 71 Area

2.1.1 Description

Building 71 was a steel-framed structure with a metal covering on a 10-inch to 14-inch thick concrete slab. The structure was approximately 100 feet wide by 160 feet long and approximately 35 feet high. An interior concrete block wall divided the structure into a northern half, curbed with concrete in several places, and a southern half enclosing 10 dip tanks. The building was demolished in September and October 1993. Building 71 was used from 1935 to the late 1970s for aircraft paint stripping and painting operations. Before approximately 1973, wastes from various operations, including paint stripping, were discharged to Pensacola Bay. After the IWTP was built in 1973, wastes entered the associated IWTP sewer line without any pretreatment or segregation. Currently, the vacant lot where Building 71 stood is being used by MWR for parking large moving trucks.

Structures surrounding Building 71 include Buildings 104, 26, and 44 immediately to the east and the former Buildings 72 and 49 to the west. Building 72, demolished in March and April 1993, was also used for paint stripping and painting operations. Building 49, used for

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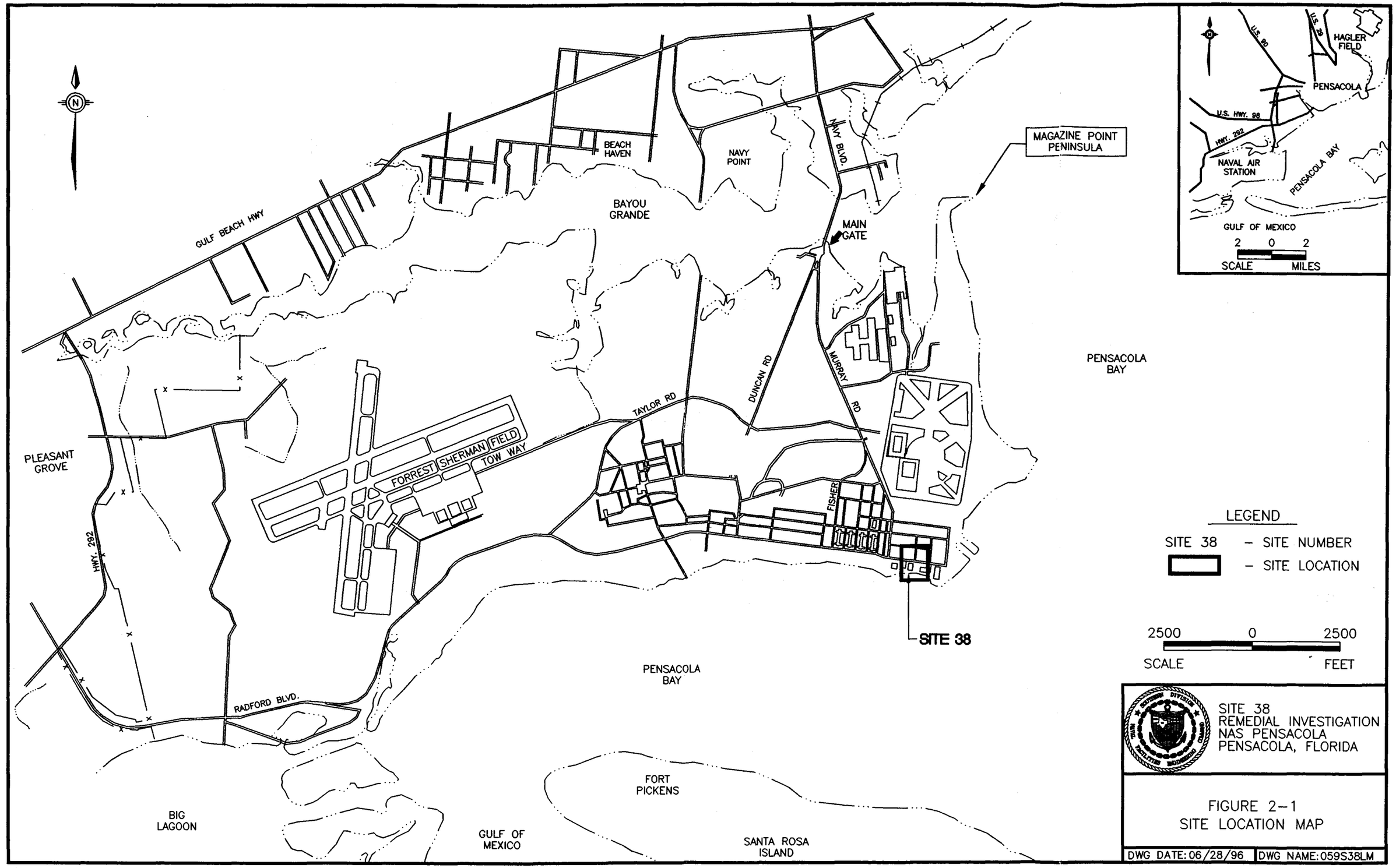
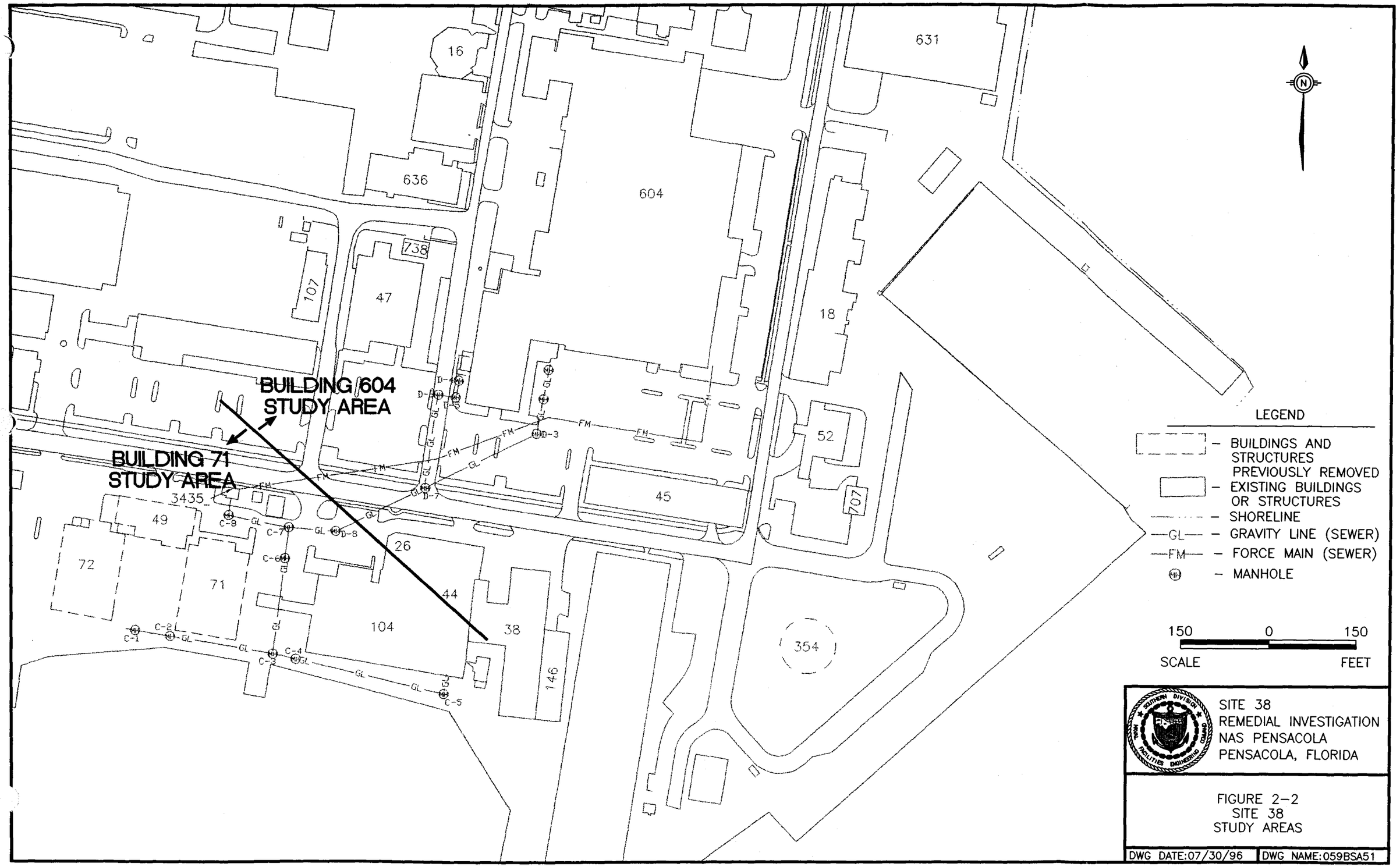

N
GULF BEACH HWY
BEACH HAVEN
NAVY POINT
NAVY BLVD.
BAYOU GRANDE
MAGAZINE POINT PENINSULA
MAIN GATE
PENSACOLA BAY
PLEASANT GROVE
HWY. 292
FORREST SHERMAN FIELD
TOW WAY
TAYLOR RD
DUNCAN RD
MURRAY RD
FISHER
SITE 38
RADFORD BLVD.
PENSACOLA BAY
FORT PICKENS
BIG LAGOON
GULF OF MEXICO
SANTA ROSA ISLAND
U.S. 90
U.S. 29
HAGLER FIELD
PENSACOLA
U.S. HWY. 98
HWY. 292
NAVAL AIR STATION
PENSACOLA BAY
GULF OF MEXICO
2 0 2
SCALE MILES
LEGEND
SITE 38 – SITE NUMBER
– SITE LOCATION
2500 0 2500
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 2-1
SITE LOCATION MAP
DWG DATE: 06/28/96
DWG NAME: 059S38LM


BUILDING 604
STUDY AREA
BUILDING 71
STUDY AREA
16
631
636
604
738
107
47
18
52
707
45
3435
49
72
71
26
44
104
38
146
354
D-4
D-3
D-7
D-8
C-8
C-7
C-6
C-2
C-1
C-4
C-3
C-5
GL
FM
N
LEGEND
BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
EXISTING BUILDINGS OR STRUCTURES
SHORELINE
GRAVITY LINE (SEWER)
FORCE MAIN (SEWER)
MANHOLE
150
0
150
SCALE
FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 2-2
SITE 38
STUDY AREAS
DWG DATE:07/30/96
DWG NAME:059BSA51

painting operations, was demolished in September and October 1993. A storage yard, approximately 90 feet wide by 145 feet long, was between Buildings 71 and 72; Building 49 was at the north end of the storage yard. Building 104 was a Navy Exchange warehouse operated by the Navy Commissary. The facility was originally used in painting operations and was later converted to a sheet metal shop in the 1960s. Building 26 was constructed in 1882 as a blacksmith shop and, at the time of the survey, functioned as a foundry for Naval Air Depot (NADEP). No foundry operations are currently being performed at the facility. Notably, this facility is currently undergoing RCRA closure.

2.1.2 Site History and Previous Investigations

History

Building 71 was originally constructed as a seaplane hangar in the early 1920s. In approximately 1935, operations changed to paint stripping (NEESA, 1983). In addition to Building 71, Buildings 72 and 49 were also used for paint stripping from 1935 to the mid-1970s. The Naval Energy and Environmental Support Activity (NEESA, since renamed) reported that an estimated 400 gallons per day (gpd) of acrylic and epoxy paint stripper and another 400 gpd of ketone were used at these buildings during stripping operations. Other compounds believed to have been used include phenols and trichloroethene (TCE). A system of interconnected grated drains and trenches in the building floor and storage yard collected waste solvents used in the stripping operations (Figure 2-3). Small parts were stripped and cleaned in 10 500-gallon dipping tanks in the southern portion of Building 71 (Figure 2-4). The contents of these tanks (reportedly paint strippers, ketones, and TCE) were drained into the floor trenches every six to eight weeks (NEESA, 1983). This floor trench drained directly into Pensacola Bay for several decades until the early 1970s, when it was connected to the IWTP sewer line. When the buildings were demolished, drainage trenches in the west yard and inside Building 71 were filled with concrete. In 1979, paint stripping was moved from Buildings 71 and 72 to Building 3557 (NEESA, 1983).

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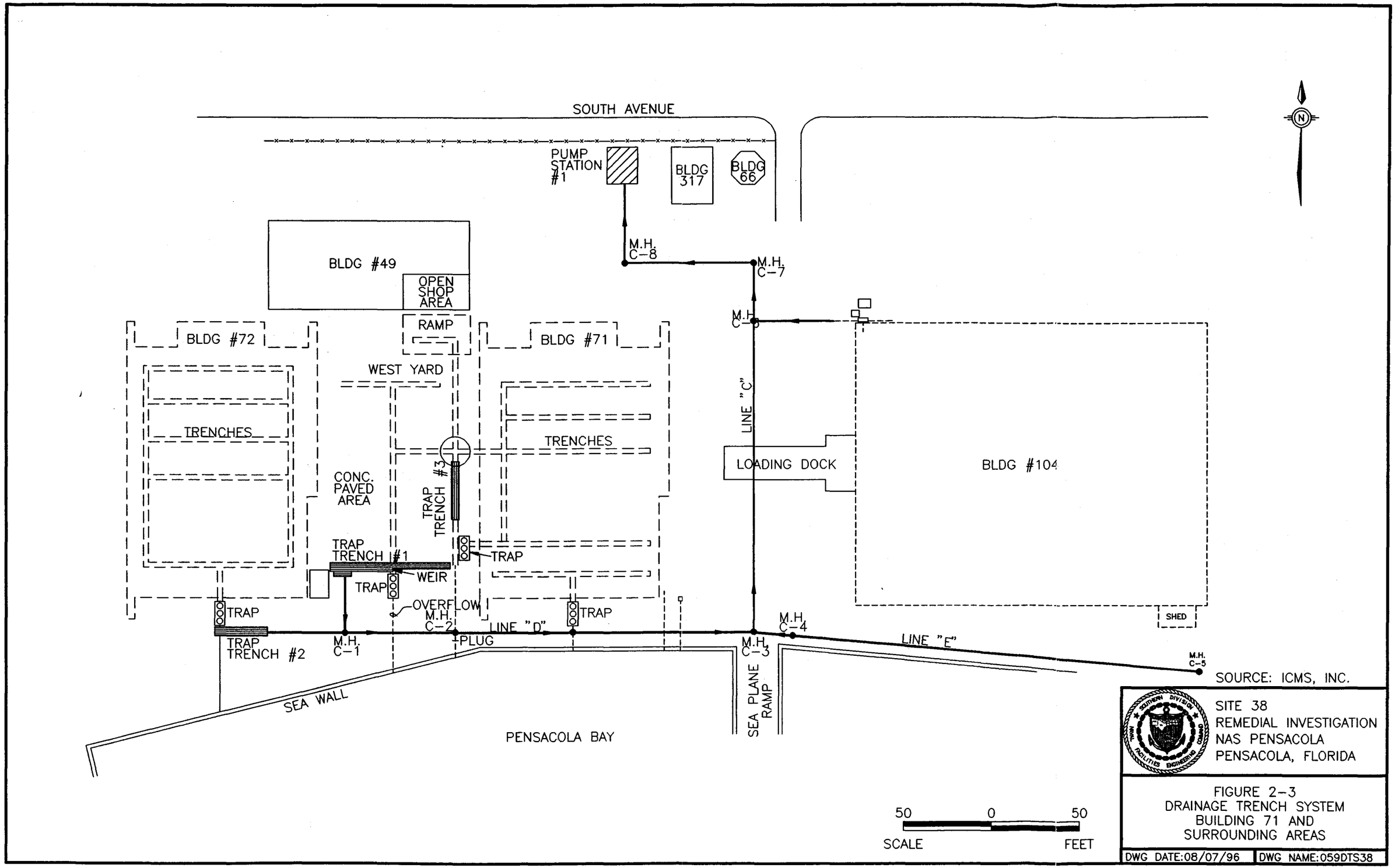
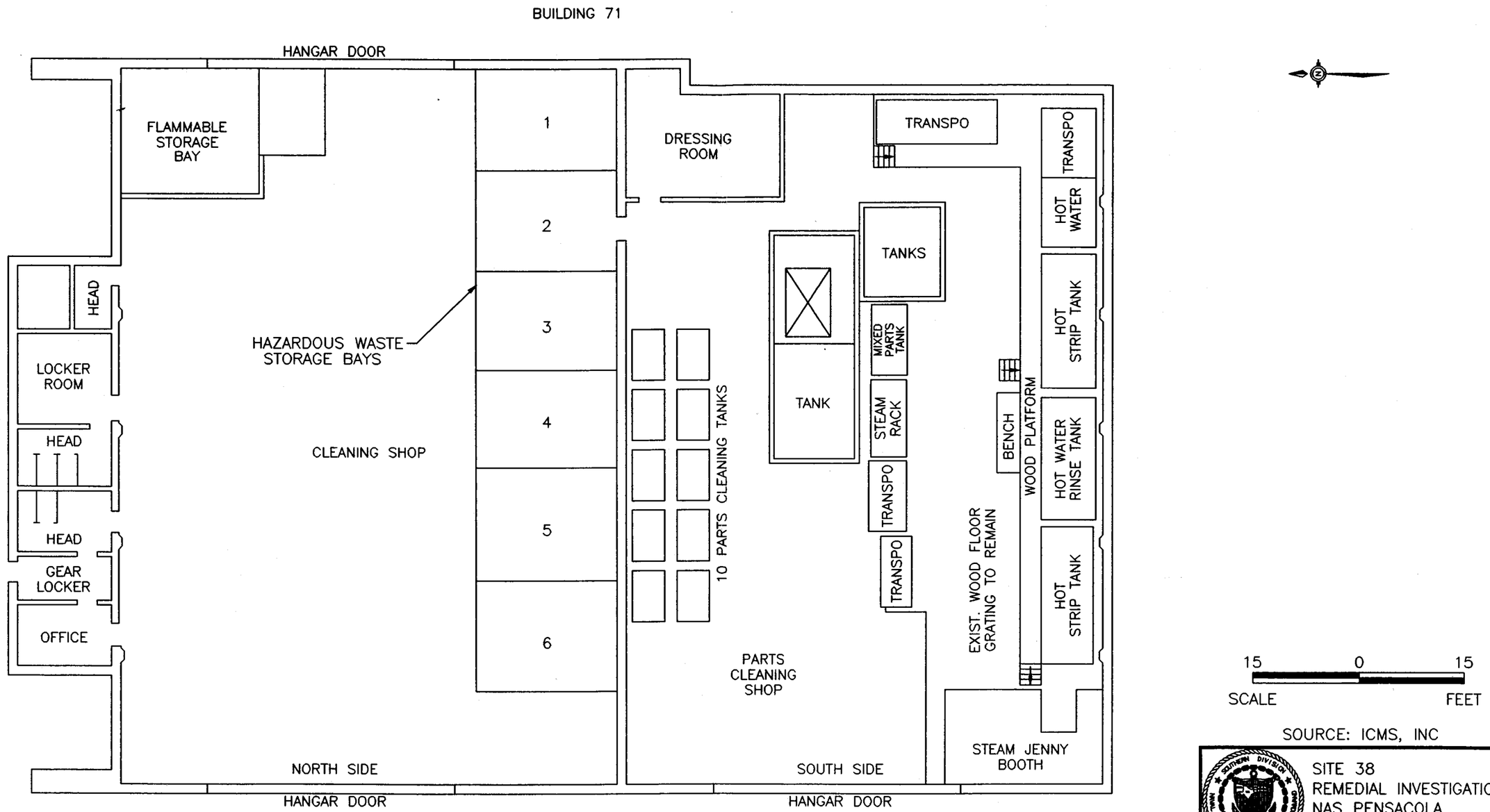

SOUTH AVENUE
PUMP STATION #1
BLDG 317
BLDG 66
M.H. C-8
M.H. C-7
M.H. C-6
BLDG #49
OPEN SHOP AREA
RAMP
BLDG #72
BLDG #71
WEST YARD
TRENCHES
TRENCHES
CONC. PAVED AREA
TRAP TRENCH #3
TRAP TRENCH #1
TRAP
WEIR
TRAP
OVERFLOW
M.H. C-2
LINE "D"
TRAP
TRAP
TRAP TRENCH #2
M.H. C-1
PLUG
LINE "C"
LOADING DOCK
BLDG #104
SHED
M.H. C-4
LINE "E"
M.H. C-5
M.H. C-3
SEA PLANE RAMP
SEA WALL
PENSACOLA BAY
50 0 50
SCALE FEET
SOURCE: ICMS, INC.
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 2-3
DRAINAGE TRENCH SYSTEM
BUILDING 71 AND
SURROUNDING AREAS
DWG DATE:08/07/96
DWG NAME:059DTS38



SOURCE: ICMS, INC

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 2-4
STRIPPING AND PARTS
CLEANING OPERATIONS LAYOUT
BUILDING 71

DWG DATE:08/07/96 | DWG NAME:58ASRM71

From 1980 to 1989, hazardous waste was stored on the north side of Building 71, which was permitted for hazardous waste storage in January 1985 by the Florida Department of Environmental Regulation (FDER) which was later renamed Florida Department of Environmental Protection (FDEP) (Kriegel, 1985; NEESA, 1983). Eighty to several hundred 55-gallon drums were reported to have been stored in Building 71; the maximum permitted storage capacity was 15,950 gallons (i.e., 290 55-gallon drums). Waste stored during this period reportedly consisted of solvents, acids, caustics, oxidizers, and liquid and nonliquid toxic materials (E&E, 1992a).

Investigations

The hazardous waste storage facility was closed under RCRA in 1989 (EnSafe, 1989). The closure permit was received in August 1989. The closure activities were outlined in a standard operating procedure (SOP) document prepared by EnSafe (1989), including decontamination of the walls and floors in the main storage area (north side of the building).

Initial verification sampling indicated that the decontamination had been unsuccessful (EnSafe, 1990a). Analytical results of the rinsate sample collected after floor and wall decontamination indicated the presence of silver, cadmium, chromium, lead, cyanide, toluene, trichloroethane, TCE, and polychlorinated biphenyls (PCBs) above background concentrations (Table 2-1). Background concentrations were determined by collecting three samples of tap water, and performing a Student's *t* test. Silver, cadmium, mercury, and lead were detected in those samples.

Analytical results of soil samples from beneath the concrete floor indicated cyanide, methyl ethyl ketone, toluene, xylenes, trichloroethane, TCE, and PCBs. Table 2-2 summarizes the background concentrations and the constituents in soil and identifies the bay (or loading/unloading apron) under which they were detected (EnSafe, 1990a). Bay locations are shown on Figure 2-4.

Table 2-1
Rinsate vs. Background Concentrations
Building 71 Initial Decontamination/Closure Activities

Constituent	Background Concentration	Rinsate Concentration	Result
Silver	0.0001	0.0152	Above background
Cadmium	<0.0001	0.021	Above background
Chromium	<0.01	0.24	Above background
Mercury	0.091	0.0045	Acceptable
Lead	0.001	0.880	Above background
Cyanide	<0.01	0.02	Above background
Methyl Ethyl Ketone	<0.01	<0.01	Acceptable
Methylene Chloride	<0.005	<0.005	Acceptable
Methyl Isobutyl Ketone	<0.01	<0.01	Acceptable
Toluene	<0.001	0.001	At background
Trichloroethane	<0.001	0.016	Above background
Trichloroethylene	<0.001	0.078	Above background
Trichlorofluoromethane	<0.005	<0.005	Acceptable
Xylenes	<0.005	<0.005	Acceptable
1,1-Dichloroethane	<0.005	<0.005	Acceptable
1,2-Dichloroethane	<0.003	<0.003	Acceptable
PCB/Water	<0.0002	0.0988	Above background

Source: EnSafe, 1990a

Notes:
All results are in milligrams per liter (mg/L).
< symbol = below detection limits

Table 2-2
Background Soil vs. Detected Concentrations
Building 71 Initial Decontamination/Closure Activities

Constituent	Background Concentration	Flammables Bay	Bay 3	Bay 4	Bay 6	Apron
Cyanide	<0.25	0.55	ND	0.35	ND	0.25
Methyl Ethyl Ketone	<0.009	ND	0.014	ND	ND	0.012
Toluene	<0.001	0.005	ND	ND	ND	0.005
Trichloroethane	<0.001	0.001	ND	ND	0.009	0.068
Trichloroethylene	<0.001	ND	ND	ND	0.003	ND
Xylenes	<0.005	0.005	ND	ND	ND	0.017
PCB	<1	210.[a] 320.	ND	130.[a] 45.	ND	1

Source: EnSafe, 1990a

Notes:
All results are in milligrams per kilogram (mg/kg).

< symbol	=	below detection limit
ND	=	not detected at or above the instrument detection limit
a	=	Because of the magnitudes of these concentrations, a second soil sample was collected in each bay by Public Works Center personnel and analyzed by a separate laboratory.

In December 1990, the Navy authorized EnSafe to prepare an addendum to the SOP document to continue closure of the walls of Building 71. As agreed by the FDER, closure was not continued on the underlying slab and soil because they would be addressed under CERCLA. The subsequent decontamination was performed on December 19, 1990, in accordance with the SOP addendum (EnSafe, 1990b). A composite final rinsate sample was collected by wet vacuum, following detergent washing and rinsing. A tap water sample was also collected to represent background conditions. The follow-up decontamination focused on constituents exceeding background rinsate thresholds. Except for PCBs, which were detected at 26 micrograms per liter (μg/L) in the rinsate sample and at 4 μg/L in the tap water sample, contaminants were not detected above reference concentrations (EnSafe, 1991). PCBs were regulated under the Toxic Substances Control Act (TSCA), not RCRA, which regulated the facility closure. Therefore, the wall decontamination was successful for the hazardous waste constituents (EnSafe, 1991). A clean-closure certificate dated October 24, 1994, was issued by FDEP. No other investigations have been conducted in the Building 71 area.

2.2 Associated IWTP Sewer Line

2.2.1 Description

The associated IWTP sewer line includes gravity lines as well as a force main (Figure 2-2). Except for the 18-foot section of line between manholes C-2 and C-1 constructed of 8-inch diameter polyvinyl chloride (PVC) pipe, the lines in this area are constructed of 8- to 12-inch diameter vitrified clay with hub and spigot joints.

Building 3435, north of the Building 71 area, houses the lift station for the force main. The interconnected gravity lines, which serve operations at Buildings 604 and 104, and previously served operations at Building 71, flow to the lift station at Building 3435. The force main extends northeast from the lift station between Buildings 604 and 45 and continues north (east of Building 604) beyond the study area, where it eventually discharges to the IWTP north of Chevalier Field.

2.2.2 Site History and Previous Investigations

History

Wastes from various types of operations entered the IWTP sewer line without pretreatment or segregation. In this area, the IWTP sewer line serviced former Buildings 49, 71, and 72 and Building 604. Consequently, the wastestream may have consisted of everything generated or used in those buildings including metal waste, paint strippers, ketones, TCE, and cyanide (before 1962).

Public Works Center Telespection: The IWTP sewer line was telespected by the Public Works Center (PWC) in July 1987. The sewer line associated with Building 71 was to be in generally good condition, except for a 176-foot section between manholes C-2 and C-3 (Figure 2-2). Several cracks were noted, and groundwater was infiltrating the line. Reworking the bottoms of manholes C-3 and C-6 was also recommended. The PWC telespection report for the entire IWTP sewer line is in Appendix A.

IWTP Sewer Line Investigation: This Phase I investigation conducted by Ecology & Environment, Inc. (E&E), included the Site 38 associated sewer line (TL 073/C southwest to the end) and was completed in 1991. Sampling was performed in accordance with the work plan (E&E, 1992b) and the results were detailed in an Interim Data Report (E&E, 1992c). The investigation results are summarized below.

Fifteen soil borings and temporary monitoring wells were completed in the subject area, as shown on Figure 2-5. Soil samples, which were composited over 5-foot sample intervals (i.e., 0 to 5 feet below land surface [bls], 5 to 10 feet bls, etc.), had concentrations of metals, total recoverable petroleum hydrocarbons (TRPHs), total polyaromatic hydrocarbons (PAHs) as benzo(a)pyrene, and phenol as trichlorophenol at or above the instrument detection limit. Concentrations of metals, total PAHs as benzo(a)pyrene and phenols as trichlorophenol were

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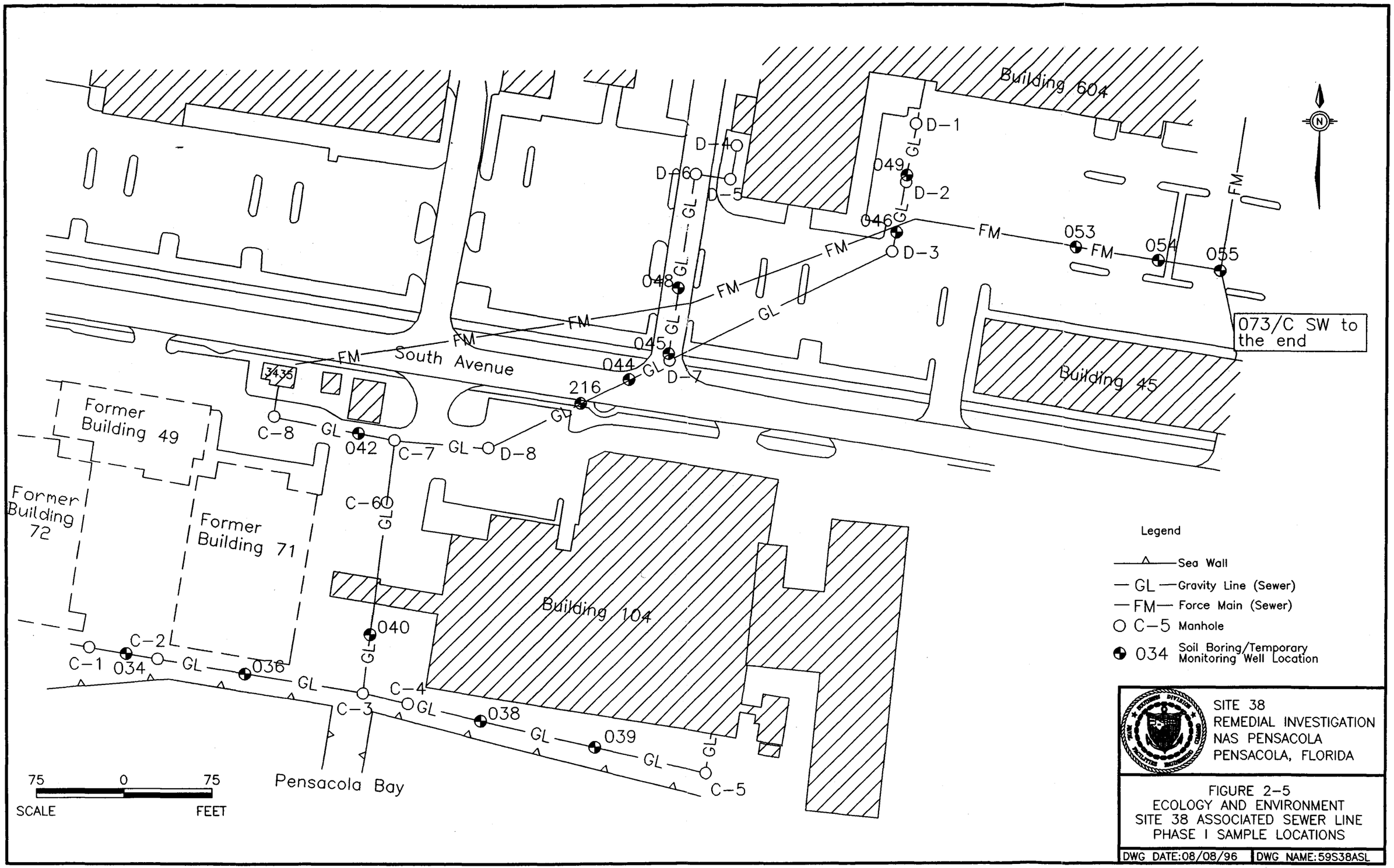
Building 604
Building 45
Building 104
Former Building 49
Former Building 72
Former Building 71
South Avenue
Pensacola Bay
3435
D-1
D-2
D-3
D-4
D-5
D-6
D-7
D-8
C-1
C-2
C-3
C-4
C-5
C-6
C-7
C-8
034
036
038
039
040
042
044
045
046
048
049
053
054
055
216
GL
FM
073/C SW to the end
75 0 75
SCALE FEET
Legend
Sea Wall
GL Gravity Line (Sewer)
FM Force Main (Sewer)
C-5 Manhole
034 Soil Boring/Temporary Monitoring Well Location
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 2-5
ECOLOGY AND ENVIRONMENT
SITE 38 ASSOCIATED SEWER LINE
PHASE I SAMPLE LOCATIONS
DWG DATE:08/08/96
DWG NAME:59S38ASL

present in groundwater samples. The analytical results are summarized in Table 2-3 for soil and Table 2-4 for groundwater.

E/A&H Investigation: E/A&H investigated the nature and magnitude of contamination at two sections of the IWTP sewer line in February 1993; one section was the Site 38 — associated IWTP sewer line (Figure 2-6). The results of the investigation were used to support construction of a fuel line along Radford Boulevard and will be discussed in this RI report.

2.3 Building 604 Study Area

2.3.1 Building 604 Site Description and History

Building 604 housed the NADEP metal plating operations until the facility was closed in May 1996. Building 604 is a two-story, irregular, brick/masonry structure built in 1937 as a hangar on the west side of East Avenue in the old Navy Yard. The building is not listed in the National Register of Historic Places; however, it was identified as possibly being eligible for listing. Plating operations were conducted in 29/604a, the western extent of Building 604, from around 1960 until the shop was demolished around 1970 (NEESA, 1983). The rubber shop, which made plastic items for aircraft, was also housed in Building 29 until 1961. This shop only used small amounts of solvents. Three cadmium plating lines and a magnesium treatment line were in the plating shop. Chromium was used in the magnesium treatment process. NEESA (1983) reports that 50-gallon tanks containing chromium solutions were drained once a month; larger tanks were present but were drained less frequently. These tanks were emptied into sewer lines that discharged into Pensacola Bay (NEESA, 1983). Cyanide solutions were also used in the plating process. Prior to 1962, cyanide waste was disposed in the sanitary sewer. Because plating wastes could upset the operation at the sewage treatment plant, cyanide and chromate wastes that were dumped into the sewer system were routed to bypass the treatment plant and flowed untreated into Pensacola Bay. Table 2-5 is a partial list of chemicals used in Building 29/604a.

Table 2-3
Ecology and Environment, Inc., Screening Results for Soil
Site 38 Associated Sewer Line

Parameter	P36S034A	P36S036A	P36S036AD	P36S038A	P36S038B	P36S039A	P36S039B	P36S040A	P36S040B	P36S040C
Arsenic	ND[a]	ND[a]	ND[a]	ND	ND	ND	ND	ND[a]	ND[a]	ND[a]
Chromium	7.9	2.6	3.8	ND	ND	30	8.2	1.6	1.0	1.4
Zinc	15	7.3	9.2	14	11	58	95	16	3.4	2.4
Lead	26	12	22	28	18	100	78	77	ND	6.3
Cadmium	ND	ND	ND	ND	ND	3.0	1.2	ND	ND	ND
Nickel	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	15	7.1	9.2	11	32	18	460	11	ND	ND
TRPHs	37	63	49	ND	36	690	280	63	ND	ND
Total PAHs as benzo(a)pyrene	(L)	ND	ND	ND	ND	ND	1,600	ND	40	19
Phenols as trichlorophenol	6,500	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 2-3 (Continued)
Ecology and Environment, Inc., Screening Results for Soil
Site 38 Associated Sewer Line

Parameter	P36S042A	P36S042B	P36S042C	P36S044A	P36S044B	P36S045A	P36S045B	P36S045C	P36S046A	P36S046B
Arsenic	ND[a]	ND[a]	ND[a]	ND	ND	ND	ND	ND	ND	ND
Chromium	6.7	2.9	1.3	2.4	ND	ND	ND	ND	5.1	13
Zinc	9.1	4.4	ND	20	ND	19	ND	2.4	74	46
Lead	26	13	ND	31	ND	30	ND	ND	110	56
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	3.7	5.7
Nickel	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.5
Copper	ND	ND	ND	10	ND	4.9	ND	ND	36	35
TRPHs	44	32	9.9	100	29	64	ND	13	1,300	80
Total PAHs as benzo(a)pyrene	4,100	1,100	ND	1,200	ND	ND	ND	4,900	(L)	ND
Phenols as trichlorophenol	6,900	1,500	ND	ND	ND	ND	ND	ND	ND	ND

Table 2-3 (Continued)
Ecology and Environment, Inc., Screening Results for Soil
Site 38 Associated Sewer Line

Parameter	P36S048A	P36S048B	P36S049A	P36S049B	P36S053A	P36S053B	P36S054A	P36S054B	P36S055A	P36S055B
Arsenic	ND	ND	6.4	ND	ND	ND	ND	ND	ND	ND
Chromium	16	5.2	12	17	1.8	ND	2.3	ND	2.0	ND
Zinc	40	2.5	95	32	74	12	5.9	4.7	24	ND
Lead	79	ND	88	66	200	40	27	ND	70	ND
Cadmium	3.0	ND	4.7	3.8	ND	ND	ND	ND	ND	ND
Nickel	9.7	ND	4.6	ND	ND	ND	ND	ND	ND	ND
Copper	20	ND	46	22	31	4.8	ND	ND	8.6	ND
TRPHs	440	25	85	86	220	67	25	25	310	39
Total PAHs as benzo(a)pyrene	ND	ND	ND	1,100	300,000	1,700	ND	ND	2,100	ND
Phenols as trichlorophenol	6,000	ND	ND	ND	410,000	ND	ND	ND	ND	ND

Source: E&E, 1992c

Notes:
All values are in micrograms per kilogram (μg/kg) except for inorganics, which are in milligrams per kilogram (mg/kg).
ND = Not detected at or above the stated detection limit.
a = Detection limit for specified parameter increased by a factor of 1.15 in this sample.
(L) = Present below stated detection limit.

Table 2-4
Ecology and Environment, Inc., Screening Results for Groundwater
Site 38 Associated Sewer Line

Parameter	TW034	TW036	TW038	TW039	TW040	TW042	TW044	TW045	TW046
Chromium	450	97	47	340	37	33	58	12	740
Zinc	480(B)	260(B)	900(B)	2,300(B)	71(B)	75(B)	86	51(B)	320
Lead	510	1,700	1,600	2,400	110	93	ND	ND	440
Cadmium	5.2	ND	ND	57	ND	ND	6.6	ND	63
Nickel	ND	ND	ND	42	ND	ND	ND	ND	49
Copper	730	320	3,600	2,800	30	ND	31	ND	190
TRPHs	ND	ND	ND	ND	ND	ND	ND	ND	13
Toluene	ND	1.7	ND	13	ND	ND	ND	ND	ND
1,2-DCB	29	17	ND	ND	ND	ND	ND	ND	ND
1,1-DCE	ND	19	ND	ND	ND	ND	ND	ND	ND
t-1,2-DCE	ND	ND	ND	ND	ND	ND	ND	ND	10
1,1-DCA	150	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-TCA	20	ND	ND	ND	ND	ND	ND	ND	ND
TCE	11	ND	ND	ND	ND	ND	ND	ND	21
PCE	ND	ND	ND	ND	ND	ND	ND	ND	ND
CB	ND	ND	ND	ND	16	ND	ND	ND	ND
Total PAHs as benzo(a)pyrene	180	ND	170	150	110	ND	ND	ND	ND
Phenols as trichlorophenol	(L)	(L)	(L)	ND	700	(L)	ND	ND	ND

Table 2-4 (Continued)
Ecology and Environment, Inc., Screening Results for Groundwater
Site 38 Associated Sewer Line

Parameter	TW048	TW049	TW053	TW053D	TW054	TW055
Chromium	280	710	19	15	ND	13
Zinc	120	2,200	170	190	40	75
Lead	230	2,200	560	400	150	ND
Cadmium	10	350	ND	ND	ND	ND
Nickel	41	ND	ND	ND	ND	ND
Copper	48	1,100	66	62	37	ND
TRPHs	ND	ND	ND	ND	ND	ND
Toluene	ND	ND[a]	ND	ND	ND	ND
1,2-DCB	ND	ND[a]	ND	ND	ND	ND
1,1-DCE	ND	ND[a]	ND	ND	ND	ND
t-1,2-DCE	ND	ND[a]	ND	ND	ND	ND
1,1-DCA	ND	ND[a]	ND	ND	ND	ND
1,1,1-TCA	ND	ND[a]	ND	ND	ND	ND
TCE	ND	ND[a]	ND	ND	ND	ND
PCE	ND	500	ND	12	ND	ND
CB	ND	ND[a]	ND	ND	ND	ND

Table 2-4 (Continued)
Ecology and Environment, Inc., Screening Results for Groundwater
Site 38 Associated Sewer Line

Parameter	TW048	TW049	TW053	TW053D	TW054	TW055
Total PAHs as benzo(a)pyrene	ND	ND	ND	ND	ND	ND
Phenols as Trichlorophenol	ND	ND	ND	ND	ND	ND

Notes:
All values are in micrograms per liter (μg/L) except for inorganics which are in milligrams per liter (mg/L)

ND	=	Not detected at or above the stated detection limit 1,
a	=	Detection limit for specified parameter increased by a factor of 1.15 in this sample.
(B)	=	Compound also present in method blank
(L)	=	Present below stated detection limit
1,2-DCB	=	1,2-Dichlorobenzene
t-1,2-DCE	=	Trans-1,2-dichloroethene
1-DCA	=	1,1-Dichloroethane
1,1,1-TCE	=	1,1,1-Trichloroethene
PCE	=	Tetrachloroethene
CB	=	Chlorobenzene
1,1-DCE	=	1,1-Dichloroethene

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16
636
604
47
18
52
49
72
71
26
44
104
38
36SB77C/36MW77C
36SB77W
36SB75C/36MW75C
36SB75E
36SB76W
36SB74N
36SB78C/36MW78C
36SB77S
36SB76E
36SB74W
36SB73C/38MW73C
36SB78W
36SB76S
36SB79W
36SB78E
36SB74C
36SB76C/36MW76C
36SB79C/36MW79C
36SB80C/36MW80C
36SB78S
36SB81W
36SB81C/36MW81C
36SB80S
36SB81S
LEGEND
BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
SHORELINE
GRAVITY LINE (SEWER)
FORCE MAIN (SEWER)
MANHOLE
SOIL BORING
SOIL BORING/ MONITORING WELL
150 0 150
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 2-6
SOIL BORING/MONITORING WELL LOCATIONS FROM E/A&H IWTP LINE INVESTIGATION
DWG DATE:08/07/96
DWG NAME:059SBMW3

Table 2-5
Partial List of Chemicals Used at Building 29/604a in 1966

Alodine (Chromium)	Ammonium Nitrate
Chromium Trioxide (Chromium)	Hydrochloric Acid
Hydrofluoric Acid	Nitric Acid
Resin Stripper (Phenol)	Sodium Carbonate
Sodium Cyanide	Sodium Dichromate (Chromium)
Sodium Hydroxide	Sulfuric Acid

Source: NEESA, 1983

Around 1970, a much larger plating shop, the southwest extension of Building 604, was constructed at the site of Building 29/604a. Appendix B, USEPA's preliminary environmental assessment report, provides additional information on Building 604's history. Figure 2-7 shows the operations at Building 604. Listed in Table 2-6 are the chemicals and constituents that were typically handled, used and could have been released at or from this facility. Hazardous materials have been stored in Building 604, on the second floor, since the early 1970s. Types of materials stored are listed in Table 2-7. All chemicals designated for separate storage on the Consolidated Hazardous Item List (CHIL) were consolidated into one segregated storage area. Reportedly, the storage area was reorganized and cleaned up in 1981. Before that time, spills and leaks frequently occurred (NEESA, 1983).

Approximately 30 plating process tanks were present in the Building 604 shop ranging in size from 40 gallons to 2,000 gallons. These tanks were drained about once a month. From 1970 to 1973, discharge was through sewer lines that emptied into Pensacola Bay. After 1973, most drain lines were connected to the IWTP; however, NEESA (1983) reports that some of the lines

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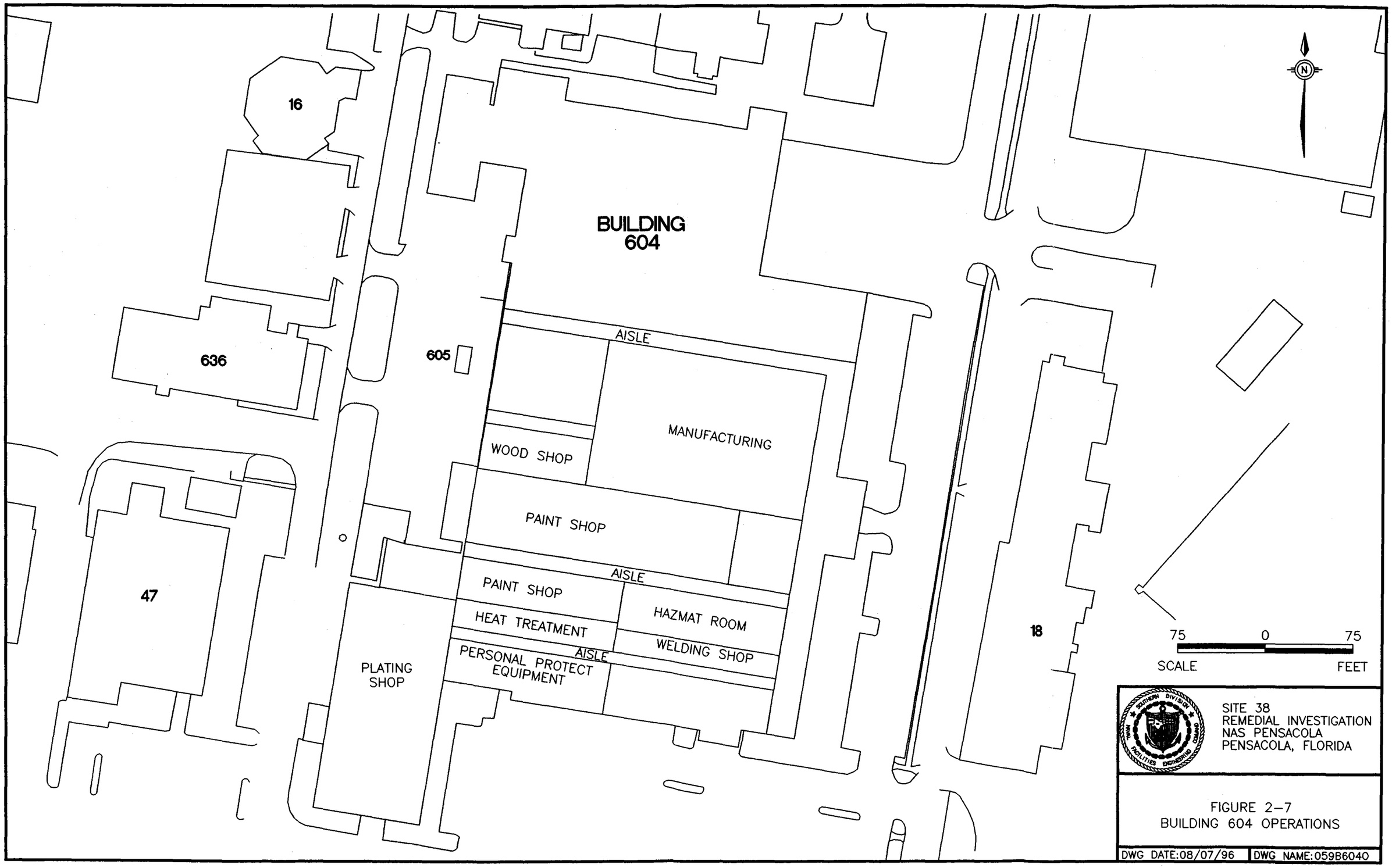

16
BUILDING
604
636
605
AISLE
MANUFACTURING
WOOD SHOP
PAINT SHOP
AISLE
PAINT SHOP
HAZMAT ROOM
HEAT TREATMENT
WELDING SHOP
AISLE
PERSONAL PROTECT
EQUIPMENT
47
PLATING
SHOP
18
N
75
0
75
SCALE
FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 2–7
BUILDING 604 OPERATIONS
DWG DATE:08/07/96
DWG NAME:059B6040

Table 2-6
List of Compounds and Substances Observed in Plating Process Area

Plating Production Line Description	List Observed Hazardous Compounds and Substances	Areas of Potential Releases
Silver Plating Line - Extreme north side, running west to east, 1st floor and basement	Sodium cyanide, silver cyanide, potassium cyanide, sodium hypochlorite, and sodium hydroxide	Cyanide process and drag tanks (2) and silver recovery equipment overflows and spills in north weired basement area. Historically drained to the cyanide waste collection sump in basement before waste collection and condensing equipment was installed.
Cadmium Plating - Two production lines south of silver line running west to east, 1st floor and basement	Ammonium nitrate, hydrochloric acid (historical use), sodium cyanide, chromium trioxide, sodium hydroxide, and cadmium oxide	Cyanide process and drag tanks (2) and cadmium recovery equipment overflows and spills in north weired basement area. Historically drained to the cyanide waste collection sump in basement before waste collection and condensing equipment was installed.
Lead/Tin and Zinc Plating (old silver plating line) - Four production lines, south of cadmium line running west to east (west wall to building mid-point), most tanks are inactive.	PD 680 solvent; PC436E alkali cleaner; hydrochloric acid, sulfuric acid, sodium stearate, sodium hydroxide, nickel pellet anodes, and zinc 980 (zinc dip)	Spills and overflows into nickel plating weired area in basement. Historical use includes cyanide plating for silver and copper.
Nickel Plating Area - Six production lines south of lead/tin line, west wall	Sodium hydroxide, zinc, nickel sulfamate, boric acid, nickel chloride, ammonia stripping solution, sodium dichromate, nitric acid, phosphoric acid, and high alkali etching solution	Spills and overflows into nickel plating weired area in basement. Historical use includes cyanide cleaning line.
Chromium Plate Strip, copper plating, Aluminum Etching Lines - six lines south of nickel plating line, north of chromium plating on west wall	Nitric acid, potassium permanganese, phosphoric acid, Black Magic (proprietary solution), hydrochloric acid, chromium trioxide, sulfuric acid, PC436E cleaner, PD 680 Solvent, zinc oxide, sodium hydroxide, sodium cyanide, copper sulfate, sulfuric acid, potassium permangnate, sodium hydroxide, chromic acid, and copper cyanide	Spill and overflows into nickel plating weired containment area in basement.
Chromium Plating and Aluminum Anodizing Lines - six lines, south of copper plating, running south to north from south wall, west side.	Chromium trioxide, sulfuric acid, sodium hydroxide, chromic acid, aluminum coloring dyes, oxalic acid, acetic acid, and nickel acetate	Spills and overflows into south basement areas and to floor drainage system. No containment structures were observed.
Cleaning Line - East wall, south of cadmium line and east entrance from old 604	Trichloroethene (historical - 2 tanks removed a few years ago), PC346E cleaner	Spills from old TCE tanks drained to basement and likely to cyanide or acid collection sumps.

Table 2-6
List of Compounds and Substances Observed in Plating Process Area

Plating Production Line Description	List Observed Hazardous Compounds and Substances	Areas of Potential Releases
Oversized parts anodizing and chromium plating, alodine dip, process wastewater storage and evaporators - south of cleaning on east wall, running north to south to south wall (south east quadrant of facility)	Alodine, manganese phosphate, nitric acid, PC436E cleaner, chromic acid, chromic trioxide, sodium dichromate, sodium hydroxide, turco accelaglo, chromic acid, sodium fluosilicate, and potassium forricyanide. NOTE: Wastewater evaporator tanks collect all wastewater (including basement fluids) and evaporates water to collect solids and sludges for hazardous waste disposal for all areas except north cyanide lines.	Spills and overflows into south basement areas and to floor drainage system. No containment structures were observed.
Penthouse: 2nd Floor - hazardous material storage, air scrubbers, scrubber cleaner, ventilation and process support equipment.	Three segregated areas store areas all compounds and substances outlined in plating processes above. Cleaner on southeast wall is used to wash scrubber filters of substances trapped from the plating processes.	Visible evidence confirmed interview discussions that the scrubber filter washer typically overflows. Discharge appears to flow through the exterior wall and down the southeast exterior wall to grass area and nearby storm sewer drain. Also floor drains under oxidizer, caustic, and poisons storage area discharge to the storm sewer system. Lastly, it appears that numerous intakes to various scrubbers (most noticeably nickel area) are leaking a dark liquid, most likely from vapor condensation, and discharging to nearby floor drains.

Table 2-7
Hazardous Materials Stored in Building 609

Area 1 Code D Cyanides	
Potassium cyanide	Barium cyanide
Cuprous cyanide	Alumon
Sodium cyanide	Silver Cyanide
Endox 214	
Area 2 Code C Dry Storage	
Potassium hydroxide	Sodium hydroxide
Turco etchant TFE-9H	
Area 3 Code B General Storage (Cage)	
Niplex nickel stripper	Lime
Nickel sulfate	Parco lubrite solution
Alcor 571 sealer	Parkerize solution
Potassium sodium tartrate (Rochelle salts)	Unichrome 80 salts
Sodium carbonate	Sodium dichromate
Sodium thiocyanate	Nickel chloride
Potassium chromate	Copper sulfate
Potassium iodine	Sulfamic acid
Potassium carbonate	Plastic coating compound (thermocote)
Ammonium hydroxide	Lead fluoborate
Sodium nitrate	Tin fluoborate
Sodium chloride	Cadium brightener
Ammonium thiosulfate	Cadmium oxide
Rhoco zoxl cad. Add. Prent	
Area 3 Code B General Storage (Cage)	
Sodium thiosulfate	Acetic acid
Sodium stannate	Oxalic acid
Iron chloride (Ferric) solution	Ammonium chloride
Mercury chloride	Calcium fluoride
Nickel carbonate	Nickel chloride
Cupric carbonate	Boric acid
Cupric sulfate	Sulfuric inhibitor
Ammonium bifluoride	Hydrochloric inhibitor
Sulfamix wetting agent	Ammonium sulfide
Sulfonic N-95	Ferrous sulfate
Calcium sulfate	Zinc chloride
Magnesium carbonate	Barium carbonate
Sodium chromate	Stannous sulfate
Sodium nitrite	Antimony oxide
Ammonium thiocyanate	Urea
Sulfamic acid	Ammonium citrate
Sodium acetate	Nickel acetate
Sodium dichromate	

Table 2-7
Hazardous Materials Stored in Building 609

Area 10 Code P Separate Storage	
Smutgo-4	Enstrip NP-2
Hydrogen peroxide	Smutgo-2
Endox 114	Turco alclean
Actane 821	Sodium stannate
Enstrip NP-1	Electrocleaner
Area 5 Code A Flammables	
Hydraulic fluid, preservative	Irridite-15
Area 6 Code M Acids	
Fluoboric acid	Nitric acid
Phosphoric acid	Sulfuric acid
Hydrofluoric acid	Corrosion remod comp.
Hydrochloric acid	
Area 7 Code N, U, V, W, Compressed Gas	
Nitrogen gas, cylinders	
Area 8 Code G Flammables	
Trichloroethane, drums	Lube oil, VVL-800 general
Area 9 Code B General Storage	
Fumetrol 101	Exthox-980
Alodine 1200	Ebonol-C
Ammonium nitrate	Chromic acid
Unichrome-65	Econo chrome-40
Area 12 Code G Flammables	
Thichlorethane-aero	Unichrome rackcoat
Spraylat maskant	Stopoff lacquer
Organoceram maskant	Lacquer reducer
Solvent, cleaning compound	Ethyl alcohol
Trichloroethane, gal. cans	
Selectron Chemicals	
Nickel neutral	Activator 1
LHE cadmium	Activator 2
Nickel special	Activator 3

may not have been connected to the IWTP until 1979, and untreated liquid waste may have been unintentionally discharged to Pensacola Bay. According to an interview with Frank Stewart, Environmental Engineer for NADEP, work on the storm sewer lines from Building 604 around 1985 found that the line leading to Outfall 1 at Site 2 had not been sufficiently plugged or diverted and that liquid waste from the facility may have been unintentionally discharged up until this time.

2.3.2 Building 604 Previous Investigations

ABB Investigation — UST 604S

ABB Environmental Services investigated an underground storage tank (UST) next to Building 604 (See Figure 2-2 [ABB, 1992]). Twelve soil borings were advanced and completed as monitoring wells. Soil samples were not analyzed in a laboratory, but groundwater samples were collected and analyzed. Detected parameters include cadmium, lead, TRPH, naphthalene, and volatile organic compounds (VOCs) including vinyl chloride, TCE, and PCE (ABB, 1992). These analytical results are provided in Appendix C.

2.4 Other Facilities

2.4.1 Building 38 Description and History

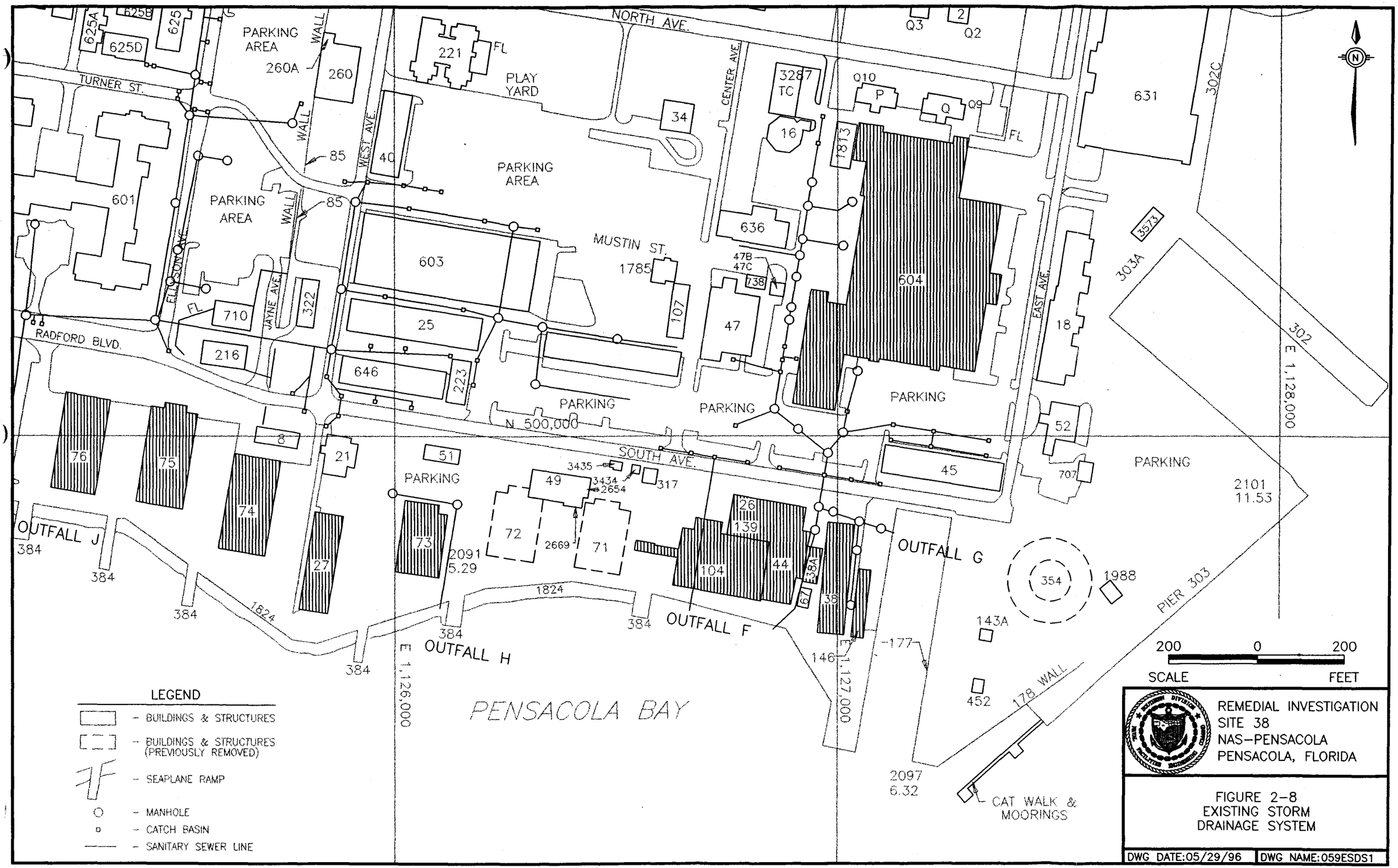
Building 38 houses Port Operations. Large bays in the building are used to maintain small boats. Shop areas and office space are in the facility. Before Port Operations moved there, the building was a machine shop for the NADEP. Sheet metal, carpentry, and welding shops were in the building during this time frame. According to engineering drawings in Building 44, Building 38 was built in 1882. The area surrounding the facility is paved with concrete and asphalt. Building 38a was used to maintain industrial instruments. No previous investigations have occurred at Building 38.

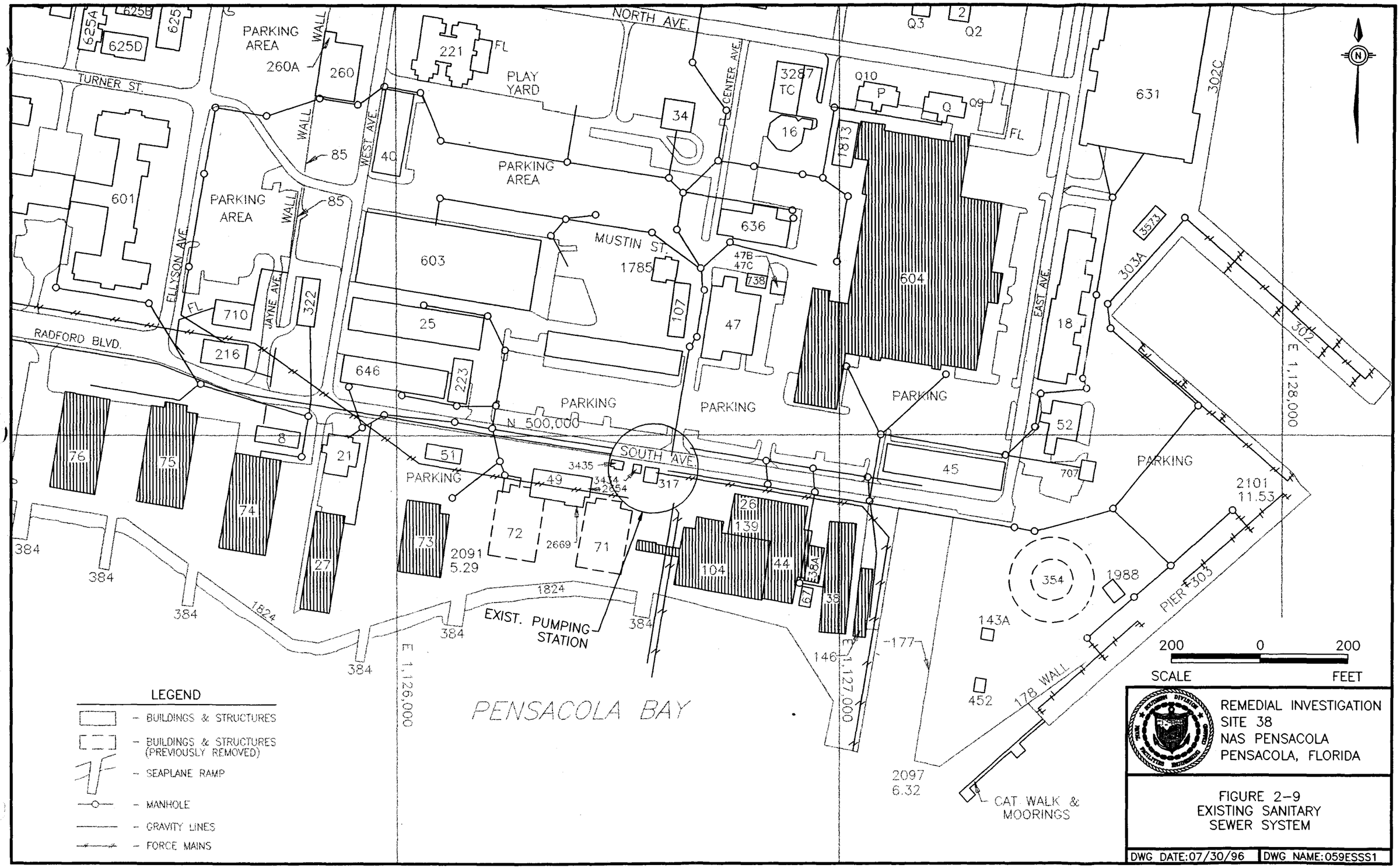
2.4.2 Building 636 Description and History

Building 636 was constructed in approximately 1940 to serve as a laundry and dry cleaning facility. The dry cleaning unit was in the southeast part of the building. The facility served as a laundry until approximately 1970, when it was converted to office space. At the time of the USEPA investigation, the building was closed. No previous investigations have occurred at Building 636.

2.4.3 Sanitary and Storm Sewer Drainage Systems

Sanitary and storm sewer drainage systems near Site 38 are shown on Figures 2-8 and 2-9. Historically, industrial waste from Buildings 71, 72, 49, and 604 were discharged via the storm drainage system to Pensacola Bay prior to completion of the IWTP line in 1973. No previous investigations of the storm drainage system have occurred. Sanitary waste from these facilities was discharged to the bay prior to the 1940s when it was routed to the sanitary sewer treatment plant.


NORTH AVE.
TURNER ST.
RADFORD BLVD.
SOUTH AVE.
MUSTIN ST.
WEST AVE.
CENTER AVE.
EAST AVE.
ELLISON AVE.
JAYNE AVE.
PARKING AREA
PLAY YARD
PARKING
WALL
FL
PENSACOLA BAY
OUTFALL J
OUTFALL H
OUTFALL F
OUTFALL G
PIER 303
178 WALL
CAT WALK & MOORINGS
N 500,000
E 1,126,000
E 1,127,000
E 1,128,000
SCALE
FEET
LEGEND
BUILDINGS & STRUCTURES
BUILDINGS & STRUCTURES (PREVIOUSLY REMOVED)
SEAPLANE RAMP
MANHOLE
CATCH BASIN
SANITARY SEWER LINE
REMEDIAL INVESTIGATION
SITE 38
NAS-PENSACOLA
PENSACOLA, FLORIDA
FIGURE 2-8
EXISTING STORM
DRAINAGE SYSTEM
DWG DATE:05/29/96
DWG NAME:059ESDS1


NORTH AVE.
TURNER ST.
RADFORD BLVD.
MUSTIN ST.
SOUTH AVE.
WEST AVE.
CENTER AVE.
EAST AVE.
ELLYSON AVE.
JAYNE AVE.
PARKING AREA
PLAY YARD
PARKING
WALL
FL
PIER 303
CAT WALK & MOORINGS
EXIST. PUMPING STATION
PENSACOLA BAY
N 500,000
E 1,126,000
E 1,127,000
E 1,128,000
SCALE
FEET
LEGEND
BUILDINGS & STRUCTURES
BUILDINGS & STRUCTURES (PREVIOUSLY REMOVED)
SEAPLANE RAMP
MANHOLE
GRAVITY LINES
FORCE MAINS
REMEDIAL INVESTIGATION
SITE 38
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 2-9
EXISTING SANITARY
SEWER SYSTEM
DWG DATE:07/30/96
DWG NAME:059ESSS1

3.0 ENVIRONMENTAL SETTING

3.1 Physiography

NAS Pensacola is in the Gulf Coast lowlands on a peninsula bounded by Pensacola Bay to the south and east and Bayou Grande to the north. The main topographic feature is a bluff paralleling the southern and eastern shorelines of the peninsula. Landward of the bluff is a gently rolling upland with elevations up to 40 feet above mean sea level (msl) (U.S. Geological Survey [USGS], 1970a/b). In the eastern part of the base, a low and nearly level marine terrace lies east of the bluff with elevations of approximately 5 feet or less above msl, constituting the areas of the former Chevalier Field and Magazine Point.

Sandy soils typify the NAS Pensacola area. Consequently, most rainfall infiltrates directly into the subsurface, resulting in few natural streams. Streams on base generally are man-made and channelized. Numerous natural wetlands occur in low-lying areas.

3.2 Stratigraphy and Hydrogeology

Stratigraphy beneath the Florida Panhandle generally consists of Quaternary marine terrace and fluvial deposits, underlain by a thick sequence of interlayered fine-grained clastic deposits and carbonate strata of Tertiary age (SEGS, 1986). Three main regional hydrogeologic units have been described within this stratigraphic column (in descending order): the Surficial/Sand-and-Gravel Aquifer, the Intermediate System, and the Floridan Aquifer System. Figure 3-1 provides a generalized cross section of these hydrogeologic units in northwest Florida.

Surficial/Sand-and-Gravel Aquifer

The Surficial Aquifer, comprising primarily unconsolidated siliciclastic sediments, is approximately 300 feet thick at NAS Pensacola. These sediments belong to undifferentiated Pleistocene-Holocene terrace deposits, the Pliocene Citronelle formation, and underlying Miocene

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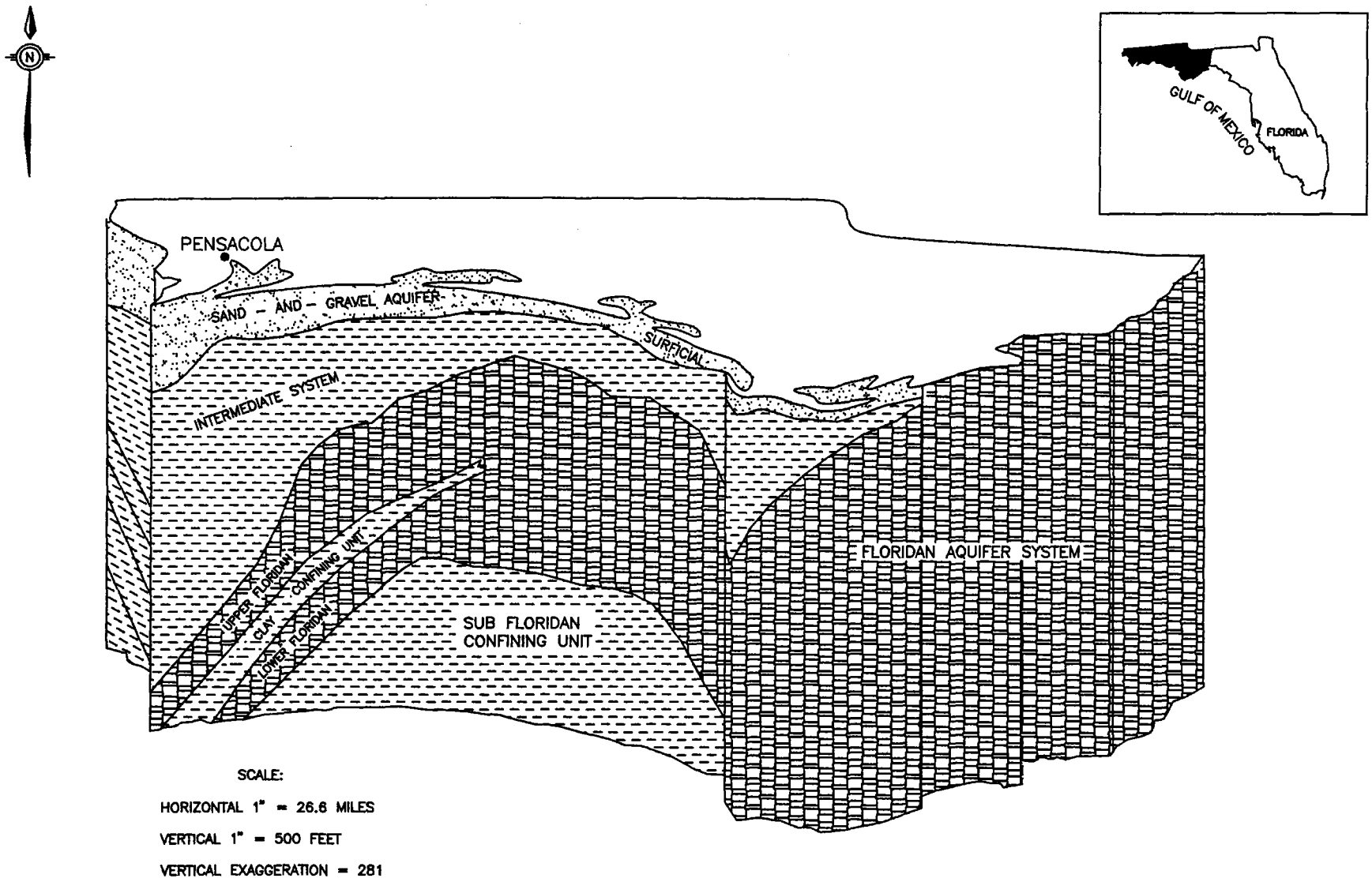

SOURCE: E&E 1992c.

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 3-1
GENERALIZED GEOLOGIC CROSS SECTION OF HYDROGEOLOGIC UNITS IN NORTHWEST FLORIDA

DATE: 08/05/96 | DWG NAME: 059SITGO

coarse clastics (Wilkins et al., 1985). West of the Choctawhatchee River in northwest Florida, the Surficial Aquifer is referred to as the Sand-and-Gravel Aquifer, and is a major source of drinking water (SEGS, 1986). The FDEP's classification of the surficial aquifer is G-1; the USEPA classification is IIA. Because the Sand-and-Gravel Aquifer is the uppermost unit contiguous with land surface and receives recharge through direct infiltration, it is susceptible to contamination from surface activities. Near NAS Pensacola, the unit has been subdivided into three distinct zones based on hydrogeologic differences (in descending order): the surficial zone, the low permeability zone, and the main producing zone (Wilkins et al., 1985). This investigation focuses on the upper (shallow depth) and basal (intermediate depth) portions of the surficial zone. Figure 3-2, a generalized cross section of the Sand-and-Gravel Aquifer produced by Geraghty and Miller (G&M, 1984) illustrates the stratigraphic relationship of these zones.

Surficial Zone

The surficial zone is contiguous with land surface and contains groundwater under water table or perched conditions. At NAS Pensacola, the surficial zone is approximately 40 to 60 feet thick and is generally composed of a poorly graded quartz sand (G&M, 1984 and 1986). Beneath the western side of the base, a substantial stratum of sand with abundant organic matter occurs within the zone and pinches out to the east. Depth to groundwater ranges from 0 to 20 feet, depending on ground surface elevation. Aquifer tests have yielded high hydraulic conductivities, on the order of 10^{+1} to 10^{+2} feet/day (ft/day) (E&E, 1990). The lower contact with the low permeability zone is transitional, resulting in a fining downward sequence in the lower portion of the surficial zone proper. Generally, this transitional zone, is thicker to the west, and thins to the east. This increased clay content in the transition from surficial to the low permeability zone is responsible for the lower hydraulic conductivities that have been measured in the base of the surficial zone. Shallow groundwater flow in the surficial zone is generally influenced by topography, usually flowing toward and discharging to the nearest surface water body.

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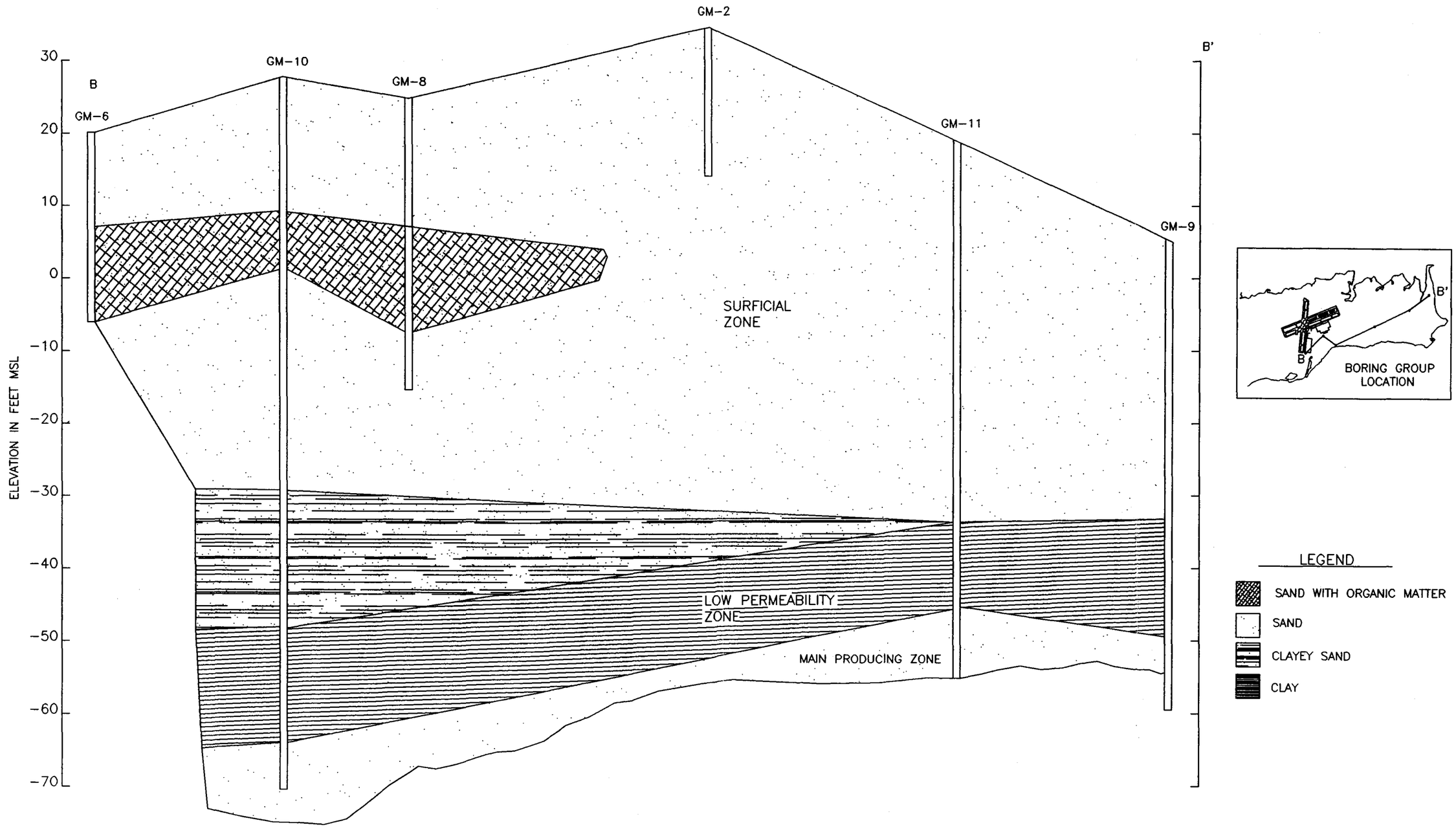

SOURCE: GERAGHTY & MILLER, 1986

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 3-2
GEOLOGICAL CROSS-SECTION
OF THE SURFICIAL AQUIFER
AT NAS PENSACOLA

DATE: 07/30/96 | DWG NAME: 059SITCS

Low Permeability Zone

The low permeability zone underlies the surficial zone and is characterized by clay and silt-sized sediments. At NAS Pensacola, this zone comprises gray to blue-gray sandy and silty marine clay with some shell fragments and clayey sands, with total thickness ranging from 8 to 40 feet (G&M, 1984 and 1986). The upper contact is transitional with the overlying surficial zone; however, the top of the low permeability zone is marked by the first occurrence of a stiff blue-gray clay. Studies at NAS Pensacola indicate the low permeability zone is continuous beneath the air station. Hydraulic conductivities of the low permeability zone are much lower than the overlying surficial zone, ranging between the orders of 10^{-4} feet/day for clays and 10^{+0} feet/day for clayey sands (G&M, 1986). Hence, the low permeability zone acts as a confining or semiconfining layer to inhibit groundwater flow between the overlying surficial and underlying main producing zone.

Main Producing Zone

The main producing zone underlies the low permeability zone and constitutes the bottom portion of the Sand-and-Gravel Aquifer. Regionally, depth to the top of the zone ranges from 60 to 120 feet. The zone is composed of sand and gravel with thin beds of silt and clay, and is estimated to be approximately 300 feet thick at NAS Pensacola. Of the three zones in the Sand-and-Gravel Aquifer, this one is generally the most permeable and is the principal source of water supply for the Pensacola area (Wilkins et al., 1985). Groundwater in this zone generally is confined. It recharges primarily north of southern Escambia County and is supplemented by leakage in the northern parts of the county, where it is present at the surface. Regional groundwater flows generally east toward Pensacola Bay and south toward the Gulf of Mexico. Three supply wells at NAS Pensacola produce water from this zone; however, they are used only as an emergency supplement to the base water supply, to irrigate the base golf course, and for fire protection due to the water's high iron content (G&M, 1984 and 1986). For potable water, NAS Pensacola depends on offsite water provided from main producing zone wells at Corry Field, approximately three miles to the north.

Intermediate System

The Intermediate System, a regionally and vertically extensive, laterally persistent hydrologic unit, underlies the Surficial/Sand-and-Gravel Aquifer. The system is comprised of fine-grained clastic units of Miocene age (Pensacola Clay, Alum Bluff Group) that lie beneath coarse clastics of the overlying Sand-and-Gravel Aquifer. In the NAS Pensacola vicinity, depth to the top of the unit is approximately 300 feet, with a thickness of approximately 1,100 feet (Wilkins et al., 1985; SEGS, 1986). The system is regionally characterized by poor to non-water-bearing conditions. Permeabilities are much lower than those of the overlying Sand-and-Gravel Aquifer and the underlying Floridan Aquifer System, and consequently the system functions as a confining unit for the underlying Floridan Aquifer System (SEGS, 1986).

Floridan Aquifer System

The Floridan Aquifer System underlies the Intermediate System at an approximate depth of 1,400 feet in the NAS Pensacola area. The unit is predominantly limestone, but is separated into upper and lower units by a significant clay layer called the Bucatunna Clay (see Figure 3-1). Groundwater within the Floridan System is highly mineralized in the area of NAS Pensacola and is not used for water supply (Wagner et al., 1984). However, groundwater from the Upper Floridan Aquifer is used for water supply approximately 25 miles east of NAS Pensacola.

3.3 Ecological Setting

3.3.1 Regional Ecological Setting

According to Wolfe et al. (1988), the Florida Panhandle has a wide variety of surface waters and physiographic regions, leading to an ecological diversity found in few other areas of the United States. Watersheds of the panhandle support a diverse array of habitats and vegetative communities. Bottom land hardwoods predominate in river floodplains and pines, mixed with a variety of other shrubs, prevail in upland areas. Wetlands are prevalent along the coastal fringe and river floodplains. Barrier islands support dune vegetation communities and salt

marshes. Bays supporting seagrass meadows and oyster reefs are present in intertidal and subtidal areas.

Seven major rivers in the region discharge into seven bar-built estuaries formed at the mouths of the rivers. The Florida Panhandle is a crossroads where animals and plants from the Gulf Coastal Plain reach their eastward distributional limits, and where many northern species reach their southern limits. Many peninsular Florida species are also distributed there. Due to the wet temperate climate of the region, the panhandle area may support the highest diversity of species of any other similar-size territory in the U.S.

The high annual rainfall and low, gently sloping terrain create numerous wetlands in the region. Bogs, swamps, marshes, wet prairies, and wet flatwoods provide a diversity of wetland types supporting a wide variety of flora and fauna. Terrestrial vegetation includes open pine woods and hardwood forests; most are second-growth forests of pines and encroaching hardwoods.

The Florida Panhandle's estuaries and nearshore marine habitats are some of the greatest natural and economic assets of the region. Important commercial organisms (such as oysters and fish) abound in these areas and contribute to the region's economy. Coastal saltmarsh habitats provide critical nursery, feeding, and refuge for these important commercial species. Seagrass beds within estuaries also are vital to the seafood industry.

3.3.2 Ecological Setting at NAS Pensacola

NAS Pensacola, which occupies approximately 5,800 acres, is bounded by Bayou Grande to the north and Pensacola Bay to the east and south. To the west, the installation transitions to less developed swampy lowlands. NAS Pensacola's eastern portion is largely developed, with military and industrial facilities and historical/cultural sites. Most of the installation's activities are on the eastern side of the base. The less developed west side of the base has approximately 3,500 acres of natural or seminatural beaches, forests, and wetlands.

NAS Pensacola is the setting for numerous aquatic and terrestrial habitats, from coastal strand and estuarine environments along the bay and bayou to inland pine flatwood communities. Wetland environments include a broad spectrum of both estuarine and palustrine varieties, as well as various disturbed habitats, many in states of recovery as they undergo reforestation or return to their natural condition.

Vegetation Communities

NAS Pensacola natural vegetation communities fall into several broad categories: (1) coastal dune scrub communities, (2) pine flatwoods communities, (3) hardwood/pine communities, (4) sand pine scrub communities, (5) bay swamps, (6) freshwater marshes, and (7) estuarine coastal marshes (USFWS, 1987). Coastal dune scrub communities are associated with shorelines subject to high-energy waves. The vegetation consists of salt-tolerant plants able to establish themselves in shifting sands. Pine flatwood communities in coastal lowlands are characterized by trees that can tolerate various soil moisture conditions. Tree species in flatwood communities are short, with a wide variety of small shrubs and herbaceous plants in the understory. Hardwood/pine communities are a highly diverse mixture of hardwood trees and pines. Sand pine scrub communities on well-drained sandy soil contain sand pines, oaks, and various shrubs. Bay swamps are wetlands with titi and cypress swamps known to contain permanent standing water and high accumulations of organic peat. Freshwater marshes occur as grass/sedge/rush/herb communities in areas with high soil saturation or standing water. Estuarine coastal marshes, including salt marshes, occur along low-energy shorelines and in tidal bayous (USFWS, 1987).

Wildlife

NAS Pensacola habitats provide potential ranges for a wide variety of animal life such as deer, squirrel, opossum, raccoon, fox, beaver, and bobcat. The station's beaches serve as resting, feeding, and nesting areas for various shorebirds. Ospreys have been observed nesting along undeveloped shoreline areas of the Big Lagoon, southeast of the Forrest Sherman Airfield.

Numerous small mammals, amphibians, and reptiles also inhabit the base. The coastal marsh, submerged grass bed, and shallow water habitats at NAS Pensacola help support fishery communities within the Pensacola Bay estuarine complex. Approximately 180 species of bony fishes form the basis of the Pensacola Bay fish community (USFWS, 1987).

Threatened and Endangered Species

Appendix A of the *Comprehensive Natural Resources Management Plan for NAS Pensacola and Outlying Field Bronson* (USFWS, 1987) lists the rare, threatened, and endangered species that may be found within NAS Pensacola boundaries. E/A&H investigations of different areas of NAS Pensacola have identified osprey, great blue heron (as well as other shorebirds), alligator snapping turtle, Godfrey's golden aster, Carolina lilaeopsis, white-top pitcher plant, and narrow-leaved sundew. All are considered rare or endangered for Escambia County, Florida, by the Florida Natural Areas Inventory (1995).

3.4 Area Climate

The Pensacola area has a mild, subtropical climate with average annual temperature ranging from 55°F in the winter to 81°F in the summer. Daily temperatures can be more extreme, ranging from less than 7°F in the winter to more than 102°F in the summer. Thunderstorms, which occur on approximately half the summer days, can cause a precipitous drop in temperature of 10 to 20 degrees in a matter of minutes (E&E, 1992a).

November is the driest month of the year, with an average rainfall of 3.2 inches, based on climatological data from 1962 to 1991. Rainfall averages approximately 60 inches a year, with the highest amounts in July and August when thunderstorms occur almost daily. Thunderstorms resulting in 3 to 4 inches of rain in an hour are common. Rainfall is lowest during spring and fall (4 inches average per month). In general, spring and fall rains are less intense, last longer, and produce less surface runoff, but higher rates of infiltration and net recharge (E&E, 1992a).

Winds, which prevail from the north during the winter and the south during the summer, are generally moderate in velocity, except during thunderstorms. A difference in the ocean-land temperature produces the sea-breeze effect, a daily clockwise rotation in the surface wind direction near the coast. Hurricanes and tornadoes can substantially damage the nearshore environment. Since 1980, eight hurricanes have passed within 50 miles of Pensacola, the most recent being Hurricanes Erin and Opal in August and October 1995, respectively.

4.0 PRELIMINARY INVESTIGATIONS

4.1 Aerial Photograph Analysis

Aerial photographs from 1951 to 1991 were examined during the Site 38 preliminary field investigation. Review of the photographs did not indicate any potential environmental impacts to the site. Physical changes to the area were noted, but the building configuration remained basically unchanged.

Photographs from 1951 show a roadway extending from Building 71 across South Avenue to north of Building 45. Photographs from 1970 show traces of the construction of the IWTP sewer line near Buildings 71 and 72. Photographs from 1981 and 1986 show that the area around Buildings 71 and 604 was repaved. The roadways and parking appear as the present configuration with South Avenue as the main roadway. The roadway shown in the 1951 photograph is now part of the parking lot between Buildings 604 and 45. Photographs from 1991 show material stored in the storage yard; however, the scale is too small to identify them.

4.2 Site Reconnaissance

A visual reconnaissance of Buildings 71 and 49 was conducted on July 7, 1993. A stained area at the southwest corner of the northern building section was noted as a possible release site. All drainage trenches were inspected for sediment accumulation for potential sampling locations, but insufficient quantities of sediment were observed. The observations of the site survey are summarized below. Building 71 was demolished in September and October of 1993. Currently, the site where Building 71 stood is being used by MWR for parking large moving trucks.

4.2.1 Inside Building 71

Building 71 was a steel frame structure with metal siding and a concrete slab foundation. The building was divided into a northern and southern section by a concrete block wall. The concrete floor in both sections was etched, probably due to numerous acid spills. As described

in Section 2, solvents and solutions were allowed to spill onto the surface and flow into the drainage trenches during stripping.

Northern Half

The northern half of the building was basically an open area with large hangar doors at the east and west ends. Small rooms at the northern end of the open area were bathrooms and showers, offices, and supply areas. Curbs forming six bays along the central dividing wall and a berm labeled "flammable storage" were in the northeast corner of the open area.

The floor of the flammable storage area appeared stained and the southwest corner of the northern section was stained with a tar-like substance that apparently had dripped from piping attached to the central dividing wall. Phenol was detected when the ambient air at the pipe opening was tested by Draeger tube.

Three parallel drainage trenches trended east-west in the floor. The floor slab was inclined toward the drains. Insufficient sediment accumulation for sampling was noted in the trenches. No staining, pitting, or etching of the concrete in the trenches was observed.

Southern Half

The southern half of the building had an upper level across the southern end that was constructed of wood. Its function was not determined. Hangar doors were at the east and west ends, but the doors on the east end were blocked by two large vats and a small cinder block room which had been added to the northeast corner of the southern section.

A drainage trench trending east-west in front of the vats discharged through a drainage trench in the center of the south wall. This is one outlet where waste solutions were likely discharged into the bay. This outlet was connected to the IWTP sewer line in 1971.

Tanks, with an estimated volume of 500 gallons, were along the east and south walls of the southern section. These tanks emitted a strong odor; however, a photoionization detected (PID) survey did not indicate VOC vapors at more than twice reference concentrations in the open room or from the tanks. Some tanks were labeled "chromic acid," "paint stripping," and "epoxy paint stripping."

A 1,000-gallon tank with a heating element in the bottom was mounted in a subfloor vault near the east center of the south section. A second unit just west of this tank had a lid with a counterbalance. Both tanks had a catwalk around them for passage over the subfloor vault, which was estimated to be 5 feet deep. No drains were visible from above; however, the subfloor vault was not entered to determine if drains extended from the base of the tanks.

Along the central dividing wall several curbs were likely footings for additional vats. Piping along the dividing wall was also likely part of the stripping system.

Several old packages of C rations, first-aid kits, and parachutes were observed in the west central area of the southern section. Green fluorescent rescue dye from a parachute pack had apparently discharged in the building and had drained into the vault near the central tanks.

4.2.2 Building 71 West Yard

The yard west of former Building 71 is covered by 8 to 12 inches of concrete which appeared moderately etched, possibly due to natural weathering. In the storage yard, two drainage trenches trend north-south and parallel most of the building. One drainage trench paralleled Building 49 and emptied into the north end of the north-south drainage trench closest to Building 71. The two main drainage trenches in the yard discharged to a fourth east-west trending trench along the southern end of the yard. The trenches were grated and, therefore, were not protected from storm water runoff.

The trench system discharged into two sediment traps at the south end of the yard that emptied to the bay until 1971, when the IWTP gravity lines were installed along the south side of Building 71. The trenches and traps contained insufficient sediment for sampling.

4.2.3 Building 49

Building 49 is at the north end of the west yard and was empty during the site walkover. The building is a single-story wood frame on a concrete slab. The main area apparently was a shop; offices occupied the rest of the building. The shop area at the southeast building corner opened to the yard; the two areas were connected by a ramp from the building to the concrete surface of the yard. The wooden shop floor had rotted, showing the concrete slab below and a concrete-lined sump about 2.5 feet deep at the southeast corner. The condition of the sump could not be determined by visual inspection during the site visit. The northernmost east-west drainage trench of the yard was at the bottom of the ramp.

4.2.4 IWTP Sewer Line

Visual inspection of the IWTP sewer line was not attempted. As detailed in Section 2, telespection of the IWTP sewer line was performed in 1987, and groundwater was observed to be infiltrating the sewer line. The sewer line was located for E/A&H by the engineering section of NAS Pensacola PWC. An 8-foot long section of the force-main line was exposed during fuel line construction in this area. The line was a 10-inch diameter steel pipe in good condition.

4.2.5 Building 604

USEPA completed a Preliminary Environmental Assessment Report in February 1995 to determine if Building 604 had sustained any environmental impact and to generate recommendations for transition to the Installation Restoration Program (IRP). The report is included in Appendix B. Investigation of Building 604 was recommended and completed as part of the RI for Site 38 by the USEPA in September and October 1996.

4.3 Contaminant Source Survey

The CSS was conducted to determine past and present site activities related to known or suspected releases of contamination to the environment. In addition, the CSS was conducted to delineate areas that might be former or present sources of contamination.

Components of the contaminant source survey included:

- Review of previously reported site history
- Review of available documents and records of site contamination.
- Interviews with current and former NAS Pensacola employees who worked onsite.
- Review of surrounding site activities which could possibly impact the site.

It should be noted that because the original study area for Site 38 was predominantly centered around Building 71, many components of the CSS and field screening surveys were not performed in the Building 604 study area. Available information can be found in the USEPA report in Appendix B. References to Site 38 in the following subsections refer to the original site area, Building 71.

4.3.1 Interview — Ed Pike

Ed Pike, who worked in Building 71 during part of the stripping operations, was later assigned to the NAS Hazardous Waste/Material Management office. The following narrative is from notes of the interview with Mr. Pike (Pike, 1993).

Building 71

The northern half of the building and the west yard were used for aircraft paint stripping. The southern half was used to clean aircraft parts. After NADEP moved from Building 71 in 1976, the northern half of the structure was used to store hazardous waste (1981 to 1989). The southern half stored survival materials and medical department books or records.

The northern section of Building 71 was modified for hazardous waste storage when six drum storage bays were constructed along the central dividing wall. In 1989, the northern half was clean-closed under RCRA (EnSafe, 1989). RCRA closure was not required on the southern half of the building since hazardous wastes were not stored there.

Building 49

This area was used in the stripping operations but Mr. Pike did not know its exact function. Empty drums were reportedly stored in Building 49 when Building 71 was used for hazardous waste storage. Mr. Pike believed the wooden floor was underlain by concrete, which was verified by reconnaissance. A concrete sump was also present at the southeast corner of the building.

Mr. Pike recalled two tanks at the northwest corner of Building 71. One stored paint stripper; the second tank's contents were unknown.

4.3.2 Interview — Frank Stewart

The following narrative is from the interview with Frank Stewart, who worked in Building 71 during the stripping operations (Stewart, 1993). Three solvents were generally used in the stripping process:

- Methylene chloride-based phenolic stripper
- Heated tank type material (Mr. Stewart did not know the substances used in the heat bath.)
- Acrylic strippers, amino activated, methylene chloride-based

Operations in Building 71 included aircraft and parts stripping, chromic acid processes, and surface treatment for aluminum. Mr. Stewart worked with the acids, which he stated had etched the concrete floor. He also said that the entire floor of Building 71 and the west yard were completely covered with concrete during the entire operation of the building. Mr. Stewart commented that paints were lead-based and that cadmium may have been stripped from aircraft parts. In addition, above ground tanks, which were previously north-northwest of Building 71, were removed approximately six years ago (approximately 1988).

Building 104/44, east of Building 71, contained an old steam cleaning operation and a paint booth at the northwest corner of the building. This building currently stores durable domestic goods.

4.3.3 Building 604 Underground Storage Tank

Mr. Mark Spitznagle provided information concerning the UST at Building 604. Originally, Building 604 was a dirigible hangar. The southern area of the building was used as a landing gear shop for several decades. Operations required cleaning parts and equipment with solvents from the UST, which was just outside the door on the south side of the building (Figure 4-1). Reportedly, solvent was hand-pumped from the UST into 5-gallon buckets and carried inside the building. The solvent was poured into squirt bottles for daily use in the landing gear shop.

4.4 Habitat and Biota Survey

Site 38 is almost completely covered by asphalt or concrete and is in an industrialized area of the base, precluding terrestrial habitat and vegetated communities. Pensacola Bay is approximately 50 feet south of the Building 71 area and is the only surface water body adjacent to Site 38. This section of Pensacola Bay is being investigated under the Site 2 RI; therefore, the habitat and biota survey and any potential impact to ecological resources in the adjacent surface water body will be discussed in that report.

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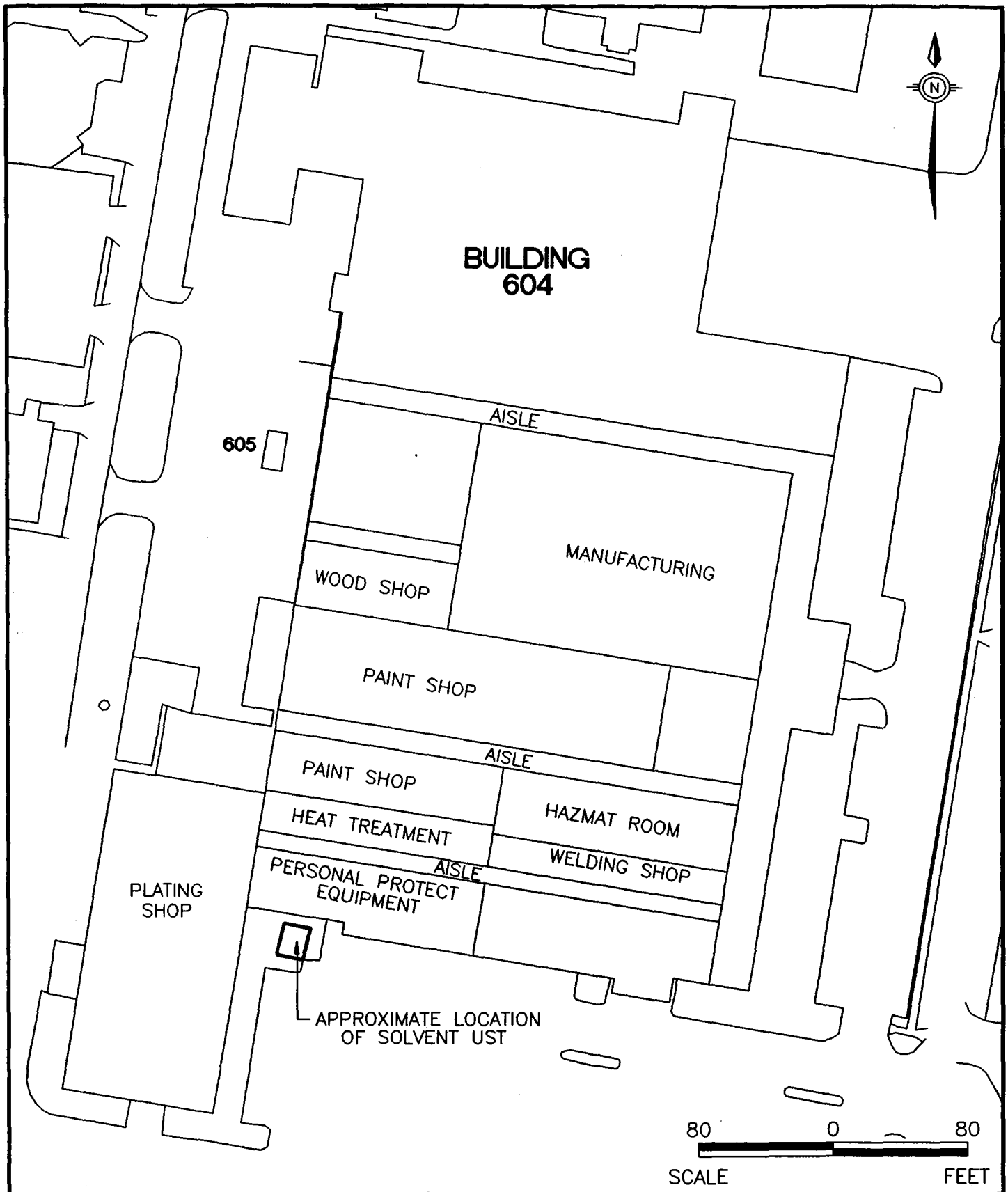

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 4-1
SITE 38
SOLVENT UST LOCATION

DWG DATE: 08/07/96 | DWG NAME: 59S38SUL

4.5 Field Screening Surveys

Site 38 was systematically surveyed to identify areas emitting contaminants to the atmosphere. The results of these surveys were used to target soil boring and monitoring well locations. Two techniques were used.

- Emissions of VOCs and radiation into the atmosphere were surveyed to screen for surface or near-surface contamination.

- Soil-gas and groundwater screening surveys were used to assess soil and groundwater contamination.

The results of the screening surveys are qualitative interpretations of field conditions and do not replace laboratory analyses of soil and groundwater samples. These screening techniques do not assess the presence of nonvolatile or nonradioactive contaminants such as heavy metals and pesticides.

4.5.1 Grid System

E/A&H personnel superimposed a 50-foot by 50-foot grid over the Building 71 area in May 1993 (Figure 4-2) using standard survey methods. Baselines were established along the north and west site boundaries. Interior points were surveyed relative to the baselines, except inside Building 71, which was condemned. Additional locations were added at 25-foot grid nodes around locations where analysis indicated total volatile hydrocarbons above 25 μg/L or a single chlorinated hydrocarbon compound above 10 μg/L.

4.5.2 Surface Volatile Emissions Survey

A surface volatile emissions survey was conducted across Site 38 on July 17, 1993. Measurements were collected at each of the 50-foot grid nodes. The 50-foot grid did not extend

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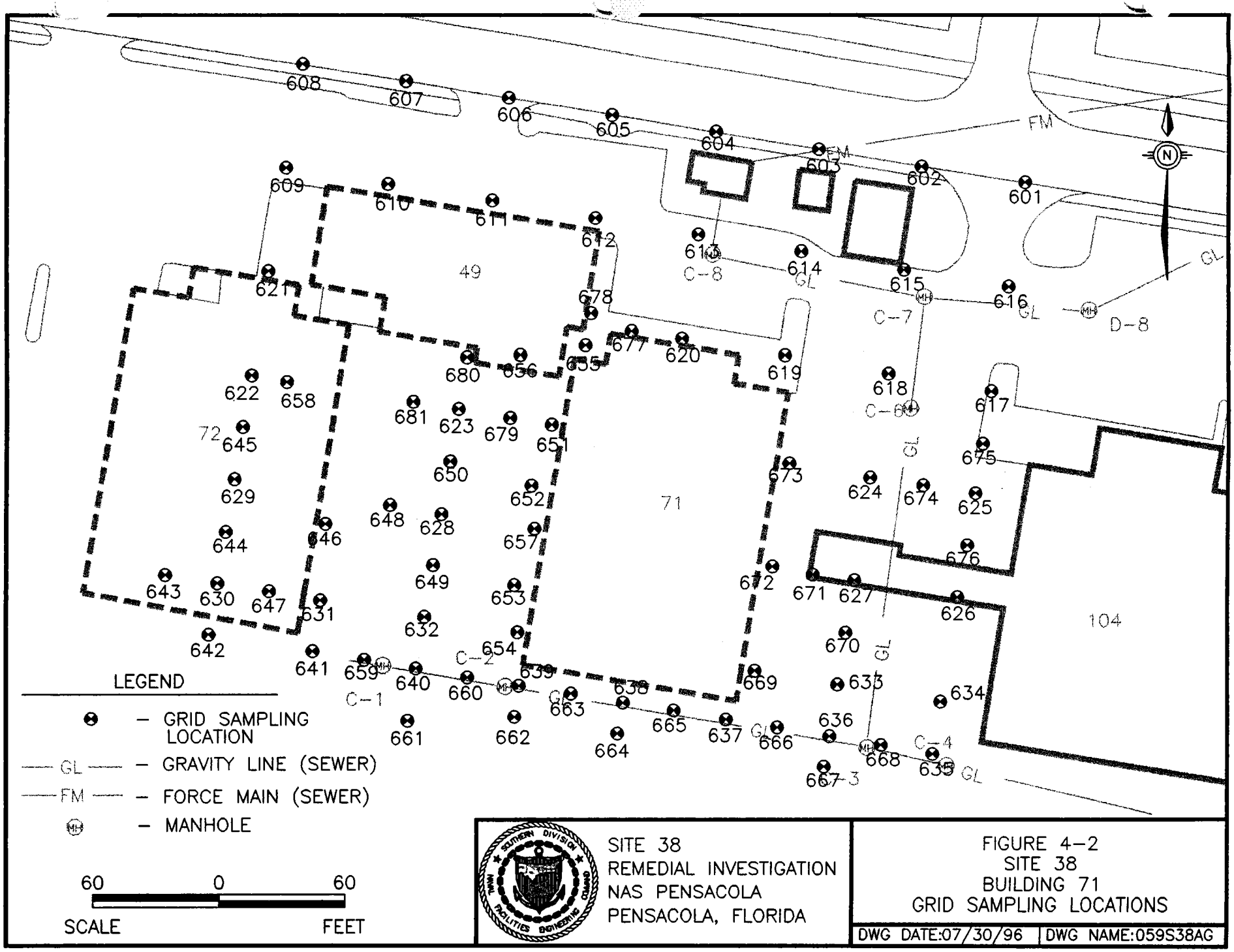

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 4-2
SITE 38
BUILDING 71
GRID SAMPLING LOCATIONS

DWG DATE:07/30/96 | DWG NAME:059S38AG

inside Building 71; however, biased points were measured during site reconnaissance inside the building.

A Photovac MicroTIP PID was used to measure organic vapor concentrations at each station at approximately 1 inch and at 3 feet above the ground surface. Volatile emissions above reference concentrations were not measured at any sampling locations. PID responses were less than 1 part per million (ppm) and were similar to general reference concentrations in the area.

4.5.3 Radiation Survey

A radiation survey was conducted by screening for radium-226 on July 16, 1993. Readings were collected at the same stations and heights as the surface emissions survey. Gamma emissions were screened with a Victoreen 190 "pancake" radiation meter and collected at each station over 30-second cumulative intervals for each height. Table 4-1 summarizes the radiation screening results. The radiation concentrations ranged from 2 to 11 micro-REMs (Roentgen equivalent man) per hour (μR/h). The readings do not vary greatly across the site, suggestive of general background conditions.

4.5.4 Soil-Gas Survey

Target Environmental Services, Inc. completed a soil-gas survey of the Building 71 area of Site 38 in June and July 1993. Data collected under this survey were classified as Data Quality Objective (DQO) Level II. The soil-gas report for Site 38 is presented in Appendix D.

Soil-gas samples were collected from a plunger-driven hole in the soil through a probe and tubing. Samples were collected to within 6 inches of the water table. The depth to water was measured at various stations throughout the site either by observing a moisture mark on the retrieved plunger bar or by noting water filling the clear intake hose upon application of suction. Groundwater was typically encountered 5 to 7 feet bls.

Table 4-1
Radiation Survey Results 07/16/93

Point	μR/hr @ 3 inches	μR/hr @ 3 feet	Point	μR/hr @ 3 inches	μR/hr @ 3 feet
622	4	4	632	3	3
658	3	3	654	3	2
645	3.5	4	653	3	3
629	3	3.5	657	2.5	2.5
643	3	3.5	628E	4	4
630	3	3	628	5	4
647	3	3	648	4	4
644	3.5	3.5	650	3	4
631	3	3	680	4	3
646	3	3	651	3	3
656	5	5	655	4	5
623	5	4	665	4	3
680	4.5	5	637	4	3
679	3.5	4	666	3	3
642	3	3	636	4	4
642E	4.5	4	667	3	3.5
641	3	3	668	3	4
641S	5	4	635	4	4
640	5	4	634	8	8
661	3	4	633	3.5	3
639	3	3	669	3.5	2.5
662	5	4	670	3	3
663	3	3.5	626	11	7
638	4	3	627E	8	5

Table 4-1
Radiation Survey Results 07/16/93

Point	μR/hr @ 3 inches	μR/hr @ 3 feet	Point	μR/hr @ 3 inches	μR/hr @ 3 feet
664	4	3.5	627	4	3
624S	4	3	671	4	4
676	10	10	672	2.5	3
625	8	8	620N	7	5
674	7	7	616	5	6
624	4	4	615	7	7
673	3	3	614	6	5
617	5	5	613	6	5
675	5	5	612	9	9
618	6	5	611	11	9
619	5	5	610	10	9
620E	5	5	609	6	5
620	5	4	608	5	5
677	7	5	607	5	5
678	5	4	606	5	7
603	5.5	5	605	6	5
602	6	5	604	6	7
601	6	5	—	—	—

To assess the accuracy and representativeness of the soil-gas survey, field quality assurance/ quality control (QA/QC) samples were collected, including a field duplicate and equipment rinsate sample for every 20 samples. A field control blank was collected for every 10 samples, as well as at the beginning and end of the day. The field control samples were labeled Sample B600 through B609; equipment rinsate blanks collected during groundwater sampling were labeled WB600 and WB601.

The soil-gas and QA/QC samples were analyzed with a portable gas chromatograph (GC) in the E/A&H field trailer the same day they were collected. Samples were analyzed using electron capture detection (ECD) and flame ionization detection (FID) for the targeted chlorinated and petroleum VOCs listed below.

GC/ECD Chlorinated Compounds:

1,1-Dichloroethylene (1,1-DCE)

cis- and trans- 1,2-Dichloroethene (c-1,2-DCE and t-1,2-DCE)

1,1-Dichloroethane (1,1-DCA)

1,1,1-Trichloroethane (1,1,1-TCA)

1,1,2-Trichloroethane (1,1,2-TCA)

Trichloroethylene (TCE)

Tetrachloroethylene (PCE)

Methylene chloride (CH_2Cl_2)

Chloroform ($CHCl_3$)

Carbon tetrachloride (CCl_4)

GC/FID

Petroleum Compounds:

Benzene

Toluene

Eethylbenzene

Xylenes

Chlorinated Compound:

Vinyl chloride

Seventy-one soil-gas samples were collected in the Building 71 area (Figure 4-1). Because they were not collected directly under the building, the actual shape of any soil-gas plume may not be fully represented. Sampling depths ranged from 2 to 4 feet due to a shallow water table; sample locations corresponded to the 50-foot grid superimposed over the site. After review of the initial data, additional soil-gas sampling locations were added at 25-foot nodal points.

Soil-Gas Results

GC/FID analysis indicated the presence of total benzene, toluene, ethylbenzene and xylenes (BTEX) and total volatile gases in the vadose zone. The reported concentrations of BTEX ranged from 1.0 μg/L to 5.0 μg/L with the mean concentration of 2.8 μg/L. Total volatile hydrocarbons ranged from 12 μg/L to 1,553 μg/L with a mean concentration of 125 μg/L (Target, 1993).

The extent of the total volatiles is shown on the isoconcentration (isocon) map presented in Figure 4-3. The higher concentrations were apparently associated with trenches in the west yard.

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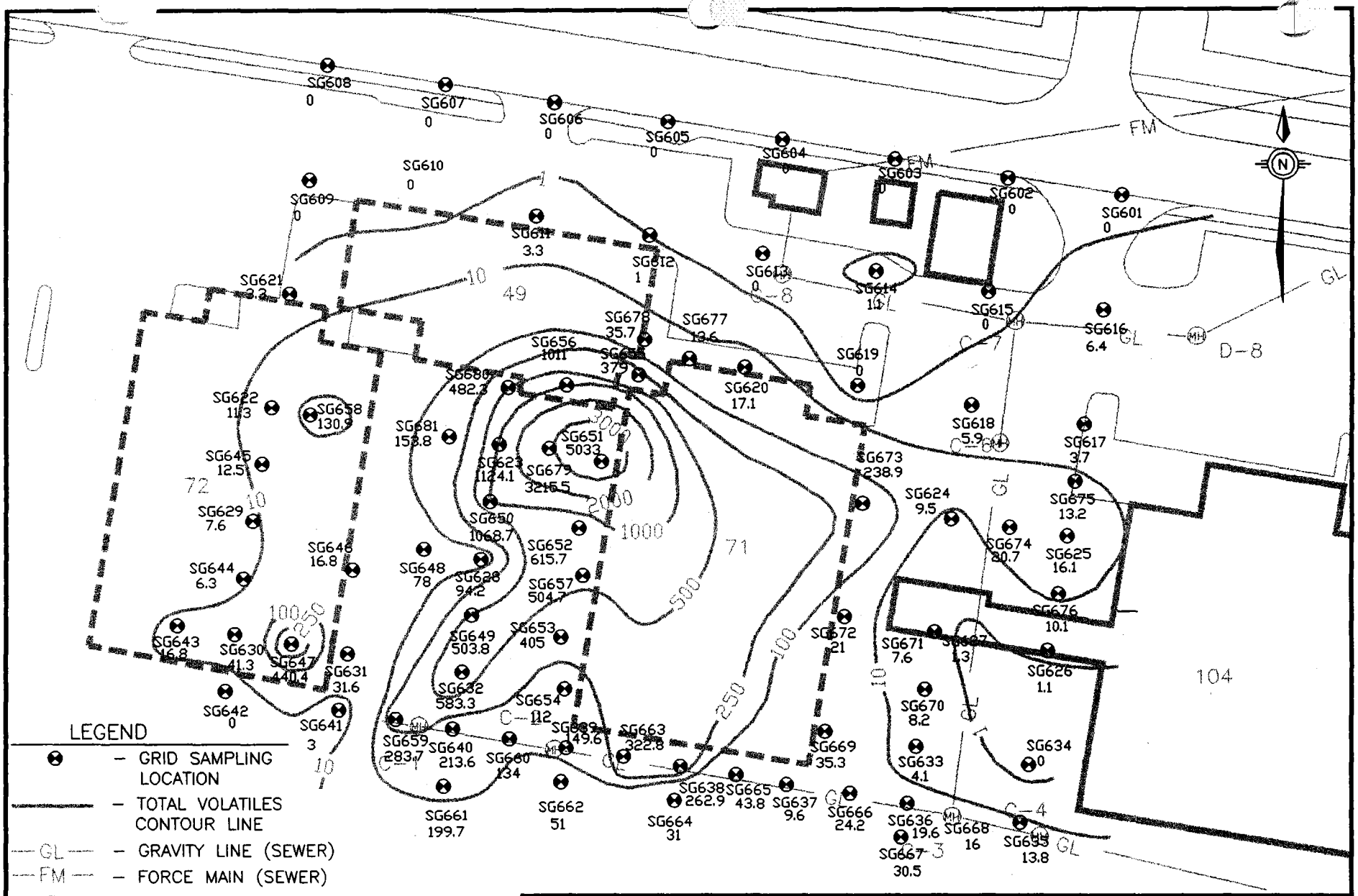

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 4-3
SITE 38
PRELIMINARY SURVEY TOTAL VOCS

DWG DATE:07/30/96 | DWG NAME:059PSTV2

The GC/ECD analysis indicated the presence of nine chlorinated hydrocarbons and two other hydrocarbon compounds. Table 4-2 lists these compounds and their range and mean concentrations. The chlorinated compounds TCE, PCE, 1,1-DCE, and 1,1,1-TCA were detected at more than half of the 71 sampling locations.

The plume distribution of these compounds was mostly limited to the west yard, similar to the distribution of BTEX and total volatile hydrocarbons, except for 1,1,1-TCA, which had a broader distribution.

Groundwater Results

Groundwater field screening samples were collected at selected grid nodes where analysis indicated total volatile hydrocarbons above 25 μg/L or a single chlorinated hydrocarbon compound above 10 μg/L. These samples, which were analyzed in the same manner as soil-gas samples, are summarized in Table 4-3 and presented in the Target report in Appendix D.

GC/FID analysis of groundwater samples detected BTEX and total volatile hydrocarbons at the following soil-gas locations: 620 (north of Building 71); 636 (southeast of Building 71); and 638 (south of Building 71). Groundwater samples collected at Location 636 had the highest detections of the following parameters (Target, 1993):

- Benzene (593 μg/L)
- Toluene (106,700 μg/L)
- Ethylbenzene (9,930 μg/L)
- Xylene (37,180 μg/L)
- Total volatile hydrocarbons (2,078,000 μg/L)

Table 4-2
Soil-Gas Results (μg/L)

Compounds	Highest Detection	Lowest Detection	Mean of Hits	Frequency
1,1-DCE	360	1.1	65.4	58/81
CH_2CL_2	88	1.0	26.4	7/81
t-1,2-DCE	2.3	1.2	1.8	2/81
1,1-DCA	91	1.1	20.5	31/81
c-1,2-DCE	151	1.6	27.5	20/81
$CHCl_3$	21	1.0	4.8	15/81
1,1,1-TCA	3,371	1.0	194.8	50/81
TCE	264	1.1	24.2	52/81
1,1,2-TCA	2.5	ND	2.5	1/81
PCE	1,127	1.0	43.9	49/81

Note:
ND = not detected at or above the instrument detection limit

Table 4-3
Groundwater Screening Results (μg/L)

Compounds	Highest Detection	Lowest Detection	Mean of Hits	Frequency
Benzene	593	ND	53.9	1/11
Toluene	106,700	68	9,718	3/11
Ethylbenzene	9,930	2,730	2,017	3/11
Xylene	37,180	3,585	4,960	3/11
Total FID	2,078,000	76,050	210,268	3/11
1,1-DCE	285	1.4	43.9	4/11
1,1-DCA	885	2.0	109	4/11
c-1,2-DCE	150	70	20	2/11
$CHCl_3$	96	ND	9	1/11
1,1,1-TCA	216	63	25.9	3/11
TCE	2,721	2.8	247.6	2/11
PCE	4,754	ND	432	1/11

Note:
ND = not detected at or above the instrument detection limit

Groundwater collected at Location 638 had the greatest frequency of chlorinated compounds detections and included the following parameters (Target, 1993):

- 1,1-DCE (285 μg/L)
- 1,1-DCA (885 μg/L)
- c-1,2-DCE (150 μg/L)
- $CHCl_3$ (96 μg/L)
- 1,1,1-TCA (216 μg/L)
- TCE (2,721 μg/L)
- PCE (4,754 μg/L)

Other locations with multiple detected chlorinated compounds include 625, 636, and 639. Only 1,1-DCE was detected at Location 640.

5.0 FIELD INVESTIGATION AND METHODOLOGY

The field investigation for Site 38 was completed through multi-phase effort by E/A&H and the NAS Pensacola BRAC Team. The BRAC Team consisted of representatives of the U.S. Navy and USEPA. The approved work plan, SAP, and SAP addendum outlined the soil and groundwater investigation for the former Building 71 and/or IWTP sewer line segment. The IWIP line investigation took place in February 1993. The initial investigation of Site 38 (Building 71 area) took place between July 1993 and January 1994. Based on the review of the initial phase of work (Draft RI report for Site 38; E/A&H, 1994a) additional sampling was required to adequately delineate the extent of contaminated soil and groundwater. This phase of the investigation was led by the USEPA and performed by the BRAC Team. The SAP for Site 38 (Building 604) (USEPA, 1995) outlined the USEPA confirmation sampling and additional investigation of the Building 604 study area. This investigation occurred in [September and October 1995]. Because the results of each phase of work indicated two potentially different source areas for contaminants, Site 38 is divided into two study areas, as shown on Figure 5-1.

Soil and groundwater were sampled in accordance with the procedures outlined in the Site 38 SAP, the addendum SAP for the associated IWTP sewer line, the Site 38 SAP (Building 604) and the USEPA Region IV *Standard Operating Procedures and Quality Assurance Manual* (SOP/QAM; USEPA, 1991a). Sampling locations and methods employed by E/A&H are discussed in Sections 5.1 through 5.6. BRAC Team sampling efforts are discussed in Section 5.7.

5.1 Soil and Groundwater Assessment

5.1.1 Analytical Parameters

Soil and groundwater samples were collected for contamination assessment and physical characterization. Contamination assessment samples provided a basis for assessing the nature and extent of site contamination. Physical characterization samples assessed specific subsurface

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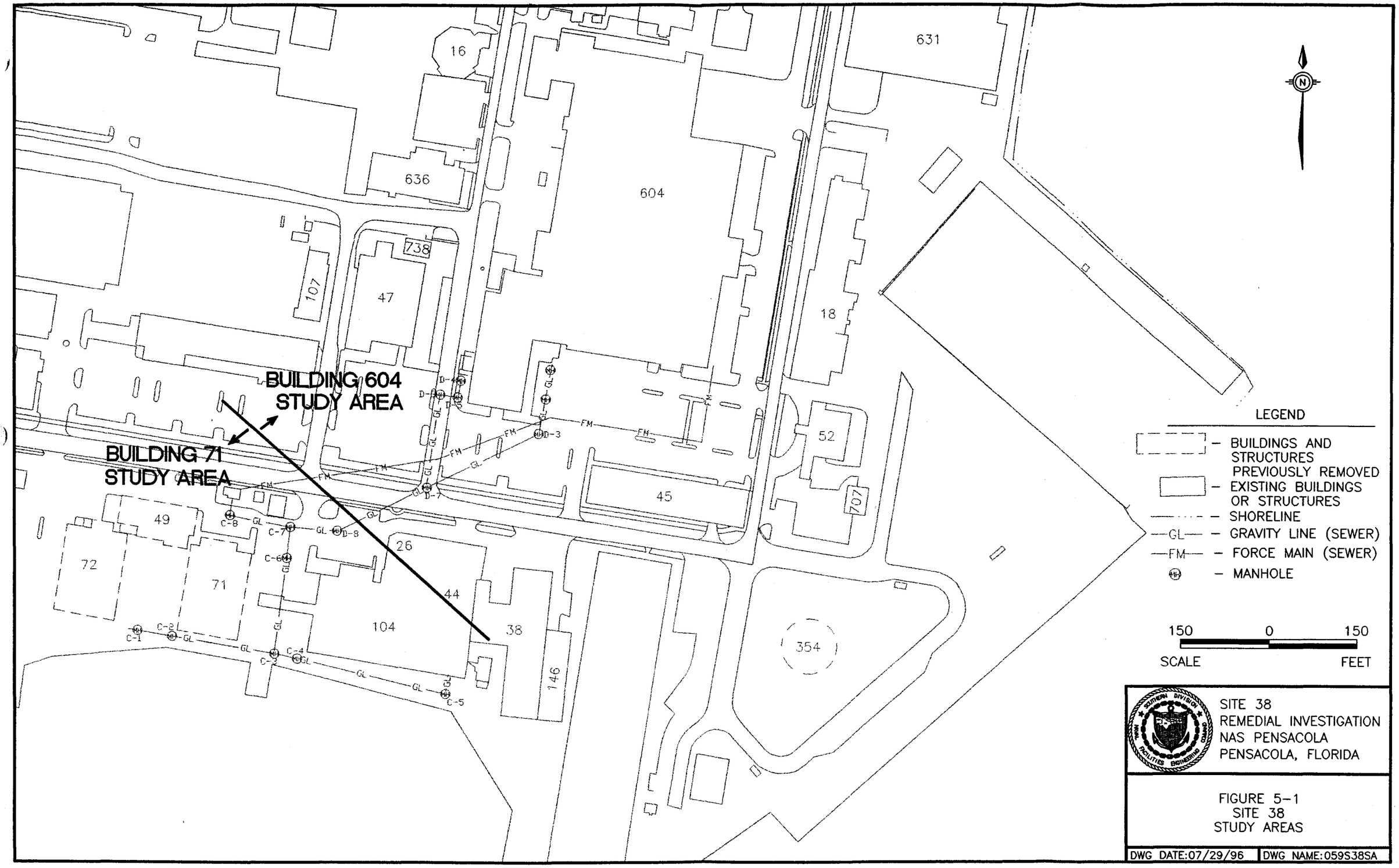
BUILDING 604
STUDY AREA
BUILDING 71
STUDY AREA
16
631
636
604
738
107
47
18
52
707
45
49
72
71
26
44
104
38
146
354
D-4
D-3
D-7
D-8
C-8
C-7
C-6
C-1
C-2
C-3
C-4
C-5
GL
FM
LEGEND
BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
EXISTING BUILDINGS OR STRUCTURES
SHORELINE
GRAVITY LINE (SEWER)
FORCE MAIN (SEWER)
MANHOLE
150 0 150
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 5-1
SITE 38
STUDY AREAS
DWG DATE:07/29/96
DWG NAME:059S38SA

migration pathways and properties of the site media for possible use in later remedial design, modeling, and/or migration studies, if needed.

Soil samples for contamination assessment were analyzed by International Technologies Analytical Laboratories of Knoxville, Tennessee; groundwater samples were analyzed by National Environmental Testing Laboratories of Bedford, Massachusetts, and Thorofare, New Jersey. All samples were analyzed in accordance with full Contract Laboratory Procedures (CLP) for Target Compound List (TCL) and Target Analyte List (TAL) parameters. The soil and groundwater sample analyses are listed in Table 5-1. Soil and groundwater samples analyzed for chemical-physical parameters were submitted to Savannah Laboratories of Mobile, Alabama. Soil samples analyzed for physical parameters were submitted to Thompson Engineering and Testing Laboratory of Mobile, Alabama. Samples designated for physical characterization were analyzed for the selected physical and chemical-physical parameters shown in Table 5-1.

5.1.2 Sample and Station Identification

Section 12.4 of the Comprehensive Sampling and Analysis Plan (CSAP) for NAS Pensacola utilizes a 10-character sample identification code for sample labeling (E/A&H, 1994b). The Site 38 SAP and SAP addendum specify an eight-character sample identification code for the two E/A&H studies, however, these earlier sample identifiers have been modified to reflect this current sample management approach. Notably, samples from the investigation of the IWTP line carry a prefix of "036" because these samples were originally collected as part of the investigation of Site 36. Explanation of the sample identification code can be found in Section 12.4 of the CSAP.

Table 5-1
Analytical Parameters
Contamination Assessment

Media	Parameter	Method
Soil	TCL Volatiles	CLP
	TCL Semivolatiles	CLP
	TCL Pesticides/PCBs	CLP
	TAL Metals and Cyanide	CLP
Groundwater	TCL Volatile	CLP
	TCL Semivolatiles	CLP
	TCL Pesticides/PCBs	CLP
	TAL Metals and Cyanide - Unfiltered	CLP
	Physical and Chemical Characterization	
Soil	**Physical Properties:**	
	Permeability	ASTM D2434 (for sand)
	Porosity	ASTM D5084 (for clay)
	Particle Size	ASTM D 422
	Bulk Density	ASTM 4253
	Specific Gravity	ASTM D 854
	Moisture Content	ASTM 2216
	Chemical-Physical Characteristics:	
	Total Phosphorus	EPA 365.3
	Nitrate-N	EPA 352.1
	Total Kjeldahl Nitrogen	EPA 351.4
	Heterotrophic Plate Count	SM 9215B
	Total Organic Carbon	SW 846-9060
	Cation Exchange Capacity	SW 846-9080
Groundwater	Total Phosphorus	EPA 365.3
	Nitrate-N	EPA 352.1
	Total Kjeldahl Nitrogen	EPA 351.4
	Heterotrophic Plate Count	SM 9215B
	5-day Biological Oxygen Demand	EPA 405.1
	Chemical Oxygen Demand	EPA 410 (.1 to .3)
	Hardness	EPA 200.7
	Total Suspended Solids	EPA 160.2
	Alkalinity	EPA 310.1
	pH	EPA 150.1
	Temperature (°C)	EPA 170.1
	Specific Conductivity	EPA 120.1

Note:
ASTM = American Society for Testing and Materials

5.2 Soil Assessment

5.2.1 Contamination Assessment Sampling

E/A&H collected soil samples from 64 shallow soil borings across Site 38 to assess the extent of soil contamination above the water table (Figure 5-2). Table 5-2 lists each of the soil sample locations and associated sample identifiers. Soil samples submitted for laboratory analysis were sampled from 0 to 1 foot bls or 0 to 2 feet bls and at 2-foot intervals thereafter until the water table was reached. However, since most of the site is covered by 8 to 10 inches of concrete or 4 inches of asphalt with an 8-inch red clay base, the land surface was considered to begin at the base of the concrete and ~~of~~ OR the asphalt or the red clay subbase.

Soil samples were collected using a hand auger or a split-spoon sampler through 4.25-inch, inside diameter (ID) hollow-stem augers (HSA). Hand-auger samples were collected by manually advancing the auger to the desired sample depth, retrieving the sample and placing the soil into a stainless-steel bowl (the volatile organic analyses (VOA) portion of the samples were placed directly into sample containers). Care was taken to prevent introducing vegetation, concrete, or asphalt into the sample during this process. Split-spoon samples were collected by advancing the augers to the sample depth, and inserting the split-spoon sampler into the annulus of the HSA. The split-spoon was then either hydraulically pushed or driven with a 140-pound hammer below the lead auger to collect an undisturbed soil sample. The split-spoon sampler was retrieved from the HSA and the sample was placed into a stainless-steel bowl. The VOC fraction was then immediately collected, the container sealed, properly labeled, and placed on ice in a cooler. The rest of the soil sample was homogenized in a stainless-steel bowl and the appropriate containers filled, properly labeled, and placed on ice in a cooler.

Soil samples were processed as described in Section 5.4 and submitted for laboratory analyses for CLP TCL/TAL parameters. Ten percent of the samples were analyzed for hexavalent chromium and physical parameters. All soil samples were classified in the field by an E/A&H

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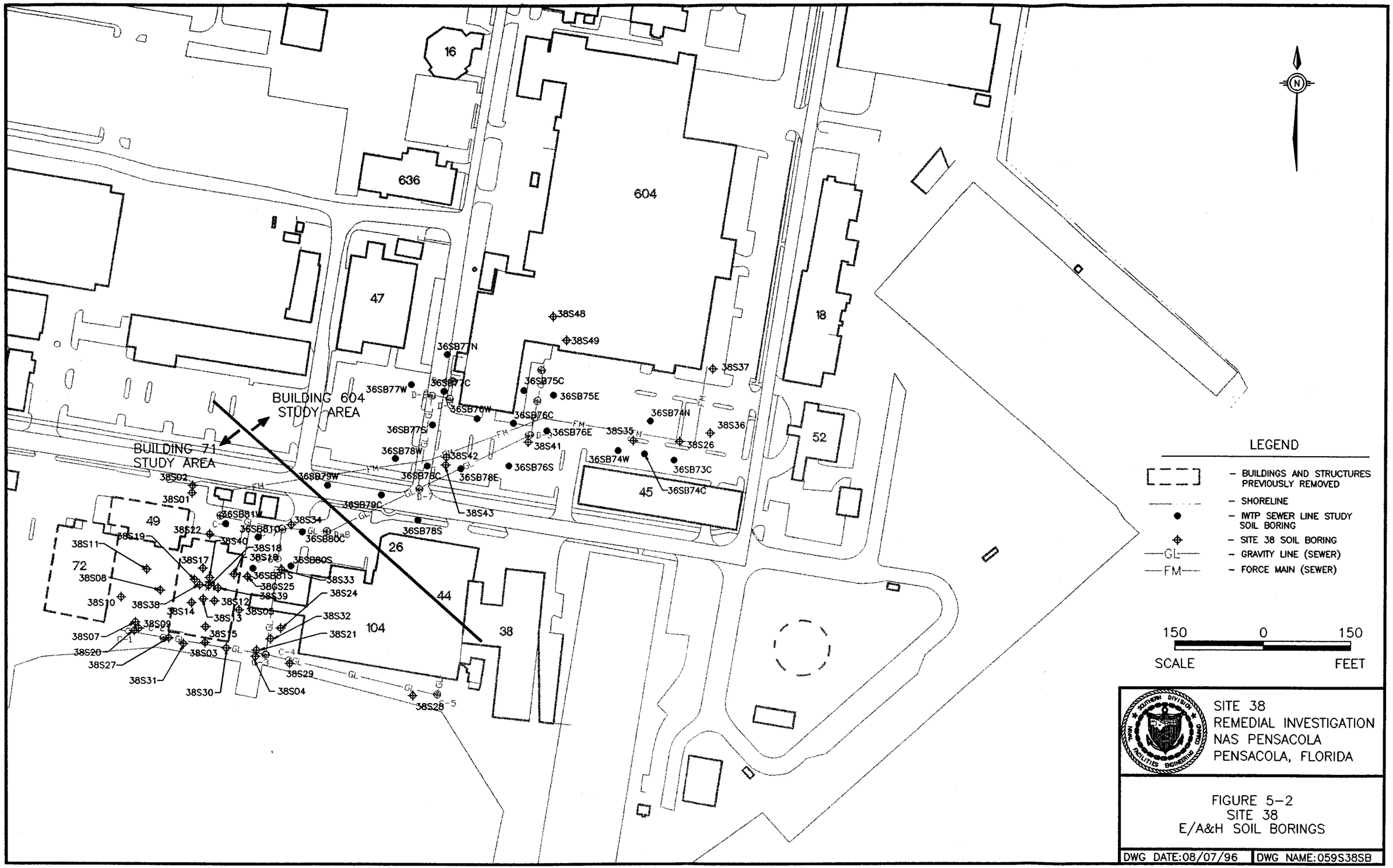

16
636
604
47
18
52
45
26
44
38
104
72
49
BUILDING 604
STUDY AREA
BUILDING 71
STUDY AREA
38S48
38S49
38S37
36SB77N
36SB77W
36SB77C
36SB75C
36SB75E
36SB76W
36SB76C
36SB74N
36SB77S
36SB76E
38S35
38S36
38S26
38S41
36SB78W
38S42
36SB76S
36SB74W
36SB73C
36SB78C
36SB78E
36SB74C
38S43
36SB79W
36SB79C
36SB78S
38S02
38S01
36SB81W
38S34
36SB81C
36SB80C
38S22
38S19
38S40
38S18
38S16
36SB80S
38S11
38S17
36SB81S
38S33
38S08
38S25
38S39
38S24
38S10
38S38
38S14
38S12
38S13
38S05
38S32
38S09
38S21
38S07
38S15
38S20
38S03
38S27
38S29
38S31
38S30
38S04
38S28
LEGEND
BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
SHORELINE
IWTP SEWER LINE STUDY SOIL BORING
SITE 38 SOIL BORING
GL GRAVITY LINE (SEWER)
FM FORCE MAIN (SEWER)
150 0 150
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 5-2
SITE 38
E/A&H SOIL BORINGS
DWG DATE:08/07/96
DWG NAME:059S38SB

Table 5-2
Site 38 E/A&H Soil Samples

Boring Location	Sample Identifier	Sample Interval	Date Sampled	Remarks
36SB73C	036S073C02	0-2 ft.	2/19/93	Soil boring only.
	036S073C02 (MS/MSD)	0-2 ft.		
	036S073C04	2-4 ft.		
36SB74C	036S074C02	0-2 ft.	2/18/93	Soil boring only.
	036S074C04	2-4 ft.		
36SB74N	036S074N02	0-2 ft.	2/19/9/3	Soil boring only.
	036S074N04	2-4 ft.		
36SB74W	036S074W02	0-2 ft.	2/19/93	Soil boring only.
	036S074W04	2-4 ft.		
36SB75C	036S075C02	0-2 ft.	2/17/93	Soil boring only.
	036S075C04	2-4 ft.		
	036S075C04 (MS/MSD)	2-4 ft.		
36SB75E	036S075E02	0-2 ft.	2/17/93	Soil boring only.
	036S075E06	4-6 ft.		
36SB76C	036S076C02	0-2 ft.	2/17/93	Soil boring only.
36SB76E	036S076E02	0-2 ft.	2/16/93	Soil boring only.
	036S076E04	2-4 ft.		
36SB76S	036S076S02	0-2 ft.	2/17/93	Soil boring only.
36SB76W	036S076W02	0-2 ft.	2/16/93	Soil boring only.
	036S076W04	2-4 ft.		
36SB77C	036S077C02	0-2 ft.	2/15/93	Soil boring only.
	036S077C04	2-4 ft.		
36SB77N	036S077N02	0-2 ft.	2/15/93	Soil boring only.
	036S077N04	2-4 ft.		
36SB77S	036S077S02	0-2 ft.	2/15/93	Soil boring only.
	036S077S04	2-4 ft.		
36SB77W	036S077W02	0-2 ft.	2/18/93	Soil boring only.
	036S077W02 (MS/MSD)	0-2 ft.		
	036S077W04	2-4 ft.		
36SB78C	036S078C02	0-2 ft.	2/18/93	Soil boring only.
	036S078C04	2-4 ft.		

Table 5-2
Site 38 E/A&H Soil Samples

Boring Location	Sample Identifier	Sample Interval	Date Sampled	Remarks
36SB78E	036S078E02 036S078E04	0-2 ft. 2-4 ft.	2/16/93	Soil boring only.
36SB78S	036S078S02	0-2 ft.	2/19/93	Soil boring only.
36SB78W	036S078W02 036S078W04 036S078W04 (MS/MSD)	0-2 ft. 2-4 ft. 2-4 ft.	2/18/93	Soil boring only.
36SB79C	036S079C02 036S079C04 036S079C04 (MS/MSD)	0-2 ft. 2-4 ft. 2-4 ft.	2/15/93	Soil boring only.
36SB79W	036S079W02 036S079W04	0-2 ft. 2-4 ft.	2/15/93	Soil boring only.
36SB80C	036S080C02 036S080C02 (MS/MSD)	0-2 ft. 0-2 ft.	2/19/93	Soil boring only.
36SB80S	036S080S02	0-2 ft.	2/12/93	Soil boring only.
36SB81C	036S081C02 036S081C04	0-2 ft. 2-4 ft.	2/12/93	Soil boring only.
36SB81S	036S081S03	1-3 ft.	2/12/93	Soil boring only.
36SB81W	036S081W02 038S081W04	0-2 ft. 2-4 ft.	2/12/93	Soil boring only.
38S01	038S000102 038S000104 038S000106	0-2 ft. 2-4 ft. 4-6 ft.	7/27/93	Collocated with well 38GI01.
38S02	—	—	—	No sample, collocated with well 38GS01.
38S03	038S000301 038S000303 038S000305	0-1 ft. 1-3 ft. 3-5 ft.	7/27/93	Soil boring only.
38S04	038S000402 038S000404	0-2 ft. 2-4 ft.	7/27/93	Collocated with well 38GI02.

Table 5-2
Site 38 E/A&H Soil Samples

Boring Location	Sample Identifier	Sample Interval	Date Sampled	Remarks
38S05	038S000501	0-1 ft.	7/29/93	Collocated with well 38GS04.
	038S000503	1-3 ft.		
	038S000505	3-5 ft.		
38S07	038S000701	0-1 ft.	7/29/93	Soil boring only.
	038S000703	1-3 ft.		
	038S000705	3-5 ft.		
38S08	038S000801	0-1 ft.	7/29/93	Collocated with well 38GS05.
	038S000803	1-3 ft.		
	038S000804	3-4 ft.		
38S09	038S000901	0-1 ft.	7/29/93	Collocated with well 38GS03.
	038S000903	1-3 ft.		
38S10	038S001001	0-1 ft.	7/29/93	Soil boring only.
	038S001003	1-3 ft.		
	038S001004	3-4 ft.		
38S11	038S001101	0-1 ft.	7/29/93	Soil boring only.
	038S001103	1-3 ft.		
	038S001104	3-4 ft.		
38S12	038S001201	0-1 ft.	7/29/93	Soil boring only.
	038S001203	1-3 ft.		
	038S001204	3-4 ft.		
38S13	038S001301	0-1 ft.	7/29/93	Soil boring only.
	038S001303	1-3 ft.		
	038S001304	3-4 ft.		
38S14	038S001401	0-1 ft.	7/29/93	Collocated with well 38GS12.
	038S001403	1-3 ft.		
	038S001405	3-5 ft.		
	038S001405[a]	3-5 ft.		
38S15	038S001501	0-1 ft.	7/29/93	Soil boring only.
	038S001503	1-3 ft.		
38S16	038S001601	0-1 ft.	8/4/93	Soil boring only.
	038S001601 (MS/MSD)	0-1 ft.		
	038S001603	1-3 ft.		
	038C001603[a]	1-3 ft.		
	038S001605	3-5 ft.		
	038C001605[a]	3-5 ft.		

Table 5-2
Site 38 E/A&H Soil Samples

Boring Location	Sample Identifier	Sample Interval	Date Sampled	Remarks
38S17	038S001701 038S001703 038S001705	0-1 ft. 1-3 ft. 3-5 ft.	8/4/93	Soil boring only.
38S18	038S001801 038S001803 038S001805	0-1 ft. 1-3 ft. 3-5 ft.	8/4/93	Soil boring only.
38S19	038S001901 038S001902	0-1 ft. 1-2 ft.	8/4/93	Soil boring only.
38S20	—	—	—	No sample, collocated with well 38GI03.
38S21	—	—	—	No sample, collocated with well 38GS02.
38S22	038S002201 038S002203	0-1 ft. 1-3 ft.	8/4/93	Collocated with well 38GS06.
38S23	—	—	—	No sample collected.
38S24	038S002403	1-3 ft.	12/1/93	Collocated with well 38GS10.
38S25	038S002501 038S002503	0-1 ft. 1-3 ft.	12/1/93	Collocated with well 38GS11.
38S26	038S002601 038S002603 038S002605	0-1 ft. 1-3 ft. 3-5 ft.	11/18/93	Collocated with well 38GI07.
38S27	038S002702 038S002704	0-2 ft. 2-4 ft.	12/1/93 12/2/93	Collocated with well 38GS13.
38S28	038S002801 038S002803	0-1 ft. 1-3 ft.	12/1/93	Soil boring only.
38S29	038S002901	0-1 ft.	12/1/93	Soil boring only.
38S30	038S003001 038S003003	0-1 ft. 1-3 ft.	12/7/93	Soil boring only.

Table 5-2
Site 38 E/A&H Soil Samples

Boring Location	Sample Identifier	Sample Interval	Date Sampled	Remarks
38S31	038S003101 038S003103	0-1 ft. 1-3 ft.	12/7/93	Soil boring only.
38S32	038S003201 038S003203 038S003205 038C003205[a]	0-1 ft. 1-3 ft. 3-5 ft. 3-5 ft.	12/2/93	Soil boring only.
38S33	038S003301 038S003303	0-1 ft. 1-3 ft.	12/7/93	Soil boring only.
38S34	038S003401 038S003403	0-1 ft. 1-3 ft.	12/7/93	Soil boring only.
38S35	038S003501 038S003503	0-1 ft. 1-3 ft.	12/8/93	Collocated with well 38GS18.
38S36	038S003601 038S003603	0-1 ft. 1-3 ft.	12/8/93	Soil boring only.
38S37	038S003701 038S003703	0-1 ft. 1-3 ft.	12/8/93	Soil boring only.
38S38	038S003801	0-1 ft.	1/11/94	Hex. Chromium sample only.
38S39	038S003901	0-1 ft.	1/11/94	Hex. Chromium sample only.
38S40	038S004001	0-1 ft.	1/11/94	Hex. Chromium sample only.
38S41	038S004102 038S004104 038S004106	0-2 ft. 2-4 ft. 4-6 ft.	—	Collocated with well 38GI08.
38S42	038S004202 038S004202 (MS/MSD) 038S004204 038S004206	0-2 ft. 0-2 ft. 2-4 ft. 4-6 ft.	11/18/93	Collocated with well 38GS09.
38S43	—	—	—	Collocated with well 38GI09.

Table 5-2
Site 38 E/A&H Soil Samples

Boring Location	Sample Identifier	Sample Interval	Date Sampled	Remarks
38S48	038S004801	0-1 ft.	—	Soil boring only.
	038S004801 (MS/MSD)	0-1 ft.		
	038S004803	1-3 ft.		
38S49	038S004901	0-1 ft.	—	Collocated with well 38GS22.
	038S004903	1-3 ft.		

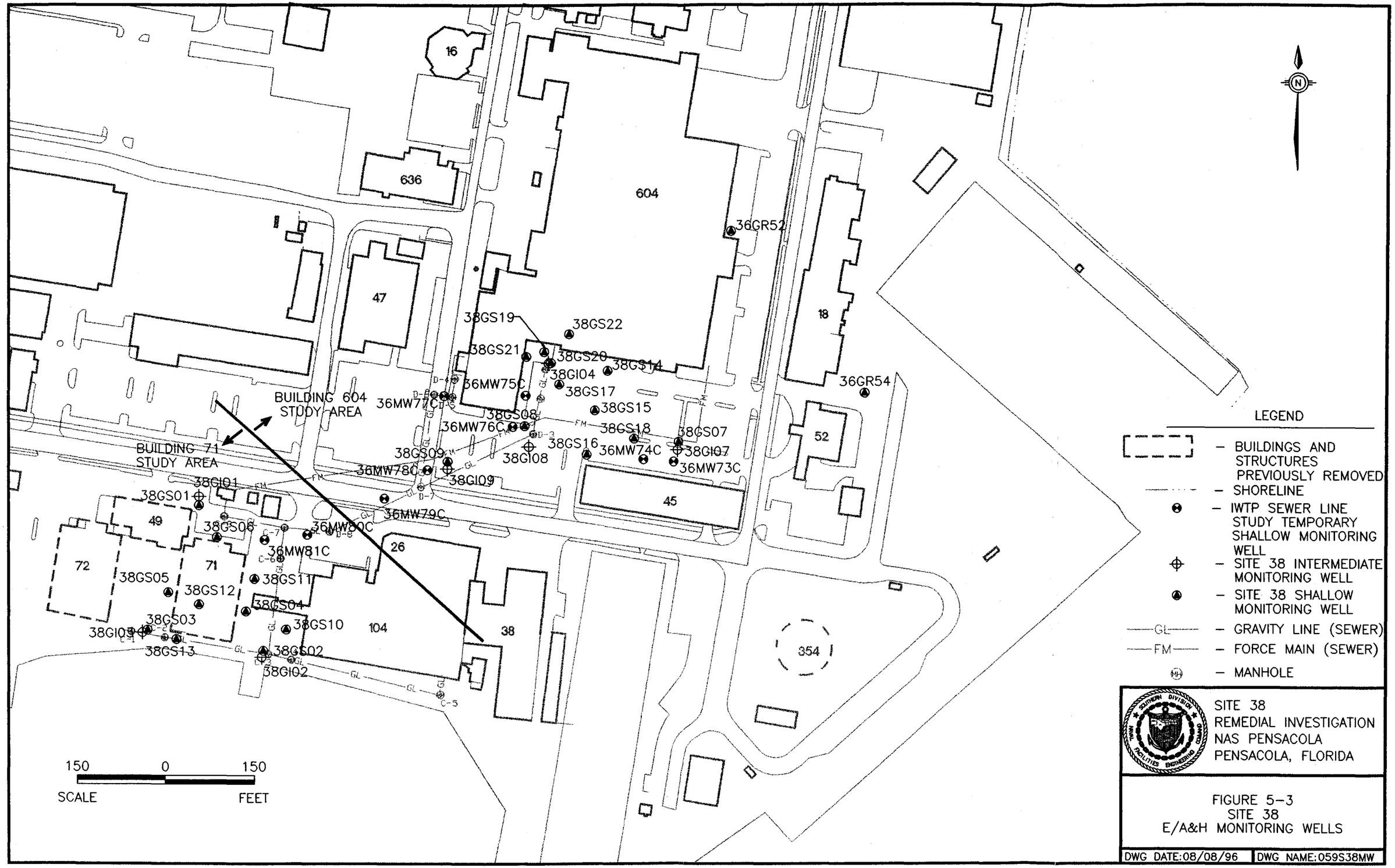
Notes:
a = Duplicate sample.
MS = Matrix Spike sample.
MSD = Matrix Spike Duplicate sample.

geologist in accordance with the Unified Soil Classification System (USCS) (visual manual procedure) and documented with other pertinent field information on individual boring logs. Information recorded on each boring log includes PID concentrations, soil types, and other relevant field information. The boring logs are in Appendix E.

5.2.2 Stratigraphic Exploration/Monitoring Well Boreholes

Contamination assessment borings provided stratigraphic information for soil above the shallow water table. Deeper stratigraphic information was obtained when completing the intermediate depth borings. Six intermediate depth borings were completed to the base of the surficial zone (approximately 45 feet bls), above the underlying clay layer while installing six intermediate depth monitoring wells. Intermediate well 038GI04 was a well from a previous study. Lithologic information from this well is included in Appendix C. Figure 5-3 shows the location of intermediate wells.

Twenty-two soil borings were advanced to approximately 13 to 15 feet bls to install nine temporary and 13 permanent shallow monitoring wells. The shallow borings were advanced to


16
636
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71
26
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38
354
36GR52
36GR54
38GS19
38GS22
38GS21
38GS20
38GS14
38GI04
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36MW75C
36MW77C
36MW76C
36MW74C
36MW73C
36MW78C
36MW79C
36MW80C
36MW81C
BUILDING 604
STUDY AREA
BUILDING 71
STUDY AREA
150 0 150
SCALE FEET
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWER LINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 5-3
SITE 38
E/A&H MONITORING WELLS
DWG DATE:08/08/96
DWG NAME:059S38MW

a depth that would allow the 10-foot well screen to intersect the water table. Installing the wells at this depth was necessary to adequately monitor any lighter than water contaminants that might be present. The locations of the shallow monitoring wells are shown on Figure 5-3. The site stratigraphy is described in Section 6.1.1.

5.2.3 Physical and Chemical Characterization Sampling

During the investigation, soil samples were collected to obtain data for use in possible remedial design, modeling, and/or migration studies. Five Shelby tube samples were collected: two from the unsaturated zone, two from the base of the surficial zone in the transition zone (described in Section 6.1.1), and one from the clay layer below the surficial zone. The Shelby tube samples were submitted to Thompson Engineering and Testing, for permeability, bulk density, porosity, specific gravity, moisture content, and grain-size analysis. Approximately 10% of the soil samples were submitted to Savannah Laboratories, for analysis of physical-chemical characteristics such as total organic carbon (TOC), cation exchange capacity (CEC), total Kjeldahl nitrogen (TKN), total phosphorus, heterotrophic plate count, and nitrate.

5.3 Groundwater Assessment

5.3.1 Contamination Assessment Sampling

Data were collected from 38 shallow and intermediate monitoring wells for the contamination assessment of the surficial zone, including wells installed during three field studies of the area (Figure 5-3). Table 5-3 lists each of the groundwater sample locations and associated sample identifiers. Nine temporary shallow monitoring wells were installed during the February 1993 study of the IWTP sewer line. Twelve shallow and six intermediate monitoring wells were installed in two stages between July 1993 and July 1994 during the RI. In addition, 10 shallow wells and one intermediate monitoring well installed during the ABB UST investigation were sampled during the RI groundwater contamination assessment. A hydrologic study was completed in several stages between December 1993 and August 1994 involving specific capacity pumping tests, potentiometric measurements, and a tidal influence study.

Table 5-3
Site 38 E/A&H Groundwater Samples

Well Number	Sample Number	Date Sampled	Remarks
36GR73C	036GR73C01	2/26/93	
36GR74C	036GR74C01	2/26/93	
36GR75C	036GR75C01	2/26/93	
36GR76C	036GR76C01 036GR76C01(MS/MSD)	2/25/93	
36GR77C	036GR77C01	2/25/93	
36GR78C	036GR78C01	2/25/93	
36GR79C	036GR79C01	2/24/93	
36GR80C	036GR80C01	2/24/93	
36GR81C	036GR81C01	2/24/93	
38GI01	038GGI0101 038HGI0101[a] 038GGI0101(MS/MSD)	1/6/94	Collocated with boring 38S01.
38GI02	038GGI0201	1/6/94	Collocated with boring 38S04.
38GI03	038GGI0301	1/6/94	Collocated with boring 38S20.
38GI04	038GGI0401	1/5/94	Groundwater sample only.
38GI07	038GGI0701	1/5/94	Collocated with boring 38S26.
38GI08	038GGI0801	1/5/94	Collocated with boring 38S41.
38GI09	038GGI0901	1/5/94	Collocated with boring 38S43.
38GS01	038GGS0101	1/4/94	Collocated with boring 38S02.
38GS02	038GGS0201	1/6/94	Collocated with boring 38S21.

Table 5-3
Site 38 E/A&H Groundwater Samples

Well Number	Sample Number	Date Sampled	Remarks
38GS03	038GGS0301 038HGS0301[a] 038GGS0301(MS/MSD)	1/6/94	Collocated with boring 38S09.
38GS04	—	—	Collocated with boring 38S05.
38GS05	038GGS0501	1/5/94	Collocated with boring 38S08.
38GS06	038GGS0601	1/5/94	Collocated with boring 38S22.
38GS07	038GGS0701	1/4/94	
38GS08	038GGS0801	1/4/94	
38GS09	038GGS0901 038HGS0901[a]	1/4/94	Collocated with boring 38S42.
38GS10	—	—	Collocated with boring 38S24.
38GS11	038GGS1101	1/5/94	Collocated with boring 38S25.
38GS12	038GGS1201	1/4/94	Collocated with boring 38S14.
38GS13	038GGS1301	1/5/94	Collocated with boring 38S27.
38GS14	038GGS1401	1/4/94	
38GS15	038GGS1501	1/4/94	
38GS16	038GGS1601	1/4/94	
38GS17	038GGS1701	1/4/94	
38GS18	038GGS1801 038GGS1801(MS/MSD)	1/4/94	Collocated with boring 38S35.
38GS19	038GGS1901	1/4/94	
38GS20	038GGS2001	1/4/94	

Table 5-3
Site 38 E/A&H Groundwater Samples

Well Number	Sample Number	Date Sampled	Remarks
38GS21	038GGS2101	1/4/94	
38GS22	038GGS2201	7/19/94	Collocated with boring 38S49.

Notes:
a = Duplicate sample.
MS = Matrix Spike sample.
MSD = Matrix Spike Duplicate sample.

Shortly after groundwater samples were collected from the nine temporary monitoring wells, in February 1993, these wells were abandoned. Groundwater samples were collected from monitoring wells 38GS04 and 38GS10 in December 1993 for priority laboratory analysis due to physical evidence of potential groundwater contamination. The remaining shallow and intermediate monitoring wells were sampled in January 1994 except 038GS22, which was sampled in July 1994. Groundwater samples were submitted to NET Laboratory for TCL/TAL analysis.

5.3.2 Physical and Chemical Characterization Sampling

Approximately 10% of the groundwater samples were submitted to Savannah Laboratories for analysis of physical-chemical characteristics such as TKN, total phosphorus, nitrate, heterotrophic plate count, five-day biological oxygen demand (five-day BOD), chemical oxygen demand (COD), hardness, total suspended solids (TSS), and alkalinity.

5.3.3 Monitoring Well Installation

The shallow monitoring wells were installed so that the static level of the water table would intersect the well screen interval at approximately 2 to 3 feet below the top of the screen, which allows light nonaqueous-phase liquids to be monitored. Intermediate-depth wells were installed

with the base of the well's screen approximately 5 to 8 feet above the underlying clay layer, which allows dense nonaqueous-phase liquids to be monitored. Intermediate monitoring wells were paired with shallow monitoring wells at each intermediate well location.

Drilling Methods

Borings for all monitoring wells were completed with a powered-rotary drill rig operated by Kelly Environmental Services of Fort Walton Beach, Florida. Drilling was conducted using 4.25-inch, ID HSA, and soil samples were collected using the procedures described in Section 5.2.1. All pertinent drilling and sampling information was recorded in the field logbook and/or the individual boring logs maintained for the site and are included in Appendix E.

Monitoring Well Construction

Groundwater monitoring wells were constructed to comply with applicable federal, state, and local agency regulations. Wells were constructed, installed, and developed in accordance with the site-specific SAP for Site 38 (E/A&H, 1992a), the SAP addendum (E/A&H, 1992b) for the associated IWTP sewer line, the CSAP for NAS Pensacola (E/A&H, 1994b), and SOUTHNAVFACENGCOM guidance (SOUTHNAVFACENGCOM, 1989). Figure 5-4 illustrates a typical monitoring well construction for wells at NAS Pensacola. Well construction information is included in Table 5-4.

Well materials consisted of 2-inch diameter, flush threaded, PVC riser casing connected to a 10-foot section of 0.010 slot PVC screen. The choice of screen size was determined to be suitable for the aquifer matrix based on grain-size analyses performed at other sites across NAS Pensacola. All monitoring wells were installed through the annulus of 4.25-inch, ID HSA. Shallow monitoring well borings were usually advanced to the water table using a stainless steel hand auger and then completed to depth with the HSA. Otherwise they were drilled completely

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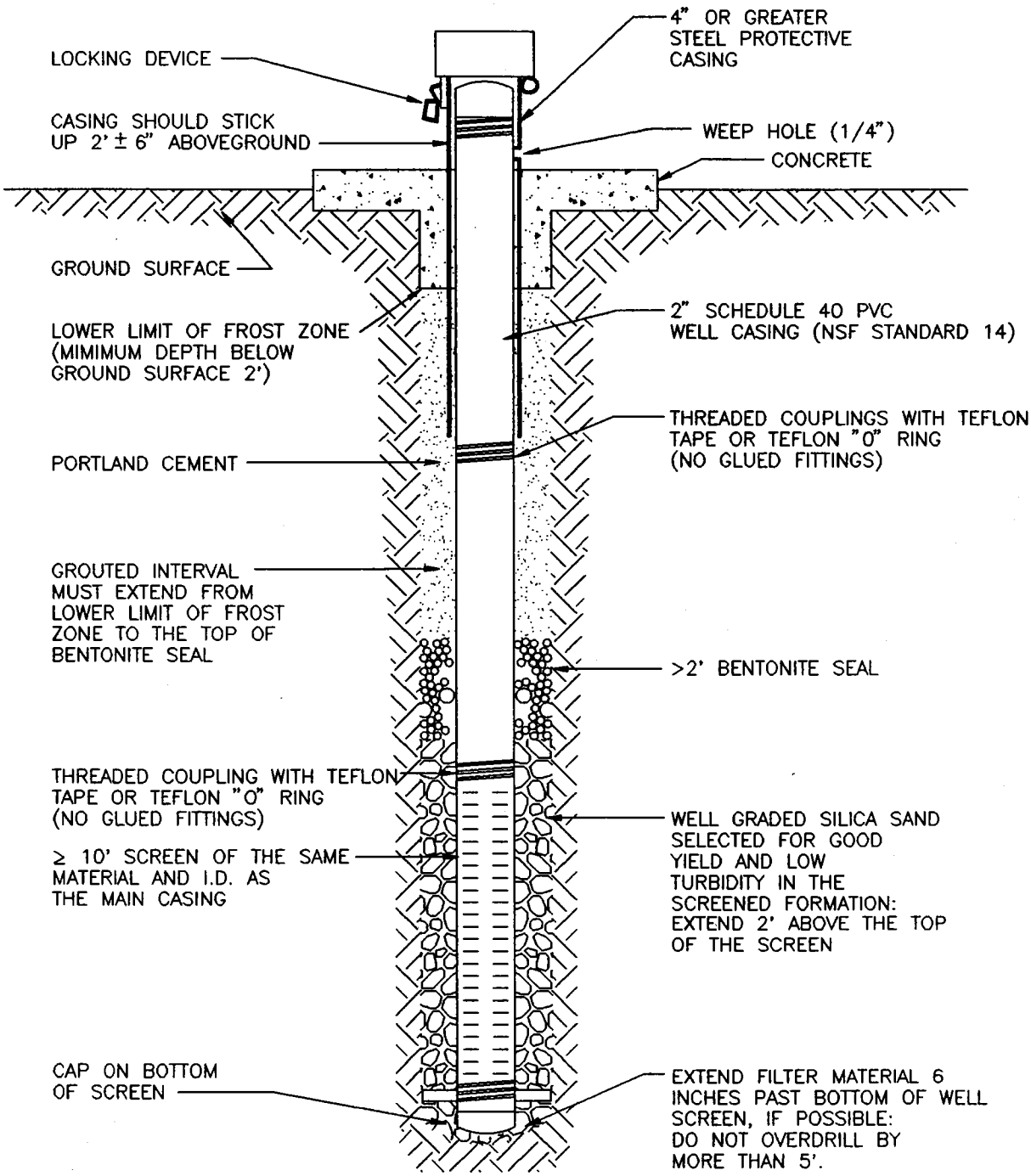
TYPICAL ILLUSTRATION OF MINIMUM SPECIFICATIONS
FOR MONITORING WELL CONSTRUCTION



SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 5-4
UNCONFINED AQUIFER
MONITORING WELL DESIGN

DWG DATE: 08/09/96 | DWG NAME: 59S38UAD

Table 5-4
Site 38 Construction and Potentiometric Data

Well Number	Surface Elevation (ft)	Top of Casing Elevation (ft)	Total Depth (ft bls)	Screened Interval (ft bls)	Depth to Water (ft btoc)	Groundwater Elev (ft msl)	Water Level Date, Time
				Shallow Wells			
38GS01	5.78	5.7	13	3-13	5.16	0.54	3/21/96, 1539
38GS02	4.25	4.17	13	3-13	4.21	-0.04	3/21/96, 1524
38GS03	3.94	4.12	13	3-13	3.97	0.15	3/21/96, 1533
38GS04	4.75	4.56	13.5	3.5-13.5	4.44	0.12	3/21/96, 1525
38GS05	4.57	4.37	13.2	3.2 - 13.2	4.19	0.18	3/21/96, 1534
38GS06	5.76	5.63	13	3-13	5.27	0.36	3/21/96, 1540
38GS07	7.59	7.31	13.7	3.7 - 13.7	7.05	0.26	3/21/96, 1530
38GS08	7.39	7.29	12.6	2.6 - 12.6	6.89	0.4	3/21/96, 1540
38GS09	6.69	6.24	13	3-13	5.89	0.35	3/21/96, 1544
38GS10	4.79	4.54	13	3-13	4.54	0	3/21/96, 1522
38GS11	4.62	4.38	13	3-13	4.2	0.18	3/21/96, 1527
38GS12	4.84	4.59	13	3-13	4.44	0.15	3/21/96, 1529
38GS13	4.21	4.04	13	3-13	4.09	-0.05	3/21/96, 1532
38GS14	8.41	8.64	13	3-13	7.95	0.69	3/21/96, 1522
38GS15	7.55	7.96	13	3-13	7.59	0.37	3/21/96, 1537
38GS16	6.94	6.71	13	3-13	6.41	0.3	3/21/96, 1535

Table 5-4
Site 38 Construction and Potentiometric Data

Well Number	Surface Elevation (ft)	Top of Casing Elevation (ft)	Total Depth (ft bls)	Screened Interval (ft bls)	Depth to Water (ft btoc)	Groundwater Elev (ft msl)	Water Level Date, Time
38GS17	7.95	7.74	13	3-13	7.25	0.49	3/21/96, 1520
38GS18	7.31	7.14	13	3-13	6.85	0.29	3/21/96, 1534
38GS19	7.88	7.85	13	3-13	7.25	0.6	3/21/96, 1517
38GS20	7.17	6.78	13	3-13	6.21	0.57	3/21/96, 1518
38GS21	7.55	7.58	13	3-13	7	0.58	3/21/96, 1515
38GS22	8.64	8.44	10.2	0.20 - 10.20	7.89	0.55	3/21/96, 1525
38GS23	5.17	4.64	21	11.00 - 21.00	4.9	-0.26	3/21/96, 1520
38GS24	6.95	6.84	14.5	4.50 - 14.50	6.3	0.54	3/21/96, 1546
38GS25	8.68	8.51	14.35	4.35 - 14.35	7.7	0.81	3/21/96, 1527
38GS26	7.05	6.98	12.3	2.30 - 12.30	6.48	0.5	3/21/96, 1545
38GS27	7.1	6.97	16.2	6.20 - 16.20	5.92	1.05	3/21/96, 1550
38GS28	6.91	6.48	15.05	5.05 - 15.05	4.94	1.54	3/21/96, 1557
38GS30	5.99	5.65	15.05	5.05 - 15.05	4.69	0.96	3/21/96, 1552
38GS31	6.91	6.61	15.15	5.15 - 15.15	5.3	1.31	3/21/96, 1555
38GS32	6.14	5.88	13.1	3.1 - 13.10	5.74	0.14	3/21/96, 1549

Table 5-4
Site 38 Construction and Potentiometric Data

Well Number	Surface Elevation (ft)	Top of Casing Elevation (ft)	Total Depth (ft bls)	Screened Interval (ft bls)	Depth to Water (ft btoc)	Groundwater Elev (ft msl)	Water Level Date, Time
Intermediate Wells							
38GI01	6.12	5.81	27	17-27	4.84	0.97	6/3/94, 0924
38GI02	4.16	3.8	43	33-43	2.93	0.87	6/3/94, 0915
38GI03	4.24	4.03	42	32-42	3.03	1	6/3/94, 0857
38GI04	7.49	7.21	32	27-32	5.97	1.24	6/3/94, 0947
38GI07	7.33	7.07	44	34-44	6.28	0.79	6/3/94, 0959
38GI08	6.68	6.49	37	27-37	5.66	0.83	6/3/94, 0942
38GI09	6.82	6.34	32	22-32	5.51	0.83	6/3/94, 0937
38GI10	4.55	4.27	40.55	30.55 - 40.55	3.94	0.33	3/21/96, 1536

Notes:
Datum = Mean sea level
btoc = Below top of casing

with 4.25-inch ID HSA. All intermediate monitoring well borings were completed with 4.25-inch, HSA; lithologic samples were collected with split-spoon samplers from select depths until the clay layer were encountered.

During intermediate well installations, flowing sand persistently entering the annulus of the HSA through the bottom opening in the lead auger, making it very difficult to install the well through the augers. As a solution, the complete auger string was retrieved from the borehole once the clay layer was encountered. The augers were placed in order on plastic as they were retrieved. A PVC end plug, wrapped with Teflon tape, was inserted into the opening of the lead auger and the boring was re-drilled to the target depth. The end plug prevented the sand from filling the annulus of the HSA. The well screen and riser pipe were screwed together as the riser pipe was inserted into the annulus of the HSA, then the weight of the well pipe pushed the PVC plug out of the lead auger.

The screened interval was backfilled with a 20/30 silica sand filter pack. For shallow wells, the sand was poured between the annulus of the well pipe and the augers, while in intermediate wells, the sand was placed using a PVC tremie pipe and water from the decontamination pad potable water source. The filter pack was placed at least 2 feet above the screened interval in all intermediate wells. In shallow wells, the sand packs were completed to about 8 to 12 inches above the screens since the water table was so close to the surface and space was needed for the bentonite seal, the manhole well cover, and well pad.

A seal consisting of 0.25-inch bentonite pellets was placed above the filter pack of the shallow wells to approximately 8 inches bls and hydrated with potable water, typically resulting in an 8 to 12-inch seal. Problems were encountered in placing the bentonite pellets at depth in the intermediate wells. To adequately protect the well screen, a bentonite slurry was mixed and pumped through a tremie pipe to the required depth. For additional protection, this slurry seal was typically 4 to 7 feet thick.

The remainder of the annulus above the bentonite seal in intermediate wells was grout-sealed using a mixture of approximately 6 gallons of water per 94-pound bag of Portland cement. All wells were finished with flush-grade, load-bearing, bolt-down well covers with a 1.5-foot by 1.5-foot, 6-inch-thick concrete surface pad. Flush-grade mounts were needed because of the volume of vehicle traffic across the site.

Monitoring Well Development

Monitoring wells were developed through alternate surging with a PVC surge block and pumping using a gasoline-powered, centrifugal surface pump and a 0.75-inch PVC line with a check valve on the submerged end. Discharge rate, pH, specific conductivity, temperature, and turbidity were monitored during development. Pumping continued until turbidity, pH, conductivity, and temperature stabilized. Generally, 55 to 200 gallons of water (typically seven to 20 well volumes) were pumped from intermediate wells during development, and at least 55 gallons of water (greater than 40 well volumes) were removed from shallow monitoring wells during development. The groundwater from all wells at Site 38 appeared fairly clear at the completion of well development, except for monitoring well 38GI03. The pH, temperature, and conductivity stabilized in 38GI03 after approximately two 55-gallon drums were filled. However, the water still had a murky greenish tint and despite pumping 200 gallons of water, it did not clear.

5.3.4 Groundwater Sampling

Groundwater samples were collected from 27 permanent monitoring wells between January 4 and 6, 1994. Before sampling, organic vapor concentrations were measured in each well headspace by inserting the PID probe beneath the well cap. Following headspace screening, water levels were measured in each well with an electronic water level indicator.

All monitoring wells were purged with a peristaltic pump using a low-flow (0.1 to 0.5 gallons per minute [gpm]) technique through a 0.5-inch Teflon tube. Groundwater was considered stable

and ready for sampling following stabilization of pH, specific conductivity, turbidity, and temperature.

These field parameters measured during sampling are presented in Table 5-5 for each sample. Turbidity was generally measured at or below 5 nephelometric turbidity units (NTU) for most of the groundwater samples, except for intermediate wells 038GI02, 038GI03, and 038GI04 (Table 5-5). After the low-flow purge, groundwater samples were collected by very slowly lowering a Teflon bailer into the water column to retrieve the groundwater sample. This method produced groundwater samples with good clarity for all except wells 38GI03 and 38GI04.

Sample containers for VOC analysis were filled first, taking precautions to minimize water disturbance, followed by containers for semivolatiles and other parameters. Weather conditions, initial water levels, purging and sampling times, purge volumes, groundwater turbidity, temperature, pH, and specific conductance were recorded on the well sample field forms during purging and sampling. Samples from all wells were collected and analyzed for CLP TCL/TAL constituents. Additional laboratory analyses included hexavalent chromium and select physical parameters at a frequency of approximately 10%.

5.4 Sampling Protocol

All sampling activities were conducted in accordance with the Site 38 SAP (E/A&H, 1992a), the SAP addendum (E/A&H, 1992b) for the associated IWTP sewer line, and the CSAP for NAS Pensacola (E/A&H, 1994b). Where warranted by field conditions, deviations from the approved procedures were conducted and appropriately documented.

Table 5-5
Groundwater Stability Data
Measured at the Time of Sampling

Sample ID	pH (Std Units)	Temperature (Degrees C)	Conductivity (µS/cm)	Turbidity (NTU)
38GS01	7.19	20.9	182	1
38GS02	7.26	20.8	340	1
38GS03	7.24	20.8	324	0
38GS04	6.98	22.8	291	0
38GS05	7.21	20.7	388	0
38GS06	7.30	21.5	296	0
38GS07	6.42	22.8	194	4
38GS08	7.23	21.7	386	0
38GS09	6.85	21.9	201	1
38GS10	6.77	23.8	243	0
38GS11	6.90	18.5	136	1
38GS12	6.96	20.0	412	2
38GS13	7.39	20.0	251	2
38GS14	7.03	24.4	303	1
38GS15	6.82	24.7	303	0
38GS16	6.56	22.8	269	0
38GS17	6.81	24.9	245	5
38GS18	6.65	21.7	300	0
38GS19	7.29	24.1	221	0
38GS20	7.15	23.5	255	1
38GS21	6.97	27.4	288	0
38GI01	7.56	25.0	564	0
38GI02	7.52	23.4	12,500	7
38GI03	6.86	23.0	3,880	14
38GI04	7.64	25.1	433	88
38GI07	7.50	24.2	189	2
38GI08	7.79	24.9	625	5
38GI09	8.00	23.4	106	1

Note:
µS/cm = microSiemens per centimeter

Sample Handling

Handling of sampled materials was minimized. Where necessary to transfer material from sampling devices to containers, the operation was conducted expediently, in as clean an environment as possible. Plastic sheeting was laid over the sample area and new gloves were donned before each sample was collected. Empty containers were kept packaged until used; once filled, they were immediately placed in coolers on ice. Sampling was not conducted in steady rain. Where sample aliquots were collected for separate analyses, those for VOC analysis were containerized first from unhomogenized soil to minimize degassing.

QA/QC Samples

QA/QC samples were collected to check field and laboratory procedures. QA/QC samples were used to test the level of reproducibility attainable the degree to which the sampling and analytical process could be accurately reproduced, the quality of equipment decontamination, quality of source waters and materials, sample exposure to ambient contamination during handling, and level of laboratory precision. All field QA/QC samples were collected in accordance with the Site 38 SAP (E/A&H, 1992a), the SAP addendum (E/A&H, 1992b) for the associated IWTP sewer line, and the CSAP for NAS Pensacola (E/A&H, 1994b). The samples were collected as follows.

Type and Frequency of QA/QC Samples:

- For each sampling task, duplicate samples were collected for every 10 media samples collected.

- One equipment rinsate sample was collected every day of field sampling from the sampling equipment specific to each task. The daily rinsate samples were submitted to the laboratory, but only samples from every other day were analyzed.

- One field blank was collected per week from the deionized water system at the E/A&H field trailer and from the potable water source at Site 38, which was the tanker truck operated by Kelly Environmental Services. The potable water sources for the tanker truck were outlets at the decontamination pads at either Site 1 or Site 11.

- One trip blank was submitted for each cooler containing samples for VOC analysis.

- One matrix spike and matrix spike duplicate (MS/MSD) sample was collected for every 20 samples collected.

- QA/QC samples were analyzed for the same parameters as the associated environmental samples.

Sample Containers and Preservation

Sample containers for all analyses were supplied pre-cleaned and certified by the laboratories. Sample preservation followed guidelines presented in the Site 38 SAP (Table 5-6).

Sample Packaging and Shipment

Sample containers were individually bubble-wrapped, placed in resealable bags, and packed on ice inside sturdy coolers. Samples were shipped to the laboratory the day of collection in iced coolers with sufficient volume to maintain uniform and appropriate preservation temperatures during shipment. Temperature blanks were placed in all coolers for laboratory verification of ambient cooler temperature upon arrival. Trip blanks were placed in coolers containing samples for VOC analysis.

Chain-of-Custody

To ensure the integrity of the sample transfer process, a strict chain-of-custody procedure was implemented for all samples collected. This procedure was initiated in the field for each sampling event and conducted through custody transfer to the contract laboratory.

Table 5-6
Sample Containers and Preservation per Medium and Analysis

Soil Analysis	Sample Container	Preservative
CLP TCL/TAL	8 oz. glass jar 4 oz. glass jar (VOC only)	4°C
Physical parameters	Shelby tube	—
Chemical-physical parameters (TOC, CEC, phosphorus, nitrate, and TKN)	1 L. Nalgene bottle	4°C
Heterotrophic plate count	2 oz. sterile plastic	4°C
Groundwater Analysis	**Sample Container**	**Preservative**
CLP TCL VOCs	40 ml glass vial	4°C - HCL, pH<2
CLP TCL SVOCs CLP TCL Pesticides/PCBs	(2) 1 L. amber bottle	4°C
CLP TAL Metals-unfiltered	1 L. Nalgene bottle	4°C - HNO_3, pH<2
Cyanide	500 ml. Nalgene bottle	4°C - NaOH, pH>10
BOD, TSS, Alkalinity, Nitrogen	1 L. Nalgene bottle	4°C
COD, Phosphorus, TKN	1 L. Nalgene bottle	4°C - H_2SO_4, pH<2
Hardness	1 L. Nalgene bottle	4°C - HNO_3, pH<2
Heterotrophic Plate Count	40 ml sterile glass vial	4°C

Chain-of-custody forms were completed for each batch of samples, indicating sample numbers, containers, preservatives, analyses requested, date and time of sampling, and express shipment number. Custody transfers were recorded by signature, date and time of relinquishment, and receipt of custody by the parties involved. The packaged samples were shipped overnight via express priority service for next morning delivery. The receiving laboratory was notified to expect a next-day delivery, and contacted to verify the shipment's arrival.

Ancillary Data

Ancillary data pertinent to sampling activities were collected for each sampling event. Field information included identification of sampling personnel, time of sampling, description of location, weather conditions, equipment/sample containers used, sampling methods used, test equipment used, physical/chemical parameters measured, soil lithology and stratigraphy, problems encountered, and procedural deviations. This information was recorded in the field logbook dedicated to the site.

Decontamination

Field equipment was decontaminated in accordance with the CSAP (E/A&H, 1994b). All exploration and sampling equipment was decontaminated before use at each sampling station, and equipment that came into contact with the actual sampled material was decontaminated between each sample collection at each station. Decontamination was accomplished as follows:

Decontamination Procedures

1. Laboratory-grade detergent and potable water wash
2. Tap water or analyte-free (deionized/organic-free) water rinse
3. Analyte-free water rinse
4. Two isopropyl alcohol rinses
5. Analyte-free water rinse
6. Air dry

Decontaminated sampling equipment was wrapped in aluminum foil if transported or stored before use. Large equipment was decontaminated at a dedicated station constructed of a wood frame and heavy plastic cover which was designed to funnel decontamination runoff water into a collection sump. A pressure-washing machine was used to spray down the large equipment and drill rig with a hot water and soap wash solution. Small equipment was decontaminated either at the dedicated area or at the site using the procedures outlined above.

5.5 Investigation-Derived Wastes

Wastes derived from the field investigation included drill cuttings, well development and purge water, decontamination water, used personal protective equipment (PPE), and well construction material wrappings. Generated wastes were handled in a manner that would minimize contact with the environment. Soil retrieved from hand-auger borings was placed on plastic sheeting or inside plastic bags, then transferred to 55-gallon drums. During drilling, plastic ground cover was placed over the boring locations to contain drilling spoils. Wastewater from the dedicated decontamination areas was collected in a plastic-lined sump. The wastewater in the sump was pumped out regularly into 55-gallon drums, and stored onsite until disposal by the U.S. Navy.

Waste generated at each soil boring/monitoring well location and at the decontamination station was containerized in 55-gallon drums and moved to an offsite location pending proper disposal by the Navy. All drums were marked with the sample location (well number, etc.), date, and type of investigation-derived waste. PPE and well construction material wrappings were containerized in the drums along with the drill cuttings, etc., or disposed in the E/A&H dumpster at the field trailer.

5.6 Methods for Hydrologic Investigations

Potentiometric Surface Data

Three water level data sets were collected at Site 38: one complete data set in May 1994, a second data set from select wells in August 1994 from high to low tide, and another complete data set in March 1996. Potentiometric surface maps were constructed from each data set (Section 6). Water levels were measured to the nearest 0.01-foot using an electronic water level indicator from a designated point on top of each well casing. The depth-to-water measurement was subtracted from the top of the well casing elevation to obtain the potentiometric surface elevation.

Specific-capacity tests were conducted to estimate the surficial zone transmissivity and hydraulic conductivity. Select monitoring wells were pumped at a constant rate and the associated drawdown in water level was monitored. Water level measurements were completed before pumping, then at scheduled time intervals from the start of pumping at 15 seconds, 30 seconds, 45 seconds, one minute, two minutes, three minutes, and five minutes. The pump was shut down and the measurements were repeated in the same manner at 15 seconds, 30 seconds, 45 seconds, etc. to monitor aquifer recovery. The drawdown and duration of pumping were entered into a computer program (described below) with other variables that characterize the aquifer and the pumping system. The program output estimated specific capacity, transmissivity, and hydraulic conductivity.

Aquifer parameters were calculated from the specific capacity test data using a computer program developed by Bradbury and Rothschild (1985). The two assumed variables entered into the specific capacity program were the storage coefficient and well-loss coefficient. A storage coefficient of 0.25 was estimated for unconfined fine- to medium-grained sand aquifers from Todd (1980) and a well-loss coefficient of 0.75 was used to approximate well efficiency. The specific capacity test results are summarized and discussed in Section 6.

A limited tidal study was completed at Site 38. Transducers were installed in five wells across the site and a sixth transducer was placed at a fixed point in Pensacola Bay adjacent to Site 38. The transducers measured the relative change in each well and the bay for approximately 42 hours. This study is detailed in Section 6.

5.7 BRAC Team Additional Sampling Activities

As part of the RI, an additional site investigation was completed by the NAS Pensacola BRAC Team at Site 38 (Building 604 Plating Shop and former Building 71 Old Plating Shop). This site is included in RI/FS Category VII of the *Revised 1995 Site Management Plan of the Installation Restoration Program for the Naval Air Station Pensacola, Pensacola, Florida*

(SOUTHNAVFACENGCOM, 1995). These additional field activities were performed at Site 38 to adequately assess the nature, magnitude, and extent of contaminated soil and groundwater, as defined by the screening values for the contaminants. Field activities performed during the site investigation included advancing 42 soil borings, installating 11 permanent and 34 temporary monitoring wells, and collecting 79 soil and 58 groundwater samples. Field sampling, analytical methods, and reporting were conducted at USEPA Level II and IV protocols, as appropriate. Data from the mobile laboratories were reported at Level II protocol, all other data were reported at Level IV protocol. Chemical analyses were performed by onsite mobile Field Analytical Services Program (FASP) laboratories operating under USEPA's Environmental Services Assistance Team (ESAT) contract, and the USEPA Region IV laboratory.

Primary references for these additional field activities include the *Sampling and Analysis Plan for Site 38 (Building 604), Site 44 (Building 3221)* (USEPA, 1995), the *Remedial Investigation Report — Site 38* (E/A&H, 1994a), the Region IV *Environmental Compliance Branch SOP/QAM* (USEPA, 1991a), and the Region IV *Analytical Support Branch Standard Operating Procedures* (USEPA, 1990a,b).

A three-phase approach was used during the BRAC Team field investigation of Site 38.

- **Phase I (nature and magnitude phase, previous RI)**. Phase I activities were performed on all sites to verify the presence of contaminants, based on comparison to the Preliminary Remedial Goals (PRGs) established for these sites. This phase was performed during the previous investigation of Site 38 by E/A&H. As a result of this investigation, permanent monitoring wells were installed.

- **Phase II (delineation phase, additional field investigation)**. During Phase II, groundwater and soil contamination was assessed by installing temporary monitoring wells, with additional sampling completed as necessary. Sampling strategies were based

on the Phase I analytical results and included tailoring the analytical suite to specific analytes or compounds of concern. Recommendations for permanent monitoring well locations were proposed during this investigation.

- **Phase III (confirmation phase, additional field investigation).** Phase III fieldwork included installing permanent monitoring wells to replace temporary ones. These were used to confirm contamination delineation and provide data for the BRA. Phase III permanent wells are also part of a base-wide periodic groundwater monitoring program.

Due to the time frame and purpose of the additional BRAC sampling activities, they are discussed in this section separately from the other RI activities. The following subsections contain discussions of BRAC sampling methods.

5.7.1 BRAC Team Methodology

The methods used for this additional BRAC investigation included the advancing soil borings, installing permanent and temporary groundwater monitoring wells, and collecting soil and groundwater samples.

Sampling Objectives

The objectives of the additional field sampling effort are to:

- Delineate the nature and extent of contamination.
- Assess the need for site remediation.

Sampling and Analytic Requirements

The sampling and analyses performed for these investigations are discussed in this section. The number of samples by medium is also listed. Changes to the field sampling plan were made in the field upon a consensus of team members present. The most significant change was the

extension of the investigation northward to Building 636, when it became apparent that the chlorinated solvent plume was not confined to the immediate area of Building 604.

Thirty-seven groundwater samples were collected from temporary monitoring wells and analyzed onsite in mobile laboratories provided by USEPA via the FASP contract. Samples for inorganic analysis were not digested (with one exception), and the resulting data must be considered to reflect the dissolved fraction. This strategy enabled the mobile laboratories to return data to the sampling team within 16 hours of sample receipt. The selection of analytes for the mobile laboratories was based upon the results of Phase I of the Site 38 RI. Specifically, the chosen contaminants were present at concentrations above their screening values and their extent was not defined.

The USEPA CLP TAL/TCL was used to provide a full spectrum of legally defensible contaminant analyses for the remaining samples, except pesticides. All Level IV groundwater samples were analyzed for pesticides, but only 21 of the 73 soil samples because pesticides were anticipated to be present only from application, not disposal, mixing, etc.

Analytical Organization

- **Full Scan Analysis (FSA).** The parameters include TAL metals (unfiltered), TCL cyanide, TCL pesticides, TCL polychlorinated biphenyls, TCL base-neutral/acid extractable organic compounds (BNAs), and TCL volatile organic compounds.

- **Full Scan Analysis/No Pesticides-PCBs (FSA/NP).** The parameters include TAL metals (unfiltered), TAL cyanide, TCL BNAs, and TCL VOCs.

- **Mobile Laboratory Parameters (MLP).** The parameters include cadmium, lead, chromium, 1,2-dichloroethene (total), tetrachloroethene, trichloroethene, and vinyl chloride.

Sample Locations and Rationale

The sampling program is described in this section. One intermediate-depth well was installed and sampled at Site 38 near the former Building 71(GW-T05). This well was installed to address a perceived data gap from Site 38 in the intermediate depth. The four previously installed intermediate depth wells at Building 604 were sampled to provide additional data.

Soil Sampling Strategy

Grab soil samples were collected from all temporary monitoring well borings at the surface and the groundwater interface. FSA was conducted on 21 soil samples from borings in unpaved areas. The remaining samples (52 total) were analyzed for FSA/NP. Grab soil samples were collected from all permanent monitoring well borings at the surface and the groundwater interface. FSA was conducted on all of these soil samples. South of the former UST, visible staining on Building 604's brick facade indicated areas of possible soil contamination. Five surface and two subsurface soil samples were collected from this area. Soil sample locations are presented on Figure 5-5.

Table 5-7 lists soil sample locations and associated sample identifier.

Groundwater Sampling Strategy

Groundwater samples were collected from temporary and permanent monitoring wells. Thirty-four temporary wells were installed, 15 more than the 19 originally proposed. All groundwater samples from temporary wells were analyzed for MLP. Based upon these data, locations for permanent shallow wells were selected in the field and these permanent wells were than installed and sampled (FSA). Eight of the 12 newly installed permanent wells were collocated with temporary wells. The preselected locations for the temporary monitoring wells were based upon data from in previous reports. Once these temporary wells were sampled and analyzed, the data were analyzed using a commercial modeling program (Surfer for Windows, v5.01). The results of the modeling program were then used to select additional monitoring well

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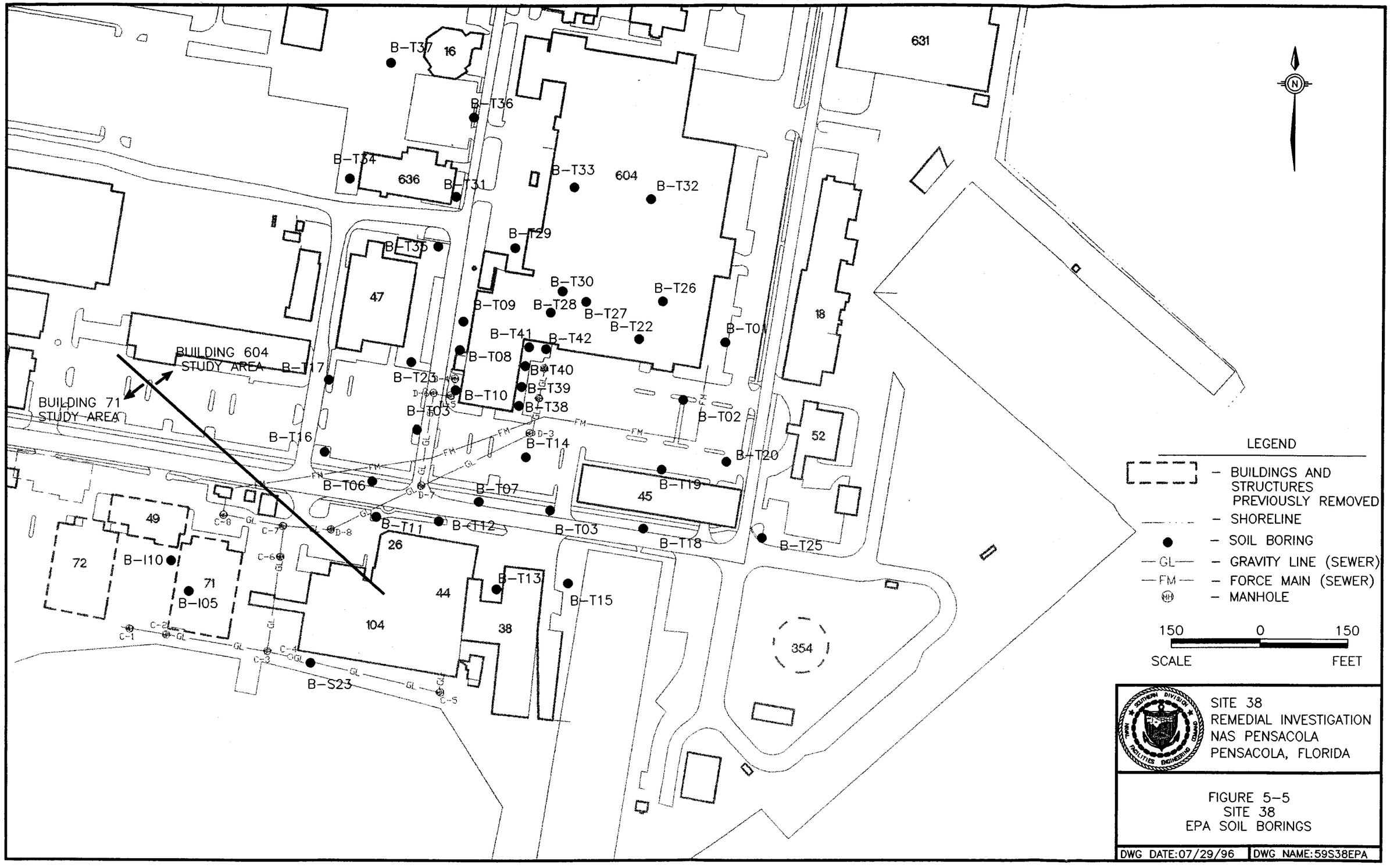
B-T37
16
B-T36
B-T34
636
B-T31
B-T33
604
B-T32
B-T29
B-T35
47
B-T30
B-T26
B-T09
B-T28
B-T27
B-T22
B-T01
B-T41
B-T42
B-T08
B-T40
B-T39
B-T38
B-T10
B-T23
B-T03
B-T02
BUILDING 604
STUDY AREA
B-T17
BUILDING 71
STUDY AREA
B-T16
B-T14
B-T20
B-T06
B-T07
B-T19
45
49
B-T11
B-T12
B-T03
B-T18
B-T25
72
B-I10
26
71
B-I05
44
B-T13
B-T15
104
38
B-S23
354
631
18
52
LEGEND
BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
SHORELINE
SOIL BORING
GRAVITY LINE (SEWER)
FORCE MAIN (SEWER)
MANHOLE
150 0 150
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 5-5
SITE 38
EPA SOIL BORINGS
DWG DATE:07/29/96
DWG NAME:59S38EPA

Table 5-7
Site 38 BRAC Additional Soil Samples

Boring Location	Sample Identifier	Sample Interval	Date Sampled	Remarks
B-I10	0SFS0I1001 0SBS0I1002	0-1 ft. At water table.	10/18/95	Collocated with permanent well 38GI10.
B-S23	0SFS0S2301 0SBS0S2302	0-1 ft. At water table.	10/19/95	Collocated with permanent well 38GS23.
B-T01	0SFS0T0101 0SBS0T0102	0-1 ft. At water table.	10/17/95	Collocated with temporary well GW-T01.
B-T02	0SFS0T0201	0-1 ft.	10/17/95	Collocated with temporary well GW-T02.
B-T03	0SFS0T0301 0SBS0T0302	0-1 ft. At water table.	10/17/95	Collocated with temporary well GW-T03.
B-T04	0SFS0T0401 0SBS0T0402	0-1 ft. At water table.	10/17/95	Collocated with permanent well 38GS26.
B-T05	0SFS0T0501 0SBS0T0502	0-1 ft. At water table.	10/17/95	Collocated with temporary well GW-T05.
B-T06	0SFS0T0601 0SBS0T0602	0-1 ft. At water table.	10/18/95	Collocated with temporary well GW-T06.
B-T07	0SFS0T0701 0SBS0T0702	0-1 ft. At water table.	10/18/95	Collocated with temporary well GW-T07.
B-T08	0SFS0T0801 0SBS0T0802	0-1 ft. At water table.	10/18/95	Collocated with temporary well GW-T08.
B-T09	0SFS0T0901 0SBS0T0902	0-1 ft. At water table.	10/18/95	Collocated with temporary well GW-T09.
B-T10	0SFS0T1001 0SBS0T1002	0-1 ft. At water table.	10/18/95	Collocated with permanent well 38GS24.
B-T11	0SFS0T1101 0SBS0T1102	0-1 ft. At water table.	10/18/95	Collocated with temporary well GW-T11.
B-T12	0SFS0T1201 0SBS0T1202	0-1 ft. At water table.	10/18/95	Collocated with temporary well GW-T12.
B-T13	0SFS0T1301 0SBS0T1302	0-1 ft. At water table.	10/18/95	Collocated with temporary well GW-T13.

Table 5-7
Site 38 BRAC Additional Soil Samples

Boring Location	Sample Identifier	Sample Interval	Date Sampled	Remarks
B-T14	0SFS0T1401 0SBS0T1402	0-1 ft. At water table.	10/18/95	Collocated with permanent well 38GS29.
B-T15	0SFS0T1501 0SBS0T1502	0-1 ft. At water table.	10/18/95	Collocated with temporary well GS-T15.
B-T16	0SFS0T1601 0SBS0T1602	0-1 ft. At water table.	10/19/95	Collocated with temporary well GW-T16.
B-T17	0SFS0T1701 0SBS0T1702	0-1 ft. At water table.	10/19/95	Collocated with temporary well GW-T17.
B-T18	0SFS0T1801 0SBS0T1802	0-1 ft. At water table.	10/19/95	Collocated with temporary well GW-T18.
B-T19	0SFS0T1901 0SBS0T1902	0-1 ft. At water table.	10/19/95	Collocated with temporary well GW-T19.
B-T20	0SFS0T2001 0SBS0T2002	0-1 ft. At water table.	10/19/95	Collocated with temporary well GW-T20.
B-T22	0SFS0T2201 0SBS0T2202	0-1 ft. At water table.	10/19/95	Collocated with temporary well GW-T22.
B-T23	0SFS0T2301 0SBS0T2302	0-1 ft. At water table.	10/20/95	Collocated with temporary well GW-T23.
B-T25	0SFS0T2501 0SBS0T2502	0-1 ft. At water table.	10/20/95	Collocated with temporary well GW-T25.
B-T26	0SFS0T2601 0SBS0T2602	0-1 ft. At water table.	10/20/95	Collocated with temporary well GW-T26.
B-T27	0SFS0T2701 0SBS0T2702	0-1 ft. At water table.	10/20/95	Collocated with temporary well GW-T27.
B-T28	0SFS0T2801 0SBS0T2802	0-1 ft. At water table.	10/20/95	Collocated with temporary well GW-T28.
B-T29	0SFS0T2901 0SBS0T2902	0-1 ft. At water table.	10/20/95	Collocated with permanent well 38GS30.
B-T30	0SBS0T3002	At water table.	10/21/95	Collocated with temporary well GW-T30.

Table 5-7
Site 38 BRAC Additional Soil Samples

Boring Location	Sample Identifier	Sample Interval	Date Sampled	Remarks
B-T31	0SFS0T3101 0SBS0T3102	0-1 ft. At water table.	10/21/95	Collocated with temporary well GW-T31.
B-T32	0SFS0T3201 0SBS0T3202	0-1 ft. At water table.	10/23/95	Collocated with permanent well 38GS25.
B-T33	0SFS0T3301 0SBS0T3302	0-1 ft. At water table.	10/23/95	Collocated with temporary well GW-T33.
B-T34	0SFS0T3401 0SBS0T3402	0-1 ft. At water table.	10/23/95	Collocated with temporary well GW-T34.
B-T35	0SFS0T3501 0SBS0T3502	0-1 ft. At water table.	10/23/95	Collocated with permanent well 38GS27.
B-T36	0SFS0T3601 0SBS0T3602	0-1 ft. At water table.	10/23/95	Collocated with permanent well 38GS31.
B-T37	0SFS0T3701 0SBS0T3702	0-1 ft. At water table.	10/23/95	Collocated with permanent well 38GS28.
B-T38	0SFS0T3801	0-1 ft.	10/24/95	Soil boring only.
B-T39	0SFS0T3901	0-1 ft.	10/24/95	Soil boring only.
B-T40	0SFS0T4001 0SBS0T4002	0-1 ft. At water table.	10/24/95	Soil boring only.
B-T41	0SFS0T4101 0SBS0T4102	0-1 ft. At water table.	10/24/95	Soil boring only.
B-T42	0SFS0T4201	0-1 ft.	10/24/95	Soil boring only.

Note:
Full Scan Analysis was performed on all samples.

locations. These were then sampled, and the data added to the model. This process continued until the plume was adequately delineated. Temporary well locations are shown on Figure 5-6. Permanent wells sampled during this phase of the investigation are shown on Figure 5-7.

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GW-T37
16
GW-T36
GW-T34
636
GW-T31
GW-T33
GW-T32
604
GW-T29
GW-T35
47
GW-T30
GW-T27
GW-T26
GW-T28
GW-T09
GW-T22
GW-T01
18
GW-T23
GW-T08
GW-T17
GW-T09
BUILDING 604
STUDY AREA
BUILDING 71
STUDY AREA
GW-T16
GW-T04
GW-T14
52
GW-T20
GW-T06
GW-T07
GW-T03
45
GW-T19
49
GW-T11
26
GW-T12
GW-T18
GW-T25
72
GW-T05
71
GW-T15
44
GW-T13
104
38
LEGEND
BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
SHORELINE
TEMPORARY WELL
GL GRAVITY LINE (SEWER)
FM FORCE MAIN (SEWER)
150 0 150
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 5-6
SITE 38
EPA TEMPORARY WELLS
DWG DATE:08/07/96
DWG NAME:59S38ETW

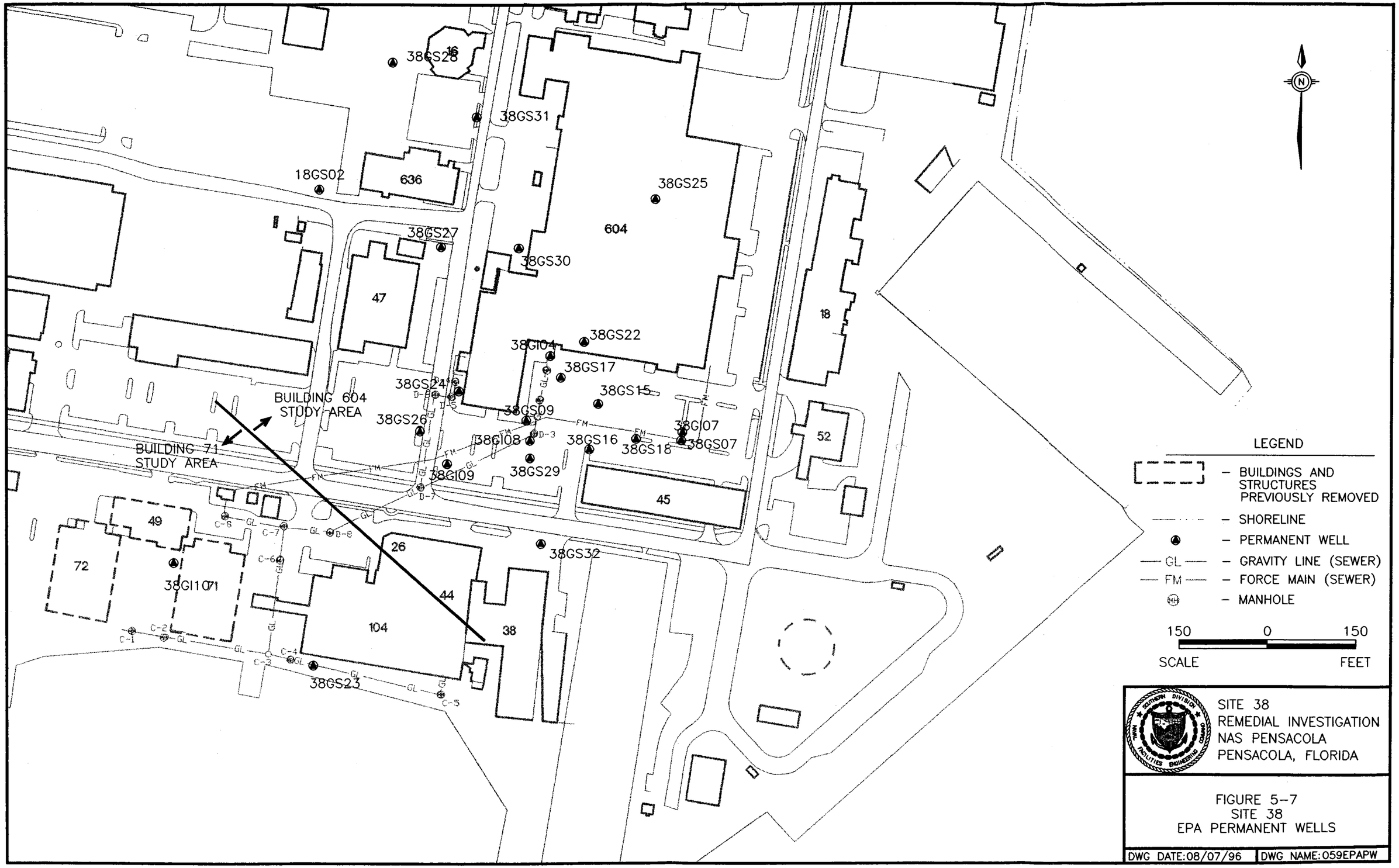
38GS28
16
38GS31
18GS02
636
38GS25
604
38GS27
38GS30
47
18
38GS22
38GI04
38GS17
38GS24
38GS15
BUILDING 604
STUDY AREA
38GS26
38GS09
38GI07
38GI08
38GS16
38GS18
38GS07
52
BUILDING 71
STUDY AREA
38GI09
38GS29
45
49
26
38GS32
72
38GI1071
44
104
38
38GS23
LEGEND
BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
SHORELINE
PERMANENT WELL
GL GRAVITY LINE (SEWER)
FM FORCE MAIN (SEWER)
MANHOLE
150 0 150
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 5-7
SITE 38
EPA PERMANENT WELLS
DWG DATE:08/07/96
DWG NAME:059EPAPW

Table 5-8 lists each groundwater sample location and associated sample identifier for permanent and temporary wells.

Sampling Procedures

The sampling procedures used were consistent with the SOP/QAM.

Soil Sampling

Soil borings were advanced using HSA drilling techniques or hand augers, as appropriate. Soil was sampled using stainless-steel split-barrel samplers or collected directly from the stainless-steel hand augers in accordance with the SOP/QAM.

Monitoring Well Installation

Temporary and permanent monitoring well borings were advanced in accordance with the SOP/QAM. Shallow temporary wells were installed using a hand auger. One intermediate-depth temporary well was installed using the drill rig. Permanent monitoring wells were installed using HSA drilling techniques. Because of possible floating contaminants, shallow monitoring wells were installed such that the well screen brackets the water table.

Upon completion, the monitoring wells were developed. Development continued until the water withdrawn was as free of turbidity as possible given the lithology of the screened interval and pH, temperature, and specific conductivity were stabilized. These measurements were recorded.

Groundwater Sampling

Groundwater was sampled in accordance with the SOP/QAM. Permanent and temporary shallow wells were purged and sampled using a peristaltic pump/vacuum jug method. This method uses a peristaltic pump and dedicated, decontaminated, 0.25-inch outside diameter (OD) Teflon tubing to purge a well at a slow, controlled pumping rate. Samples were collected

Table 5-8
Site 38 BRAC Team Additional Groundwater Samples

Well Number	Sample Number	Date Sampled	Remarks	Analysis
18GS02	018GS00201	10/24/95	Permanent well	FSA
38GI04	038GI00401	10/24/95	Permanent well	FSA
38GI07	038GI00701	10/24/95	Permanent well	FSA
38GI08	038GI00801	10/24/95	Permanent well	FSA
38GI09	038GI00901	10/23/95	Permanent well	FSA
38GI10	038GI01001	10/23/95	Permanent well	FSA
38GS07	038GS00701	10/24/95	Permanent well	FSA
38GS09	038GS00901	10/25/95	Permanent well	FSA
38GS15	038G0G1501	10/21/95	Permanent well	MLP
38GS16	038GOG1601	10/21/95	Permanent well	MLP
38GS17	038G0G1701	10/21/95	Permanent well	MLP
	038GS01701	10/24/95		FSA
38GS18	038GS01801	10/24/95	Permanent well	FSA
38GS22	038GS02201	10/25/94	Permanent well	FSA
38GS23	038GS02301	10/23/95	Permanent well	FSA
38GS24	038GS02401	10/25/95	Permanent well	FSA
38GS25	038GS02501	10/25/95	Permanent well	FSA
38GS26	038GS02601	10/25/95	Permanent well	FSA
38GS27	038GS02701	10/25/95	Permanent well	FSA
38GS28	038GS02801	10/25/95	Permanent well	FSA
[redacted]	038GS02901	10/25/95	Permanent well	FSA
38GS30	038GS03001	10/25/95	Permanent well	FSA
38GS31	038GS03101	10/25/95	Permanent well	FSA
38GS32	038GS03201	10/25/95	Permanent well	FSA
GW-T01	0GWG0T0101	10/17/95	Temporary well	MLP

Table 5-8
Site 38 BRAC Team Additional Groundwater Samples

Well Number	Sample Number	Date Sampled	Remarks	Analysis
GW-T03	0GWG0T0301	10/17/95	Temporary well	MLP
GW-T04	0GWG0T0401	10/17/95	Temporary well converted to permanent well 38GS26	MLP
GW-T05	0GWG0T0501	10/18/95	Temporary well	FSA
GW-T06	0GWG0T0601	10/18/95	Temporary well	MLP
GW-T07	0GWG0T0701	10/18/95	Temporary well	MLP
GW-T08	0GWG0T0801	10/18/95	Temporary well	MLP
GW-T09	0GWG0T0901	10/18/95	Temporary well	MLP
GW-T10	0GWG0T1001	10/18/95	Temporary well converted to permanent well 38GS24	MLP
GW-T11	0GWG0T1101	10/18/95	Temporary well	MLP
GW-T12	0GWG0T1201	10/18/95	Temporary well	MLP
GW-T13	0GWG0T1301	10/18/95	Temporary well	MLP
GW-T14	0GWG0T1401	10/18/95	Temporary well converted to permanent well 38GS29	MLP
GW-T15	0GWG0T1501	10/18/95	Temporary well	MLP
GW-T16	0GWG0T1601	10/19/95	Temporary well	MLP
GW-T17	0GWG0T1701	10/19/95	Temporary well	MLP
GW-T18	0GWG0T1801	10/19/95	Temporary well	MLP
GW-T19	0GWG0T1901	10/19/95	Temporary well	MLP
GW-T20	0GWG0T2001	10/19/95	Temporary well	MLP
GW-T22	0GWG0T2201	10/19/95	Temporary well	MLP
GW-T23	0GWG0T2301	10/20/95	Temporary well	MLP
GW-T25	0GWG0T2501	10/20/95	Temporary well	MLP
GW-T26	0GWG0T2601	10/20/95	Temporary well	MLP

Table 5-8
Site 38 BRAC Team Additional Groundwater Samples

Well Number	Sample Number	Date Sampled	Remarks	Analysis
GW-T27	0GWG0T2701	10/20/95	Temporary well	MLP
GW-T28	0GWG0T2801	10/20/95	Temporary well	MLP
GW-T29	0GWG0T2901	10/20/95	Temporary well converted to permanent well 38GS30	MLP
GW-T30	0GWG0T3001	10/21/95	Temporary well	MLP
GW-T31	0GWG0T3101	10/21/95	Temporary well	MLP
GW-T32	0GWG0T3201	10/23/95	Temporary well converted to permanent well 38GS25	MLP
GW-T33	0GWG0T3301	10/23/95	Temporary well	MLP
GW-T34	0GWG0T3401	10/23/95	Temporary well	MLP
GW-T35	0GWG0T3501	10/23/95	Temporary well converted to permanent well 38GS27	MLP
GW-T36	0GWG0T3601	10/23/95	Temporary well converted to permanent well 38GS31	MLP
GW-T37	0GWG0T3701	10/23/95	Temporary well converted to permanent well 38GS28	MLP

Notes:
FSA = Full Scan Analysis
MLP = Mobile Laboratory Parameters

directly into the sample containers. To prevent potential degassing of volatiles, samples for VOC analyses were collected by disconnecting the tubing from the pump, and allowing the water in the tube to drain into the sample vials. Groundwater samples were collected at the top of the water column and were as clear as possible given the subsurface geology. Field parameters recorded during groundwater sampling included organic vapor levels, pH, temperature, specific conductivity, and turbidity.

Sample Identification

A 10-digit code identifies soil and groundwater samples. This code identifies samples by site, sample medium, and location.

The first three digits identify the site or sample media as follows:

018	=	Site 18
038	=	Site 38
0GW	=	Groundwater sample from Site 38 temporary well
0SB	=	Subsurface soil sample from Site 38
0SF	=	Surface soil sample from Site 38

The fourth and fifth digits identify the sample matrix as follows:

GS	=	Groundwater sample from a shallow well
GI	=	Groundwater sample from an intermediate well
G0	=	Groundwater sample from a temporary well
S0	=	Soil sample

The sixth through eighth digits identify the sampling location as follows:

I10	=	Soil sample from boring B-I10
S23	=	Soil sample from boring B-S23
T01	=	Soil or groundwater sample from temporary T01
G15	=	Groundwater sample from well GS15

The ninth and tenth digits identify the sampling depth intervals follows:

01	=	0-1 ft. soil sample interval or top of the water column
02	=	Sample collected from the groundwater interface

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6.0 SITE GEOLOGICAL AND HYDROLOGICAL CONDITIONS

Soil and groundwater data were collected to develop an understanding of the site stratigraphy and hydrologic system for the FS and, if necessary, the remedial design. Soil boring logs were used to describe the site stratigraphy; aquifer tests and tidal influence studies were used to assess the surficial aquifer's hydraulic characteristics. In addition, soil and groundwater samples were submitted for laboratory analysis of physical characteristics and chemical properties. This information was used to assess contaminant fate and transport, and to evaluate possible remedial actions.

6.1 Surficial Soil Zone Assessment

Data from 67 soil borings were used to develop the stratigraphic information included in this RI, including 25 borings advanced in February 1993, and 42 borings advanced between July and December 1993. The soil boring locations are shown on Figure 6-1; boring logs are in Appendix E. Forty-one soil borings were completed to the water table to collect soil samples, 20 soil borings were completed to install permanent or temporary shallow monitoring wells (typically less than 13 feet bls), and six borings were completed to the base of the surficial zone to install intermediate monitoring wells.

ABB advanced 12 soil borings during the UST investigation south of Building 604. No soil samples were collected, but monitoring wells were installed in all borings. Copies of the ABB boring logs are included in Appendix C.

6.1.1 Site Stratigraphy

The stratigraphy observed at Site 38 is consistent with previous findings at NAS Pensacola. The typical shallow soil profile is shown in two cross sections, A-A' (Figure 6-2) which trends north-south across the Building 71 area and B-B' (Figure 6-3) which trends east-west along the force-main IWTP sewer line. The surficial zone thickness varies from 30 to 45 feet and consists

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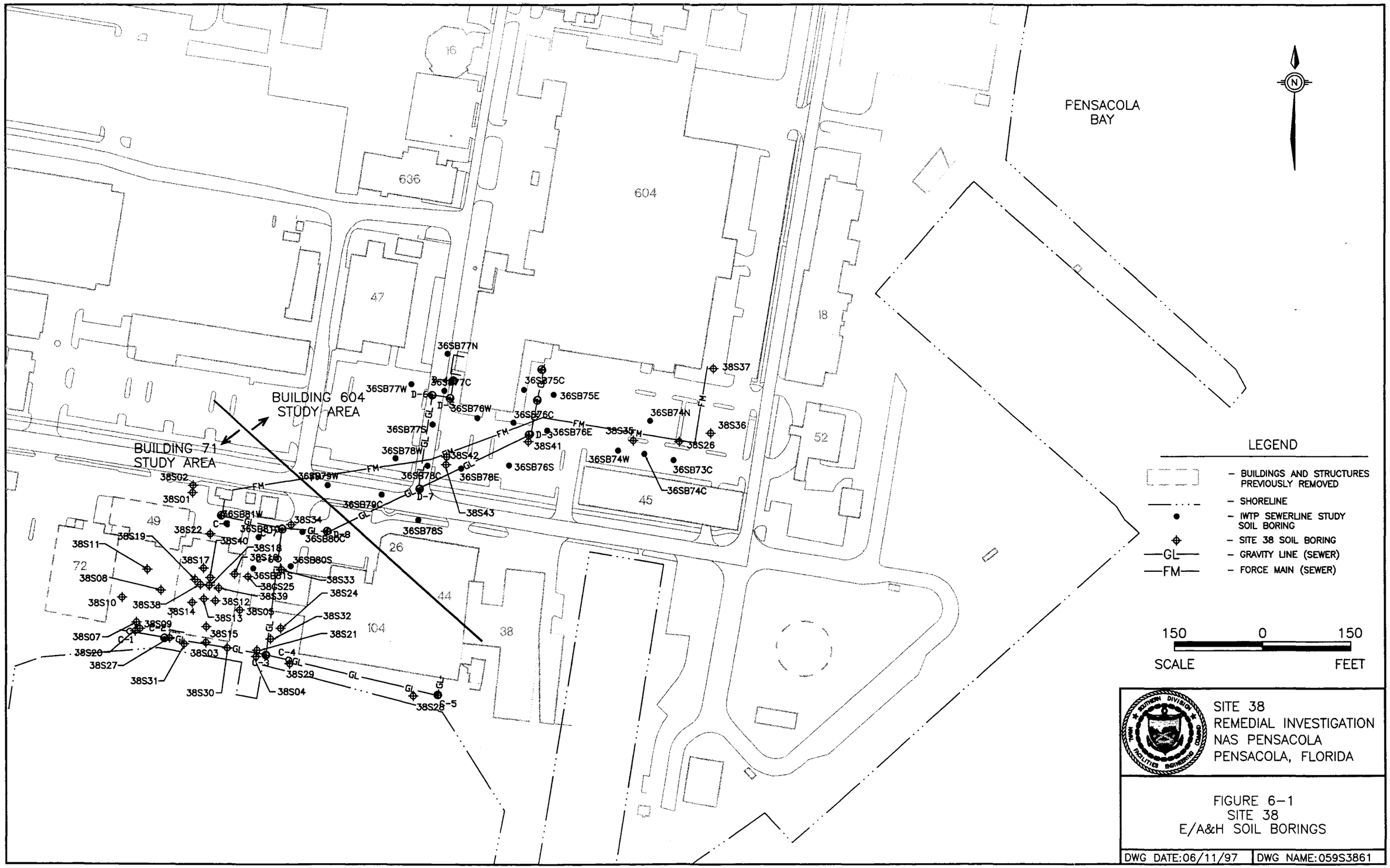
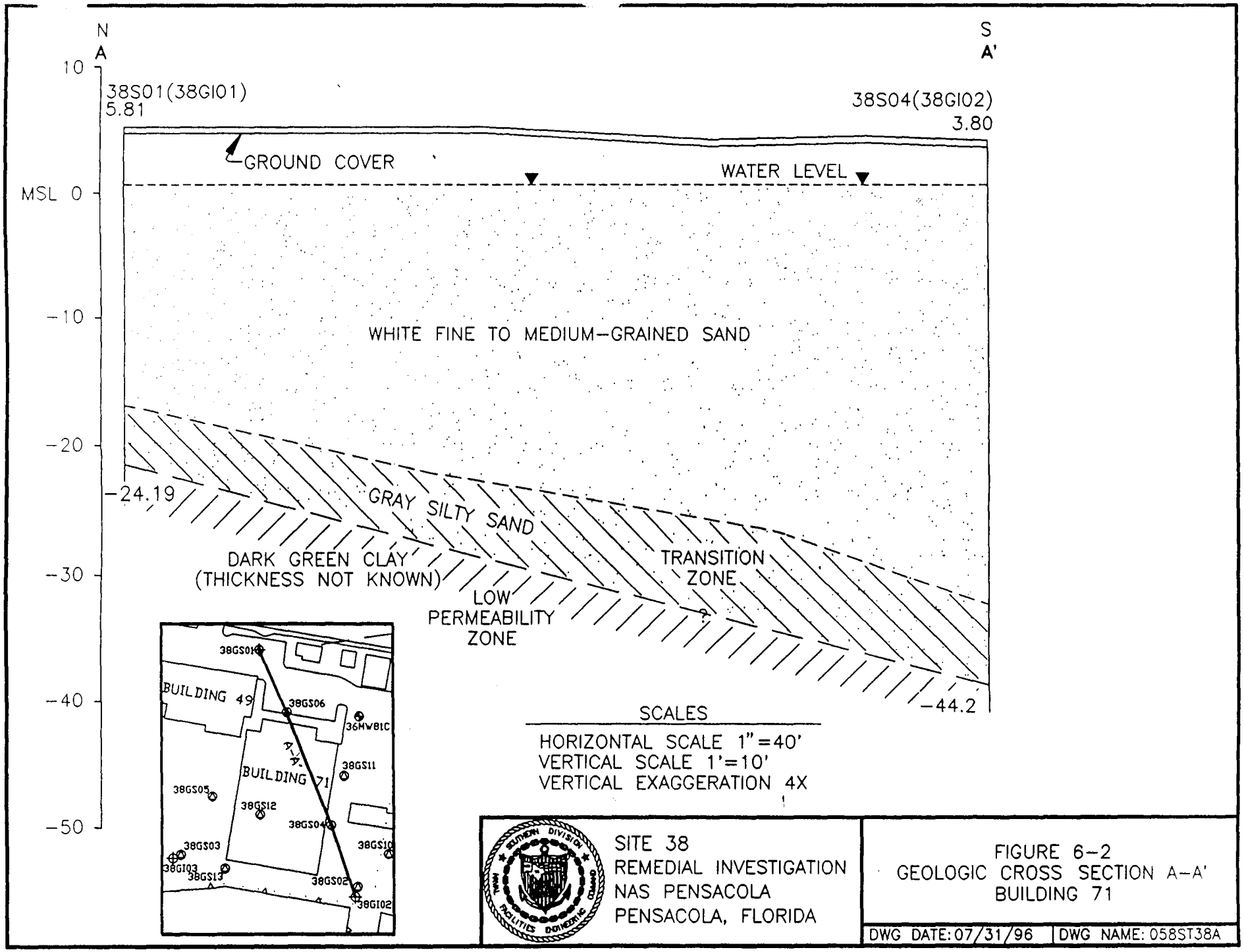

FENSACOLA BAY
N
604
636
47
16
18
52
45
49
72
26
44
104
38
BUILDING 604 STUDY AREA
BUILDING 71 STUDY AREA
36SB77N
36SB77W
36SB77C
36SB76W
36SB75C
36SB75E
36SB76C
36SB76E
36SB77S
36SB78W
36SB78C
36SB78E
36SB76S
36SB74N
36SB74W
36SB73C
36SB74C
36SB79W
36SB79C
36SB78S
36SB81W
36SB81C
36SB80C
36SB80S
36SB81S
38S37
38S36
38S35
38S26
38S42
38S41
38S43
38S34
38S02
38S01
38S22
38S19
38S40
38S18
38S17
38S11
38S08
38S10
38S38
38S14
38S12
38S13
38S39
38S25
38S33
38S24
38S32
38S21
38S09
38S07
38S20
38S27
38S31
38S03
38S15
38S30
38S04
38S29
38S28
D-1
D-2
D-3
D-4
D-5
D-6
D-7
D-8
C-1
C-2
C-3
C-4
C-5
GL
FM
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY SOIL BORING
– SITE 38 SOIL BORING
—GL— – GRAVITY LINE (SEWER)
—FM— – FORCE MAIN (SEWER)
150 0 150
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 6-1
SITE 38
E/A&H SOIL BORINGS
DWG DATE:06/11/97
DWG NAME:059S3861


N
A
S
A'
10
MSL 0
-10
-20
-30
-40
-50
38S01(38GI01)
5.81
38S04(38GI02)
3.80
GROUND COVER
WATER LEVEL
WHITE FINE TO MEDIUM-GRAINED SAND
-24.19
GRAY SILTY SAND
DARK GREEN CLAY
(THICKNESS NOT KNOWN)
LOW
PERMEABILITY
ZONE
TRANSITION
ZONE
?
-44.2
SCALES
HORIZONTAL SCALE 1"=40'
VERTICAL SCALE 1'=10'
VERTICAL EXAGGERATION 4X
38GS01
BUILDING 49
38GS06
36HWB1C
A-A'
BUILDING 71
38GS11
38GS05
38GS12
38GS04
38GS10
38GS03
38GI03
38GS13
38GS02
38GI02
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 6-2
GEOLOGIC CROSS SECTION A-A'
BUILDING 71
DWG DATE: 07/31/96
DWG NAME: 058ST38A

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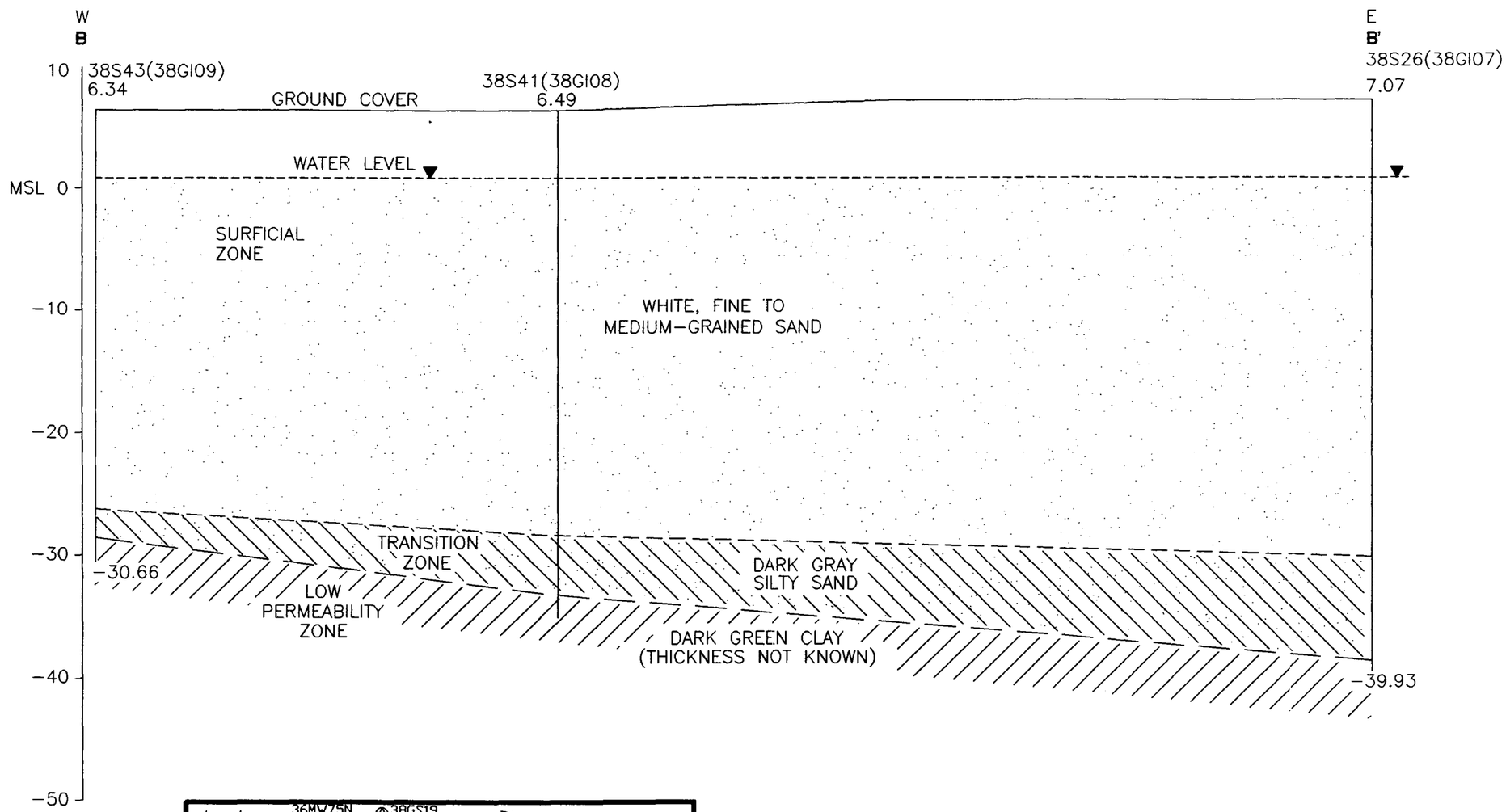
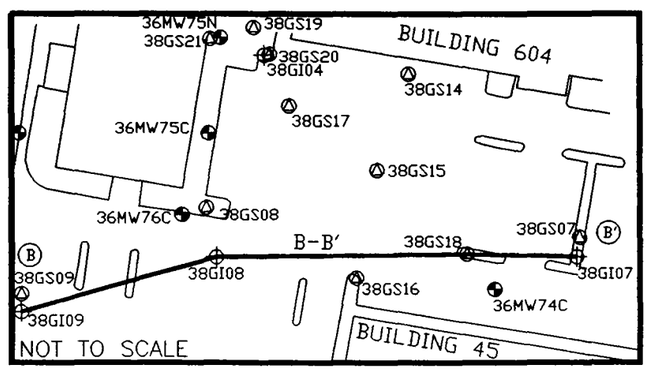




SCALES

HORIZONTAL SCALE 1"=40'
VERTICAL SCALE 1'=10'
VERTICAL EXAGGERATION 4X

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 6-3
GEOLOGIC CROSS SECTION B-B'
BUILDING 604 AREA

DWG DATE:06/06/97 | DWG NAME:59GCS604

of fine- to medium-grained, grayish-white quartz sand with localized, thin layers of silty clay. A "transition zone" ranging from 2 to 12 feet thick is at the base of the surficial zone, and it grades downward from a poorly sorted sand and silty clay into a dense, dark greenish-gray lean clay. This clay layer is 30 to 45 feet bls and was encountered in all intermediate depth borings. The clay thickness at Site 38 was not determined, but it reportedly varies from 12 to 17 feet thick in the NAS Pensacola area.

6.1.2 Soil Physical Properties

Five Shelby tube samples were collected from borings 36SB75C, 36SB73N, 38S43, 38S20, and 38S26. Two samples were collected from the unsaturated soil zone, two from the transition zone, and one from the clay layer. Each Shelby Tube sample was analyzed for grain-size distribution, vertical permeability, percent porosity, and specific gravity. These data are presented in Table 6-1. Soil porosity is the percentage of void space per sample volume, and permeability is the soil capacity for transmitting fluid. Specific gravity is the ratio of the mass of soil to the mass of an equal volume of water. The results are consistent with findings from other NAS Pensacola sites. Vertical permeability decreases with increasing depth, with the greatest change occurring between the transition zone (base of the surficial zone) and the underlying clay layer. The vertical permeability of the transition zone is 4.784×10^{-3} centimeters per second (cm/sec) compared to 1.036×10^{-8} cm/sec for the clay layer. A unit may be classified as an aquitard if the permeability is less than 1×10^{-5} cm/sec (Fetter, 1988). An aquitard that is laterally continuous, such as the clay layer at the base of the surficial zone, would likely retard the vertical migration of groundwater and site contaminants.

6.1.3 Soil Chemical Properties

Fifteen soil samples were collected at Site 38 and analyzed for CEC, TOC, TKN, nitrate, total phosphorus, and heterotrophic plate count. The data are summarized in Table 6-2. The Shelby

Table 6-1
Soil Physical Properties

Sample # (Boring)	Soil Zone	Sample Depth (Feet)	Percent Porosity	Specific Gravity	Vertical Permeability cm/sec[a] (ft/day)	USCS Classification
36S75C02 (36S75C)[b]	UZ	0 to 2	42.02	2.649	1.934e-02 (54.82)	Medium to fine sand, trace gravel (SP)
36S73N02 (36S73N)[b]	UZ	0 to 2	39.87	2.649	2.438e-3 (6.91)	Coarse to fine sand, trace gravel (SP-SM)
38GI09 (38S43)[b]	TZ	35 to 37	54.07	2.603	4.784e-3 (13.56)	Silty fine sand (SM)
38S09B1 (38S20)[b]	TZ/CL	45 to 47	57.82	2.599	1.167e-4 (0.31)	Medium to fine sandy lean clay (CL)
38GI07 (38S26)[b]	CL	45 to 47	70.50	2.468	1.036e-8 (2.937e-5)	Lean clay (CL)

Notes:
a = cm/sec are multiplied by 2,835 to calculate ft/day.
b = Numbers in parentheses are the laboratory report sample identification.
Soil Zones = unsaturated zone (UZ), transition zone (TZ), and clay layer (CL).
The laboratory reports are provided Appendix F.

Table 6-2
Soil Chemical Properties

Parameter Sample ID	CEC meq/100g	TOC mg/kg	TKN mg/kg	Nitrate mg/kg	Phosphorus mg/kg	Heterotrophic Plate Count No/g
Data from Remedial Investigation						
38S0303	1.30	710	ND	3.3	ND	3,100,000
38S1103	0.72	ND	ND	ND	ND	3,700,000
38S1803	7.00	2,100	410	ND	170	1,600,000
38S2203	4.90	ND	74	ND	20	2,100,000
38S3001	0.38	94	ND	2.0	ND	260,000
38S3101	0.87	220	ND	3.1	12	170,000
38S3301	2.60	460	180	5.2	120	420,000
38S3401	4.40	450	56	4.3	140	210,000
38S3501	9.50	1,200	330	2.0	160	3,200,000
38S3601	3.20	540	59	ND	150	40,000
38S3701	7.00	550	250	ND	210	3,300,000
Data from February 1993 Study						
36S81W02	7.60	630	98	15.0	160	150,000
36S79C02	4.50	940	250	16.0	140	2,100,000
36S76W02	4.30	400	75	4.5	71	90,000
36S75E04	19.00	1,700	2,900	110.0	160	600,000

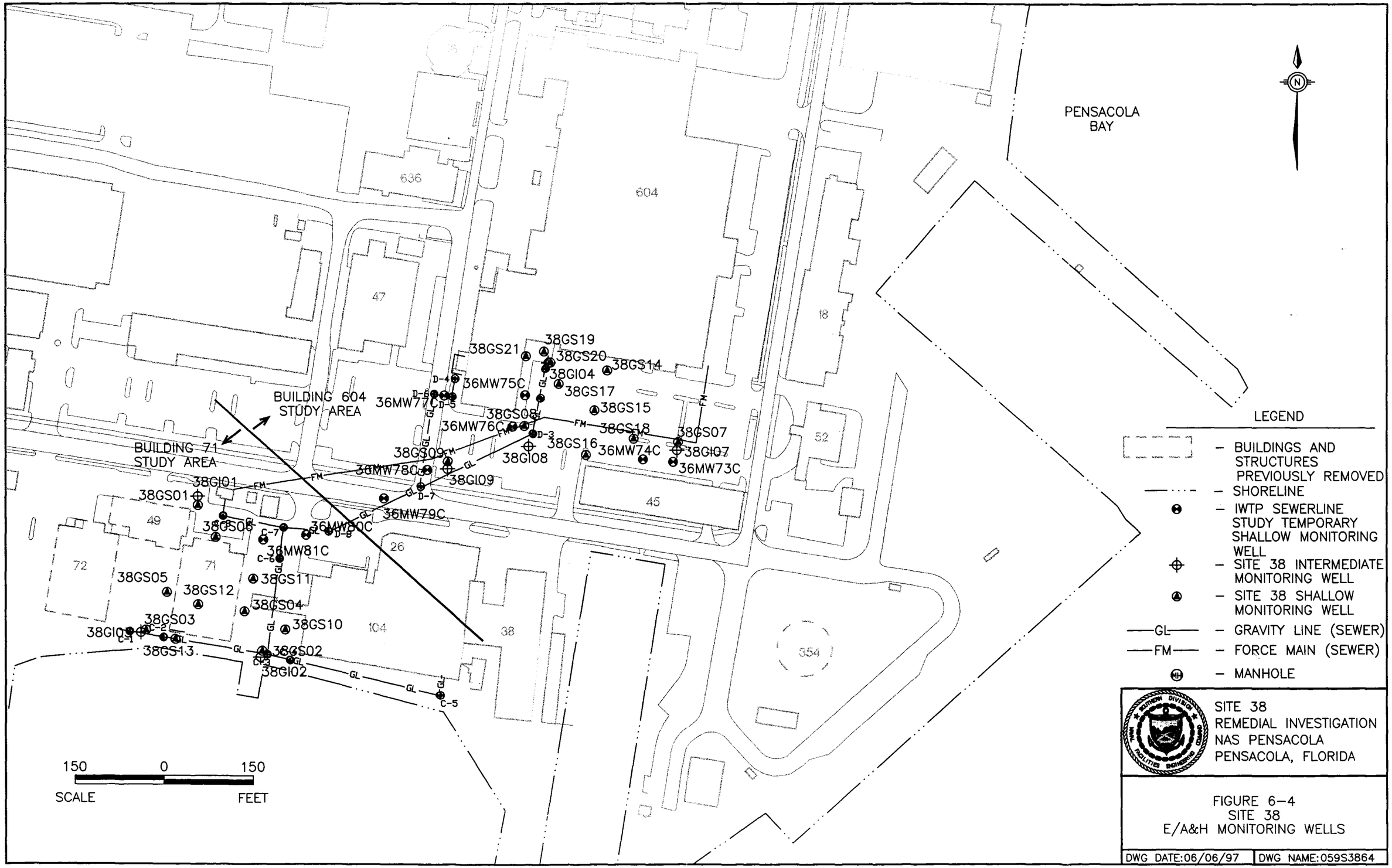
Notes:
CEC = Reported in milliequivalents per 100 grams
ND = Not detected above sample detection limit

Tube and Soil Chemistry Analytical Data are included in Appendix F. CEC ranged from 0.38 to 19.0 milliequivalents per 100 grams (meq/100g), and TOC ranged from below detection limits to 2,100 milligrams per kilogram (mg/kg). TKN concentrations ranged from below detection limits to 2,900 mg/kg, nitrate ranged from nondetect to 110.0 mg/kg, and phosphorus ranged from nondetect to 210 mg/kg. Heterotrophic plate count ranged from 90,000 to 3,700,000 colonies per gram (No/g), which indicates the biological activity. The implications of these data will be discussed in Section 9, Contaminant Fate and Transport.

6.2 Surficial Aquifer Assessment

Transmissivity, hydraulic conductivity, and the general flow characteristics, including tidal influence, were assessed. Specific capacity tests were completed on several wells. In addition, a study was conducted to assess tidal effects on the potentiometric surface. Groundwater chemical property data were collected such as general water quality, nutrient availability, biological activity, and available oxygen for chemical and biological reactions.

Thirty-seven monitoring wells have been installed at Site 38 during three field studies. Eleven permanent monitoring wells were installed during the ABB UST investigation south of Building 604, nine temporary monitoring wells were installed in February 1993, and 17 permanent monitoring wells were installed between July and December 1994 during the two studies completed by E/A&H. Figure 6-4 shows all monitoring well locations. The 11 ABB wells were renumbered and designated as Site 38 monitoring wells for this investigation. The temporary monitoring wells retained their original identification of 36GR# (well number), indicating Site 36, G for groundwater and R for temporary well. These wells were abandoned in accordance with the Northwest Florida Water Management District (NWFWMD) regulations after one sampling event.


PENSACOLA BAY
N
636
604
47
18
52
45
49
72
71
26
104
38
354
BUILDING 604 STUDY AREA
BUILDING 71 STUDY AREA
38GS19
38GS21
38GS20
38GS14
38GI04
38GS17
38GS15
36MW75C
36MW77C
38GS08
36MW76C
38GS18
38GS07
38GS16
36MW74C
38GI07
36MW73C
38GI08
38GS09
38GI09
36MW78C
38GI01
38GS01
36MW79C
38GS06
36MW80C
36MW81C
38GS05
38GS12
38GS11
38GS04
38GS03
38GI03
38GS10
38GS13
38GS02
38GI02
D-4
D-6
D-5
D-3
D-7
D-8
C-7
C-6
C-1
C-2
C-3
C-5
GL
FM
150 0 150
SCALE FEET
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 6–4
SITE 38
E/A&H MONITORING WELLS
DWG DATE:06/06/97
DWG NAME:059S3864

6.2.1 Groundwater Chemical Properties

Shallow monitoring wells 38GS03, 38GS09, and 38GS09, and intermediate monitoring well, 38GI01, were sampled for analysis of alkalinity, TSS, hardness, five day BOD, COD, TKN, nitrate, total phosphorus, and standard heterotrophic plate count (Table 6-3). The standard heterotrophic plate count at shallow depth ranged from 4,700 to 8,900 No/g and was identified at 46,000 No/g at intermediate depth. At shallow depth, TKN, nitrate, and phosphorous ranged from below detection limits to 0.41 mg/L, nondetect to 0.11 mg/L, and 0.054 to 0.62 mg/L, respectively. At intermediate depth, TKN, nitrate and phosphorus were detected at 1.6 mg/L, 0.1 mg/L, and 0.35 mg/L, respectively. The shallow depth alkalinity, TSS, and hardness ranged from 88 to 140 mg/L, 39 to 290 mg/L, and from 79 to 120 mg/L, respectively. At the intermediate depth, alkalinity, TSS, and hardness were 250 mg/L, 82mg/L, and 180 mg/L.

Temperature, pH, specific conductivity, and turbidity were measured in the field when groundwater samples were collected; Tables 6-4 and 6-5 summarize the final readings before samples were collected. Temperature ranged from 18.5° to 27.4° Celsius in shallow wells, and from 23.0° to 25.1° Celsius in intermediate wells. In shallow wells conductivity ranged from 136 to 412 microSiemens per centimeter (μS/cm) and pH ranged from 6.42 to 7.39. Conductivity and pH in intermediate wells ranged from 106 to 12,500 μS/cm and 6.86 to 8.00, respectively. Turbidity was measured at <1 NTU in 11 of 21 shallow wells and a maximum of 5 NTUs in wells 38GS17. Turbidity ranged from <1 to 88 NTUs in the intermediate wells.

6.2.2 Surficial Aquifer Characteristics

Understanding the variables influencing groundwater movement is necessary for assessing contaminant migration, since many of the same ones govern contaminant movement. Hydraulic conductivity, transmissivity, specific capacity, and flow velocity are some aquifer properties that govern groundwater movement. However, nearshore environments are dynamic systems altered

Table 6-3
Groundwater Chemical Properties

Sample ID Parameter	38GI01	38GS03	38GS09	38GS15
Alkalinity (mg/L)	250	140	88	120.00
TSS (mg/L)	82	290	140	39.00
Hardness (mg/L)	180	120	79	120.00
5-day BOD (mg/L)	4.4	1.6	ND	3.20
COD (mg/L)	38	160	30	35.00
TKN-N (mg/L)	1.6	0.41	ND	0.23
Nitrate-N (mg/L)	0.10	ND	0.11	ND
Phosphorus (mg/L)	0.35	0.62	0.47	0.054
Std Plate Ct (No/ml)	46,000	5,700	8,900	4,700

Table 6-4
Groundwater Stability Data
Shallow Monitoring Wells

Sample ID	pH (Std Units)	Temperature (Degrees C)	Conductivity (μS/cm)	Turbidity (NTU)
38GS01	7.19	20.9	182	1
38GS02	7.26	20.8	340	1
38GS03	7.24	20.8	324	<1
38GS04	6.98	22.8	291	<1
38GS05	7.21	20.7	388	<1
38GS06	7.30	21.5	296	<1
38GS07	6.42	22.8	194	4
38GS08	7.23	21.7	386	<1
38GS09	6.85	21.9	201	1
38GS10	6.77	23.8	243	<1
38GS11	6.90	18.5	136	1
38GS12	6.96	20.0	412	2
38GS13	7.39	20.0	251	2
38GS14	7.03	24.4	303	1
38GS15	6.82	24.7	303	<1
38GS16	6.56	22.8	269	<1
38GS17	6.81	24.9	245	5
38GS18	6.65	21.7	300	<1
38GS19	7.29	24.1	221	<1
38GS20	7.15	23.5	255	1
38GS21	6.97	27.4	288	<1

Table 6-5
Groundwater Stability Data
Intermediate Monitoring Wells

Sample ID	pH (Std Units)	Temperature (Degrees C)	Conductivity (μS/cm)	Turbidity (NTUs)
38GI01	7.56	25.00	564.00	<1
38GI02	7.52	23.40	12,500.00	7
38GI03	6.86	23.00	3,880.00	14
38GI04	7.64	25.10	433.00	88
38GI07	7.50	24.20	189.00	2
38GI08	7.79	24.90	625.00	5
38GI09	8.00	23.40	106.00	1

Notes:
pH is reported in standard (Std) units.
Temperature is in degrees Celsius (°C).

daily by tidal fluctuations, causing short-term changes in the flow characteristics. Specific capacity tests, potentiometric data analysis, and a tidal influence study were conducted to assess aquifer properties and flow characteristics. The results are presented below; however, the relationship of the aquifer characteristics to contaminant movement will be summarized in Section 9 and detailed in the FS report.

Specific Capacity Pumping Tests

Specific capacity pumping tests were completed on select shallow and intermediate monitoring wells as described in Section 5.6. The data generated from these tests were input into the computer program, *A Computerized Technique for Estimation the Hydraulic Conductivity of Aquifers from Specific Capacity Data*, Bradbury, K.R. and Rothschild, E.R. (1985). The hydrologic data reports from this program are presented in Appendix G. The output is an estimate of specific capacity, transmissivity, and hydraulic conductivity (Table 6-6).

Table 6-6
Aquifer Characteristics

Well ID	Specific Capacity (gpm/ft)	Transmissivity (ft^2/day)	Hydraulic Conductivity (ft/day)
Shallow Monitoring Wells			
38GS01	3.93	3,370	84
38GS14	9.44	7,208	180
38GS13	17.78	13,614	340
38GS11	14.64	11,285	282
38GS08	11.53	8,844	221
38GS07	12.83	9,858	246
38GS03	18.19	13,288	332
Intermediate Monitoring Wells			
38GI09	5.44	3,001	75
38GI07	1.49	790	20
38GI03	1.18	624	16
38GI01	8.85	4,955	124

Groundwater elevations ranged from 0.66 to 1.04 feet msl at shallow depths and from 0.83 to 1.24 feet msl at intermediate depths. Figures 6-5 and 6-6 are potentiometric maps of the upper and lower surficial zones, respectively. Groundwater generally flows south-southeast at the shallow depth and southeast at intermediate depth, becoming easterly along the shoreline. The flow direction was shown to reverse around wells near the shoreline. This is discussed in more detail below.

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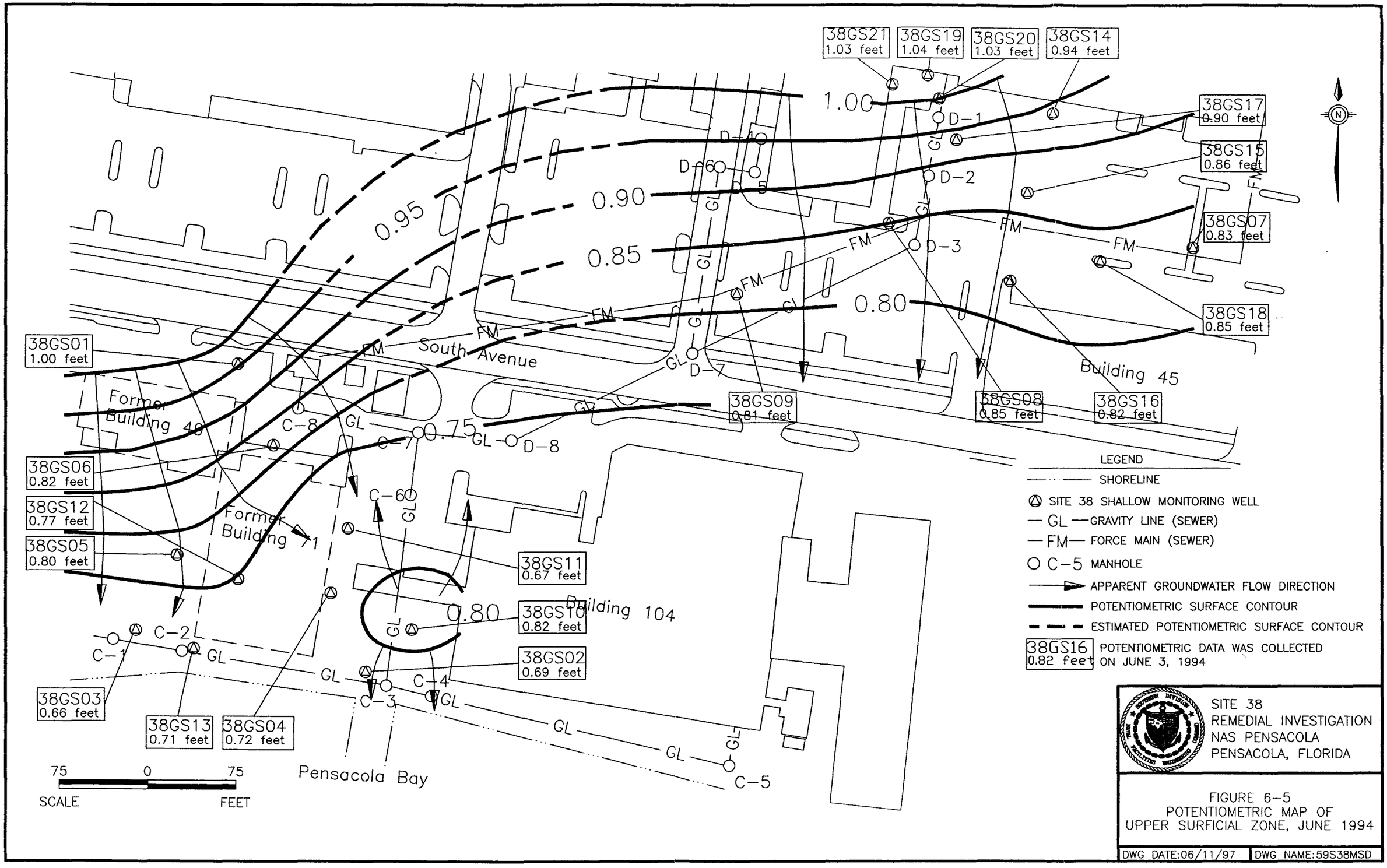
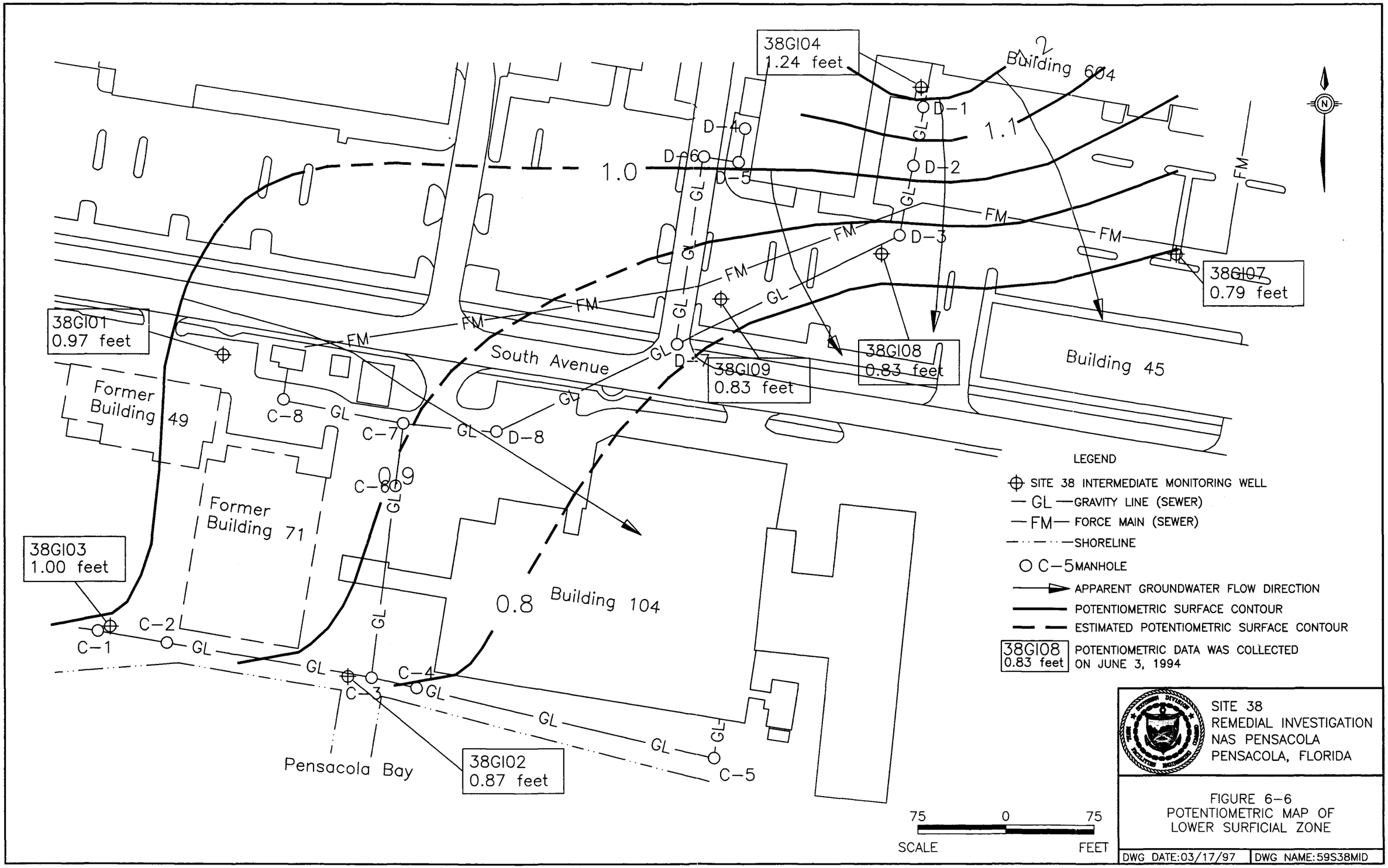

38GS21
1.03 feet
38GS19
1.04 feet
38GS20
1.03 feet
38GS14
0.94 feet
38GS17
0.90 feet
38GS15
0.86 feet
38GS07
0.83 feet
38GS18
0.85 feet
38GS01
1.00 feet
38GS09
0.81 feet
38GS08
0.85 feet
38GS16
0.82 feet
38GS06
0.82 feet
38GS12
0.77 feet
38GS05
0.80 feet
38GS11
0.67 feet
38GS10
0.82 feet
38GS02
0.69 feet
38GS03
0.66 feet
38GS13
0.71 feet
38GS04
0.72 feet
1.00
0.95
0.90
0.85
0.80
0.75
0.80
D-1
D-2
D-3
D-4
D-5
D-6
D-7
D-8
C-1
C-2
C-3
C-4
C-5
C-6
C-7
C-8
GL
FM
South Avenue
Former Building 40
Former Building 1
Building 45
Building 104
Pensacola Bay
N
LEGEND
SHORELINE
SITE 38 SHALLOW MONITORING WELL
GL GRAVITY LINE (SEWER)
FM FORCE MAIN (SEWER)
C-5 MANHOLE
APPARENT GROUNDWATER FLOW DIRECTION
POTENTIOMETRIC SURFACE CONTOUR
ESTIMATED POTENTIOMETRIC SURFACE CONTOUR
38GS16 0.82 feet POTENTIOMETRIC DATA WAS COLLECTED ON JUNE 3, 1994
75 0 75
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 6-5
POTENTIOMETRIC MAP OF
UPPER SURFICIAL ZONE, JUNE 1994
DWG DATE:06/11/97
DWG NAME:59S38MSD


38GI04
1.24 feet
Building 604
1.1
1.0
D-1
D-2
D-3
D-4
D-5
D-6
D-7
D-8
GL
FM
38GI07
0.79 feet
38GI08
0.83 feet
38GI09
0.83 feet
38GI01
0.97 feet
South Avenue
Building 45
Former Building 49
Former Building 71
C-8
C-7
C-6
0.9
38GI03
1.00 feet
C-1
C-2
C-3
C-4
C-5
0.8
Building 104
Pensacola Bay
38GI02
0.87 feet
N
LEGEND
SITE 38 INTERMEDIATE MONITORING WELL
GL GRAVITY LINE (SEWER)
FM FORCE MAIN (SEWER)
SHORELINE
C-5 MANHOLE
APPARENT GROUNDWATER FLOW DIRECTION
POTENTIOMETRIC SURFACE CONTOUR
ESTIMATED POTENTIOMETRIC SURFACE CONTOUR
38GI08 0.83 feet
POTENTIOMETRIC DATA WAS COLLECTED ON JUNE 3, 1994
75 0 75
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 6-6
POTENTIOMETRIC MAP OF
LOWER SURFICIAL ZONE
DWG DATE:03/17/97
DWG NAME:59S38MID

Specific capacity measures well productivity, and is defined as the ratio between the rate of pumping and the drawdown (or change in water level) in the well. Transmissivity is defined as the rate at which water flows through a vertical strip of an aquifer one unit wide, extending the full saturated thickness of the aquifer, under a unit hydraulic gradient. Hydraulic conductivity describes the rate at which water can move through a permeable medium (Fetter, 1988). Calculations for this report assumed the following: a homogeneous aquifer with uniform thickness, hydraulic conductivity that is constant in all directions, a storativity of 0.25, and a well loss coefficient of 0.75. Aquifer thickness for both the shallow and intermediate depths was calculated by subtracting the elevation of the bottom of the intermediate depth wells at their contact with the low permeability zone from the static-water level elevation.

A difference was noted between hydraulic conductivities, specific capacities, and transmissivities of shallow and intermediate depths. Table 6-6 summarizes the results. Specific capacities range at shallow depths from 3.93 to 18.19 gpm per foot (gpm/ft), and range at intermediate depths from 1.18 to 8.85 gpm/ft. The hydraulic conductivities at intermediate depths range from 16 to 124 ft/day, and at shallow depths from 84 to 340 ft/day. Transmissivities at shallow depths ranged from 3,370 to 13,614 feet squared per day (ft^2/day), and from 624 to 4,955 ft^2/day at intermediate depths. The apparent general decrease in values at intermediate depth may be attributed to the relatively finer-grained lithologies, and consequent reduction in permeabilities, of the transition zone at the base of the surficial zone.

Groundwater Flow Characteristics

Some groundwater flow characteristics are estimated based on potentiometric (groundwater elevation) data, including flow direction, horizontal and vertical flow gradients, and flow velocities. Groundwater levels were synaptically measured initially on June 3, 1994, between 8:57 and 9:59 a.m. Table 6-7 lists the groundwater elevations in feet msl and the time measured for

Table 6-7
Potentiometric Data Shallow Wells
June 3, 1994

Well #	Top of Casing Elevation (Feet msl)	Depth to Water (Feet)	Water Elevation (Feet msl)	Time
38GS01	5.74	4.74	1.00	930
38GS02	4.18	3.49	0.69	914
38GS03	3.88	3.22	0.66	900
38GS04	4.55	3.83	0.72	909
38GS05	4.38	3.58	0.80	905
38GS06	5.6	4.78	0.82	919
38GS07	7.34	6.51	0.83	958
38GS08	7.29	6.44	0.85	941
38GS09	6.25	5.44	0.81	938
38GS10	4.69	3.87	0.82	911
38GS11	4.3	3.63	0.67	917
38GS12	4.6	3.83	0.77	907
38GS13	4.04	3.33	0.71	903
38GS14	8.43	7.49	0.94	952
38GS15	7.98	7.12	0.86	953
38GS16	6.75	5.93	0.82	954
38GS17	7.71	6.81	0.90	944
38GS18	7.18	6.33	0.85	956
38GS19	7.87	6.83	1.04	948
38GS20	6.81	5.78	1.03	946
38GS21	7.62	6.59	1.03	949
Potentiometric Data Intermediate Wells				
38GI01	5.81	4.84	0.97	924
38GI02	3.8	2.93	0.87	915
38GI03	4.03	3.03	1.00	857
38GI04	7.21	5.97	1.24	947
38GI07	7.07	6.28	0.79	959
38GI08	6.49	5.66	0.83	942
38GI09	6.34	5.51	0.83	937

the shallow and intermediate wells. High tide was predicted to peak at 7:47 a.m. at 1.0 feet msl. The influence of tidal effects on groundwater movement is discussed later in this section.

Because of the anomaly seen in the shallow groundwater potentiometric map (Figure 6-5) in the Building 71 area, water levels were remeasured in the shallow wells across the site on March 21, 1996 (Table 6-8). Measurements were made during a falling tide approximately three hours after high tide. The potentiometric surface is presented in Figure 6-7. Groundwater flow was consistent with the previous measurements and remained toward the south-southeast. The anomaly seen in the previous water level measurement event was absent.

Horizontal Groundwater Gradients

Horizontal groundwater gradients were calculated for three shallow and one intermediate well pair in the IWTP sewer line area and for three shallow and one intermediate well pairs in the Building 71 area. Table 6-9 shows the calculated gradients. The horizontal gradients for the intermediate and shallow depths are similar, ranging from 0.0007 to 0.0027 and 0.0006 to 0.0020. Gradients measured from the March 1996 data were also consistent, averaging 0.0014 in the Building 604 area and 0.0027 in the Building 71 area.

Groundwater gradients were calculated by the following equation:

$$\nabla = \frac{\mathbf{A - B}}{\mathbf{C}}$$

where:

∇	=	Gradient (ft/ft)
A	=	Elevation of 1st well (ft msl)
B	=	Elevation of 2nd well (ft msl)
C	=	Distance AB (ft)

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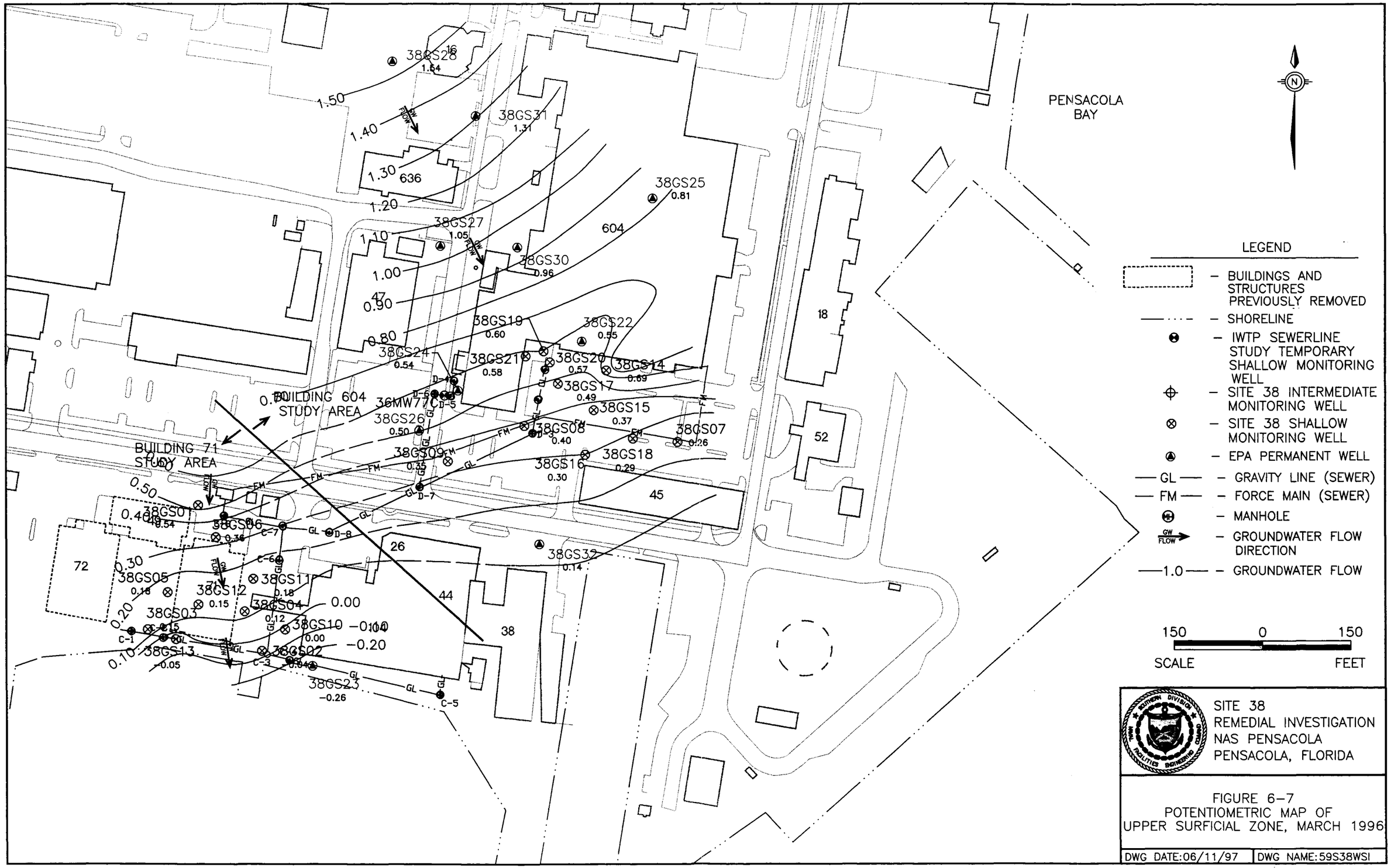
PENSACOLA BAY
N
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
– EPA PERMANENT WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
– MANHOLE
GW FLOW – GROUNDWATER FLOW DIRECTION
1.0 – GROUNDWATER FLOW
150 0 150
SCALE FEET
BUILDING 604 STUDY AREA
BUILDING 71 STUDY AREA
38GS28 1.64
38GS31 1.31
38GS25 0.81
38GS27 1.05
38GS30 0.96
38GS19 0.60
38GS22 0.55
38GS24 0.54
38GS21 0.58
38GS20 0.57
38GS14 0.69
38GS17 0.49
38GS15 0.37
38GS08 0.40
38GS07 0.26
38GS18 0.29
38GS16 0.30
38GS09 0.35
38GS26 0.50
36MW77
38GS01 0.54
38GS06 0.36
38GS05 0.16
38GS12 0.15
38GS11 0.18
38GS04 0.12
38GS10 0.00
38GS03 0.15
38GS13 -0.05
38GS02 0.04
38GS23 -0.26
38GS32 0.14
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
636
604
47
18
52
45
26
44
38
72
71
D-4
D-5
D-6
D-7
D-8
C-1
C-3
C-5
C-6
C-7
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 6-7
POTENTIOMETRIC MAP OF
UPPER SURFICIAL ZONE, MARCH 1996
DWG DATE:06/11/97
DWG NAME:59S38WSI

Table 6-8
Site 38 Construction and Potentiometric Data

Well Number	Surface Elevation (ft)	Top of Casing Elevation (ft)	Total Depth (ft bls)	Screened Interval (ft bls)	Depth to Water (ft btoc)	Groundwater Elev (ft msl)	Water Level Date, Time
			Shallow Wells				
38GS01	5.78	5.7	13	3-13	5.16	0.54	3/21/96, 1539
38GS02	4.25	4.17	13	3-13	4.21	-0.04	3/21/96, 1524
38GS03	3.94	4.12	13	3-13	3.97	0.15	3/21/96, 1533
38GS04	4.75	4.56	13.5	3.5-13.5	4.44	0.12	3/21/96, 1525
38GS05	4.57	4.37	13.2	3.2 - 13.2	4.19	0.18	3/21/96, 1534
38GS06	5.76	5.63	13	3-13	5.27	0.36	3/21/96, 1540
38GS07	7.59	7.31	13.7	3.7 - 13.7	7.05	0.26	3/21/96, 1530
38GS08	7.39	7.29	12.6	2.6 - 12.6	6.89	0.4	3/21/96, 1540
38GS09	6.69	6.24	13	3-13	5.89	0.35	3/21/96, 1544
38GS10	4.79	4.54	13	3-13	4.54	0	3/21/96, 1522
38GS11	4.62	4.38	13	3-13	4.2	0.18	3/21/96, 1527
38GS12	4.84	4.59	13	3-13	4.44	0.15	3/21/96, 1529
38GS13	4.21	4.04	13	3-13	4.09	-0.05	3/21/96, 1532
38GS14	8.41	8.64	13	3-13	7.95	0.69	3/21/96, 1522
38GS15	7.55	7.96	13	3-13	7.59	0.37	3/21/96, 1537
38GS16	6.94	6.71	13	3-13	6.41	0.3	3/21/96, 1535
38GS17	7.95	7.74	13	3-13	7.25	0.49	3/21/96, 1520

Table 6-8
Site 38 Construction and Potentiometric Data

Well Number	Surface Elevation (ft)	Top of Casing Elevation (ft)	Total Depth (ft bls)	Screened Interval (ft bls)	Depth to Water (ft btoc)	Groundwater Elev (ft msl)	Water Level Date, Time
38GS18	7.31	7.14	13	3-13	6.85	0.29	3/21/96, 1534
38GS19	7.88	7.85	13	3-13	7.25	0.6	3/21/96, 1517
38GS20	7.17	6.78	13	3-13	6.21	0.57	3/21/96, 1518
38GS21	7.55	7.58	13	3-13	7	0.58	3/21/96, 1515
38GS22	8.64	8.44	10.2	0.20 - 10.20	7.89	0.55	3/21/96, 1525
38GS23	5.17	4.64	21	11.00 - 21.00	4.9	-0.26	3/21/96, 1520
38GS24	6.95	6.84	14.5	4.50 - 14.50	6.3	0.54	3/21/96, 1546
38GS25	8.68	8.51	14.35	4.35 - 14.35	7.7	0.81	3/21/96, 1527
38GS26	7.05	6.98	12.3	2.30 - 12.30	6.48	0.5	3/21/96, 1545
38GS27	7.1	6.97	16.2	6.20 - 16.20	5.92	1.05	3/21/96, 1550
38GS28	6.91	6.48	15.05	5.05 - 15.05	4.94	1.54	3/21/96, 1557
38GS30	5.99	5.65	15.05	5.05 - 15.05	4.69	0.96	3/21/96, 1552
38GS31	6.91	6.61	15.15	5.15 - 15.15	5.3	1.31	3/21/96, 1555
38GS32	6.14	5.88	13.1	3.1 - 13.10	5.74	0.14	3/21/96, 1549

Table 6-8
Site 38 Construction and Potentiometric Data

Well Number	Surface Elevation (ft)	Top of Casing Elevation (ft)	Total Depth (ft bls)	Screened Interval (ft bls)	Depth to Water (ft btoc)	Groundwater Elev (ft msl)	Water Level Date, Time
Intermediate Wells							
38GI01	6.12	5.81	27	17-27	4.84	0.97	6/3/94, 0924
38GI02	4.16	3.8	43	33-43	2.93	0.87	6/3/94, 0915
38GI03	4.24	4.03	42	32-42	3.03	1	6/3/94, 0857
38GI04	7.49	7.21	32	27-32	5.97	1.24	6/3/94, 0947
38GI07	7.33	7.07	44	34-44	6.28	0.79	6/3/94, 0959
38GI08	6.68	6.49	37	27-37	5.66	0.83	6/3/94, 0942
38GI09	6.82	6.34	32	22-32	5.51	0.83	6/3/94, 0937
38GI10	4.55	4.27	40.55	30.55 - 40.55	3.94	0.33	3/21/96, 1536

Notes:
Datum = Mean sea level
btoc = Below top of casing

Table 6-9
Horizontal Hydraulic Gradient Calculations

IWTP Sewer Line Area	Building 71 Area
▿ (38GS21/38GS08) = $\frac{1.03\text{ ft} - 0.85\text{ ft}}{120\text{ ft}}$ = 0.0015	▿ (38GS01/38GS11) = $\frac{1.00\text{ ft} - 0.67\text{ ft}}{167\text{ ft}}$ = 0.0020
▿ (38GS20/38GS16) = $\frac{1.03\text{ ft} - 0.82\text{ ft}}{169\text{ ft}}$ = 0.0012	▿ (38GS05/38GS13) = $\frac{0.80\text{ ft} - 0.71\text{ ft}}{81\text{ ft}}$ = 0.0011
▿ (38GS14/38GS18) = $\frac{0.94\text{ ft} - 0.85\text{ ft}}{134\text{ ft}}$ = 0.0007	▿ (38GS12/38GS02) = $\frac{0.77\text{ ft} - 0.69\text{ ft}}{135\text{ ft}}$ = 0.0006
▿ (38GI04/38GI08) = $\frac{1.24\text{ ft} - 0.83\text{ ft}}{150\text{ ft}}$ = 0.0027	▿ (38GI03/38GI02) = $\frac{1.00\text{ ft} - 0.87\text{ ft}}{225\text{ ft}}$ = 0.0007

Vertical Groundwater Gradients

Table 6-10 presents the calculated vertical hydraulic gradients between six of the shallow/intermediate well pairs. The vertical gradients were calculated by subtracting the intermediate water elevation from the shallow water elevation (feet msl), then dividing by the vertical distance (feet) between the center of each well screen. Positive gradients indicate a potential for downward flow, and negative gradients indicate upward flow potential. Positive vertical gradients were calculated at three locations and a slight negative gradient was calculated at location 38GS09/38GI09 at -0.0011. The two largest gradients are negative and were calculated for wells pairs 38GS02/38GI02 and 38GS03/38GI03 along the shore (Figure 6-4). High tide was less than two hours before the water levels were measured in these wells. In general, the vertical flow appears to be downward across most of the site, except for a limited area between the bay and well location 38GI01.

Groundwater Velocity

Horizontal groundwater velocities at shallow depths range from 0.47 to 1.58 ft/day while horizontal velocities at intermediate depths are less, ranging from 0.10 to 0.40 ft/day. Calculated groundwater velocities are based on the geometric mean of hydraulic conductivity

Table 6-10
Vertical Gradients Calculations

Shallow Monitoring Wells	Groundwater Elevation (Feet msl)	Center Screen Elevation (Feet msl)	Intermediate Monitoring Wells	Groundwater Elevation (Feet msl)	Center Screen Elevation (Feet msl)	Calculated Vertical Hydraulic Gradients
38GS01	1.00	-7.76	38GI01	0.97	-21.85	0.0021
38GS02	0.69	-7.59	38GI02	0.87	-35.39	-0.0065
38GS03	0.66	-7.78	38GI03	1.00	-36.32	-0.0119
38GS07	0.83	-8.68	38GI07	0.79	-39.12	0.0013
38GS08	0.85	-7.64	38GI08	0.83	-32.94	0.0008
38GS09	0.81	-8.3	38GI09	0.83	-27.15	-0.0011

Notes:
Vertical gradients were calculated by subtracting the intermediate water elevation from the shallow water elevation, then dividing by the vertical distance between the centers of the well screens.

values calculated for each portion of the surficial zone, the lowest and highest horizontal groundwater gradients determined within each zone, and an effective porosity of 28% for the surficial zone sands (Heath, 1989). The horizontal groundwater velocities were calculated using the following derivation of Darcy's Law (Fetter, 1988):

$$V = \frac{Ki}{n}$$

where:

K = geometric mean hydraulic conductivity from specific capacity tests

i = groundwater gradient

n = effective porosity of aquifer matrix

Tidal Influence Study

Aquifers connected to tidally influenced surface water bodies are subject to short-term fluctuations in head due to the tidal change. The amplitude of fluctuation is greatest at wells nearest the shore and diminishes with distance inland. The rise and fall of groundwater elevation affects flow gradients, velocity, and flow directions. In addition, the change in groundwater elevation parallels the tidal fluctuations. A tidal study was conducted to estimate the tidal influence on the surficial aquifer, and includes a time lag study and high-to-low tide water level measurements.

Time Lag

The difference in time between the tidal peak and the water level peak in a given well inland is defined as time lag (Fetter, 1988) and is dependent on the tidal period, and the storativity and transmissivity of the aquifer. Electronic pressure transducers were placed in five monitoring wells across the site and at a station in Pensacola Bay to measure the tidal level and groundwater level fluctuations. The water level fluctuations were measured over 42 hours using a Hermit datalogger between January 10 and 12, 1994. Table 6-11 list the wells used in the study, their distance inland, and the estimated time lag. During the test period, tides fluctuated 2.5 feet. Barometric pressure dropped slightly during the study, which would theoretically cause the water levels in the wells to rise slightly. Since the pressure drop was small, however, the effects were minimal.

Figure 6-8 shows the tidal fluctuations and the resulting impact on groundwater elevations. The time lag for each well was determined from the graph in Figure 6-8. The time lag was approximately 4.5 hours for 38GS03 and 8 hours for 38GS01. The water levels in monitoring wells 38GS08 and 38GS21 did not vary greatly nor did they appear to fluctuate parallel to the tidal fluctuations. This suggests they are beyond the zone of tidal influence.

Table 6-11
Time Lag Study

Well Number	Distance Inland (Feet)	Water Level Change (Feet)[a]	Time Lag (Hours)[b]
38GS01	240	0.184	8.0
38GS02	30	0.419	3.0
38GS03	53	0.421	4.5
38GS08	510	0.087	Not Determined
38GS21	636	0.062	Not Determined
Day	**High Tide Time/ft msl**		**Low Tide Time/ft msl**
01/10/94	2145/1.3	2.0	0808/-0.7
01/11/94	2232/1.2	1.8	0852/-0.6
01/12/94	2315/1.1	1.6	0933/-0.5

Notes:

a = The values shown for 38GS01, 38GS02, and 38GS03 reflect the water level differences between the 01/11/94 low and high tides. The values shown for 38GS08 and 38GS21 indicate maximum water level fluctuation across the entire time of the study. Fluctuations in these two wells were consistent between both tidal cycles represented.

b = The values shown for 38GS01, 38GS02, and 38GS03 reflect the water levels associated with the 01/11/94 low tide-to-high tide cycle.

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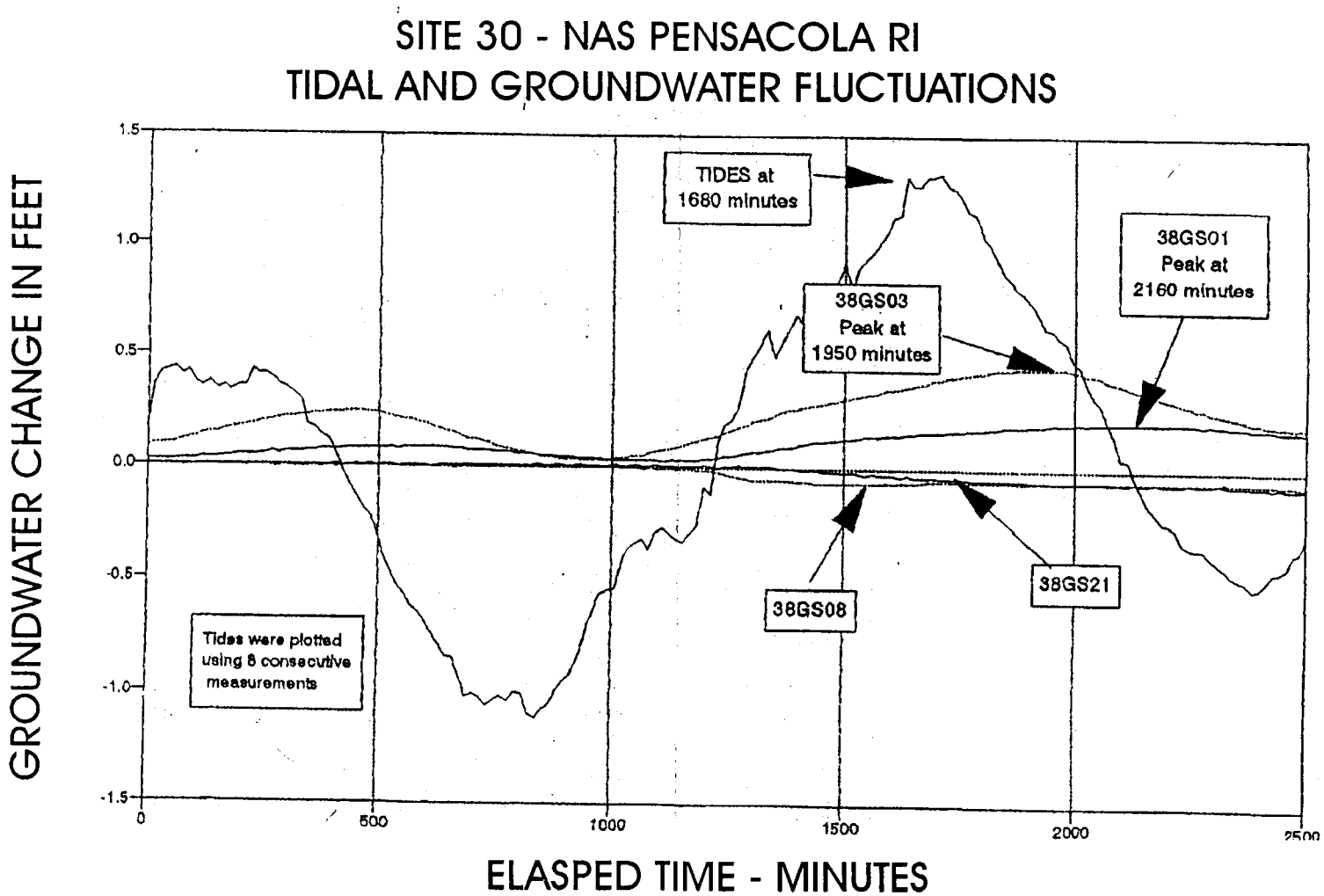

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 6-8
TIDAL EFFECTS ON
GROUND WATER LEVELS

DWG DATE: 07/31/96 | DWG NAME: BORDER

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High Tide Water Elevations

According to National Oceanic Survey records, the normal sea level elevation in Pensacola, Florida, is 1.2 feet msl. The highest tides are typically due to storms and are 3 feet msl. These elevated tides occur once a month. The predicted maximum high tide in Pensacola for 1994 was 1.9 feet. The tidal study was performed on August 18, 1994 during the field work, because the high tide was predicted to peak at 8:24 a.m. at 1.8 feet msl on this date. This level was very close to the predicted high tide for the year and was selected to represent the seasonal high tide for NAS Pensacola. On this date, water elevations were measured from the wells listed in Table 6-12 every hour from 8:00 a.m. to 4:00 p.m.

6.3 Summary

The following summarizes the geological and hydrogeological information gathered during this investigation.

Figures 6-9, 6-10, and 6-11 are potentiometric maps for 9 a.m., noon, and 3 p.m., respectively on August 16, 1994. Rising water levels in the wells adjacent to the seawall represents the onshore flow in response to high tide (Figures 6-9 and 6-10). The flow reverses later in the day as the tide continues to fall and low tide is approached (Figure 6-11). However, an anomalous low point occurs around 38GS11. The water level in 38GS11 remains lower than the surrounding wells during the tidal cycle. Because of field measurement problems, data from this well are suspect.

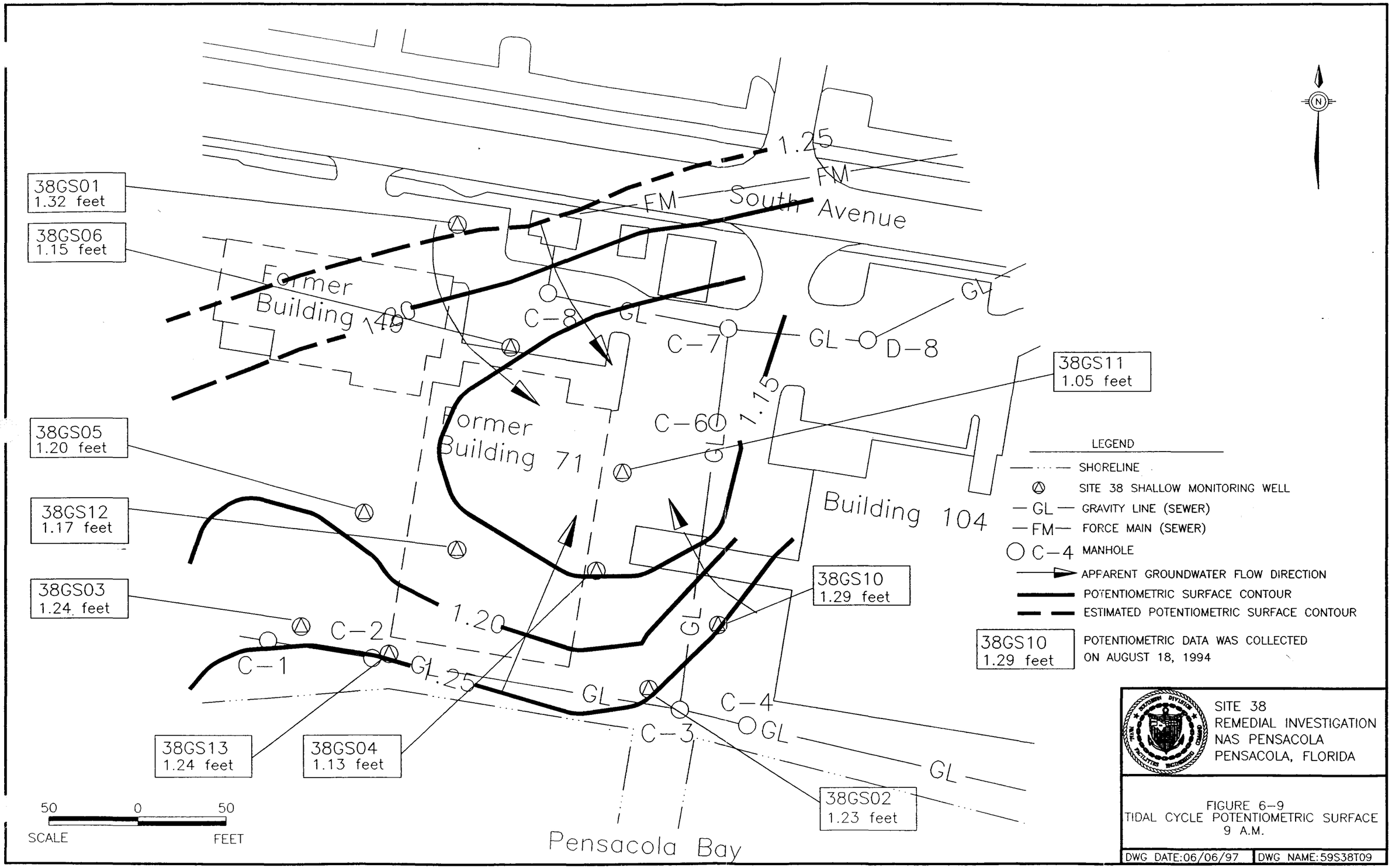
Surficial Soil Zone Assessment

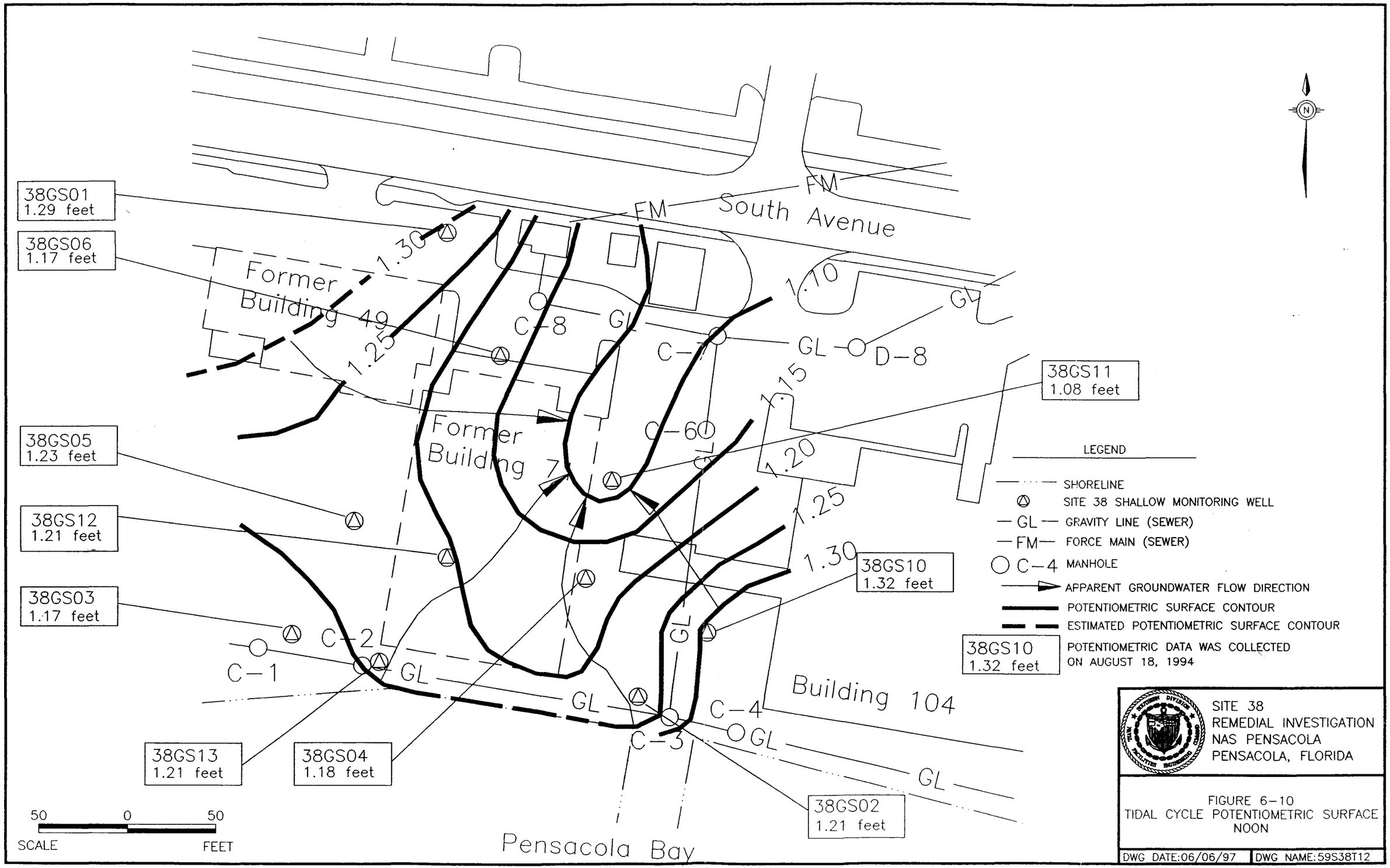
Sixty-seven soil borings were advanced during the RI, including 41 into the unsaturated zone to collect soil samples, 20 in the upper part of the surficial zone to install permanent or temporary shallow monitoring wells, and six to the base of the surficial zone to install intermediate

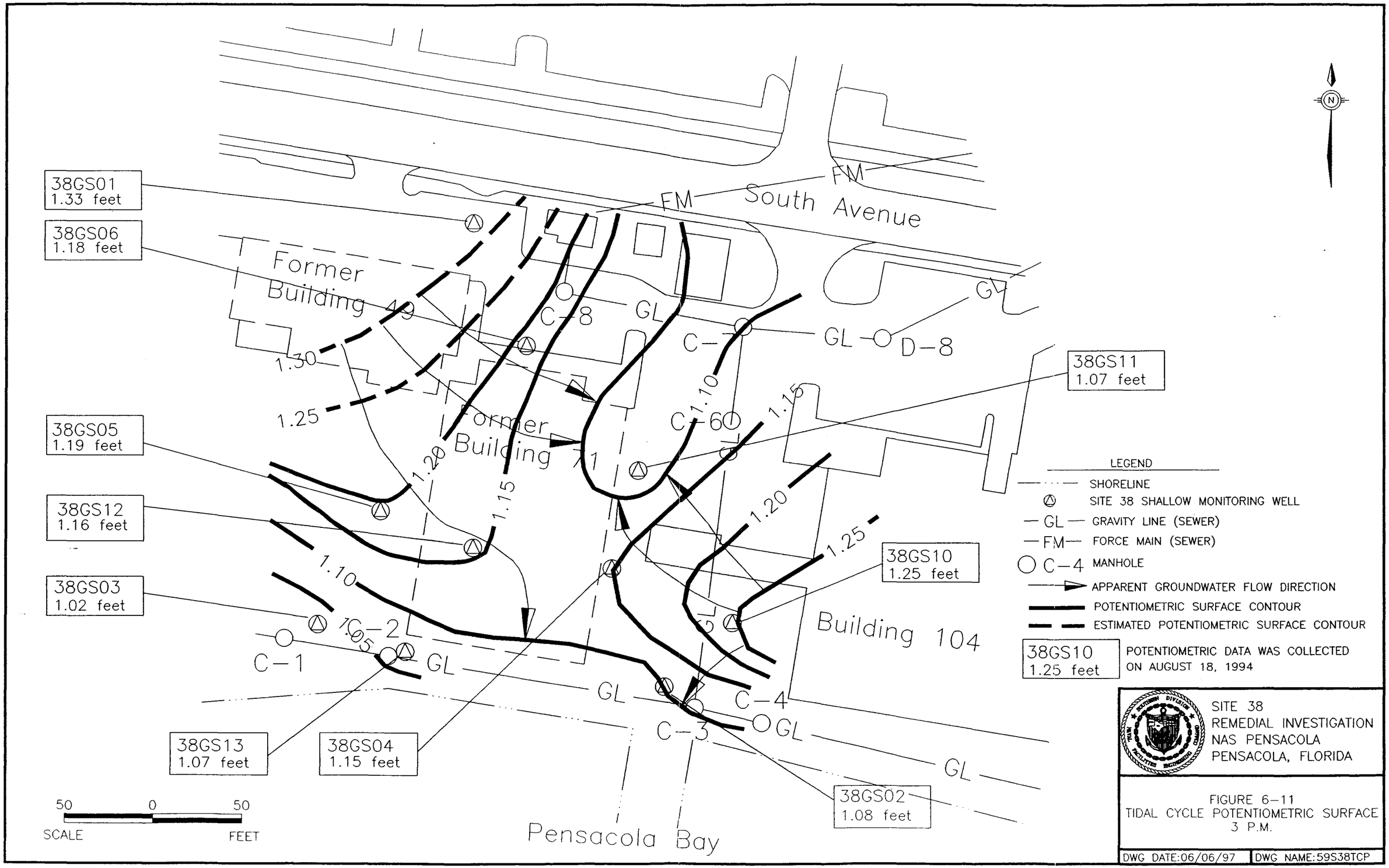
Table 6-12
Water Elevation Data
High to Low Tides[a]

Time	38GS01	38GS02	38GS03	38GS04	38GS05	38GS06	38GS10	38GS11	38GS12	38GS13
0800	1.30	1.22	1.18	1.14	1.19	1.15	1.26	~~1.73~~	1.16	1.25
0900	1.32	1.23	**1.24**	1.13	1.20	1.15	1.29	~~1.05~~	1.17	1.24
1000	1.29	**1.25**	1.19	1.16	1.21	1.16	1.30	~~1.06~~	1.19	1.24
1100	1.29	1.24	1.19	1.16	1.22	1.17	1.32	~~1.07~~	1.19	**1.28**
1200	1.29	1.21	1.17	**1.18**	**1.23**	1.17	**1.32**	~~1.08~~	**1.21**	1.21
1300	1.30	1.18	1.13	1.17	1.22	1.18	1.30	~~1.09~~	1.20	1.18
1400	1.31	1.18	1.08	1.16	1.21	**1.19**	1.27	~~**1.10**~~	1.18	1.12
1500	**1.33**	1.08	1.02	1.15	1.19	1.18	1.25	~~1.07~~	1.16	1.07
1600	1.31	1.04	0.96	1.12	1.17	1.17	1.21	~~0.87~~	1.14	1.00

Notes:
Bold indicates observed high water level elevation in the well.
~~Strikeout~~ indicates erroneous datum due to field measurement error.
The shaded lines indicated the data presented in potentiometric maps on Figures 6-8, 6-9, and 6-10.
a = The tidal forecast on 08/16/94 indicated high tide at 0824 hours at 1.8 feet msl, and low tide at 1925 hours at 0.1 feet msl.


38GS01
1.32 feet
38GS06
1.15 feet
38GS05
1.20 feet
38GS12
1.17 feet
38GS03
1.24 feet
38GS13
1.24 feet
38GS04
1.13 feet
38GS11
1.05 feet
38GS10
1.29 feet
38GS02
1.23 feet
1.25
FM
South Avenue
Former Building 149
Former Building 71
Building 104
C-8
C-7
C-6
C-2
C-1
C-3
C-4
D-8
GL
1.15
1.20
1.25
Pensacola Bay
50 0 50
SCALE FEET
LEGEND
SHORELINE
SITE 38 SHALLOW MONITORING WELL
GL GRAVITY LINE (SEWER)
FM FORCE MAIN (SEWER)
C-4 MANHOLE
APPARENT GROUNDWATER FLOW DIRECTION
POTENTIOMETRIC SURFACE CONTOUR
ESTIMATED POTENTIOMETRIC SURFACE CONTOUR
38GS10
1.29 feet
POTENTIOMETRIC DATA WAS COLLECTED ON AUGUST 18, 1994
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 6-9
TIDAL CYCLE POTENTIOMETRIC SURFACE
9 A.M.
DWG DATE:06/06/97
DWG NAME:59S38T09


38GS01
1.29 feet
38GS06
1.17 feet
38GS05
1.23 feet
38GS12
1.21 feet
38GS03
1.17 feet
38GS13
1.21 feet
38GS04
1.18 feet
38GS11
1.08 feet
38GS10
1.32 feet
38GS02
1.21 feet
FM
South Avenue
Former Building 49
Former Building 7
Building 104
Pensacola Bay
GL
C-1
C-2
C-3
C-4
C-6
C-7
C-8
D-8
1.30
1.25
1.10
1.15
1.20
1.25
1.30
50 0 50
SCALE FEET
LEGEND
SHORELINE
SITE 38 SHALLOW MONITORING WELL
GL GRAVITY LINE (SEWER)
FM FORCE MAIN (SEWER)
C-4 MANHOLE
APPARENT GROUNDWATER FLOW DIRECTION
POTENTIOMETRIC SURFACE CONTOUR
ESTIMATED POTENTIOMETRIC SURFACE CONTOUR
38GS10 1.32 feet
POTENTIOMETRIC DATA WAS COLLECTED ON AUGUST 18, 1994
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 6-10
TIDAL CYCLE POTENTIOMETRIC SURFACE
NOON
DWG DATE:06/06/97
DWG NAME:59S38T12


38GS01
1.33 feet
38GS06
1.18 feet
38GS11
1.07 feet
38GS05
1.19 feet
38GS12
1.16 feet
38GS03
1.02 feet
38GS10
1.25 feet
38GS13
1.07 feet
38GS04
1.15 feet
38GS02
1.08 feet
FM
South Avenue
Former Building 49
Former Building 1
Building 104
Pensacola Bay
GL
C-8
C-6
C-2
C-1
C-3
C-4
D-8
1.30
1.25
1.20
1.15
1.10
1.05
LEGEND
SHORELINE
SITE 38 SHALLOW MONITORING WELL
GL GRAVITY LINE (SEWER)
FM FORCE MAIN (SEWER)
C-4 MANHOLE
APPARENT GROUNDWATER FLOW DIRECTION
POTENTIOMETRIC SURFACE CONTOUR
ESTIMATED POTENTIOMETRIC SURFACE CONTOUR
38GS10
1.25 feet
POTENTIOMETRIC DATA WAS COLLECTED ON AUGUST 18, 1994
50 0 50
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 6-11
TIDAL CYCLE POTENTIOMETRIC SURFACE
3 P.M.
DWG DATE:06/06/97
DWG NAME:59S38TCP

monitoring wells. Stratigraphic information was generated on boring logs, and soil samples were submitted for analyses of select physical and chemical soil properties.

- The stratigraphy is consistent with other findings at NAS Pensacola. The surficial zone is a fine- to medium-grained quartz sand and is 30 to 45 feet thick. The bottom 2 to 12 feet of the surficial zone grades into finer-grained sand, silts and clays in a "transition zone." Below the surficial/transition zone, is a dense, dark greenish-gray clay layer which is estimated to be approximately 12 to 17 feet thick in the NAS Pensacola area. This clay layer was encountered at each intermediate well location, suggesting that it is laterally continuous beneath the site.

- Laboratory analysis of Shelby tube samples indicate the vertical permeability decreases with depth from 1.934×10^{-2} cm/sec near the surface, to 4.784×10^{-3} cm/sec in the transition zone to the lowest value of 1.036×10^{-8} cm/sec for the clay layer. Fetter (1988) classifies a unit with a permeability less than 1×10^{-5} cm/sec as an aquitard.

- Select soil chemical properties were determined by laboratory analyses including TOC, CEC, TKN, nitrate, total phosphorus, and heterotrophic plate count. These data were collected for use in the FS and, if necessary, a remedial design.

Surficial Aquifer Assessment

Thirty-seven monitoring wells were used during the RI, including nine temporary wells, 21 shallow wells, and seven intermediate wells. Groundwater samples were collected and analyzed for water quality and chemical properties. Specific capacity pumping tests and field measurements were conducted to assess aquifer properties.

- Select groundwater chemical properties were determined by laboratory analyses including five-day BOD, COD, alkalinity, TSS, hardness, TKN, nitrate, total phosphorus, and heterotrophic plate count. These data were collected for use in the FS and, if necessary, a remedial design.

- Specific capacity, transmissivity, and hydraulic conductivity values were estimated for the surficial aquifer by entering data from specific capacity pumping test into a computer program. Specific capacities range from 3.93 to 18.19 gpm/ft, transmissivities range from 624 to 13,614 ft^2/day, and hydraulic conductivities range at intermediate depths from 16 to 124 ft/day, and at shallow depths range from 84 to 340 ft/day.

- Potentiometric data were used to estimate groundwater flow directions, flow velocities, and vertical and horizontal flow gradients. Shallow groundwater flows south-southeast with an estimated velocity ranging from 1.38 to 3.18 ft/day. Groundwater at the intermediate depth flows south with an estimated velocity ranging from 0.10 to 0.61 ft/day. Horizontal gradients were similar at the shallow and intermediate depth, ranging from 0.0006 to 0.0027. The maximum and minimum estimated vertical gradients were -0.0119 and 0.0008, respectively. In general, the potential for vertical flow appears to be downward (positive) across most of the site. However, there is a limited area between the bay and well location 38GI01, where negative vertical gradients were observed, indicating potential upward flow.

- A tidal study was completed to assess the effect of tidal changes on the potentiometric surface of the surficial zone. A time lag was observed between the tidal peak and the water level peak in wells, also, the magnitude of change in water level decreased inland. Well 38GS03 is approximately 53 feet inland and had an observed time lag of 4.5 hours

and a change in water level of 0.421 feet, while at well 38GS01, approximately 240 feet inland, the observed time lag was eight hours with a change in water level of 0.184 feet.

A second part of the tidal study involved monitoring the hourly change in water level in select wells over nine hours. Monitoring began at 8 a.m., approximately 24 minutes before high tide on August 18, 1994. Potentiometric maps were generated for 9 a.m., noon, and 3 p.m. The general shape of the potentiometric surface remained the same, suggesting minimal changes in general flow direction or flow gradients. However, local changes were observed in the flow direction and flow gradients in nearshore wells, suggesting short-term reversals of flow direction in response to tidal peaks.

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7.0 NATURE AND EXTENT OF CONTAMINATION

Sections 7.1 and 7.2 discuss the analytical results for Site 38 soil and groundwater samples, respectively. The analytical results presented herein represent the culmination of several sampling events and phases of investigation. These events include the 1993 investigation of the Site 36 IWTP Sewer Line, the 1993-94 investigation of Building 71, the 1995 USEPA confirmation sampling at Building 71, and the 1995 USEPA investigation of Building 604. A summary report was completed by the USEPA for the 1995 sampling events. This EPA summary report, along with the complete analytical data, set is included as Appendix H. The complete analytical reports for all soil and groundwater samples evaluated for this report are included in Appendices I and J, respectively. Several monitoring wells were resampled in the subsequent phases of the investigation. Where this occurred, the most recent analytical data from a given location was evaluated.

As discussed earlier, the site was divided into two primary areas, the Building 71 study area and the Building 604 study area (Figure 7-1). The segment of the IWTP Sewer Line assessed in this RI will be discussed with the study area it traverses.

Establishment of Preliminary Remediation Goals

State of Florida and/or USEPA risk-based concentrations, general guidance concentrations, and promulgated standards have been defined as PRGs for this investigation. Resultingly, PRGs have been used as the screening criteria for evaluating potential site contamination. Inorganic parameters detected in site samples were first screened by comparison to reference concentrations. Comparisons to the PRGs were then made if a reference concentration was exceeded. PRGs also include the background concentrations (reference concentrations) used to evaluate Site 38 analytical results for inorganic contaminant distribution and risk assessment purposes. Discussions of analytical results specifically address the relationships between detected parameters and the PRGs listed below.

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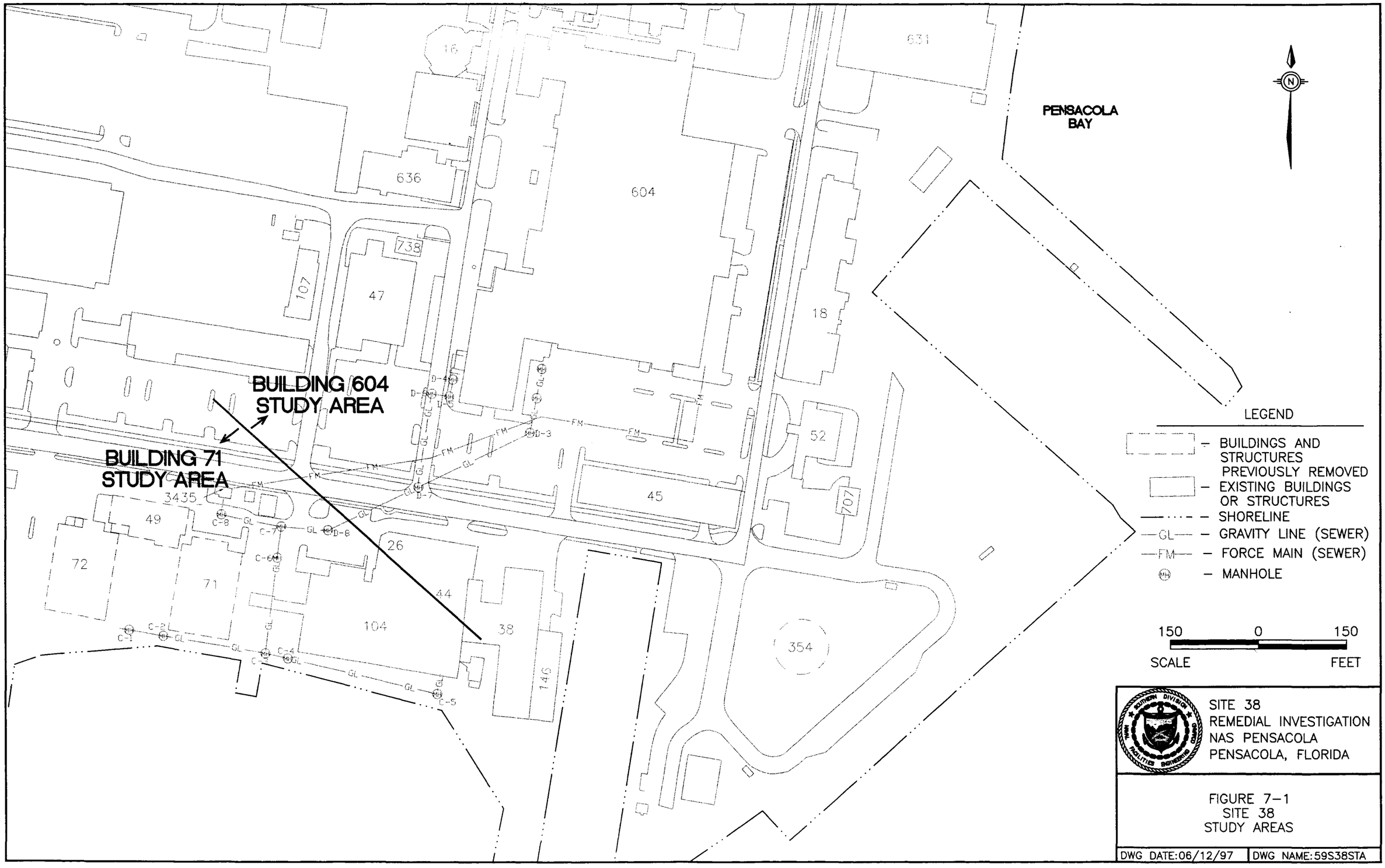


FIGURE 7–1
SITE 38
STUDY AREAS

Soil

- USEPA Region III Risk-based Concentrations (RBCs) for Residential soil (June 3, 1996) (USEPA, 1996a);

- USEPA Region III Soil Screening Levels: Soil-to-groundwater transfer (June 3, 1996) (USEPA, 1996a);

- FDEP health-based and leachability-based Cleanup Goals (CGs) for residential soil (September 29, 1995) (FDEP, 1995); and

- USEPA Office of Solid Waste and Emergency Response (OSWER) draft Revised Interim Soil Lead Guidance (June 3, 1994) (USEPA, 1994a).

Analytical results of soil samples were compared to different standards based on sample depth. Surface soil samples (0 to 1 foot) were compared to the health-risk based standards from the above references. However, results of samples below 1 foot (subsurface samples) were compared to soil leachability-based standards considered protective of groundwater.

Groundwater

- USEPA Maximum Contaminant Levels (MCLs) (February 1996) (USEPA, 1996b);

- Florida Primary and Secondary Drinking Water Standards (FPDWS and FSDWS, respectively; June 2, 1994) (FDEP, 1994); and

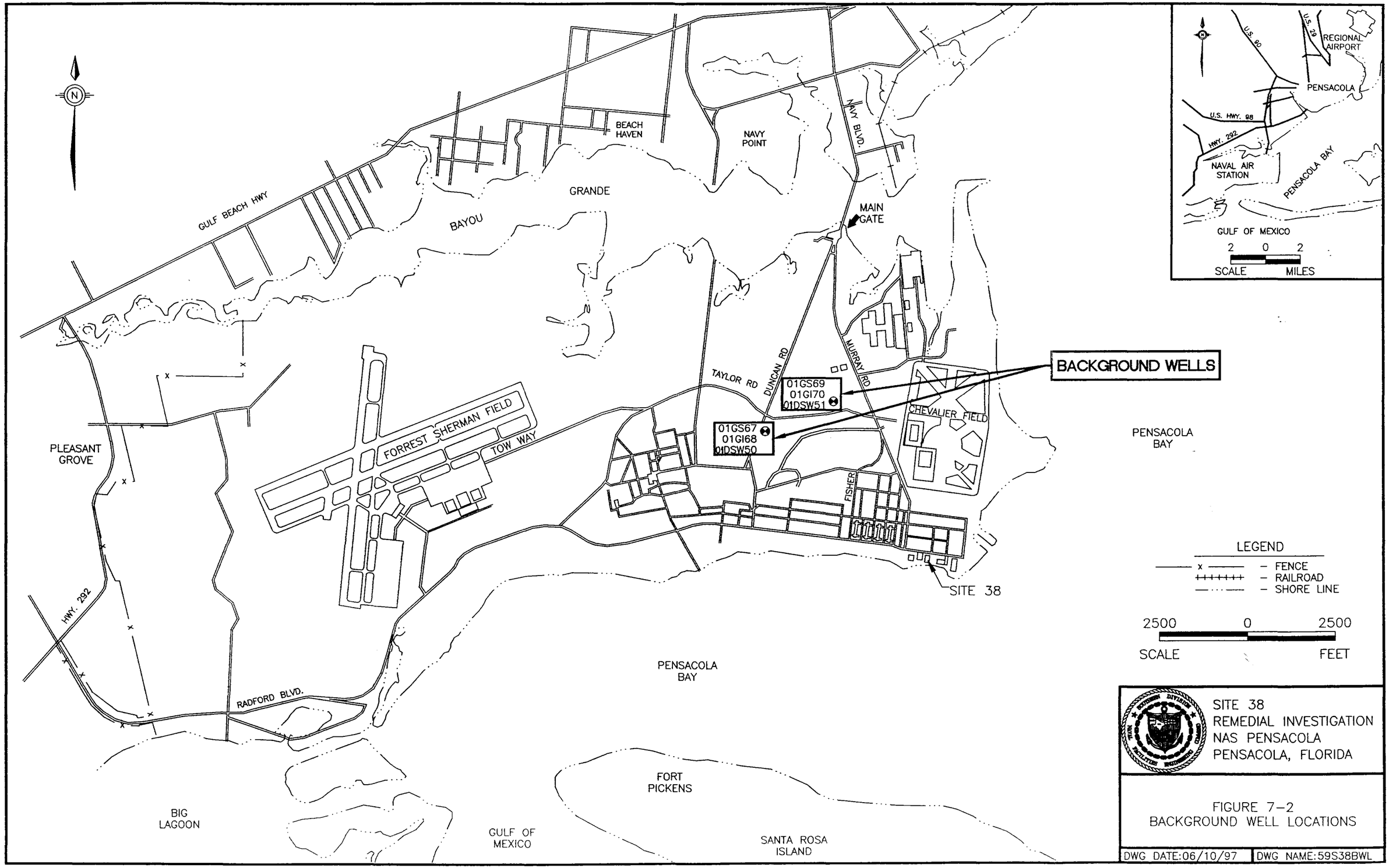
- Florida Groundwater Guidance Concentrations including systemic toxicants, carcinogens, and organoleptic concentrations (June 2, 1994) (FDEP, 1994).

All listed PRGs are presented in Appendix K.

Establishment of Background

Background concentrations of soil and groundwater inorganics for use in NAS Pensacola remedial investigations were determined in 1993 during the Site 1 RI. Background sample locations are shown on Figure 7-2. Soil samples were collected while installing background wells 01GS67, 01GI68, 01GS69, and 01GI70 during the 1993 Site 1 RI. These shallow and intermediate wells (01GS67 and 01GS69, 01GI68 and 01GI70, respectively) were sampled in 1993 (using Teflon bailers). Due to sample turbidity these wells were resampled in July 1994 using low flow rate quiescent sampling techniques. Data from both sampling events were used to generate the background reference concentrations for the base.

Deep supply wells 01DSW50 and 01DSW51 were also sampled during the 1993 Site 1 RI to obtain the deep zone background data. Because supply wells contained operable turbine pumps, these wells were sampled directly from a valve at the wellhead without the use of a bailer. These samples exhibited low turbidities comparable to those collected from the shallow wells sampled using low-flow techniques. For comparison, background sample (1993 soil samples, 1994 shallow and intermediate groundwater samples, and 1993 deep groundwater samples) results were used to define a range of concentrations for each detected inorganic parameter considered representative of ambient conditions. Furthermore, a "reference concentration" (RC) was then calculated for each inorganic parameter, equal to two times the parameter's mean concentration. In instances where an analyzed parameter was not detected above the quantitation limit, a value of one-half the reported detection limit was used to calculate the mean concentration for the RC. Calculated RCs for detected inorganic parameters are presented with the PRGs in Appendix K. These RCs were derived during the Site 1 RI. The values are included in Appendices G and H. (E/A&H, 1996b)


N
GULF BEACH HWY
BAYOU
GRANDE
BEACH HAVEN
NAVY POINT
NAVY BLVD.
MAIN GATE
TAYLOR RD
DUNCAN RD
MURRAY RD
FISHER
CHEVALIER FIELD
FORREST SHERMAN FIELD
TOW WAY
PLEASANT GROVE
HWY. 292
RADFORD BLVD.
BACKGROUND WELLS
01GS69
01GI70
01DSW51
01GS67
01GI68
01DSW50
SITE 38
PENSACOLA BAY
PENSACOLA BAY
FORT PICKENS
BIG LAGOON
GULF OF MEXICO
SANTA ROSA ISLAND
U.S. 90
U.S. 29
REGIONAL AIRPORT
PENSACOLA
U.S. HWY. 98
HWY. 292
NAVAL AIR STATION
PENSACOLA BAY
GULF OF MEXICO
2 0 2
SCALE MILES
LEGEND
FENCE
RAILROAD
SHORE LINE
2500 0 2500
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-2
BACKGROUND WELL LOCATIONS
DWG DATE:06/10/97
DWG NAME:59S38BWL

As noted in Appendix K, concentrations of aluminum and iron detected in background groundwater samples exceeded secondary drinking water standards for all wells, indicating that these metals occur naturally at relatively high concentrations in the groundwater at NAS Pensacola. Specifically, the lithology of the surficial zone of the Sand-and-Gravel Aquifer can locally contain high percentages of ferrous/manganese hydroxides, clays, and detrital shell material, so the abundance of Al, Fe, Mn, and Ca is not unexpected. In addition to comparisons to site-specific background, comparisons for some inorganics in groundwater are occasionally made using data presented by the Northwest Florida Water Management District (Clemens et al., 1989). This publication presents ambient water quality data for all of the district but comparisons are limited to only data from the Sand-and-Gravel Aquifer in southern Escambia County.

7.1 Soil Assessment

The analytical results for soil samples were assessed by dividing the samples into two intervals, surface and subsurface soil. Surface soil was collected from 0 to 1 foot deep in most of the samples although some samples from the earlier events were collected from 0 to 2 feet. Subsurface soil samples were collected from depths below 1 or 2 feet but above the water table. Human health risk-based PRGs were used for comparison with the surface soil analytical results while leachability-based PRGs, protective of groundwater, were compared with subsurface sample results. Inorganic parameters detected in site samples were first screened by comparison to reference concentrations. Comparisons to the PRGs were then made if a reference concentration was exceeded. Soil borings used for the Building 71 study area are shown on Figure 7-3. From the forty borings surrounding Building 71, 78 associated soil samples were evaluated for the RI. One hundred twenty-seven samples from 67 borings were evaluated for the assessment of the Building 604 study area. Boring locations for the Building 604 study area are shown on Figure 7-4. Data summary tables listing soil samples with parameter concentrations exceeding a PRG are provided in Appendix L. The complete soil analytical data report is included in Appendix I.

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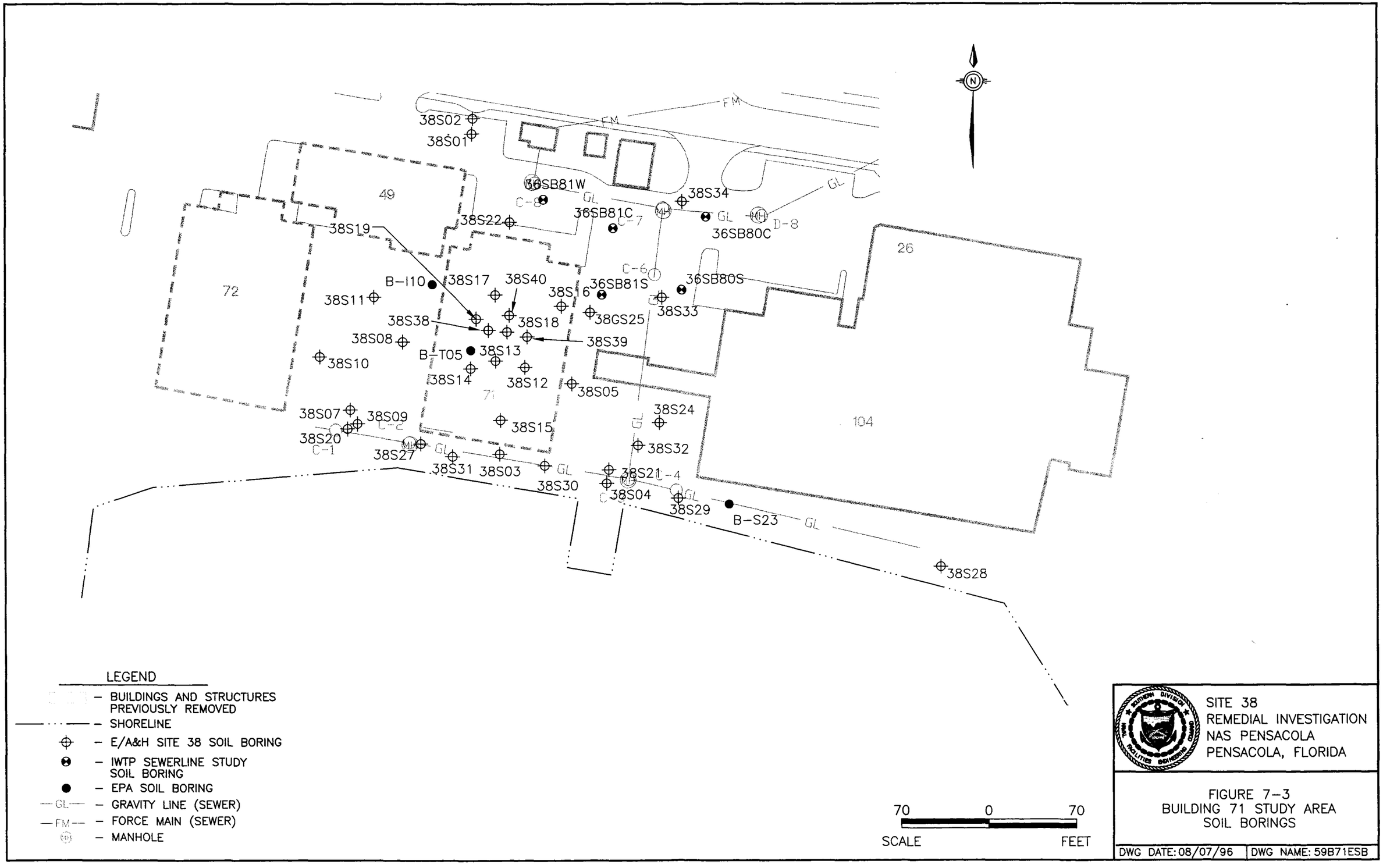


LEGEND

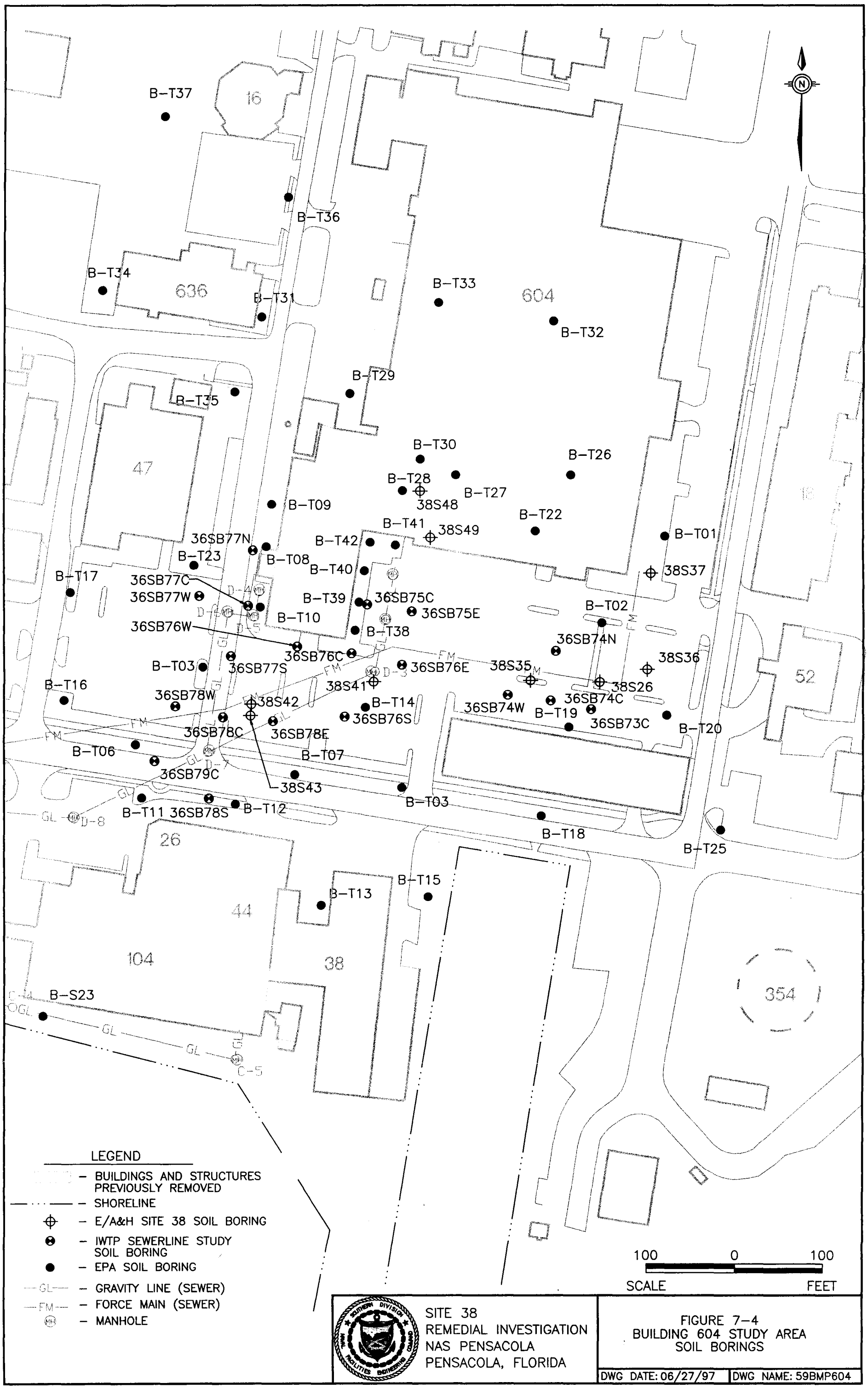
- BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
- SHORELINE
- E/A&H SITE 38 SOIL BORING
- IWTP SEWERLINE STUDY SOIL BORING
- EPA SOIL BORING
- GL — GRAVITY LINE (SEWER)
- FM — FORCE MAIN (SEWER)
- MANHOLE

70 0 70
SCALE FEET

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7-3
BUILDING 71 STUDY AREA
SOIL BORINGS

DWG DATE: 08/07/96 | DWG NAME: 59B71ESB


B-T37
16
B-T36
B-T34
636
B-T31
B-T33
604
B-T32
B-T29
B-T35
47
B-T30
B-T26
B-T28
38S48
B-T27
B-T09
B-T22
B-T41
38S49
B-T01
36SB77N
B-T42
B-T23
B-T08
B-T40
38S37
B-T17
36SB77C
36SB77W
B-T39
36SB75C
36SB75E
B-T02
B-T10
36SB76W
B-T38
36SB74N
36SB76C
38S36
B-T03
36SB77S
36SB76E
38S35
52
B-T16
38S41
38S26
36SB78W
38S42
B-T14
36SB74C
36SB74W
B-T19
36SB76S
36SB73C
36SB78C
36SB78E
B-T20
B-T06
B-T07
36SB79C
38S43
B-T03
B-T11
36SB78S
B-T12
B-T18
B-T25
26
B-T15
B-T13
44
104
38
354
B-S23
C-5
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– E/A&H SITE 38 SOIL BORING
– IWTP SEWERLINE STUDY SOIL BORING
– EPA SOIL BORING
– GRAVITY LINE (SEWER)
– FORCE MAIN (SEWER)
– MANHOLE
100 0 100
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-4
BUILDING 604 STUDY AREA
SOIL BORINGS
DWG DATE: 06/27/97
DWG NAME: 59BMP604

7.1.1 Building 71 Study Area

7.1.1.1 Surface Soil

Inorganics

Inorganic parameters detected above PRGs and RCs in surface soil samples are shown on Figure 7-5. Common elements, aluminum and iron, along with antimony, arsenic, cadmium, chromium, and copper were detected in surface soil above their PRGs and RCs. The RC exceeded the PRG for arsenic, beryllium, and iron in surface soil samples. The RC for arsenic (1.56 mg/kg) was exceeded in eight of the 17 samples exceeding the RBC of 0.43 mg/kg. Beryllium exceeded the RBC of 0.15 mg/kg at four locations; however, each beryllium concentration was less than the RC of 0.41 mg/kg. Iron was more ubiquitous across the site and exceeded the RBC of 2,300 mg/kg at 12 locations ranging from 2,410 mg/kg to 14,100 mg/kg. Eleven of the iron exceedances also exceeded the RC of 2,745 mg/kg. All other inorganic elements above standards in surface soils exceeded both the RC and PRG. The PRG and RC for cadmium, 3.9 mg/kg and 1.0 mg/kg, was exceeded in two locations, 38S10 and 38S14. Detected chromium concentrations above the PRG and RC ranged from 53.4 mg/kg at 38S17 to 713 mg/kg at 38S13. Three borings (38S38, 38S39 and 38S40) completed around 38S18 were analyzed for hexavalent chromium (Figure 7-5). A concentration of 23 mg/kg was detected in 38S40. Total chromium concentrations were compared with the hexavalent chromium PRG. Isolated exceedances of antimony and copper occurred in samples 38S22 and 36SB80S, respectively.

Organics

Detected organic compounds included semivolatiles, pesticides, and PCBs; no VOCs were detected in surface soil at concentrations which exceed any PRGs. Two semivolatile organic compounds (SVOCs) were detected above PRGs in surface soil in the Building 71 study area, benzo(a)pyrene and dibenz(a,h)anthracene (Figure 7-6). Benzo(a)pyrene occurred above the PRG at three locations with a maximum concentration at 38S32 of 690 micrograms per kilogram

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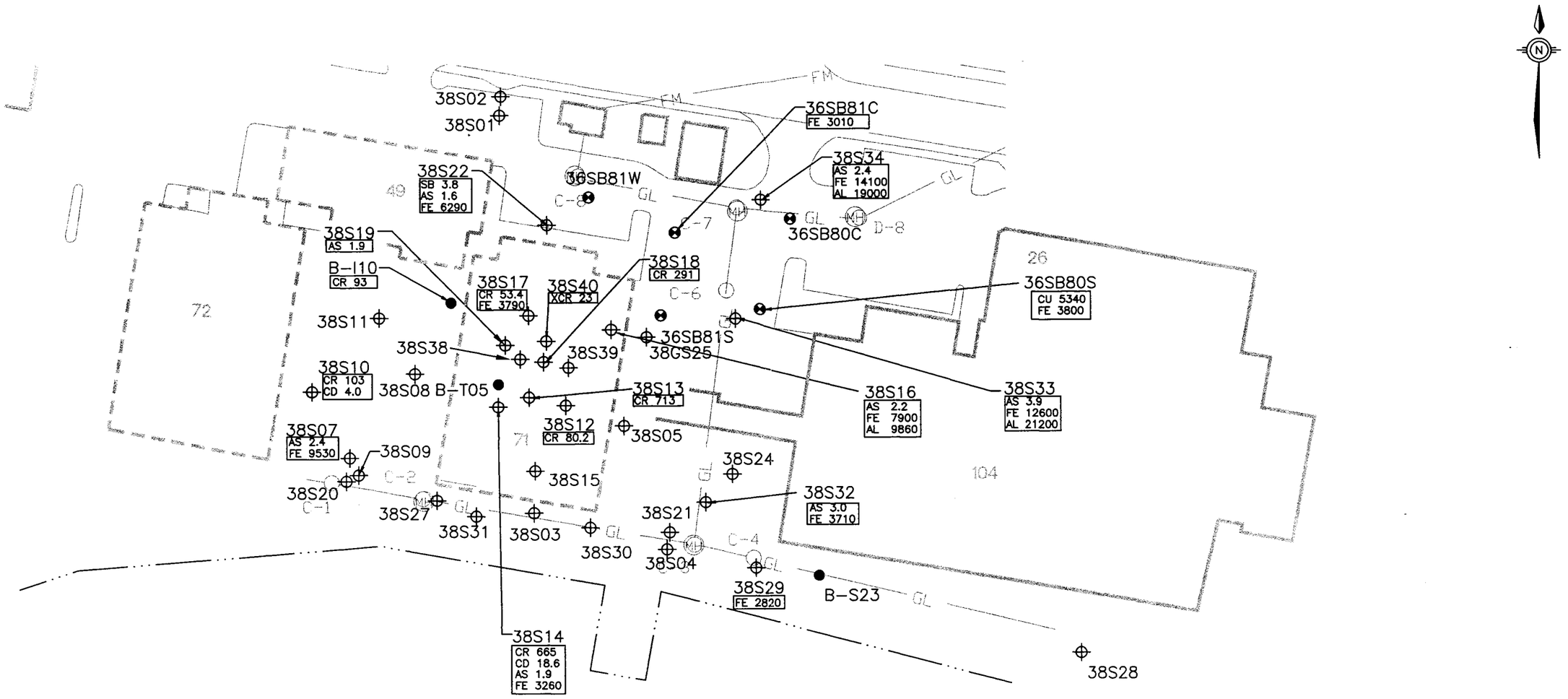

LEGEND

- BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
- SHORELINE
- E/A&H SITE 38 SOIL BORING
- IWTP SEWERLINE STUDY SOIL BORING
- EPA SOIL BORING
- GL — GRAVITY LINE (SEWER)
- FM — FORCE MAIN (SEWER)
- MH — MANHOLE

NOTE : ALL CONCENTRATIONS IN mg/kg.

70 0 70
SCALE FEET

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7-5
BUILDING 71 STUDY AREA
INORGANIC PARAMETERS EXCEEDING
PRGS AND RCS IN SURFACE SOIL

DWG DATE: 06/12/97 | DWG NAME: 59S38IPE

(μg/kg). The maximum concentration of dibenz(a,h)anthracene, 230 μg/kg, was also detected at 38S32. These detections appeared to be isolated along parts of the IWTP sewer line.

Pesticides and PCBs detected in surface soil above the PRGs are shown on Figure 7-7. Aroclor-1254 was detected above the PRG at two locations in close proximity to each other beneath former Building 71, with a maximum concentration of 16,000 μg/kg at 38S18. This sample also contained gamma chlordane at a concentration of 630 μg/kg, which exceeded the PRG.

7.1.1.2 Subsurface Soil

Inorganics

Inorganic elements exceeding the RCs and PRGs in subsurface soil are presented in Figure 7-8. Arsenic, cadmium, and chromium, which were detected in surface soil were also detected in subsurface soil samples above their PRGs and RCs. The RC for thallium (0.82 mg/kg) exceeds its subsurface PRG (0.4 mg/kg). Thallium at one location (0.61 mg/kg at 38S12) was detected above the PRG, but below the RC. Arsenic was only detected in one location, 38S12, at a concentration of 15.6 mg/kg. Cadmium was detected in two locations with a maximum concentration of 8.4 mg/kg at 38S18. Chromium exceedances occurred primarily beneath former Building 71 with a maximum concentration of 553 mg/kg in the 1- to 3-foot interval of boring 38S13. Generally, these metals concentrations diminished greatly or were absent in the subsurface where exceedances were noted in coincident surface soil samples. Barium at two locations and nickel at one location, respectively, were also detected in one location each exceeding above their respective PRGs and RCs. Lead was detected above its PRG of 400 mg/kg at 38S07 (425 mg/kg) and 38S18 (491 mg/kg).

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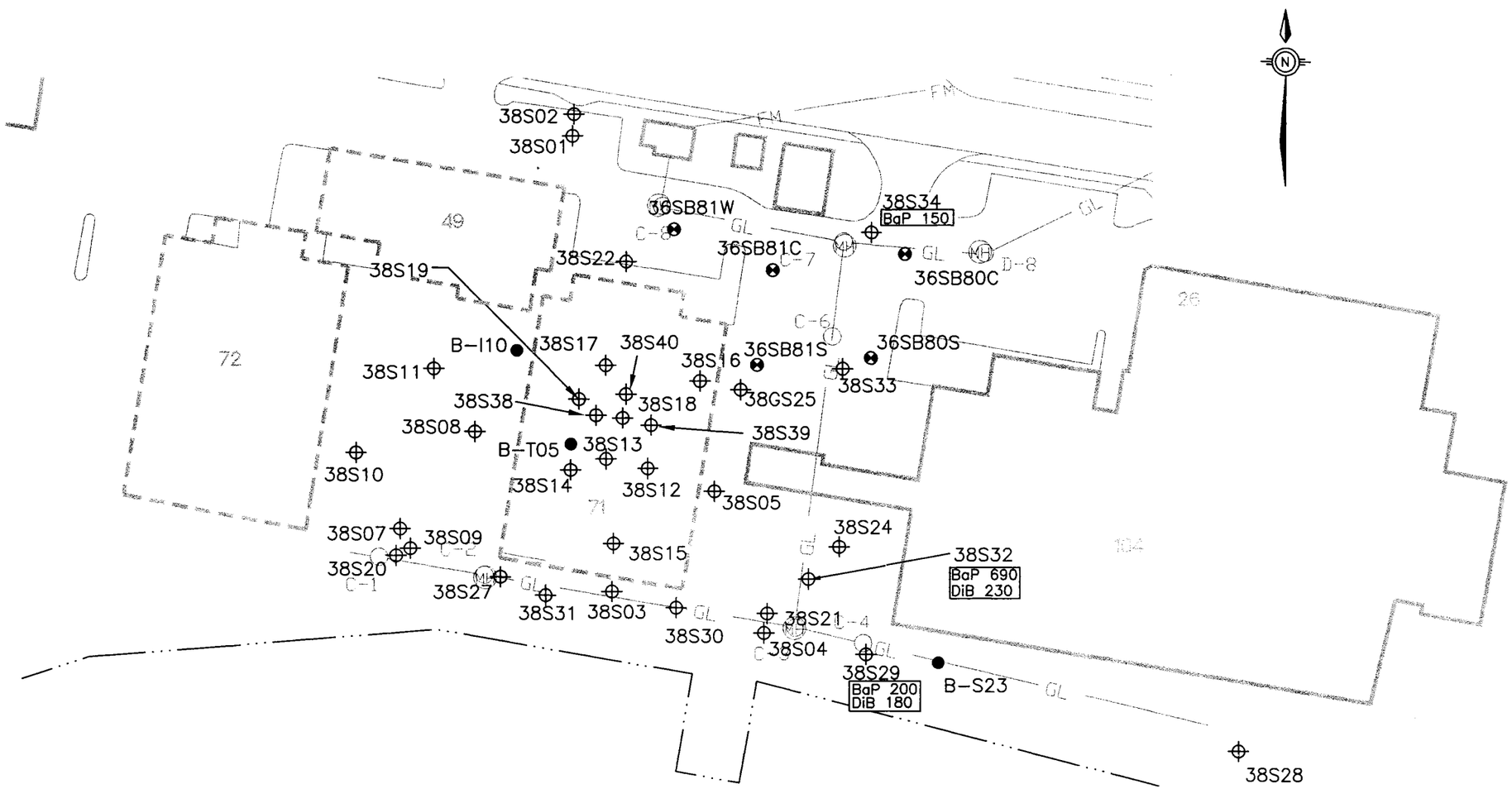


LEGEND

- BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
- SHORELINE
- SITE 38 SOIL BORING
- IWTP SEWERLINE STUDY SOIL BORING
- EPA SOIL BORING
- GL – GRAVITY LINE (SEWER)
- FM – FORCE MAIN (SEWER)
- MH – MANHOLE
- BaP – BENZO-(A)-PYRENE
- DiB – DIBENZ (A,H) ANTHRACENE

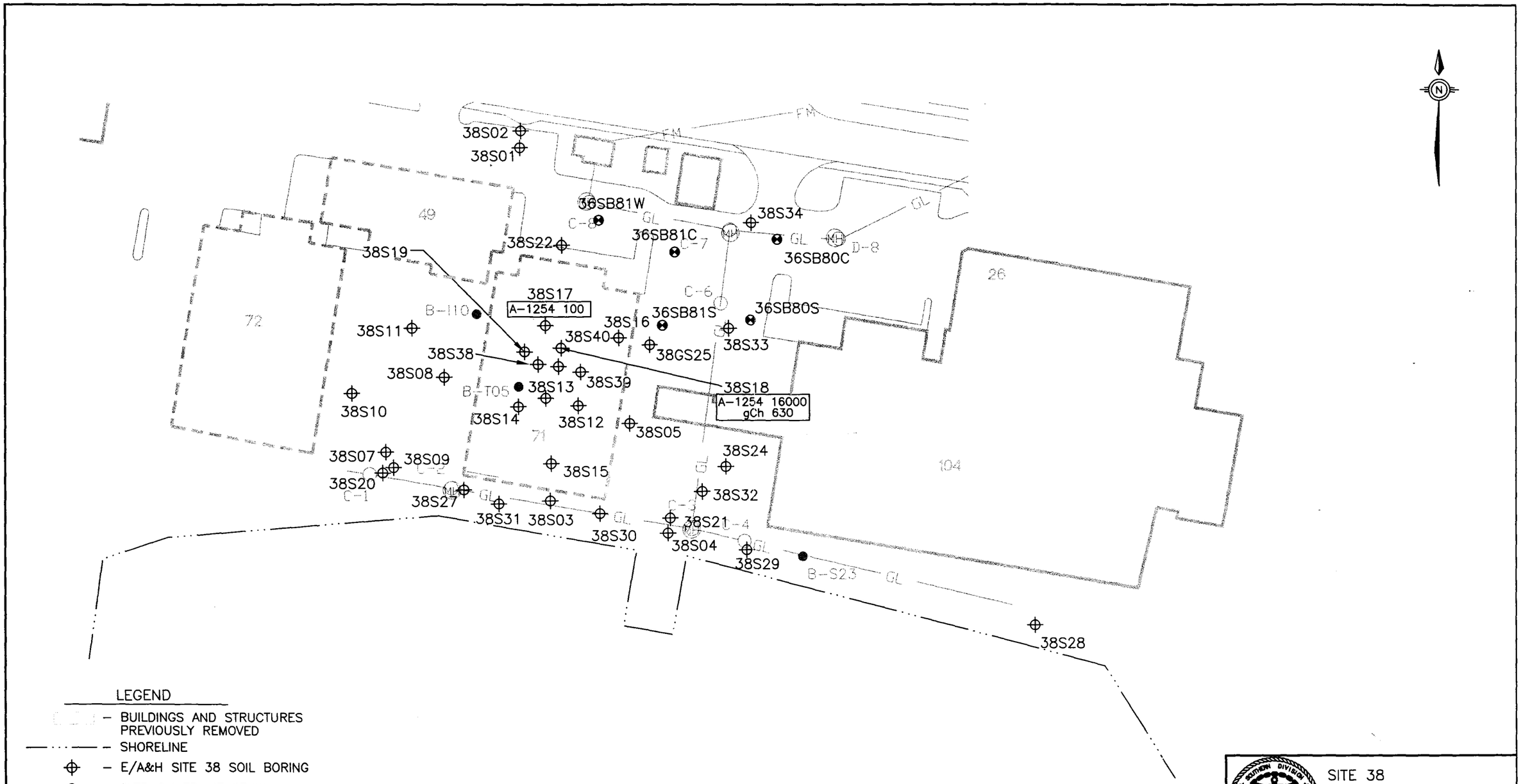
*NOTE: ALL CONCENTRATIONS IN $\mu g/kg$.

70 0 70
SCALE FEET

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7-6
BUILDING 71 STUDY AREA
SEMIVOLATILE PARAMETERS EXCEEDING
PRGS IN SURFACE SOIL

DWG DATE: 06/10/97 | DWG NAME: 59S38SPE



LEGEND

- BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
- SHORELINE
- E/A&H SITE 38 SOIL BORING
- IWTP SEWERLINE STUDY SOIL BORING
- EPA SOIL BORING
- GL — GRAVITY LINE (SEWER)
- FM — FORCE MAIN (SEWER)
- MH — MANHOLE
- A–1254 — AROCLOR 1254
- gCH — GAMMA CHLORDANE

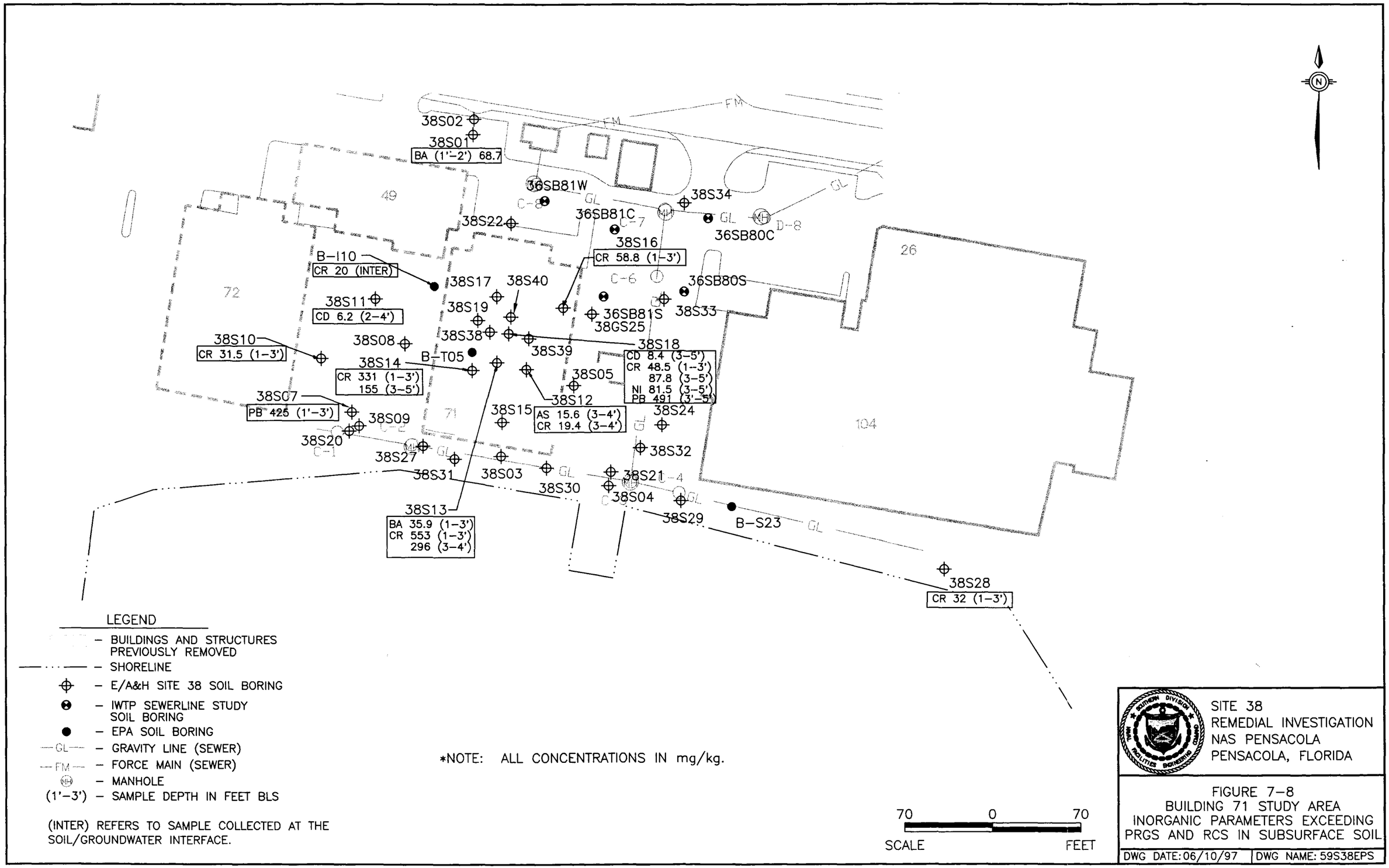
*NOTE: ALL CONCENTRATIONS IN $\mu g/kg$.

70 0 70
SCALE FEET

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7–7
BUILDING 71 STUDY AREA
PESTICIDE/PCB PARAMETERS
EXCEEDING PRGS IN SURFACE SOIL

DWG DATE: 06/10/97 | DWG NAME: 59S38PPE


38S02
38S01
BA (1'-2') 68.7
FM
36SB81W
38S34
GL
36SB81C
36SB80C
38S22
38S16
CR 58.8 (1-3')
B-I10
CR 20 (INTER)
38S17
38S40
36SB80S
38S11
CD 6.2 (2-4')
38S19
36SB81S
38S33
38GS25
38S10
CR 31.5 (1-3')
38S08
38S38
38S39
38S18
CD 8.4 (3-5')
CR 48.5 (1-3')
87.8 (3-5')
NI 81.5 (3-5')
PB 491 (3'-5')
B-T05
38S14
CR 331 (1-3')
155 (3-5')
38S05
38S07
PB 425 (1'-3')
38S12
38S15
AS 15.6 (3-4')
CR 19.4 (3-4')
38S24
38S09
38S20
38S32
38S27
38S31
38S03
38S21
38S30
38S04
38S13
BA 35.9 (1-3')
CR 553 (1-3')
296 (3-4')
38S29
B-S23
38S28
CR 32 (1-3')
49
72
71
26
104
C-8
C-7
C-6
C-1
C-2
C-4
D-8
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– E/A&H SITE 38 SOIL BORING
– IWTP SEWERLINE STUDY SOIL BORING
– EPA SOIL BORING
– GRAVITY LINE (SEWER)
– FORCE MAIN (SEWER)
– MANHOLE
(1'-3') – SAMPLE DEPTH IN FEET BLS
(INTER) REFERS TO SAMPLE COLLECTED AT THE SOIL/GROUNDWATER INTERFACE.
*NOTE: ALL CONCENTRATIONS IN mg/kg.
70 0 70
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-8
BUILDING 71 STUDY AREA
INORGANIC PARAMETERS EXCEEDING
PRGS AND RCS IN SUBSURFACE SOIL
DWG DATE: 06/10/97
DWG NAME: 59S38EPS

Organics

SVOCs, pesticides, and VOCs were detected in subsurface soil above the PRGs. SVOCs exceeding the PRGs included PAHs and phenols (Figure 7-9). Generally the greatest variety and highest concentration of PAHs, was detected at boring B-T05. Boring 38S14 contained the maximum concentration of total phenols 1,590 μg/kg. SVOC contamination was observed primarily beneath former Building 71.

DDE was detected above the PRG in both subsurface soil intervals at boring 38S18 (Figure 7-10). This boring also contained the gamma chlordane exceedance in surface soil. These exceedances may represent residues of pesticide treatments during the construction of Building 71.

VOCs exceeded PRGs at 11 locations, including 1,1,2,2-tetrachloroethane, 1,2,-dichloroethane, chloroform, methylene chloride, tetrachloroethene, and TCE (Figure 7-11). The maximum total VOC concentration of 1,044 μg/kg was detected in boring 38S14. This sample also exhibited the greatest variety of VOCs. Tetrachloroethene and TCE were the most prevalent volatiles and were detected at four and nine locations, respectively. Most exceedances occurred in the soil beneath former Building 71. These occurrences were not coincident with surface soil exceedances beneath Building 71 implying that although surface soil does not apparently pose a health risk, subsurface soils could potentially affect groundwater quality via leaching.

7.1.2 Building 604 Study Area

7.1.2.1 Surface Soil

Inorganics

Inorganics detected above PRGs and RCs in surface soil are presented on Figure 7-12 and included aluminum, iron, manganese, cadmium, chromium, copper, arsenic, lead, and vanadium. Similar to the Building 71 study area, the RC exceeded the PRG for arsenic, beryllium, and iron in surface soil samples. Arsenic exceeded the PRG in 27 samples ranging from 0.46 mg/kg at 36S76E to

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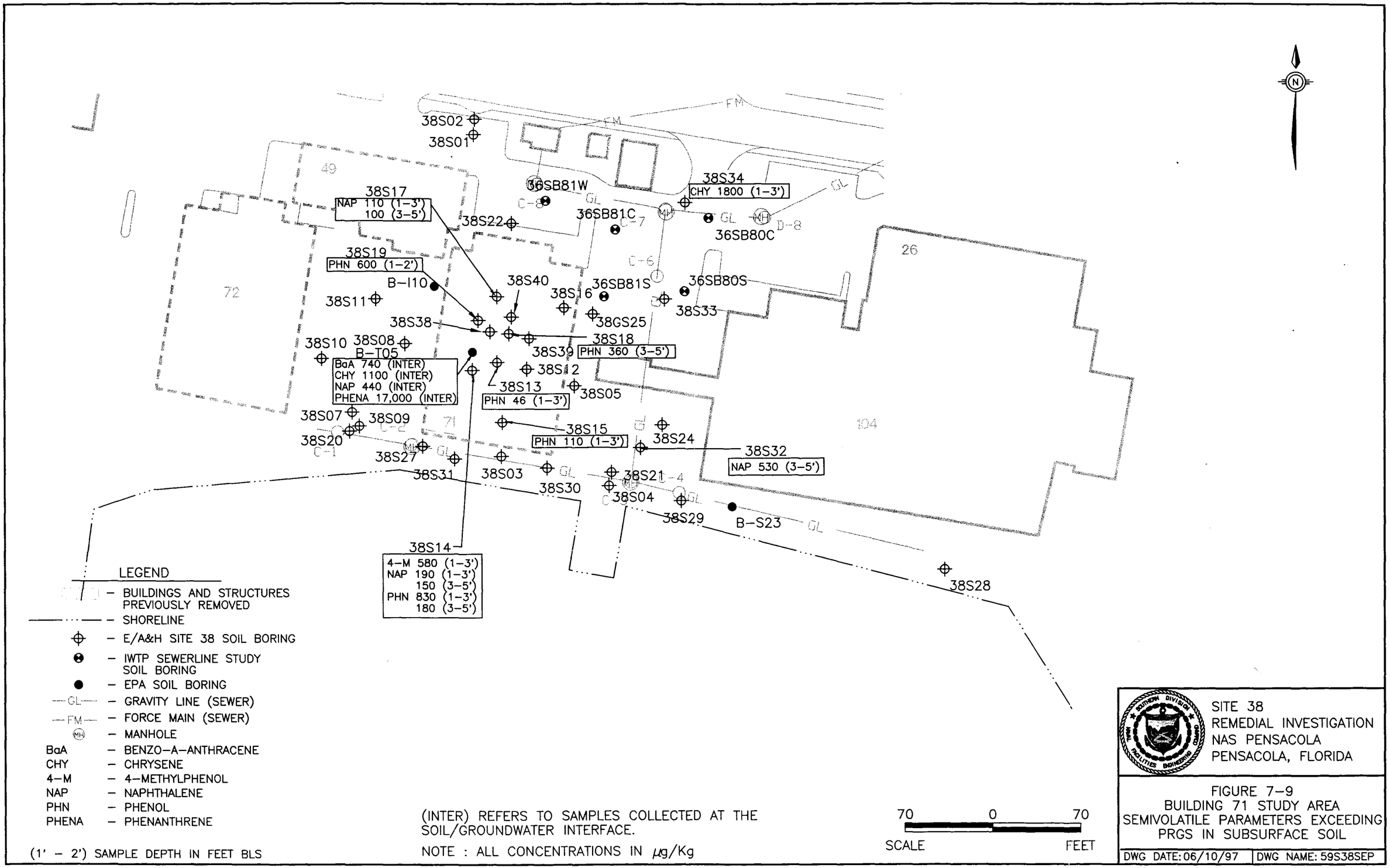
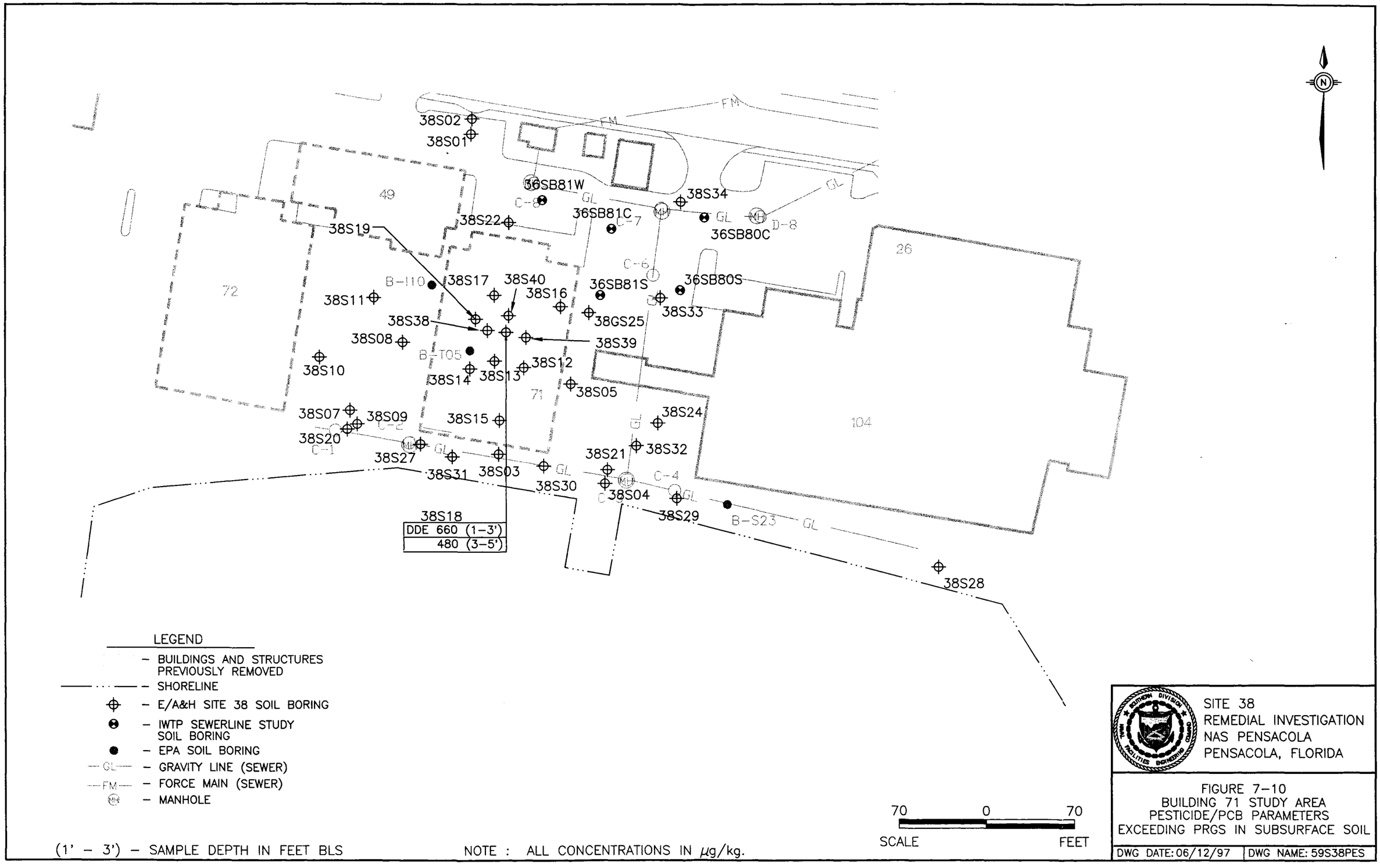
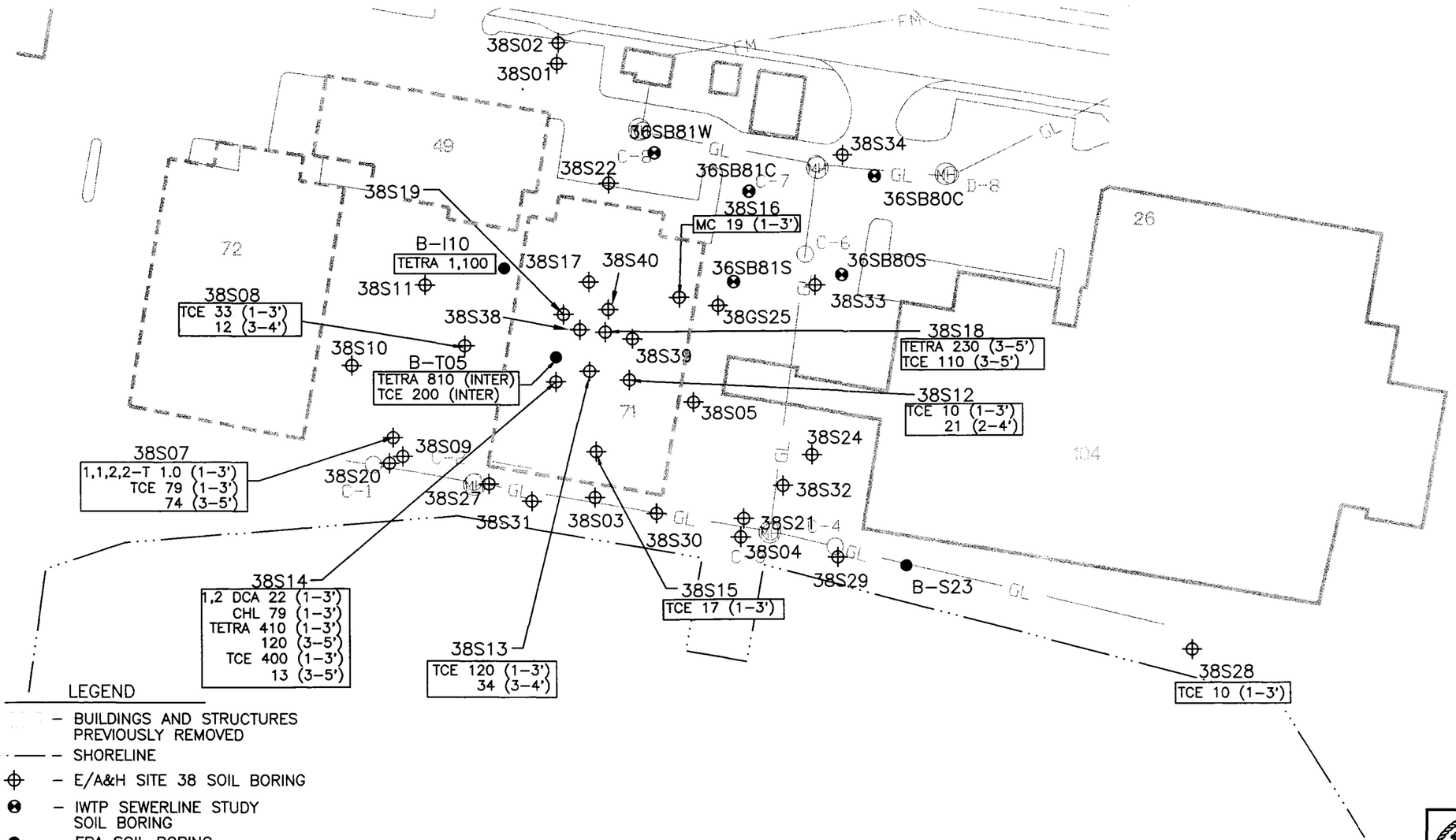

38S02
38S01
FM
49
38S17
NAP 110 (1–3')
100 (3–5')
36SB81W
C-8
GL
38S22
36SB81C
C-7
MH
GL
MH
D-8
36SB80C
38S34
CHY 1800 (1–3')
GL
26
38S19
PHN 600 (1–2')
B–I10
72
38S40
38S16
36SB81S
C-6
36SB80S
38S33
38S11
38S38
38GS25
38S18
38S10
38S08
B–T05
38S39
PHN 360 (3–5')
BaA 740 (INTER)
CHY 1100 (INTER)
NAP 440 (INTER)
PHENA 17,000 (INTER)
38S12
38S13
PHN 46 (1–3')
38S05
38S07
38S09
71
C-2
38S15
PHN 110 (1–3')
38S24
104
38S20
C-1
38S27
38S32
NAP 530 (3–5')
38S31
38S03
38S21
C-4
38S30
38S04
38S29
B–S23
38S14
4–M 580 (1–3')
NAP 190 (1–3')
150 (3–5')
PHN 830 (1–3')
180 (3–5')
38S28
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– E/A&H SITE 38 SOIL BORING
– IWTP SEWERLINE STUDY SOIL BORING
– EPA SOIL BORING
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
BaA – BENZO–A–ANTHRACENE
CHY – CHRYSENE
4–M – 4–METHYLPHENOL
NAP – NAPHTHALENE
PHN – PHENOL
PHENA – PHENANTHRENE
(1' – 2') SAMPLE DEPTH IN FEET BLS
(INTER) REFERS TO SAMPLES COLLECTED AT THE SOIL/GROUNDWATER INTERFACE.
NOTE : ALL CONCENTRATIONS IN μg/Kg
70 0 70
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7–9
BUILDING 71 STUDY AREA
SEMIVOLATILE PARAMETERS EXCEEDING PRGS IN SUBSURFACE SOIL
DWG DATE: 06/10/97
DWG NAME: 59S38SEP


38S02
38S01
FM
FM
GL
36SB81W
C-8
38S34
GL
36SB81C
C-7
MH
GL
MH
D-8
36SB80C
38S22
38S19
49
72
26
C-6
B-110
38S17
38S40
38S16
36SB81S
36SB80S
38S11
38S33
38S38
38GS25
38S08
38S39
B-T05
38S10
38S12
38S14
38S13
71
38S05
38S07
38S09
38S15
38S24
104
38S20
C-1
C-2
38S27
GL
38S21
38S32
38S31
38S03
GL
C-4
38S30
38S04
GL
38S29
B-S23
GL
38S18
DDE 660 (1-3')
480 (3-5')
38S28
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– E/A&H SITE 38 SOIL BORING
– IWTP SEWERLINE STUDY SOIL BORING
– EPA SOIL BORING
– GRAVITY LINE (SEWER)
– FORCE MAIN (SEWER)
– MANHOLE
(1' – 3') – SAMPLE DEPTH IN FEET BLS
NOTE : ALL CONCENTRATIONS IN µg/kg.
70 0 70
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-10
BUILDING 71 STUDY AREA
PESTICIDE/PCB PARAMETERS
EXCEEDING PRGS IN SUBSURFACE SOIL
DWG DATE: 06/12/97
DWG NAME: 59S38PES



LEGEND

- BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
- SHORELINE
- E/A&H SITE 38 SOIL BORING
- IWTP SEWERLINE STUDY SOIL BORING
- EPA SOIL BORING
- GL – GRAVITY LINE (SEWER)
- FM – FORCE MAIN (SEWER)
- MH – MANHOLE
- 1,2 DCA – 1,2 DICHLOROETHANE
- CHL – CHLOROFORM
- 1,1,2,2–T – 1,1,2,2–TETRACHLOROETHANE
- MC – METHYLENE CHLORIDE
- TETRA – TETRACHLOROETHENE
- TCE – TRICHLOROETHENE
- (1' – 3') SAMPLES IN FEET BLS

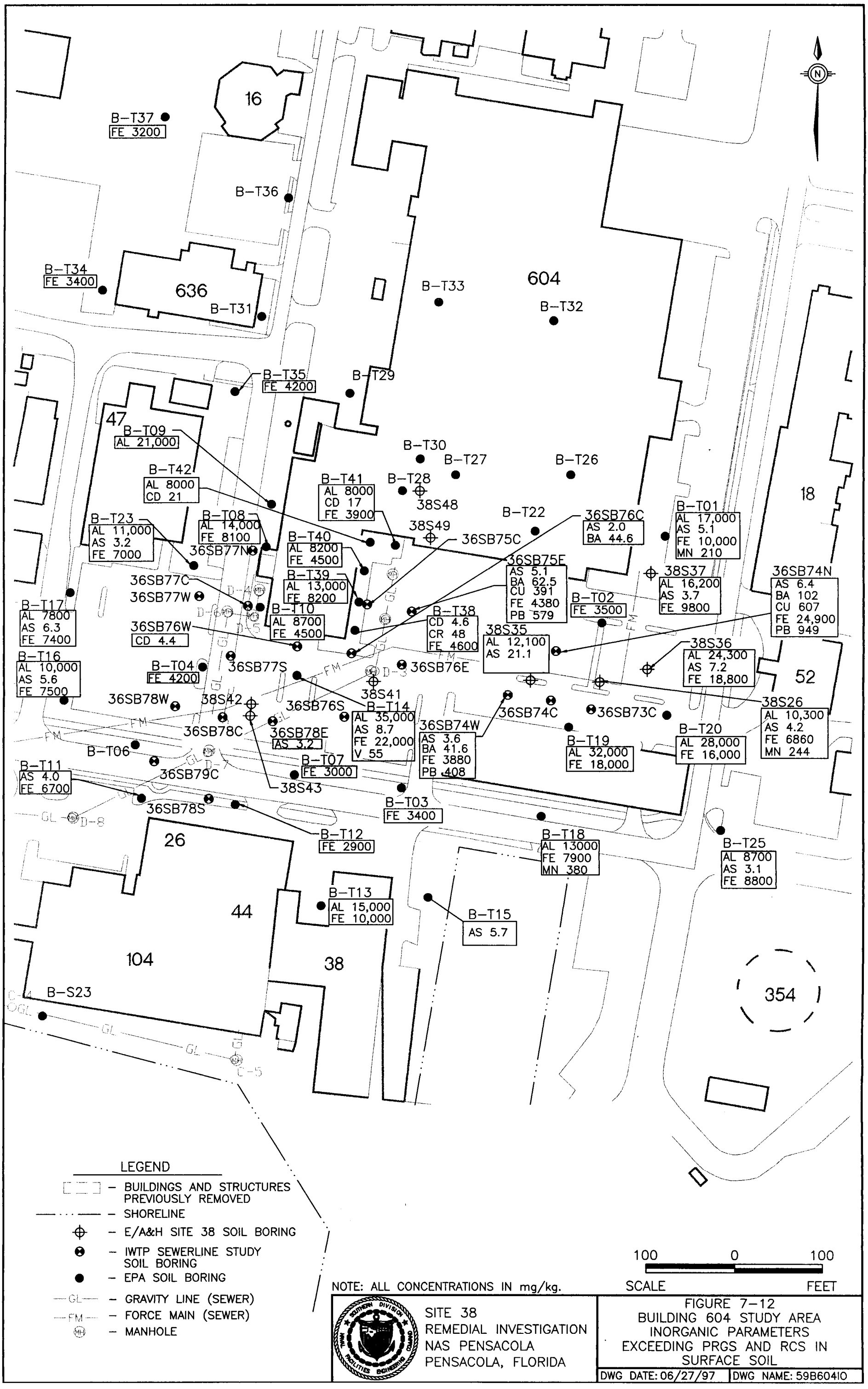
NOTE : ALL CONCENTRATIONS IN µg/kg.
(INTER) REFERS TO SAMPLE COLLECTED OF THE SOIL/GROUNDWATER INTERFACE.

70 0 70
SCALE FEET

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7–11
BUILDING 71 STUDY AREA
VOLATILE ORGANIC PARAMETERS
EXCEEDING PRGS IN SUBSURFACE SOIL

DWG DATE: 06/10/97 | DWG NAME: 59S38VOP


16
B-T37
FE 3200
B-T36
B-T34
FE 3400
636
B-T31
604
B-T33
B-T32
B-T35
FE 4200
B-T29
47
B-T09
AL 21,000
B-T30
B-T27
B-T26
B-T42
AL 8000
CD 21
B-T41
AL 8000
CD 17
FE 3900
B-T28
38S48
18
B-T01
AL 17,000
AS 5.1
FE 10,000
MN 210
B-T23
AL 11,000
AS 3.2
FE 7000
B-T08
AL 14,000
FE 8100
36SB77N
B-T40
AL 8200
FE 4500
38S49
36SB75C
B-T22
36SB76C
AS 2.0
BA 44.6
36SB75E
AS 5.1
BA 62.5
CU 391
FE 4380
PB 579
38S37
AL 16,200
AS 3.7
FE 9800
36SB74N
AS 6.4
BA 102
CU 607
FE 24,900
PB 949
36SB77C
36SB77W
B-T39
AL 13,000
FE 8200
B-T17
AL 7800
AS 6.3
FE 7400
B-T10
AL 8700
FE 4500
B-T38
CD 4.6
CR 48
FE 4600
B-T02
FE 3500
36SB76W
CD 4.4
38S35
AL 12,100
AS 21.1
38S36
AL 24,300
AS 7.2
FE 18,800
B-T16
AL 10,000
AS 5.6
FE 7500
B-T04
FE 4200
36SB77S
36SB76E
52
36SB78W
38S42
38S41
36SB76S
B-T14
AL 35,000
AS 8.7
FE 22,000
V 55
36SB74C
36SB73C
38S26
AL 10,300
AS 4.2
FE 6860
MN 244
36SB78C
36SB78E
AS 3.2
36SB74W
AS 3.6
BA 41.6
FE 3880
PB 408
B-T20
AL 28,000
FE 16,000
B-T06
B-T19
AL 32,000
FE 18,000
B-T11
AS 4.0
FE 6700
36SB79C
B-T07
FE 3000
38S43
36SB78S
B-T03
FE 3400
B-T12
FE 2900
26
B-T18
AL 13000
FE 7900
MN 380
B-T25
AL 8700
AS 3.1
FE 8800
B-T13
AL 15,000
FE 10,000
44
B-T15
AS 5.7
104
38
354
B-S23
GL
FM
D-8
C-4
C-5
N
LEGEND
BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
SHORELINE
E/A&H SITE 38 SOIL BORING
IWTP SEWERLINE STUDY SOIL BORING
EPA SOIL BORING
GRAVITY LINE (SEWER)
FORCE MAIN (SEWER)
MANHOLE
100 0 100
SCALE FEET
NOTE: ALL CONCENTRATIONS IN mg/kg.
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-12
BUILDING 604 STUDY AREA
INORGANIC PARAMETERS
EXCEEDING PRGS AND RCS IN
SURFACE SOIL
DWG DATE: 06/27/97
DWG NAME: 59B60410

21.1 mg/kg at 38S35. However, only 17 samples exceeded the RC for arsenic of 1.56 mg/kg. Beryllium exceeded the PRG at three locations; however, these concentrations were below the RC of 0.41 mg/kg. Iron exceedances were prevalent across much of the site, and in most cases were also above the RC of 2,745 mg/kg. Aluminum exceedances were also prevalent across much of the site. Manganese was detected across much of the site but only exceeded the PRG of 180 mg/kg in three surface samples. Cadmium and chromium exceeded their PRGs in samples surrounding the former plating area at Building 604. Cadmium was detected at a maximum concentration of 21 mg/kg at boring B-T42. The maximum concentration of chromium was 48 mg/kg at B-T38. Copper exceeded the PRG in two samples south of Building 604 along the IWTP sewer line with a maximum concentration of 607 mg/kg. Lead also exceeded its PRG of 400 ppm in three samples. The highest concentration, 949 mg/kg, occurred at boring 36S74N. A single detection of vanadium above the PRG occurred in boring B-T14. Barium exceeded the PRG and RC at four locations 36SB74W, 36SB74N, 36SB75E, and 36SB76C.

Organics

SVOCs, pesticides, and PCBs were detected in surface soil above the PRGs; no VOCs exceeded a PRG. SVOCs exceeding a PRG are presented on Figure 7-13 and include the PAHs benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene. Benzo(a)pyrene exceeded the PRG at eight locations, ranging from 160 μg/kg at 36S26 to 2,200 μg/kg at B-T27. All remaining PAH exceedances occurred in boring B-T27.

Dieldrin was the only pesticide detected above a PRG (Figure 7-14). These detections were from borings located in grassy areas along the street and are likely the result of routine application. Aroclor-1260 was detected above the PRG in three locations (B-T01, 38S37, and B-T18) ranging in concentrations of 83 to 810 μg/kg (Figure 7-14).

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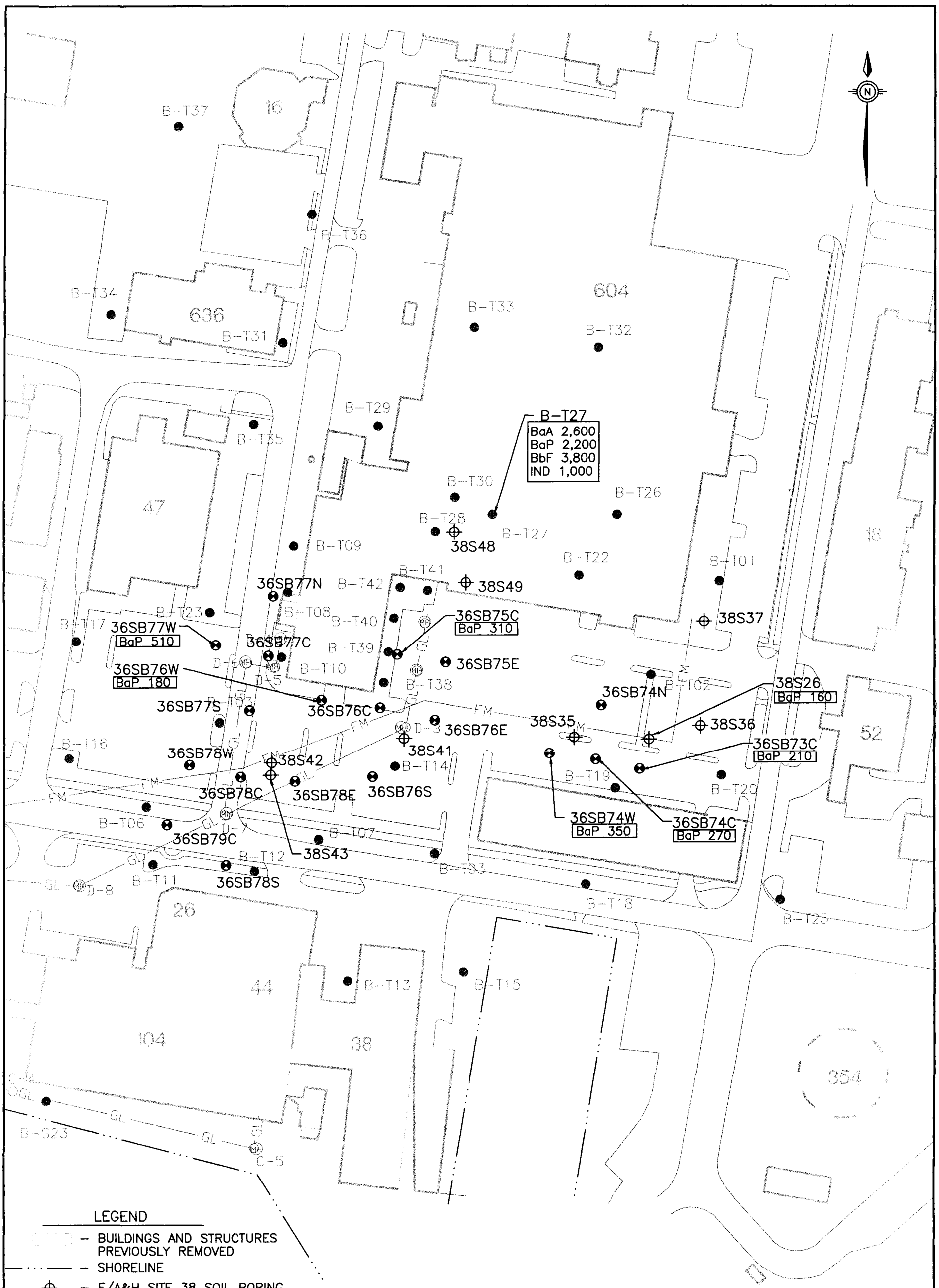
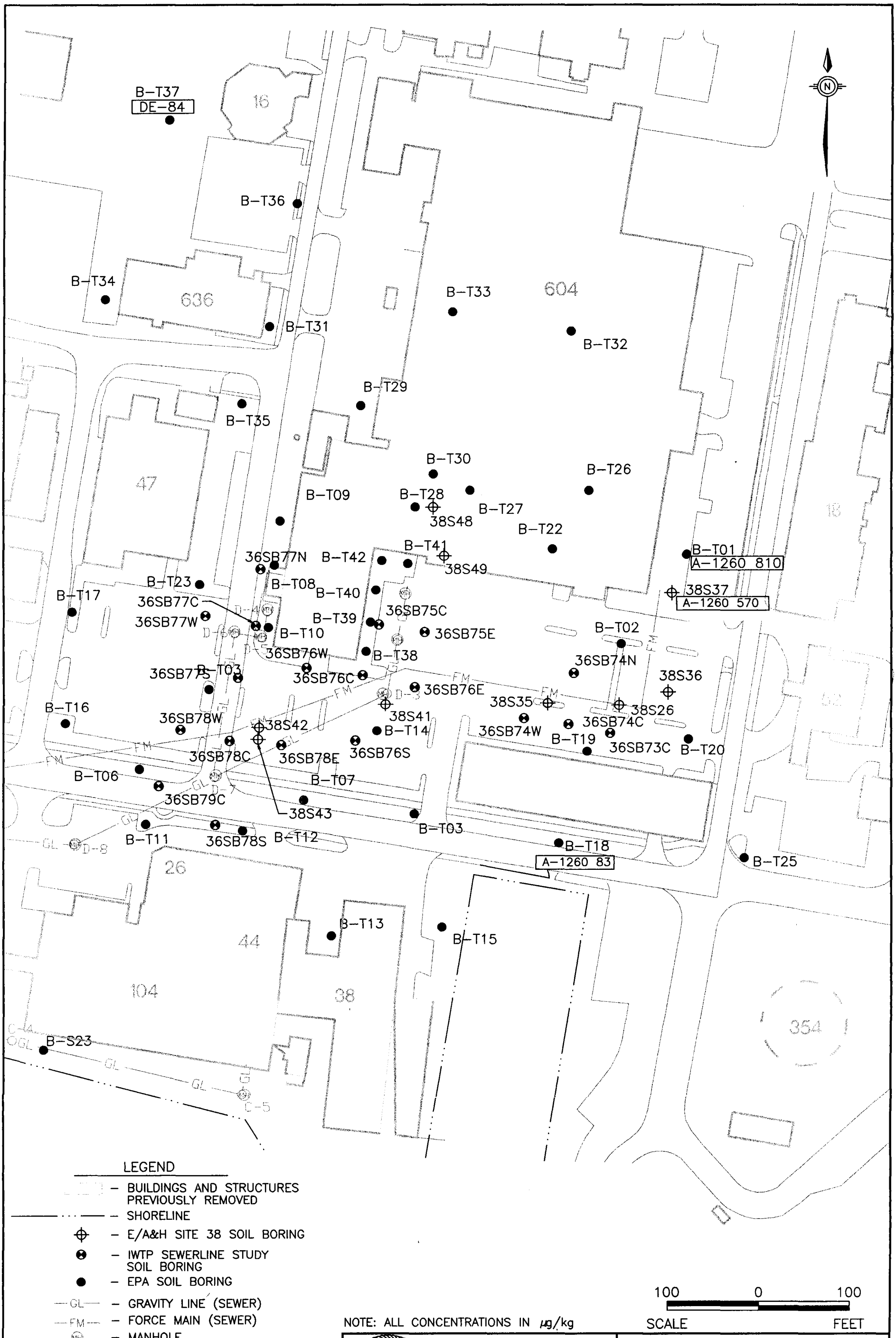


NOTE: ALL CONCENTRATIONS IN µg/kg

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7-13
BUILDING 604 STUDY AREA
SEMIVOLATILE PARAMETERS
EXCEEDING PRGS IN SURFACE SOIL

DWG DATE: 06/27/97 | DWG NAME: 59B604SE


B-T37
DE-84
16
B-T36
B-T34
636
B-T31
B-T33
604
B-T32
B-T29
B-T35
47
B-T30
B-T26
B-T09
B-T28
38S48
B-T27
B-T22
B-T41
B-T01
A-1260 810
36SB77N
B-T42
38S49
B-T23
B-T08
B-T40
38S37
A-1260 570
B-T17
36SB77C
36SB77W
B-T39
36SB75C
B-T10
36SB75E
B-T02
36SB76W
B-T38
36SB74N
36SB77S
B-T03
36SB76C
36SB76E
38S36
B-T16
38S41
38S35
38S26
36SB78W
38S42
B-T14
36SB74W
36SB74C
B-T19
36SB73C
B-T20
36SB78C
36SB78E
36SB76S
B-T06
B-T07
36SB79C
38S43
B-T03
B-T11
36SB78S
B-T12
B-T18
A-1260 83
B-T25
26
B-T13
B-T15
44
104
38
354
B-S23
C-5
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– E/A&H SITE 38 SOIL BORING
– IWTP SEWERLINE STUDY SOIL BORING
– EPA SOIL BORING
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
A-1260 – AROCLOR-1260
DE – DIELDRIN
NOTE: ALL CONCENTRATIONS IN µg/kg
100 0 100
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-14
BUILDING 604 STUDY AREA
PESTICIDE/PCB PARAMETERS
EXCEEDING PRGS IN SURFACE SOIL
DWG DATE: 06/27/97
DWG NAME: 59B604PC

7.1.2.2 Subsurface Soil

Inorganics

All subsurface soil inorganics which exceed a PRG were also above their respective RC. Inorganics detected above a PRG and RC in subsurface soil are presented in Figure 7-15 and included barium, cadmium, chromium, lead, and selenium. Barium was detected above the PRG and RC in four soil borings, B-T18, B-T19, 36SB77C and 36SB75E, at concentrations ranging from 33 to 110 mg/kg. Barium detected in the surface soil at these locations did not exceed the PRG. Cadmium and chromium each exceeded their respective PRGs and RCs at one boring location each. Lead was detected at 38S26 at a concentration of 896 mg/kg. Selenium also exceeded the PRG and RC at one boring. These exceedances were not coincident with surface soil exceedances but were in the general area of the former plating facility at Building 604.

Organics

SVOCs, pesticides, and VOCs were detected above PRGs in subsurface soil. Boring 36S74C contained PAHs including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene and phenanthrene all above their respective PRGs (Figure 7-16).

Dieldrin was detected above the PRG at two locations (Figure 7-17). These occurrences were not coincident with surface detections; however, the borings in which they occur are in areas where routine application of pesticides probably occurs.

The VOCs, tetrachloroethene and TCE were detected above their PRGs in subsurface soil (Figure 7-18). The occurrence of tetrachloroethene at B-T29 is consistent with a similar detection in a well adjacent to Building 636. Because this sample was collected near the water table, the detection may represent a sample from the capillary zone and may not be representative of soil contamination. Notably, no tetrachloroethene was detected in the surface soil at this location. TCE was detected above the PRG in boring 38S42. No surface soil exceedances were observed

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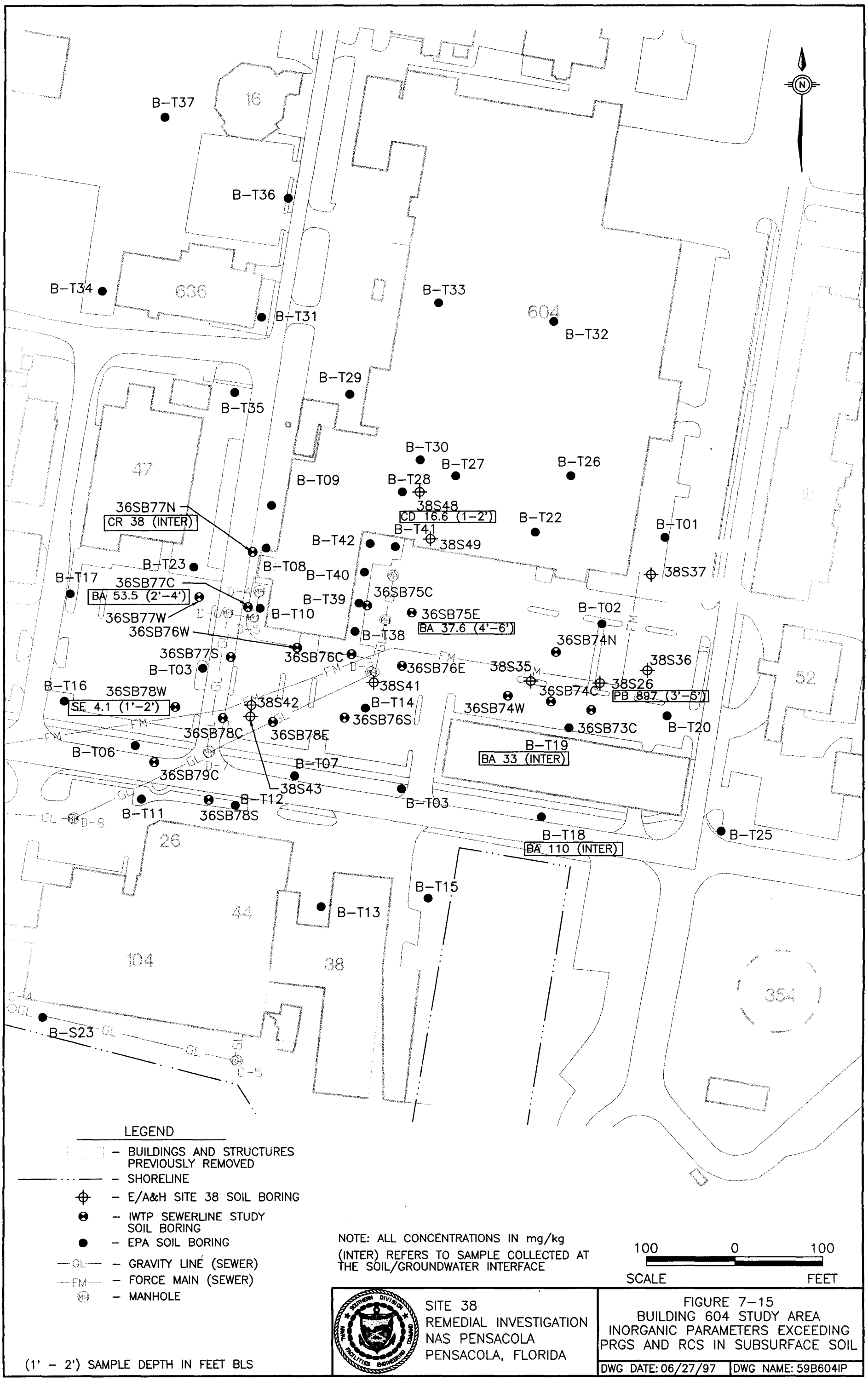
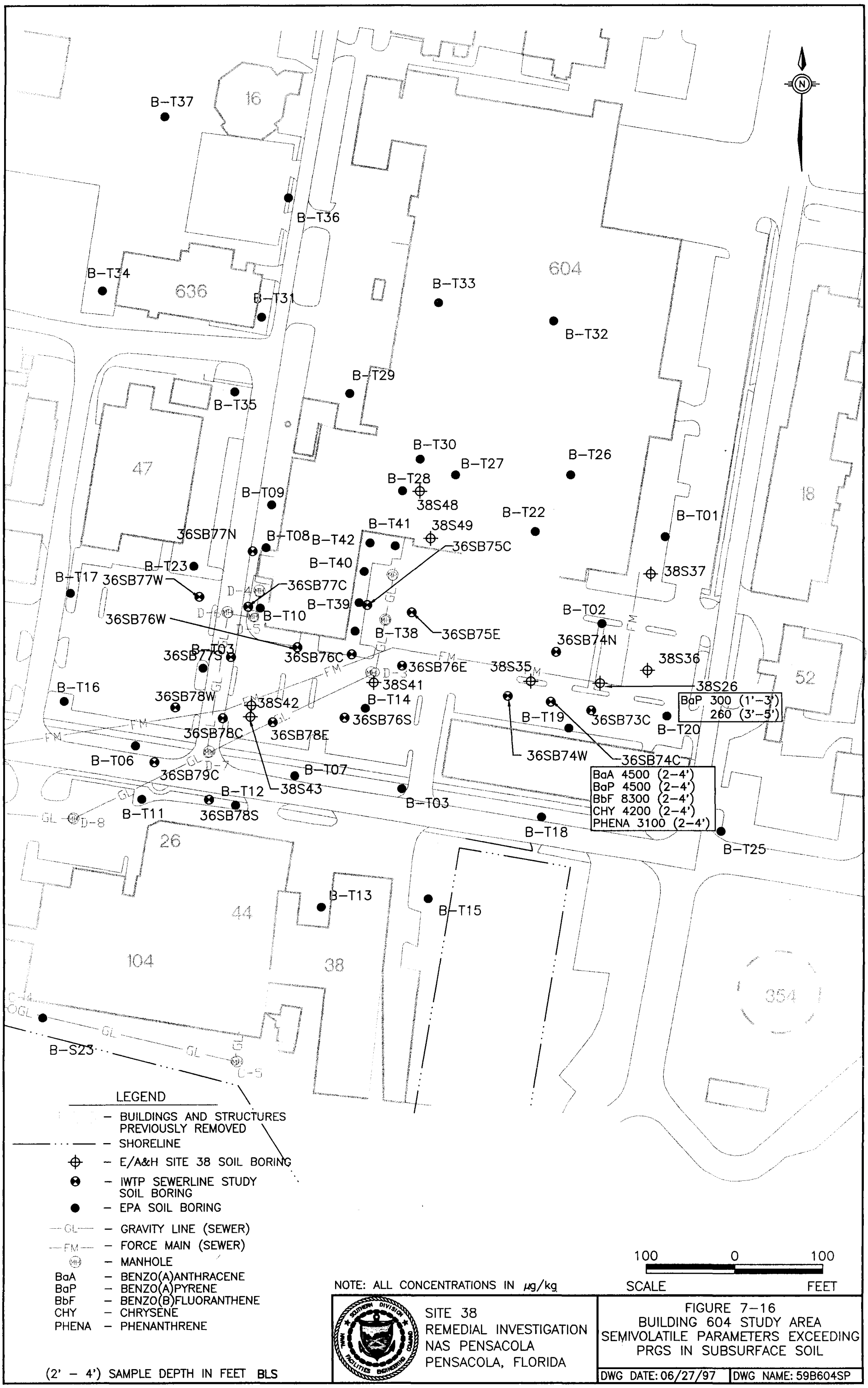
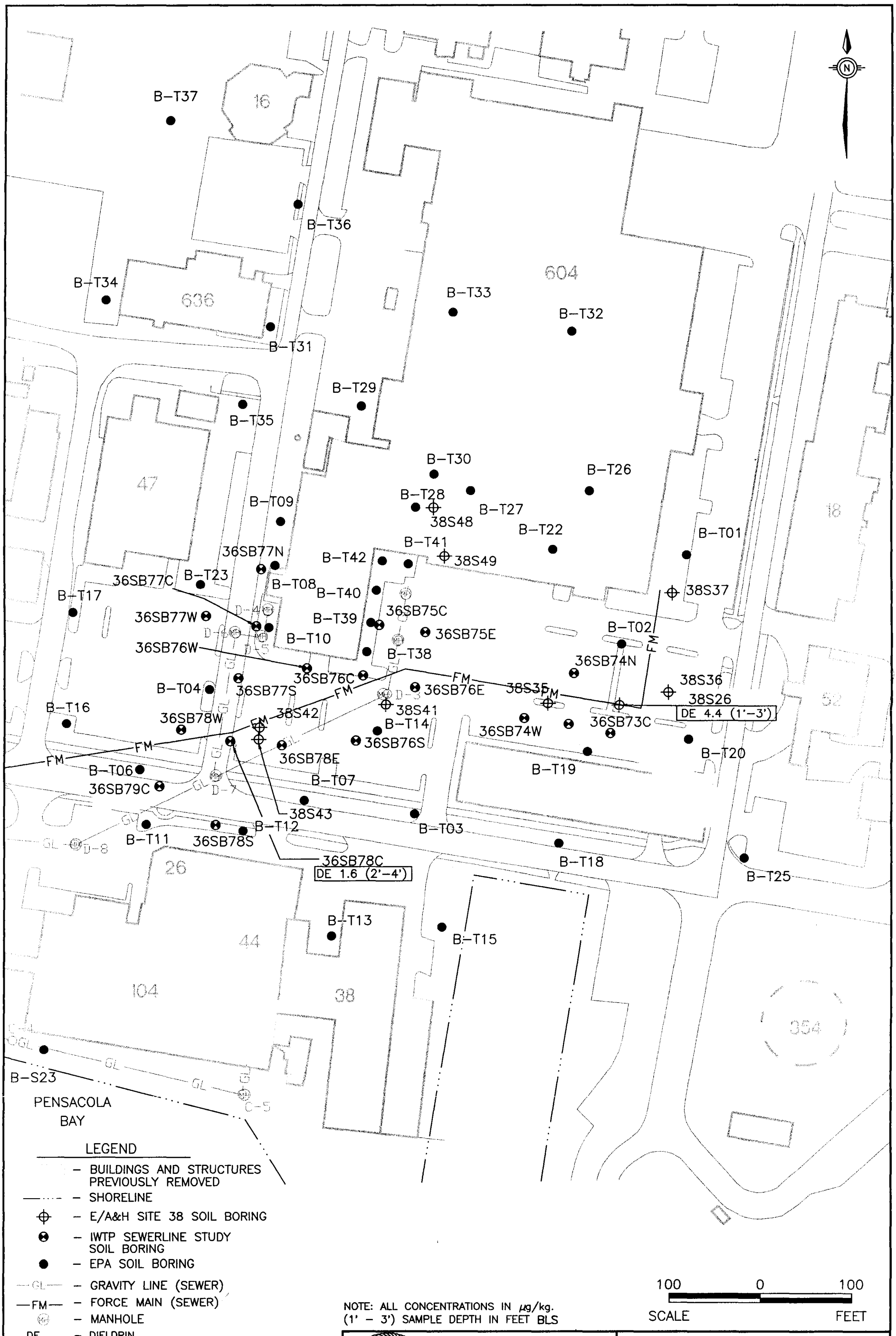

B-T37
16
B-T36
B-T34
636
B-T31
B-T33
604
B-T32
B-T29
B-T35
47
B-T30
B-T27
B-T26
B-T09
B-T28
38S48
CD 16.6 (1-2')
B-T22
B-T01
36SB77N
CR 38 (INTER)
B-T41
38S49
B-T42
B-T23
B-T08
B-T40
38S37
B-T17
36SB77C
BA 53.5 (2'-4')
36SB75C
B-T39
36SB77W
B-T10
36SB75E
BA 37.6 (4'-6')
B-T02
36SB76W
B-T38
36SB74N
36SB77S
36SB76C
38S36
B-T03
36SB76E
38S35
38S26
B-T16
36SB78W
38S41
36SB74C
PB 897 (3'-5')
SE 4.1 (1'-2')
38S42
B-T14
36SB74W
36SB76S
36SB73C
B-T20
36SB78C
36SB78E
B-T06
B-T19
BA 33 (INTER)
B-T07
36SB79C
38S43
B-T12
B-T03
B-T11
36SB78S
B-T18
BA 110 (INTER)
B-T25
26
B-T15
44
B-T13
104
38
354
B-S23
GL
FM
MH
D-3
D-4
D-5
D-6
D-7
D-8
C-4
C-5
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– E/A&H SITE 38 SOIL BORING
– IWTP SEWERLINE STUDY SOIL BORING
– EPA SOIL BORING
– GRAVITY LINE (SEWER)
– FORCE MAIN (SEWER)
– MANHOLE
(1' – 2') SAMPLE DEPTH IN FEET BLS
NOTE: ALL CONCENTRATIONS IN mg/kg
(INTER) REFERS TO SAMPLE COLLECTED AT THE SOIL/GROUNDWATER INTERFACE
100 0 100
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-15
BUILDING 604 STUDY AREA
INORGANIC PARAMETERS EXCEEDING
PRGS AND RCS IN SUBSURFACE SOIL
DWG DATE: 06/27/97
DWG NAME: 59B604IP

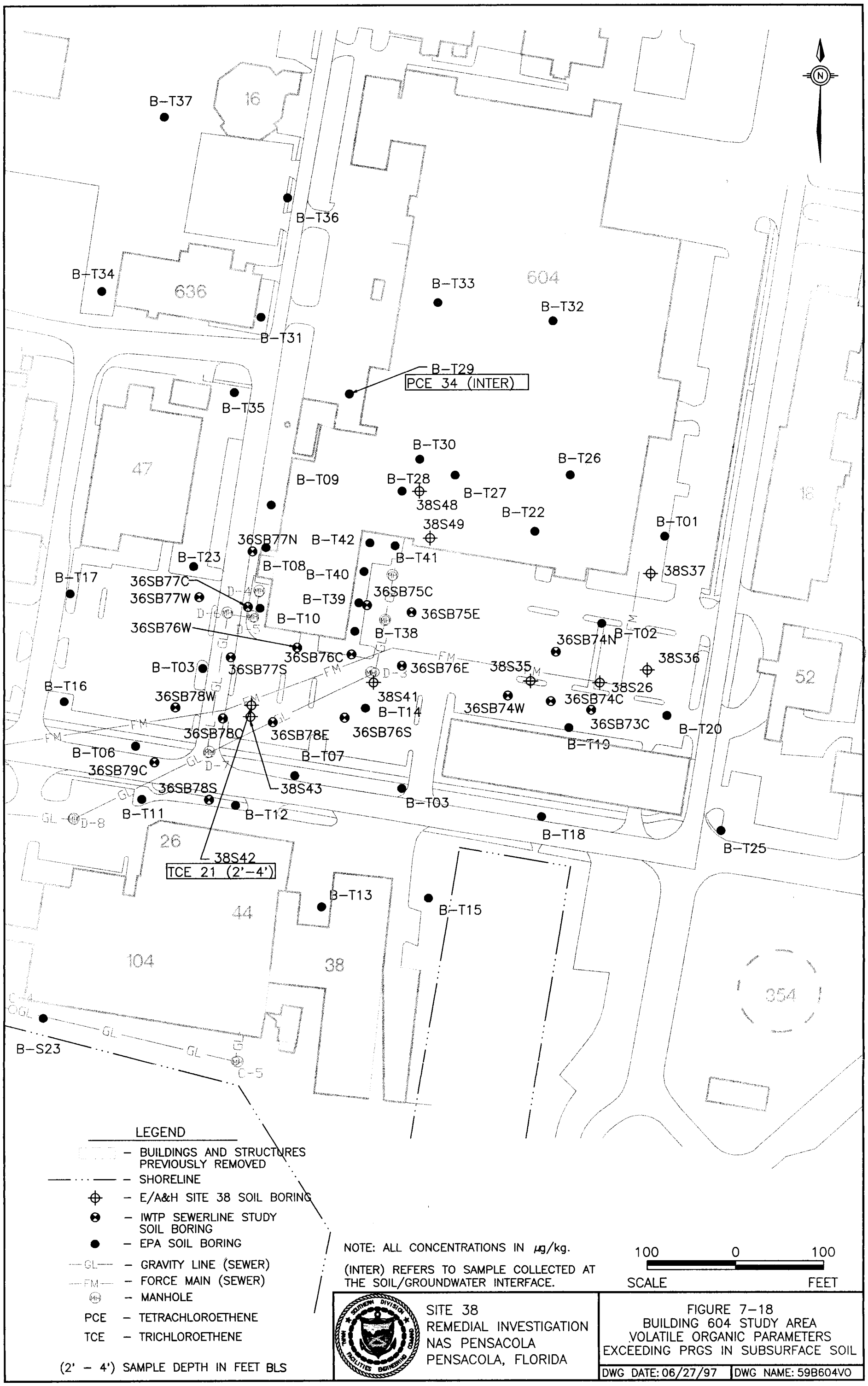

B-T37
16
B-T36
B-T34
636
B-T31
604
B-T33
B-T32
B-T29
B-T35
47
B-T30
B-T27
B-T26
B-T28
38S48
B-T09
B-T22
18
B-T01
B-T41
38S49
36SB77N
B-T08
B-T42
36SB75C
B-T40
B-T23
38S37
B-T17
36SB77W
36SB77C
B-T39
B-T10
B-T02
36SB76W
B-T38
36SB75E
36SB74N
B-T03
36SB77S
36SB76C
36SB76E
38S35
38S36
52
38S41
38S26
B-T16
36SB78W
38S42
B-T14
BaP 300 (1'-3')
260 (3'-5')
36SB76S
B-T19
36SB73C
B-T20
36SB78C
36SB78E
36SB74W
36SB74C
B-T06
36SB79C
B-T07
BaA 4500 (2-4')
BaP 4500 (2-4')
BbF 8300 (2-4')
CHY 4200 (2-4')
PHENA 3100 (2-4')
B-T12
38S43
B-T03
B-T11
36SB78S
B-T18
B-T25
26
B-T13
B-T15
44
104
38
354
B-S23
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– E/A&H SITE 38 SOIL BORING
– IWTP SEWERLINE STUDY SOIL BORING
– EPA SOIL BORING
– GRAVITY LINE (SEWER)
– FORCE MAIN (SEWER)
– MANHOLE
BaA – BENZO(A)ANTHRACENE
BaP – BENZO(A)PYRENE
BbF – BENZO(B)FLUORANTHENE
CHY – CHRYSENE
PHENA – PHENANTHRENE
(2' – 4') SAMPLE DEPTH IN FEET BLS
NOTE: ALL CONCENTRATIONS IN µg/kg
100 0 100
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-16
BUILDING 604 STUDY AREA
SEMIVOLATILE PARAMETERS EXCEEDING
PRGS IN SUBSURFACE SOIL
DWG DATE: 06/27/97
DWG NAME: 59B604SP



SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7-17
BUILDING 604 STUDY AREA
PESTICIDES/PCBS EXCEEDING
PRGS IN SUBSURFACE SOIL

DWG DATE: 08/01/97 | DWG NAME: 59B604PS


B-T37
16
B-T36
B-T34
636
B-T31
B-T33
604
B-T32
B-T29
PCE 34 (INTER)
B-T35
B-T30
B-T26
47
B-T09
B-T28
38S48
B-T27
B-T22
38S49
B-T01
36SB77N
B-T42
B-T41
B-T23
B-T08
B-T40
38S37
B-T17
36SB77C
36SB77W
B-T39
36SB75C
36SB75E
B-T10
36SB76W
B-T38
36SB74N
B-T02
36SB76C
38S36
B-T03
36SB77S
36SB76E
38S35
52
B-T16
38S26
36SB78W
38S41
36SB74C
B-T14
36SB74W
36SB73C
36SB78C
36SB78E
36SB76S
B-T20
B-T19
B-T06
B-T07
36SB79C
36SB78S
38S43
B-T03
B-T11
B-T12
B-T18
B-T25
26
38S42
TCE 21 (2'-4')
B-T13
B-T15
44
104
38
354
B-S23
C-5
LEGEND
BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
SHORELINE
E/A&H SITE 38 SOIL BORING
IWTP SEWERLINE STUDY SOIL BORING
EPA SOIL BORING
GL GRAVITY LINE (SEWER)
FM FORCE MAIN (SEWER)
MH MANHOLE
PCE TETRACHLOROETHENE
TCE TRICHLOROETHENE
(2' - 4') SAMPLE DEPTH IN FEET BLS
NOTE: ALL CONCENTRATIONS IN µg/kg.
(INTER) REFERS TO SAMPLE COLLECTED AT THE SOIL/GROUNDWATER INTERFACE.
100 0 100
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-18
BUILDING 604 STUDY AREA
VOLATILE ORGANIC PARAMETERS
EXCEEDING PRGS IN SUBSURFACE SOIL
DWG DATE: 06/27/97
DWG NAME: 59B604VO

in the boring 38S42. The presence of TCE in this boring at depth may be related to its proximity to the IWTP line which transferred wastes, including solvents.

7.1.3 Summary of Soil Contamination at Site 38

Surface soil contaminants detected in the Building 71 study area above PRGs included inorganics, SVOCs, pesticides, and PCBs. No VOCs were detected above PRGs in surface soil. Inorganic contamination was observed in the soil beneath Building 71 with contamination diminishing with distance from the building. Organic parameter exceedances in surface soil at Building 71 were very limited. Pesticide and PCB exceedances were limited to two locations beneath Building 71. The pesticide exceedances are likely a result of pretreatment during building construction. SVOC exceedances were associated with samples along the IWTP line with no exceedances in the soil beneath Building 71.

Subsurface soil contained inorganics, SVOCs, pesticides, and VOCs at concentrations exceeding PRGs or RCs. Again, much of the contamination appeared to be centered beneath Building 71. Inorganic and pesticide exceedances were consistent with exceedances in surface soil. SVOC and VOC exceedances were extensive in subsurface soil beneath Building 71 when compared to the leachability PRGs. Notably, no surface soil SVOC and VOC exceedances occurred in this area. In general, the contaminants present include heavy metals, chlorinated solvents, and petroleum solvents potentially related to the past activities of paint stripping and metal refinishing at Building 71. Soil in the Building 71 study area is completely covered with concrete or asphalt. The implications of this will be discussed in Sections 9 and 10.

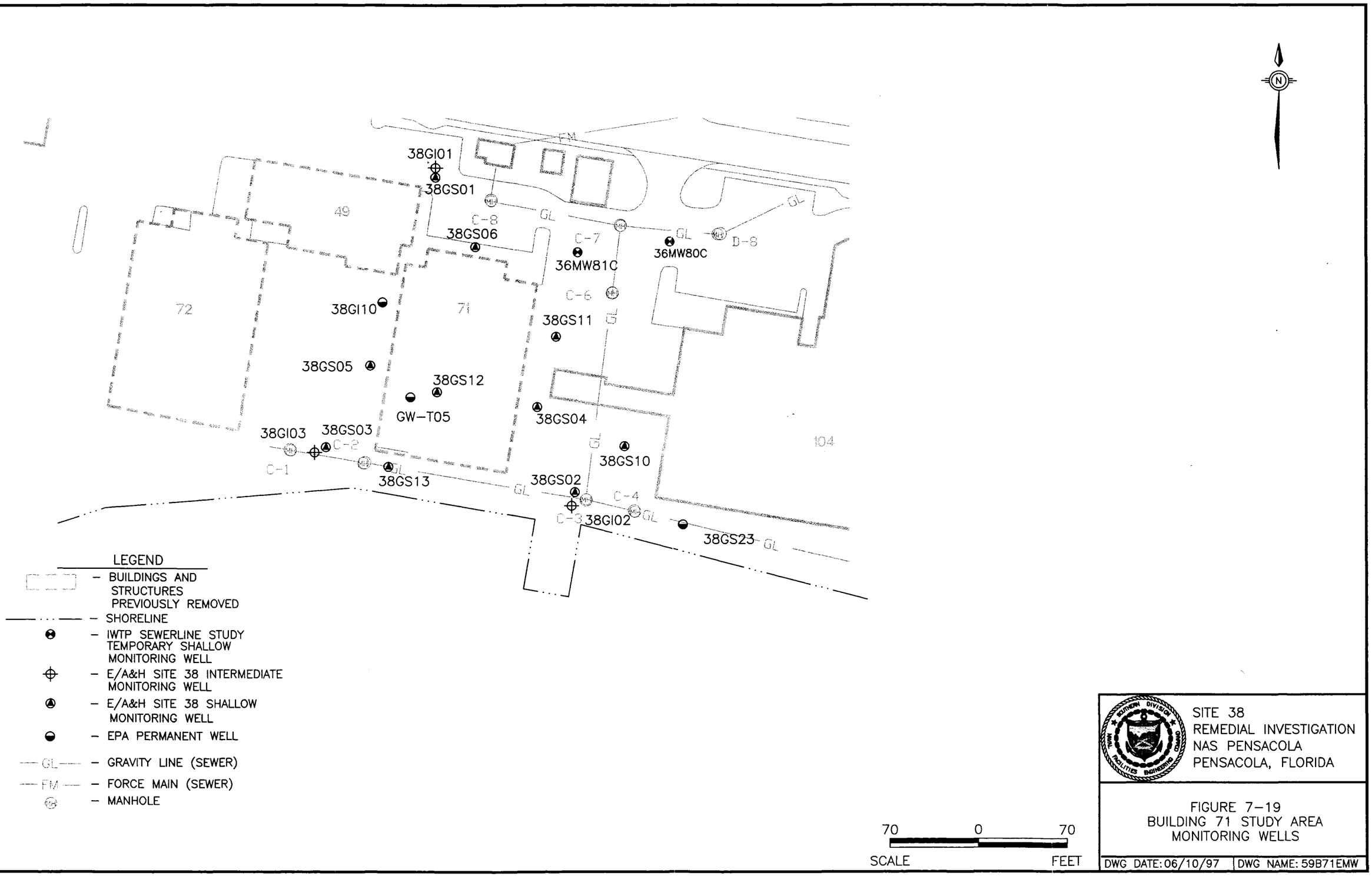
Building 604 study area surface soil exceedances included inorganics, SVOCs, pesticides, and PCBs. Many of the inorganic parameters, including aluminum, arsenic, and iron, were fairly ubiquitous across the site and may indicate, in part, local ambient concentrations. Heavy metals related to past plating activities exceeded PRGs in the surface soil surrounding the former plating

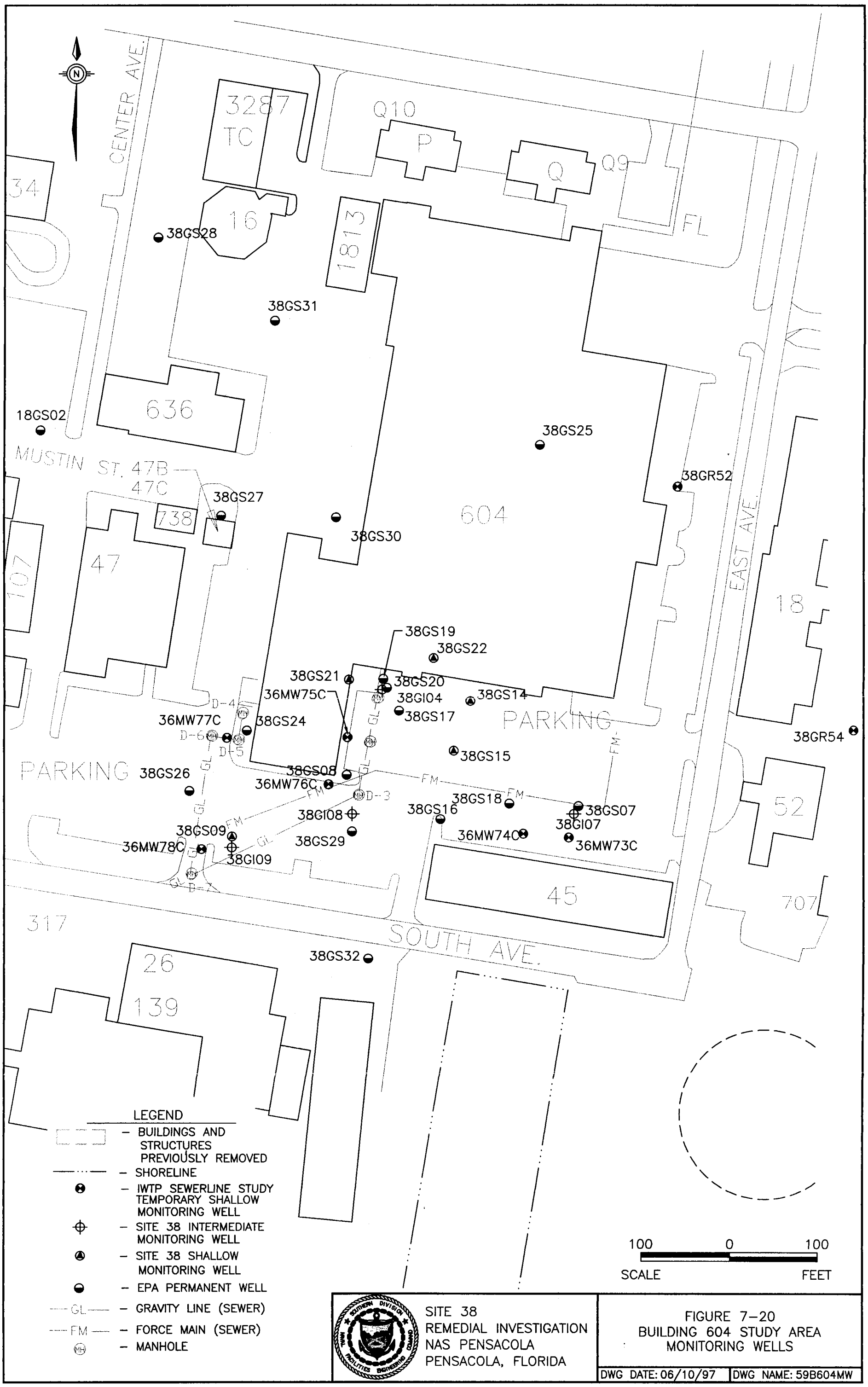
facility at the southwest extension of Building 604. SVOC contaminant exceedances were primarily associated with the IWTP line except for one location beneath the southern part of Building 604. Parts cleaning took place in the general vicinity of this sample. Pesticide and PCB exceedances occurred in samples from grassy areas onsite. Pesticide detections in these areas are likely the result of residuals remaining from routine spraying.

Subsurface contaminants detected above PRGs included inorganics, SVOCs, pesticides, and VOCs. Heavy metals, including chromium and cadmium, were detected above RCs and PRGs near the former plating facility. SVOC exceedances included PAHs at one location along the IWTP line. Dieldrin was the only pesticide detected. Its occurrence is likely a result of routine application of pesticides in the area. Two VOCs, TCE and tetrachloroethene, were detected above PRGs. Both of these detections are associated with solvent exceedances in the groundwater and may reflect inadvertent sampling of the capillary zone and not true soil contamination.

7.2 Groundwater Assessment

Discussions in this section will refer to the upper (shallow depth) and lower (intermediate depth) surficial zones. As described in Section 3.2, the upper surficial zone generally refers to a depth from the water table to approximately 15 feet and the lower surficial zone refers to the basal portion of the surficial zone immediately above the low permeability zone. The groundwater investigation in both study areas addressed the upper and lower surficial zones. In the Building 71 study area, groundwater samples from 13 shallow wells and five intermediate wells were evaluated (Figure 7-19). Groundwater samples from thirty-one shallow wells and four intermediate wells were evaluated in the Building 604 study area (Figure 7-20). Data summary tables identifying the groundwater samples with parameter concentrations exceeding PRGs are provided in Appendix M. The complete groundwater analytical report is included as Appendix J.


38GI01
38GS01
FM
49
C-8
GL
38GS06
C-7
36MW81C
36MW80C
D-8
72
38GI10
71
C-6
38GS11
38GS05
38GS12
GW-T05
38GS04
38GI03
38GS03
C-2
C-1
38GS13
38GS10
104
38GS02
C-4
C-3
38GI02
38GS23
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– E/A&H SITE 38 INTERMEDIATE MONITORING WELL
– E/A&H SITE 38 SHALLOW MONITORING WELL
– EPA PERMANENT WELL
– GRAVITY LINE (SEWER)
– FORCE MAIN (SEWER)
– MANHOLE
70 0 70
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-19
BUILDING 71 STUDY AREA
MONITORING WELLS
DWG DATE: 06/10/97
DWG NAME: 59B71EMW


N
CENTER AVE.
3287
TC
Q10
P
Q
Q9
FL
34
16
38GS28
1813
38GS31
636
18GS02
38GS25
MUSTIN ST.
47B
47C
38GR52
38GS27
738
604
38GS30
EAST AVE.
47
107
18
38GS19
38GS22
38GS21
38GS20
36MW75C
38GI04
38GS14
38GS17
PARKING
D-4
36MW77C
38GS24
D-6
D-5
38GR54
38GS15
PARKING
38GS26
38GS08
36MW76C
D-3
38GS18
38GS07
38GI08
38GS16
38GI07
38GS09
38GS29
36MW74C
36MW73C
36MW78C
38GI09
D-7
52
45
707
317
SOUTH AVE.
38GS32
26
139
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
– EPA PERMANENT WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
100 0 100
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-20
BUILDING 604 STUDY AREA
MONITORING WELLS
DWG DATE: 06/10/97
DWG NAME: 59B604MW

7.2.1 Building 71 Study Area

7.2.1.1 Shallow Groundwater

Inorganics

Inorganic parameters, including aluminum, iron, arsenic, cadmium, chromium, lead, manganese, and vanadium, were detected in shallow groundwater above a PRG and RC in the Building 71 study area and are presented on Figure 7-21. Aluminum and/or iron were detected in all of the wells exceeding a PRG. The RC for aluminum, 3,882.8 μg/L, was exceeded in only four samples. Seven samples had iron concentrations exceeding the RC of 1707.8 μg/L. The maximum concentration of iron and aluminum, 17,600 and 11,400 μg/L, respectively, occurred in well 38GS12, within the bounds of former Building 71. Ten of the 13 wells sampled had lead concentrations exceeding the PRG. The maximum concentration, 362 μg/L, was detected in the sample from 38GS02, along the seawall. Manganese exceeded the PRG of 50 μg/L in seven samples. The maximum concentration of 174 μg/L was detected in the sample from 38GS01. Each manganese exceedance was above the RC of 22 μg/L. Cadmium and chromium were detected in two samples exceeding the PRG and RC. Arsenic and vanadium were detected in the sample from 38GS12 exceeding their respective PRGs and RCs. Arsenic, cadmium, and chromium were detected in the subsurface soil beneath Building 71 above the leachability-based PRGs. To assess potential chromium leaching to groundwater, three additional samples were collected in June 1997. These samples were collected near 38S13 and 38S14 and were designated 38S13A, 38S13B, and 38S14A. Chromium was detected in all the samples, the greatest of the three (38S13A) detected 383 mg/kg near 38S13. A synthetic leaching procedure (EPA Method 1312) detected 0.16 mg/L of chromium in the leachate from 38S13A. Leachates from the other samples (38S13B and 38S14A) did not detect any chromium. This data suggests minimal leaching of chromium from soil to groundwater.

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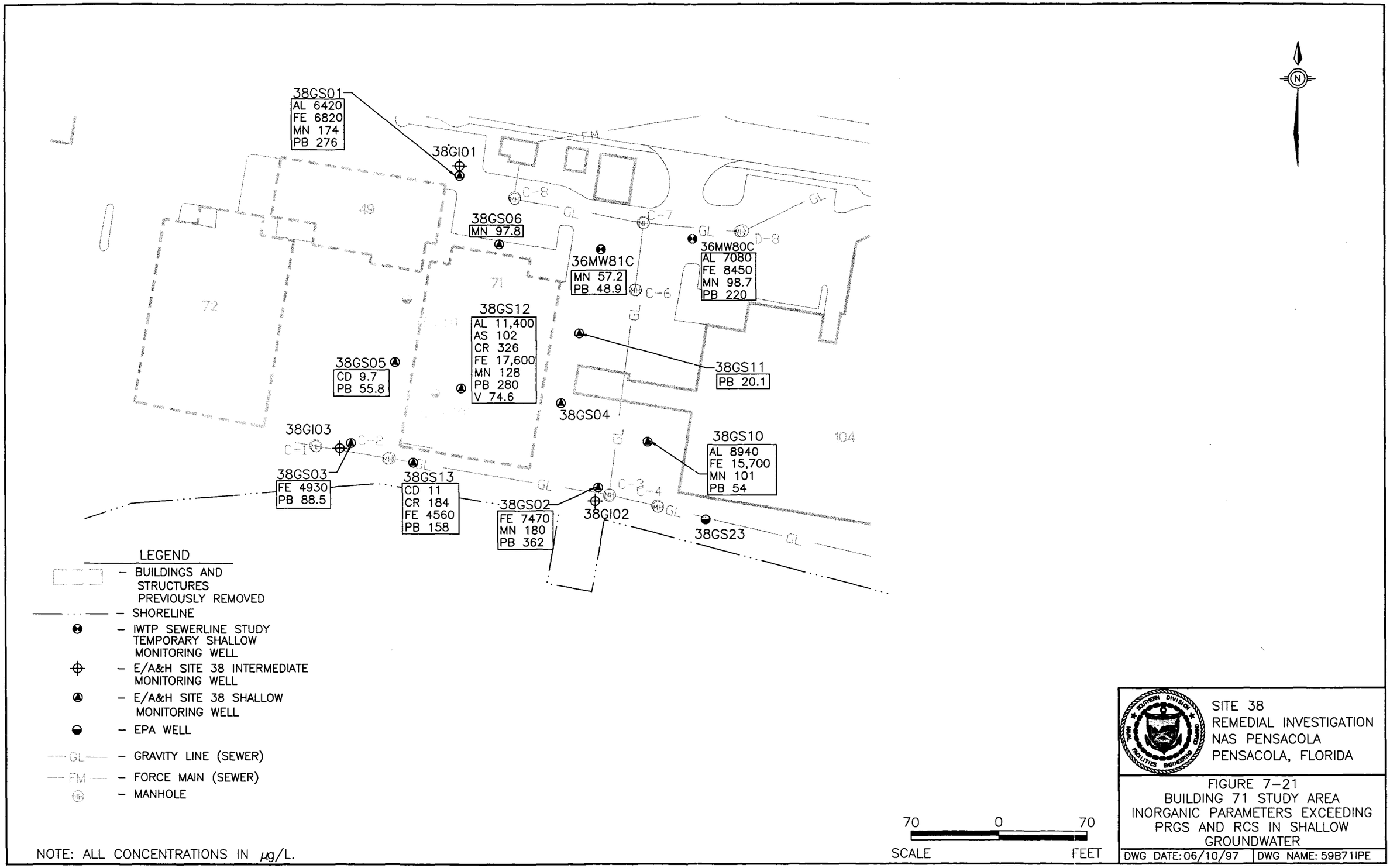

NOTE: ALL CONCENTRATIONS IN $\mu g/L$.

Organics

Detected organic parameters in shallow groundwater included SVOCs and VOCs. Naphthalene was the only SVOC detected that exceeded a PRG (Figure 7-22). A concentration of 44 μg/L was detected in samples from 38GS02 and 38GS12.

Several VOCs, including chloroform, 1,1-dichloroethene, tetrachloroethene, trichloroethene, 1,1,1-trichloroethane, and vinyl chloride, were detected above a PRG (Figures 7-23 to 7-28). The highest total VOC concentration, 922 μg/L, was detected in the sample from well 38GS12, within the bounds of former Building 71 (Figure 7-29). Most of the organic parameters detected in groundwater were also detected in the overlying soil exceeding leachability-based PRGs indicating that leaching has occurred and that these soils may pose a continued impact to the shallow groundwater in this area.

7.2.1.2 Intermediate Groundwater

Inorganics

Iron, sodium, and vanadium were detected above PRGs and RCs in samples from the intermediate depth wells (Figure 7-30). However, concentrations of aluminum above PRGs were below the RC of 3,882.8. Vanadium exceeded the PRG and RC at three locations ranging from 140 to 230 μg/L. Sodium was detected at 538,000 μg/L in 38GI03 indicating a saltwater interaction at this depth.

Organics

No organics were detected above a PRG in the intermediate depth groundwater samples from the Building 71 study area.

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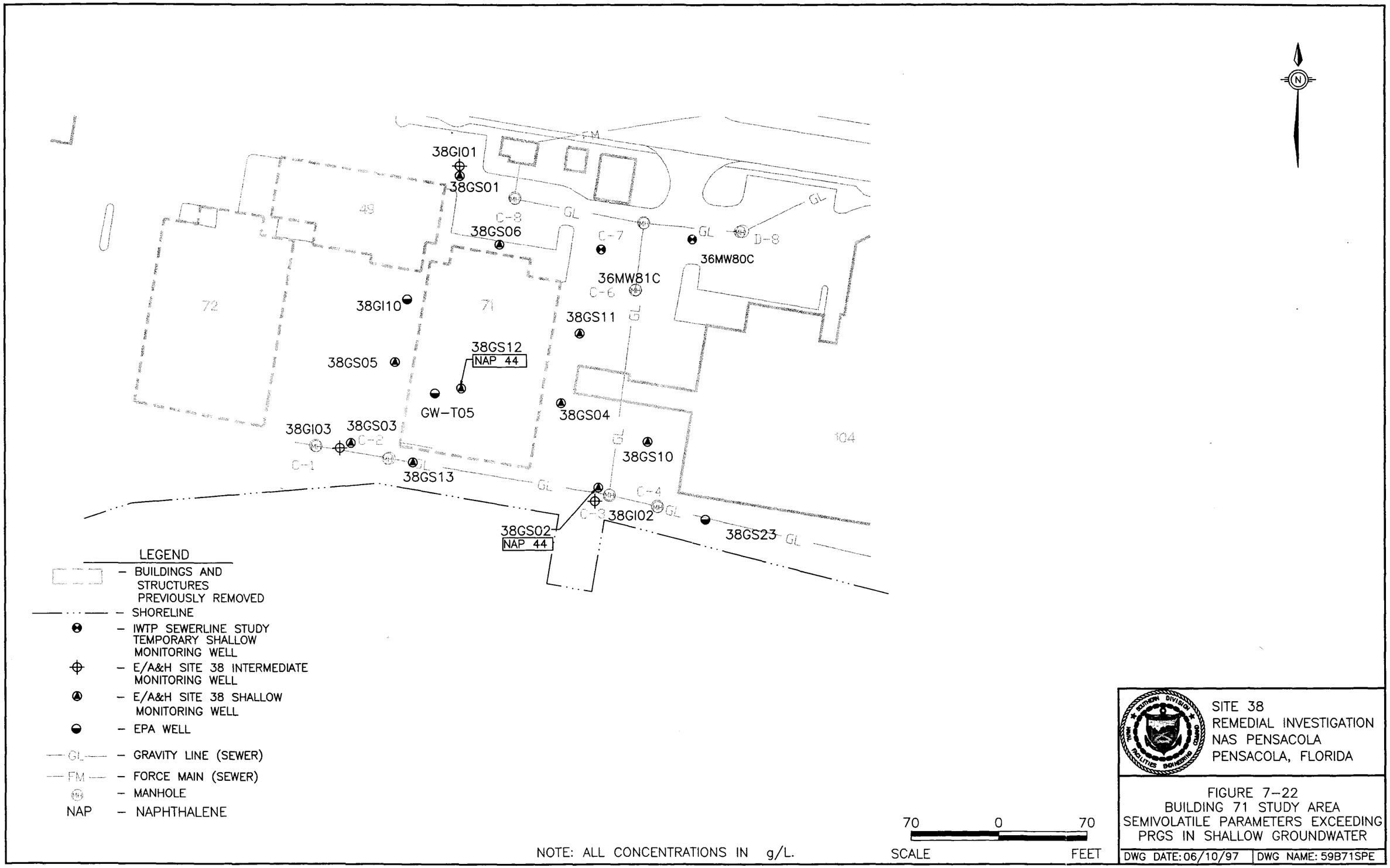
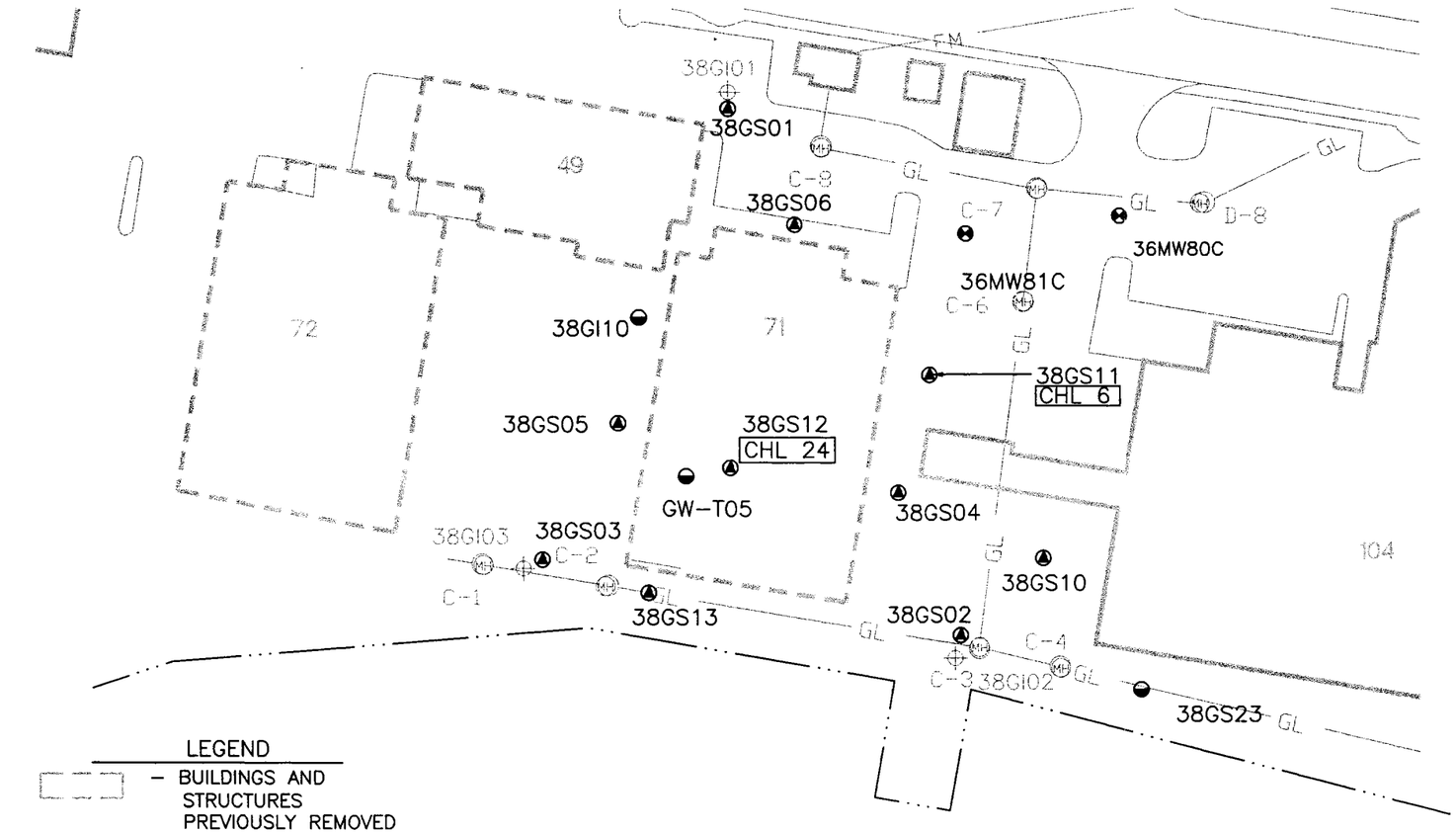

38GI01
38GS01
38GS06
36MW80C
36MW81C
38GI10
38GS11
38GS12
NAP 44
38GS05
GW-T05
38GS04
38GI03
38GS03
38GS10
38GS13
38GI02
38GS02
NAP 44
38GS23
49
72
71
104
C-1
C-2
C-3
C-4
C-6
C-7
C-8
D-8
GL
FM
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– E/A&H SITE 38 INTERMEDIATE MONITORING WELL
– E/A&H SITE 38 SHALLOW MONITORING WELL
– EPA WELL
– GRAVITY LINE (SEWER)
– FORCE MAIN (SEWER)
– MANHOLE
NAP – NAPHTHALENE
70 0 70
SCALE FEET
NOTE: ALL CONCENTRATIONS IN g/L.
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-22
BUILDING 71 STUDY AREA
SEMIVOLATILE PARAMETERS EXCEEDING
PRGS IN SHALLOW GROUNDWATER
DWG DATE: 06/10/97
DWG NAME: 59B71SPE



LEGEND

- BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
- SHORELINE
- IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
- E/A&H SITE 38 INTERMEDIATE MONITORING WELL
- E/A&H SITE 38 SHALLOW MONITORING WELL
- EPA WELL
- GL — GRAVITY LINE (SEWER)
- FM — FORCE MAIN (SEWER)
- MH — MANHOLE
- CHL — CHLOROFORM

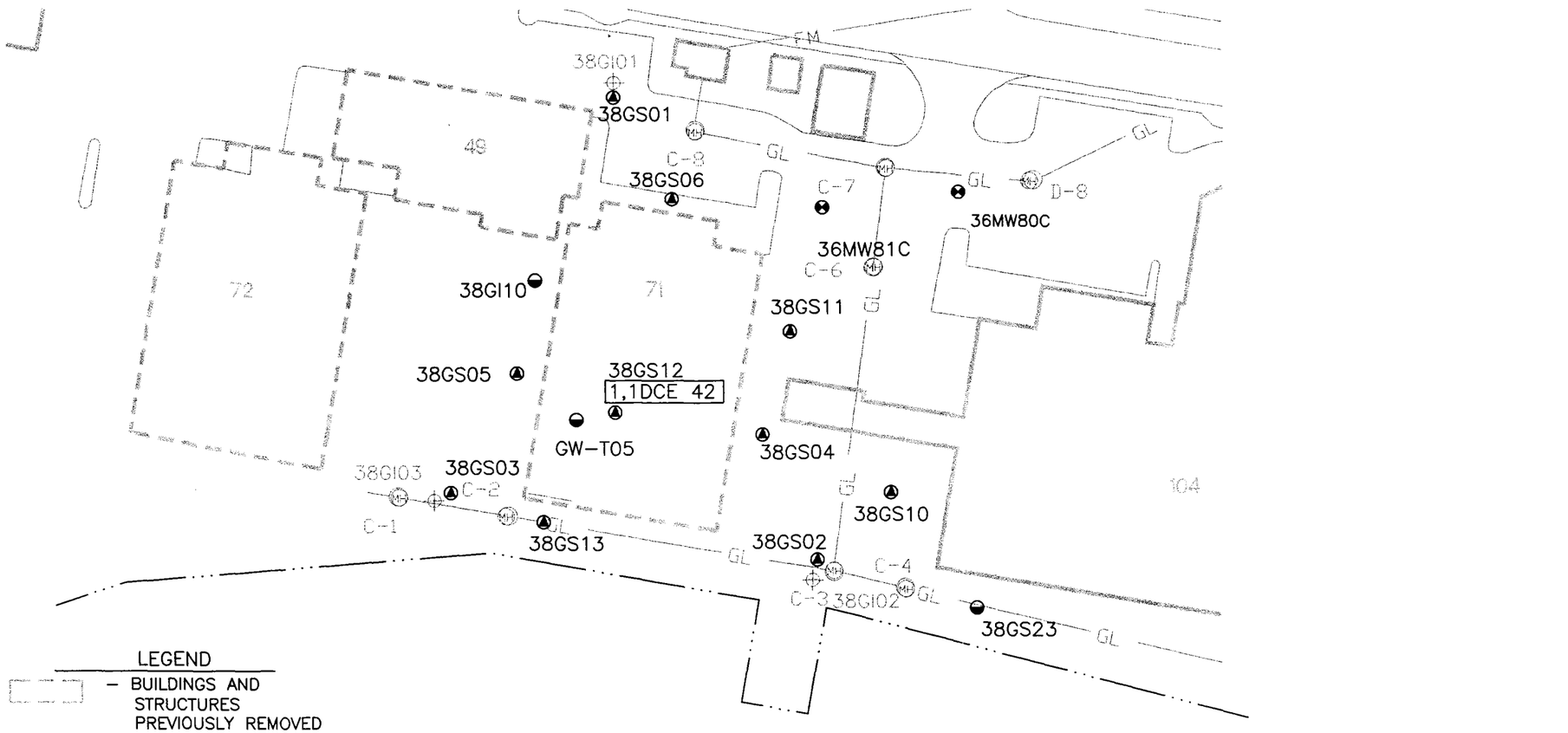
*NOTE: ALL CONCENTRATIONS IN $\mu g/L$.

70 0 70
SCALE FEET

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7-23
BUILDING 71 STUDY AREA
CHLOROFORM CONCENTRATIONS
EXCEEDING PRGS IN
SHALLOW GROUNDWATER

DWG DATE: 06/10/97 | DWG NAME: 59B71CCE



LEGEND

- BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
- SHORELINE
- IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
- E/A&H SITE 38 INTERMEDIATE MONITORING WELL
- E/A&H SITE 38 SHALLOW MONITORING WELL
- EPA WELL
- GL — GRAVITY LINE (SEWER)
- FM — FORCE MAIN (SEWER)
- MANHOLE
- 1,1 DCE — DICHLOROETHENE

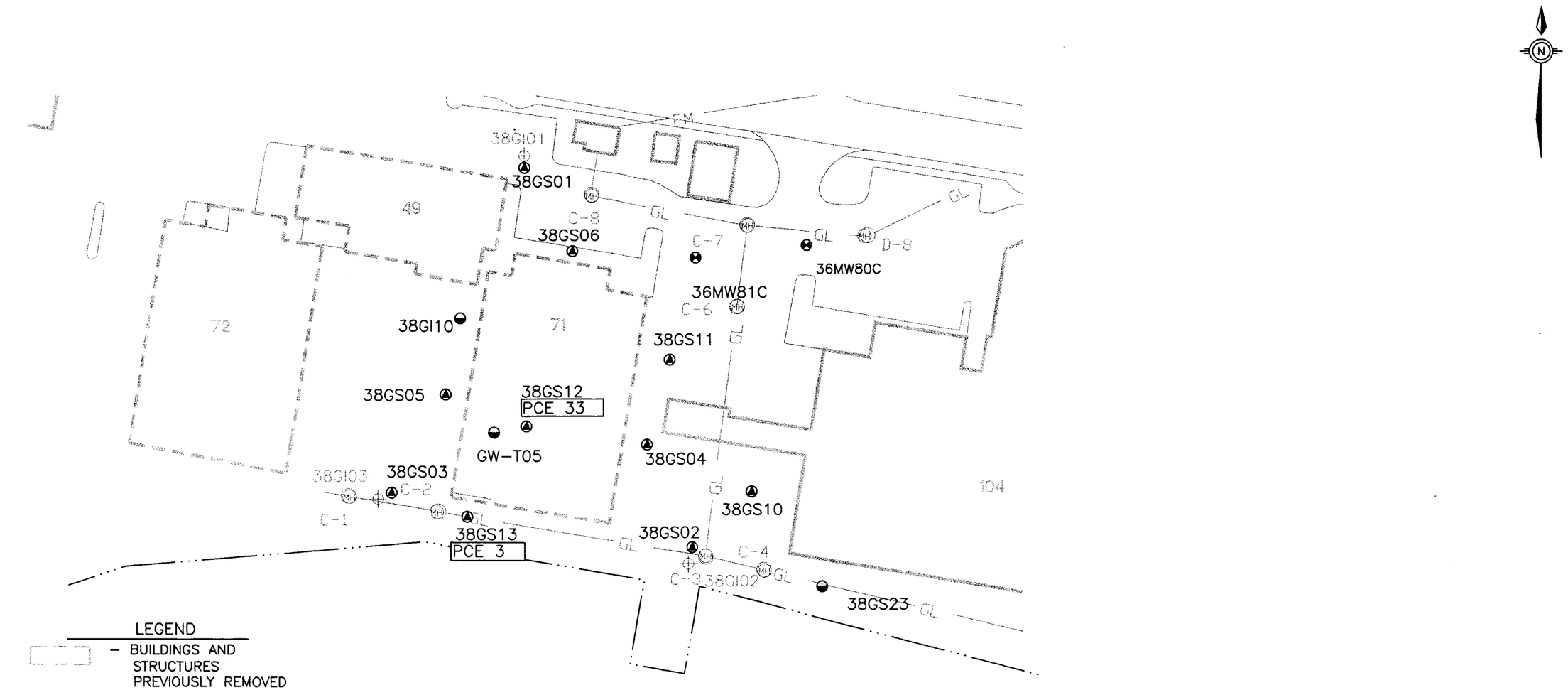
*NOTE: ALL CONCENTRATIONS IN $\mu g/L$.

70 0 70
SCALE FEET

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7-24
BUILDING 71 STUDY AREA
1,1 DICHLOROETHENE CONCENTRATIONS
EXCEEDING PRGS IN
SHALLOW GROUNDWATER

DWG DATE: 06/10/97 | DWG NAME: 59B71DCE



LEGEND

- BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
- SHORELINE
- IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
- E/A&H SITE 38 INTERMEDIATE MONITORING WELL
- E/A&H SITE 38 SHALLOW MONITORING WELL
- EPA WELL
- GL – GRAVITY LINE (SEWER)
- FM – FORCE MAIN (SEWER)
- MH – MANHOLE
- PCE – TETRACHLOROETHENE

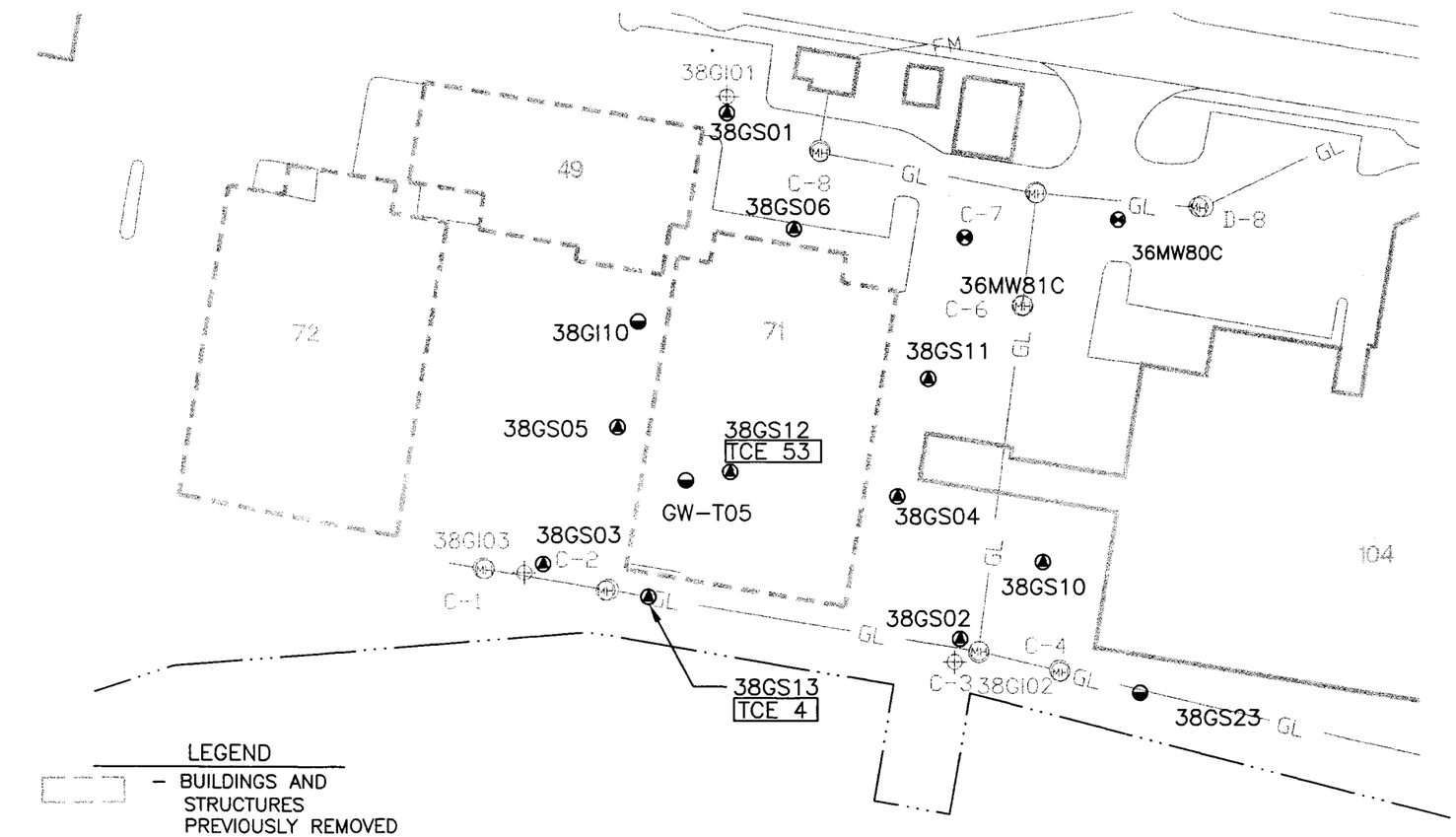
*NOTE: ALL CONCENTRATIONS IN $\mu g/L$.

70 0 70
SCALE FEET

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7-25
BUILDING 71 STUDY AREA
TETRACHLOROETHENE CONCENTRATIONS
EXCEEDING PRGS IN
SHALLOW GROUNDWATER

DWG DATE: 08/08/96 | DWG NAME: 59B71TCE



LEGEND

- BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
- SHORELINE
- IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
- E/A&H SITE 38 INTERMEDIATE MONITORING WELL
- E/A&H SITE 38 SHALLOW MONITORING WELL
- EPA WELL
- GL — GRAVITY LINE (SEWER)
- FM — FORCE MAIN (SEWER)
- MH — MANHOLE
- TCE — TRICHLOROETHENE

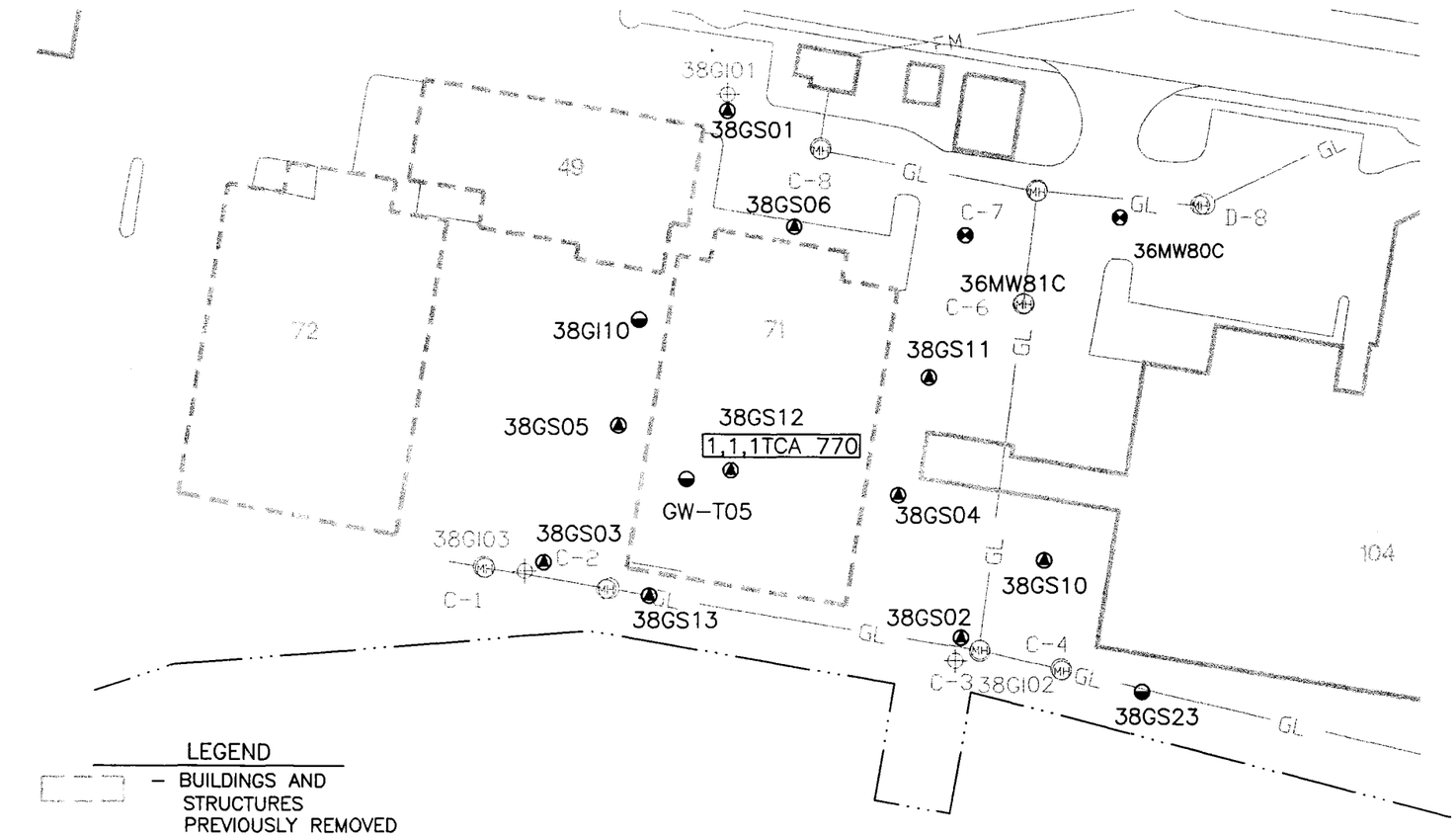
*NOTE: ALL CONCENTRATIONS IN $\mu g/L$.

70 0 70
SCALE FEET

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7-26
BUILDING 71 STUDY AREA
TRICHLOROETHENE CONCENTRATIONS
EXCEEDING PRGS IN
SHALLOW GROUNDWATER

DWG DATE: 06/10/97 | DWG NAME: 59B71TCS



LEGEND

- BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
- SHORELINE
- IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
- E/A&H SITE 38 INTERMEDIATE MONITORING WELL
- E/A&H SITE 38 SHALLOW MONITORING WELL
- EPA WELL
- GL — GRAVITY LINE (SEWER)
- FM — FORCE MAIN (SEWER)
- MH — MANHOLE
- 1,1,1 TCA — 1,1,1 TRICHLOROETHANE

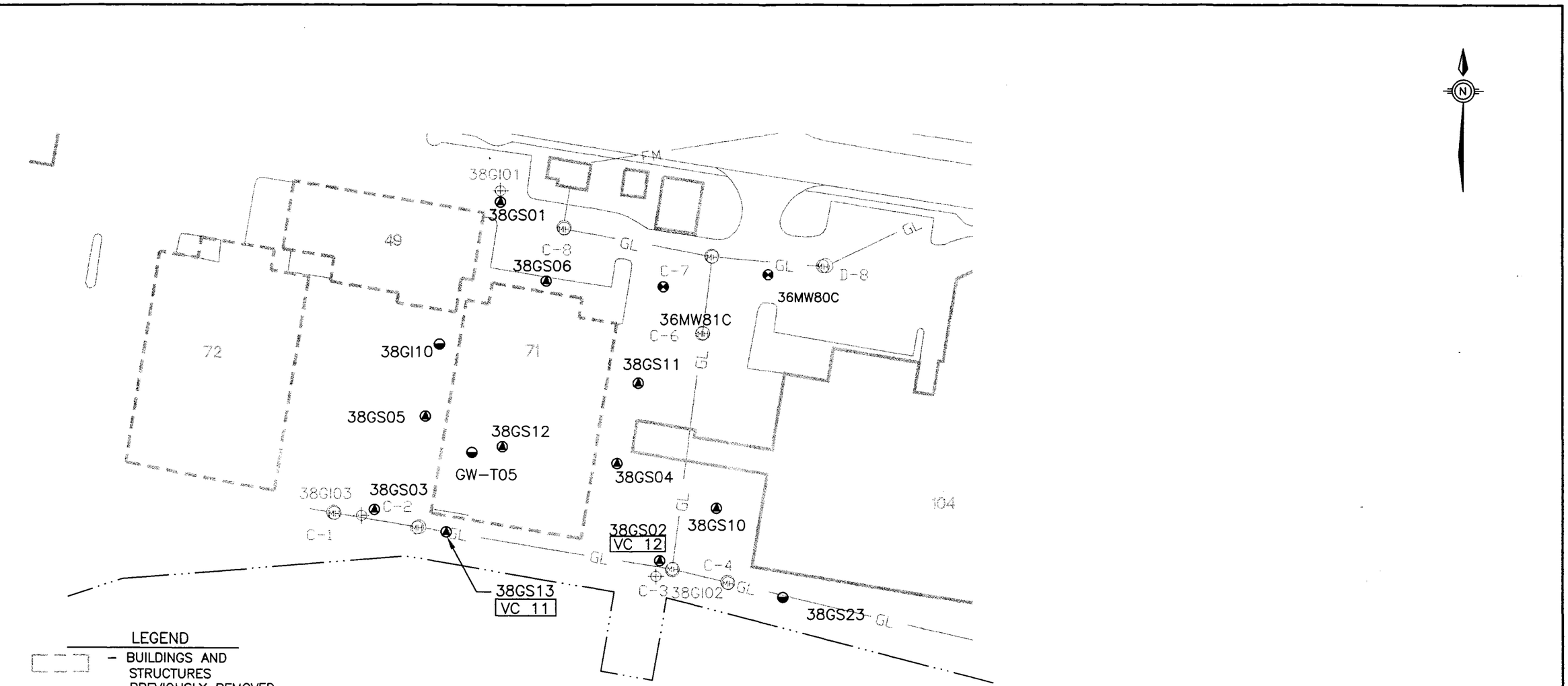
*NOTE: ALL CONCENTRATIONS IN $\mu g/L$.

70 0 70
SCALE FEET

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7-27
BUILDING 71 STUDY AREA
1,1,1 TRICHLOROETHANE
CONCENTRATIONS EXCEEDING PRGS
IN SHALLOW GROUNDWATER

DWG DATE: 06/10/97 | DWG NAME: 59B71PRG



LEGEND

- BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
- SHORELINE
- IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
- E/A&H SITE 38 INTERMEDIATE MONITORING WELL
- E/A&H SITE 38 SHALLOW MONITORING WELL
- EPA WELL
- GL — GRAVITY LINE (SEWER)
- FM — FORCE MAIN (SEWER)
- MH — MANHOLE
- VC — VINYL CHLORIDE

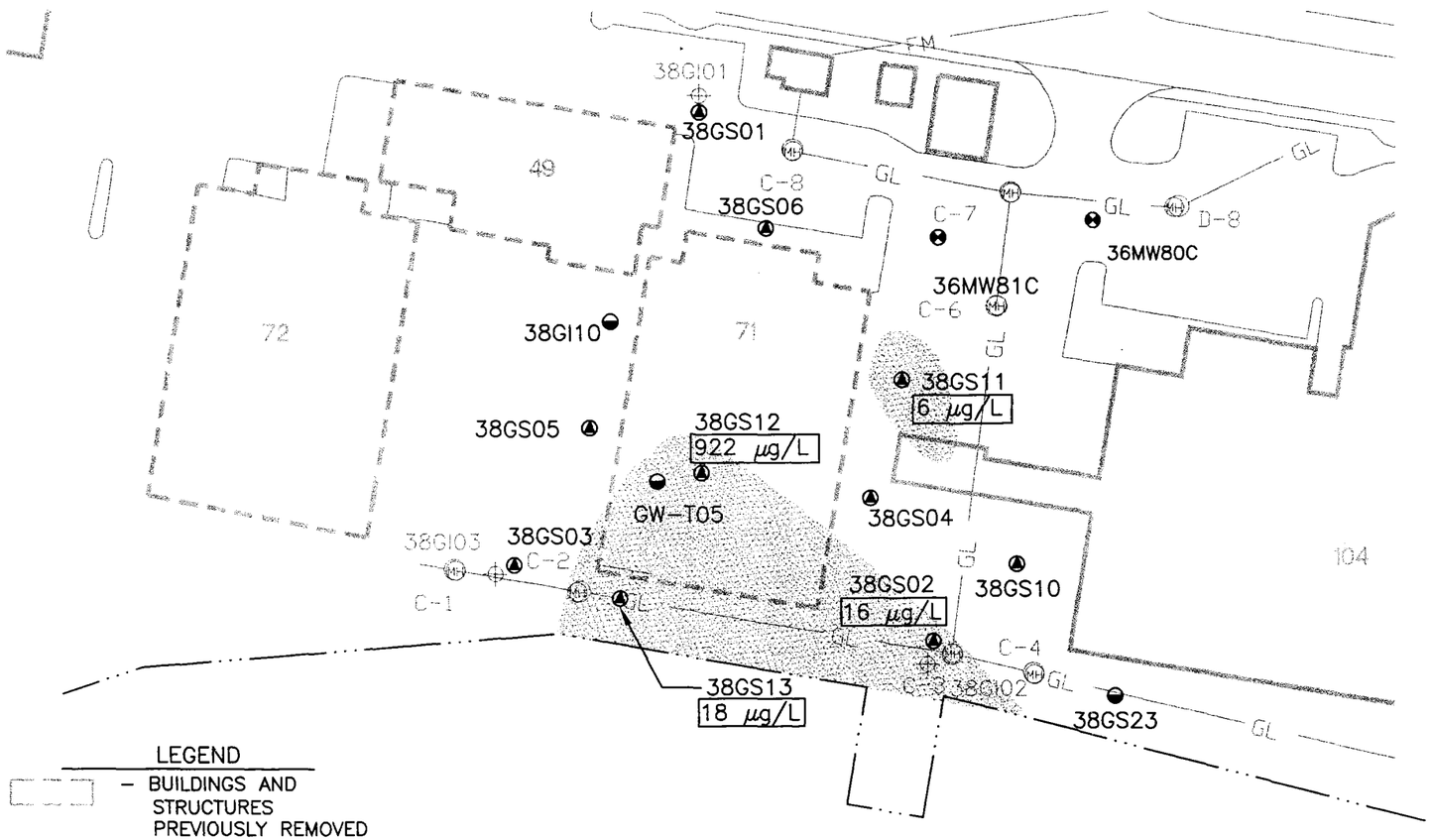
*NOTE: ALL CONCENTRATIONS IN $\mu g/L$.

70 0 70
SCALE FEET

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7-28
BUILDING 71 STUDY AREA
VINYL CHLORIDE CONCENTRATIONS
EXCEEDING PRGS IN
SHALLOW GROUNDWATER

DWG DATE: 06/10/97 | DWG NAME: 59B71VCS



LEGEND

- BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
- SHORELINE
- IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
- E/A&H SITE 38 INTERMEDIATE MONITORING WELL
- E/A&H SITE 38 SHALLOW MONITORING WELL
- EPA WELL
- GL — GRAVITY LINE (SEWER)
- FM — FORCE MAIN (SEWER)
- MANHOLE

*NOTE: ALL CONCENTRATIONS IN µg/L. TOTAL VOC CONCENTRATIONS PRESENTED ONLY FOR SAMPLES WITH INDIVIDUAL PRG EXCEEDANCES.

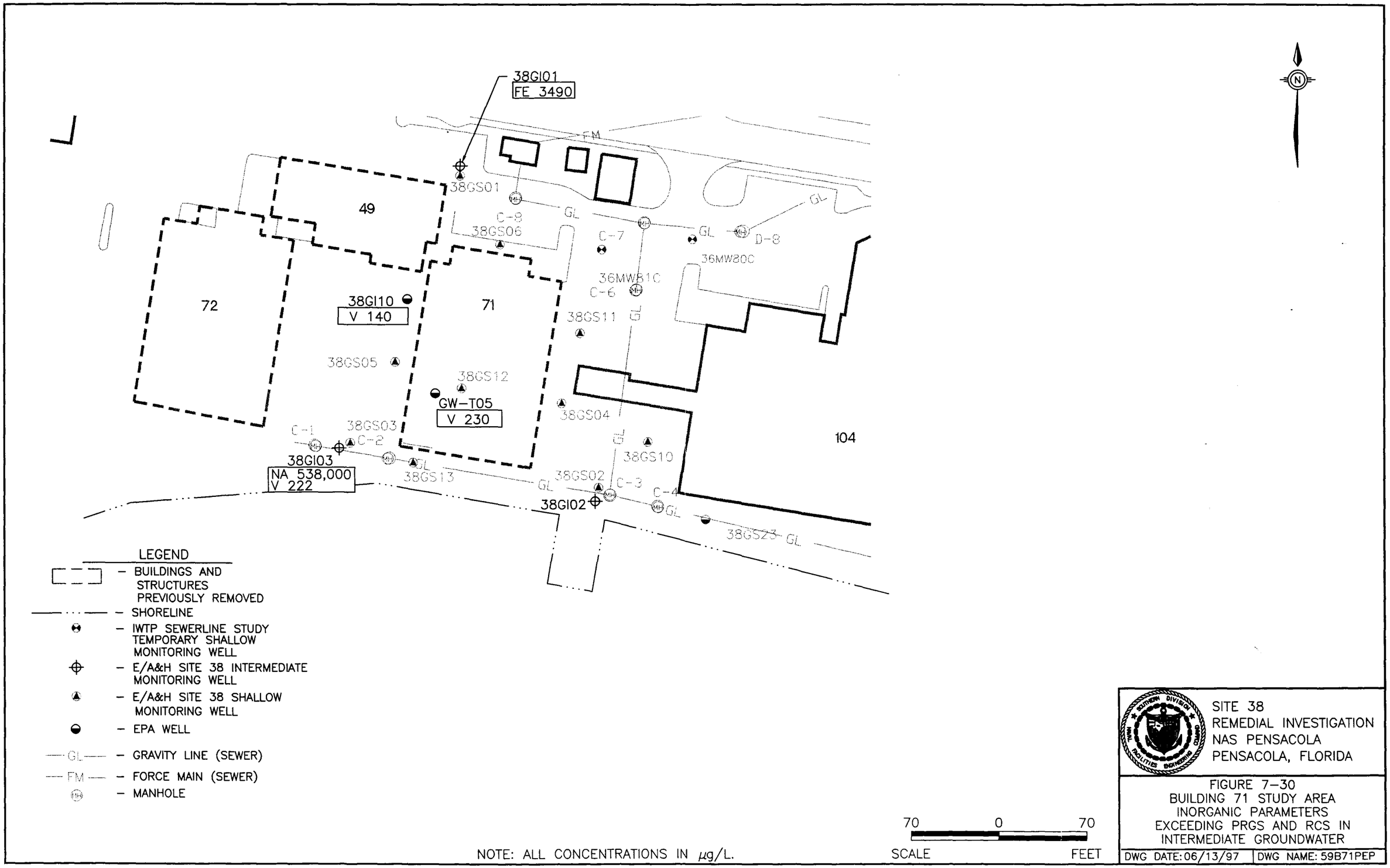
SHADED AREA INDICATES APPROXIMATE EXTENT OF GROUNDWATER CONTAMINATION BASED ON PRG EXCEEDANCES.

70 0 70
SCALE FEET

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7-29
BUILDING 71 STUDY AREA
TOTAL VOC CONCENTRATIONS
IN SHALLOW GROUNDWATER SAMPLES

DWG DATE: 06/10/97 | DWG NAME: 59B71TVC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FE 3490
FM
38GS01
C-8
38GS06
GL
C-7
GL
D-8
36MW80C
36MW81C
C-6
38GS11
49
72
71
38GI10
V 140
38GS05
38GS12
GW-T05
V 230
38GS04
104
C-1
38GS03
C-2
38GI03
NA 538,000
V 222
38GS13
38GS10
38GS02
C-3
C-4
38GI02
38GS23
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– E/A&H SITE 38 INTERMEDIATE MONITORING WELL
– E/A&H SITE 38 SHALLOW MONITORING WELL
– EPA WELL
– GRAVITY LINE (SEWER)
– FORCE MAIN (SEWER)
– MANHOLE
70 0 70
SCALE FEET
NOTE: ALL CONCENTRATIONS IN µg/L.
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-30
BUILDING 71 STUDY AREA
INORGANIC PARAMETERS
EXCEEDING PRGS AND RCS IN
INTERMEDIATE GROUNDWATER
DWG DATE: 06/13/97
DWG NAME: 59B71PEP

7.2.2 Building 604 Study Area

7.2.2.1 Shallow Groundwater

Inorganics

Inorganic parameters detected above a PRG in the shallow groundwater in the Building 604 study area are shown on Figure 7-31. In many instances, aluminum and iron concentrations exceeded PRGs, but were below their respective RCs. Aluminum exceeded the PRG of 50 μg/L and the RC of 3,882.8 μg/L in five wells. The maximum concentration, 20,000 μg/L, was detected in well 38GS20. Iron, manganese, and lead were detected frequently across the site. Iron exceeded the RC in 11 samples. Manganese exceeded the RC in 14 samples. The RC for cadmium was exceeded in nine samples, ranging from 8.1 to 382 μg/L. Most of these exceedances were in the vicinity of the former plating shop at Building 604. Chromium also exceeded the PRG in seven samples surrounding the former plating shop. Chromium exceedances ranged from 156 to 544 μg/L. Lead exceeded its RC and PRG in 23 samples ranging from 18.6 to 639 μg/L. A single exceedance of vanadium was observed in well 38GS20. Cadmium and chromium exceedances were consistent with exceedances of these parameters in the subsurface soil surrounding the former plating shop indicating a potential for these soils to continue to impact shallow groundwater.

Organics

SVOCs and VOCs were detected in the shallow groundwater in the Building 604 study area; no pesticides or PCBs were detected. Naphthalene was detected above a PRG at four sample locations (Figure 7-32). Exceedances for naphthalene ranged from 7 μg/L to 140 μg/L. One sample, 36MW77C, contained several PAH exceedances at concentrations slightly above the PRGs (Figure 7-32). This sample was collected adjacent to the IWTP sewer line. Several halogenated aliphatic hydrocarbons and their degradation products were detected in the shallow groundwater, including 1,1-dichloroethene, tetrachloroethene, trichloroethene, vinyl chloride, 1,2-dichloroethene, and 1,2-dichloroethane. Figures 7-33 through 7-38 show the extent of

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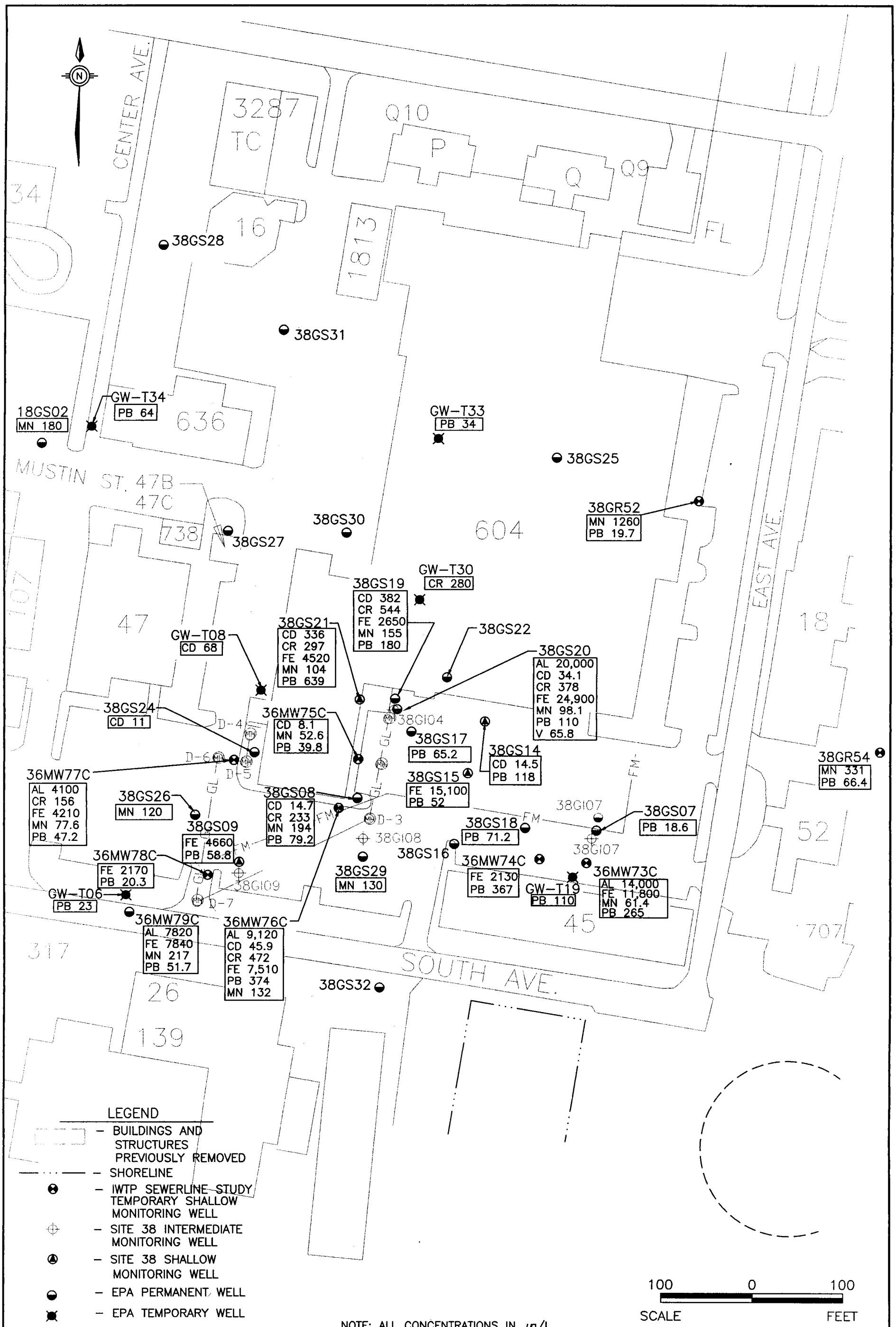
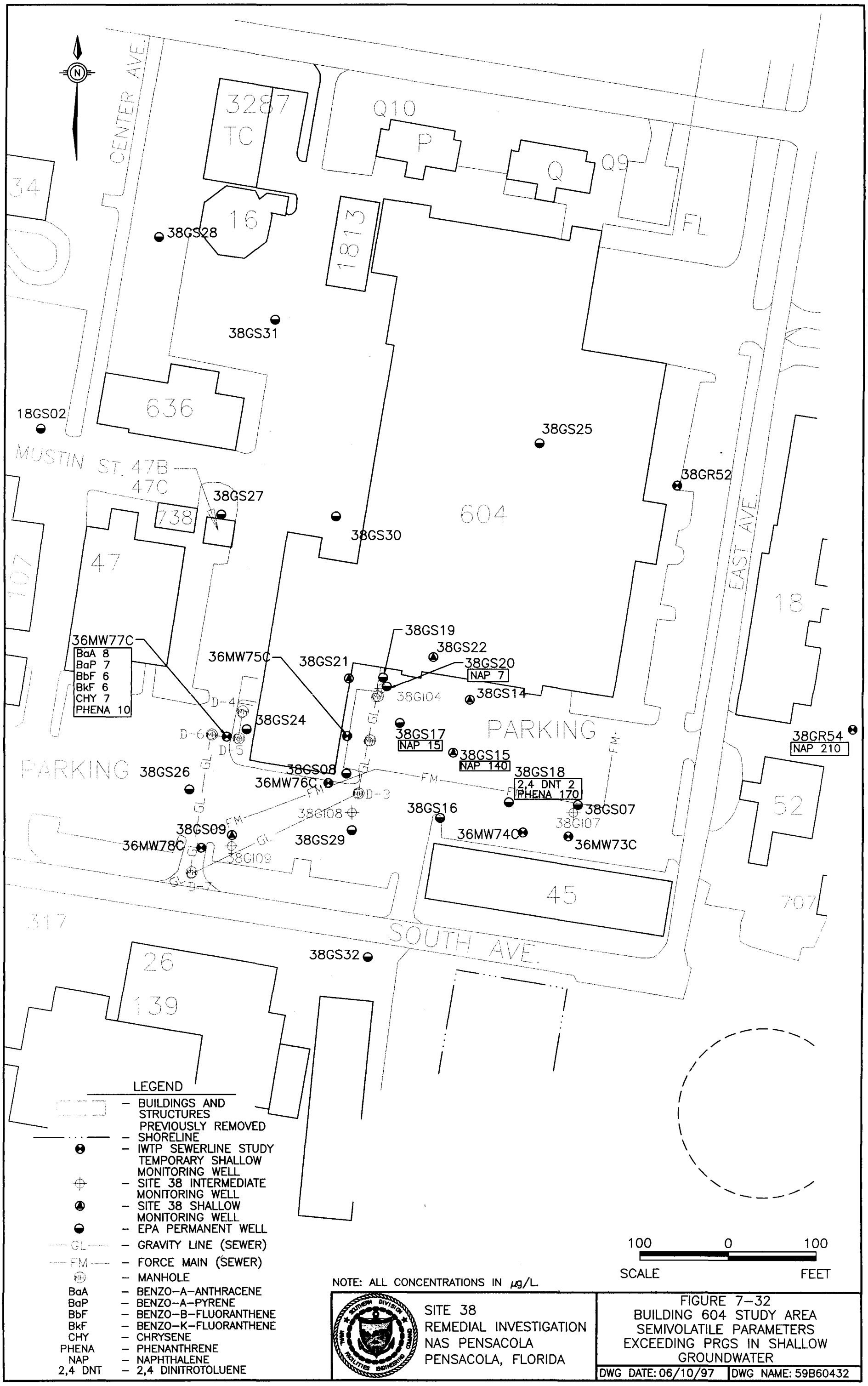


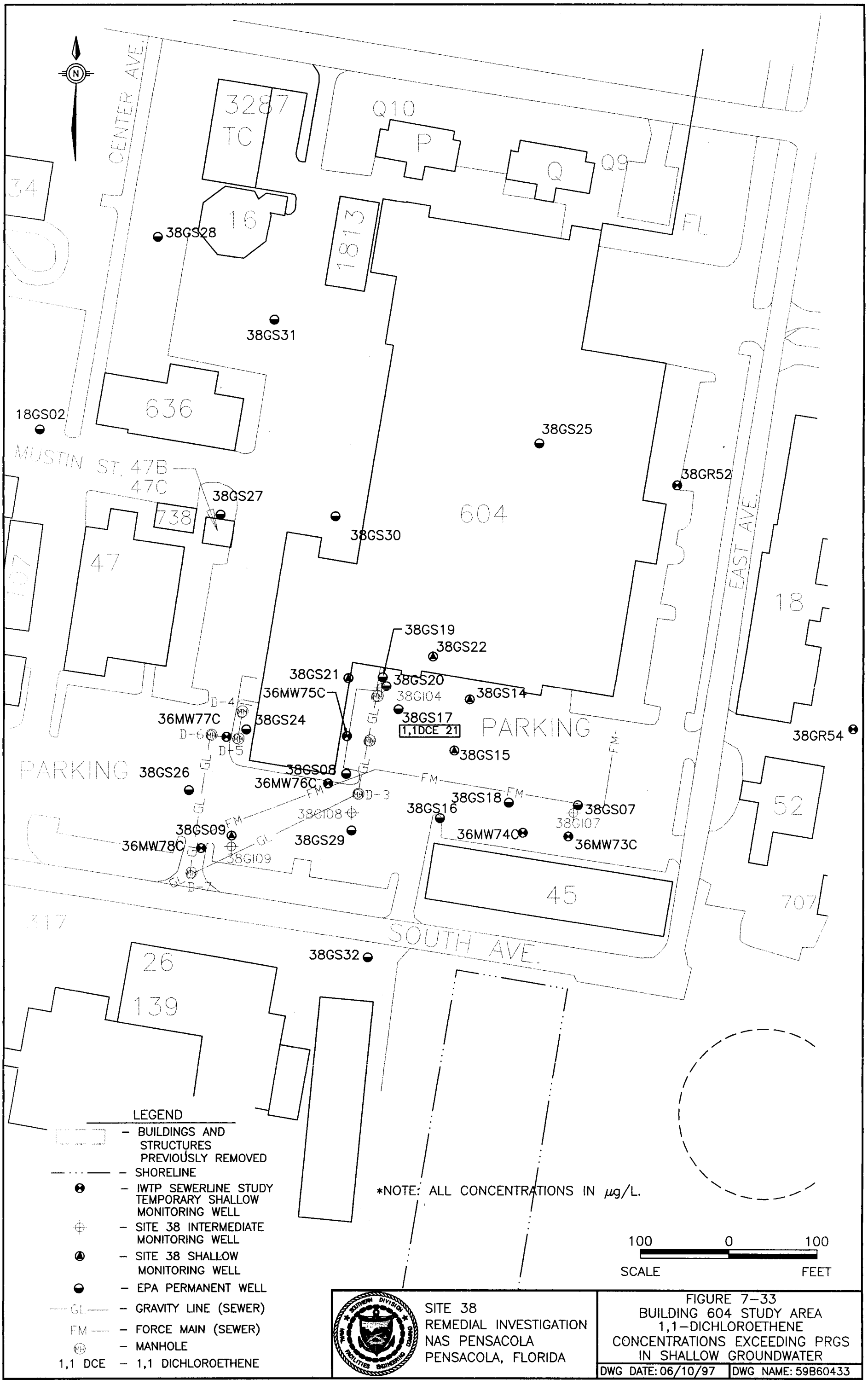
NOTE: ALL CONCENTRATIONS IN $\mu g/L$.

SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 7-31
BUILDING 604 STUDY AREA
INORGANIC PARAMETERS EXCEEDING PRGS AND RCS IN SHALLOW GROUNDWATER

DWG DATE: 06/10/97 | DWG NAME: 59B60431


CENTER AVE.
3287
TC
Q10
P
Q
Q9
FL
34
16
38GS28
1813
38GS31
636
18GS02
38GS25
MUSTIN ST.
47B
47C
738
38GS27
38GR52
604
38GS30
EAST AVE.
47
107
18
36MW77C
BaA 8
BaP 7
BbF 6
BkF 6
CHY 7
PHENA 10
36MW75C
38GS21
38GS19
38GS22
38GS20
NAP 7
38GI04
38GS14
D-4
38GS24
D-6
D-5
38GS17
NAP 15
PARKING
38GS15
NAP 140
38GR54
NAP 210
PARKING
38GS26
38GS08
36MW76C
38GS18
2,4 DNT 2
PHENA 170
D-3
38GI08
38GS16
38GS07
38GI07
52
38GS09
36MW78C
38GS29
36MW74C
36MW73C
38GI09
D-7
45
707
317
SOUTH AVE.
38GS32
26
139
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
– EPA PERMANENT WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
BaA – BENZO-A-ANTHRACENE
BaP – BENZO-A-PYRENE
BbF – BENZO-B-FLUORANTHENE
BkF – BENZO-K-FLUORANTHENE
CHY – CHRYSENE
PHENA – PHENANTHRENE
NAP – NAPHTHALENE
2,4 DNT – 2,4 DINITROTOLUENE
100 0 100
SCALE FEET
NOTE: ALL CONCENTRATIONS IN µg/L.
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-32
BUILDING 604 STUDY AREA
SEMIVOLATILE PARAMETERS
EXCEEDING PRGS IN SHALLOW
GROUNDWATER
DWG DATE: 06/10/97
DWG NAME: 59B60432


CENTER AVE.
3287
TC
Q10
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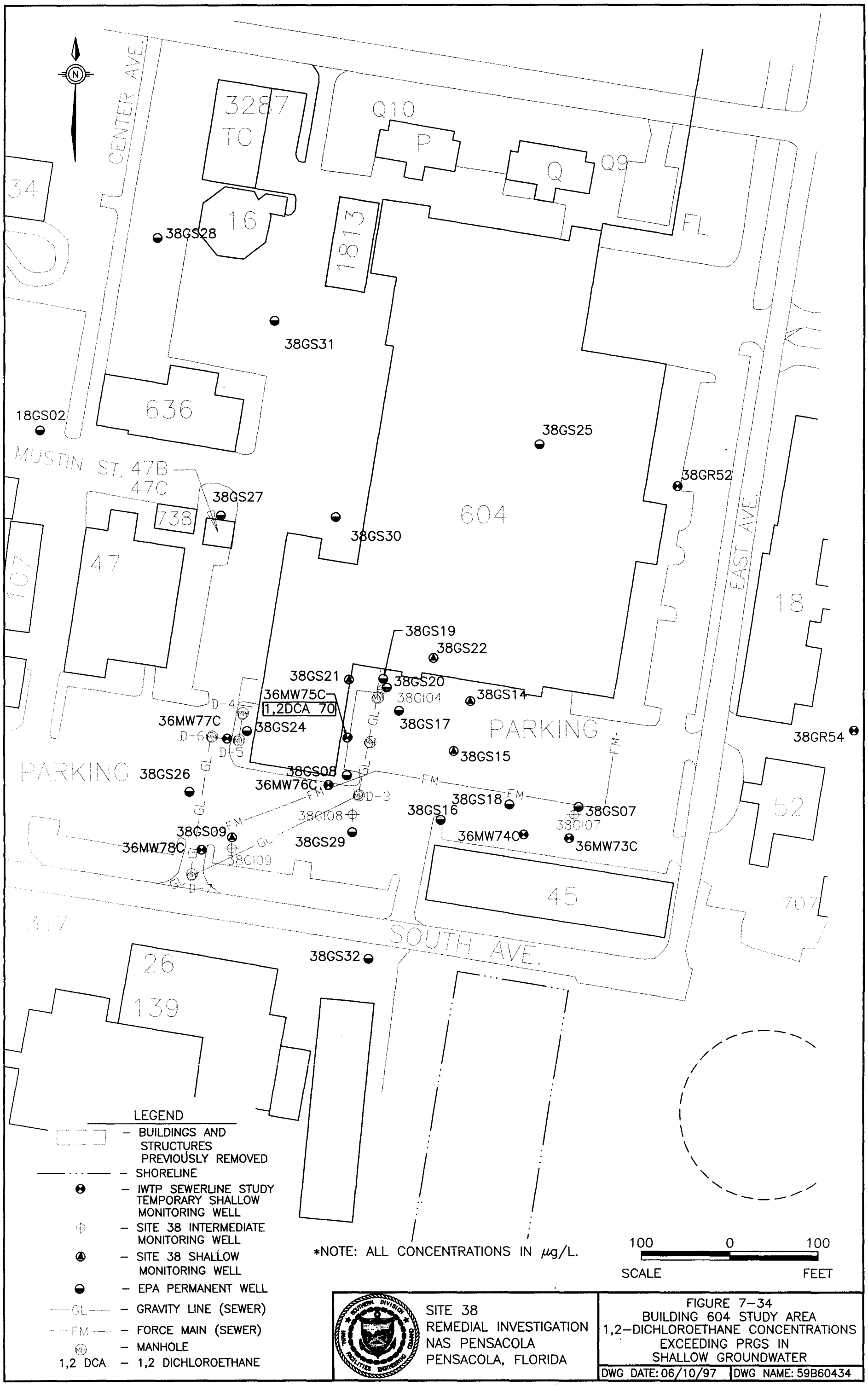
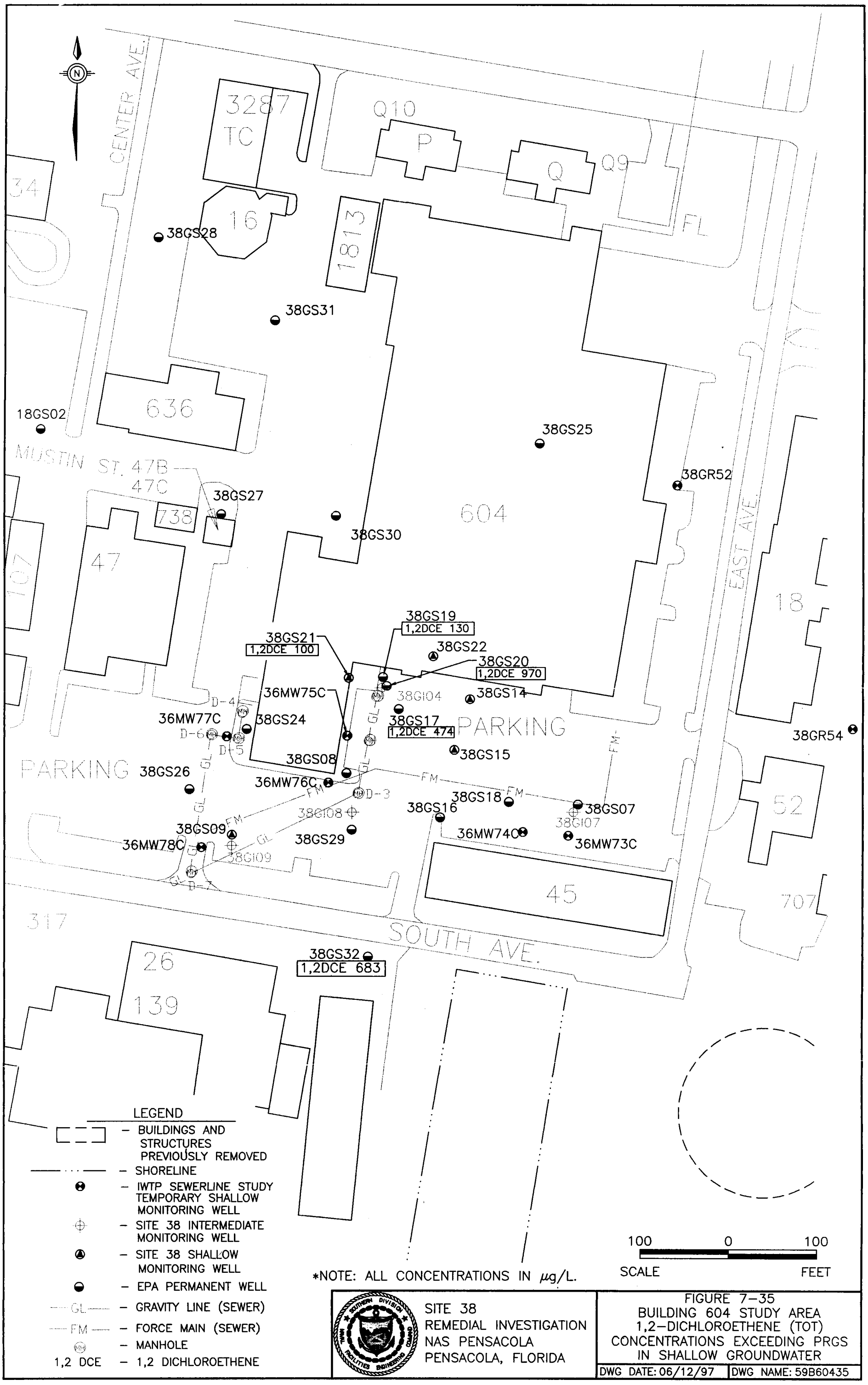
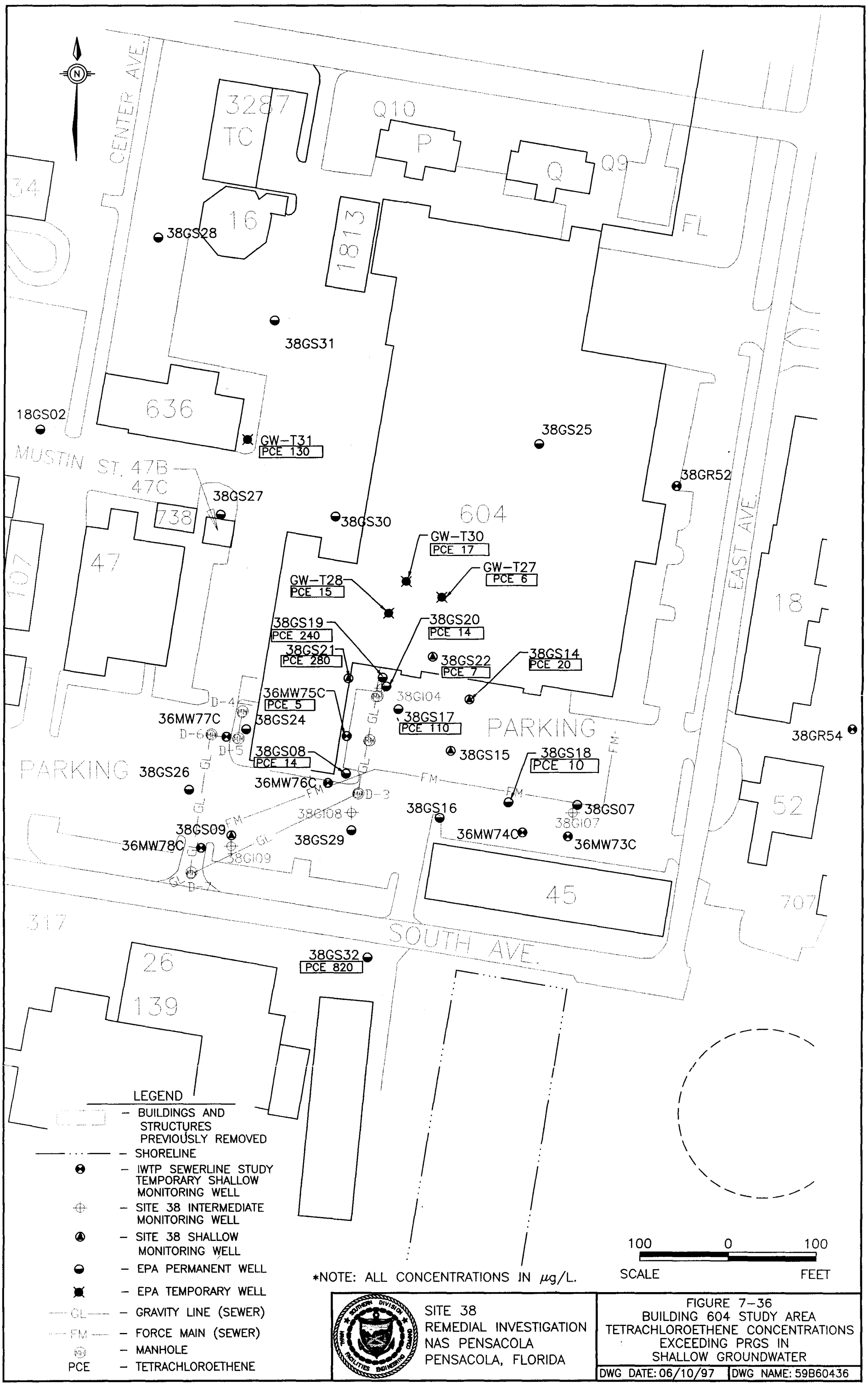
Q
Q9
34
16
38GS28
1813
FL
38GS31
636
18GS02
38GS25
MUSTIN ST.
47B
47C
38GR52
38GS27
738
604
38GS30
47
EAST AVE.
18
38GS19
38GS22
38GS21
38GS20
36MW75C
38GI04
38GS14
D-4
36MW77C
38GS24
38GS17
1,1DCE 21
PARKING
38GR54
D-6
D-5
38GS15
PARKING
38GS26
38GS08
36MW76C
FM
D-3
38GS18
38GS07
52
38GS16
38GI08
38GI07
38GS09
38GS29
36MW74C
36MW73C
36MW78C
38GI09
D-7
45
707
317
SOUTH AVE.
38GS32
26
139
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
– EPA PERMANENT WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
1,1 DCE – 1,1 DICHLOROETHENE
*NOTE: ALL CONCENTRATIONS IN µg/L.
100 0 100
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-33
BUILDING 604 STUDY AREA
1,1-DICHLOROETHENE
CONCENTRATIONS EXCEEDING PRGS
IN SHALLOW GROUNDWATER
DWG DATE: 06/10/97
DWG NAME: 59B60433


N
CENTER AVE.
3287
TC
Q10
P
Q
Q9
34
16
38GS28
1813
FL
38GS31
636
18GS02
38GS25
MUSTIN ST. 47B
47C
38GR52
738
38GS27
604
38GS30
EAST AVE.
47
107
18
38GS19
38GS22
38GS21
38GS20
38GI04
38GS14
36MW75C
1,2DCA 70
D-4
36MW77C
38GS24
D-6
D-5
38GS17
PARKING
38GR54
38GS15
PARKING
38GS26
38GS08
36MW76C
D-3
38GS18
38GS07
38GS16
52
38GI08
38GS09
38GI07
36MW74C
36MW78C
38GS29
36MW73C
38GI09
D-7
45
707
317
SOUTH AVE.
38GS32
26
139
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
– EPA PERMANENT WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
1,2 DCA – 1,2 DICHLOROETHANE
*NOTE: ALL CONCENTRATIONS IN µg/L.
100 0 100
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-34
BUILDING 604 STUDY AREA
1,2-DICHLOROETHANE CONCENTRATIONS
EXCEEDING PRGS IN
SHALLOW GROUNDWATER
DWG DATE: 06/10/97
DWG NAME: 59B60434


N
CENTER AVE.
3287
TC
Q10
P
Q
Q9
34
16
38GS28
1813
FL
38GS31
636
18GS02
38GS25
MUSTIN ST.
47B
47C
738
38GS27
38GR52
604
38GS30
47
107
EAST AVE.
18
38GS19
1,2DCE 130
38GS21
1,2DCE 100
38GS22
38GS20
1,2DCE 970
36MW75C
38GI04
38GS14
D-4
36MW77C
38GS24
38GS17
1,2DCE 474
PARKING
D-6
D-5
38GS15
38GR54
38GS08
PARKING
38GS26
36MW76C
FM
D-3
38GS18
38GS07
38GS16
52
38GI08
38GI07
38GS09
38GS29
36MW74C
36MW78C
36MW73C
38GI09
D-7
45
707
317
SOUTH AVE.
38GS32
1,2DCE 683
26
139
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
– EPA PERMANENT WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
1,2 DCE – 1,2 DICHLOROETHENE
*NOTE: ALL CONCENTRATIONS IN μg/L.
100 0 100
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-35
BUILDING 604 STUDY AREA
1,2-DICHLOROETHENE (TOT)
CONCENTRATIONS EXCEEDING PRGS
IN SHALLOW GROUNDWATER
DWG DATE: 06/12/97
DWG NAME: 59B60435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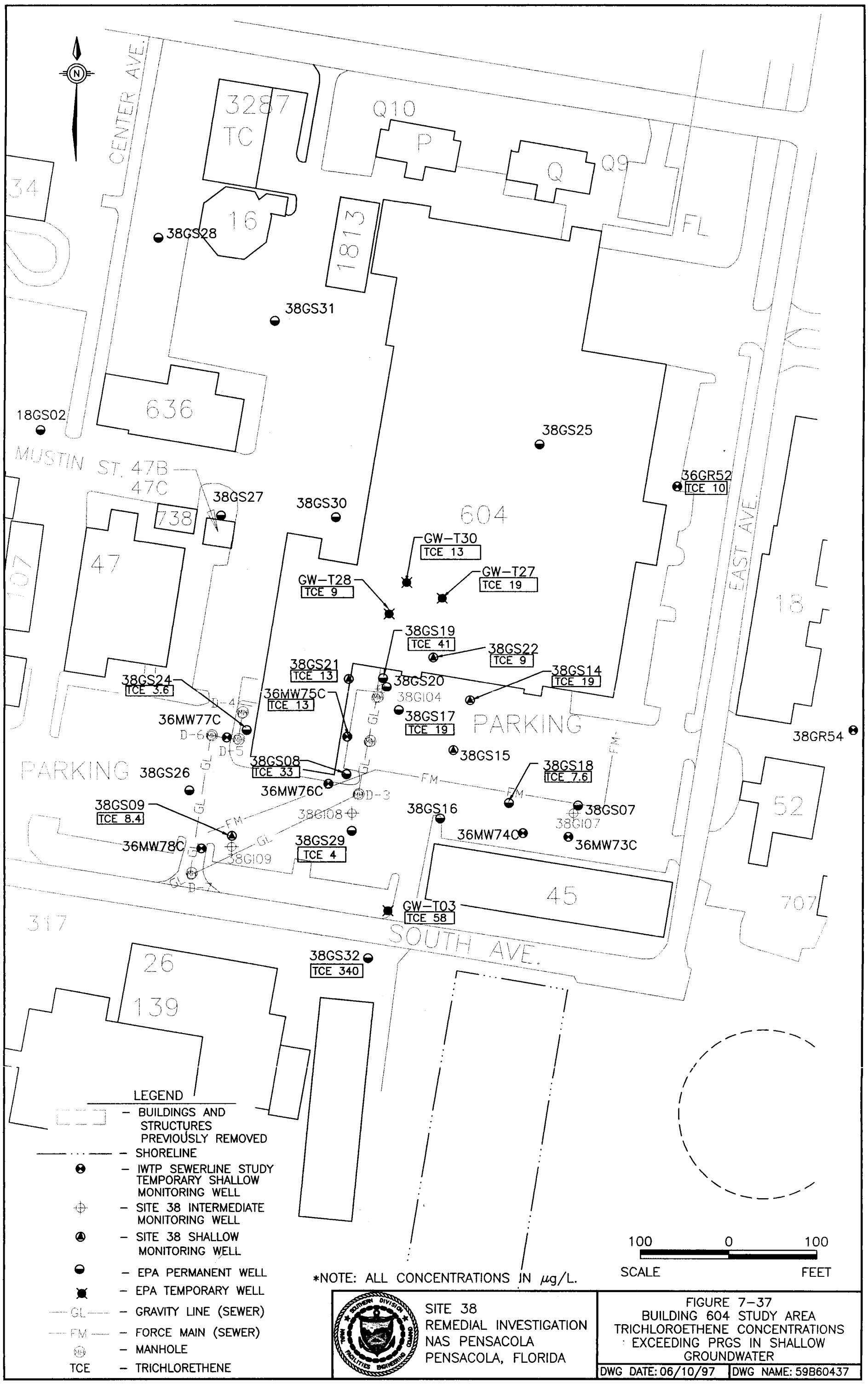
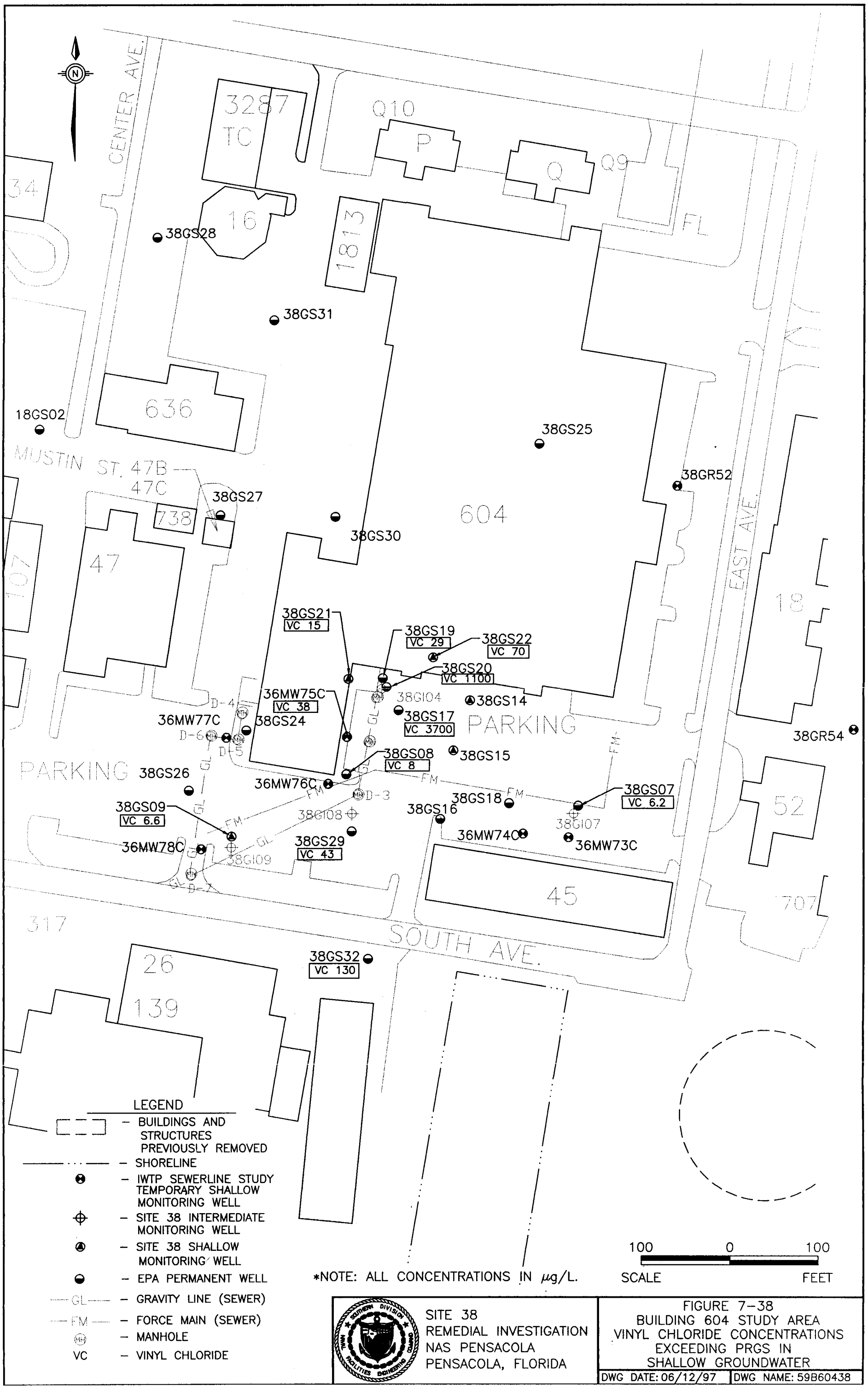
CENTER AVE.
3287
TC
Q10
P
Q
Q9
34
16
38GS28
1813
FL
38GS31
636
18GS02
GW-T31
PCE 130
38GS25
MUSTIN ST.
47B
47C
38GR52
38GS27
738
38GS30
604
GW-T30
PCE 17
GW-T27
PCE 6
47
107
GW-T28
PCE 15
EAST AVE.
18
38GS19
PCE 240
38GS20
PCE 14
38GS21
PCE 280
38GS22
PCE 7
38GS14
PCE 20
36MW75C
PCE 5
38GI04
D-4
36MW77C
38GS24
38GS17
PCE 110
PARKING
D-6
D-5
38GR54
38GS08
PCE 14
38GS15
38GS18
PCE 10
PARKING
38GS26
36MW76C
FM
D-3
38GI08
38GS16
38GS07
52
38GS09
38GI07
36MW78C
38GS29
36MW74C
36MW73C
38GI09
GL
D-7
45
707
317
SOUTH AVE.
26
38GS32
PCE 820
139
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
– EPA PERMANENT WELL
– EPA TEMPORARY WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
PCE – TETRACHLOROETHENE
*NOTE: ALL CONCENTRATIONS IN μg/L.
100 0 100
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-36
BUILDING 604 STUDY AREA
TETRACHLOROETHENE CONCENTRATIONS
EXCEEDING PRGS IN
SHALLOW GROUNDWATER
DWG DATE: 06/10/97
DWG NAME: 59B60436


N
CENTER AVE.
3287
TC
Q10
P
Q
Q9
34
16
38GS28
1813
FL
38GS31
636
18GS02
38GS25
MUSTIN ST. 47B
47C
738
38GS27
38GS30
604
36GR52
TCE 10
EAST AVE.
47
GW-T30
TCE 13
GW-T27
TCE 19
GW-T28
TCE 9
18
38GS19
TCE 41
38GS22
TCE 9
38GS21
TCE 13
38GS14
TCE 19
38GS24
TCE 3.6
38GS20
36MW75C
TCE 13
38GI04
38GS17
TCE 19
PARKING
36MW77C
D-4
D-6
D-5
38GR54
38GS15
PARKING
38GS26
38GS08
TCE 33
38GS18
TCE 7.6
36MW76C
D-3
38GS09
TCE 8.4
38GI08
38GS16
38GS07
52
38GI07
36MW74C
36MW73C
36MW78C
38GS29
TCE 4
38GI09
D-7
45
GW-T03
TCE 58
707
317
SOUTH AVE.
38GS32
TCE 340
26
139
GL
FM
MH
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
– EPA PERMANENT WELL
– EPA TEMPORARY WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
TCE – TRICHLORETHENE
*NOTE: ALL CONCENTRATIONS IN μg/L.
100 0 100
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-37
BUILDING 604 STUDY AREA
TRICHLOROETHENE CONCENTRATIONS
EXCEEDING PRGS IN SHALLOW
GROUNDWATER
DWG DATE: 06/10/97
DWG NAME: 59B60437


N
CENTER AVE.
3287
TC
Q10
P
Q
Q9
FL
34
16
38GS28
1813
38GS31
636
18GS02
38GS25
MUSTIN ST.
47B
47C
738
38GS27
38GR52
604
38GS30
47
107
EAST AVE.
18
38GS21
VC 15
38GS19
VC 29
38GS22
VC 70
38GS20
VC 1100
36MW75C
VC 38
38GI04
38GS14
D-4
36MW77C
38GS24
38GS17
VC 3700
PARKING
D-6
D-5
38GR54
38GS08
VC 8
38GS15
PARKING
38GS26
36MW76C
FM
D-3
38GS18
38GS07
VC 6.2
38GS09
VC 6.6
38GI08
38GS16
52
38GI07
36MW74C
36MW73C
36MW78C
38GS29
VC 43
38GI09
D-7
45
707
317
SOUTH AVE.
38GS32
VC 130
26
139
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
– EPA PERMANENT WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
VC – VINYL CHLORIDE
*NOTE: ALL CONCENTRATIONS IN µg/L.
100 0 100
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-38
BUILDING 604 STUDY AREA
VINYL CHLORIDE CONCENTRATIONS
EXCEEDING PRGS IN
SHALLOW GROUNDWATER
DWG DATE: 06/12/97
DWG NAME: 59B60438

exceedances for these parameters in the shallow groundwater. Ethylbenzene was detected in sample 38GS15 at a concentration of 89 μg/L, exceeding the PRG of 30 μg/L (Figure 7-39). Figure 7-40 presents the total volatile concentrations. Total volatile concentrations ranged from 6.7 μg/L, representing a single detection of vinyl chloride in well 38GS07 to 4,324 μg/L in the sample from 38GS17. Much of the VOC contamination occurs near the former solvent UST immediately east of the former plating shop. However, anomalous hits of these compounds were observed in two locations. Trichloroethene, tetrachloroethene, and vinyl chloride were detected in the sample from well 38GS32. No immediate sources are known in this area; however, this well is located adjacent to a storm drain. Historically, the storm drainage system was used to discharge plating waste (i.e., metals, solvents, etc.) to the bay via the outlet in the Port Operations boat slip.

These detections may represent contamination caused by leaks in the storm drainage system. Observances made during field reconnaissance indicate that the discharge outlet is continually below sea level; thus, discharge from this pipe could not be monitored. Another detection occurred in a sample from a temporary well GWT-31. Tetrachloroethene was detected at 130 μg/L in this sample. The well was adjacent to a former laundry and dry cleaning facility, Building 636, which may have been the source of the contamination.

7.2.2.2 Intermediate Groundwater

Inorganics

Aluminum, cadmium, chromium, and manganese were detected above the RC and PRG in one intermediate groundwater sample at well 38GI04 (Figure 7-41). The sodium exceedance for 38GI07 suggests saltwater influence from the bay.

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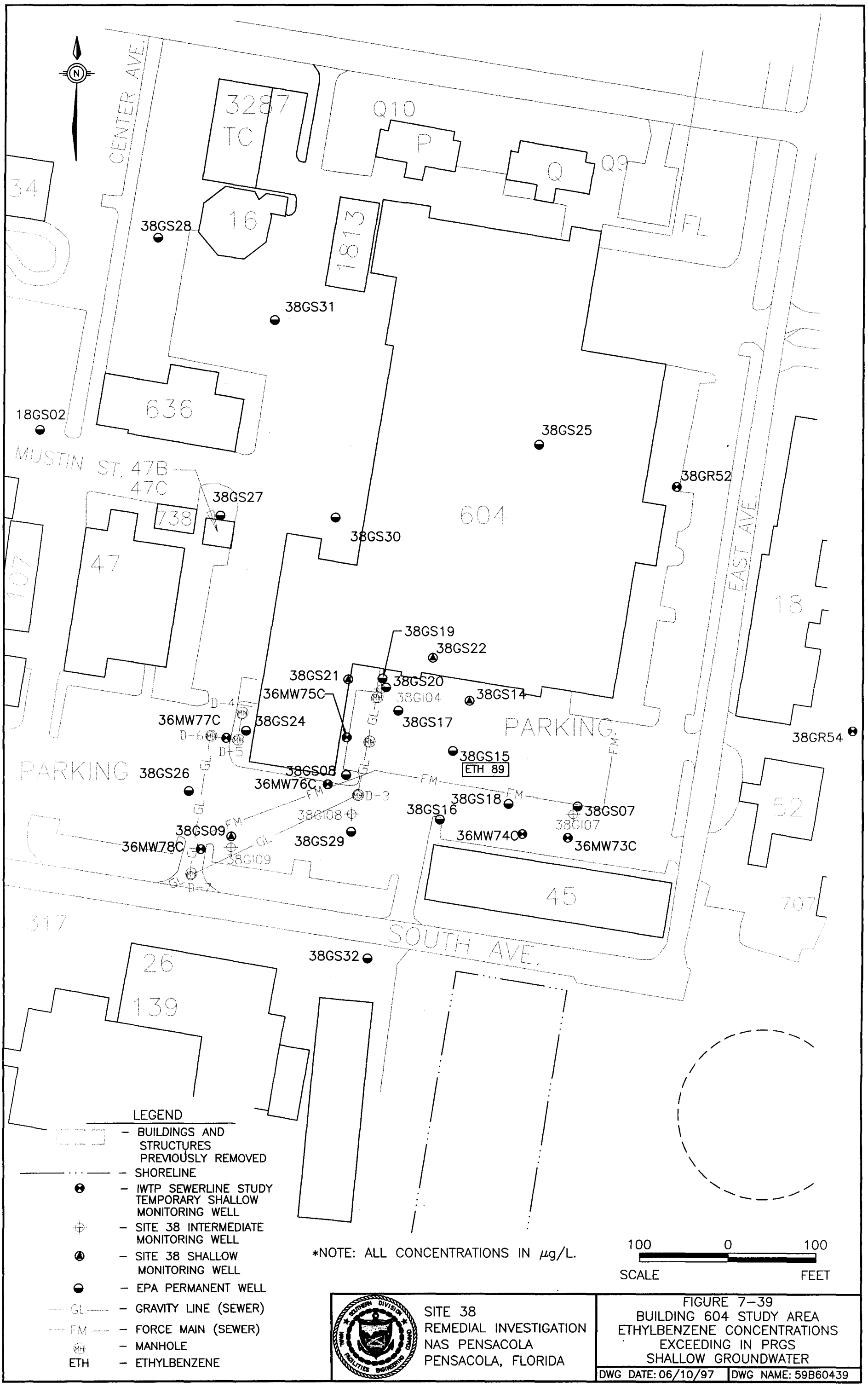
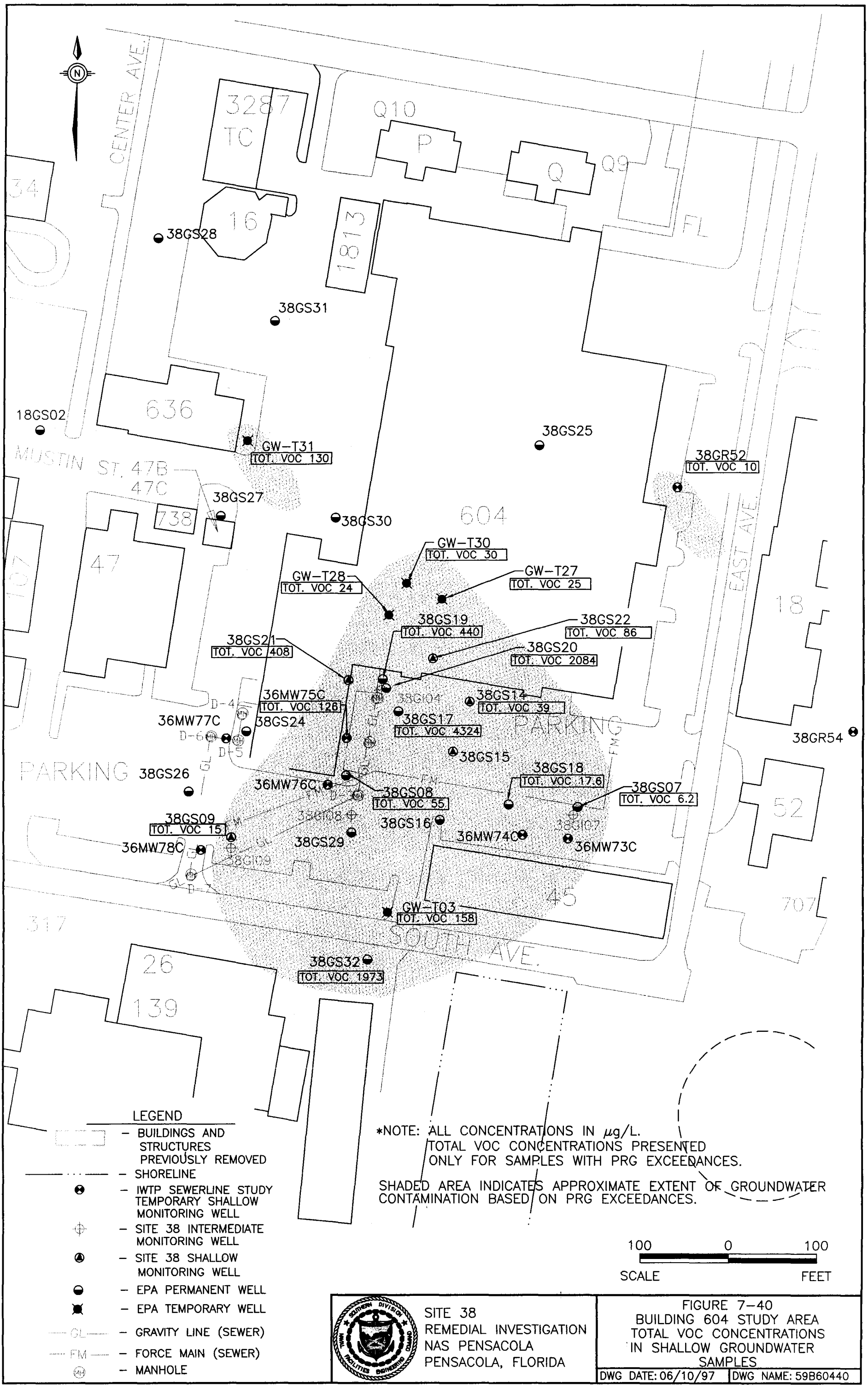
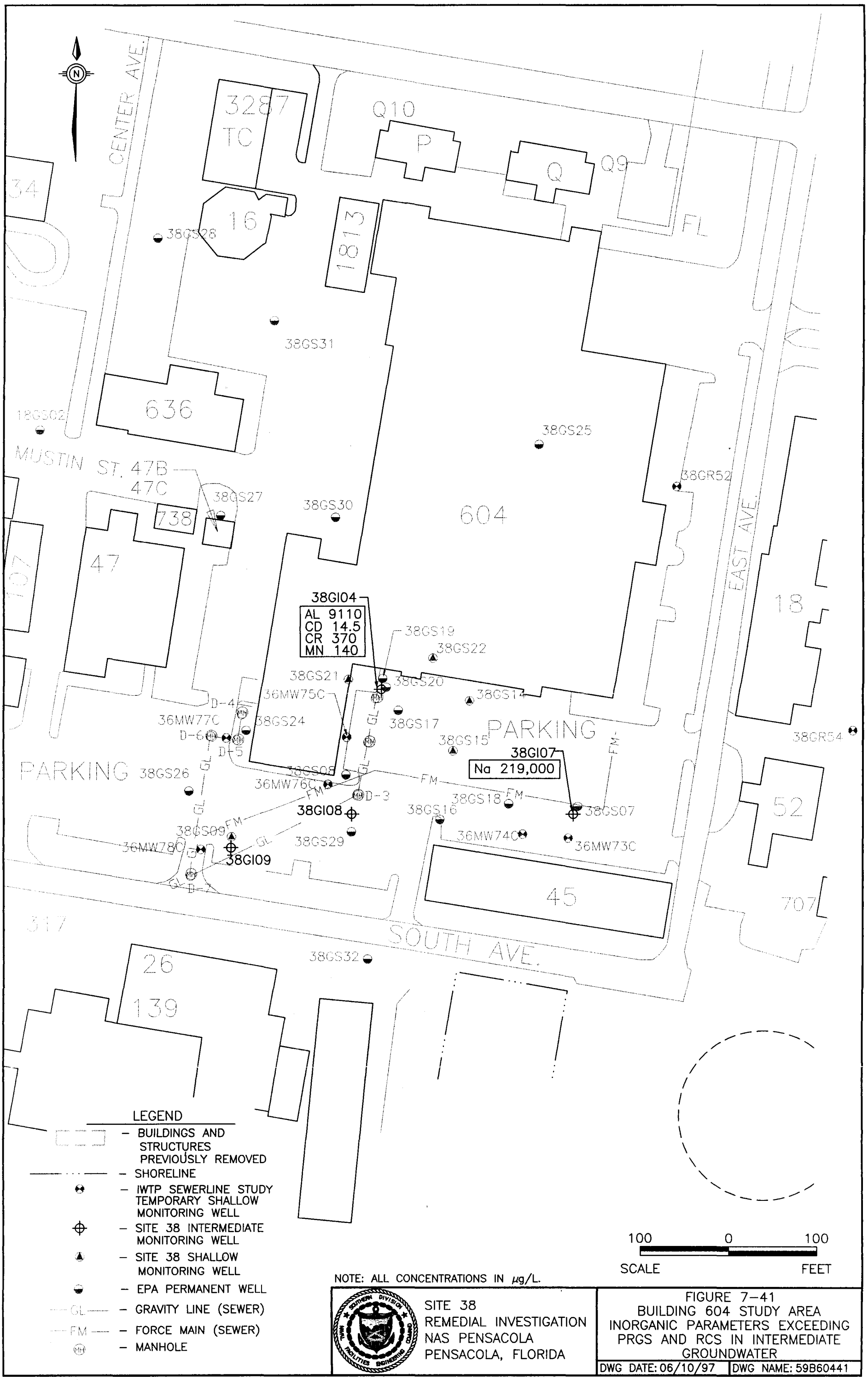

CENTER AVE.
3287
TC
Q10
P
Q
Q9
FL
34
16
38GS28
1813
38GS31
636
18GS02
38GS25
MUSTIN ST.
47B
47C
38GS27
738
38GR52
604
38GS30
47
EAST AVE.
18
38GS19
38GS22
38GS21
38GS20
36MW75C
38GI04
38GS14
D-4
36MW77C
38GS24
38GS17
PARKING
38GR54
D-6
D-5
38GS15
ETH 89
PARKING
38GS26
38GS08
36MW76C
FM
D-3
38GS18
38GS07
52
38GI08
38GS16
38GI07
38GS09
38GS29
36MW74C
36MW73C
36MW78C
38GI09
D-7
45
707
317
SOUTH AVE.
38GS32
26
139
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
– EPA PERMANENT WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
ETH – ETHYLBENZENE
*NOTE: ALL CONCENTRATIONS IN μg/L.
100 0 100
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7–39
BUILDING 604 STUDY AREA
ETHYLBENZENE CONCENTRATIONS
EXCEEDING IN PRGS
SHALLOW GROUNDWATER
DWG DATE: 06/10/97
DWG NAME: 59B60439


N
CENTER AVE.
3287
TC
Q10
P
Q
Q9
FL
34
16
38GS28
1813
38GS31
636
18GS02
GW-T31
TOT. VOC 130
38GS25
38GR52
TOT. VOC 10
MUSTIN ST.
47B
47C
38GS27
738
38GS30
604
GW-T30
TOT. VOC 30
GW-T28
TOT. VOC 24
GW-T27
TOT. VOC 25
47
107
EAST AVE.
18
38GS19
TOT. VOC 440
38GS22
TOT. VOC 86
38GS21
TOT. VOC 408
38GS20
TOT. VOC 2084
36MW75C
TOT. VOC 126
38GI04
38GS17
TOT. VOC 39
D-4
36MW77C
38GS24
38GS17
TOT. VOC 4324
PARKING
D-6
D-5
38GR54
38GS15
PARKING
38GS26
38GS18
TOT. VOC 17.6
36MW76C
38GS08
TOT. VOC 55
38GS07
TOT. VOC 6.2
52
38GS09
TOT. VOC 151
38GI08
38GS16
38GI07
36MW78C
38GS29
36MW74C
36MW73C
38GI09
45
707
GW-T03
TOT. VOC 158
317
SOUTH AVE.
26
38GS32
TOT. VOC 1973
139
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
– EPA PERMANENT WELL
– EPA TEMPORARY WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
*NOTE: ALL CONCENTRATIONS IN μg/L.
TOTAL VOC CONCENTRATIONS PRESENTED ONLY FOR SAMPLES WITH PRG EXCEEDANCES.
SHADED AREA INDICATES APPROXIMATE EXTENT OF GROUNDWATER CONTAMINATION BASED ON PRG EXCEEDANCES.
100 0 100
SCALE FEET
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-40
BUILDING 604 STUDY AREA
TOTAL VOC CONCENTRATIONS
IN SHALLOW GROUNDWATER
SAMPLES
DWG DATE: 06/10/97
DWG NAME: 59B60440


N
CENTER AVE.
3287
TC
Q10
P
Q
Q9
FL
34
16
38GS28
1813
38GS31
636
18GS02
38GS25
MUSTIN ST. 47B
47C
738
38GS27
38GS30
604
38GR52
EAST AVE.
47
707
18
38GI04
AL 9110
CD 14.5
CR 370
MN 140
38GS19
38GS22
38GS21
38GS20
38GS14
36MW75C
D-4
36MW77C
38GS24
D-6
D-5
38GS17
PARKING
38GS15
38GR54
38GI07
Na 219,000
PARKING
38GS26
38GS08
36MW76C
D-3
38GS18
38GS07
52
38GI08
38GS16
38GS09
38GS29
36MW74C
36MW73C
36MW78C
38GI09
D-7
45
707
317
SOUTH AVE.
38GS32
26
139
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
– EPA PERMANENT WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
100 0 100
SCALE FEET
NOTE: ALL CONCENTRATIONS IN μg/L.
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7–41
BUILDING 604 STUDY AREA
INORGANIC PARAMETERS EXCEEDING
PRGS AND RCS IN INTERMEDIATE
GROUNDWATER
DWG DATE: 06/10/97
DWG NAME: 59B60441

Organics

Vinyl chloride was detected in the intermediate groundwater samples at two locations (Figure 7-42), ranging from 1.9 to 4.2 μg/L. These exceedances are coincident with halogenated aliphatics in the shallow groundwater.

7.2.3 Summary of Groundwater Contamination at Site 38

Contaminants detected above a PRG in shallow groundwater in the Building 71 study area included inorganics, SVOCs, and VOCs. No pesticides or PCBs were detected above a PRG. Detected heavy metals potentially related to past paint stripping and metal refinishing processes included cadmium, chromium, and lead. These elements exceeded RCs and PRGs in wells 38GS05 and 38GS12 in the southwest part of the study area beneath former Building 71 and in downgradient well 39GS13. Aluminum, iron, manganese, and lead exceedances were widespread across the site. Concentrations of these metals from well 38GS01, upgradient of the site, were among the highest detected. The highest total inorganic concentrations were detected in the sample from well 38GS12, beneath former Building 71. Naphthalene was the only SVOC detected above a PRG. It exceeded the PRG in samples from wells 38GS12 and 38GS02. VOC contamination centered around the sample from 38GS12, beneath Building 71, and in downgradient locations along the seawall south and east of the former building. Total VOC concentrations for 38GS12 equaled 922 μg/L; concentrations in other wells diminished greatly downgradient. These VOCs included several halogenated aliphatic hydrocarbons and their presence is likely the result of past paint stripping and parts cleaning operations at Building 71.

Contaminants detected in the shallow groundwater were not detected above the PRGs in intermediate groundwater with the exception of aluminum, iron, sodium, and vanadium. Aluminum and iron appeared to be representative of ambient conditions; however, vanadium exceeded the PRG and RC in the three locations it was detected. The occurrence of these

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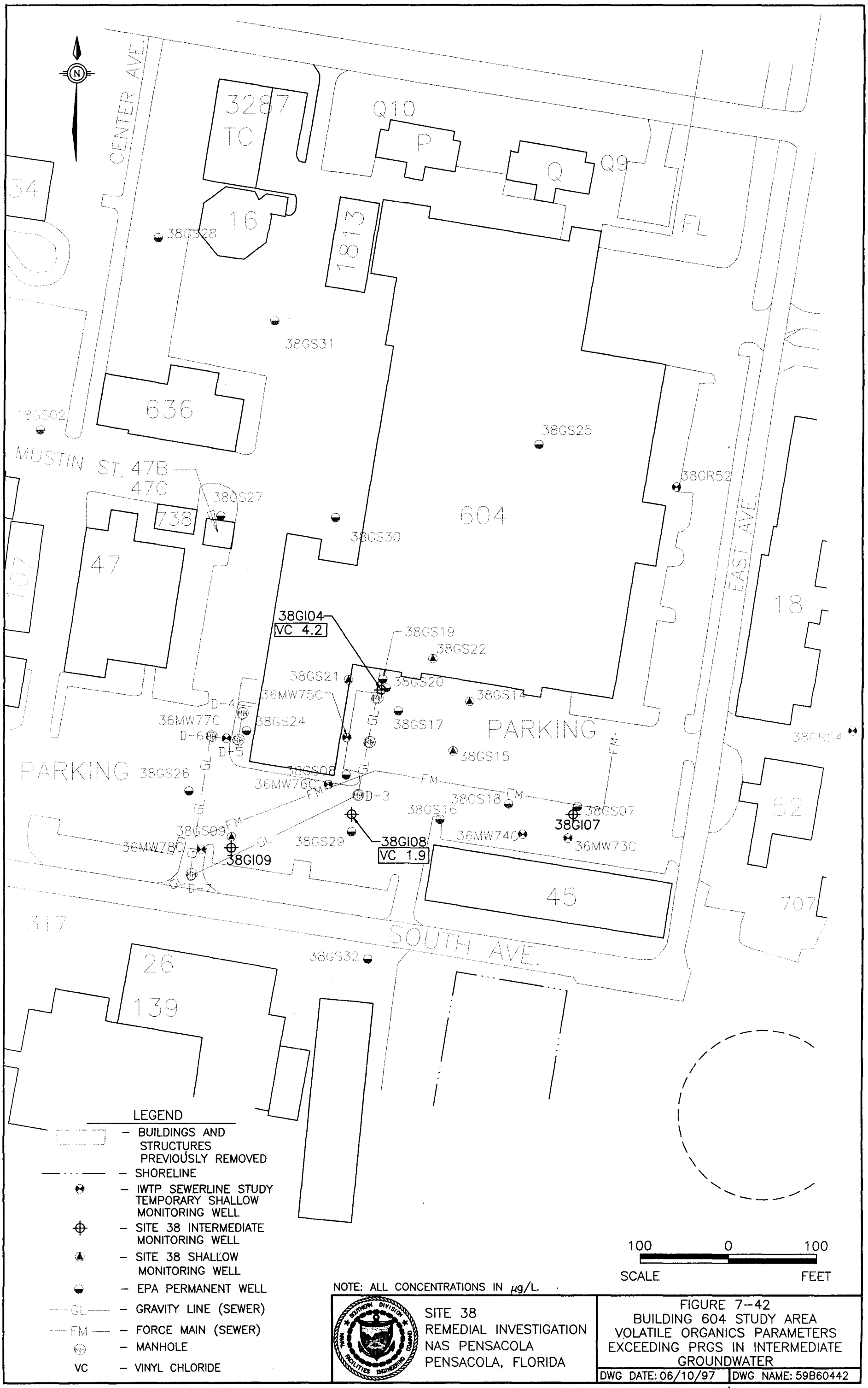
CENTER AVE.
3287
TC
Q10
P
Q
Q9
FL
34
16
38GS28
1813
38GS31
636
38GS02
38GS25
MUSTIN ST.
47B
47C
738
38GS27
38GR52
604
38GS30
47
107
EAST AVE.
18
38GI04
VC 4.2
38GS19
38GS22
38GS21
38GS20
38GS14
36MW75C
D-4
36MW77C
38GS24
38GS17
PARKING
D-6
D-5
38GS15
38GR54
PARKING
38GS26
38GS08
36MW76C
D-3
38GS18
38GS16
38GS07
38GI07
52
38GS09
38GS29
38GI08
VC 1.9
36MW74C
36MW73C
36MW78C
38GI09
D-7
45
707
417
SOUTH AVE.
38GS32
26
139
LEGEND
– BUILDINGS AND STRUCTURES PREVIOUSLY REMOVED
– SHORELINE
– IWTP SEWERLINE STUDY TEMPORARY SHALLOW MONITORING WELL
– SITE 38 INTERMEDIATE MONITORING WELL
– SITE 38 SHALLOW MONITORING WELL
– EPA PERMANENT WELL
GL – GRAVITY LINE (SEWER)
FM – FORCE MAIN (SEWER)
MH – MANHOLE
VC – VINYL CHLORIDE
100 0 100
SCALE FEET
NOTE: ALL CONCENTRATIONS IN µg/L.
SITE 38
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 7-42
BUILDING 604 STUDY AREA
VOLATILE ORGANICS PARAMETERS
EXCEEDING PRGS IN INTERMEDIATE
GROUNDWATER
DWG DATE: 06/10/97
DWG NAME: 59B60442

exceedances was consistent with exceedances in shallow groundwater. Sodium concentrations also exceeded the RC, however, this is most likely due to intrusion of saltwater from the bay.

Inorganics, SVOCs, and VOCs were also detected in the shallow groundwater in the Building 604 study area. Aluminum, iron, manganese, and lead were again fairly ubiquitous across the site at concentrations exceeding the PRGs; however, many of these exceedances were below their respective RCs. Heavy metals, including cadmium and chromium, were detected above PRGs surrounding the former plating shop and are likely a result of past plating operations. Naphthalene was detected above the PRG in the area and downgradient of the former solvent tank. Several PAHs also exceeded the PRG in the sample from well 36MW77C. This well is adjacent to the IWTP line. No exceedances were noted in surrounding and/or downgradient wells. Several halogenated aliphatic hydrocarbons, including tetrachloroethene, TCE, and vinyl chloride, were detected above the PRG. The area most highly impacted was in the vicinity of the former solvent UST east of the former plating shop. Total VOC concentrations reached a maximum of 4,324 μg/L in the sample from well 38GS17. VOC concentrations appeared to diminish in samples farther downgradient to the south and east. Two other areas where VOCs exceedances occurred were at a temporary well adjacent to Building 636 and north of the Port Operations, Building 38. Tetrachloroethene was detected in a well east of Building 636, a former dry cleaning facility. This dry cleaning operation may likely be the source of the tetrachloroethene. No surrounding wells had detections above the PRG. The other VOC detection was in a well north of Building 38. This well is adjacent to the storm drain system leading from Building 604. Historically, solvent and metal waste were discharged through this system to the bay. Possible leaks to this system may be responsible for the detections of chlorinated solvents in this well. In general, contamination in the Building 604 study areas centers around the former plating shop and former solvent UST areas and in downgradient areas to the southeast. Notably, contaminants were not detected in the temporary wells near the seawall downgradient of the site.

Contaminants detected above a PRG and/or RC in the intermediate groundwater were aluminum, cadmium, chromium, and vinyl chloride. These exceedances were consistent with those in the shallow zone. The maximum concentration detected in the intermediate zone was 4.2 μg/L.

Generally, the investigation of soil and groundwater at Site 38 has adequately assessed the nature and extent of contamination at Site 38.

7.3 Shoreline Groundwater Compared to Surface Water Criteria

Recently, FDEP has requested a comparison of groundwater from wells directly adjacent to the shoreline to surface water criteria. The results of this comparison are presented in Table 7-1. The contaminants listed are likely to enter the marine environment due to groundwater to surface water discharge. In no way does this comparison represent the actual impact on surface water quality.

As seen in Table 7-1, seven metals and three organic compounds detected in groundwater exceed a saltwater criteria for either USEPA or FDEP. The location of these wells can be found on Figure 7-30.

Table 7-1
A Comparison of Shoreline Groundwater to Surface Water Criteria

Parameter	Sample ID	Units	Result	FDEP Saltwater Criteria	USEPA Saltwater Criteria
Aluminum	38GS13	μg/L	**2320.0**	1500	
	38GS03	μg/L	**2700.0**		
	38GI03	μg/L	895.0 J		
	38GI02	μg/L	1090.0 J		
	38GS02	μg/L	1330.0		
Beryllium	38GI03	μg/L	**1.2 J**	0.13	0.13
Cadmium	38GS13	μg/L	**11.0**	9.3	
Chromium	38GS02	μg/L	11.1	103	673000
	38GI02	μg/L	11.0 J		
	38GS03	μg/L	74.8		
	38GS13	μg/L	**184.0**		
	38GS03	μg/L	70.6		
Copper	38GS13	μg/L	**319.0**	2.9	2.9
	38GS02	μg/L	**311.0**		
	38GS03	μg/L	**45.6**		
	38GI03	μg/L	**8.5**		
	38GI02	μg/L	**12.5**		
Iron	38GS03	μg/L	**1250.0 J**	300	
	38GS02	μg/L	**7470.0**		
	38GS03	μg/L	**4930.0**		
	38GS13	μg/L	**4560.0**		
	38GI02	μg/L	**1570.0 J**		
Lead	38GS03	μg/L	**88.5**	5.6	
	38GS02	μg/L	**362.0 J**		
	38GS13	μg/L	**158.0**		
Zinc	38GS03	μg/L	**819.0**	86	
	38GS13	μg/L	**684.0**		
	38GS02	μg/L	**133.0**		

Table 7-1
A Comparison of Shoreline Groundwater to Surface Water Criteria

Parameter	Sample ID	Units	Result	FDEP Saltwater Criteria	USEPA Saltwater Criteria
Zinc (continued)	38GI03	μg/L	17.0		
	38GI02	μg/L	**142.0 J**		
bis(2-Ethylhexyl)phthalate	38GI03	μg/L	**1.0 J**	0.3	
	38GI02	μg/L	**1.0 J**		
Naphthalene	38GS02	μg/L	**44.0**	23.5	
1,1-Dichloroethane	38GS13	μg/L	**20.0**	10.8	
		μg/L	**44.0**		

Note:
J = Indicates a laboratory estimate.
Bold indicates an exceedance of the saltwater criteria.

8.0 DATA VALIDATION

Data have been validated for all field and analytical samples collected from the RI of Site 38 by E/A&H. Analytical data received from the USEPA for the 1995 phase of the investigation were accepted as validated data and are not discussed in this section. Site 38 soil was analyzed by International Technology Analytical Services (ITAS), Knoxville, Tennessee, groundwater was analyzed by NET, Cambridge Division, Bedford, Massachusetts. The soil and groundwater for the industrial waste line was analyzed by Pace Laboratories, Inc. of Hampton Beach, New Hampshire. The analytical protocols were performed in accordance with the following guidance documents:

- USEPA Contract Laboratory Program, *Statement of Work for Organic Analyses* (USEPA, 1990a).

- USEPA Contract Laboratory Program, *Statement of Work for Inorganic Analyses* (USEPA 1990b).

- Determination of hexavalent chromium in soil and aqueous samples based on Method 7196A, contained in *Test Methods for Evaluating Solid Wastes (SW-846, 3rd Edition)* (USEPA, 1986).

- NEESA Level D QA/QC guidelines as stated in: *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation and Restoration Program* (NEESA 20.2-047B) (NEESA, 1988).

Data validation was performed in accordance with the following guidance documents.

- USEPA Contract Laboratory Program, *National Functional Guidelines for Organic Data Review,* which includes the Multi-Media Multi-Concentration Organic Analysis method, and the Low Concentration Water Organic Analysis method (USEPA, 1994b).

- USEPA Contract Laboratory Program, *National Functional Guidelines for Inorganic Data Review*, (USEPA, 1994b).

Section 8.1 will discuss data validation for Site 38, likewise Section 8.2 will begin the discussion for the associated IWTP sewer line investigation.

8.1 Site 38 Data Quality

The overall quality of data received for Site 38 has been validated based on data usability and contractual satisfaction with the appropriate data qualifiers as required. Sample collection for Site 38 was performed under five Sample Delivery Groups (SDGs) for soil and two case or job numbers for groundwater samples. Batch analyses performed by NET were recorded under different job numbers and/or case numbers and not under SDGs as suggested in the Statement of Work (SOW). However, because of the laboratory's computer software, NET was able to track batches of groundwater samples and QA/QC samples comparable to SDGs by defining different case numbers for every 20 samples. All data qualifiers used in the qualification of sample results are listed and explained at the end of this section.

8.1.1 Organic Analysis

All samples were received by both laboratories in good condition and with the proper custody documents and seals intact. All method and contractual holding times were found to be within compliance with QC requirements. All laboratory Verified Time of Sample Receipt (VTSR) dates were considered in combination with sample collection dates and sample extraction and analysis dates. All extraction and analysis dates were completed within contract and QC requirements.

Volatile and semivolatile sample analyses were within QC requirements. Initial pesticide and PCB analysis of samples in SDG PN001 indicated an increase in endrin aldehyde sensitivity in the initial calibration standard INDBMRI; however, no endrin aldehyde hits were found in any of the samples above the instrument detection limit (IDL). Also, pesticide d-BHC failed QC criteria but there were no reported positive results for this compound. The second analysis yielded only endosulfan sulfate at a concentration well below the IDL. The sample data were evaluated and validated in accordance with CLP protocol. In SDG PN002, an aliquot of the extract for sample 38S1401 was lost during Gel Permeation Chromatography (GPC) cleanup that resulted in low surrogate recoveries. GPC is used as a method of cleanup for semivolatile and pesticide/PCB samples. Although, the sample was re-extracted and the acceptable surrogate recoveries were obtained, the second extraction exceeded holding times by three days and all associated positive values were qualified as estimated (J-flag).

In SDG PN003, the internal standard areas of 1,4-difluorobenzene and chlorobenzene-d5 were below QC limits in sample 38S1701. The laboratory re-analyzed the sample and both internal standards were still below QC limits. The laboratory indicated that the continued low recoveries were due to matrix effects present within the sample and that re-analysis of the sample verified that this was the principal factor. Laboratory analysis also indicated that sample 38S1703 had a low internal standard recovery for chlorobenzene-d5 due to matrix effects quite similar to those reported in sample 38S1701. The sample was also re-analyzed at a 1:2 dilution and the internal standard chlorobenzene-d5 was still below QC limits. All positive sample results associated with chlorobenzene-d5 were qualified accordingly.

In SDG PN025, only six samples were analyzed for Site 38: 38GI0801, 38GI0802, 38GI0803, 38GE1117 and field and trip blanks 58FT1117 and 38GT1117. No problems were reported during volatile, semivolatile and pesticide and PCB analysis. During volatile analysis of SDG PN026, samples 38GS0902 and 38GS0902RE had high surrogate recoveries for toluene-d8 and low

recoveries for bromofluorobenzene. In SDG PN030, several analytes failed QA/QC limits for pesticides and PCBs.

Blanks

Blanks assist in determining the presence and magnitude of any contamination resulting from the laboratory or field. All associated data were evaluated to determine whether there is an inherent variability in the data, or if the problem was an isolated occurrence and did not affect the data. The blank data associated with the investigation of Site 38 indicated various concentrations of acetone, 2-butanone and methylene chloride for volatiles and several phthalate esters for semivolatiles. These compounds are considered common laboratory artifacts and were evaluated and qualified based on the action levels found for each SDG and case data package.

Action levels are based on the highest positive sample concentration of any laboratory artifact found in each method blank(s) or QC sample above or below the Contract Required Quantitation Limit (CRQL). In other words, no positive sample result for a common laboratory artifact is reported unless the concentration of that particular artifact exceeds the action level of 10 times (10X) the amount found in any blank(s). For compounds that are not considered to be common laboratory artifacts, the action level is five times (5X) the amount found in any blank or QC sample.

Two types of blanks were created in the laboratory during preparation and sample analysis. Each sample designation was followed by a number corresponding to that blank. For example, the third volatile method blank was designated "VBLK03."

Method Blank

VBLK	=	Volatile Method Blank
SBLK	=	Semivolatile Method Blank
PBLK	=	Pesticide/PCB Method Blank

These blanks are used by the laboratory to determine the concentrations of contamination associated with the processing and analysis of samples. Method blanks are identified by the laboratory using the first letter of the analysis fraction performed followed by the abbreviation BLK for "Blank."

Instrument Blank

PIBLK	=	Pesticide/PCB Instrument Blank

An instrument blank is used by the laboratory to determine if any contamination is present before, during or after pesticide/PCB sample analysis that can be attributed to the gas chromatography instrumentation.

During data validation procedures for SDGs PN001, the common volatile laboratory artifacts methylene chloride, acetone, and 2-butanone were identified above the CRQL in the associated method blanks, trip blanks and field blanks. Field blanks were defined as de-ionized (DI) water system blanks and associated potable water blanks. The trip blanks, potable water blanks, field equipment rinsates, and DI system blanks contained 2-propanol at concentrations between 1 and 10 parts per billion (ppb). Although this analyte is not considered a target compound or common laboratory artifact, it was used extensively during decontamination as required by USEPA procedures. Therefore, to remove 2-propanol as a site contaminant, action levels were calculated using the 5X criteria for blank contamination, and all associated positive sample results for 2-propanol were qualified accordingly.

The target compound xylene was also found in method blanks VBLK2Q, VBLK3Q and VBLK4Q in SDG PN001. Method blank contamination is indicative of laboratory contamination introduced during sample handling, preparation and/or analysis, therefore all positive results for xylene were qualified according to the 5X action level calculated for target analytes not considered to be common laboratory artifacts.

The trip blank associated with SDG PN003 contained a low concentration of the target compound toluene. All associated positive sample results were qualified accordingly. In case FD1086, the volatile compounds methylene chloride, acetone, 2-hexanone, chloromethane and 1,1,2,2-tetrachloroethane were present at various concentrations in blanks VBLK11194L, VBLK012294M, VBLK011394L, VBLK011394K, and VBLK011494G. The semivolatile compound bis(2-ethylhexyl)phthalate was detected in method blank SBLK010794F at a concentration of 1 μg/L. Action levels for each compound were calculated to qualify associated samples.

In SDGs PN001, PN002 and PN003, common semivolatile laboratory artifacts bis(2-ethylhexyl)phthalate, butylbenzylphthalate, diethylphthalate, and di-n-butylphthalate were present at low concentrations in the method blanks and in several samples. In SDG PN025, volatile analysis indicated high concentrations of acetone and 2-butanone in several samples. These samples were diluted and re-analyzed; all associated positive sample results were qualified accordingly.

In SDG PN030, methylene chloride and acetone were reported at concentrations ranging from 1 to 380 ppb in the samples, with the acetone concentrations being the higher of the two. In the volatile method blanks, methylene chloride was the most prevalent compound. Indicating that methylene chloride was present within the atmosphere in and around the sample analysis instrumentation and location. However, site history reveals the use of methylene chloride on site

as a paint stripper. Methylene chloride results are suspect and have been qualified in accordance with CLP guidance.

In SDG PN030, several semivolatile phthalate esters were reported in samples 38S3001, 38S3301, 38S3302, 34S3402, and 38SD3101. The values reported for these phthalate esters were below the action levels calculated for semivolatile blank contaminants; therefore, action levels were calculated and all associated positive sample results were qualified accordingly.

During pesticide/PCB analysis, the laboratory reported low concentrations of various pesticides/PCBs in the method blanks of several organic SDGs. For instance, in SDG PN001, the method blanks PBLK13 and PBLK14 each contained low concentrations of the target analyte heptachlor, while method blank PBLK61 had a low concentration of 4,4'-DDT contamination. A low concentration of methoxychlor contamination was detected in the instrument blank PIBLKL2. There was no contamination present in SDG PN030. Since no target pesticide and PCB analyte is considered to be a common laboratory artifact, E/A&H believes that the associated QA/QC blank sample contamination was introduced by ITAS and NET at the time of sample handling, preparation, dilution and sample analysis. Therefore, action levels were calculated based on analyte concentrations indicated for each sample data package and all associated sample results were qualified accordingly.

In conclusion, the data for samples and quality control samples were evaluated concluding all frequencies and compliance requirements were found to be satisfactory. E/A&H believes that these common laboratory artifacts and other blank contaminants are partially, if not all, a result of laboratory conditions at the time of sample analysis. No conclusions or recommendations for Site 38 at NAS Pensacola are based on laboratory artifacts or suspect data.

Tentatively Identified Compounds

Nontarget compounds identified during volatile and semivolatile analysis are labeled as *Tentatively Identified Compounds* (TICs). In the volatile analysis for SDG PN001, the laboratory characterized several TICs in nearly all of the volatile samples as common laboratory artifacts; however, other TICs were labeled as alcohols, ketones, aldehydes, 2-propanol, substituted and unsubstituted hydrocarbons, and unknowns.

In SDG PN001, volatile TICs were characterized as either a laboratory artifact or related to decontamination, specifically 2-propanol. Xylene and 2-propanol were detected in several method blanks including VBLK1QA and VBLK2Q. TICs present in many of the samples for SDG PN002 could be characterized as laboratory artifacts or related to the use of 2-propanol as a decontamination solvent. Several samples for SDG PN030 contained only one TIC. Since the spectrum of these TICs indicated the presence of methylene chloride, acetone, 2-butanone and an unknown, the TICs were identified as an unknown and TCL analytes. Since these compounds are known laboratory artifacts, all associated samples were qualified based on calculated action levels.

TICs found in all the samples for SDG PN001 could be characterized as unknowns, laboratory artifacts, ketones, aldol condensation reaction products, and blank contaminants; however, they were not considered to be sample constituents. TICs found in the volatile samples for SDG PN003 were identified as laboratory artifacts, blank contaminants, derivatives of benzene, 2-propanol and unknowns while TICs reported for semivolatiles were characterized as blank contaminants, laboratory artifacts, aldols, siloxanes, phthalate esters, polyaromatic hydrocarbons, hydrocarbons, alcohol derivatives and unknowns. These TICs represent compound fragments indicative of a matrix interference present in the sample.

In SDG PN025, no volatile TICs were reported for any of the samples analyzed and all TICs reported for semivolatile analysis were characterized as unknowns, hydrocarbons, ketones, and

chlorinated cyclic hydrocarbons. TICs found in all the samples for SDG PN026 for volatile analysis were identified as unknowns, hydrocarbons, and laboratory artifacts. Semivolatile analysis of the TICs in SDG PN026 were characterized as unknowns, hydrocarbons, ketones, derivatives of benzene, alcohols, aldehydes, and laboratory artifacts. Many of the unknown compounds identified as TICs were reported at high concentrations, resulting in elevated quantitation levels for several samples. However, this is a common consequence of matrix effects due to compounds that are not target compounds. TICs found in SDG PN030 were characterized as unknowns, ketones, cyclic hydrocarbons, unknown alkanes, and alcohols.

8.1.1.1 Calibration

Requirements for instrument calibration were established to ensure that the data provided are acceptable qualitatively and quantitatively. The initial calibration measures the instrument's stability which gives an indication of its sensitivity and capabilities prior to the analytical run. The continuing calibration indicates the instrument's performance throughout and at the end of each subsequent analytical run. Historical performance data indicate poor response or erratic behavior by compounds known to be common laboratory artifacts. Since no contractual criteria for these compounds exists, for review and data validation purposes, all compounds including the common laboratory artifacts were considered for qualification when the following criteria were met.

- Initial/continuing calibration standard relative response factors (RRFs) for all target compounds and surrogates less than 0.05.

- Percent relative standard deviation (%RSD) less than $\pm$ 30 percent in the initial calibration.

- Percent difference (%D) not exceeding $\pm$ 25 percent in the continuing calibration.

Several volatile compounds, including methylene chloride, acetone and 2-butanone, consistently failed %RSD criteria during the initial calibration analysis for almost every organic SDG. Also, acetone, 2-butanone, 2-hexanone, chloromethane, 1,2-dichloroethane and the surrogate 1,2-dichloroethane-d5 each failed %D criteria during the continuing calibration analysis for several SDGs. However, the RRFs for each compound mentioned above were within CLP QC criteria.

In the case of semivolatile analysis, the compounds 2,2'-oxybis(1-chloropropane), 2-nitroaniline, di-n-octylphthalate, bis(2-ethylhexyl)phthalate, hexachlorobutadiene and the surrogate 2,4,6-tribromophenol failed %D criteria because of poor response and frequent intervals of erratic behavior. Although, this was a systematic occurrence, these poor responders represent the large majority of compounds which failed both %D and %RSD in nearly each SDG. The %RSD was greater than 30 percent, and elimination of either the high point or low point on the initial calibration curve and if recalculation of the %RSD value did not restore the %RSD result to a value less than or equal to 30 percent, all associated positive sample results outside the linear portion of the initial calibration curve were qualified with a J flag as estimated. However, if this action did restore the %RSD result to a value below 30 percent, no action was deemed necessary in accordance with CLP.

8.1.1.2 Precision

In each analytical method used to analyze environmental samples, there are variations in the reported results that may be due to the random differences in the handling and analysis of that matrix. These variations are referred to as the *precision* or the *reproducibility of results*. To demonstrate reproducibility, the CLP SOW specifies the addition of known quantities of several compounds to two separate aliquots of each sample matrix type. The "spiked" aliquots are referred to as the MS and the MSD. These samples can then be analyzed by applying the same preparation techniques and analytical methods used for all the samples of similar matrix types. This enables the MS and MSD to be used to detect matrix effects caused by contaminants during

sample analysis that interfere with the compounds of interest that may also be present within the sample.

ITAS indicated that matrix interferences were encountered during volatile analysis of sample 38GI0101 MS and MSD in SDG PN001 which caused the internal standard area for chlorobenzene-d5 to be low for this sample, but within QC limits for the original sample analysis. Therefore, data validation procedures of sample 38GI0101 resulted in all positive results for the initial volatile analysis being qualified as estimated (J-flag). Also, the laboratory indicated that surrogate recoveries were not met in the initial pesticide and PCBs analysis for samples due to possible extraction problems.

MS/MSD results in SDG PN001 for volatiles and semivolatiles were within QC criteria. However, the pesticide compounds heptachlor, aldrin and dieldrin in the MSD exhibited high relative percent difference (RPD) that were attributed to matrix interferences generally experienced by less efficient spike recoveries during extraction and analysis of spiked soil samples. Semivolatile analysis for SDG PN003, indicated a very low recovery for the compound pentachlorophenol in both the MS and MSD. The laboratory indicated that the very low recovery was due to matrix interferences within sample 38S1803. Also, the recovery of the spiked target compound (phenol) was above the advisory QC limits for the MSD and eight of the compounds were outside advisory QC limits. In SDG PN025, MS/MSD analysis of 2,4-dinitrotoluene was reported high and outside QA/QC criteria.

In SDG PN026, volatile analysis of the MSD indicated a very high recovery for toluene in sample 38GS0901. This was the only compound reported outside QC limits in the MS and/or MSD within this SDG. In SDG PN030, volatile and semivolatile MS/MSD compounds were within QC criteria. Pesticide compounds g-BHC (Lindane), dieldrin, and endrin were reported outside QC limits for the MS during sample analysis and the percent recovery for g-BHC and endrin in the

MSD were also outside QC criteria. The RPD for dieldrin was outside QC limits due to the low spike recoveries. In case FD1086, volatile sample 38GI01 was spiked and all the associated QA/QC protocol was within control limits. The spiking data for semivolatile sample analysis indicated that analytes 4-nitrophenol, pentachlorophenol, and pyrene showed high recovery limits and pesticide/PCB spiking data indicated that only 4,4-DDT was outside QA/QC criteria. All associated positive sample results were qualified accordingly using informed professional judgement since CLP protocols concerning MS/MSD data are advisory only.

E/A&H believes that the MS/MSD results indicate the effect of sample matrix on the associated sample data, including the MS/MSD samples themselves. This can be acknowledged by consistent high percent recoveries when deionized water is analyzed and the inconsistent percent recoveries and RPD reported when soil samples are analyzed. As a general rule, no action is taken on MS/MSD data alone. However, the MS and MSD results are used in conjunction with other QC criteria such as surrogate recoveries, internal standard area QC requirements and the comparison of RSD results of non-spiked compounds between the original sample result, MS, and MSD to determine the need to qualify some of the associated sample results as estimated.

8.1.1.3 Accuracy

Accuracy is the degree to which a given result agrees with the *true* value. To check the accuracy in a volatile, semivolatile, pesticide and/or PCB analysis, the CLP SOW requires the addition of known amounts of *surrogate compounds* or compounds which are not likely to be found in the actual samples. If, upon analysis of the sample, the percent recovered for the surrogate compounds are accurate, that is close to the known concentrations as defined within the limits set by the CLP, the reported target compound concentrations are assumed to be accurate. Also, the accuracy of the overall measurement system indicates any bias in the environmental laboratory and/or in the field sampling/analysis plan. Possible sources of error may include the sampling process, field and/or laboratory contamination, preservation, and handling, or the sample matrix

itself. Other methods used to determine field inaccuracies include trip blanks and the preparation and analysis of field blanks and equipment rinsate blanks.

Analysis of volatile sample 38S1403 in SDG PN002 indicated a high recovery for the surrogate bromofluorobenzene that could be attributed to matrix effects. Also, in SDG PN001, semivolatile surrogate spike analysis of sample 38S1103 indicated a very low recovery for 2-fluorophenol.

In SDG #PN001, pesticide/PCB surrogate recovery criteria for decachlorobiphenyl (DCB) was not met for the method blank PBLK1, PBLK2, PBLK4 and samples 38RB0728, 38GI0101, 38GI0102, 38GI0103, 38GI0401, 38GI0402, 38S0301, 38S0302, 38S0303, 38S0501, 38S0502, 38S0503, 38S1303, 38GI0102MS, 38GI0102MSD and 38S1201 on both the primary and confirmation columns. Also, the sample 38S1201 failed advisory QC limits for tetrachloro-xylene (TCX) on the confirmation column only. Pesticide samples 38S1202, 38S1203, and 38S1301 failed surrogate recovery for TCX on the confirmation column and sample 38S1302 failed surrogate recovery for TCX on the confirmation column. Although CLP QC limits are advisory and no action is provided for samples with failing surrogate recoveries, all associated pesticide/PCB analytical data within this SDG are believed to be reliable and usable with the appropriate data qualifiers.

In SDG PN003, the laboratory analyzed samples 38S1603, 38S1701, 38S1703, 38S1901, 38S1902, 38S2201, 38S2202, 38S1602D, and 38S1603D at a 1:2 dilution factor and samples 38S1601, 38S1602, 38S1801, 38S1802 and 38S1803 at a 1:5 dilution factor. The laboratory indicated that these dilutions were based on sample extract appearance. The surrogate recovery for 2,4,6-tribromophenol was also outside QC limits for sample 38S1803. Therefore, all associated positive sample results were qualified accordingly.

For SDG PN003, samples 38FB0803, LCS1, and method blank PBLK1 failed DCB surrogate recovery on both the primary and confirmation columns. In addition, sample 38S1701 failed surrogate recovery for DCB and TCX on both the primary and confirmation columns. Pesticide/PCB analysis of samples 38S1602, 38S1602D, 38S1703, 38S1803, and 38S1803DL each failed surrogate recovery for DCB and/or TCX on either the primary and/or confirmation columns and sample 38S1601MSD failed surrogate recovery for DCB on the confirmation column. In SDG PN025, sample 38GE1117 reported a low recovery for DCB on the primary column.

Volatile sample analysis of SDG PN026 indicated that surrogates toluene-d8 and bromofluorobenzene were outside QC limits for samples 38GS0902 and 38GS0902RE. Semivolatile analysis indicated that surrogate 1,2-dichlorobenzene-d4 was not within QC criteria for sample 38GS0902. In the pesticide/PCB fraction, method blank PBLK4 failed surrogate recovery for DCB on the primary column and method blank PBLK6 failed surrogate analysis for TCX on the primary column. Also, sample 38GS0903 failed surrogate recovery for DCB on the confirmation column during analysis.

In SDG PN030, all surrogates were within QC criteria in the volatile and semivolatile analysis. However, during pesticide and PCB analysis of samples, 38SE1207 failed surrogate recovery for DCB on both the primary and confirmation columns. Sample 38SD3301 failed TCX and DCB on both the primary and confirmation columns and sample 38S3402 failed surrogate recovery for DCB on the primary column only.

All positive sample results for volatile and semivolatile sample analysis were qualified based on CLP protocol for samples with low and/or unusually high surrogate recoveries; however, all associated sample results were qualified using informed professional judgement since CLP QC limits for pesticide/PCB surrogates are advisory only.

All volatile surrogate recoveries were within QA/QC criteria in case FD1086. In semivolatile analysis, samples 38GI01D, 38GI02, 38GI03, 38GI04, 38GI07, 38GI09, 38GS05, 38GS13DL, and 38GI01MS failed QA/QC recovery for surrogate terphenyl-d14. Pesticide analysis indicated percent recoveries for DCB on both the primary and the confirmation column outside QA/QC control limits for the following: PBLK20110AA, 38GI01, 38GI01D, 38GI07, 38GI08, 38GI09, 38GS06, 38GS13, and PCB0107A1 . Pesticide samples 38GI03, 38GI04, 38GS05 and 38GS13 failed surrogate recovery for TCX and DCB on both the primary and confirmation columns.

However, the pesticide/PCB analytical data within each SDG were determined to be reliable and usable with the appropriate data qualifiers based on the evaluation of all associated QC such as surrogates, initial and continuing calibrations, retention time criteria and %D and %RSD criteria since CLP QC limits are advisory and no action is provided for samples with failing surrogate recoveries.

8.1.1.4 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristic of a population, parameter variations at a sampling point, or an environmental condition. The duplicate samples assist in indicating overall field and laboratory precision. A greater variance should be expected for the soil sample duplicates compared to water sample duplicates due to the differences in matrix. In all cases, the duplicate results closely agreed with the original results since most variations are due mainly to common laboratory artifacts.

8.1.1.5 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid. There were 151 samples initially analyzed for the investigation of Site 38 and all of the sample results were determined to be valid with some qualification. Therefore, the data meet the 90 percent completeness level.

8.1.1.6 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. All samples for Site 38 were collected using the EPA Region IV SOPs and analyzed according to CLP SOW protocol.

8.1.2 Inorganic Analysis

The analytical methods were performed in accordance with the EPA CLP *SOW for Inorganic Analyses* guidelines (USEPA 1990b). For hexavalent chromium analysis the laboratory employed Method 7196A contained in *Test Methods for Evaluating Solid Wastes, SW-846, 3rd Edition.* Results were reported according to CLP format outlined including forms, but not limited to, those listed under NEESA Level D guidelines.

8.1.2.1 Holding Times

All samples were received by the laboratory in good condition with the proper custody documents and seals intact. From the date of collection to the date of sample digestion and preparation, sample holding times were found to be within method and contractual requirements.

8.1.2.2 Calibration

The purpose of the initial and continuing calibration is to ensure that the instrument is capable of acceptable and quantitative performance at the beginning of each analytical run and throughout. Initial and continuing calibrations were performed for the analysis of inorganics within the criteria established by the EPA CLP Inorganics SOW.

8.1.2.3 Blanks

Blank results are used to determine the presence and magnitude of any contamination problems. After reviewing the data, it was determined that the preparation blank and/or calibration blanks in SDG PN003 contained low concentrations of aluminum, iron and sodium at or above the

instrument detection limit. The preparation blank indicated low concentrations of calcium, zinc and beryllium. In SDG PN025, magnesium was found in the initial, continuing and preparation blanks at concentrations ranging 30 ppb to 70 ppb. Low concentrations of zinc were also reported as required under CLP QC guidelines. All associated sample results were qualified based on the calculated action levels determined from the concentrations of blank contaminants found in each SDG. In SDG PN026, calcium was found in the continuing calibration blank and iron, magnesium, and zinc was found in the preparation blank at concentrations ranging from 50 ppb to 100 ppb.

Antimony was the only analyte found in the initial calibration blank in SDG PN030. All other calibration blanks and preparation blanks indicated no other analyte contamination. Although antimony was reported as a contaminant in one blank, it was also reported with a low spike recovery; therefore, all associated sample results were qualified according to CLP protocol.

8.1.2.4 ICP Interference Check Sample Analyses

The inductively coupled plasma Interference Check Sample analysis (ICS) is performed to check the laboratory's instrument and the background correction factors. The ICS was analyzed without any indication of interferences. Analysis of the ICS also met QC compliance criteria and requirements as stated under CLP.

8.1.3 Other Control Samples

Control samples monitor overall efficiency during analysis. For inorganic analysis, the types of control samples used are laboratory control samples, duplicates, and spikes samples.

8.1.3.1 Laboratory Control Sample Analyses

The Laboratory Control Sample analysis (LCS) is designed to monitor of efficiency of the overall performances in all steps of analysis, including the digestion procedures. LCS analyses and results were found to be within QC compliance criteria and requirements.

8.1.3.2 Duplicate/Spike

Duplicate samples are used to determine the precision of analytical methods for each parameter. The spiked samples are designed to provide information about the effects of the sample matrix on the digestion and measurement methodology. In SDG PN003, sample 38S1601 was used to prepare the duplicate and spike pair. Spike recovery results were within acceptance limits for all analyses, except for selenium by graphite furnace; however there were no positive results for selenium in any samples. Also, aluminum and iron concentrations were greater than four times the spike added; therefore, spiking criteria did not apply to these analytes.

Several types of interference effects may contribute to inaccuracies in the determination of trace elements. Two of the most common types of spectral interferences are overlap of a spectral line from another element and background contribution from stray light from the line emission of high concentration elements. Therefore, Site 38 sample analysis indicated various concentrations of sodium, calcium, iron and vanadium in most of the samples. Therefore depending on the concentration, these analytes can interfere with the spike recoveries of such elements as arsenic, aluminum, selenium, copper, magnesium, and chromium.

In SDG PN025, all spiked analytes and duplicate analysis were within QC limits. In SDG PN026, spike sample recovery for mercury was above 129 percent and in SDG PN030, the analytes aluminum, chromium, lead, and manganese were reported outside QC limits for duplicate recoveries and the analytes antimony, selenium and cyanide each had spike recoveries below

71 percent; therefore, all associated sample results were qualified according to CLP QC guidelines as estimated values.

8.1.4 Validation Worksheets

As with every EnSafe/Allen & Hoshall validation project, worksheets are used which detail the evaluation of analytical data. On certain sheets, the validation procedures will be equivalent to the Standard Operating Procedures provided by the CLP *National Functional Guidelines for Organic and Inorganic Data Review.* Other sections will cover areas which are more subjective due to the complexities of the analytical methods and will only provide documentation on the actions taken by the data evaluator. The worksheets will be provided upon request or otherwise will become a part of the NAS Pensacola Site 38-*Final Report Reference File.*

8.1.5 Data Assessment

The trip blanks, potable water blanks and DI system blanks contained several volatile target compounds which were detected by the laboratory as contamination introduced during preparation, handling and/or analysis of the samples. These analytes include toluene, dibromochloromethane, chloroform, bromodichloromethane, bromoform, and carbon disulfide. Also, analysis of semivolatile method blanks, equipment rinsate blanks and potable water blanks indicated low concentrations of bis(2-ethylhexyl)phthalate, butylbenzylphthalate, diethylphthalate, and di-n-butylphthalate contamination in several SDGs and cases. Action levels were calculated for each compound and all associated sample results were qualified as required under CLP protocol.

The analytes arsenic, cyanide, and thallium in samples 38GI01D and 38GI02, and arsenic, lead, selenium, silver, and thallium in samples 38SE1201, 38SE1202, and 38SE1207 were qualified as estimated at the detection limit.

Several metals failed duplicate and/or spike recoveries during inorganic analysis. However, the most evident were arsenic, potassium and selenium which showed very low spike recoveries in SDG PN025. Cyanide exhibited poor recoveries in Case FD1086. As indicated earlier, the poor recoveries of some of these analytes may be attributed to interference caused by the high calcium, iron and/or vanadium content in the samples and in some blanks.

In conclusion, the overall data quality of the analytical work done for Site 38 at NAS Pensacola, except for those sample results that were qualified as unusable, were considered to be satisfactory and usable for site remediation and risk assessment.

8.2 Associated IWTP Sewer Line Investigation — February 1993

In support of a jet fuel line to be installed north of Building 71 and along a portion of the IWTP sewer line, E/A&H completed fieldwork in February 1993 describing soil and groundwater contamination in this area. Because of the proximity to Building 71 and the connection between Building 71 and the IWTP sewer line, these data sets are presented together. The IWTP sewer line is currently named Site 36, although this is not a complete study of the entire IWTP sewer line.

8.2.1 Data Validation

Data validation has been performed for all field and analytical data collected from the investigation to support construction on Site 36 at NAS Pensacola. The analytical work was conducted by Pace Inc., Hampton, New Hampshire.

8.2.2 Data Quality

The overall quality of work for Site 36 at NAS Pensacola has been deemed satisfactory and all data are acceptable and usable with the appropriate data qualifiers. Sample collection at NAS Pensacola Site 36 was performed and reported under 12 separate SDGs.

8.2.3 Organic Analysis

Each SDG was received by the laboratory in good condition with the proper custody documents and seals intact. The contractual holding times from the VTSR until the time of sample extraction and/or analysis were found to be within compliance with contract requirements.

8.2.3.1 Calibration

Criteria for instrument calibration were established to ensure the production of acceptable qualitative and quantitative data. The initial calibration ensures the instrument's capabilities prior to the analytical run and the continuing calibration ensures the instrument's capabilities throughout each subsequent analytical run. Based on historical performance data, certain volatile and semivolatile compounds (also called "poor responders"), show an indication of poor response and/or erratic behavior. Therefore, no contractual criteria are provided for these compounds. For review and validation purposes, however, all compounds, including these "poor responders," were considered for qualification when the following criteria were <u>not</u> met.

- Initial/continuing calibration standard RRFs for all target compounds and surrogates must be equal to or greater than 0.05.

- %RSD must not exceed $\pm$ 30% in the initial calibration.

- %D not to exceed $\pm$ 25 percent in the continuing calibration.

Among these volatile "poor responders" are acetone, methylene chloride and 2-butanone and among the semivolatile "poor responders" are the phthalate ester compounds. Acetone and 2-butanone were found to be consistently outside the percent difference criteria for the continuing calibration in the volatile analysis.

8.2.3.2 Precision

For each analytical method used to analyze environmental samples, there are variations in the reported results that may be due to the random differences in the handling and analysis of that matrix. These variations are referred to as the precision or the reproduceability of results. To demonstrate reproduceability, the CLP SOW specifies the addition of known quantities of several compounds to two separate aliquots of each sample matrix type. The "spiked" aliquots are referred to as the MS and the MSD. These samples are then analyzed using the same preparation and analytical methods used for all the samples of similar matrix types. These samples can be used to detect matrix effects in which other sample components interfere with the analysis of the contaminants.

MS/MSD results were found generally to be satisfactory in all analytical data packages, with the exception of the pesticide analysis in SDG 36GT1. The sample designated as the MS/MSD was 36GR76C. Due to a technician error, no spiking compounds were added to the sample, but instead surrogate compounds were detected at two times the normal concentrations. Reanalysis could not be performed due to the expired holding time for extraction. As a result of the error, the MS/MSDs were decided to be unusable. However, the analytical data within this SDG is not suspected to have been affected and with the evaluation of other QC results, the method's precision and accuracy was assumed to be acceptable.

8.2.3.3 Accuracy

Accuracy is the degree to which a given result agrees with the "true" value. To check the accuracy in a volatile, semivolatile, pesticide and/or PCB analysis, the CLP SOW requires the addition of known amounts of "surrogate compounds" (compounds which are not likely to be found in the actual samples). If upon analysis of the sample, the percent recovered for the surrogate compounds are accurate (i.e., close to the known concentrations) as defined within the

limits set by the CLP, then the reported target compound concentrations are assumed to be accurate.

The accuracy of the overall measurement system is an indication of any bias that exists in the environmental laboratory and in the field sampling/analysis plan. Possible sources of error may be from the sampling process, field and/or laboratory contamination, preservation, handling and/or from the sample matrix itself. Methods used to determine field inaccuracies include the trip blanks and the preparation of the field blanks and equipment rinsate blanks.

Blanks assist in determining the existence and the magnitude of any contamination resulting from the laboratory or field. If problems are found in any of the blanks, all associated data are evaluated to determine whether there is an inherent variability in the data, or if the problem is an isolated occurrence and does not affect the data. The blanks consist of the trip blanks, equipment rinsate blanks, field blanks and the laboratory's method blanks.

Common laboratory-derived contaminants are handled within the laboratory by qualifying all associated samples with the same contaminants with a B-flag. The B-flag is applied to those contaminants which are also found in the associated blanks.

The data validation procedures also evaluate the contaminants further by determining the possible sources using other QC samples and information in which the laboratory do not typically have access. The actions regarding any positive sample concentrations less than or equal to 10 times (10x) the amount detected in the associated blank(s) for common laboratory contaminants, or 5 times (5x) the amount detected in the blank(s) for other contaminant types, require the elevation of the quantitation limit to the action level. The action level is the actual number as a result of multiplying 10 (or 5) to the blank compound concentration.

In evaluating the data provided by these QC samples, all frequencies and compliance requirements were found to be satisfactory. In most cases, the blank contamination were considered to be the common laboratory artifacts (e.g., methylene chloride, acetone, 2-butanone and phthalate esters).

Due to analytical scheduling problems, certain pesticide/PCB samples were extracted at the New Hampshire laboratory but analyzed at the Pace-Minnesota laboratory. The affect of the QC samples to the associated samples were not considered to render them ineffective, however, some judgement was used to adequately qualify the data.

8.2.3.4 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristic of a population, parameter variations at a sampling point, or an environmental condition. The duplicate samples assist in giving an indication of overall (i.e., field and laboratory) precision. A greater variance should be expected for the soil sample duplicates compared to water sample duplicates due to the matrix differences.

In most cases, the duplicate results were found to be in agreement with original results, with the exception of samples 36S77N02 and 36S77N02D. The laboratory had reported visual dissimilarities between the two samples. Sample 36S77N02 appeared brown and contained quantities of rocks with some sediment, while sample 36S77N02D appeared reddish in color and had a granular sandy texture. Discussion with the project geologist indicated that duplicates were not easily obtainable due to an asphalt base with an underlying rocky bed. Since sample 36S77NO2 was found to have contained little sediment due to the asphalt and rocky layers, sample 3677N02D is believed to be more representative of the soil beneath this asphalt base.

8.2.3.5 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid measurements. In all 76 samples analyzed for Site 36 and only two sample results were determined to be invalid. Hence, the data satisfactorily meets the 95 percent completeness level.

8.2.3.6 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. All the samples were collected using the EPA Region IV SOPs and analyzed according to CLP protocol.

8.2.4 Inorganic Analysis

The analytical methods were performed in accordance with the EPA CLP SOW for Inorganic Analyses guidelines (USEPA 1990b). Results were reported according to CLP format outlined including forms, but not limited to, those listed under NEESA LEVEL D guidelines.

8.2.4.1 Holding Times

Each SDG was received by the laboratory in good condition with the proper custody documents and seals intact. From the date of collection to the date of sample digestion/preparation, sample holding times were found to be within contractual requirements.

8.2.4.2 Calibration

The purpose of the initial and continuing calibration is to ensure that the instrument is capable of acceptable and quantitative performance at the beginning and throughout each analytical run. Initial and continuing calibrations were performed for the inorganics analysis within the criteria established by the EPA CLP Inorganics SOW.

8.2.4.3 Blanks

Blank results are used to determine the presence and magnitude of any contamination problems. In review of the data, action regarding the blank results were not found to have been required, since no detected quantities of contamination was found. Analysis of the blanks were also found to meet compliance requirements as required under the CLP.

8.2.4.4 Interference Check Sample Analyses

The inductively coupled plasma ICS analyses are performed to check the laboratory's instrument and the background correction factors. The ICS was found to have been analyzed without any indication of interferences. Analysis of the ICS was also found to satisfactorily meet the compliance requirements as stated under the CLP.

8.2.4.5 Laboratory Control Sample Analyses

The LCS analyses is designed to serve as a monitor of efficiency of the overall performances in all steps of analysis, including the digestion procedures. Laboratory control sample analyses and results were low for aluminum, iron, thallium and vanadium in SDG M36S31 AND M36SPO. As a result of the low findings, sample results of these metals in the associated SDGs were qualified with the appropriate "J" flag.

8.2.4.6 Duplicate/Spike

Duplicate samples are used to determine the precision of analytical methods for each parameter. The spiked samples are designed to provide information about the effects of the sample matrix on the digestion and measurement methodology. The matrix spike recovery and inductively coupled plasma serial dilutions for several metals were found to be consistently outside QC criteria. Due to the severity of the low MS/MSD recoveries found in the analysis of selenium and chromium in SDG M36GT1, sample data associated with these metals within SDG M36GT1 were qualified

with the appropriate "J" flag. [**Note:** The letter "M" in the SDG #M36GT1 indicates the inorganic fraction of the data set. The organic fraction SDG is designated as 36GT1.]

8.2.5 Data Assessment

Concentrations of methylene chloride and acetone were found to be relatively consistent in each SDG. In many cases, the sample detections of methylene chloride and acetone were qualified accordingly due to the sample concentrations being under the action limits. In other cases, the sample concentrations of these laboratory artifacts were detected above the calculated action limits. It is strongly believed that these compounds are partially, if not all, a result of the laboratory conditions and as such should be considered laboratory artifacts. No conclusions or recommendations for the project are based on these laboratory artifacts.

Sample 36GR77C of SDG 36GT1 in the semivolatiles analysis was inadvertently not spiked with the surrogate mix and was not rerun due to insufficient time until expiration of the sample's holding time. Data associated with this sample was qualified as unusable for undetected compounds (R-flag) and positively detected compounds were qualified as estimated (J-flag).

A similar problem was also found in the pesticide analysis of the MS/MSD using sample 36GR76C of SDG 36GT1. The sample was incorrectly spiked and not rerun due to insufficient time until sample holding time expiration. The MS/MSD was determined to be unusable. Overall quality of analytical work was considered to be acceptable and usable for support of construction on Site 36 at NAS Pensacola.

8.2.6 Data Validation Worksheets

The following sections will include the validated analytical data and the data validation worksheets filled out with the evaluation of the analytical data. These worksheets are intended to provide valid documentation of the laboratory data evaluation and validation procedures. On some sheets,

the validation procedures will be equivalent to the Standard Operating Procedures provided by the CLP *National Functional Guidelines for Organic and Inorganic Data Review* (USEPA 1994a, 1994b). Other sheets will cover areas which are more subjective due to the complexities of the analytical method and will only provide documentation on the actions taken by the data evaluator.

The worksheets provided hereafter will be arranged by SDGs. The cover sheet, called the "Data Quality Objectives Summary Form," outlines a general overview of the project's objectives. Following the DQO Summary Forms are the Organic and Inorganic Worksheets. Areas covered within these worksheets will entail the criteria of an acceptable data package. Each of the organic and inorganic worksheets will be followed with a Data Assessment form specific for the attached set of worksheets.

The analytical data only will be in summary form and lists the positively detected compounds only, or qualified data critical to the reader.

8.3 Data Qualifier Definitions

The following provides brief explanations of the data qualifiers as a result of the validation process. These qualifiers, often called "flags", should bring to the reader's attention certain characteristics in accordance with the CLP protocol.

U – The compound was analyzed for, but was not detected above the reported sample quantitation limit.

J – The compound was positively detected, however, the reported concentration is considered to approximate the concentration within the sample.

UJ – The compound was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the compound in the sample.

R – The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the compound cannot be verified.

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9.0 FATE AND TRANSPORT

Fate and transport evaluates the ability of chemical constituents to become mobile or change in the environment, based on their chemical and physical properties and on processes that govern the interaction of the constituents with environmental media. A discussion of fate and transport of contaminants helps to identify potential receptors that may be impacted by constituent movement in the environment.

9.1 Contamination Summary

Environmental media sampled as part of the Site 38 RI include surface soil, subsurface soil, shallow groundwater, and intermediate groundwater. Groundwater samples were collected from the upper and basal portions of the surficial zone. Section 7 summarizes the nature and extent of contamination based on comparison to soil and groundwater PRGs and RCs.

Total Exceedances

Table 9-1 presents the total number of chemicals exceeding their respective PRGs and/or RCs for surface soil, subsurface soil, shallow groundwater, and deep groundwater at Site 38.

Table 9-1
Number of Chemicals Exceeding Screening Levels at Site 38

	Surface Soil	Subsurface Soil	Shallow GW	Intermediate GW
Inorganics	10	5	8	3
VOCs	0	6	11	1
SVOCs	5	6	9	0
Pests/PCBs	4	2	0/0	0/0

9.2 Contaminant Migration

Following a discussion in Section 9.2.1 of the contaminant and environmental media properties affecting fate and transport of constituents, fate and transport pathways for Site 38 are evaluated in Section 9.2.2.

9.2.1 Properties Affecting Fate and Transport

Numerous chemical and physical properties of both the chemical constituents and the surrounding media are used to evaluate fate and transport mechanisms.

9.2.1.1 Contaminant Properties Affecting Fate and Transport

Chemical and physical properties of constituents used to evaluate fate and transport include vapor pressure, density, solubility, Henry's law constant, half-life, organic carbon/water partitioning coefficient, and molecular weight. Table 9-2 provides an overview of chemical constituent behavior based on these properties. Table 9-3 contains chemical and physical property data for each chemical detected in Site 38 samples (soil and groundwater).

Compounds with similar chemical and physical properties display similar fate and transport behavior. This facilitates the general grouping of contaminants, based on chemical and physical properties, into these categories: VOCs, SVOCs, pesticides/PCBs, and inorganics.

VOCs

The chemical and physical properties with the greatest influence on the fate and transport of VOCs are solubility, Henry's law constant, and vapor pressure. Typical fate and transport characteristics include the following:

Table 9-2
Constituent Characteristics Based On Chemical and Physical Properties

Property	Critical Value	High (>)	Low (<)
Vapor Pressure (VP)	10^{-3} mm Hg	volatile	nonvolatile
Density[a] (D)	1.0 g/cm^3	sinks/falls	floats/rises
Solubility[a] (S)	0 to 100 mg/L	leaches from soil; mobile in water; does not readily volatilize from water	sorbs to soil; immobile in water; volatilizes from water
Henry's Law Constant (HL)	$5x10^{-6}$ to $5x10^{-3}$ atm-m^3/mole	resistance to mass transfer in the aqueous phase	resistance to mass transfer in the gas phase
Half-life ($T_{1/2}$)	biologically dependent	does not degrade readily	degrades readily
Organic Carbon/Water Partitioning Coefficient[a] (K_{oc})	10 to 10,000 kg_{oc}/L_{water}	tends to sorb to organic material in soil; immobile in the soil matrix	tends not to sorb to organic material in soil; mobile in the soil matrix
Molecular Weight (MW)	400 g/mole	characteristics listed above may not hold true; more detailed evaluation necessary	all of the above generally hold true

Notes:

[a]	=	Determinations of the Critical Values were based on literature review and professional judgment.
mmHg	=	millimeters of mercury
g/cm^3	=	grams per cubic centimeter
atm-m^3/mole	=	atmospheres per cubic meter per mole
g/mole	=	grams per mole

Table 9-3
Fate and Transport Properties for Constituents Detected in Soil and Groundwater
NAS Pensacola, Site 38
Pensacola, Florida

Parameter	Vapor Pressure (mm Hg)	Density (g/cm3)	Solubility (mg/L)	Henry's Law Constant (atm-m3/ mole)	Organic Carbon/ Water Partitioning Coefficient (L/kg)
Acenaphthene	1.55E-03	1.024	3.47E+00	1.70E-04	4.60E+03
Acenaphthylene	2.90E-02	0.899	3.93E+00	2.00E-04	2.50E+03
Acetone	2.70E+02	0.791	1.00E+06	3.97E-05	2.19E+00
Aluminum	NA	NA	NA	NA	NA
Anthracene	1.95E-04	1.260	4.50E-02	6.50E-05	2.60E+04
Antimony	NA	NA	NA	NA	NA
Aroclor 1254	7.70E-05	1.505	1.20E-02	2.70E-03	4.31E+05
Aroclor 1260	4.05E-05	1.566	8.00E-02	7.10E-03	8.22E+05
Arsenic	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA
Benzene	9.52E+01	0.868	1.75E+03	5.40E-03	5.00E+01
Benzo(g,h,i)perylene	1.01E-10	NDA	2.60E-04	1.40E-07	7.76E+06
Benzo(a)pyrene Equivalents					
Benzo(a)anthracene	2.20E-08	1.274	1.20E-02	2.30E-06	1.40E+06
Benzo(a)pyrene	5.60E-09	1.351	3.90E-03	2.40E-06	1.77E+06
Benzo(b)fluoranthene	5.00E-07	NDA	1.40E-03	1.20E-05	5.50E+05
Benzo(k)fluoranthene	9.59E-11	NDA	5.50E-04	1.04E-03	4.37E+06
Chrysene	6.30E-09	1.274	1.80E-03	7.26E-20	9.52E+04
Dibenzo(a,h)anthracene	1.00E-10	1.282	5.00E-03	7.33E-09	3.30E+06
Indeno(1,2,3-cd)pyrene	1.00E-10	NDA	6.20E-02	2.96E-20	1.60E+06
Beryllium	NA	NA	NA	NA	NA
Bromomethane	1.63E+03	1.676	1.32E+04	2.00E-01	8.30E+01
2-Butanone (MEK)	7.75E+01	0.805	2.70E+05	4.66E-05	3.88E+00
Cadmium	NA	NA	NA	NA	NA
Carbazole	4.00E+02	1.100	*Insoluble*	NDA	NDA
Carbon disulfide	3.00E+02	1.260	2.10E+03	1.33E-02	6.18E+01
Carbon tetrachloride	1.40E+02	1.597	8.00E+02	3.02E-02	4.37E+02
alpha-Chlordane	1.00E-05	1.600	5.60E-02	4.80E-05	4.95E+04
gamma-Chlordane	1.00E-05	1.600	5.60E-02	3.93E-03	4.95E+04
Chlorobenzene	1.00E+01	1.095	4.88E+02	3.93E-03	1.73E+02
Chloroethane	1.00E+03	0.900	5.74E+03	6.15E-04	3.50E+01
Chloroform	1.60E+02	1.500	8.00E+03	3.23E-03	4.60E+01
Chromium	NA	NA	NA	NA	NA
Chromium (hexavalent)	NA	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA
4,4'-DDD	1.02E-06	1.476	2.00E-02	2.16E-05	4.37E+04
4,4'-DDE	6.49E-06	NDA	4.00E-02	2.34E-05	2.45E+05
4,4'-DDT	1.90E-07	1.560	5.00E-03	4.89E-05	3.87E+05
Dibenzofuran	NDA	1.089	1.00E+01	NDA	1.00E+04
1,2-Dichlorobenzene	1.00E+00	1.306	1.00E+02	1.90E-03	1.82E+02
1,4-Dichlorobenzene	6.00E-01	1.248	7.90E+01	3.10E-03	2.40E+03
1,1-Dichloroethane	1.80E+02	1.175	5.50E+03	5.45E-03	3.40E+01
1,2-Dichloroethane	6.40E+01	1.300	8.70E+03	9.80E-04	1.41E+01
trans-1,2-Dichloroethene	NDA	1.257	NDA	NDA	NDA
1,2-Dichloroethene (total)	3.00E+02	NDA	3.50E+03	5.00E-03	2.30E-02
Dieldrin	1.80E-07	1.750	2.00E-01	2.00E-05	1.34E+04
2,4-Dimethylphenol	6.20E-02	0.970	4.20E+03	2.38E-06	2.63E+02
2,4-Dinitrotoluene	5.10E-03	1.400	2.40E+02	5.09E-06	1.00E+02
Endosulfan I	1.00E-05	1.745	5.30E-01	1.01E-04	2.04E+03
Endosulfan II	1.00E-05	1.745	2.80E-01	1.91E-05	2.34E+03

Table 9-3
Fate and Transport Properties for Constituents Detected in Soil and Groundwater
NAS Pensacola, Site 38
Pensacola, Florida

Parameter	Vapor Pressure (mm Hg)	Density (g/cm3)	Solubility (mg/L)	Henry's Law Constant (atm-m3/ mole)	Organic Carbon/ Water Partitioning Coefficient (L/kg)
Endosulfan sulfate	NDA	NDA	1.17E-01	NDA	2.34E+03
Endrin	7.00E-07	1.650	2.30E-01	5.00E-07	8.32E+03
Endrin aldehyde	2E-07	NDA	0.26	3.86E-07	26900
Endrin ketone	NDA	NDA	NDA	NDA	NDA
Ethylbenzene	7.08E+00	0.867	1.52E+02	6.60E-03	1.87E+02
bis(2-Ethylhexyl)phthalate (BEHP)	2.00E-07	0.987	3.00E-01	1.10E-05	2.00E+09
Fluoranthene	5.00E-06	1.252	2.40E-01	1.69E-02	3.80E+04
Fluorene	7.00E-04	1.203	1.69E+00	2.10E-04	5.01E+03
Heptachlor epoxide	2.60E-06	NDA	3.50E-01	3.20E-05	2.09E+04
Iron	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA
Methoxychlor	1.43E-06	1.410	4.00E-02	1.58E-05	7.94E+04
4-Methyl-2-Pentanone (MIBK)	1.50E+01	0.800	1.70E+04	1.49E-05	2.06E+01
Methylene chloride	3.49E+02	1.327	2.00E+04	2.00E-03	2.30E+01
2-Methylnaphthalene	NDA	1.006	2.46E+01	4.11E-04	8.51E+03
2-Methylphenol (o-Cresol)	2.40E-01	1.000	2.50E+04	1.50E-06	8.91E+01
3-Methylphenol/4-Methylphenol	NDA	NDA	NDA	NDA	NDA
4-Methylphenol (p-Cresol)	4.00E-02	1.018	2.30E+04	7.92E-07	4.90E+01
Molybdenum	NA	NA	NA	NA	NA
Naphthalene	5.40E-02	1.145	3.00E+01	4.60E-04	9.40E+02
Nickel	NA	NA	NA	NA	NA
Phenanthrene	6.80E-04	1.179	1.00E+00	3.90E-05	2.29E+04
Phenol	2.00E-01	1.058	8.20E+04	2.70E-07	6.00E+00
Pyrene	2.50E-06	1.271	1.35E-01	1.09E-05	6.46E+04
Selenium	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA
Strontium	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NDA	1.593	2900	NDA	118
Tetrachloroethene	1.40E+01	1.623	1.50E+02	1.53E-02	2.64E+02
Thallium	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA
Titanium	NA	NA	NA	NA	NA
Toluene	2.20E+01	0.867	5.15E+02	6.70E-03	1.29E+02
1,2,4-Trichlorobenzene	2.90E-01	1.500	3.00E+01	2.31E-03	2.00E+04
1,1,1-Trichloroethane	1.00E+02	1.300	1.60E+03	1.62E-02	1.28E+02
Trichloroethene	5.78E+01	1.464	1.10E+03	9.10E-03	8.70E+01
Vanadium	NA	NA	NA	NA	NA
Vinyl chloride	2.60E+03	0.910	1.10E+03	1.22E+00	1.10E+01
Xylene (total)	8.70E+00	0.880	2.00E+02	7.10E-03	2.34E+02
Yttrium	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA

FOOTNOTES TO TABLE 9-3

NA - Not applicable
NDA - No data available

- VOCs can leach from soil into groundwater.
- VOCs tend to be highly mobile in both soil and groundwater.
- VOCs tend to volatilize from both soil and groundwater.
- VOCs tend to dissipate relatively quickly.

The VOCs have low molecular weights, high solubilities, and high vapor pressures. Densities may be less than or greater than that of water. Because of these properties, VOCs are expected to be highly mobile in the environment and, therefore, quick to migrate from soil and groundwater.

SVOCs

The chemical and physical properties with the greatest influence on the fate and transport of SVOCs are solubility, vapor pressure, and organic carbon/water partitioning coefficient. Typical fate and transport characteristics are as follows:

- SVOCs tend to sorb to soil particles.
- SVOCs tend to be immobile in the environment.
- SVOC movement tends to occur more often by colloidal suspension than by diffusion (i.e., greater mobility occurs when coupled with "carrier" compounds).

SVOCs have high molecular weights, low to moderate vapor pressures, moderate to high densities, and generally high organic carbon/water partitioning coefficients. Overall, SVOCs are relatively immobile in soil and diffuse only slightly to groundwater. Exceptions to anticipated SVOC immobility in the environment are the base-neutral/acid extractable organic compounds (BNAs) (e.g., phenols and substituted phenols), as they readily hydrolyze in water.

Pesticides/PCBs

The chemical and physical properties with the greatest influence on the fate and transport of pesticides/PCBs are solubility, Henry's law constant, and organic carbon/water partitioning coefficient. Typical fate and transport characteristics include the following:

- Pesticides/PCBs tend to sorb to soil particles.
- Pesticides/PCBs tend to be hydrophobic (avoid water).
- Pesticides/PCBs tend to be immobile in the environment.
- Pesticides/PCBs tend to degrade relatively slowly.

Pesticides/PCBs have moderate to high molecular weights, generally high densities and organic carbon/water partitioning coefficients, and generally low solubilities, vapor pressures, and Henry's law constants. Most pesticides/PCBs are immobile and persistent in the environment, not readily diffusing into groundwater.

Inorganics

Solubility has the greatest influence on the fate and transport of inorganics. Typical fate and transport characteristics are as follows:

- Inorganics tend to sorb to soil particles.
- Inorganics are not degradable.
- Inorganics tend to have moderate to low mobility; however, in environments where pH is less than 5 (i.e., acidic conditions), inorganics can become mobile.

Properties of the surrounding environmental media tend to dictate the fate and transport mechanisms of inorganic elements. Overall, inorganics are anticipated to be immobile and to remain sorbed to soil particles, not readily diffusing into groundwater.

9.2.1.2 Media Properties Affecting Fate and Transport

The properties of environmental media used to evaluate fate and transport are TOC, normalized partition coefficient, CEC, redox conditions, pH, soil type, and retardation rate. The following paragraphs briefly discuss these properties.

Total Organic Carbon

TOC indicates the soil's sorptive capabilities. The higher the TOC, the higher the potential for a chemical, particularly an organic compound, to sorb to soil particles.

Normalized Partition Coefficient (K_d)

Normalized Partition Coefficient (K_d) is used to predict the capacity for a constituent to partition between soil and water; it is a function of both the constituent and the soil. To estimate K_d, the constituent's organic carbon/water partitioning coefficient (K_{oc}) is adjusted by the soil's TOC: $K_d = K_{oc} * f_{oc}$, where f_{oc} = organic carbon content fraction of the soil. Soils with higher K_d s have a higher potential to sorb organic compounds.

Cation Exchange Capacity

CEC reflects the soil's capacity to adsorb ions, neutralizing ionic deficiencies on the surfaces of its particles. Generally, trivalent ions are preferentially adsorbed to soil over divalent ions, and divalent ions are preferentially adsorbed over monovalent ions. Although this relationship generally holds true, the process also depends on soil pH. Soils with high CEC values have the potential to adsorb inorganic ions, although organic compounds with dipole moments also are affected by CEC.

Oxidation/Reduction (Redox) Conditions

Redox is the process which includes oxidation (the loss of electrons) and reduction (the gain of electrons). The resultant change in valence generates products that are different from the parent

reactants in their solubilities, toxicities, reactivities, and mobilities. Extreme redox conditions tend to mobilize chemicals, especially transition metals.

pH

The pH value is a negative inverse logarithmic measure of hydrogen ions in the soil or groundwater, indicating the acidity or alkalinity of the medium. Chemicals react differently as pHs change. Low pH conditions tend to mobilize most metals and facilitate substitution in organic compounds. High pH conditions may cause metals to precipitate and organic molecules to degrade.

Soil Type

The mineral composition, particle size distribution, and organic content of soil affect chemical fate and transport. Soil characteristics influence or determine hydraulic conductivity, effective porosity, and hydraulic gradient which, in turn, dictate groundwater flow.

Retardation Factor (R_f)

The retardation factor (R_f) is used to describe the ability of an aquifer to inhibit the movement of chemicals relative to that of groundwater by preferentially binding to those with high organic carbon/water partitioning coefficients. Because dissolved constituents generally travel more slowly through an aquifer than does groundwater itself, contaminant travel time is some multiple of groundwater travel time. The multiple is called the retardation factor, R_f:

$$R_f = 1 + (K_d \rho_b / n)$$

where K_d is the normalized partition coefficient, ρ_b is the dry bulk density of the soil, and n is the soil porosity. K_d is based on K_{oc} and TOC as shown above in this section, while ρ_b and n are obtained from Shelby tube analysis. The given equation for R_f assumes a linear equilibrium

sorption isotherm, in which the concentration of solute sorbed on the solid phase is linearly related to the dissolved concentration. This assumption is considered valid when the equilibrium concentration of the solute is less than half of its limit of solubility. Linear sorption isotherms are commonly used to describe sorption of chlorinated solvents, and have also been used for radionuclides and heavy metals. Use of a single retardation factor over the entire migration route is a significant simplification of reality because it assumes a constant sorptive capability of the aquifer, ignoring potential spatial heterogeneity of hydrogeological properties.

9.2.2 Migration Pathways

The presence of the same chemical contaminant in both source and receptor media is considered direct evidence of past contaminant transport. Likewise, the presence of contaminants in soil at concentrations exceeding screening levels for transfers to other media, or of constituents in groundwater at concentrations exceeding drinking water PRGs, indicates the potential for present contaminant transport and future impact on receptors. This section of the report discusses possible pathways for contaminant transport at the site.

Site 38 is on low-lying land that is almost entirely covered with buildings, the sites of former buildings, and pavement. Rainwater falling on impervious surfaces drains into storm sewers or flows laterally through openings in the seawall into Pensacola Bay. The small amount of rainwater that infiltrates the soil percolates into the unconfined surficial zone aquifer, which is the uppermost unit of the regional Sand-and-Gravel Aquifer. Groundwater moves from the topographically higher northern part of the area, generally south-southeastward toward the surface water of the bay. After evaluating Site 38 for the constituent and media properties discussed in Section 9.2.1, and for the hydrogeologic characteristics described in Section 6, four potential routes of constituent migration have been identified for further investigation:

- Leaching of constituents from soil to groundwater
- Transport of constituents in groundwater
- Transport of constituents in surface water
- Air emissions resulting from VOCs released from surface soil

9.2.2.1 Leaching from Soil to Groundwater

Contaminants may be leached from soil through percolation of rainwater or through direct continual contact with groundwater during periods of elevated water table due to tidal fluctuations or heavy precipitation. Soil at Site 38 has high vertical permeability, resulting in quick infiltration and minimal contact time between percolating water and soil in the vadose zone. As described above, little rainwater is able to infiltrate the soil because of widespread impervious surfaces. Nevertheless, there is evidence of contaminant leaching in the past and potential for additional leaching into groundwater.

Chemicals present above PRGs in both subsurface soil and groundwater at Site 38, indicating past or current contaminant transport, include three metals (arsenic, cadmium, and chromium), three VOCs (chloroform, tetrachloroethene, and trichloroethene), and six SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, naphthalene, and phenanthrene). Chemicals identified above PRGs in subsurface soil but not groundwater, signifying potential contaminant transport, include two metals (barium and nickel), three VOCs (1,1,2,2-tetrachloroethane; 1,2-dichloroethane; and methylene chloride), two SVOCs (4-methylphenol and phenol), and two pesticides (DDE and dieldrin). The distribution of these chemicals is detailed in Sections 7.1 (soil) and 7.2 (groundwater).

Table 9-4 summarizes the chemical and physical parameters of Site 38 soil used to evaluate fate and transport. The average CEC for Site 38 surface soil is 3.81 meq/100g. Ranges for CEC

Table 9-4
Soil Parameters Used to Evaluate Fate and Transport
Surficial Zone: Shallow Depth

Parameter	Site 38 Minimum Value	Site 38 Maximum Value	Site 38 Average Value	Units
Cation Exchange Capacity	0.38	9.5	3.81	(meq/100g)
Total Organic Carbon	25	2,100	579	(mg/kg)
pH[a]	6.0	11.5	8.2	(—)
Total Porosity[b]	0.399	0.420	0.409	(—)
Bulk Density[b]	1.54	1.59	1.56	(kg/m^3)

Notes:
[a] = pH values compiled from pesticide analysis pre-screening by the laboratory
[b] = Total porosity and bulk density values based on Site 38 shallow Shelby tube sample data
kg/m^3 = kilograms per cubic meter

were from 0.38 to 9.5 meq/100g for surface soil. The average value for pH in Site 38 soil samples (measured as part of the pesticide analysis) is 8.2 for surface soil and 8.3 for subsurface soil. The range of pH values is 6.0 to 11.5 in surface soil and 6.9 to 11.2 in subsurface soil. These soil conditions indicate limited mobility for inorganics by the processes of advection, diffusion, and dispersion; however, the possible presence of organic chelating agents associated with marine ecosystems could mobilize inorganics by separating metallic ions from soil particles in areas along the seawall. The average TOC concentration for Site 38 surface soil samples is 579 mg/kg. TOC measurements indicate a relatively low organic content that will only moderately inhibit the movement of contaminants, particularly those with high K_{oc} values, due to soil adsorption.

Inorganics exceedances in soil are concentrated around the site of former Building 71 and the metal plating shop in the southwestern corner of Building 604. Despite the limitations on their mobility dictated by site soil characteristics, numerous inorganics have migrated into shallow groundwater at Site 38. VOCs have been identified at low concentrations in surface soil and at somewhat higher concentrations in subsurface soil. Their presence at high concentrations in shallow groundwater at several locations (Section 7.2) indicates that they have sufficient mobility to migrate from soil to groundwater directly beneath their source areas. SVOCs are present in soil at moderate concentrations and in shallow groundwater at low concentrations in isolated samples. Phenol and 4-methylphenol (in the Building 71 area) both have the potential to migrate to groundwater because of their high solubilities, but other SVOCs in soil at Site 38 are expected to remain relatively immobile. The lack of detected pesticides or PCBs in groundwater suggests that these compounds are effectively adsorbed to soil onsite.

Naval industrial operations at Site 38 date back to the 1880s, while known heavy use of solvents, strippers, and plating solutions dates from the 1930s. All operations have ceased in and around Building 71 and Building 604. Building 636 is no longer used for dry cleaning. Groundwater was probably impacted largely during the period of heaviest use and onsite disposal of chemicals. Now that operations have been stopped, removing potential new sources of contaminants, the small amounts of rainwater able to infiltrate and percolate through the soil are less likely to leach constituents from the soil matrix into groundwater in the same quantities as previously.

9.2.2.2 Groundwater Transport

Groundwater at Site 38 moves generally south-southeastward to Pensacola Bay under a consistently low hydraulic gradient (Figures 6-5 and 6-6). The portion of the bay immediately seaward from Site 38 makes up Site 2, which is covered by a separate RI. Other than Pensacola Bay, Site 38 does not include or adjoin any surface water, and no surface water samples were collected as part of the Site 38 RI. Because most of the site is within a few hundred feet of

the bay, and the Building 71 area is separated from it only by a concrete seawall, potential contaminant transport from groundwater at Site 38 to surface water in the bay is of particular concern. The seawall is constructed on a shallow footer whose base is slightly above mean surficial zone groundwater level (USEPA, 1995a), apparently allowing unimpeded movement of groundwater from the Building 71 area downgradient into bay sediments. Existing contaminant plumes of metals and organic compounds, described below, probably already impinge upon the freshwater-saltwater interface in the sediments. The effect of this interface on transport of the particular groundwater constituents at Site 38 is not known. Tidal fluctuations that have been measured in wells near the shoreline may increase dispersion of contaminants migrating toward the bay.

Eight inorganics, 11 VOCs, and nine SVOCs were detected in shallow groundwater at concentrations exceeding their respective PRGs or RC, as described above in Section 9.1.2. The inorganics with the largest and most numerous exceedances were cadmium, chromium, and lead. Cadmium and chromium are each present in two small, roughly coincident plumes centered under former Building 71, used for painting, stripping, and plating, and the metal plating shop in the southwestern part of Building 604 (Figures 7-21 and 7-31). Lead is more widely distributed (Figures 7-21 and 7-31), although most of detections appear to originate from the same two sources. The probable source of the lead detected in temporary well sample GWT34001, just west of Building 636, is soil at Site 18, just southwest of the well location. Groundwater pH was measured in the low 6s range, which may be acidic enough to mobilize small amounts of lead from the soil matrix. The metals plumes at Building 71 already impinge on the seawall.

Among the VOCs, tetrachloroethene, trichloroethene, and vinyl chloride reported the most exceedances in shallow groundwater, with lower numbers for 1,2-dichloroethene and only scattered occurrences of the others. SVOC exceedances were minor. VOC plumes apparently originate from the same two source areas as the metals plumes, with the addition of a significant

tetrachloroethene source under the site of the former dry cleaning operation in Building 636 and the large VOC concentrations from well 38GS32 (Figure 7-36). This well is directly downgradient from the likely source at the plating shop in Building 604. The spatial distributions of 1,2-dichloroethene and vinyl chloride (Figures 7-35 and 7-38), downgradient from the plating shop, indicate that these compounds may be daughter products of tetrachloroethene. As with the metals plumes, at least some of the VOC plumes in the Building 71 area are in contact with the seawall; in addition, the southeastern portions of the larger VOC plumes originating at Building 604 may extend to the boat slip east of Building 38. Although, temporary well data did not indicate any VOC exceedances in this area.

Although the hydraulic gradient at Site 38 is low, the relatively clean, well-sorted sands of the surficial zone aquifer are responsible for high values of hydraulic conductivity, especially in the aquifer's upper portion, resulting in relatively high mean groundwater velocities at most locations. Moderately low TOC concentrations in the soil produce only mild retardation of organic constituents, so that advective movement of groundwater serves as an effective means of organic contaminant transport. Inorganic constituents are expected to be less mobile because of moderately high CEC levels; the limited spatial extent of the cadmium and chromium plumes relative to those of the VOCs bears this out. The relative differential between horizontal and vertical hydraulic conductivities, increasing with depth, yields advective movement that is primarily parallel to bed boundaries, although positive and negative vertical hydraulic gradients in different parts of the site result in some downward and upward groundwater movement as well.

The average porosity of the upper sand interval at Site 38, as determined through Shelby tube analysis, is 41%. Mean vertical permeability, as determined by analysis of two Shelby tube samples, is 30.9 feet/day; median hydraulic conductivity, based on specific capacity tests in seven shallow wells, is 246 feet/day. A preliminary travel time analysis was performed to focus attention on the ability of constituents to increase their areal extent in the aquifer and to impact

adjoining surface water bodies. Table 9-5 lists the approximate travel time for groundwater flow from significantly impacted points within Site 38 to the nearest point of Pensacola Bay, depending on direction of flow, local groundwater gradient, and local hydraulic conductivity. Travel times were calculated was based on an assumed mean elevation of -0.3 feet msl for water in the Bay, slightly lower than the lowest measured level in the wells. The travel times shown in the table represent bulk groundwater movement due to advection only.

Table 9-5
Travel Time Analysis: Shallow Part of Surficial Zone

Source Location	Hydraulic Conductivity (feet/day)[a]	Horizontal Gradient (—)	Effective Porosity (—)[b]	Horizontal Velocity (feet/day)	Horizontal Distance (feet)[c]	Travel Time (days)
Building 71 (38GS12)	318	0.00294	0.41	2.28	85	37
Building 636 (GWT31001)	207	0.00163	0.41	0.82	650	793
UST Location (38GS17)	201	0.00126	0.41	0.62	310	500
North of Building 38 (38GS32)	234	0.00131	0.41	0.75	275	367

Notes:
[a] = Based on specific capacity test data from adjacent monitoring wells.
[b] = Based on mean of two Shelby tube samples collected in the upper sand.
[c] = Based on the potentiometric path of groundwater flow.

Based on the calculated values shown in Table 9-5, advective travel time from the former dry cleaning operation in Building 636 to Pensacola Bay is approximately 793 days. Tetrachloroethene is one of the most mobile compounds detected in Site 38 groundwater. Using a K_{oc} value of 264 liters per kilogram (L/kg) (Table 9-3) and mean values of aquifer parameters for the upper portion of the surficial zone (Table 9-4: TOC=0.000579; porosity=0.41; bulk density=1.56), a retardation factor of 1.37 was calculated for tetrachloroethene in the shallow part

of the aquifer (see Section 9.2.1.2). Travel time for tetrachloroethene via groundwater over the specified course is estimated at 1086 days or 2.98 years.

The shallow and intermediate depth monitoring wells at Site 38 are completed in the upper and basal portions, respectively, of the surficial zone aquifer. Measured water levels in well pairs provide evidence of both positive and negative vertical gradients within the surficial zone. Because the underlying main producing zone serves as a regional water supply, maximum contaminant concentrations from shallow and intermediate well samples were compared to identify possible downward constituent migration. In contrast to results for shallow groundwater, only one VOC (vinyl chloride) and six inorganics (aluminum, cadmium, chromium, iron, manganese, and vanadium) were detected in intermediate groundwater samples at concentrations above their respective PRGs. Detection rates and concentrations were consistently much lower for both organic and inorganic chemicals in intermediate groundwater, with significant numbers of detections only for inorganics in the Building 71 area. However, the vertical distribution of contaminant concentrations in the surficial zone indicates that the basal part of the zone, while minimally impacted now, is subject to future contamination in parts of the site where positive vertical hydraulic gradients cause downward migration of groundwater constituents.

9.2.2.3 Surface Water Transport

Impervious surfaces (buildings and pavement) limit contact between precipitation and soil throughout much of Site 38 by diverting rainfall to storm drains and surface drainage pathways. Surface water drains through onsite storm sewers or gutter storm drains along roadways, collects in catch basins, and discharges through several outfalls into Pensacola Bay. Scuppers along the seawall also help control rainwater runoff by directing water into the bay.

Most of the past activities generating hazardous waste at Site 38 have ceased, and present site activities and waste disposal practices are not expected to pose a significant environmental impact.

Since soil and groundwater contaminants are largely covered with buildings and paved surfaces, surface water transport of contamination should be minimal. Routine pesticide application may represent a minor ongoing source to surface water. Contaminants in surface water in Pensacola Bay offshore from Site 38 were evaluated in the Site 2 RI (E/A&H, 1996a) and are discussed in Section 11 of this report.

9.2.2.4 Surface Soil to Air Transport

The surface soil to air pathway applies to fugitive dusts and VOCs in soil exposed to the atmosphere. Fugitive dusts were not monitored at Site 38. Although 18 VOCs were identified in surface soil onsite, none was detected at a concentration exceeding either its risk-based PRG or its soil-to-air screening level. Degradation due to sunlight, biological activity, and their natural volatility will continue to reduce VOCs in surface soil, aided by the subtropical temperatures and rainfalls observed at NAS Pensacola. Consequently, the soil to air migration pathway is not expected to be significant at Site 38.

9.2.2.5 Other Pathways

Other possible migration pathways at Site 38 include surface soil to surface water and surface soil to sediment. As stated above, only a very small percentage of surface soil at the site is exposed. Because the site includes no surface water features or wetlands, the receptor body for any contaminants transported via these pathways is the portion of Pensacola Bay immediately offshore, which has been discussed in the Site 2 RI (E/A&H, 1996a).

9.3 Current and Potential Receptors

Transport of contaminants at Site 38 is generally downward from surface soil through subsurface soil to groundwater, and thence to the sediments and surface water of Pensacola Bay. The primary current receiving body is the surficial zone of the Sand-and-Gravel Aquifer. Described in Section 6, the surficial zone is a porous and permeable unconfined aquifer with relatively small amounts

of organic carbon, all of which make it an effective migration pathway for dissolved and entrained contaminants, particularly organic compounds. It is not used as a water-supply source anywhere around Pensacola because of its high iron and aluminum content and its susceptibility to local contamination. Twenty organic compounds and eight inorganics were reported at concentrations greater than their PRGs in Site 38 groundwater samples from the surficial zone. The most significant plumes are those of tetrachloroethene, trichloroethene, vinyl chloride, cadmium, chromium, and lead. Contaminants appear at higher concentrations and are more widespread in the upper portion of the surficial zone than in the basal part.

A potential receptor of contamination from the surficial zone aquifer at Site 38 is the main producing zone, which underlies the surficial zone and serves as a potable water source from wells several miles north and upgradient in Escambia County. Water from the main producing zone is not considered potable at NAS Pensacola because of its high iron and aluminum content, but the aquifer is used as a supplementary water source for the base. Although the main producing zone is separated from the surficial zone and presumably protected by a low-permeability clay layer, chlorinated solvents such as tetrachloroethene and trichloroethene are capable of migrating differentially faster through some clays, and should be considered a threat to the aquifer. Groundwater from the main producing zone was not sampled as part of the Site 38 RI.

The other potential receptor of surficial zone contaminants is Pensacola Bay. The proximity of the site to the bay, coupled with the relatively short travel times calculated for migration of constituents (particularly VOCs) via groundwater, indicate that some impact to the bay may have already occurred. Runoff from rainwater may cause additional minor impacts (Section 9.2.2.3). Surface water, sediment, and ecological receptors adjoining Site 38 were evaluated as part of the Site 2 RI (E/A&H, 1996a) and are discussed in Section 11 of this report.

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10.0 BASELINE RISK ASSESSMENT

10.1 Introduction

A baseline risk assessment (BRA) analyzes the potential adverse effects on actual or hypothetical human and ecological receptors that could arise from exposures to hazardous substances released from a site assuming no remedial actions are taken to reduce the extent of present environmental contamination. Generally, a BRA is composed of two parts; one addresses human health risk, and another assesses ecological risk. Section 11 assesses potential ecological risks at Site 38.

This human health risk assessment (HHRA) is divided into four sections. Data management and assessment methods used in this HHRA are discussed in Section 10.2, and site-specific assessment information is discussed in Section 10.3. Site 38 was divided into the Building 71 and Building 604 study areas based on potential sources of contamination, a dividing road, and the IWTP sewer line. Risk estimates are presented separately in Sections 10.3.1 and 10.3.2, where specific sources of uncertainty and variability are discussed for each area. Because more than one-half of an HHRA is generally tables — the flow of text is broken, and reading and review is more difficult — tables and figures are not incorporated into the text. Tables are included at the end of Section 10.

The Navy intends to restrict Site 38 land use to industrial land use only and will prevent groundwater use in accordance with the Land Use Restriction Agreement signed August 31, 1998 between the Navy, FDEP, and USEPA. However, for the sake of completeness, this assessment includes exposure pathways and land use scenarios developed since 1992.

This HHRA for Site 38 was prepared generally in accordance with the following guidelines, and additional references are made throughout the text:

- *Risk Assessment Guidance for Superfund (RAGS), Volume I — Human Health Evaluation Manual (Part A)*, (USEPA, 1989a), (RAGS Part A).

- *RAGS, Volume I — Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals)*, (USEPA, 1991b), (RAGS Part B).

- *Dermal Exposure Assessment: Principles and Applications — Interim Report,* ORD, EPA/600/8-91/011B, (January 1992a).

- *RAGS, Volume I — Human Health Evaluation Manual, Supplemental Guidance — Dermal Risk Assessment — Interim Guidance,*(USEPA, 1992b), (Supplemental Dermal Guidance).

- Supplemental Guidance to RAGS: Region IV Bulletin, *Human Health Risk Assessment — Interim*, (USEPA 1995b).

- Supplemental Guidance to RAGS: Region IV Bulletin, *Development of Health-Based Preliminary Remediation Goals, Remedial Goal Options (RGO) and Remediation Levels* (Supplemental RGO Guidance), (November 1995) (USEPA, 1995c).

- Supplemental Guidance to RAGS: Region IV Bulletin, *Provisional Guidance of Quantitative Risk Assessment of PAHs,* (USEPA 1993a), (PAH Guidance).

- *Exposure Factors Handbook*, (USEPA, 1989b).

- USEPA Region III, *Risk-Based Concentration Table, July-December 1995,* (USEPA February 1996), (RBC Screening Tables) (USEPA, 1996b).

- Florida DEP, *Technical Memorandum — Soil Cleanup Goals for Florida*, September 1995 (FDEP, 1995).

- *Technical Memorandum Guidance on Estimating Exposure to VOCs During Showering*, (USEPA, 1991c).

These references are identified fully in Section 13.

Objectives

The objectives of the HHRA are to:

- Characterize the source media and determine the chemicals of potential concern (COPCs) for affected environmental media.

- Identify potential receptors and quantify potential exposures for those receptors under current and future conditions for all affected environmental media.

- Qualitatively and quantitatively evaluate the adverse effects associated with the site-specific COPCs in each medium.

- Characterize the potential baseline carcinogenic risk and noncarcinogenic hazards associated with exposure to impacted environmental media at Site 38 under current and future conditions.

- Evaluate the uncertainties related to exposure estimates, toxicological data, and resulting carcinogenic risk and noncarcinogenic hazard estimates.

- Establish RGOs for chemicals of concern (COCs) in each environmental medium based on risk/hazard to facilitate risk management decision-making.

Organization

An HHRA, as defined by RAGS Part A, includes the following steps:

- *Site characterization*: evaluation of data regarding site geography, geology, hydrogeology, climate, and demographics.

- *Data collection*: analysis of environmental media samples, including background/ reference samples.

- *Data evaluation*: statistical analysis of analytical data to identify the nature and extent of contamination and to establish a preliminary list of COPCs from risk-based and background screening. This list will subsequently be refined to identify COCs.

- *Exposure assessment*: identification of potential receptors under current and predicted conditions, visualization of potential exposure pathways, calculation of exposure point concentrations (EPCs), and quantification of chemical intakes.

- *Toxicity assessment*: qualitative evaluation of the adverse effects of the COPCs, and quantitative estimate of the relationship between exposure and severity or probability of effect.

- *Risk characterization*: a combination of the outputs of the exposure assessment and the toxicity assessment to quantify the total noncancer and cancer risk to the hypothetical receptors.

- *Uncertainty*: discussion and evaluation of the areas of recognized uncertainty in human health risk assessments in addition to medium- and exposure pathway-specific influences.

- *Risk/Hazard Summary*: presentation and discussion of the results of the quantification of exposure (risk and hazard) for the potential receptors and their exposure pathways identified under current and future conditions.

- *Remedial Goal Options*: computation of exposure concentrations corresponding to risk projections within the USEPA target risk range of 10^{-6} to 10^{-4} for carcinogenic COCs and Hazard Quotient (HQ) goals of 0.1, 1, and 3 for noncarcinogenic COCs.

10.2 Site 38 Human Health Risk Assessment Methods

10.2.1 Site Characterization

Site 38 was divided into two primary areas, the Building 71 study area and the Building 604 study area (Figure 7-1). These areas were addressed separately because exposure areas are divided by Radford Road and contaminant sources are reportedly different for each area. A portion of the IWTP Sewer Line traverses this site, so IWTP samples collected within the exposure areas were assessed in this RI and were included in the risk estimates. In addition to estimating risk for each area in accordance with RAGS, point risk estimates were calculated for each sample location and each COPC to provide cumulative risk estimates for each location.

Each individual site is detailed in the Sections 2 and 5, which discuss the site history and investigative approach, respectively. Tables in Section 10.3 show the sample identification numbers and analytical methods for each sample included in this HHRA. At these sites, sampling activities consisted of collecting surface (i.e., zero to 1 foot bls) and subsurface (i.e., from 1 foot bls to the water table) soil samples. Groundwater was sampled from monitoring wells installed in the shallow and intermediate aquifers underlying the zone. Shallow and intermediate

groundwater analytical data were combined, assuming a well could be screened across more than one water-bearing zone. Sediment and surface water samples were collected from Pensacola Bay adjacent to Site 38 as part of another RI. These samples were addressed in the *RI/FS for NAS Pensacola Site 2* (E/A&H, 1996a) and are beyond the scope of this RI. Human exposure to media assessed in the Site 2 RI was determined to be extremely unlikely. Consequently, the focus of the Site 2 BRA was ecological risk assessment. Analytical results from surface soil and shallow and intermediate groundwater were used to assess possible human exposure to environmental contaminants. Subsurface soil data were addressed in Section 9.

10.2.2 Data Sources

Soil and groundwater were collected and analyzed to delineate the sources, nature, magnitude, and extent of any contamination associated with current or past site operations. The data used in the HHRA for each site were obtained from the results of the sampling activities associated with RI activities and UST investigations.

As discussed in previous sections, USEPA collected samples at Site 38, and data used in this RI were compiled from several sampling events. These events are described in Sections 4 and 5 and include the 1993 investigation of the Site 36 IWTP Sewer Line, the 1993-94 investigation of Building 71, the USEPA 1995 confirmation sampling at Building 71, and the USEPA 1995 investigation of Building 604. A summary report was completed by USEPA for the 1995 sampling events. The USEPA report and corresponding analytical data set are included as Appendix H, and the data set used in this HHRA differs from that presented in Section 7. Several monitoring wells sampled during the earlier events were resampled in the subsequent phases of the investigation. Where this occurred, analytical data from both data sets were included as independent samples to address potential temporal variability.

Analytical methods and DQO laboratory deliverables are also summarized in Section 5. Soil and groundwater were sampled in accordance with the procedures outlined in the Site 38 SAP, the addendum SAP for the associated IWTP sewer line, the Site 38 SAP (Building 604), and the USEPA Region IV SOP/QAM; (USEPA, 1991a). Sampling locations and methods employed by E/A&H are discussed in Sections 5.1 through 5.6. EPA sampling efforts are discussed in Section 5.7.

10.2.3 Data Validation

Data validation is an after-the-fact, independent, systematic process of evaluating data and comparing them to established criteria to confirm they are of the technical quality necessary to support the RI/FS decisions. Parameters specific to the data are reviewed to determine whether they meet the stipulated DQOs. The quality objectives address five principal parameters: precision, accuracy, completeness, comparability, and representativeness. To verify that these objectives are met, field measurements, sampling and handling procedures, laboratory analysis and reporting, and nonconformances and discrepancies in the data are examined to determine compliance with appropriate and applicable standards. Data collected for the Site 38 RI were validated in accordance with the USEPA CLP Functional Guidelines and are discussed in Section 8 of this report. Data reports for the Site 38 data set are included in Appendices I and J.

Independent validation of USEPA's data presented in Appendix H was not possible. The Tier I Partnering Team decided to assume the data were useful for risk assessment and to combine the USEPA data, Site 38 RI data, and select Site 36 data to develop the data set for this HHRA (July 26 and 27, 1995 Tier I Partnering Team Meeting Minutes). Therefore, this HHRA is based on the combined data set. Specific sample designations are listed in the site-specific HHRA's to clarify which samples were used.

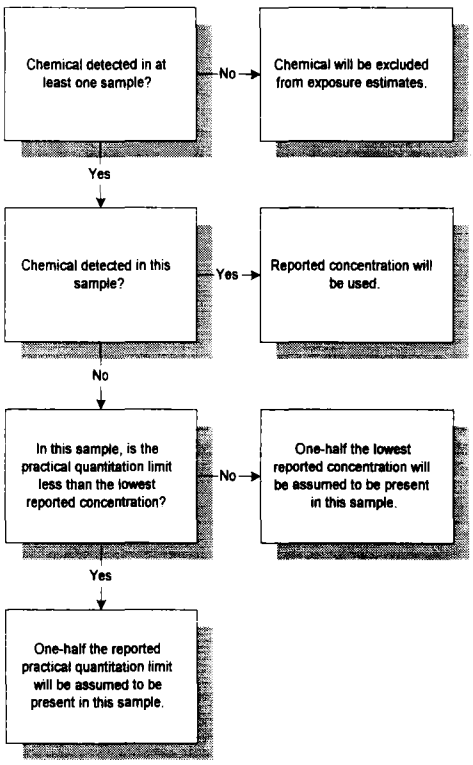
10.2.4 Management of Site-Related Data

All environmental sampling data were evaluated for suitability for use in the HHRA. Data obtained via the following methods were not appropriate for the HHRA:

- Analytical methods that are not specific for a particular chemical, such as TOC or total organic halogen.
- Field screening instruments including total organic vapor monitoring units and organic vapor analyzers.

Various software packages were used to electronically manage site data and calculate statistics. For each set of data describing the concentration of chemicals in a contaminated area, the following information was tabulated: frequency of detection, range of nondetected values, range of detected values, average of detected concentrations, and the calculated 95% upper confidence limit (UCL) for the mean of log-transformed concentrations values. Estimated or "J" qualified data were considered to be hits, which are usually reported approaching one-tenth the sample quantitation limit (SQL). The procedures used to estimate exposure are detailed in Section 10.2.7.

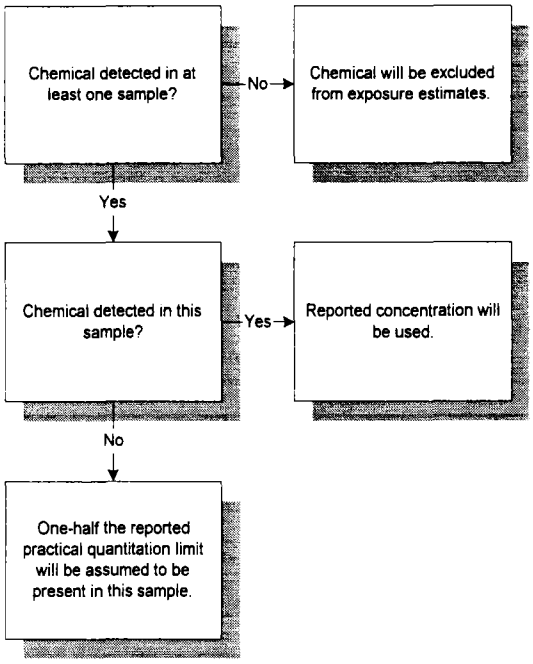
Management of UCL Data for Organic Compounds



Data Management for Calculating UCL

Current technology limits the chemical concentrations laboratory instruments can quantify. Chemicals identified as COPCs were sometimes reported as nondetects

Management of UCL Data for Inorganic Compounds



(*U*-qualified results), indicating the concentration of a COPC would be in the range of zero through the SQL, which is determined by the analytical method, the instrument used, and possible matrix interferences. Limitations of analytical results were addressed by including estimated or assumed concentrations for reported nondetects. Figures on this and the previous page show the decision flow. A nondetect indicates that the analyte was not detected above the sample practical quantitation limit of the sample ("U"qualified results), which is determined by the analytical method, the instrument used, and possible matrix interferences. However, a nondetected analyte could exist at a concentration between zero and the quantitation limit. For this reason, one-half the "U" value could serve as an unbiased estimate of the nondetect. Because the estimated values of "J" qualified hits are frequently much lower than the sample quantitation limits of "U" qualified nondetects for organic compounds, one-half of each "U" value will be compared to one-half of the lowest hit (normally "J" qualified) at the same site. The lesser of these two values will be used as the best estimate of the concentration potentially present below the SQL, and will be inserted into the adjusted data set. The first figure summarizes the method that will be used to determine assumed organic chemical concentrations, while the second summarizes the method that will be used to determine assumed concentrations for inorganic chemicals.

For inorganic chemicals, the decision rule is simpler: one-half of each "U" value will be used to represent the concentration of the corresponding sample when compiling the adjusted data set. If two nondetects are reported for any one location (a result of QA/QC samples), one-half the lesser

of the "U" values will be compared to the lowest hit at the site (for organics, as above) or applied directly (for inorganics) to estimate a concentration value to be used in the risk calculations. If a parameter is not detected at a site, neither data management method will be applied, and the parameter will not be considered in screening or formal assessment.

Statistical methods were used to evaluate the analytical results to determine EPCs at potential receptor locations. The statistical methods used in data evaluation are discussed below. The rationale used to develop this methodology and the statistical techniques to implement it were discussed during the April 8, 1997 conference call between the Navy, USEPA, and FDEP and the decision to implement this method was agreed upon during the January 27, 1998 Tier I Partnering Meeting (April 8, 1997 Conference Call Minutes; January 27, 1998 Tier I Partnering Meeting Minutes). The rationale is based on the following sources:

- RAGS Part A
- *Statistical Methods for Environmental Pollution Monitoring* (Gilbert, 1987)
- *Supplemental Guidance to RAGS: Calculating the Concentration Term* (USEPA, 1992c)
- *Supplemental Guidance to RAGS: Bulletin 2 Toxicity Assessment* (USEPA, 1995b)

10.2.5 Selection of Chemicals of Potential Concern

Before estimating the potential excess risk/hazard associated with Site 38 media, it was first necessary to delineate the contamination onsite by noting the chemicals detected in environmental media as chemicals present in site samples (CPSSs). The nature and general extent of CPSSs at each site are discussed in detail in Section 7.

COPCs are selected by comparison with risk-based and reference screening concentrations. Chemicals with concentrations greater than screening concentrations are identified as COPCs, unless the chemicals are eliminated for other reasons, such as USEPA Region IV guidance to

eliminate essential elements. In addition, USEPA indicated in the June 25, 1997 *Summary of TQM Contractor Meeting* email, iron's Reference Dose (RfD) is not a proper RfD. In accordance with this guidance, iron should be addressed in the uncertainty section, if at all. Consequently, iron was not considered a COPC in this HHRA. This decision was revisited by FDEP in their November 26, 1997 review comments and discussed during the January 27, 1998 Tier I Partnering Meeting. The partnering team agreed that iron should be excluded from the Site 38 Risk Assessment because reported concentrations are below FDEP's screening concentrations (January 27, 1998 Tier I Partnering Meeting Minutes). Screening comparisons were performed as described below to reduce the list of CPSSs and thereby focus the risk assessment on COPCs.

Comparison of Site-Related Data to Risk-Based Screening Concentrations

Many state and federal guidance concentrations, screening values, and methods were finalized after agreements were made between USEPA, FDEP, and the Navy. The approved work plan for Site 38 pre-dates USEPA and FDEP guidance, as well as the partnering agreement (E/A&H, July 1992). For example, risk-based screening values were discussed by the Tier I Partnering Team during several meetings before USEPA Supplemental Guidance to RAGS was produced in November 1995. A February 21, 1994 screening memorandum was distributed and approved by USEPA on March 11, 1994 (USEPA, 1989; February 21, 1994 letter from E/A&H to USEPA; March 11, 1994 approval letter from USEPA). This approach used USEPA Region III RBCs as screening values in accordance with USEPA Supplemental Guidance to RAGS, *Bulletin 1, Data Collection and Evaluation*, but the USEPA document was not available until the following year (USEPA, 1995). Soon after receiving the March 11, 1994 letter from USEPA, FDEP distributed their 1995 *Soil Cleanup Goals for Florida*, which were also incorporated into the report as risk-based screening values (FDEP, 1995). FDEP and USEPA have developed additional methods and screening values since that time. Many of these changes are due to USEPA decisions regarding toxicological data available for various chemicals, and the Navy has modified screening values during each revision to reflect these changes.

The Tier I Partnering Team discussed screening values during various meetings and conference calls between 1994 and 1998, and decided that the most conservative FDEP and USEPA values would to be used as screening values in the risk assessment, and that the screening values should be based on risk. This decision recently changed during the September 1998 Tier I Partnering Meeting, where FDEP and USEPA suggested incorporating ARARs into the screening phase of the risk assessment. However, Site 38 was not discussed, and the question was raised regarding other pending risk assessments. The recent USEPA and FDEP guidance for screening values states is that changes based on toxicological information should be made, but neither agency would require that reports be revisited when screening comparisons were performed in accordance with current guidance. Consequently, ARARs were included in this RI, but they were not used as screening values for the risk assessment unless they were based on risk.

In this assessment, the maximum concentrations of CPSSs detected in samples were compared to risk-based screening values. These values were obtained from two sources for soil: *Risk-Based Concentrations, (USEPA 1996a),* or the FDEP *Technical Memorandum — Soil Cleanup Goals for Florida* (FDEP, 1995). In accordance with USEPA Region IV supplemental guidance, groundwater results were compared to USEPA tap water screening values. Comparisons to other concentrations and ARARs were made in Sections 7 and 8 of this RI, and ARARs were included as Remedial Goal Options in accordance with RAGS (USEPA, 1989).

Reported concentrations were compared to one-tenth USEPA screening concentrations to reflect a target HQ goal of 1.0 to 0.1 for noncarcinogens in accordance with USEPA's Supplemental Guidance, *Bulletin 1 Data Collection and Evaluation* (USEPA, 1995d). Screening values shown in the tables are not adjusted and are excerpted directly from USEPA Region III and FDEP. As previously stated, comparisons were made to USEPA screening values which reflect a target HQ of 0.1. A risk goal of 10^{-6} was used by FDEP and USEPA to calculate screening concentrations for carcinogens. FDEP calculated hazard-based cleanup goals using an HQ of 1.0.

Consistent with recent OSWER directives considering protection of a hypothetical child resident, 400 mg/kg was used as the soil screening value for lead; the lead groundwater screening value used was the USEPA Office of Water treatment technique action level of 15 μg/L (USEPA, 1996c).

In accordance with recent USEPA Region IV Supplemental Guidance to RAGS: Bulletin 2 (USEPA, 1995b), benzo(a)pyrene equivalents (BEQs) were computed by multiplying the reported concentration of each carcinogenic PAH (cPAH) by its corresponding toxicity equivalence factor (TEF). The BEQ values were then summed for each sample, and the total was compared to the benzo(a)pyrene Risk-Based Concentration (RBC) value during the screening process. Subsequent exposure quantification and risk/hazard projections for cPAHs in soil and groundwater were performed using total BEQ values for each sampling location rather than individual compound concentrations. Tables detail this information in Section 10.3.

Screening values based on surrogate compounds were used if no screening values were available. Surrogate compounds were selected based on structural, chemical, or toxicological similarities. Results from the comparison of the list of CPSSs to other screening levels can be found in Section 9, Fate and Transport. Other screening levels for groundwater include groundwater protection soil screening levels (SSLs). Compounds that had been screened from the list of COPCs were included in Section 9 when appropriate, based on comparisons to other screening concentrations.

Comparison of Site-Related Data to Background Concentrations

The background reference concentration is a fixed value assumed to represent naturally occurring levels for a chemical in a specific matrix. Soil and groundwater background concentrations were determined for NAS Pensacola, as described in Section 7. The Tier I Partnering Team agreed during its May 27-29, 1997 meeting to use these values as background reference concentrations meeting (May 27-29, 1997 Tier I Partnering Team Meeting Minutes). The background concentrations for NAS Pensacola were originally proposed in the Site 1 Work Plan, which was approved by USEPA on September 1, 1992 and by FDEP on December 16, 1991 (USEPA September 1, 1992 approval letter; FDEP December 16, 1991 approval letter). CPSSs with maximum detected concentrations exceeding both corresponding background reference concentrations and risk-based concentrations were retained as COPCs in the HHRA. This comparison helps account for chemicals that are common in nature, such as aluminum, manganese, and arsenic. By virtue of this process, risk and/or hazard associated with naturally occurring chemicals is not addressed where their concentrations are not above corresponding background.

In summary, if the maximum concentration of a CPSS was determined to be less than either background or the risk-based screening value, the CPSS was not considered further in the risk assessments unless deemed appropriate based on chemical-specific characteristics (e.g., degradation product with greater toxicity).

Elimination of Chemicals from Area-Wide Risk Estimates Based on Detection Frequency

Chemicals reported in 5% or less of the samples were eliminated from area-wide risk estimates because exposure would occur in a limited area. In addition, COPCs eliminated from area-wide risk estimates based on frequency of detection were included in point risk estimates to account for their influence at specific sample locations.

Elimination of Molybdenum

Based on Tier I Partnering Team discussions, molybdenum was not associated with past site uses and was not part of the Data Quality Objectives. During the USEPA sampling phase described in Section 7, USEPA reported molybdenum at a concentration higher than the corresponding risk-based screening value. Because no other concentrations exceeded the screening value and molybdenum was not part of the Data Quality Objectives it was excluded from the risk assessment as determined by the Tier I Partnering Team. This decision was revisited and agreed upon during the January 27, 1998 Tier I Partnering Team Meeting (January 27, 1998 Tier I Partnering Team Meeting Minutes).

Elimination of Essential Elements — Calcium, Iron, Magnesium, Potassium, and Sodium

In accordance with RAGS Part A, essential elements that are potentially toxic only at extremely high concentrations may be eliminated from further consideration as COPCs in a risk assessment. Specifically, an essential nutrient may be screened out of a risk assessment if it is present at concentrations that are not associated with adverse health effects. Based on RAGS, the lack of risk-related data, and USEPA Region IV's recommendations, the following essential nutrients were eliminated from the human health risk assessment: calcium, iron, magnesium, potassium, and sodium. The decision to remove sodium and iron was revisited, and the Tier I Partnering Team agreed to eliminate sodium (January 27, 1998 Tier I Partnering Team Meeting Minutes).

10.2.6 Exposure Assessment

This section of the HHRA determines the magnitude of contact that a potential receptor may have with site-related COPCs. Exposure assessment involves four stages:

- Characterizing the physical setting and land use of the site;
- Identifying COPC release and migration pathway(s);

- Identifying the potential receptors, under various land use or site condition scenarios, and the pathways through which they might be exposed; and

- Quantifying the intake rates, or contact rates, of COPCs.

Exposure Setting and Land Use

This section of each HHRA describes the basic layout of the individual site as well as the suspected source(s) of contamination, while the site setting is discussed in Section 3. In addition, current and future use of the site is discussed if information is available. At Site 38, existing features such as asphalt/concrete surfaces, buildings, and fences would prevent and/or minimize exposure to impacted media if they are maintained under base reuse plans. As part of each site-specific HHRA, the potential influences of existing site features on exposure were evaluated.

The Navy intends to restrict Site 38 to industrial land use only and will prevent groundwater use in accordance with the Land Use Restriction Agreement signed August 31, 1998 between the Navy, FDEP, and USEPA. However, for the sake of completeness, this assessment includes exposure pathways and land use scenarios developed since 1992.

Potentially Exposed Populations

This section describes who may be exposed to contaminants in environmental media. Table 10-1 summarizes exposure pathways and receptors for current and future land use and justifies including or excluding various exposure pathways. In this HHRA, the potentially exposed populations addressed were current and future site workers, as well as hypothetical future site residents and trespassers. Because current site workers at Site 38 would be expected to have limited contact with contaminated media, worker-related exposure was addressed exclusively for maximally exposed future site workers. This approach, while providing a reasonably conservative

assessment of future site worker risk/hazard, also renders a highly conservative approximation of risk/hazard for current site workers. This approach accounts for the fact that the specific nature of future industrial uses cannot be definitively stated.

Exposure Pathways

This section summarizes how potential human receptors (site workers, residents, etc.), may be exposed to contaminated media. In general, soil matrix-related pathways include incidental ingestion and dermal contact. For groundwater, ingestion and inhalation of volatilized contaminants were the primary pathways of exposure evaluated.

Exposure Point Concentrations

The EPC is the concentration of a contaminant in an exposure medium that will be contacted by a real or hypothetical receptor. Determining the EPC depends on factors such as:

- Availability of data
- Amount of data available to perform statistical analysis
- Reference concentrations not attributed to site impacts
- Location of the potential receptor

USEPA Region IV Supplemental Guidance to RAGS calls for assuming lognormal distributions for environmental data and calculating the 95% UCL for the mean of concentrations to quantify exposure (Bulletin 3; USEPA, 1995e). Applying the UCL is generally inappropriate with fewer than 10 samples (Gilbert, 1987). In general, outliers were included when calculating the UCL because high values seldom appear as outliers for a lognormal distribution. Including outliers increases the overall uncertainty of the calculated risks and conservatively increases the estimate of the human health threat.

For sample sets of 10 and greater, the UCL was calculated for a lognormal distribution as e^x as follows:

$$X = \left(\bar{a} + 0.5 s_a^2 + \frac{H_{0.95} \; x \; s_a}{\sqrt{n-1}} \right)$$

where:

$\bar{a}$	=	$\Sigma a/n$ = sample arithmetic mean of the log-transformed data, a = ln(reported concentration)
s_a	=	sample standard deviation of the log-transformed data
n	=	number of samples in the data set
$H_{0.95}$	=	value for computing the one-sided 95% upper confidence limit for a lognormal mean from standard statistical tables (Gilbert, 1987)

The calculated values for the 95% UCL are presented in Section 10.3, along with the data used to calculate the UCLs. Included for each COPC are the number of samples analyzed, mean and standard deviation of the natural log-transformed data (including the assumed nondetect values), the H-statistic, the maximum of detected concentrations, the EPC.

USEPA Region IV recommends using the arithmetic mean of chemical concentrations in the most concentrated area of a plume as an EPC for estimating groundwater exposure. This is stated in the Supplemental Guidance to RAGS: Region IV Bulletin 3 Exposure Assessment (USEPA, 1995e). Supplemental sampling performed by USEPA to define the extent of contaminated areas focused on unimpacted areas of the aquifer, which would bias a UCL low. Plumes in Site 38 groundwater are generally defined by few samples, so the highest concentrations in the plume are all concentrations reported. Consequently, the arithmetic mean of the highest concentrations in the plume would be closely approximated by the arithmetic mean of the detected concentrations.

However, the maximum value was used in this HHRA as the groundwater EPC based on FDEP's recommendations (January 27, 1998 Tier I Partnering Team Meeting Minutes).

For chemicals detected in surface soil, either the UCL or the maximum detected concentration was used as the EPC. To determine which concentration to use as EPC, the UCL was compared to the maximum reported concentration. The lesser value was used as the EPC, and this is indicated in corresponding tables in Section 10.3.

Risk was estimated at each sample location. In addition to the standard tabular presentation of risk estimates in Section 10.3, point estimate maps summarizing risk and hazard were plotted for soil and groundwater to provide a visual supplement (Section 10.3). As an extension of conventional data presentation, excess cancer risk and hazard were each estimated for each sample location. Tables were generated by summing the contributions of each COC detected in the corresponding sample. Each mapped sample location was then color-coded to signify a cumulative range of risk or hazard. Relevant maps are referenced in the site-specific HHRA in Section 10.3. This information supplements the HHRA to clarify the spatial distribution of chemicals and their relative risk estimates for specific land use scenarios and to facilitate remedial alternative screening as part of the FS.

Figures presented in this report are approximations which include many uncertainties. Site-specific uncertainties are discussed in Section 10.2.6, and should be considered when making risk management decisions. Point estimates of risk and hazard were developed for three exposure scenarios, residential, trespassing, and commercial/industrial. For the residential scenario, the lifetime weighted average (LWA) was used to estimate Incremental Lifetime Cancer Risk (ILCR), and the child resident to estimate Hazard Index (HIs) shown on point risk figures and tables.

Quantification of Exposure

This section describes the models, equations, and intake model variables used to quantify doses or intakes of the COPCs for the surface soil and groundwater exposure pathways. The models are designed to estimate route- and medium-specific factors, which are multiplied by the EPC to estimate chronic daily doses. The intake model variables generally reflect 50th or 95th percentile values which, when applied to the EPC, ensure that the estimated intakes represent the reasonable maximum exposure (RME). Formula were derived from RAGS, Part A unless otherwise indicated.

In accordance with RAGS, the adult and child intake variables will be combined to estimate exposure to carcinogens. This factor is referred to as the LWA. The LWA considers the difference in daily ingestion rates for soil and drinking water, body weights, and exposure durations for children (ages 1 to 6) and adults (ages 7 to 30). The exposure frequency is assumed to be identical for the adult and child exposure groups, and an example is shown after the equations are presented below.

A CPSS not eliminated from the HHRAs based on the screening comparisons still could be eliminated from area-wide assessment, where appropriate, as discussed in Section 10.3. As previously discussed, COPCs excluded from area-wide assessment based on detection frequency were included in point risk estimates.

Table 10-2 lists input variables used to compute chronic daily intake (CDI) multipliers for potential receptors exposed to surface soil and/or groundwater contaminants. These soil and groundwater pathway assumptions were applied for each site. Because future site use cannot be assumed with any certainty, conservative assumptions were used to account for any reasonable future use. Age-adjusted ingestion factors were derived for the potential future residential receptors (resident adult and resident child combined) for carcinogenic endpoints. These factors consider the difference

in daily ingestion rates for soil and drinking water, body weights, and exposure durations for children (ages 1 to 6) and adults (ages 7 to 31). The exposure frequency is assumed to be identical for the adult and child exposure groups.

Because long-term exposure to subsurface soil would be unlikely, and groundwater at Site 38 is sometimes encountered at 2 to 4 feet bls, the Tier I Partnering Team agreed that the default site worker scenario included in this assessment would be protective of construction worker exposure to subsurface soil (January 27, 1998 Tier I Partnering Team Meeting Minutes).

Surface Soil Pathway Exposure

Ingestion of COPCs in Surface Soil

The following equation is used to estimate the ingestion of COPCs in soil:

$$CDI_s = (C_s)(IR)(EF)(ED)(F)(FI)/(BW)(AT)$$

where:

CDI_s	=	ingested dose (mg/kg-day)
C_s	=	concentration of contaminant in soil (mg/kg)
IR	=	ingestion rate (mg/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
F	=	conversion factor (10^{-6} kg/mg)
FI	=	fraction ingested from contaminated source (unitless)
BW	=	body weight (kg)
AT	=	averaging time (days)

The LWA is used to calculate carcinogenic CDI for site residents. An example of the LWA calculation is shown below for the soil ingestion pathway, and LWAs are similarly calculated for subsequent equations.

$$LWA = [(IR_a \times ED_a)/BW_a] + [(IR_c \times ED_c)/BW_c]$$

where:

LWA	=	lifetime weighted average
IR	=	ingestion rate (milligrams per day [mg/day])
ED	=	exposure duration (years)
BW	=	body weight (kg)
$_a$	=	adult
$_c$	=	child

Consequently, CDI for carcinogens would be calculated as follows for site residents:

$$CDI_s = (EPC_s)(EF)(LWA)(F)(FI)/(AT)$$

where:

CDI_s	=	ingested dose (mg/kg-day)
C_s	=	exposure point concentration of contaminant in soil (mg/kg)
EF	=	exposure frequency (days/year)
F	=	conversion factor (1E-6 kg/mg)
FI	=	fraction ingested from contaminated source (unitless)
AT	=	averaging time (days)
LWA	=	lifetime weighted average

Dermal Contact with COPCs in Surface Soil

The following equation is used to estimate intake due to dermal contact with COPCs in soil:

$$CDI_{sd} = (C_s)(CF)(EF)(ED)(F)(FC)(ABS)(AF)/(BW)(AT)$$

where:

CDI_{sd}	=	dermal dose (mg/kg-day)
C_s	=	concentration of contaminant in soil (mg/kg)
CF	=	contact factor (cm^2)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
F	=	conversion factor (10^{-6} kg/mg)
FC	=	fraction contacted from contaminated source (unitless)
ABS	=	absorption factor (unitless value, specific to organic versus inorganic compounds)
AF	=	adherence factor (mg/cm^2)
BW	=	body weight (kg)
AT	=	averaging time (days)

Groundwater Pathway Exposure

Ingestion and Inhalation of COPCs in Groundwater

The following equation is used to estimate the ingestion and/or inhalation of COPCs in groundwater:

$$CDI_w = (C_w)(IR)(EF)(ED)(FI)/(BW)(AT)$$

where:

CDI_w	=	ingested/inhaled dose (mg/kg-day)
C_w	=	concentration of contaminant in water (mg/L)
IR	=	ingestion rate (L/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
FI	=	fraction ingested from contaminated source (unitless)
BW	=	body weight (kg)
AT	=	averaging time (days)

In accordance with USEPA guidance, the potential exposure to volatiles originating from groundwater during showering and domestic use has been estimated to be equivalent to that ingested through consumption of 2 liters/day of contaminated groundwater. Although the inhalation CDI computed on this basis is equal to that for ingestion exposures, risk and/or hazard associated with inhaled volatile contaminants are characterized using toxicological values specific to the inhalation pathway (e.g., inhalation slope factors [SFs] and RfDs).

HHRAs are composed of many tables, and intake tables serve only as an intermediate check when reviewing the document. The CDI equations above can be solved assuming a concentration of 1, and the result can be used as a universal multiplier. Therefore, a significant number of tables in this HHRA were eliminated. An example of the abbreviated CDI method is shown below:

$$CDI = (EPC)(M)$$

where:

CDI	=	chronic daily intake (mg/kg-day)
EPC	=	exposure point concentration (mg/kg or mg/L)
M	=	multiplier specific to the exposure scenario, land use, and potential receptor selected

Because multipliers can be reviewed separately, CDIs are incorporated into the risk and hazard equations and are not presented separately. Multipliers developed for each land use scenario are listed below.

Residential soil exposure via incidental ingestion:

- $1.37E\text{-}6_{\text{adult — noncarcinogens}}$
- $1.28E\text{-}5_{\text{child — noncarcinogens}}$
- $1.57E\text{-}6_{\text{LWA — carcinogens}}$

Residential soil exposure to organic chemicals via dermal contact:

- $5.62E\text{-}7_{\text{adult — noncarcinogens}}$
- $1.85E\text{-}6_{\text{child — noncarcinogens}}$
- $3.51E\text{-}7_{\text{LWA — carcinogens}}$

Residential groundwater exposure via ingestion or inhalation:

- 2.74E-2 $_{\text{adult — noncarcinogens}}$
- 6.39E-2 $_{\text{adult — noncarcinogens}}$
- 1.49E-2 $_{\text{LWA — carcinogens}}$

Industrial site worker soil exposure via incidental ingestion:

- 4.89E-7 $_{\text{noncarcinogens}}$
- 1.75E-7 $_{\text{carcinogens}}$

Industrial site worker soil exposure to organic chemicals via dermal contact:

- 4.01E-7 $_{\text{noncarcinogens}}$
- 1.43E-7 $_{\text{carcinogens}}$

Industrial site worker groundwater exposure via ingestion or inhalation:

- 9.73E-3 $_{\text{noncarcinogens}}$
- 3.49E-3 $_{\text{carcinogens}}$

Adolescent soil exposure via incidental ingestion:

- 3.17E-7 $_{\text{noncarcinogens}}$
- 4.52E-8 $_{\text{carcinogens}}$

Adolescent soil exposure to organic chemicals via dermal contact:

- $1.30E\text{-}7_{\text{noncarcinogens}}$
- $1.85E\text{-}8_{\text{carcinogens}}$

The multiplier to estimate exposure to inorganics via dermal contact with soil equals the organic compounds times 0.1. The dermal absorption factor of 0.01 is included in the organic multiplier, so multiplying this value by 0.1 adjusts the multiplier to reflect a dermal absorption factor of 0.001, which is used for inorganics.

10.2.7 Toxicity Assessment

Carcinogenicity and Noncancer Effects

USEPA has established a classification system for rating the potential carcinogenicity of environmental contaminants based on the weight of scientific evidence. Cancer weight-of-evidence class "A" (human carcinogens) means that human toxicological data have shown a proven correlation between exposure and the onset of cancer (in varying forms). The "B1" classification indicates some human exposure studies have implicated the compound as a probable carcinogen. Weight-of-evidence class "B2" indicates a possible human carcinogen, a description based on carcinogenicity in laboratory animals but lacking confirmatory human data. Weight-of-evidence class "C" identifies possible human carcinogens, and class "D" indicates a compound not classifiable for its carcinogenic potential. The USEPA has established SFs for carcinogenic compounds. The SF is defined as a "plausible upper-bound estimate of the probability of a response (cancer) per unit intake of a chemical over a lifetime" (USEPA, 1989a).

In addition to potential carcinogenic effects, most chemicals also can produce other toxic responses at doses greater than experimentally derived threshold concentrations. The USEPA has derived RfD values for these chemicals. A chronic RfD is defined as, "an estimate (with uncertainty

spanning perhaps an order of magnitude or greater) of a daily exposure concentration for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime." These toxicological values are used when estimating risk to assess the upper-bound level of cancer risk and noncancer hazard associated with exposure to a given contaminant concentration.

For carcinogens, the potential risk posed by a chemical is computed by multiplying the CDI (mg/kg-day) by the SF (kg-day/mg). The HQ (for noncarcinogens) is computed by dividing the CDI by the RfD (mg/kg-day). The USEPA has set standard limits (or points of departure) for carcinogens and noncarcinogens to evaluate whether significant risk is posed by a chemical (or combination of chemicals). For carcinogens, the point of departure is 10^{-6}, with a generally accepted range of 10^{-6} to 10^{-4}. These risk values correlate with a one-in-10,000 and a one-in-one-million excess cancer incidence resulting from exposure to xenobiotics.

For noncarcinogens, other toxic effects are generally considered possible if the HQ (or sum of HQs for a pathway, HI) exceeds 1.0. Although both cancer risk and noncancer hazard are generally additive (within each group) only if the target organ is common to multiple chemicals, a most conservative estimate of each may be obtained by summing the individual risks or hazards, regardless of target organ. The following HHRAs have taken the universal summation approach for each class of toxicant. Additional details regarding the risk formulae applied to site data are provided in the Risk Characterization section of this document.

Critical studies used in establishing SFs and RfDs by USEPA are shown in the Integrated Risk Information System (IRIS) database (primary source) and/or Health Effects Assessment Summary Tables (HEAST), Fiscal Year 1995 (secondary source). If toxicological information is unavailable in IRIS or HEAST, values were obtained from reports issued by the Environmental Criteria and Assessment Office (ECAO)/National Center for Environmental Assessment (NCEA). Where

applicable, these values were also included in the database for these HHRAs. Table 10-3 summarizes toxicological data in the form of RfDs and SFs obtained for the relevant COPCs, as well as uncertainty/modifying factors, target organs, and cancer classes (where available) for all COPCs identified in this HHRA.

Toxicity Profiles for COPCs

In accordance with RAGS, this HHRA includes brief toxicological profiles for all COPCs identified at either site in Section 10.3. Most information for the profiles was gleaned from IRIS and HEAST, as mentioned in the preceding text, and the toxicological database information table. Any additional references are noted specifically in the profiles. The profiles summarize adverse effects of COPCs and the amounts associated with such effects.

Acetone is a colorless, volatile liquid with a fragrant mint-like odor. It is moderately toxic by various routes. Acetone is a skin and eye irritant which induces narcotic effects at high concentrations. This compound is relatively polar (i.e. more water soluble than many other solvents) and can function as a dermal vehicle (i.e. transfer through the skin) for other compounds. In addition, potentiation of hepatotoxicity can occur if acetone exposure is paired with exposure to halogenated hydrocarbons. Exposure to this compound elicits increased liver and kidney weights, and nephrotoxicity. USEPA set the oral RfD to 0.1 mg/kg-day (Dreisbach, et al, 1987). The uncertainty factor for the oral RfD for acetone is 1000, and there is a modifying factor of 1. The No-observed-adverse-effects level (NOAEL) for acetone is 100 mg/kg-day and the Lowest-observed-adverse-effects level (LOAEL) is 500 mg/kg-day. (IRIS, 1996).

Aluminum is one of the most abundant metals in the earth's crust (7% aluminum), and it is ubiquitous in air and water, as well as soil. This metal is water-soluble, silvery, and ductile, which suggests its usefulness in many processes. Ingesting aluminum can affect the absorption of other elements within the gastrointestinal tract and can alter intestinal function. Aluminum can potentially interfere with the absorption of essential nutrients and cholesterol. Another effect on the gastrointestinal system is the inhibition of acetylcholine-induced contractions, which are part of the neuro-muscular system controlling bowel muscles. The effect could explain why aluminum-containing antacids often produce constipation and indicates aluminum could affect the uptake of other chemicals. Aluminum dust is moderately flammable and explosive in heat. Inhaling this dust can cause fibrosis (aluminosis) (Klaassen, et al., 1986; Dreisbach et al., 1987). No data are available on an applicable SF or the USEPA cancer group. The USEPA Region IV Office of Health Assessment suggested using the provisional oral RfD of 1.0 mg/kg/day. The aesthetic-based secondary maximum contaminant level (SMCL) for drinking water is 50 to 200 μg/L.

Arsenic exposure via the ingestion route darkens and hardens the skin in chronically exposed humans. Inhalation exposure to arsenic causes neurological deficits, anemia, and cardiovascular effects (Klaassen et al., 1986). USEPA set 0.3 μg/kg-day as the RfD for arsenic based on a NOAEL of 0.8 μg/kg-day in a human exposure study. Arsenic's effects on the nervous and cardiovascular systems are primarily associated with acute exposure to higher concentrations. Exposure to arsenic-containing materials has been shown to cause cancer in humans. Inhaling these materials can lead to increased lung cancer risk, and ingestion is associated with increased skin cancer rates. Arsenic has been classified as a group A carcinogen by USEPA, which set the 1.5 kg-day/mg oral SF for arsenic. As listed in IRIS (search date 9/1/95), the classification is based on sufficient evidence from human data. An increased lung cancer mortality was observed in multiple human populations exposed primarily through inhalation. Also, increased mortality from multiple internal organ cancers (liver, kidney, lung, and bladder) and an increased incidence of skin cancer were observed in populations consuming drinking water high in inorganic arsenic.

Human milk contains about 3 μg/L arsenic. The RBC for arsenic in tap water is 0.038 μg/L. As listed in IRIS, the critical effect of this chemical is hyperpigmentation, keratosis, and possible vascular complications. The uncertainty factor was 3 and the modifying factor was 1.

Antimony belongs to the same periodic group as arsenic. This element is absorbed slowly through the gastrointestinal tract, which is the target of this element. Another target is the blood, where antimony concentrates. Due to frequent industrial use, the primary exposure route for antimony to the general population is food. Antimony is also a common air pollutant from industrial emissions. USEPA has not classified antimony as a carcinogen, and the oral RfD is 0.0004 mg/kg-day (Klaassen, et al., 1986). The oral RfD is based on a LOAEL of 0.35 mg/kg bw/day, an uncertainty factor of 1000, and a modifying factor of 1 (IRIS, 1996).

bis(2-ethylhexyl)phthalate, otherwise known as BEHP, is a plasticizer used in virtually every major product category. Phthalate esters are ubiquitously distributed in the environment. Although the toxicity of this compound is relatively low, it is a carcinogen. Reproductive effects are also possible (indicated in animal studies) due to chronic exposure to BEHP. This compound is classified as a B2 carcinogen, and USEPA set the oral RfD and oral SF to 0.02 mg/kg-day and 0.014 kg-day/mg, respectively (Klaassen et al., 1986).

Bromomethane causes epithelial hyperplasia of the forestomach when ingested. The oral RfD is 1.4E-03 mg/kg-day with an uncertainty factor of 1,000. The RfD is based on a NOAEL of 1.4 mg/kg-day and a LOAEL of 7.1 mg/kg-day. The inhalation RfD is 1.43E-03 mg/kg-day with an uncertainty factor of 100. Inhalation of bromomethane causes degenerative and proliferative lesions of the olfactory epithelium of the nasal cavity (IRIS, 1996). Bromomethane has been classified as group "D" by USEPA's carcinogenic weight-of-classification, due to inadequate human and animal data. A single mortality study from which direct exposure associations could

not be deduced and studies in several animal species with too few animals, too brief exposure or observation time for adequate power. Bromomethane has shown genotoxicity (IRIS, 1996).

Cadmium can upset the stomach, leading to vomiting and diarrhea in acute exposure; acute inhalation of cadmium-containing dust can irritate the lungs. Chronic exposure to cadmium, either via inhalation or ingestion, has been shown to cause kidney damage (including kidney stones), emphysema, and high blood pressure. Other tissues reportedly injured by cadmium exposure in animals and humans include the lungs, testes, liver, immune system, blood, and the nervous system (Klaassen et al., 1986). An oral RfD of 0.001 (mg/kg-day) has been determined by USEPA, based on human studies (food) involving chronic exposure in which significant increased protein was found in the urine. A separate oral RfD for water has been determined by USEPA to be 0.0005 mg/kg-day. For inhalation exposure, cadmium has been classified by USEPA as a group B1, or probable human carcinogen, based on limited evidence from epidemiological studies in which an excess risk of lung cancer was observed in cadmium smelter workers. As listed in IRIS (search date 6/28/95), the classification is based on limited evidence from occupational epidemiologic studies consistent across investigations and study populations. There is sufficient evidence of carcinogenicity in rats and mice by inhalation and intramuscular and subcutaneous injection. Seven rat and mice studies where cadmium salts (acetate, sulfate, chloride) were administered orally have shown no evidence of carcinogenic response. There is sufficient evidence of increased risk of lung cancer in rats and mice exposed to cadmium via inhalation. Seven studies in which cadmium was administered orally to rats and mice have shown no evidence of carcinogenic response following exposure via this route. As listed in IRIS, the critical effect of this chemical in water and food is significant proteinuria. The uncertainty factor was 10 and the modifying factor was 1. The uncertainty factor was 10 and the modifying factor was 1.

Chlordane is a polycyclic chlorinated pesticide. Acute exposure to high doses of chlordane causes tremors and convulsions. Chronic exposure can cause emotional and neuromuscular disturbances.

Exposed individuals revert to normal approximately one week after the source is removed (Dreisbach et al., 1987). USEPA has established an oral RfD of 6E-5 mg/kg/day and an oral SF of 1.3 (kg-day/mg) (IRIS, 1998).

Chlorobenzene is a volatile organic that affects the central nervous system (CNS), causes liver and kidney damage, and irritates the mucous membranes, skin, and eyes. USEPA set the oral RfD and inhalation RfD to 0.02 and 0.00571 mg/kg-day, respectively (Dreisbach et al., 1987).

Chloroform, a halogenated hydrocarbon, has been used as a fumigant and an additive to suppress the fire hazard of carbon disulfide, as well as having a low capacity for insect control. Volatile and gaseous anesthetics such as chloroform are sometimes used to produce general anesthesia. This contaminant is the primary chlorinated hydrocarbon produced during chlorination of drinking water, and is commonly present at low concentrations in most drinking water supplies. This compound depresses all CNS function in descending order from the cortex to the medulla. Additional target organs include the liver, heart, and kidney. Chloroform exposure to the heart sensitizes the muscle to arrhythmias, as do many halogenated hydrocarbons. This action could interfere with digitalis glycosides or a pacemaker in the form of premature or uncontrolled beats. Chloroform is a class B2 carcinogen, and USEPA set the oral SF and inhalation SF to 0.0061 and 0.0805 kg-day/mg, respectively. The oral RfD is 0.01 mg/kg-day (Dreisbach et al., 1987).

Chromium exists in two stable, natural forms: trivalent (CrIII) and hexavalent (CrVI). Acute exposure to chromium can result in kidney damage following oral exposure or damage to the nasal mucosa and septum following inhalation exposure. Chronic inhalation exposure to hexavalent chromium has resulted in kidney and respiratory tract damage, as well as excess lung cancer in both animals and humans following occupational exposure. Only hexavalent chromium is believed to be carcinogenic by inhalation (IRIS, 1996). Oral RfD values for both forms of chromium are 1.0 and 5E-3 (mg/kg-day). For trivalent chromium, the RfD is based on liver

toxicity in the rat. For the hexavalent form, the RfD is based on unspecified pathological changes observed in rat studies. In addition, hexavalent chromium is considered a group A carcinogen for inhalation exposures, and an oral SF of 42 kg-day/mg has been established for the hexavalent form. Vitamin supplements contain approximately 0.025 mg of chromium. As listed in IRIS (search date 6/28/95), no critical effects were observed for chromium (III). The uncertainty factor was 100 and the modifying factor was 10. As listed in IRIS (search date 6/28/95), no critical effects were observed for chromium (VI). The uncertainty factor was 500 and the modifying factor was 1.

Copper is a nutritionally essential element, necessary for many of the body's enzymes. In the past, lead pipes and solder were used for residential water pipes, and resulting lead concentrations in drinking water exceeded USEPA guidelines. Copper has been used to replace water pipes in residences due to its lower toxicity to man. Short-term exposure to copper can result in anemia (the lack of iron), the breakdown of red blood cells, and liver and kidney lesions. The target organs for copper are the liver, kidney, and red blood cell. Vitamin C reduces copper uptake from the gut, and other substances can also influence copper uptake. Copper fumes can cause metal fume fever (Klaassen et al., 1986). As listed in IRIS (search date 6/28/95), the D classification is based on no human data, inadequate animal data from assays of copper compounds, and equivocal mutagenicity data. The USEPA oral RfD is 0.0371 mg/kg-day, which is 2.6 mg/day for the average adult (70 kg). In typical vitamin supplements, 2 mg/day is the approximate dose (NRC, 1989).

1,4-Dichlorobenzene is a CLP SVOC; however, it was evaluated for the inhalation pathway as a volatile due to its Henry's Law Constant. This compound affects the CNS, causes liver and kidney damage, and irritation of the mucous membranes, skin, and eyes (Dreisbach, et al., 1987). This compound is classified by USEPA as a B2 carcinogen, with an oral SF of 0.024 kg-day/mg. The inhalation RfD was set to 0.229 mg/kg-day. As listed in IRIS (search date 6/29/95), the

critical effect of this chemical is increased liver weights in P1 males. The uncertainty factor was determined to be 100 and the modifying factor was determined to be 1. The IRIS RfC is 0.8 mg/m^3.

1,1-Dichloroethane is a mutagen (i.e., can cause gene mutations) and a carcinogen (i.e., can cause proliferation of mutated cells in certain species which has historically been used as an insect fumigant for stored grain products. However, this compound is not listed as a human carcinogen by USEPA due to a paucity of applicable data (group C classification). Chronic exposure to this compound could elicit an increase in certain enzymes. This change in enzyme activity could result in unexpected responses to other chemicals such as inhibitory or synergistic effects. In more sensitive species such as mice, chronic exposure to this compound is cytotoxic (i.e., directly toxic to cells). 1,1-Dichloroethane is generally toxic to the nervous system, liver, kidneys, and heart. USEPA set the oral RfD and inhalation RfD to 0.1 and 0.143 mg/kg-day, respectively (Dreisbach, et al., 1987).

1,2-Dichloroethane is a clear, human-made liquid that evaporates at room temperature and has a pleasant smell and a sweet taste. It is used to make vinyl chloride and several solvents that remove grease, glue, and dirt. It is also used to remove lead from gasoline. 1,2-Dichloroethane remaining on soil from a spill or improper disposal can travel through the ground into water and may remain in water or soil for more than 30 days (ATSDR, 1991).

Adverse effects on the central nervous system, gastrointestinal tract, and respiratory tract are often the first responses observed after acute exposure to a high concentration of 1,2-dichloroethane. In instances where exposure has resulted in death, the cause has usually been attributed to kidney failure in animals. Death resulting from cardiac arrhythmia and hepatotoxicity has been documented in humans. Gross and histopathological examination of autopsied tissues taken from humans and animals that died following high-level acute exposure to 1,2-dichloroethane generally

revealed congestion, degeneration, necrosis, and/or hemorrhagic lesions of most internal organs. The primary target organs for 1,2-dichloroethane-induced toxicity are the lungs, the liver, and the kidneys. USEPA has classified 1,2-dichloroethane as a Group B2 carcinogen (IRIS, 1996). 1,2-dichloroethane has also been issued a both an oral SF and an inhalation SF of 9.1E-02 (IRIS, 1996). A provisional value is given by EPA-NCEA Regional Support for an inhalation RfD of 2.86E-03.

1,1-Dichloroethene is a VOC, primarily toxic to the liver, CNS, and kidneys. The mucous membrane, skin, lung, and cornea (irritation) are also affected. 1,1-dichloroethene is more toxic than 1,2-dichloroethene. This chlorinated compound is a USEPA group C carcinogen. The oral RfD is 0.009 mg/kg-day, and the oral SF and inhalation SF are 0.6 and 0.175 kg-day/mg, respectively (Dreisbach et al., 1987).

1,2-Dichloroethene is a halogenated hydrocarbon associated with toxicity to the mucous membrane, skin, lung, cornea (irritation), and liver. This compound is less toxic than its alkane counterparts, and is neither mutagenic nor carcinogenic. There is no USEPA carcinogenicity listing for this compound (Dreisbach et al., 1987). However, the oral RfD has been set to 1E-02 mg/kg-day for the cis-isomer, and at 2E-02 mg/kg-day for the trans- isomer by USEPA (USEPA, 1995f and IRIS, 1996). An oral RfD has also been set for the 1,2-dichloroethene mixture as 9E-03 mg/kg-day (USEPA, 1995f). Data for this compound were reported differently by USEPA and different laboratories. Consequently, the most conservative RfD (9E-03 mg/kg-day) was used in this HHRA when specific isomers were not differentiated by the reporting laboratory.

Dieldrin is a polycyclic chlorinated pesticide. Short-term exposure to high doses of dieldrin causes tremors and convulsions. Chronic exposure can cause emotional and neuromuscular disturbances. Exposed individuals revert to normal approximately one week after the dieldrin

source is removed. Dieldrin is classified as a B2 carcinogen by USEPA; the oral SF, inhalation SF, and oral RfD were set to 16 kg-day/mg, 16.1 kg-day/mg, and 0.00005 mg/kg-day, respectively (Dreisbach et al., 1987).

Lead has been classified as a group B2 carcinogen by USEPA based on animal data. No RfD or SF has been set by USEPA. However, an action level for soil protective of child residents has been proposed by USEPA Region IV: 400 mg/kg. USEPA's OSWER has recommended a 1,000 mg/kg cleanup standard for industrial properties. USEPA's Office of Water has established a treatment technique action level of 15 μg/L. As listed in IRIS (search date 10/17/95), the classification is base on sufficient animal evidence. Ten rat bioassays and one mouse assay have shown statistically significant increases in renal tumors with dietary and subcutaneous exposure to several soluble lead salts. Animal assays provide reproducible results in several laboratories, in multiple rat strains with some evidence of multiple tumor sites. Short-term studies show that lead affects gene expression. Human evidence is inadequate. An RfD and SF have not been set because of the confounding nature of lead toxicity. Lead can accumulate in bone marrow, and effects have been observed in the CNS, blood, and mental development of children. RfDs are based on the assumption that a threshold must be exceeded to result in toxic effects (other than carcinogenicity). Once lead accumulates in the body, other influences cause the actual levels in the blood to fluctuate — sometimes the lead is attached to binding sites; sometimes lead is free flowing. If an exposed individual has previously been exposed to lead, this individual could lose weight and set fat-bound lead free. This fluctuation and lack of previous lead exposure data are two of the reasons lead effects are difficult to predict (Klaassen et al., 1986).

Manganese is an essential nutrient, but chronic exposure (0.8 mg/kg-day) causes mental disturbances. Studies have shown that manganese uptake from water is greater than manganese uptake from food, and the elderly appear to be more sensitive than children (Klaassen et al., 1986; Dreisbach et al., 1987). USEPA determined the RfD to be 0.14 mg/kg-day

based on dietary uptake. USEPA recommended using a modifying factor of 3 when estimating intake from soil and water. In addition, the body is roughly twice as efficient absorbing manganese in water compared to manganese in food. Because of the different uptake rates in water and food, a modified RfD was used in this HHRA. The RfD used was 0.047 mg/kg-day. Inhalation of manganese dust causes neurological effects and increased incidence of pneumonia. An inhalation RfD was set to 0.0000143 mg/kg/day. According to USEPA, manganese cannot be classified as to its carcinogenicity. Therefore, the cancer class for manganese is group D. As listed in IRIS (search date 7/3/96), the classification is based on studies that are inadequate to assess the carcinogenicity of manganese. Manganese is an element considered essential to human health. The typical vitamin supplement dose of manganese is 2.5 mg/day. As listed in IRIS, the critical effects of this chemical in water in the oral summary are CNS effects. The uncertainty factor was 1 and the recommended modifying factor of 3 was used to estimate soil and groundwater intake. The critical effects of this chemical are CNS effects. As listed in IRIS, the critical effect of this chemical in the inhalation summary is impairment of neuro-behavioral function. For inhalation uptake, the uncertainty factor was 1,000 and the modifying factor was 1. The IRIS RfD is 0.00005 mg/m^3.

PCB Aroclors are a group of chlorinated hydrocarbons (such as ***Aroclors-1248, 1254, and 1260***) that accumulate in fat tissue. Occupational exposure (both inhalation and dermal) to PCBs causes eye and lung irritation, loss of appetite, liver enlargement, increased serum liver enzyme levels, rashes and chloracne, and decreased birth weight of infants in heavily exposed worker/mothers. Of the effects listed above, the liver is the primary target organ (Klaassen et al., 1986; Dreisbach et al., 1987). USEPA classified PCB Aroclors as group B2 carcinogens, primarily based on animal data. As listed in IRIS (search date 6/29/95), the classification is based on hepatocellular carcinomas in three strains of rats and two strains of mice and inadequate yet suggestive evidence of excess risk of liver cancer in humans by ingestion and inhalation or dermal contact. Oral ingestion of PCBs causes liver and stomach tumors in rat studies. USEPA set

2.0 kg-day/mg as the oral SF for PCB Aroclors in soil, and 0.4 as the oral SF for PCB Aroclors in groundwater. The oral RfD for PCB Aroclor-1254 was set to 2E-05 mg/kg-day.

Carcinogenic Polyaromatic Hydrocarbons or **BEQ** include the following list of COPCs:

Benzo(a)anthracene	TEF	0.1
Benzo(b)fluoranthene	TEF	0.1
Dibenz(a,h)anthracene	TEF	1.0
Benzo(k)fluoranthene	TEF	0.01
Benzo(a)pyrene	TEF	1.0
Indeno(1,2,3-cd)pyrene	TEF	0.1
Chrysene	TEF	0.001

Some PAHs are toxic to the liver, kidney, and blood. However, the toxic effects of the PAHs above have not been well established. There are no RfDs for the PAHs above due to a lack of data. All PAHs listed above are classified by USEPA as B2 carcinogens, and their carcinogenicity is addressed relative to that of benzo(a)pyrene (BAP), having an oral SF 7.3 kg-day/mg. TEFs, also set by USEPA, are multipliers that are applied to the detected concentrations, which are subsequently used to calculate excess cancer risk. These multipliers are discussed further in the exposure and toxicity assessment sections. Most carcinogenic PAHs have been classified as such due to animal studies using large doses of purified PAHs. There is some doubt as to the validity of these listings, and the SFs listed in USEPA's RBC table are provisional. However, these PAHs are carcinogens when the exposure involves a mixture of other carcinogenic substances (e.g., coal tar, soot, cigarette smoke, etc.). As listed in IRIS (search date 6/28/95), the B2 classification is based on insufficient human data specifically linking BAP to a carcinogenic effect. Multiple animal studies in many species have demonstrated BAP to be carcinogenic by numerous routes.

BAP has produced positive results in numerous genotoxicity assays. At the June 1992 CRAVE Work Group meeting, a revised risk estimate for BAP was verified (see Additional Comments for

Oral Exposure). This section provides information on three aspects of the carcinogenic risk assessment for the agent in question: the USEPA classification and quantitative estimates of exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in application of a low-dose extrapolation procedure and presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per μg/L drinking water or risk per $\mu g/m^3$ air breathed. The third form in which risk is presented is drinking water or air concentration providing cancer risks of one in 10,000 or one in million. The Carcinogenicity Background Document provides details on the carcinogenicity values found in IRIS. Users are referred to the Oral Reference Dose and Reference Concentration sections for information on long-term toxic effects other than carcinogenicity.

As listed in IRIS, dibenz(a,h)anthracene and benzo(b)fluoranthene are classified B2 based on no human data but sufficient data from animal bioassays. Benzo(b)fluoranthene produced tumors in mice after lung implantation, intraperitoneal or subcutaneous injection, and skin painting. As listed in IRIS, the benzo(a)anthracene is classified B2 based on no human data but sufficient data from animal bioassays. Benzo(a)anthracene produced tumors in mice exposed by gavage; intraperitoneal, subcutaneous, or intramuscular injection; and topical application. Benzo(a)anthracene produced mutations in bacteria and in mammalian cells, and transformed mammalian cells in culture. As listed in IRIS, benzo(k)fluoranthene is classified B2 based on no human data but sufficient data from animal bioassays. Benzo(k)fluoranthene produced tumors after lung implantation in mice and when administered with a promoting agent in skin-painting studies. Equivocal results have been found in a lung adenoma assay in mice. Benzo(k)fluoranthene is mutagenic in bacteria (Klaassen et al., 1986).

Other PAHs — those not classified by USEPA as carcinogens — are toxic to the liver, kidney and blood. This group of PAHs includes compounds such as *pyrene*, *acenaphthene, acenaphthylene*,

benzo(g,h,i)perylene, and *phenanthrene*. USEPA determined RfDs for only two of these compounds: pyrene's Oral Reference Dose (RfDo) of 0.03 mg/kg/day is also used as a surrogate RfDo for phenanthrene. The RfDo for acenaphthene was 0.06 mg/kg/day. Carbazole is another PAH which is a carcinogen. USEPA determined the carbazole oral SF to be 0.02 kg-day/mg, which is listed in HEAST.

Tetrachloroethene (PCE) has been used as a solvent in industry and occurs as a volatile constituent in other chlorinated hydrocarbons. Tetrachloroethene exposure can result in long-lasting narcosis with delayed onset and damage to the liver and kidneys. The principal manifestations of overexposure to this halogenated hydrocarbon are coma, jaundice, oliguria, and irritation of the eyes and nose followed by headache and nausea. Cyanosis and CNS depression progressing to coma appear one to four hours after the short-term exposure. Liver and kidney damage after apparent recovery or after repeated exposures cause acute symptoms as nausea, vomiting, abdominal pain, jaundice, oliguria, and uremia. PCE exposure via the inhalation and/or skin absorption exposure pathways could result in headache, tremor, dizziness, peripheral paresthesia, hypesthesia or anesthesia. PCE is a carcinogen, but is currently under review by USEPA; it is currently classified as a B2-C carcinogen. The oral RfD has been set to 0.01 mg/kg-day, and the oral SF and inhalation SF have been set to 0.052 and 0.0023 kg-day/mg, respectively, by USEPA (Dreisbach et al., 1987).

1,1,1-Trichloroethane has historically been used as a fumigant and a solvent in paint removers, typewriter correction fluid, crafts, cleaning, and degreasing agents. This compound primarily depresses the CNS. This compound is not carcinogenic, but the resultant liver toxicity can be increased where exposure to 1,1,1-trichloroethane also includes exposure to alcohols and/or ketones (Dreisbach et al., 1987). USEPA set the oral RfD and inhalation RfD to 0.035 and 0.286, respectively. The inhalation RfD has been withdrawn from IRIS, but this value was used to determine screening concentrations for this compound by USEPA Region III.

Trichloroethene is a mobile, volatile liquid which has the characteristic odor of chloroform. Inhalation, intravenous, and subcutaneous routes are all viable exposure pathways for this compound. TCE is a strong skin and eye irritant that is relatively less toxic if ingested. Inhaling high concentrations causes narcosis and anesthesia. This compound targets the liver and other organs. TCE is a B2 carcinogen, and the oral SF and inhalation SF have been set by USEPA to 0.011 and 0.006 kg-day/mg, respectively. USEPA also set the oral RfD to 0.006 mg/kg-day (Dreisbach et al., 1987).

Vanadium is not readily absorbed through the skin or oral ingestion and is a ubiquitous element. It is also a by-product of petroleum refining. Vanadium is soluble in fats and oils (Klaassen et al., 1986). Municipal water supplies contain 0.001 to 0.006 mg/L. The target organ is unclear, and the primary focus of toxicological information is inhalation of vanadium dust. Typical vitamin supplements contain approximately 0.010 mg in a daily dose. The oral RfD set by USEPA is 0.007 mg/kg/day.

Vinyl chloride is a volatile organic that can cause Raynaud's Phenomenon or white finger disease. It has been shown to cause angiosarcoma, a cancer. It has been also been associated with reproductive dysfunction in men and women. The primary target organs for noncarcinogenic effects are the liver, kidney, and nervous system. This compound inhibits one of the main metabolic pathways of the body (a group of enzymes), and can influence the toxicity of other compounds because of this effect. Due to the carcinogenicity of this compound, USEPA classified vinyl chloride as a class A carcinogen and set the inhalation SF and oral SF to 0.3 and 1.9 kg-day/mg, respectively (Klaassen et al., 1986; Dreisbach et al., 1987).

Zinc is an essential, ubiquitous element present in food, water, and soil. The average American daily intake is approximately 12 to 15 mg, and the recommended daily allowance is 15 mg. Excessive exposure to zinc is relatively uncommon and requires exposure to high concentrations.

This element does not accumulate under chronic exposure conditions, and body content is self-regulated by zinc liver concentrations and absorption mechanisms. Inhaling zinc dust can cause metal fume fever, and the primary effect of zinc ingestion (at toxic concentrations) is gastrointestinal disturbance and irritation. Other effects on the blood, liver, and kidney are possible at higher concentrations. Twelve grams of elemental zinc per day were not shown to elicit effects other than gastrointestinal disturbances over two days (or 48 hours). Experimental animals have been given 100 times the dietary requirements without discernible effects. USEPA determined that the oral RfD is 0.3 mg/kg-day (Klaassen et al., 1986).

10.2.8 Risk Characterization

Risk characterization combines the results of the exposure and toxicity assessments to yield qualitative and quantitative expressions of risk and/or hazard for hypothetically exposed receptors. The quantitative component expresses the probability of developing cancer, or a nonprobabilistic comparison of the estimated dose with a reference dose for noncancer effects. These quantitative estimates are developed for individual chemicals, exposure pathways, and source media, and for each receptor for all media to which a receptor may be exposed. The qualitative component usually involves comparing COC concentrations in media with established criteria or standards for chemicals for which there are no corresponding toxicity values. The risk characterization is used to guide risk management decisions.

Generally, the risk characterization follows the methodology prescribed by RAGS Part A, as modified by more recent information and supplemental guidance cited earlier. The USEPA methods are, appropriately, designed to be health-protective, and tend to overestimate, rather than underestimate, risk. The risk results, therefore, are generally overly conservative, because risk characterization involves multiplying the conservative assumptions built into the exposure and toxicity assessments.

Section 10.3 characterizes health risks associated with the intake of chemicals originating from the respective sites. The USEPA methods used to estimate the types and magnitudes of health effects associated with exposure to chemicals have been supplemented by graphical representations of risk and hazard. The objective of presenting this supplemental information is to more clearly depict the spatial distribution.

Risk Characterization Methodology

Risk to humans following exposure to COPCs is estimated in accordance with USEPA Supplemental Guidance to RAGS Bulletin 4 *Risk Characterization* (USEPA, 1995g). These health-protective methods are likely to overestimate risk. Risks from hazardous chemicals are calculated for either carcinogenic or noncarcinogenic effects. Some carcinogenic chemicals may also pose a noncarcinogenic hazard. The potential human health effects associated with chemicals that produce systemic toxic and carcinogenic influences are characterized for both types of health effects. As mentioned in Section 10.2.7, inhalation exposure-related risk and hazard were computed using appropriate route-specific (inhalation) SFs and RfDs (where available).

Unlike the methods for estimating inhaled or ingested dose of COPCs, which quantify the dose presented to the barrier membranes (the pulmonary or gastrointestinal mucosa, respectively), dermal dose is estimated as the dose that crosses the skin and is systemically absorbed. For this reason, oral toxicity values must be adjusted to reflect the dermally absorbed dose.

Appendix A of RAGS Volume I Part A states that, in the absence of chemical-specific data, an assumption of 5% oral absorption efficiency would be relatively conservative. In accordance with Supplemental Guidance to RAGS: Region IV Bulletin 3 Exposure Assessment (USEPA, 1995e), oral to dermal absorption factors (ABFs) of 80% for VOCs, 50% for SVOCs, and 20% for inorganics were used in the HHRA and are reflected in the applicable risk/hazard tables and estimates.

Dermal RfD values and SFs are derived from the corresponding oral values. In deriving a dermal RfD, the oral RfD is multiplied by the ABF, expressed as a decimal fraction. The resulting dermal RfD is based on the absorbed dose, the appropriate value with which to compare a dermal dose, because dermal doses are expressed as absorbed rather than administered (intake) doses. For the same reasons, a dermal SF is derived by dividing the oral SF by the ABF. The oral SF is divided rather than multiplied because SFs are expressed as reciprocal doses.

Carcinogenic Effects of Chemicals

The risk attributed to exposure to carcinogens is estimated as the probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. In the low-dose range, which would be expected for most environmental exposures, cancer risk is estimated from the following linear equation (RAGS, part A):

$$ILCR = (CDI)(SF)$$

where:

ILCR	=	incremental lifetime excess cancer risk, a unitless expression of the probability of developing cancer, adjusted for reference incidence
CDI	=	chronic daily intake, averaged over 70 years (mg/kg-day)
SF	=	cancer slope factor (kg-day/mg)

For a given pathway with simultaneous exposure of a receptor to several carcinogens, the following equation is used to sum cancer risks:

$$Risk_p = ILCR(chem_1) + ILCR(chem_2) + \ldots ILCR(chem_i)$$

where:

$Risk_p$	=	total pathway risk of cancer incidence
$ILCR(chem_i)$	=	incremental lifetime excess cancer risk for a specific chemical

Cancer risk for a given receptor across pathways and across media is summed in the same manner.

Noncarcinogenic Effects of Chemicals

The risks associated with the noncarcinogenic effects of chemicals are evaluated by comparing an exposure level or intake with a reference dose. The HQ, defined as the ratio of intake to RfD, is defined as (RAGS, Part A):

$$HQ = CDI/RfD$$

where:

HQ	=	hazard quotient (unitless)
CDI	=	intake of chemical (mg/kg-day)
RfD	=	reference dose (mg/kg-day)

Chemical noncarcinogenic effects are evaluated on a chronic basis, using chronic RFD values. An HQ of unity or 1 indicates that the estimated intake equals the RfD. If the HQ is greater than unity, there may be a concern for potential adverse health effects.

For simultaneous exposure of a receptor to several chemicals, an HI will be calculated as the sum of the HQs by:

$$HI = HQ_1 + HQ_2 + \ldots HQ_i$$

where:

HI	=	Hazard Index (unitless)
HQ	=	Hazard Quotient (unitless)

Tables summarize risk and hazard estimates following the general discussions of risk and hazard quantification methods. Subsections included in site-specific HHRAs are organized based on the following: land use scenario, receptor, exposure medium, exposure pathway, carcinogenicity, and chemical.

Identification of Chemicals of Concern

Tables in each HHRA summarize risk and hazard estimates are used to identify COCs for each impacted environmental medium. COCs are identified for each medium based on cumulative (all pathway) risk and hazard projected for each site, and are shown in tabular form. USEPA has established a generally acceptable risk range of 10^{-4} to 10^{-6}, and an HI threshold of 1.0 (unity). As recommended by FDEP, a COC was identified in three steps. First, land use scenarios with risk estimates greater than 10^{-6} or HIs greater than 1.0 were identified. Secondly, media contributing more than these thresholds were identified. Lastly, individual chemicals contributing more than 10^{-6} to risk estimates or 0.1 to HI for a specific medium were identified as COCs. For carcinogens, this approach is relatively conservative, as a cumulative risk of 10^{-4} (and individual ILCR of 10^{-6}) is generally recognized by USEPA Region IV as the actionable trigger for establishing COCs. Under the traditional risk-based COC trigger provisions, fewer COCs would be identified. The COC selection method presented was used to provide a more comprehensive evaluation of chemicals contributing to carcinogenic risk or noncarcinogenic hazard during the RGO development process.

10.2.9 Risk Uncertainty

This section of the HHRAs presents and discusses the uncertainty and/or variability inherent in the risk assessment process in addition to medium-specific and exposure pathway-specific influences. Risk assessment sections are discussed separately below, and specific examples of uncertainty sources are included where appropriate.

General

Uncertainty is a factor in each step of the exposure and toxicity assessments summarized above. Overall, uncertainties associated with the initial stages of the risk assessment process become magnified when they are combined with other uncertainties. Together, the use of high-end estimates of potential exposure concentrations, frequencies, durations, and rates leads to conservative estimates of CDI. Toxicological values for chemicals derived from USEPA databases and other sources are generally derived from animal studies. Uncertainty and modifying factors are applied to extrapolate the results of these studies to predict potential human responses, providing a margin of safety based upon confidence in the studies. During the risk characterization process, individual chemical risk is added to determine the incremental excess cancer risk for each exposure pathway. If the individual exposure predictions were calculated based on the upper limit estimates of exposure to each chemical, the margin of safety of the cumulative incremental risk is the sum of all the individual safety margins applied throughout the process. Use of these safety margins during all exposure and risk/hazard computations provides an extremely conservative means of predicting potential human health effects. The margins of safety or "conservatisms" inherent in each step of the human health risk assessment are addressed in the Risk Uncertainty discussions. It is not possible to eliminate all uncertainties or potential variability in the risk assessment process; however, recognizing the influences of these factors is fundamental to understanding and subsequently using risk assessment results.

The Risk Uncertainty section of each HHRA presents the uncertainty and/or variability of site-specific and medium/pathway-specific factors introduced as part of the risk assessment process, in addition to other factors influencing the uncertainty of the calculated incremental excess cancer risks and hazard quotients/indices. Risk and hazard estimates reflect the underlying variability of the analytical results that they are based on; they also embody uncertainty about potentially unsampled maxima and minima in the analytes. The exposure pathways considered for selection in the Exposure Assessment Section of the HHRA are extremely conservative.

Assumptions are made as part of the risk assessment process based on population studies and USEPA guidance. This guidance divides the assumptions into two basic categories: the upper bound (90th to 95th percentile) and the 50th percentile central tendency (CT) exposure assumptions. As discussed in the Exposure Assessment section, the RME exposure is based on the upper-bound assumptions, and CT exposure is based on mean or median assumptions. Therefore, risk and hazard calculated using RME exposure assumptions are generally overestimates rather than underestimates. The following paragraphs discuss sources of uncertainty and variability pertinent to each exposure pathway evaluated.

Quality of Data

Data collected and validated during the investigation of Site 38 are presented in Section 7 and Appendices I and J. Data validation verifies that the QC requirements of the data set have been met and characterizes the weakness of questionable data.

Most analytical results for environmental samples have inherent uncertainty. This uncertainty is a function of the matrix characteristics and heterogeneity, the precision and accuracy of sampling, and preparation and analysis methods employed. Although data are typically considered to be exact values, they are in reality the laboratory's best estimate within a range defined by method

control limits. As a result, reported concentrations for any chemical can be under or overestimates of actual concentrations.

The data used for this risk assessment were combined from several different investigations and phases of investigations, so variability between data sets could lead to over- or underestimation of exposure and risk. For example, data from the IWTP (Site 36), original Building 71 investigation (Site 38), Building 604 UST investigation, and USEPA investigation were combined to develop the data set used in this risk assessment. Different sampling techniques, seasonal and tidal influences, as well as temporal differences and laboratory methods could be sources of variability in the data.

Exposure Pathways and Contaminants of Concern

As discussed in Section 10.2.5 comparisons were made using the most conservative set of screening values (residential land use) recommended by the Tier I Partnering Team for each exposure medium. Many CPSSs were eliminated from the formal assessment on this basis. Although potential cumulative effects associated with multiple chemicals dismissed through this process are a valid concern, the fact that maximum detected concentrations were used in the screening comparison in concert with low range risk/hazard goals alleviates much uncertainty. A large number (i.e., greater than 10) of constituents would have to be present at near-RBC concentrations to substantiate a concern for cumulative effects. Although the screening method is highly conservative, inhalation and dermal exposure are not incorporated into the soil screening values calculated by USEPA. If these pathways were the primary concern (as opposed to ingestion), the screening method could eliminate contaminants that should otherwise be considered COPCs.

Comparison to Reference Concentrations (Background)

Because the intent of the HHRA is to estimate the excess cancer risk or health hazard posed by COPCs, individual sample data values of inorganic chemicals were compared to background reference concentrations presented in Section 7 after comparing them to risk-based screening values. Additional uncertainty is introduced by comparing site data to nonspecific screening reference data. Although the background concentrations are specific to NAS Pensacola, they are not site-specific.

Background or non-site-related contamination was not considered in identifying organic COPCs for NAS Pensacola sites. In accordance with USEPA Region IV Supplemental Guidance for RAGS, cPAHs were addressed in terms of BEQs, as described in Section 10.2.5 (USEPA, 1995). The compounds that make up this group are commonly found in association with tar, asphalt, used oils, and combustion by-products. At NAS Pensacola, all three types of cPAH sources existed at some time. During RI activities, cPAHs were frequently detected where surface soil samples were collected near roadways and parking lots. Tar has been used extensively across NAS Pensacola as a base for roads and parking lots. Because coal and combustion generate cPAHs, the detection of cPAHs in soil mixed near asphalt or containing asphalt runoff is expected.

Elimination of Essential Nutrients

In accordance with RAGS, the following nutrients were eliminated from the Site 38 HHRAs: calcium, sodium, potassium, magnesium, and iron. Toxicity from overexposure to the nutrients listed above is possible only if human receptors are exposed to extremely high doses. USEPA recommends eliminating these compounds from formal risk assessment. Because no screening comparison was performed, the HIs calculated in the HHRA could be positively influenced by the nutrient concentrations detected onsite. Therefore, the HIs are possibly underestimates. With respect to essential nutrients, however, their contribution would be small relative to other chemical concentrations reported in Site 38 media.

Characterization of Exposure Setting and Identification of Exposure Pathways

The potential for high bias is introduced through the exposure setting and pathway selection due to the highly conservative assumptions (e.g., future residential use) recommended by USEPA Region IV and FDEP when assessing potential and current exposure. The exposure assumptions made in the site worker scenario are also very conservative and would tend to overestimate exposure. Current site workers are not exposed to site groundwater and contact with soil is expected to be minimal due to coverage by existing features.

Future residential use of Site 38 resulting in exposure current soil conditions is unlikely. If this area were developed as residential sites, most of the present buildings would be demolished and the surface soil conditions would likely change — the existing soil could be covered with roads, paved driveways, landscaping soil, and/or houses. These factors indicate that exposure pathways assessed in the HHRA would generally overestimate the risk and hazard posed to current site workers and future site residents and that site conditions would change.

To more accurately assess potential exposure under current site conditions, existing features were evaluated to determine whether they might preclude or minimize contact. Asphalt parking/road surfaces, buildings, and concrete slabs are examples of features under which soil samples were collected. Assuming the future site use involves maintaining these structures, onsite workers would not be chronically exposed to soil beneath them. These factors should be considered by risk management, because this site contains significant surface features and is paved.

Groundwater is not currently used at NAS Pensacola as a source of potable or process water. Water is obtained from a wellfield north of Bayou Grande at NAS Corry Station. As a result, groundwater would not be expected to be used under future site use scenarios. Therefore, the scenario established to project risk/hazard associated with groundwater exposure is highly conservative, and associated pathways are not expected to be completed in the future.

Because chronic RME estimates of risk/hazard exceeded risk and hazard thresholds, CT was analyzed for the residential and site worker scenarios. To estimate risk for groundwater COPCs, the EPC was not modified, and tables are referenced in the site-specific HHRAs which present the EPCs used. CT exposure scenarios were constructed consistent with standard CT exposure assumptions provided in *Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure-Draft* (USEPA, November 1993b), and CT exposure assumptions are shown in Table 10-4.

Groundwater is not currently used at NAS Pensacola as a source of potable or process water. Water is obtained from a wellfield across Bayou Grande at NAS Corry Station. As a result, groundwater would not be expected to be used under future site use scenarios. Therefore, the scenario established to project risk/hazard associated with groundwater exposure is highly conservative, and associated pathways are not expected to be completed in the future.

Determination of Exposure Point Concentrations

Based on the guidance provided by USEPA, EPCs are concentrations used to estimate CDI. The uncertainty associated with EPCs stems primarily from their statistical determination or the imposition of maximum concentrations, described below.

Statistical Estimation of Exposure Point Concentrations

USEPA's *Supplemental Guidance to RAGS: Calculating the Concentration Term* guidance (May 1992) (USEPA, 1992c), outlines a statistical estimation of EPC. These calculated concentrations are 95% UCLs for the mean, which are based on certain assumptions and were used to assess soil only. USEPA assumes that most (if not all) environmental data are lognormally distributed. This assumption can lead to over- or underestimation of the concentration term because many environmental data are neither normally nor lognormally distributed.

The UCL calculation method includes a statistical value, the H-statistic, which is based on the number of samples analyzed for each COPC and the standard deviation of the results. To obtain this number, a table must be referenced, and the value must be interpolated (an estimation) from the table. The equation for the H-statistic has not been provided in the supplemental guidance, nor does the document referred to in the guidance provide the equation. Although the statistic appears to be nonlinear, local linearity was assumed to facilitate interpolation of the statistic for each COPC addressed in the HHRAs.

Linear interpolation provides a good estimate of H; however, both the UCL formula and H are natural log values. The effect of multiplying natural log numbers is not equivalent to multiplying untransformed values. When data are log-transformed, adding two numbers is the equivalent of multiplying the two numbers if they were not transformed. The effect of multiplying a number while in log form is exponential; and here, H is applied as a multiplier. In summary, using this method to calculate the UCL has the effect of overestimating, often providing concentrations greater than the maximum detected onsite. The limited number of soil and groundwater samples used to assess site conditions often resulted in considerable variability between data points, and thus relatively high standard deviations about the mean. The high standard deviation elevates UCL projections.

Although RAGS advocates using neither worst-case scenarios nor maximum concentrations as EPCs, the use of the H-statistic often necessitates using the reported maximum concentration as the EPC. In accordance with RAGS, the lesser of either the maximum concentration or the UCL is used as the EPC. As reviewed above, summation of risk based on maximum concentrations leads to overestimation of exposure, especially in the case of low detection frequency or spatially segregated COPCs. This concept is further discussed below.

Frequency of Detection and Spatial Distribution

Because of the influence of standard deviation on EPC, low frequency of detection can cause COPCs to be addressed inappropriately in the risk assessment. More specifically, COPCs detected only once or twice in all soil samples analyzed (having concentrations exceeding the RBCs and reference concentrations) would be expected to have relatively higher standard deviations as concentration variability or range widens when proxy concentrations are used to account for nondetects. Higher standard deviation results in a high H-statistic, typically leading to a UCL greater than the maximum concentration detected onsite. If that is the case, then using the UCL or maximum concentration detected as EPC (or possibly the inclusion of the COPC in question as a COC) may not be appropriate when EPC is assumed to be distributed equally across the site. It is not feasible for a receptor to be simultaneously exposed to maximum concentrations of different contaminants at several locations. The use of the maximum concentrations (or the UCL) is questionable for these contaminants, and the calculated risk and hazard could be skewed upward due to the low frequency of detection. The question that must be answered is does this define a hot spot, or is the contamination simply part of a larger exposure area?

In some instances, it is possible to define hot spots within the investigation area. A hot spot is an isolated area of concentrated contamination within a larger area which is not impacted, or much less so. Exposure quantification in the presence of a hot spot may be achieved by calculating an FI/FC from contaminated source factor based on the percentage of the total exposure area encompassed by the hot spot, then using this term to modify the maximum (or restricted area average) contaminant concentration to derive the EPC. However, this method was not used in this HHRA based on FDEP's recommendations in their November 26, 1997 Comments on the Errata for the September 5, 1997 NAS Pensacola Site 38 RI.

Chemicals reported in less than 5% of the samples analyzed were excluded from area-wide assessments but were included in point risk estimates, as discussed in Section 10.2.5. Site-specific HHRAs reference the EPC tables in Section 10.3.

Toxicity Assessment Information

There is a generally recognized uncertainty in human toxicological risk values developed from experimental data primarily due to the uncertainty of data extrapolation in the areas of: (1) high- to low-dose exposure and (2) animal data to human experience. The site-specific uncertainty is mainly in the degree of accuracy of the exposure assumptions. Most of the assumptions used in this and any risk assessment have not been verified. For example, the degree of chemical absorption from the gut or through the skin or the amount of soil contact is not known with certainty.

The uncertainty of toxicological values from the IRIS and HEAST databases provided by USEPA is summarized (where available) in Section 10.2.8. The uncertainty factors assigned to these values account for acute to chronic dose extrapolation, study inadequacies, and sensitive subpopulations, among other factors. Although uncertainty factors for a specific compound may be 1,000 or higher, these safety factors are applied by USEPA to help guarantee that the overall assessment of risk/hazard is conservative toward human health concerns. In the presence of such uncertainty, the USEPA and the risk assessor are obligated to make conservative assumptions so that the chance is very small for the actual health risk to be greater than what is determined through the risk assessment process. Conversely, the process is not intended to yield overly conservative risk values that have no basis in actual conditions. This balance was kept in mind in developing exposure assumptions and pathways and in interpreting data and guidance.

Evaluation of Chemicals for Which No Toxicity Values Are Available

In addition to the typical uncertainties inherent in toxicity values, parameters that do not have corresponding RBCs due to the lack of approved toxicological values were not included in the CDI calculation data. This does not indicate that chemicals lacking approved toxicological values pose no risk/hazard. As stated previously, essential nutrients were eliminated based on their low potential for toxicity. Therefore, these chemicals were not assessed further in the HHRA.

Evaluation of Potential Acute Cadmium Toxicity

During the January 27, 1998 Tier I Partnering Team Meeting, FDEP recommended that the potential for acute cadmium toxicity be evaluated (January 27, 1998 Tier I Partnering Team Meeting Minutes). Since that time, FDEP developed the April 30, 1998 Final Report *Soil Cleanup Target Levels (SCTLs)*, which contains an acute cadmium screening value of 0.05 mg/kg.

The acute cadmium SCTL would not be appropriate to assess Site 38 soil for several reasons:

- the background concentration for cadmium in surface soil is higher than the SCTL
- the future land use of the site will not likely be residential
- most of the site is paved
- the toxic benchmark would not be applicable
- a more applicable screening value was already used and agreed upon by the Tier I Partnering Team

The Navy will restrict land use at Site 38 to industrial use only and will prevent groundwater use in accordance with the Land Use Restriction Agreement signed August 31, 1998 between the Navy, FDEP, and USEPA. Most of the site is paved, and a list of unpaved locations is provided in Table 10-13. On page 32, FDEP's document states that the high ingestion rate is used "to

address the possibility that some children may exhibit soil pica (ingestion) in quantities far greater than the 200 mg/day value." USEPA recommends an ingestion rate of 200 mg/day for children and has suggested 5 g/day to address pica. The FDEP document used 10 g to address pica and used the chronic oral RfD rather than an acute toxic effect to address acute exposure. As stated in the document on page 37, "... because this RfD is based on an effect (renal toxicity) that is not a concern with acute ingestion, it could be argued that this value is too conservative." The screening value for chronic effects is 39 mg/kg cadmium in soil for residential land use, which was used in this HHRA as a screening value as discussed in Section 10.2.5. The industrial screening value would likely be more appropriate to screen cadmium concentrations in soil at this site based on the most likely future land use scenario.

Quantification of Risk/Hazard

This section of each HHRA discusses potential sources of uncertainty or variability identified in the quantification of risk and hazard that are not covered in preceding sections. Each exposure medium addressed in the formal risk assessment process is discussed briefly.

Mapping Risk/Hazard

Maps were constructed to show cumulative risk and hazard estimates for sample locations, based on the location-specific data for the medium of interest. Location-specific totals were summed and plotted to illustrate ranges of total risk or total hazard.

Risk and hazard point mapping is useful in risk assessment for determining whether isolated areas of contamination exist within an otherwise unimpacted area. This information is important because heterogeneous contaminant concentrations can affect the manner in which receptors are exposed to the affected media. As discussed earlier, it is sometimes appropriate to estimate the FI/FC from the contaminated source in estimating exposure. Point maps allow for visual analysis of risk and hazard distributions and facilitate estimation of the extent of hot spots relative to the

overall site area. These maps also support preliminary scoping of remedial requirements as well as assessment of potential cleanup alternatives in the FS.

Cumulative risk maps could be misleading when different chemicals contribute to elevated risk estimates in a cluster of sample locations. The area would appear to be a hot spot, when chemicals with different toxicology were reported at each location. For this reason, it is important to support the figures with tables showing individual chemical concentrations along with risk and hazard estimates. These tables are sorted by sample location and also show cumulative values for each location.

10.2.10 Risk Summary

In each site-specific HHRA, this section summarizes the risk and hazard projected for each receptor group, exposure medium, and exposure pathway.

10.2.11 Remedial Goal Options

RGOs are chemical concentrations computed to equate with specific risk and/or hazard goals that may be established for a particular site. COCs were identified in Section 10.3, requiring RGO calculation. COCs and RGOs are listed in Sections 10.3.1 and 10.3.2. Inclusion in the RGO table does not necessarily indicate that remedial action will be required to address a specific chemical. Instead, RGOs are provided to facilitate risk management decisions.

In accordance with USEPA Supplemental Guidance to RAGS *Bulletin 5 Development of Risk-Based Remedial Options* (USEPA, 1995c), RGOs were calculated at 10^{-4}, 10^{-5}, and 10^{-6} risk levels for carcinogenic COCs and HQ goals of 3, 1, and 0.1 for noncarcinogenic COCs. RGOs for carcinogens were based on the residential lifetime weighted average and chronic adult site worker exposure. Groundwater RGOs for the site resident and site worker are presented in separate tables

(where applicable) in each site-specific HHRA. Hazard-based RGOs were calculated based on either the hypothetical child resident or the adult site worker, as noted in each corresponding table.

10.3 Site-Specific Human Health Risk Assessments

The following sections present the HHRA prepared for individual sites. The HHRAs are presented and organized as described above.

10.3.1 Human Health Risk Assessment for Building 71

10.3.1.1 Site Background and Investigative Approach

The focus of the investigation near Building 71 was an assessment of the effects of the past management of a variety of industrial wastes generated near Building 71. Building 71 was demolished from September to October 1993, and Sections 2.1.3 and 2.2.1 summarize the site history. Thirty-five surface soil samples (discussed in Section 7) were collected, and the analytical data were used to estimate exposure in this HHRA. Eighteen groundwater samples discussed in Section 7 were collected from shallow and intermediate depth monitoring wells, the results of which were used to estimate exposure to chemicals in groundwater. Sample designations and corresponding analytical methods for soil and groundwater samples are shown in Tables 10-5 and 10-6, respectively. In addition, hexavalent chromium analyses were performed on 10 selected soil samples and four groundwater samples.

10.3.1.2 COPC Identification

Soil

Based on the screening comparisons described in Section 10.2.5 of this RI and presented in Tables 10-7 and 10-8, this HHRA will focus on the following COPCs: 1,2-dichloroethene, Aroclor-1254, BEQ, aluminum, antimony, arsenic, cadmium, chromium (total), copper, gamma-chlordane, and manganese. Table 10-9 presents BEQ concentrations.

Groundwater

As shown in Tables 10-10 and 10-11, the COPCs identified in groundwater for this site are: 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethane, 1,2-dichloroethene (total), 1,4-dichlorobenzene, bromomethane, chlorobenzene, chloroform, tetrachloroethene, trichloroethene, vinyl chloride, aluminum, arsenic, cadmium, chromium (total), copper, lead, manganese, vanadium, and zinc. 1,1-dichloroethene, 1,2-dichloroethane, 1,4-dichlorobenzene, and bromomethane were excluded from area-wide estimates but were included in point risk estimates based on low detection frequency.

Table 10-12 summarizes COPCs for this exposure area.

10.3.1.3 Exposure Assessment

Exposure Setting

Building 71 is southwest of Building 604, and is separated from Building 604 by a road and an IWTP line. The area will likely remain a paved and industrially zoned area. Sections 2.1.1 and 3 describe the site's history and setting.

Potentially Exposed Populations

As shown in Table 10-1 in Section 10.2, potentially exposed populations are hypothetical future site residents, current and hypothetical future site workers, and hypothetical adolescent trespassers. The Navy plans to maintain this paved, industrial area, and there are no known construction plans or projected zoning changes. Current site workers traverse the paved site, which is sometimes used as a parking area.

Standard default hypothetical future site resident and worker land use scenarios were addressed in this risk assessment, and the adolescent trespasser scenario was included for the soil exposure pathway only. Land use scenarios in this HHRA assumed soil sample locations that are currently

paved would be unpaved, making direct soil contact possible. Continuous exposure to surface soil conditions was assumed, as well as assuming groundwater would be used as a source of drinking water.

Some islands of grass have been planted amid the pavement, making soil exposure currently possible at some locations. Samples were collected at some of these locations, as indicated in Table 10-13.

Construction work generally requires less than one year to complete a project, and chronic exposure is typically seven years or more, according to RAGS. The future site worker scenario used in this assessment assumes 25-year exposure. Therefore, future worker assessment is considered to be protective of both current site use and future construction/maintenance workers' exposure to surface soil.

Subsurface soil data and indirect pathways are addressed in Section 9. Direct contact with subsurface is unlikely because the water table is very close to land surface.

In summary, land use scenarios included in this HHRA assume exposure pathways would be complete. Scenarios are for hypothetical potential future land use.

Exposure Pathways

Specific surface soil exposure pathways for the hypothetical site residents, trespassers, and site workers are dermal contact and incidental ingestion. Groundwater exposure pathways for hypothetical site residents and site workers include ingestion and inhalation of groundwater COPCs, assuming drinking water wells would be installed and the general water quality of the aquifers sampled would be sufficient for a drinking water supply. Table 10-1 in Section 10.2

summarizes the exposure pathways assessed in this HHRA. Uniform exposure was assumed for all soil sample locations.

Exposure Point Concentrations and Quantification of Exposure

Thirty-five surface soil samples were analyzed for this site. Table 10-14 presents the EPCs for the COPCs identified in surface soil. Eighteen groundwater samples were analyzed, and EPCs for the COPCs identified in groundwater are the maximum reported concentrations shown in Tables 10-9 and 10-10 in accordance with FDEP's recommendations regarding EPCs for groundwater at Site 38 (January 27, 1998 Tier I Partnering Team Meeting Minutes).

10.3.1.4 Toxicity Assessment

Toxicity assessment terms and methods are discussed in Section 10.2.8 of this report. Table 10-4 in Section 10.2.8 presents toxicological information for this HHRA. This information was used to quantify risk and hazard associated with soil and groundwater contaminants. Toxicological profiles for each COPC are provided in Section 10.2.8.

Chromium exists in predominantly two valence states. For screening purposes, all chromium data were assumed to be present in the more toxic chromium VI valence state. The RfD for chromium VI is 0.005 mg/kg/day as opposed to 1 mg/kg/day for chromium III. Realistically, chromium exists in a balance between chromium III and chromium VI. Due to the past uses of Site 38 (plating, scrap metal recycling, and paint stripping), hexavalent chromium samples were collected. These data indicate total chromium reported in TAL metals at Site 38 is primarily trivalent. Consequently, the RfD for chromium used at Site 38 is 1 mg/kg-day.

Manganese was identified as a COPC, which has an RfD of 0.014 mg/kg-day for food. In accordance with recommendations in IRIS, a modifying factor of 3 should be applied to this value when assessing soil and groundwater exposure. This modification results in the adjusted

manganese RfD of 0.047 mg/kg-day, which was used to estimate the HQ in this HHRA. FDEP recommends an RfD of 0.023 mg/kg-day, which would double the HQ in this HHRA. Tables are noted to this effect as agreed during the January 27, 1998 Tier I Partnering Team Meeting (January 27, 1998 Tier I Partnering Team Meeting Minutes).

10.3.1.5 Risk Characterization

Risk estimates for soil and groundwater pathways are summarized in Table 10-15.

Land Use Scenarios

Three hypothetical future land use scenarios were assessed in this HHRA: residential, industrial site worker, and site trespasser.

Surface Soil Pathways

Exposure to surface soil onsite was evaluated under residential, industrial (site worker), and adolescent trespasser scenarios. Exposure pathways evaluated are incidental ingestion and dermal contact. For future site residents, HQs were estimated separately for child and adult exposure, and the LWA was used to estimate ILCR assuming a receptor would be exposed during childhood and as an adult. ILCRs and HQs associated with the incidental ingestion of and dermal contact with site surface soil are presented in Tables 10-16 and 10-17, respectively.

Groundwater Pathways

Exposure to groundwater onsite was evaluated under both residential and industrial scenarios. The groundwater exposure pathways were evaluated assuming that site groundwater will be used for potable and/or domestic purposes and that an unfiltered well will be installed, drawing from the corresponding water-bearing zone. Future site residents' HI was computed separately for child and adult receptors. Tables 10-18 and 10-19 present the ILCRs and HQs for the ingestion and inhalation exposure pathways, respectively.

Hypothetical Future Site Residents

Soil

The sum soil ILCR estimate for hypothetical future site resident is 1E-5. The ingestion ILCR for surface soil is 9E-6, while the dermal pathway ILCR is 3E-6. Arsenic and BEQ are the primary contributors for the ingestion pathway with BEQ also contributing significantly to the dermal pathway.

The sum soil HI estimates for the hypothetical future adult and child residents are 0.06 and 0.09, respectively. HI estimates for the hypothetical future adult and child residents are 0.05 and 0.45 respectively for the soil ingestion pathway. HIs for the hypothetical future adult and child dermal contact pathways are 0.014 and 0.045. Aluminum was the primary contributor for both pathways.

Groundwater

The sum groundwater ILCR estimate is 3E-3 for the hypothetical future site resident receptor. For the ingestion and inhalation pathways, the lifetime weighted average ILCR estimates are 3E-3 and 2E-4, respectively. Arsenic, 1,1-dichloroethene, and vinyl chloride are primary contributors to the ingestion ILCR, while tetrachloroethene, trichloroethene, and chloroform are secondary contributors. Primary contributors to the inhalation pathway are vinyl chloride and chloroform, while trichloroethene is a secondary contributor.

The sum hypothetical future site resident adult and child HI estimates are 12.9 and 31.6, respectively. Ingestion pathway HI estimates for the hypothetical future adult and child resident are 12.9 and 30.2, and inhalation HI estimates for the hypothetical future adult and child resident are 0.6 and 1.4. The primary contributor to the ingestion HI is arsenic, with most secondary contributors accounting for approximately an order of magnitude less of the total HI. Trichloroethene is the primary contributor to the inhalation HI.

Lead Toxicity

Currently, USEPA has established neither a slope factor nor a reference dose for lead. Although lead is currently classified as a B2 carcinogen, the USEPA considers the noncarcinogenic neurotoxic effects in children to be the critical toxic effect with respect to establishing health-based environmental cleanup objectives. The neurotoxic effects of chronic low-level lead exposure in children may occur at blood levels as low as 10 μg/dL. USEPA recommends a pharmacokinetic model when assessing lead exposure to estimate the blood lead level of a child receptor.

Lead was not identified as a soil COPC. The average surface soil lead concentration is 74.3 mg/kg. However, the average lead concentration reported in groundwater (0.1062 mg/L) is greater than the treatment technique action level (0.015 mg/L). USEPA's lead model was used to estimate blood lead levels in children who hypothetically would drink groundwater and directly contact soil. Based on the average lead concentrations reported in onsite soil and groundwater, the projected blood lead levels were greater than 10 μg/dL and lead was identified as a COC. The USEPA model output is presented in Table 10-20. The geometric mean and intercept using a probability density histogram were 9.1 μg/dL and 40.37%.

Hypothetical Site Trespassers

The sum soil ILCR estimate is 4E-7 for the adolescent site trespasser. Site trespasser ILCR is 3E-7 for the incidental ingestion pathway and 1E-7 for the dermal contact pathway. BEQ and arsenic are primary contributor for both pathways. The sum soil HI for the adolescent site trespasser is 0.01. HIs are 0.01 for the ingestion pathway and 0.003 for the dermal pathway.

Hypothetical Future Site Workers

Soil

The sum soil ILCR estimate for the hypothetical future site worker is 2E-6. Hypothetical future site worker ILCR is 1E-6 for both the incidental ingestion and dermal contact pathways. BEQ and

arsenic are the primary contributors for both pathways. The sum soil HI estimate is 0.03 for the hypothetical future site worker. HIs are 0.02 for the ingestion pathway and 0.01 for the dermal pathway. Contributors are shown in Tables 10-16 and 10-17; no one contributor accounted for the majority of the HI.

Groundwater

The sum groundwater ILCR estimate is 8E-4 for the hypothetical future site worker receptor. For the ingestion and inhalation pathways, the ILCR estimates are 7E-4 and 5E-5, respectively. Arsenic is the primary contributor to ingestion ILCR, while 1,1-dichloroethene, vinyl chloride, and tetrachloroethene are secondary contributors. The primary contributor to the inhalation pathway is vinyl chloride, with chloroform and as a secondary contributor.

The sum groundwater HI estimate for the hypothetical future site worker is 4.8. HIs for the ingestion and inhalation pathways are 4.6 and 0.22, respectively. The primary contributor to the ingestion HI is arsenic, with cadmium as a secondary contributor. 1,1-Dichloroethane and trichloroethene are primary contributors to inhalation HI.

Current Site Workers

Surface soil is currently covered by pavement near former Building 71, the area is infrequently used, and groundwater is not used as a drinking water source at NAS Pensacola. In the absence of completed exposure pathways, no threat to human health would be posed by the chemicals reported in soil and groundwater.

COCs Identified

COCs were identified based on either cumulative risk or hazard estimated for soil or groundwater pathways. Table 10-21 summarizes COCs identified in each medium based on contribution to cumulative ILCR or HI.

Graphical Presentation of Risk Estimates

In addition to the standard RAGS tabular presentation of risk estimates, point estimate maps were plotted for soil and groundwater to clarify the spatial distribution for risk managers. As an extension of conventional data presentation, excess cancer risk and hazard estimates were calculated for each sample location. Point estimates of risk and hazard were developed for all land use scenarios included in this HHRA.

Tables were generated to present risk estimates for each COPC at each sample location using the ratio of the reported concentration to the corresponding RGO and risk estimate used to develop the RGO. For example, the residential RGO for arsenic is 0.416 mg/kg when estimated at 1E-6 risk for an LWA residential receptor. A soil arsenic concentration of 18.03 mg/kg would result in a risk estimate of 4.3E-5. This method incorporates both incidental ingestion and dermal contact exposure pathways, the basis for calculating RGOs.

After estimating risk for each COPC and each sample location, risk estimates were summed to provide cumulative risk estimates for each sample location and land use scenario to facilitate graphical presentation. Tables presenting hazard estimates were similarly developed. ArcView, a graphical data presentation and geographic information system software package, was used to plot risk and hazard estimates on base maps. The risk or hazard for individual locations was plotted using corresponding northing and easting data. All graphical presentations of risk and corresponding tables are based on RME exposure assumptions and RGOs presented in Section 10.3. Figures were developed for the residential land use scenario only. Point estimates for a residential land use scenario are shown in corresponding tables.

Risk and hazard point mapping is useful for determining whether hot spots (or isolated areas of gross contamination) exist within an otherwise unimpacted area and in identifying areas where remedial activities would be more effective. This information is important because heterogeneous

contaminant concentrations can affect the manner in which receptors are exposed to the affected media. Point maps allow for visual analysis of risk and hazard distributions and facilitate estimation of the extent of hot spots relative to the overall site area. These maps also support preliminary scoping of remedial requirements as well as assessment of potential cleanup alternatives in the FS.

Cumulative risk maps could be misleading when different chemicals contribute to elevated risk estimates in a cluster of sample locations. Such an area could appear to be a hot spot, when in fact chemicals with different toxicology were reported at each location. For this reason, it is important to support the figures with tables showing individual chemical concentrations along with risk and hazard estimates. These tables are sorted by sample location and also show cumulative values for each location.

Figures 10-1 through 10-4 are approximations which include many uncertainties. Groundwater quality and the availability of drinking water from Corry Station would make using onsite groundwater highly unlikely, and groundwater exposure pathways are not currently completed, nor are they expected to be in the future. Point estimates shown in Tables 10-22 and 10-23 would overestimate risk and hazard. The numerous uncertainties in risk and hazard estimates presented in tables and figures below should be considered by risk management when making decisions regarding the potential for exposure to site media. If an exposure pathway will not be completed, that pathway poses no risk.

Risk figures were developed for soil risk, soil hazard, groundwater risk, and groundwater hazard. As previously discussed, figures were developed only for a residential land use scenario, although estimates assuming other land uses are provided in corresponding tables.

10.3.1.6 Risk Uncertainty

Characterization of Exposure Setting and Identification of Exposure Pathways

The potential for high bias is introduced through the exposure setting and pathway selection due to the highly conservative residential assumptions recommended by USEPA Region IV and FDEP when assessing exposure. The exposure assumptions in this HHRA are highly protective and would generally tend to overestimate exposure, because actual exposure would likely be limited relative to the assumed exposure conditions used to estimate risk in this HHRA.

Residential use of the site is not expected, based on current site uses and the nature of surrounding buildings. If this area were to become a residential site, it would require that the buildings would be demolished, the asphalt surface removed, and the surface soil conditions would likely change dramatically. In addition, the area near Building 71 is paved, and the location having the highest cumulative ILCR estimate is directly under a building. Because construction onsite would change surface soil conditions, exposure to current surface soil conditions would not be likely under a true future residential scenario. These factors indicate that exposure pathways assessed in this HHRA would overestimate the risk and hazard posed to current site workers and future site residents by surface soil and groundwater.

Future site workers' exposure projections are overestimates for the same reasons — most soil locations are currently paved and construction would dramatically change current soil conditions. Current site workers' exposure to soil is limited and occurs only at the unpaved areas listed in Table 10-13

Groundwater is not currently used at NAS Pensacola for potable or industrial purposes. Drinking water is provided from NAS Corry Station across Bayou Grande. This system will remain in operation under the current base reuse plan. Consequently, groundwater would not be expected to be used under future site use scenarios. In addition, groundwater contains high sodium and

other inorganics which would make its use as a drinking water source unlikely. Therefore, the scenario established to estimate exposure to groundwater is highly conservative, and groundwater exposure pathways are not expected to be completed in the future.

Determination of Exposure Point Concentrations

A 95% UCL was calculated for COCs in surface soil, and either the UCL or maximum reported concentration was applied as the EPC to estimate soil risk and hazard in accordance with RAGS (USEPA, 1989). In accordance with FDEP's guidance during the January 27, 1998 Tier I Partnering Meeting, the maximum concentration of each COC identified in groundwater was used as the EPC (January 27, 1998 Tier I Partnering Meeting Minutes).

RAGS does not advocate "worst-case" scenarios (USEPA, 1989). In Section 6.5.1, RAGS recommends using the UCL as the EPC when groundwater data are grouped and suggests treating sample data separately (e.g., point risk estimates) depending on the future land use and expected location of drinking water wells (USEPA, 1989). USEPA Region IV Supplemental Guidance differs slightly in suggesting that the arithmetic mean of the highest concentrations within a plume would be a more appropriate EPC (USEPA, 1995). FDEP's recommendation, using the maximum reported concentration, is more conservative than these methods; therefore, exposure was likely overestimated. For example, if a chemical is reported in one of 18 samples, the reported concentration was used to represent the entire site in accordance with FDEP's suggestions. In addition, FDEP's method does not account for spatial distribution or variability in reported concentrations (January 27, 1998 Tier I Partnering Team Meeting Minutes).

Frequency of Detection and Spatial Distribution

Surface Soil

As discussed in Section 7 and shown in Tables 10-22 and 10-23 summary point estimates, no VOCs were detected above PRGs in surface soil. Reported inorganic contamination was in the

soil underneath Building 71, with minimal contamination observed at distance from the building. Exceedances reported for organic chemicals in surface soil at Building 71 were few. Pesticide and PCB exceedances were limited to two locations beneath Building 71, and sample locations are shown in Section 7 figures. The pesticide contamination is likely a result of the pretreatment during building construction or regular post construction applications, and PCBs could be from hydraulic fluids used when Building 71 was a hangar. Semivolatile exceedances were associated with samples along the IWTP line and roads, with no exceedances reported in the soil beneath Building 71.

Shallow Groundwater

Contaminant concentrations reported above a PRG in groundwater in the Building 71 study area included inorganics, semivolatiles, and VOCs. No pesticides or PCBs were detected above a PRG. Detected heavy metals potentially related to past paint stripping and metal refinishing processes included cadmium and chromium. These elements exceeded PRGs in wells 38GS05 and 38GS12 in the southwest part of the study area beneath former Building 71 and in downgradient well 39GS13.

Using the NAS Pensacola background data as a screening tool was agreed upon by the Tier I Partnering Team and has been used in RIs and RODs accepted by both FDEP and USEPA Region IV. In Section 4.4 of RAGS, two types of background are defined; naturally occurring levels and anthropogenic levels. Naturally occurring refers to "ambient concentrations present in the environment that have not been influenced by humans (e.g., aluminum, manganese)." Anthropogenic levels are, "concentrations of chemicals that are present in the environment due to human-made, non-site sources (e.g., industry, automobiles)." Background locations containing concentrations above MCLs could indicate an upgradient source and/or a natural source. Aluminum, iron, manganese, and lead exceedances were widespread across the site and may have added, in part, to the corresponding groundwater concentrations at Site 38.

Concentrations of these metals reported in well 38GS01, upgradient of the site, were among the highest levels detected. The highest concentrations of these elements were found in the sample from well 38GS12, beneath former Building 71. Soil naturally contains these elements at concentrations which sometimes exceed risk-based screening concentrations, as evidenced in Dragun and Chaisson's *Elements in North American Soils,* 1991. Logically, these elements could be reported in groundwater, and conditions permitting, groundwater background concentrations could naturally exceed MCLs.

VOC contamination centered around the sample from 38GS12, beneath Building 71, and in downgradient locations along the seawall south and east of the former building. Total VOC concentrations for 38GS12 were highest, with diminishing concentrations in downgradient wells. These VOCs included several halogenated aliphatic hydrocarbons and their presence was likely the result of past paint stripping and parts cleaning at Building 71.

1,1-Dichloroethene, a primary contributor to risk, was reported in only one of 18 samples, so the entire site risk would be overestimated. Nondetects were reported at 17 of 18 locations, indicating that point risk estimates would be more useful to risk managers, and that spatial distribution should be considered.

Intermediate Groundwater

Contaminants detected in the groundwater were not reported at concentrations above the PRGs in intermediate groundwater except for aluminum, iron, and vanadium. Aluminum and iron appeared to be representative of ambient conditions based on comparisons to RCs; however, vanadium exceeded the PRG and RC at three soil sample locations. The occurrence of these exceedances were consistent with those in groundwater. Section 7.1.2 details the spatial distribution of Site 38 soil and groundwater COPCs.

Quantification of Risk/Hazard

As indicated by the discussions above, the uncertainty inherent in the risk assessment process is great. In addition, many site-specific factors have affected the uncertainty of this assessment that would upwardly bias the risk and hazard estimates. Exposure pathway-specific sources of uncertainty are discussed below. CT estimates are presented in Tables 10-24 and 10-25, and CT assumptions are presented in Section 10.2 Table 10-3.

Chromium primarily exists in two valence states — trivalent and hexavalent, with both present in nature in variable proportions. The standard TAL analytical method used for chromium does not distinguish between trivalent and hexavalent chromium. Therefore, 10 surface soil and four groundwater samples were collected in areas more likely to contain hexavalent chromium, and the samples were analyzed for hexavalent chromium. Hexavalent chromium was not identified as a COPC based on the hexavalent chromium data presented in Appendices I and J. However, chromium was identified as a COPC based on total chromium data. Consequently, the proportion of hexavalent chromium to trivalent chromium is lower than expected near Site 38, based on the hexavalent and total chromium data presented in Appendices I and J. Based on comparison of hexavalent chromium to the hexavalent chromium RBC and reported total chromium concentrations, the RfD for trivalent chromium was used to estimate the HQ.

Arsenic was assessed as a carcinogen, and arsenic ILCR was a primary contributor to risk estimates for most exposure pathways. USEPA's oral SF for arsenic is based on increased skin cancer incidence in populations consuming drinking water high in arsenic. As stated in IRIS, "the association between skin cancer and arsenic is weak," (IRIS 1996). Therefore, USEPA has assessed arsenic separately at some sites and has used 1E-3 as the target risk for remedial goals (USEPA, 1988). This should be considered in risk management decisions where arsenic is a primary contributor to risk.

Soil

Of the organic CPSSs screened and eliminated from formal assessment, none was reported at a concentration within approximately 10% of the RBC. This minimizes the likelihood of potentially significant cumulative risk/hazard based on the eliminated organic CPSSs. The maximum concentrations of antimony and barium exceeded the corresponding RBCs, and these inorganics were eliminated based on the corresponding background concentrations.

Aluminum is a naturally occurring element and is found abundantly in nature. In the absence of toxicity data for aluminum, a provisional RfD has been provided by the ECAO/NCEA. Aluminum could be naturally occurring and could result in overestimating site-related soil HI.

Although the future land use of Site 38 is unknown, worker, residential, and trespasser exposure scenarios were assessed in this HHRA. As previously discussed, it is likely that these scenarios would lead to overestimates of risk and/or hazard based on the high exposure frequencies and durations used for RME exposure, and the area around Building 71 is currently paved.

Groundwater

Of the organic CPSSs screened and eliminated from formal assessment, none were reported at a concentration within approximately 10% of the RBC. The maximum concentrations of antimony and thallium exceeded the corresponding RBCs, and these inorganics were eliminated based on the corresponding background reference concentrations.

Aluminum and arsenic were significant contributors to soil and groundwater-based ILCR or HI estimates. Aluminum is a naturally occurring element and is found abundantly in nature. In the absence of toxicity data for aluminum, a provisional RfD has been provided by the ECAO/NCEA. Naturally occurring aluminum concentrations could result in overestimating

groundwater HQ. The arithmetic mean of arsenic reported in groundwater, 0.019 mg/L, is less than the arsenic MCL (0.05 mg/L).

Groundwater is not currently used at NAS Pensacola for potable or industrial purposes. Drinking water is provided from NAS Corry Station across Bayou Grande. This system will remain in operation under the current base reuse plan. As previously mentioned, it is highly unlikely that the site will be developed as a residential area, and it is unlikely that a potable-use well would be installed onsite. It is probable that, if residences were constructed onsite and an unfiltered well were installed, the salinity and dissolved solids would preclude this aquifer from being an acceptable potable water source. Therefore, the scenario established to estimate exposure to groundwater is highly conservative and would likely overestimate exposure to chemicals in groundwater.

Summary Risk Mapping

Summary figures were developed assuming a residential exposure scenario and were constructed based on data sampled during different time periods. As previously discussed, some locations were sampled more than once, and the most recent data from any one location were used in this RI for mapping purposes. The data, sampling methods, and analytical methods are described in Sections 2 through 7.

Point estimates for exposure to soil are primarily composed of samples collected from beneath pavement. Currently, only islands of grass around buildings and parking lots are accessible, making occasional exposure to site soil possible under current land use conditions. Table 10-15 lists unpaved sample designations. Pavement depth differs across Site 38, which is a source of uncertainty and variability when assuming the pavement will be removed and the soil immediately beneath the pavement would be frequented by site workers or residences would be constructed

onsite. The soil exposure pathways assessed in this HHRA would not likely be completed, and point estimates would overestimate risk and hazard.

Groundwater quality and the availability of drinking water from Corry Station would make using onsite groundwater highly unlikely, and groundwater exposure pathways would not likely be completed. Point estimates shown in various tables and figures would overestimate risk and hazard for the groundwater pathways. Groundwater flow into Pensacola Bay was identified as a possible contaminant pathway, and the Site 2 RI concluded that if chemicals from NAS Pensacola have reached the bay, concentrations were diluted to undetectable quantities or the chemicals did not migrate from Site 38 in detectable quantities (E/A&H, 1996a). The numerous uncertainties in risk and hazard estimates presented in these tables and figures should be considered by risk management when making decisions regarding the potential for exposure to site media. If an exposure pathway will not be completed, no risk is posed by that pathway.

10.3.1.7 Risk Summary

The risks and hazards posed by chemicals at Building 71 were assessed for the hypothetical site worker and the hypothetical future site resident under RME and CT assumptions. For surface soil, the incidental ingestion and dermal contact pathways were assessed in this HHRA. The ingestion and inhalation pathways were evaluated for groundwater. Adolescent trespassers' exposure was also evaluated for the soil pathways. Table 10-15 presents the risk summary for each pathway/receptor group evaluated for Building 71 at Site 38.

The Navy will restrict land use at Site 38 to industrial use only and will prevent groundwater use in accordance with the Land Use Restriction Agreement signed August 31, 1998 between the Navy, FDEP, and USEPA. However, this assessment includes exposure pathways and land use scenarios which were developed since 1992 for completeness.

10.3.1.8 Remedial Goal Options

Soil

Surface soil RGOs for carcinogens presented in Table 10-26 were based on the lifetime weighted average site resident and adult site worker, respectively. Hazard-based RGOs were calculated based on either the hypothetical child resident or the adult site worker.

Groundwater

Groundwater RGOs based on site residents and site workers are shown in Table 10-27. The remedial goal option for lead is the treatment-technique action level of 15 mg/L.

10.3.2 Human Health Risk Assessment for Building 604

10.3.2.1 Site Background and Investigative Approach

The investigation near Building 604 focused on an assessment of past uses and possible impacts on environmental media. Results from 64 surface soil samples were discussed in Section 5. Corresponding analytical data were used to estimate soil-related exposure in this HHRA. Sixty-six groundwater samples discussed in Section 5 were collected from temporary and permanent monitoring wells screened in the shallow and intermediate water-bearing zones. Well depths and sample IDs are presented in Section 7 and in USEPA's report in Appendix H.

Analytical methods were specific to the sample designation. The frequency of detection sometimes differs for specific methods, depending upon what methods were specified. For example, most groundwater results are reported as the number of hits reported in 40 samples rather than the number reported in 66. For clarity, Tables 10-28 and 10-29 present sample designations and analytical methods applied to each sample. In addition, hexavalent chromium analyses were performed on 10 selected soil samples and four groundwater samples during the Site 38 investigation.

10.3.2.2 COPC Identification

Soil

Basd on the screening comparisons described in Section 10.2.5 of this RI and presented in Tables 10-30 and 10-31, the focus of this HHRA is on the following COPCs: Aroclor-1260, BEQ, dieldrin, aluminum, arsenic, cadmium, chromium, copper, lead, manganese, and vanadium. Table 10-32 presents BEQ concentrations.

Groundwater

As shown in Tables 10-33 and 10-34, the COPCs identified in groundwater for this site are 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethane, 1,2-dichloroethene (total), acetone, aluminum, arsenic, BEQ, cadmium, chloroform, chromium, copper, lead, manganese, tetrachloroethene, trichloroethene, vanadium, vinyl chloride, bis(2-ethylhexyl)phthalate (BEHP), cis-1,2-dichloroethene, and trans-1,2-dichloroethene. BEHP, BEQ, and chloroform were excluded from area-wide estimates but were included in point risk estimates based on low detection frequency.

Table 10-35 summarizes COPCs for this exposure area.

10.3.2.3 Exposure Assessment

Exposure Setting

Building 604 is northeast of Building 71, and is separated from Building 71 by a Radford Road and an IWTP line. The area will likely remain industrially zoned in support of downsized shop operations in Building 604, and no construction activities have been planned to date. Sections 2.2.1, 2.3.1, and 2.3.3 describe the history and setting of the site, and Section 5 describes the investigative approach.

Potentially Exposed Populations

As shown in Table 10-1 in Section 10.2, potentially exposed populations are hypothetical future site residents, current and hypothetical future site workers, and hypothetical adolescent trespassers. The Navy plans to maintain this paved, industrial area, and there are no known construction plans or projected zoning changes. Current site workers traverse the paved site, which is sometimes used as a parking area.

Standard default hypothetical future site resident and worker land use scenarios were addressed in this risk assessment, and the adolescent trespasser scenario was included for the soil exposure pathway only. Land use scenarios in this HHRA assumed soil sample locations that are currently paved would be exposed, making direct soil contact possible. Continuous exposure to surface soil conditions was assumed, as well as assuming groundwater would be used as a source of drinking water.

Some islands of grass have been planted amid the pavement, making soil exposure currently possible at some locations. Samples were collected at some of these locations, which are indicated in Table 10-36.

Construction work generally requires less than one year to complete a project, and chronic exposure is typically seven years or more, according to RAGS. The current site worker scenario used in this assessment assumes 25-year exposure. Therefore, future worker assessment is considered to be protective of both current site use and future construction/maintenance workers' exposure to surface soil. Subsurface soil data are addressed in Section 9. The shallow depth to groundwater would make it unlikely for construction events to penetrate into subsurface soil.

In summary, land use scenarios included in this HHRA assume exposure pathways would be complete and are potential future land use scenarios. Except for a limited number of small

landscaping "islands," soil exposure pathways are generally not complete at this site under current conditions.

Exposure Pathways

Exposure pathways for the site workers are dermal contact and incidental ingestion of surface soil, as well as ingestion and inhalation of groundwater COPCs through potable use. The exposure pathways for future residential land use are the same as those for the future site worker. In addition, ingestion and dermal contact exposure to surface soil was estimated for the adolescent trespasser scenario. Table 10-1 summarizes the exposure pathways assessed in this HHRA. Uniform exposure was assumed for all sample locations.

Exposure Point Concentrations and Quantification of Exposure

Sixty-six surface soil samples were analyzed for this site. Table 10-37 presents the EPCs for the COPCs identified in surface soil. Thirty-five monitoring wells were sampled at this site. In accordance with FDEP's recommendations, EPCs for the COPCs identified in groundwater are the maximum reported concentrations shown in Tables 10-33 and 10-34.

10.3.2.4 Toxicity Assessment

Toxicity assessment terms and methods are discussed in Section 10.2.8 of this report. Table 10-4 presents toxicological information for Site 38. This information was used to quantify risk/hazard associated with soil and groundwater contaminants. Toxicological profiles for each COPC are provided in Section 10.2.8.

Chromium exists in predominantly two valence states. For screening purposes, all chromium data were assumed to be present in the more toxic chromium VI valence state. Realistically, chromium exists in a balance between chromium III and chromium VI. Due to the past uses of Site 38 (plating, scrap metal recycling, and paint stripping), hexavalent chromium samples were collected,

indicating total chromium reported in TAL metals at Site 38 is primarily trivalent. The RfD for chromium VI is 0.005 mg/kg/day as opposed to 1 mg/kg/day for chromium III. Consequently, the RfD for chromium used at Site 38 is 1 mg/kg-day.

Manganese was identified as a COPC, which has an RfD of 0.014 mg/kg-day for food. In accordance with recommendations in IRIS, a modifying factor of 3 should be applied to this value when assessing soil and groundwater exposure. This modification results in the adjusted manganese RfD of 0.047 mg/kg-day, which was used to estimate the HQ in this HHRA. FDEP recommends an RfD of 0.023 mg/kg-day, which would double the HQ in this HHRA. Tables are noted to this effect as agreed during the January 27, 1998 Tier I Partnering Team Meeting (January 27, 1998 Tier I Partnering Team Meeting Minutes).

10.3.2.5 Risk Characterization

Risk estimates for soil and groundwater pathways are summarized in Table 10-38, including chemical-specific as well as multi-pathway estimates.

Land Use Scenarios

Three hypothetical future land use scenarios were assessed in this HHRA: residential, industrial site worker, and site trespasser.

Surface Soil Pathways

Exposure to surface soil onsite was evaluated under residential, industrial (site worker), and adolescent trespasser scenarios. Exposure pathways evaluated are incidental ingestion and dermal contact. For future site residents, HQs were estimated separately for child and adult exposure, and the LWA was used to estimate ILCR assuming a receptor would be exposed during childhood and as an adult. ILCRs and HQs associated with the incidental ingestion of and dermal contact with site surface soil are presented in Tables 10-39 and 10-40, respectively.

Groundwater Pathways

Exposure to groundwater onsite was evaluated under both residential and industrial scenarios. The groundwater exposure pathways were evaluated assuming that site groundwater will be used for potable and/or domestic purposes and that an unfiltered well will be installed, drawing from the corresponding water-bearing zone. Future site residents' HI was computed separately for child and adult receptors. Tables 10-41 and 10-42 present the ILCRs and HQs for the ingestion and inhalation exposure pathways, respectively.

Hypothetical Future Site Residents

Soil

The sum soil ILCR estimate for hypothetical future site resident is 5E-5. The ingestion ILCR for surface soil is 4E-5, while the dermal pathway ILCR is 1E-5. BEQ and arsenic are the primary contributors for both the ingestion pathway and dermal pathways.

The sum soil HI estimates for the hypothetical future adult and child residents are 0.09 and 0.75, respectively. HI estimates for the hypothetical future adult and child residents are 0.07 and 0.7 respectively for the soil ingestion pathway. HIs for the hypothetical future adult and child dermal contact pathways are 0.015 and 0.05. Aluminum was the primary contributor for both pathways.

Groundwater

The sum groundwater ILCR estimate is 1E-1 for the hypothetical future site resident receptor. For the ingestion and inhalation pathways, the lifetime weighted average ILCR estimates are 1E-1 and 2E-2, respectively. Vinyl chloride is the primary contributor to the ingestion ILCR, while arsenic, 1,1-dichloroethene, 1,2-dichloroethane, tetrachloroethene, and trichloroethene are secondary contributors. The primary contributor to the inhalation pathway is vinyl chloride, while 1,1-dichloroethene, 1,2-dichloroethane, tetrachloroethene, trichloroethene are secondary contributors.

The sum hypothetical future site resident adult and child HI estimates are 42.5 and 99.2 respectively. Ingestion pathway HI estimates for the hypothetical future adult and child resident are 33.2 and 77.4, and inhalation HI estimates for the hypothetical future adult and child resident are 9.3 and 21.8. The primary contributor to the ingestion and inhalation HI is vinyl chloride, with cadmium and arsenic as secondary contributors to the ingestion HI.

Lead Toxicity

Currently, USEPA has established neither a slope factor nor a reference dose for lead. USEPA believes that the available studies in animals and humans do not provide sufficient quantitative information for their calculation. Although lead is currently classified as a B2 carcinogen, the USEPA considers the noncarcinogenic neurotoxic effects in children to be the critical toxic effect with respect to establishing health-based environmental cleanup objectives. The neurotoxic effects of chronic low-level lead exposure in children may occur at blood levels as low as 10 μg/dL.

Because the arithmetic average lead concentration reported in surface soil (117.8 mg/kg) is less than USEPA's residential action level of 400, lead was not identified as a soil COC. However, the average lead concentration reported in groundwater (92.1 mg/L) is greater than the treatment technique action level (0.015 mg/L). USEPA's lead model was used to estimate blood lead levels in children who hypothetically would directly contact soil and drink groundwater. Based on the average lead concentration reported in groundwater, the projected blood lead levels were greater than 10 μg/dL and lead was identified as a COC. The USEPA model output is presented in Table 10-43. The geometric mean and intercept using a probability density histogram were 9.1 μg/dL and 40.37%.

Hypothetical Site Trespassers

The sum soil ILCR estimate is 2E-6 for the adolescent site trespasser. Site trespasser ILCR is 1E-6 for the incidental ingestion pathway and 7E-7 for the dermal contact pathway. BEQ and

arsenic are primary contributors for both pathways. The sum soil HI for the adolescent site trespasser is 0.02. HI is 0.02 for the ingestion pathway and 0.004 for the dermal pathway, respectively.

Hypothetical Future Site Workers

Soil

The sum soil ILCR estimate for the hypothetical future site worker is 9E-6. Hypothetical future site worker ILCR is 4E-6 for the incidental ingestion pathway, while the dermal contact pathway estimate is 5E-6. BEQ and arsenic are the primary contributors for both pathways. The sum soil HI estimate is 0.05 for the hypothetical future site worker. HIs are 0.03 for the ingestion pathway and 0.016 for the dermal pathway, with individual contributors each accounting for approximately an order of magnitude less of the total HI.

Groundwater

The sum groundwater ILCR estimate is 3E-2 for the hypothetical future site worker receptor. For the ingestion and inhalation pathways, the ILCR estimates are 3E-2 and 4E-3, respectively. Vinyl chloride is the primary contributor to ingestion ILCR, while arsenic, 1,1-dichloroethene, 1,2-dichloroethene, tetrachloroethene, and trichloroethene are secondary contributors. The primary contributor to the inhalation pathway is vinyl chloride, with 1,1-dichloroethene, 1,2-dichloroethene, tetrachloroethene, and trichloroethene as secondary contributors.

The sum groundwater HI estimate for the hypothetical future site worker is 15.1. HIs for the ingestion and inhalation pathways are 11.8 and 3.3, respectively. The primary contributor to the ingestion HI is vinyl chloride, with cadmium, arsenic, 1,2-dichloroethane, and 1,2-dichloroethene (total) as secondary contributors. 1,2-Dichloroethene (total), 1,2-dichloroethane, tetrachloroethene, and trichloroethene are primary contributors to inhalation HI.

Current Site Workers

Surface soil near Building 604 is currently covered by pavement or buildings, the area is infrequently used, and groundwater is not used as a drinking water source at NAS Pensacola. In the absence of completed exposure pathways, no threat to human health would be posed by the chemicals reported in soil and groundwater.

COCs Identified

COCs were identified based on either cumulative risk or hazard estimated for soil or groundwater pathways. Table 10-44 summarizes COCs identified in each medium based on contribution to cumulative ILCR or HI.

Graphical Presentation of Risk Estimates

In addition to the standard RAGS tabular presentation of risk estimates, point estimate maps were plotted for soil and groundwater to clarify the spatial distribution for risk managers. As an extension of conventional data presentation, excess cancer risk and hazard estimates were calculated for each sample location. Point estimates of risk and hazard were developed for all land use scenarios included in this HHRA.

Tables were generated to present risk estimates for each COPC at each sample location using the ratio of the reported concentration to the corresponding RGO and risk estimate used to develop the RGO. For example, the residential RGO for arsenic is 0.416 mg/kg when estimated at 1E-6 risk for an LWA residential receptor. A soil arsenic concentration of 18.03 mg/kg would result in a risk estimate of 4.3E-5. This method incorporates both incidental ingestion and dermal contact exposure pathways, the basis for calculating RGOs.

After estimating risk for each COPC and each sample location, risk estimates were summed to provide cumulative risk estimates for each sample location and land use scenario to facilitate

graphical presentation. Tables presenting hazard estimates were similarly developed. ArcView, a graphical data presentation and geographic information system software package, was used to plot risk and hazard estimates on base maps. The risk or hazard for individual locations was plotted using corresponding northing and easting data. All graphical presentations of risk and corresponding tables are based on RME exposure assumptions and RGOs presented in Section 10.3. Figures were developed for the residential land use scenario only. Point estimates for a residential land use scenario are shown in Tables 10-45 and 10-46 for soil and groundwater, respectively.

Risk and hazard point mapping is useful for determining whether hot spots (or isolated areas of gross contamination) exist within an otherwise unimpacted area and in identifying areas where remedial activities would be more effective. This information is important because heterogeneous contaminant concentrations can affect the manner in which receptors are exposed to the affected media. As discussed earlier, it is sometimes appropriate to estimate the FI/FC from the contaminated source in computing CDI. Point maps allow for visual analysis of risk and hazard distributions and facilitate estimation of the extent of hot spots relative to the overall site area. These maps also support preliminary scoping of remedial requirements as well as assessment of potential cleanup alternatives in the FS.

Cumulative risk maps could be misleading when different chemicals contribute to elevated risk estimates in a cluster of sample locations. Such an area could appear to be a hot spot, when chemicals with different toxicology were reported at each location. For this reason, it is important to support the figures with tables showing individual chemical concentrations along with risk and hazard estimates. These tables are sorted by sample location and also show cumulative values for each location.

Figures 10-5 through 10-8 are approximations which include many uncertainties. Groundwater quality and the availability of drinking water from Corry Station would make using onsite groundwater highly unlikely, and groundwater exposure pathways are not currently completed, nor are they expected to be in the future. Point estimates shown in tables and figures below would overestimate risk and hazard for the groundwater pathways. The numerous uncertainties in risk and hazard estimates presented in tables and figures below should be considered by risk management when making decisions regarding the potential for exposure to site media. If an exposure pathway will not be completed, that pathway poses no risk.

Risk figures were developed for soil risk, soil hazard, groundwater risk, and groundwater hazard. As previously discussed, figures were developed only for a residential land use scenario, although estimates assuming other land uses are provided in corresponding tables.

10.3.2.6 Risk Uncertainty

Characterization of Exposure Setting and Identification of Exposure Pathways

The potential for high bias is introduced through the exposure setting and pathway selection due to the highly conservative residential assumptions recommended by USEPA Region IV when assessing exposure. The exposure assumptions made in the site worker scenario are highly protective and would tend to overestimate exposure. As a result, limited exposure to these maximally impacted areas is possible, although the frequency and duration of direct contact events are likely quite low.

Residential use of the site is not expected, based on current site uses and the nature of surrounding buildings. If this area were to become a residential site, it would require that the buildings would be demolished, the asphalt surface removed, and the surface soil conditions would likely change dramatically. In addition, the area near Building 604 is paved, and the location having the highest cumulative ILCR estimate is directly under a building. Because construction onsite would change

surface soil conditions, exposure to current surface soil conditions would not be likely under a true future residential scenario. These factors indicate that exposure pathways assessed in this HHRA would overestimate the risk and hazard posed to current site workers' and future site residents' exposure to surface soil.

Future site workers' exposure projections are overestimates for the same reasons — most soil locations are currently paved and construction would dramatically change current soil conditions. Current site workers' exposure to soil is limited and occurs only at the unpaved areas listed in Table 10-36.

Groundwater is not currently used at NAS Pensacola for potable or industrial purposes. Drinking water is provided from NAS Corry Station across Bayou Grande. This system will remain in operation under the current base reuse plan. Consequently, groundwater would not be expected to be used under future site use scenarios. Therefore, the scenario established to estimate exposure to groundwater is highly conservative, and groundwater exposure pathways are not expected to be completed in the future.

Determination of Exposure Point Concentrations

A 95% UCL was calculated for COCs in surface soil, and either the UCL or maximum reported concentration was applied as the EPC to estimate soil risk and hazard in accordance with RAGS (USEPA, 1989). In accordance with FDEP's guidance during the January 27, 1998 Tier I Partnering Meeting, the maximum concentration of each COC identified in groundwater was used as the EPC (January 27, 1998 Tier I Partnering Meeting Minutes).

RAGS does not advocate "worst-case" scenarios (USEPA, 1989). In Section 6.5.1, RAGS recommends using the UCL as the EPC when groundwater data are grouped, and suggests treating sample data separately (e.g., point risk estimates) depending on the future land use and expected

location of drinking water wells (USEPA, 1989). USEPA Region IV Supplemental Guidance differs slightly in suggesting that the arithmetic mean of the highest concentrations within a plume would be a more appropriate EPC (USEPA, 1995). FDEP's recommendation, using the maximum reported concentration, is more conservative than these methods; therefore, exposure was likely overestimated. For example, if a chemical is reported in one of 18 samples, the reported concentration was used to represent the entire site in accordance with FDEP's suggestions. In addition, FDEP's method does not account for spatial distribution or variability in reported concentrations (January 27, 1998 Tier I Partnering Team Meeting Minutes).

Frequency of Detection and Spatial Distribution

Surface Soil

As discussed in Section 7, heavy metals related to past plating activities exceeded PRGs in the surface soil surrounding the former plating facility at the southwest extension of Building 604. Semivolatile contaminant exceedances were primarily associated with the IWTP line except one location beneath the southern part of Building 604, where parts were cleaned in the general vicinity of this sample. Pesticide and PCB exceedances were noted in samples from grassy areas onsite. Pesticide detections in these areas are likely the result of routine historical spraying.

Shallow Groundwater

Inorganics, semivolatiles, and VOCs were also detected in the shallow groundwater in the Building 604 study area. Aluminum, manganese, and lead were fairly consistent across the site at concentrations exceeding the PRGs; however, many of these exceedances were below their respective RCs. Heavy metals, including cadmium and chromium, were detected above PRGs surrounding the former plating shop and are likely a result of past plating operations. Naphthalene was detected above the PRG in the area and downgradient of the former solvent tank. Several PAHs also exceeded the PRG in the sample from well 36MW77C. This well is adjacent to the IWTP line. No exceedances were noted in surrounding and/or downgradient wells.

Several halogenated aliphatic hydrocarbons, including tetrachloroethene, TCE, and vinyl chloride, were detected above the PRG. The most highly impacted area was near the former solvent UST east of the former plating shop. Total VOC concentrations reached a maximum of 3,850 μg/L in the sample from well 38GS17. VOC concentrations appeared to diminish in samples farther downgradient to the south and east. Two other areas where VOCs exceedances occurred were at a temporary well adjacent to Building 636 and north of the Port Operations, Building 38. Tetrachloroethene was detected in a well east of Building 636, a former dry cleaning facility. These dry cleaning operations may likely be the source of the tetrachloroethene. No surrounding wells had detections above the PRG. The other VOC detection was in a well north of Building 38. This well is adjacent to the storm drain system leading from Building 604. Historically, solvent and metal waste were discharged through this system to the bay. Possible leaks to this system may be responsible for the chlorinated solvents detected in this well. In general, contamination in the Building 604 study areas centers around the former plating shop and former solvent UST areas and in downgradient areas to the southeast. Notably, contaminants were not detected in the temporary wells near the downgradient seawall.

Intermediate Groundwater

Only two contaminants were detected above PRGs in the intermediate groundwater, aluminum, and vinyl chloride. Aluminum concentrations were well below its RC. Vinyl chloride exceedances were consistent with those in the shallow zone, and the maximum concentration detected was 4.2 μg/L. Section 7.1.2 discusses the spatial distribution of Site 38 soil and groundwater COPCs.

Quantification of Risk/Hazard

As indicated by the discussions above, the uncertainty inherent in the risk assessment process is great. In addition, many site-specific factors have affected the uncertainty and variability of this assessment that would upwardly bias the risk and hazard estimates. Exposure pathway-specific

sources of uncertainty are discussed below. CT estimates are presented in Tables 10-47 and 10-48, and exposure assumptions are presented in Section 10.2 Table 10-3.

Chromium primarily exists in two valence states — trivalent and hexavalent, with both present in nature in variable proportions. The standard TAL analytical method used for chromium does not distinguish between trivalent and hexavalent chromium. Therefore, 10 surface soil and four groundwater samples were collected in areas more likely to contain hexavalent chromium across Site 38, and the samples were analyzed for hexavalent chromium. Hexavalent chromium was not identified as a COPC based on the hexavalent chromium data presented in Appendices I and J. However, chromium was identified as a COPC based on total chromium data. Consequently, the proportion of hexavalent chromium to trivalent chromium is lower than expected near Site 38, based on the hexavalent and total chromium data presented in Appendices I and J. Chromium HIs are overestimates because hexavalent chromium concentrations did not exceed the hexavalent chromium RBC. The RfD for trivalent chromium was used to estimate the HQ.

Arsenic was assessed as a carcinogen, and arsenic ILCR was a primary contributor to risk estimates for most exposure pathways. USEPA's oral SF for arsenic is based on increased skin cancer incidence in populations consuming drinking water high in arsenic. As stated in IRIS, "the association between skin cancer and arsenic is weak," (IRIS 1996). Therefore, USEPA has assessed arsenic separately at some sites and has used 1E-3 as the target risk for remedial goals. This should be considered in risk management decisions where arsenic is a primary contributor to risk. Tables P-2 and P-4 present location-specific risk estimates for arsenic (and other identified COPCs).

Soil

Of the organic CPSSs screened and eliminated from formal assessment, none was reported at a concentration within approximately 10% of the RBC. This minimizes the likelihood of potentially

significant cumulative risk/hazard based on the eliminated organic CPSSs. The maximum beryllium concentration exceeded the corresponding RBC, and beryllium was eliminated as a COPC based on the background reference concentration.

Aluminum is a naturally occurring element and is found abundantly in nature. In the absence of toxicity data for aluminum, a provisional RfD has been provided by the ECAO/NCEA. Aluminum could be naturally occurring and could result in overestimation of site-related soil HI.

Although the future land use of Site 38 is unknown, worker, residential, and trespasser exposure scenarios were assessed. As previously discussed, it is likely that these scenarios would lead to overestimates of risk and/or hazard, and the area around Building 604 is mostly paved.

Groundwater

Of the organic CPSSs screened and eliminated from formal assessment, only mercury was reported at a concentration within approximately 10% of the RBC. No inorganic parameters were eliminated from formal assessment based strictly upon comparison to background RCs.

Aluminum and arsenic were significant contributors to soil and groundwater-based ILCR or HI estimates. Aluminum is a naturally occurring element and is found abundantly in nature. In the absence of toxicity data for aluminum, a provisional RfD has been provided by the ECAO/NCEA. Naturally occurring aluminum concentrations could result in overestimating groundwater HQ. The arithmetic mean arsenic concentration reported in groundwater (0.007 mg/L) is less than the arsenic MCL (0.05 mg/L).

Groundwater is not currently used at NAS Pensacola for potable or industrial purposes. Drinking water is provided from NAS Corry Station across Bayou Grande. This system will remain in operation under the current base reuse plan. As previously mentioned, it is highly unlikely that

the site will be developed as a residential area, and it is unlikely that a potable-use well would be installed onsite. It is probable that, if residences were constructed onsite and an unfiltered well were installed, the salinity and dissolved solids would preclude this aquifer from being an acceptable potable water source. Therefore, the scenario established to estimate exposure to groundwater is highly conservative and would likely overestimate exposure to chemicals in groundwater.

Summary Risk Mapping

Summary figures were developed assuming a residential exposure scenario and were constructed based on data sampled during different time periods. As previously discussed, some locations were sampled more than once, and the most recent data from any one location was used in this RI for mapping purposes. The data, sampling methods, and analytical methods are described in Sections 2 through 7.

Point estimates for exposure to soil are primarily composed of samples collected from beneath pavement. Currently, only islands of grass around buildings and parking lots are accessible, making occasional exposure to site soil a current possibility. Table 10-36 lists unpaved area sample designations. Pavement depth differs across Site 38, which is a source of uncertainty and variability when assuming the pavement will be removed and the soil immediately beneath the pavement would be frequented by site workers or residences would be constructed onsite. The soil exposure pathways assessed in this HHRA would not likely be completed, and point estimates would overestimate risk and hazard.

Groundwater quality and the availability of drinking water from Corry Station would make using site groundwater highly unlikely, and groundwater exposure pathways would not likely be completed. Point estimates shown in corresponding tables and figures would overestimate risk and hazard for the groundwater pathways. Groundwater flow into Pensacola Bay was identified

as a possible contaminant pathway, and the Site 2 RI concluded that chemicals from NAS Pensacola have reached the bay and were either diluted to undetectable quantities or did not migrate into the Bay (E/A&H, 1996a). The numerous uncertainties in risk and hazard estimates presented in tables and figures should be considered by risk management when making decisions regarding the potential for exposure to site media. If an exposure pathway will not be completed, that pathway poses no risk.

10.3.2.7 Risk Summary

The risks and hazards posed by chemicals at Building 604 were assessed for the hypothetical site worker and the hypothetical future site resident under RME and CT assumptions. For surface soil, the incidental ingestion and dermal contact pathways were assessed in this HHRA. The ingestion and inhalation pathways were evaluated for groundwater. Adolescent trespassers' exposure was also evaluated for the soil pathways. Table 10-38 summarizes risk for each pathway/receptor group evaluated for Building 604 at Site 38.

The Navy will restrict land use at Site 38 to industrial use only and will prevent groundwater use in accordance with the Land Use Restriction Agreement signed August 31, 1998 between the Navy, FDEP, and USEPA. However, this assessment includes exposure pathways and land use scenarios which were developed since 1992 for completeness.

10.3.2.8 Remedial Goal Options

Soil

Surface soil RGOs for carcinogens presented in Table 10-49 were based on the lifetime weighted average site resident and adult site worker, respectively. Hazard-based RGOs were calculated based on either the hypothetical child resident or the adult site worker.

Groundwater

Groundwater RGOs based on site residents and site workers are shown in Table 10-50. The remedial goal option for lead is the treatment-technique action level of 15 mg/L.

10.4 HHRA Summary

Risk and hazard were assessed for Site 38 by dividing the site into two study areas, Building 71 and Building 604. Soil exposure pathways included ingesting and directly contacting soil, while groundwater exposure pathways included ingesting and inhaling chemicals in groundwater. Uniform exposure was assumed for each exposure pathway. Hypothetical future site residents and workers were assessed for these pathways. The soil exposure pathway was also assessed for the adolescent site trespasser. In addition, risk and hazard were estimated for each sample location with easting and northing data.

By using these scenarios to estimate exposure to chemicals reported in Site 38 media, several significant assumptions were made. Most soil sampled at Site 38 is beneath pavement, and if the property assessed were developed for residential or commercial use, soil conditions would be expected to change. Base reuse plans for NAS Pensacola are updated every five years, and the base plans are currently being drafted for the upcoming five years. The future land use of Site 38 is unknown, but continued industrial/commercial use is expected. Soil conditions were assumed to be static, and exposure was considered to be uniform.

USEPA's acceptable risk range is 1E-6 to 1E-4, and FDEP's risk goal is 1E-6. For the hypothetical exposure pathways included in this report, the site resident and site worker soil risk estimates for Building 71 and Building 604 exceed FDEP's threshold, assuming the soil exposure pathways will be completed. The primary contributors to soil risk at both sites are arsenic and BEQ. Consequently, chemicals of concern have been identified for the site residents and workers.

Neither Building 71 nor Building 604 trespasser risk estimates exceed USEPA acceptable risk range.

Soil hazard estimates are less than the USEPA and FDEP threshold of 1.0 for site residents, site workers, or site trespassers. Therefore, chemicals of concern have not been identified for soil based on the hazard index.

Drinking water is supplied by Corry Station, and the water-bearing zone beneath NAS Pensacola would not be expected to be used as a drinking water source. Assuming groundwater exposure pathways would be completed, risk estimates for both areas would exceed USEPA and FDEP risk and hazard thresholds. In groundwater near Building 71, arsenic and volatile organic compounds and primarily account for risk and hazard estimates. However, the 95th percentile upper confidence limit, arithmetic mean, and geometric mean of the arsenic concentrations reported in groundwater did not exceed the MCL or FPDWS.

The Navy intends to restrict Site 38 land use to industrial land use only and will prevent groundwater use in accordance with the Land Use Restriction Agreement signed August 31, 1998 between the Navy, FDEP, and USEPA. However, for the sake of completeness, this assessment includes exposure pathways and land use scenarios developed since 1992.

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Table 10-1
Exposure Pathways Summary — Site 38
NAS Pensacola
Pensacola, Florida

Potentially Exposed Population	Medium and Exposure Pathway[a]	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Current Land Uses			
Current Site Users/Maintenance	Air — Inhalation of gaseous contaminants emanating from soil	No	No significant VOC concentrations were reported in surface soil, and portions of the site area are paved/covered by buildings.
	Air — Inhalation of chemicals entrained in fugitive dust	No[b]	Most of Site 38 is paved, and unpaved areas are vegetated, limiting fugitive dust generation.
	Groundwater — Ingestion of contaminants during potable or general use	No	Groundwater is not currently used as a source of potable or nonresidential water at NAS Pensacola.
	Groundwater — Inhalation of volatilized groundwater contaminants	No	Groundwater is not currently used as a source of potable or nonresidential water at NAS Pensacola.
	Soil — Incidental ingestion	No (Qualified)	Future land use assessment is considered to be protective of current receptors.
	Soil — Dermal contact	No (Qualified)	Future land use assessment is considered to be protective of current receptors.
Future Land Uses			
Future Site Residents (Child and Adult) and Future Site Worker	Air — Inhalation of gaseous contaminants emanating from soil	No	No significant VOC concentrations were reported in surface soil, and portions of the site area are paved/covered by buildings.
	Air — Inhalation of chemicals entrained in fugitive dust	No[b]	Most of Site 38 is paved, and unpaved areas are vegetated, limiting fugitive dust generation.
	Groundwater — Ingestion of contaminants during potable or general use	Yes	COPCs were identified based on the screening process described in Section 10.2.5.
	Groundwater — Inhalation of volatilized contaminants during domestic use	Yes	COPCs were identified based on the screening process described in Section 10.2.5.
	Soil — Incidental ingestion	Yes	COPCs were identified based on the screening process described in Section 10.2.5.
	Soil — Dermal contact	Yes	COPCs were identified based on the screening process described in Section 10.2.5.
	Wild game or domestic animals — Ingestion of tissue impacted by media contamination	No	Hunting/taking of game and/or raising livestock is prohibited at NAS Pensacola.
	Fruits and vegetables — Ingestion of plant tissues grown in media	No	The potential for significant exposure via this pathway is low relative to that of other exposure pathways assessed.

Notes:

a = In addition to the exposure pathways noted above, incidental ingestion and dermal contact exposure pathways were formally assessed assuming adolescent trespassers would be exposed to surface soil.

b = Inhalation of fugitive dust was evaluated using a sample calculation to determine if this exposure pathway would significantly contribute to overall exposure (see Appendix N).

Table 10-2
Variables Used to Estimate CDI at RME

Pathway Parameters	Resident Adult	Resident Child	Adult Worker	Adolescent Trespasser	Units
Surface Soil Ingestion and Dermal Contact					
Ingestion Rate (soil)	100[a]	200[a]	50[a]	100[a]	mg/day
Ingestion Rate (water)	2	1	1	NA	L/day
Exposure Frequency	350[b]	350[b]	250[b]	52[g]	days/year
Exposure Duration	24[c]	6[c]	25[c]	10[c]	years
Dermal Contact Area	4,100[d]	2,900[d]	4,100[d]	4,100[d]	cm^2
Skin Adherence Factor	1	1	1	1	mg/cm^2
Absorbance Factor	0.01 (organics) 0.001 (inorganics)	0.01 (organics) 0.001 (inorganics)	0.01 (organics) 0.001 (inorganics)	0.01 (organics) 0.001 (inorganics)	unitless
Dermal Adjustment Factor	0.8 (VOCs) 0.5 (other organic compounds) 0.2 (inorganics)	0.8 (VOCs) 0.5 (other organic compounds) 0.2 (inorganics)	0.8 (VOCs) 0.5 (other organic compounds) 0.2 (inorganics)	0.8 (VOCs) 0.5 (other organic compounds) 0.2 (inorganics)	unitless
Conversion Factor	1E-6	1E-6	1E-6	1E-6	kg/mg
Body Weight	70[a]	15[a]	70[a]	45[a]	kg
Averaging Time, Noncancer[e]	8,760	2,190	9,125	3,650	days
Averaging Time, Cancer	25,550[f]	25,550[f]	25,550[f]	25,550[f]	days

Notes:

a = USEPA (1989a) "Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual (Part A)."

b = USEPA (1991d) "Risk Assessment Guidance for Superfund Vol. I: Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors," Interim Final, OSWER Directive: 9285.6-03.EPA/600/8-89/043.

c = USEPA (1991b), "Risk Assessment Guidance for Superfund: Vol. I — Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals)," OSWER Directive 9285.7-01B.

d = Resident Adult accounts for head, hands, and forearms at 90th percentile values from Table 4B.1, Exposure Factors Handbook; assumes individual is clothed with shoes, long pants, and short sleeves; rounded up from 4,090 cm^2. Resident Child accounts for head, hands, forearms, lower leg, and feet using 90th percentile total body surface area values for male children 1 to 6 years old (6,000 cm^2 assumed for 1 to 2 years old); because individual body part information is not available for 5 to 6 year olds, mean of other groups was assumed. Forearm surface area set equal to 46% of full arm; lower leg set equal to 41% of full leg measurement.

e = Calculated as the product of exposure duration (years) x 365 days/year.

f = Calculated as the product of 70 years (assumed lifetime) x 365 days/year.

g = Calculated assuming one day per week each year.

NA = Not applicable.

Table 10-3
Toxicological Reference Information
for Chemicals of Potential Concern
Site 38
NAS Pensacola

	Non-Carcinogenic Toxicity Data									
Chemical	Oral Reference Dose (mg/kg-day)		Confidence Level	Critical Effect	Uncertainty Factor Oral	Inhalation Reference Dose (mg/kg-day)		Confidence Level	Critical Effect	Uncertainty Factor Inhalation
1,1,1-Trichloroethane	0.035	d	NA	NA	NA	0.286	e	NA	NA	NA
1,1-Dichloroethane	0.1	b	NA	none observed	1,000	0.143	c	NA	NA	NA
1,1-Dichloroethene	0.009	a	M	liver lesions	1,000	0.009	h	NA	NA	NA
1,2-Dichloroethane	0.00286	i	NA	NA	NA	0.00286	e	NA	NA	NA
1,2-Dichloroethene (total)	0.009	b	L	increased serum phosphatase	1,000	0.009	h	NA	NA	NA
1,4-Dichlorobenzene	0.229	i	NA	NA	NA	0.229	a	M	increased liver weight	100
Acetone	0.1	a	M/L	increased liver and kidney weights and nephrotoxicity	1,000	NA		NA	NA	NA
Aluminum	1	d	NA	NA	NA	NA		NA	NA	NA
Antimony	0.0004	a	L	whole body/blood increased mortality	1,000	NA		NA	NA	NA
Arsenic	0.0003	a	M	hyperpigmentation	3	NA		NA	NA	NA
BEQ	NA		NA	NA	NA	NA		NA	NA	NA
bis(2-Ethylhexyl)phthalate	0.02	a	M	increased liver weight	1,000	NA		NA	NA	NA
Bromomethane	0.0014	a	M	epithelial hyperplasia of the forestomach	1,000	0.00143	a	H	nasal lesions	100
Cadmium (food)	0.001	a	H	proteinuria	10	NA		NA	NA	NA
Cadmium (water)	0.0005	a	H	proteinuria	10	NA		NA	NA	NA
Chlorobenzene	0.02	a	M	liver changes	1,000	0.00571	c	NA	NA	10000
Chloroform	0.01	a	M/L	fatty cysts in liver	1,000	0.01	h	NA	NA	NA
Chromium (III)	1	a	L	NA	100/10	5.71E-07	e	NA	NA	NA
cis-1,2-Dichloroethene	0.01	b	NA	decreased hematocrit, decreased hemoglobin	3,000	0.01	h	NA	NA	NA
Copper	0.0371	b	NA	NA	NA	NA		NA	NA	NA
Dieldrin	0.00005	a	M	liver lesions	100	NA		NA	NA	NA
Lead	NA		NA	NA	NA	NA		NA	NA	NA
Manganese	0.047	a	NA	neurological effects	1	0.0000143	a	M	neurological effects	1000
PCB Aroclor-1254 (soil)	2E-05	a	M	various	NA	NA		NA	NA	NA
PCB Aroclor-1254 (water)	2E-05	a	M	various	NA	NA		NA	NA	NA
PCB Aroclor-1260 (soil)	NA		NA	NA	NA	NA		NA	NA	NA
PCB Aroclor-1260 (water)	NA		NA	NA	NA	NA		NA	NA	NA
Tetrachloroethene	0.01	a	M/L	hepatotoxicity in mice, weight gain in rats	1,000	0.01	h	NA	NA	NA
trans-1,2-Dichloroethene	0.02	a	M/L	increased serum alkaline phosphatase in male mice	1,000	0.02	h	NA	NA	NA
Trichloroethene	0.006	e	NA	NA	NA	0.006	h	NA	NA	NA
Vanadium	0.007	a	NA	unclear	100	NA		NA	NA	NA
Vinyl chloride	NA		NA	NA	NA	NA		NA	NA	NA
Zinc	0.3	a	M	decreased enzyme levels	3	NA		NA	NA	NA

Table 10-3
Toxicological Reference Information
for Chemicals of Potential Concern
Site 38
NAS Pensacola

	Carcinogenic Toxicity Data					
Chemical	Oral Slope Factor (kg-day/mg)		Inhalation Slope Factor (kg-day/mg)		Weight of Evidence	Tumor Type
1,1,1-Trichloroethane	NA		NA		D	NA
1,1-Dichloroethane	NA		NA		C	NA
1,1-Dichloroethene	0.6	a	0.175	a	C	kidney adenosarcoma
1,2-Dichloroethane	0.091	a	0.091	a	B2	stomach sarcoma, hemangiosarcoma, mammary adenomas
1,2-Dichloroethene (total)	NA		NA		D	NA
1,4-Dichlorobenzene	0.024	b	0.024	j	B2	NA
Acetone	NA		NA		D	NA
Aluminum	NA		NA		NA	NA
Antimony	NA		NA		D	NA
Arsenic	1.5	a	15.1	a	A	various
BEQ	7.3	a	6.1	e	B2	mutagen
bis(2-Ethylhexyl)phthalate	0.014	a	NA		B2	hepatoma
Bromomethane	NA		NA		D.	NA
Cadmium (food)	NA		6.3	a	B1	lung
Cadmium (water)	NA		6.3	a	B1	lung
Chlorobenzene	NA		NA		D	NA
Chloroform	0.0061	a	2.3E-05 ((ug/cm3)-1)	a	B2	hepatocellular carcinoma
Chromium (III)	NA		42	a	D	NA
cis-1,2-Dichloroethene	NA		NA		NA	NA
Copper	NA		NA		D	NA
Dieldrin	16	a	16.1	a	B2	hepatocarcinoma
Lead	NA		NA		B2	various
Manganese	NA		NA		D	NA
PCB Aroclor-1254 (soil)	2	a	NA		B2	hepatocellular carcinoma
PCB Aroclor-1254 (water)	0.4	a	NA		B2	hepatocellular carcinoma
PCB Aroclor-1260 (soil)	2	a	NA		B2	hepatocellular carcinoma
PCB Aroclor-1260 (water)	0.4	a	NA		B2	hepatocellular carcinoma
Tetrachloroethene	0.052	d	0.00203	d	NA	NA
trans-1,2-Dichloroethene	NA		NA		D	NA
Trichloroethene	NA		0.006	e	B2	forestomach tumors in mice
Vanadium	NA		NA		D	NA
Vinyl chloride	1.9	b	0.3	b	A	hepatocellular carcinoma
Zinc	NA		NA		D	NA

Notes:

a = Integrated Risk Information System (IRIS)
b = Health Effects Assessment Summary Tables (HEAST)
c = HEAST alternative method
d = EPA NCEA - Cincinnati (provisional)
e = Withdrawn from IRIS/HEAST
f = Information collected from IRIS, based on 2,4-dinitrotoluene and 2,6-dinitrotoluene mixture
g = Information collected from EPA documents other than those listed above
h = Oral RfD used as a surrogate
i = Inhalation RfD used as a surrogate
j = Oral SF used as a surrogate
NA = Not applicable or not available
H = High confidence
L = Low confidence
M = Medium confidence

Table 10-4
Variables Used to Estimate CDI at CT

Pathway Parameters	Resident Adult	Resident Child	Adult Worker	Units
Surface Soil Ingestion and Dermal Contact				
Ingestion Rate (soil)	50[a]	100[a]	50[a]	mg/day
Ingestion Rate (water)	1.4	1	1	L/day
Exposure Frequency	234[b]	234[b]	250[b]	days/year
Exposure Duration	7[c]	2[c]	5[c]	years
Dermal Contact Area	4,100[d]	2,900[d]	4,100[d]	cm^2
Skin Adherence Factor	1	1	1	mg/cm^2
Absorbance Factor	0.01 (organics) 0.001 (inorganics)	0.01 (organics) 0.001 (inorganics)	0.01 (organics) 0.001 (inorganics)	unitless
Dermal Adjustment Factor	0.8 (VOCs) 0.5 (other organic compounds) 0.2 (inorganics)	0.8 (VOCs) 0.5 (other organic compounds) 0.2 (inorganics)	0.8 (VOCs) 0.5 (other organic compounds) 0.2 (inorganics)	unitless
Conversion Factor	1E-6	1E-6	1E-6	kg/mg
Body Weight	70[a]	15[a]	70[a]	kg
Averaging Time, Noncancer[e]	8,760	2,190	1,825	days
Averaging Time, Cancer	25,550[f]	25,550[f]	25,550[f]	days

Notes:

a = USEPA (1989a) "Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual (Part A)."

b = USEPA (1991d) "Risk Assessment Guidance for Superfund Vol. I: Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors," Interim Final, OSWER Directive: 9285.6-03.EPA/600/8-89/043.

c = USEPA (1991b), "Risk Assessment Guidance for Superfund: Vol. I — Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals)," OSWER Directive 9285.7-01B.

d = Resident Adult accounts for head, hands, and forearms at 90th percentile values from Table 4B.1, Exposure Factors Handbook; assumes individual is clothed with shoes, long pants, and short sleeves; rounded up from 4,090 cm^2. Resident Child accounts for head, hands, forearms, lower leg, and feet using 90th percentile total body surface area values for male children 1 to 6 years old (6,000 cm^2 assumed for 1 to 2 year olds); because individual body part information is not available for 5 to 6 year olds, mean of other groups was assumed. Forearm surface area set equal to 46% of full arm; lower leg set equal to 41% of full leg measurement.

e = Calculated as the product of exposure duration (years) x 365 days/year.

f = Calculated as the product of 70 years (assumed lifetime) x 365 days/year.

NA = Not applicable.

Table 10-5
Analytical Methods
Building 71 Area Surface Soil Samples
Site 38 — NAS Pensacola RI

Sample_ID	Metal	Pest	SVOA	VOA
036S080C02	X	X	X	X
036S080S02	X	X	X	X
036S081C02	X	X	X	X
036S081S03	X	X	X	X
036S081W02	X	X	X	X
038S000102	X	X	X	X
038S000301	X	X	X	X
038S000402	X	X	X	X
038S000501	X	X	X	X
038S000701	X	X	X	X
038S000801	X	X	X	X
038S000901	X	X	X	X
038S001001	X	X	X	X
038S001101	X	X	X	X
038S001201	X	X	X	X
038S001301	X	X	X	X
038S001401	X	X	X	X
038S001501	X	X	X	X
038S001601	X	X	X	X
038S001701	X	X	X	X
038S001801	X	X	X	X
038S001901	X	X	X	X
038S002201	X	X	X	X
038S002403	X	X	X	X
038S002501	X	X	X	X
038S002702	X	X	X	X

Table 10-5
Analytical Methods
Building 71 Area Surface Soil Samples
Site 38 — NAS Pensacola RI

Sample ID	Metal	Pest	SVOA	VOA
038S002901	X	X	X	X
038S003001	X	X	X	X
038S003101	X	X	X	X
038S003201	X	X	X	X
038S003301	X	X	X	X
038S003401	X	X	X	X
038S0I1002	X	X	X	X
038S0S2301	X	X	X	X
038S0T0501	X		X	X

Notes:

Metal = TAL (Target Analyte List) metals plus tin:
Method: CLP ILMO4.0

Pest = Chlorinated Pesticides: Method: CLP OLMO3.2

SVOA = Semi-volatile Organics: Method: CLP OLMO3.2

VOA = Volatile Organics: Method: CLP OLMO3.2

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Table 10-6
Analytical Methods
Building 71 Area Groundwater Samples
Site 38 — NAS Pensacola RI

Sample	Metal	Pest	SVOA	VOA
036GR80C01	X	X	X	X
036GR81C01	X	X	X	X
038G0I1001	X	X	X	X
038G0S2301	X	X	X	X
038G0T0501	X	X	X	X
038GGI0101	X	X	X	X
038GGI0201	X	X	X	X
038GGI0301	X	X	X	X
038GGS0101	X	X	X	X
038GGS0201	X	X	X	X
038GGS0301	X	X	X	X
038GGS0401	X	X	X	X
038GGS0501	X	X	X	X
038GGS0601	X	X	X	X
038GGS1001	X	X	X	X
038GGS1101	X	X	X	X
038GGS1201	X	X	X	X
038GGS1301	X	X	X	X

Notes:

Metal = TAL (Target Analyte List) metals plus tin:
Method: CLP ILMO4.0

Pest = Chlorinated Pesticides: Method: CLP OLMO3.2

SVOA = Semi-volatile Organics: Method: CLP OLMO3.2

VOA = Volatile Organics: Method: CLP OLMO3.2

Table 10-7
Chemicals Present in Site Samples
Building 71 Area — Organics in Surface Soil (μg/kg)
Site 38 — NAS Pensacola RI

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	FDEP CG	Number over FDEP CG	COPC?
Fluoranthene	10/35	38 - 620	162.1	330 - 3900	3,100,00	a,n		2,900,000		
gamma-Chlordane	2/32	0.034 - 0.63	0.349	0.0017 - 0.0023	1800	a,c		N/A	3000	Y
Indeno(1,2,3-cd)pyrene	4/35	38 -570	247	330 - 3900	880	a,c		1,400		
Methylene chloride	2/35	4 - 9	6.5	4 - 9600	85,000	a,c		16,000		
Naphthalene	3/35	46 - 640	338.7	330 - 3900	3,100,00	a,n		1,300,000		
Phenanthrene	5/35	55 - 270	172.2	330 - 3900	2,300,000	a,n		1,700,000		
Phenol	6/35	39 - 990	419.7	330 - 3900	4,700,000	a,n		3,400,000		
Pyrene	11/35	40 - 480	147.6	330 - 3900	2,300,000	a,n		2,200,000		
Tetrachloroethene	13/35	1 - 1,100	128.9	9 - 60	12,000	a,c		12,000		

Notes:

μg/kg	= micrograms per kilogram
a	= Screening concentration based on residential soil ingestion from June 3, 1996 Region III RBC tables
c	= Carcinogen
n	= Noncarcinogen
RBC	= Risk-based concentration
FDEP-CG	= Based on Florida Department of Environmental Protection's screening concentration for surface soil
COPC	= Chemical of potential concern
DNE	= Does not exist
N/A	= Not Applicable
Y	= Yes, the chemical is considered a COPC

Table 10-8
Chemicals Present in Site Samples
Building 71 Area — Inorganics in Soil (mg/kg)
Site 38 — NAS Pensacola RI

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	FDEP CG	Number over FDEP CG	BG	Number over BG	COPC?
Aluminum	35 / 35	14 - 21,200	2,570	-	78,000	a,n	4	75,000		1,661	8	Y
Antimony	2 / 35	2.7 - 3.8	3.3	2.1 - 6.6	31	a,n	1	26		2.91	1	Y
Arsenic	19 / 35	0.28 - 3.9	1.5	0.17 - 3	0.430	a,c	18	1	16	1.56	9	Y
Boron	37 / 70	0.14 - 68.7	9.6	0 - 1.8	7,000	a,n		7,000		ND	37	
Cadmium	13 / 35	0.6 - 18.6	3.2	0.42 - 1.1	39	a,n	2	37		1	11	Y
Calcium	33 / 35	20.6 - 50,300	4,873	50 - 50	DNE	b	N/A	DNE	N/A	912.37	24	
Chromium	33 / 35	1.1 - 713	65.6	0.54 - 1	39	a,n	26	66,000		6.13	21	Y
Cobalt	3 / 35	0.49 - 6	3	0.3 - 4.4	4,700	a,n		4,700		1.87	2	
Copper	33 / 35	1.7 - 5,340	183	1 - 1	3,100	a,n	1	DNE	N/A	5.74	25	Y
Cyanide	1 / 35	2.2	2.2	0.01 - 1.1	1,600	a,n		1,600		0.52	1	
Iron	33 / 35	24 - 14,100	2,758	3,700 - 3,960	23,000	a,b,n	14	DNE	N/A	2,745	13	
Lead	35 / 35	1.3 - 273	74.3	-	400	d		500		7.32	33	
Magnesium	29 / 35	4.3 - 7,210	423.5	10 - 160	DNE	b	N/A	DNE	N/A	133.33	15	
Manganese	28 / 35	0.25 - 337	27.8	0.87 - 9.6	1,800	a,n	1	370		21.36	9	Y
Mercury	15 / 34	0.03 - 0.79	0.1	0.02 - 0.27	23	a,n		23		0.1	5	
Nickel	3 / 35	2 - 6.8	3.9	1.5 - 4.4	1,600	a,n		1,500		6.38	1	
Potassium	6 / 35	40.4 - 1,460	314.4	24.8 - 231	DNE	b	N/A	DNE	N/A	460.67	1	
Selenium	2 / 35	0.21 - 0.22	0.2	0 - 4	390	a,n		390		0.62		
Sodium	21 / 35	8.1 - 302	68.3	20.5 - 100	DNE	b	N/A	DNE	N/A	107.85	2	
Strontium	1 / 3	1.2	1.2	1 - 1	47,000	a,n		47,000		ND	1	

Table 10-8
Chemicals Present in Site Samples
Building 71 Area — Inorganics in Soil (mg/kg)
Site 38 — NAS Pensacola RI

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	FDEP CG	Number over FDEP CG	BG	Number over BG	COPC?
Titanium	3 / 3	2.6 - 21	10.8	-	DNE	N/A	N/A	DNE	N/A	ND		
Vanadium	17 / 35	1 - 33.4	10.6	0.54 - 2.5	550	a,n		490		5.83	10	
Zinc	33 / 35	2.4 - 435	67.9	1 - 4.2	23,000	a,n		23,000		16.87	25	

Notes:

mg/kg = milligrams per kilogram
a = Screening concentration based on residential soil ingestion from June 3, 1996 Region III RBC tables
b = Essential nutrient
c = Carcinogen
d = Screening based on 400 mg/kg lead in soil
n = Noncarcinogen; comparison was made to one-tenth this concentraion, in accordance with Supplemental Guidance to RAGS, Bulletin 1, Data Collection and Evaluation
RBC = Risk-based concentration
FDEP-CG = Based on Florida Department of Environmental Protection's screening concentration for surface soil
BG = Background concentration
COPC = Chemical of potential concern
DNE = Does not exist
N/A = Not Applicable
ND = Not determined due to lack of information
Y = Yes, the chemical is considered a COPC

Table 10-9
BEQ Concentrations per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

Sample ID	Chemical	Reported Result (µg/kg)	VQUAL	TEF	Adjusted (a) Concentration (µg/kg)
036S080S02	Benzo(a)anthracene	390	U	0.1	3.05
	Benzo(a)pyrene	390	U	1	20.5
	Benzo(b)fluoranthene	200	J	0.1	20
	Benzo(k)fluoranthene	390	U	0.01	0.19
	Chrysene	390	U	0.001	0.0175
	Dibenzo(a,h)anthracene	390	U	1	28.5
	Indeno(1,2,3-cd)pyrene	390	U	0.1	1.9
	BEQ				74.1575
038S000102	Benzo(a)anthracene	190	J	0.1	19
	Benzo(a)pyrene	200	J	1	200
	Benzo(b)fluoranthene	280	J	0.1	28
	Benzo(k)fluoranthene	220	J	0.01	2.2
	Chrysene	220	J	0.001	0.22
	Dibenzo(a,h)anthracene	100	J	1	100
	Indeno(1,2,3-cd)pyrene	190	J	0.1	19
	BEQ				368.42
038S000701	Benzo(a)anthracene	61	J	0.1	6.1
	Benzo(a)pyrene	46	J	1	46
	Benzo(b)fluoranthene	62	J	0.1	6.2
	Benzo(k)fluoranthene	51	J	0.01	0.51
	Chrysene	71	J	0.001	0.071
	Dibenzo(a,h)anthracene	350	U	1	28.5
	Indeno(1,2,3-cd)pyrene	350	U	0.1	1.9
	BEQ				89.281
038S000801	Benzo(a)anthracene	330	U	0.1	3.05
	Benzo(a)pyrene	330	U	1	20.5
	Benzo(b)fluoranthene	43	J	0.1	4.3
	Benzo(k)fluoranthene	53	J	0.01	0.53
	Chrysene	35	J	0.001	0.035
	Dibenzo(a,h)anthracene	330	U	1	28.5
	Indeno(1,2,3-cd)pyrene	330	U	0.1	1.9
	BEQ				58.815
038S001001	Benzo(a)anthracene	70	J	0.1	7
	Benzo(a)pyrene	350	U	1	20.5
	Benzo(b)fluoranthene	56	J	0.1	5.6
	Benzo(k)fluoranthene	38	J	0.01	0.38
	Chrysene	85	J	0.001	0.085
	Dibenzo(a,h)anthracene	350	U	1	28.5

Table 10-9
BEQ Concentrations per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

Sample ID	Chemical	Reported Result (µg/kg)	VQUAL	TEF	Adjusted (a) Concentration (µg/kg)
	Indeno(1,2,3-cd)pyrene	350	U	0.1	1.9
	BEQ				63.965
038S001401	Benzo(a)anthracene	100	J	0.1	10
	Benzo(a)pyrene	67	J	1	67
	Benzo(b)fluoranthene	200	J	0.1	20
	Benzo(k)fluoranthene	70	J	0.01	0.70
	Chrysene	140	J	0.001	0.14
	Dibenzo(a,h)anthracene	57	J	1	57
	Indeno(1,2,3-cd)pyrene	350	U	0.1	1.9
	BEQ				156.74
038S001901	Benzo(a)anthracene	78	J	0.1	7.8
	Benzo(a)pyrene	77	J	1	77
	Benzo(b)fluoranthene	200	J	0.1	20
	Benzo(k)fluoranthene	92	J	0.01	0.92
	Chrysene	120	J	0.001	0.12
	Dibenzo(a,h)anthracene	680	U	1	28.5
	Indeno(1,2,3-cd)pyrene	680	U	0.1	1.9
	BEQ				136.24
038S002201	Benzo(a)anthracene	700	U	0.1	3.05
	Benzo(a)pyrene	700	U	1	20.5
	Benzo(b)fluoranthene	700	U	0.1	2.15
	Benzo(k)fluoranthene	700	U	0.01	0.19
	Chrysene	73	J	0.001	0.073
	Dibenzo(a,h)anthracene	700	U	1	28.5
	Indeno(1,2,3-cd)pyrene	700	U	0.1	1.9
	BEQ				56.363
038S002702	Benzo(a)anthracene	680	U	0.1	3.05
	Benzo(a)pyrene	680	U	1	20.5
	Benzo(b)fluoranthene	680	U	0.1	2.15
	Benzo(k)fluoranthene	110	J	0.01	1.1
	Chrysene	70	J	0.001	0.07
	Dibenzo(a,h)anthracene	680	U	1	28.5
	Indeno(1,2,3-cd)pyrene	680	U	0.1	1.9
	BEQ				57.27
038S002901	Benzo(a)anthracene	120	J	0.1	12
	Benzo(a)pyrene	200	J	1	200
	Benzo(b)fluoranthene	370	J	0.1	37

Table 10-9
BEQ Concentrations per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

Sample ID	Chemical	Reported Result (µg/kg)	VQUAL	TEF	Adjusted (a) Concentration (µg/kg)
	Benzo(k)fluoranthene	290	J	0.01	2.9
	Chrysene	110	J	0.001	0.11
	Dibenzo(a,h)anthracene	180	J	1	180
	Indeno(1,2,3-cd)pyrene	190	J	0.1	19
	BEQ				451.01
038S003101	Benzo(a)anthracene	340	U	0.1	3.05
	Benzo(a)pyrene	340	U	1	20.5
	Benzo(b)fluoranthene	48	J	0.1	4.8
	Benzo(k)fluoranthene	340	U	0.01	0.19
	Chrysene	340	U	0.001	0.0175
	Dibenzo(a,h)anthracene	340	U	1	28.5
	Indeno(1,2,3-cd)pyrene	340	U	0.1	1.9
	BEQ				58.9575
038S003201	Benzo(a)anthracene	480	J	0.1	48
	Benzo(a)pyrene	690	J	1	690
	Benzo(b)fluoranthene	580	J	0.1	58
	Benzo(k)fluoranthene	720	J	0.01	7.2
	Chrysene	540	J	0.001	0.54
	Dibenzo(a,h)anthracene	230	J	1	230
	Indeno(1,2,3-cd)pyrene	570	J	0.1	57
	BEQ				1090.74
038S003301	Benzo(a)anthracene	360	U	0.1	3.05
	Benzo(a)pyrene	41	J	1	41
	Benzo(b)fluoranthene	45	J	0.1	4.5
	Benzo(k)fluoranthene	360	U	0.01	0.19
	Chrysene	360	U	0.001	0.0175
	Dibenzo(a,h)anthracene	360	U	1	28.5
	Indeno(1,2,3-cd)pyrene	38	J	0.1	3.8
	BEQ				81.0575

Table 10-9
BEQ Concentrations per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

Sample ID	Chemical	Reported Result (µg/kg)	VQUAL	TEF	Adjusted (a) Concentration (µg/kg)
038S003401	Benzo(a)anthracene	110	J	0.1	11
	Benzo(a)pyrene	150	J	1	150
	Benzo(b)fluoranthene	160	J	0.1	16
	Benzo(k)fluoranthene	710	U	0.01	0.19
	Chrysene	120	J	0.001	0.12
	Dibenzo(a,h)anthracene	710	U	1	28.5
	Indeno(1,2,3-cd)pyrene	710	U	0.1	1.9
	BEQ				207.71

Notes:

(a) = As discussed in Section 10.2.4, the lesser of one-half the lowest hit and one-half the SQL was the concentration assumed to be present, unless no BEQ compounds were detected at a given location; the adjusted value equals the reported or assumed concentration times the TEF.

BEQ = Benzo(a)pyrene equivalent

VQUAL = Validation qualifier

TEF = Toxicity equivalence factor

J = The associated numerical value is an estimated quantity.

U = The material was analyzed for, but not detected; the associated value is the lesser of one half of the sample quantitation limit, or one half of the lowest detected concentration.

µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

Table 10-10
Chemicals Present in Site Samples
Building 71 — Organics in Groundwater (μg/L)

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	COPC?
1,1,1-Trichloroethane	6 / 18	0.64 - 770	134.5	5 - 100	790	a,n	1	Y
1,1-Dichloroethane	6 / 18	1.2 - 640	121.2	5 - 100	810	a,n	1	Y
1,1-Dichloroethene	1 / 18	42	42	5 - 100	0.044	a,c	1	Y
1,2-Dichlorobenzene	2 / 18	5 - 9	7	5 - 15	270	a,n		
1,2-Dichloroethane	1 / 18	2	2	5 - 100	0.12	a,c	1	b
1,2-Dichloroethene (total)	3 / 15	2 - 14	6	3 - 100	55	a,n	1	Y
1,4-Dichlorobenzene	1 / 18	0.72	0.7	5 - 110	0.44	a,c	1	b
2,4-Dimethylphenol	1 / 18	2	2	10 - 110	730	a,n		
2-Butanone (MEK)	1 / 18	34	34	10 - 100	1,900	a,n		
2-Methylnaphthalene	3 / 18	2 - 14	8.7	10 - 110	1,500	a,n		
4-Methylphenol (p-Cresol)	1 / 15	1	1	10 - 110	180	a,n		
Acenaphthene	1 / 18	1	1	10 - 110	2,200	a,n		
Acetone	1 / 18	7	7	10 - 100	3,700	a,n		
Bromomethane	1 / 18	3	3	5 - 100	8.7	a,n	1	b
Chlorobenzene	2 / 18	4 - 5.2	4.6	1 - 100	39	a,n	2	Y
Chloroethane	1 / 18	8	8	5 - 100	8,600	a,n		
Chloroform	2 / 18	6 - 24	15	5 - 100	0.15	a,c	2	Y
Ethylbenzene	3 / 18	1 - 22	8.7	5 - 100	1,300	a,n		
Naphthalene	3 / 18	1.0 - 44	29.8	10 - 320	1,500	a,n		
Phenanthrene	1 / 18	3.7	3.7	10 - 110	1,100	a,n		

Table 10-10
Chemicals Present in Site Samples
Building 71 — Organics in Groundwater (μg/L)

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	COPC?
Phenol	1 / 18	9	9	10 - 110	22,000	a,n		
Tetrachloroethene	5 / 18	0.8 - 33	8.1	5 - 100	1	a,c	3	Y
Toluene	1 / 18	3	3	5 - 100	750	a,n		
Trichloroethene	5 / 18	1 - 53	12.4	5 - 100	1.6	a,c	4	Y
Vinyl chloride	2 / 18	11 - 12	11.5	1 - 100	0.019	a,c	2	Y
Xylene (Total)	3 / 15	2 - 3	2.7	10 - 100	12,000	a,n		
bis(2-Ethylhexyl)phthalate (BEHP)	3 / 18	1 - 3	1.7	1 - 330	4.8	a,c		
trans-1,2-Dichloroethene	1 / 3	0.74	0.7	5 - 5.	120	a,n		

Notes:

μg/L = micrograms per liter
a = Screening concentration based on residential groundwater ingestion from June 3, 1996 Region III RBC tables
b = Excluded from area-wide assessment due to low detection frequency; included in point risk estimates
c = Carcinogen
n = Noncarcinogen; comparison was made to one-tenth this concentraion, in accordance with Supplemental Guidance to RAGS, Bulletin 1, Data Collection and Evaluation
RBC = Risk-based concentration
COPC = Chemical of potential concern
Y = Yes, the chemical is considered a COPC

Table 10-11
Chemicals Present in Site Samples
Building 71 —- Inorganics in Groundwater (μg/L)

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	BG	Number over BG	COPC?
Aluminum	18 / 18	30.9 - 11,400	3,016	-	37,000	a,n	4	3,883	4	Y
Antimony	1 / 18	25	25	14 - 35	15	a,n	1	30.2		
Arsenic	12 / 18	2.1 - 102	19.9	2 - 30	0.045	a,c	12	2.8	11	Y
Boron	22 / 39	0 - 152	39.6	1 - 47.2	3,300	a,n		ND		
Cadmium	3 / 18	3 - 11	7.9	2 - 5	18	a,n	3	3.4	2	Y
Calcium	18 / 18	12 - 72,500	34,900	-	DNE	b	N/A	17,560	13	
Chromium	15 / 18	4 - 326	62	3 - 30.3	180	a,n	2	35	6	Y
Cobalt	5 / 18	3 - 5.1	3.8	2 - 10	2,200	a,n		4.1	1	
Copper	15 / 18	6.1 - 319	74.1	5 - 10	1,500	a,n	2	16.2	10	Y
Iron	16 / 18	1.2 - 17,600	4,754	0.05 -6,390	11,000	a,b,n	11	1,708	8	
Lead	15 / 18	2.8 - 362	106.2	2 - 10	DNE	d	N/A	1.6	15	Y
Magnesium	18 / 18	16 - 117,000	11,051	-	DNE	b	N/A	2,873	12	
Manganese	16 / 18	16.7 - 174	60.3	45.7 - 87.2	840	a,n	5	22	14	Y
Mercury	1 / 18	0.33	0.3	0.2 - 0.58	11	a,n		0.2	1	
Molybdenum	2 / 3	22 - 31	26.5	10 - 10	180	a,n	2	ND		
Nickel	2 / 18	10 - 15.9	13	8 - 25.8	730	a,n		39.9		
Potassium	17 / 18	21 - 72,800	9,225	3,640 - 3,640	DNE	b	N/A	12,168	2	
Selenium	5 / 18	2 - 5	2.9	1 - 40	180	a,n		3.9	1	
Sodium	18 / 18	350 - 538,000	47,171	-	DNE	b	N/A	18,345	4	
Strontium	3 / 3	140 - 1,100	480	-	22,000	a,n		ND		

Table 10-11
Chemicals Present in Site Samples
Building 71 — Inorganics in Groundwater (μg/L)

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	BG	Number over BG	COPC?
Thallium	1 / 18	2	2	2 - 100	2.9	a,n		3.6		
Titanium	3 / 3	14 - 140	83.7	-	DNE	N/A	N/A	ND		
Vanadium	17 / 18	3 - 230	48.9	3 - 3	260	a,n	5	9.6	13	Y
Yttrium	2 / 3	23 - 52	37.5	10 - 10	DNE	N/A	N/A	ND		
Zinc	16 / 18	5.6 - 1,230	296.3	5 - 10	11,000	a,n	1	153.2	7	Y
Zirconium	3 / 3	-	-	-	DNE	N/A	N/A	ND		

Notes:

μg/L = micrograms per liter
a = Screening concentration based on residential groundwater ingestion from June 3, 1996 Region III RBC tables
b = Essential nutrient
c = Carcinogen
d = Screening based on 15 μg/L lead in groundwater
n = Noncarcinogen; comparison was made to one-tenth this concentraion, in accordance with Supplemental Guidance to RAGS, Bulletin 1, Data Collection and Evaluation
RBC = Risk-based concentration
BG = Background concentration
COPC = Chemical of potential concern
DNE = Does not exist
N/A = Not Applicable
ND = Not determined due to lack of information
Y = Yes, the chemical is considered a COPC

Table 10 - 12
COPC Summary
Site 38 - Building 71 Area
NAS Pensacola

Chemical	COPC in Surface Soil?	COPC in Groundwater
1,1,1-Trichloroethane	No	Yes
1,1-Dichloroethane	No	Yes
1,1-Dichloroethene	No	Yes
1,2-Dichlorothane	No	Yes
1,2-Dichloroethene (total)	Yes	Yes
1,4-Dichlorobenzene	No	Yes
Aluminum	Yes	Yes
Antimony	Yes	No
Aroclor-1254	Yes	No
Arsenic	Yes	Yes
BEQ	Yes	No
Bromomethane	No	Yes
Cadmium	Yes	Yes
Chlorobenzene	No	Yes
Chloroform	No	Yes
Chromium	Yes	Yes
Copper	Yes	Yes
gamma-Chlordane	Yes	No
Lead	No	Yes
Manganese	Yes	Yes
Tetrachloroethene	No	Yes
Trichloroethene	No	Yes
Vanadium	No	Yes
Vinyl Chloride	No	Yes
Zinc	No	Yes

Notes:

COPC = Chemical of potential concern
BEQ = Benzo(a)pyrene equivalent

Table 10-13
Unpaved Soil Locations
Site 38
NAS Pensacola

Sample Designations
038S0T01
038S0T02
038S0T03
038S0T04
038S0T06
038S0T07
038S0T10
038S0T11
038S0T12
038S0T15
038S0T16
038S0T17
038S0T18
038S0T23
038S0T25
038S0T31
038S0T34
038S0T35
038S0T36
038S0T37
038S0026
038S0035
038S0037

Table 10 - 14
Statistical Analysis of COPCs in Surface Soil
Site 38 - Building 71 Area
NAS Pensacola

COPC	n	Natural Log Mean	Transformed SD	H-stat	UCL (mg/kg)	MAX (mg/kg)	EPC	
Aluminum	35	69.236	1.896	3.603	9936.7	21200	9936.7	UCL used
Antimony	35	0.731	0.386	1.839	2.53	3.8	2.53	UCL used
Aroclor 1254	34	-3.736	1.223	2.680	0.089	16	0.089	UCL used
Arsenic	35	-0.406	1.069	2.484	1.861	3.9	1.861	UCL used
BEQ	14	4.8502	0.9289	2.686	0.393	1.09	0.393	UCL used
Cadmium	35	-0.396	1.043	2.453	1.799	18.6	1.799	UCL used
Chromium	35	2.35	1.750	3.390	134.11	713	134.11	UCL used
Copper	35	2.453	1.659	3.262	116.48	5340	116.48	UCL used
1,2-Dichloroethene	32	-7.315	1.049	2.478	0.0018	0.056	0.0018	UCL used
gamma-Chlordane	32	-6.757	1.172	2.632	0.004	0.63	0.004	UCL used
Manganese	35	1.929	1.159	3.170	58.33	337	58.33	UCL used

Notes:

COPC = Chemical of potential concern
n = Number of samples analyzed
MEAN = Arithmetic mean of the log transformed data
SD = Standard deviation
H-stat = "H" statistic from Gilbert 1987' cuboidal interpolation was used to determine the value in accordance with USEPA Supplemental Guidance to RAGS, Calculating the Concentration Term
UCL = 95th percentile upper confidence level mean
MAX = Maximum reported concentration
EPC = Exposure point concentration
mg/kg = milligrams per kilograms

Table 10-15
Summary Risk Estimates for All Exposure Pathways
Building 71 Area - Site 38
NAS Pensacola

	Site Resident			*Site Worker*		*Site Trespasser*	
	Adult	*Child*	*LWA*	*Adult*		*Adolescent*	
Medium and Exposure Pathway	**HI**	**HI**	**ILCR**	**HI**	**ILCR**	**HI**	**ILCR**
Soil - Incidental Ingestion	0.05	0.45	9E-06	0.02	1E-06	0.01	3E-07
Soil - Dermal Contact	0.013	0.043	3E-06	0.01	1E-06	0.003	1E-07
Sum of Soil Pathway	0.06	0.490	1.E-05	0.026	2.E-06	0.014	4.E-07
Groundwater - Ingestion	12.9	30.2	3.E-03	4.60	7.E-04	NA	NA
Groundwater - Inhalation of VOCs	0.6	1.4	2.E-04	0.22	5.E-05	NA	NA
Sum of Groundwater Pathway	13.6	31.6	3.E-03	4.8	8.E-04	NA	NA
Sum of Soil and Groundwater Pathways	13.6	32.1	3.E-03	4.8	8.E-04	0.014	4.E-07

Notes:

LWA = Lifetime weighted average
HI = Hazard index
ILCR = Incremental lifetime excess cancer risk

Table 10-16
Hazard Quotients and Incremental Lifetime Cancer Risks
Incidental Soil Ingestion
Site 38 - Building 71 Area
NAS Pensacola

				Site Resident			*Site Worker*		*Site Trespasser*	
				Adult	*Child*	*LWA*	*Adult*		*Adolescent*	
Chemical	**EPC (mg/kg)**	**Oral RfD mg/kg-day**	**Oral SF kg-day/mg**	**HQ**	**HQ**	**ILCR**	**HQ**	**ILCR**	**HQ**	**ILCR**
Aluminum	9936.7	1	NA	0.014	0.127	NA	0.0049	NA	0.0031	NA
Antimony	2.53	0.0004	NA	0.0087	0.081	NA	0.0031	NA	0.002	NA
Aroclor 1254	0.0891	0.00002	2	0.006	0.057	2.8E-07	0.0022	3.1E-08	0.0014	8.1E-09
Arsenic	1.861	0.0003	1.5	0.0085	0.079	4.4E-06	0.003	4.9E-07	0.002	1.3E-07
BEQ	0.392	NA	7.3	NA	NA	4.5E-06	NA	5.0E-07	NA	1.3E-07
Cadmium	1.799	0.0005	NA	0.0049	0.046	NA	0.0018	NA	0.0011	NA
Chromium	134.11	1	NA	0.00018	0.0017	NA	0.000066	NA	0.000043	NA
Copper	116.48	0.04	NA	0.004	0.037	NA	0.0014	NA	0.00092	NA
1,2-Dichloroethene	0.00184	0.009	NA	0.00000028	0.000003	NA	0.00000010	NA	0.00000006	NA
gamma-Chlordane	0.004	0.00006	1.3	0.000091	0.00085	8.2E-09	0.000033	9.1E-10	0.000021	2.4E-10
Manganese[1]	58.33	0.047	NA	0.00170	0.016	NA	0.0006	NA	0.00039	NA
Cumulative HI or ILCR:				0.05	0.4	9E-06	0.02	1E-06	0.01	3E-07

Notes:

LWA = Lifetime weighted average
EPC = Exposure point concentration
RfD = Reference Dose
SF = Slope factor
HQ = Hazard quotient
ILCR = Incremental lifetime excess cancer risk
HI = Hazard Index
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
kg-day/mg = kilograms per day per milligram

[1]The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would double the manganese hazard quotient shown.

Table 10-17
Hazard Quotients and Incremental Lifetime Cancer Risks
Dermal Contact with Surface Soil
Site 38 - Building 71 Area
NAS Pensacola

				Site Resident			*Site Worker*		*Site Trespasser*	
				Adult	*Child*	*LWA*	*Adult*		*Adolescent*	
Chemical	**EPC (mg/kg)**	**Dermal RfD mg/kg-day**	**Dermal SF kg-day/mg**	**HQ**	**HQ**	**ILCR**	**HQ**	**ILCR**	**HQ**	**ILCR**
Aluminum	9936.7	0.2	NA	0.0028	0.009	NA	0.00199	NA	0.00065	NA
Antimony	2.53	0.0001	NA	0.00142	0.0047	NA	0.00101	NA	0.0003	NA
Aroclor 1254	0.0891	0.00001	4	0.005	0.0165	1.3E-07	0.0036	5.1E-08	0.00116	6.6E-09
Arsenic	1.861	0.00006	7.5	0.00174	0.0057	4.9E-07	0.00124	2.0E-07	0.0004	2.6E-08
BEQ	0.392	NA	14.6	NA	NA	2.0E-06	NA	8.2E-07	NA	1.1E-07
Cadmium	1.799	0.0001	NA	0.0010	0.0033	NA	0.00072	NA	0.00023	NA
Chromium	134.11	0.2	NA	3.8E-05	0.00012	NA	0.000027	NA	0.0000087	NA
Copper	116.48	0.01	NA	0.00065	0.0022	NA	0.00047	NA	0.00015	NA
1,2-Dichloroethene	0.002	0.01	NA	0.00000010	0.00000034	NA	0.000000074	NA	0.000000024	NA
gamma-Chlordane	0.004	0.00003	2.6	0.0000749	0.00025	3.7E-09	0.000053	1.5E-09	0.0000173	1.9E-10
Manganese[1]	58.33	0.009	NA	0.00036	0.0012	NA	0.00026	NA	0.00008	NA
Cumulative HI or ILCR:				0.013	0.043	3E-06	0.01	1E-06	0.003	1E-07

Notes:

LWA = Lifetime weighted average
EPC = Exposure point concentration
RfD = Reference Dose
SF = Slope factor
HQ = Hazard quotient
ILCR = Incremental lifetime excess cancer risk
HI = Hazard Index
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
kg-day/mg = kilograms per day per milligram

[1]The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would double the manganese hazard quotient shown.

Table 10-18
Hazard Quotients and Incremental Lifetime Cancer Risks
Ingestion of Groundwater
Site 38 - Building 71 Area
NAS Pensacola

				Site Resident			Site Worker	
				Adult	Child	LWA	Adult	
Chemical	**EPC (mg/L)**	**Oral RfD mg/kg-day**	**Oral SF kg-day/mg**	**HQ**	**HQ**	**ILCR**	**HQ**	**ILCR**
1,1,1-Trichloroethane	0.77	0.035	NA	0.60	1.41	NA	0.21	NA
1,1-Dichloroethane	0.64	0.1	NA	0.18	0.41	NA	0.06	NA
1,1-Dichloroethene	0.042	0.009	0.6	0.13	0.30	3.8E-04	0.05	8.8E-05
1,2-Dichloroethene (total)	0.014	0.009	NA	0.04	0.10	NA	0.02	NA
Aluminum	11.4	1	NA	0.31	0.73	NA	0.11	NA
Arsenic	0.102	0.0003	1.5	9.32	21.73	2.3E-03	3.31	5.3E-04
Cadmium	0.011	0.0005	NA	0.60	1.41	NA	0.21	NA
Chlorobenzene	0.0052	0.02	NA	0.0071	0.0166	NA	0.0025	NA
Chloroform	0.024	0.01	0.0061	0.0658	0.1534	2.2E-06	0.0234	5.1E-07
Chromium	0.326	1	NA	0.01	0.02	NA	0.003	NA
Copper	0.319	0.0371	NA	0.24	0.55	NA	0.08	NA
Manganese[1]	0.174	0.047	NA	0.10	0.24	NA	0.04	NA
Tetrachloroethene	0.033	0.01	0.052	0.09	0.21	2.6E-05	0.03	6.0E-06
Trichloroethene	0.053	0.006	0.011	0.24	0.56	8.7E-06	0.09	2.0E-06
Vanadium	0.23	0.007	NA	0.90	2.10	NA	0.32	NA
Vinyl chloride	0.012	NA	1.9	NA	NA	3.4E-04	NA	8.0E-05
Zinc	1.23	0.3	NA	0.11	0.26	NA	0.04	NA
Cumulative HI or ILCR:				12.9	30.2	3.0E-03	4.6	7.1E-04

Notes:

LWA = Lifetime weighted average
EPC = Exposure point concentration
RfD = Reference Dose
SF = Slope factor
HQ = Hazard quotient
ILCR = Incremental lifetime excess cancer risk
HI = Hazard Index
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
kg-day/mg = kilograms per day per milligram

[1]The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would double the manganese hazard quotient shown in this table.

Table 10-19
Hazard Quotients and Incremental Lifetime Cancer Risks
Inhalation of Groundwater
Site 38 - Building 71 Area
NAS Pensacola

				Site Resident			Site Worker	
				Adult	Child	LWA	Adult	
Chemical	**EPC (mg/L)**	**Inhalation RfD mg/kg-day**	**Inhalation SF kg-day/mg**	**HQ**	**HQ**	**ILCR**	**HQ**	**ILCR**
1,1,1-Trichloroethane	0.77	0.286	NA	0.07	0.17	NA	0.03	NA
1,1-Dichloroethane	0.64	0.143	NA	0.12	0.29	NA	0.04	NA
1,1-Dichloroethene	0.042	0.009	0.175	0.13	0.30	1.1E-04	0.05	2.6E-05
1,2-Dichloroethene (total)	0.014	0.009	0.091	0.04	0.10	1.9E-05	0.02	4.4E-06
Aluminum	11.4	NA	NA	NA	NA	NA	NA	NA
Arsenic	0.102	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.011	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	0.0052	NA	NA	NA	NA	NA	NA	NA
Chloroform	0.024	NA	0.0805	NA	NA	2.9E-05	NA	6.7E-06
Chromium	0.326	NA	NA	NA	NA	NA	NA	NA
Copper	0.319	NA	NA	NA	NA	NA	NA	NA
Manganese	0.174	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	0.033	0.01	0.00203	NA	NA	1.0E-06	NA	2.3E-07
Trichloroethene	0.053	0.006	0.006	0.24	0.56	4.7E-06	0.09	1.1E-06
Vanadium	0.23	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.012	NA	0.3	NA	NA	5.4E-05	NA	1.3E-05
Zinc	1.23	NA	NA	NA	NA	NA	NA	NA
Cumulative HI or ILCR:				0.6	1.4	2.2E-04	0.2	5.1E-05

Notes:

LWA = Lifetime weighted average
EPC = Exposure point concentration
RfD = Reference Dose
SF = Slope factor
HQ = Hazard quotient
ILCR = Incremental lifetime excess cancer risk
HI = Hazard Index
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
kg-day/mg = kilograms per day per milligram

Table 10-20
LEAD MODEL Version 0.99d

AIR CONCENTRATION: 0.100 ug Pb/m3 DEFAULT
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 106.20 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	74.3	74.3
1-2	74.3	74.3
2-3	74.3	74.3
3-4	74.3	74.3
4-5	74.3	74.3
5-6	74.3	74.3
6-7	74.3	74.3

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 2.50 ug Pb/dL

Table 10-20
LEAD MODEL Version 0.99d

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	7.0	13.15	1.63
1-2:	10.1	25.75	2.39
2-3:	10.0	27.51	2.44
3-4:	9.8	28.53	2.50
4-5:	9.5	29.30	1.89
5-6:	9.3	30.95	1.72
6-7:	8.9	31.87	1.64

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.37	9.12	0.00	0.02
1-2:	2.29	21.04	0.00	0.03
2-3:	2.63	22.38	0.00	0.06
3-4:	2.59	23.37	0.00	0.07
4-5:	2.55	24.79	0.00	0.07
5-6:	2.72	26.42	0.00	0.09
6-7:	3.03	27.11	0.00	0.09

Table 10-21
COC Summary
Building 71 - Site 38
NAS Pensacola

	Residential Scenario			Worker Scenario		Trespasser Scenario	
COC	**HQ (adult)**	**HQ (child)**	**ILCR (LWA)**	**HQ**	**ILCR**	**HQ**	**ILCR**
Aluminum	c	a,c			c		
Arsenic	c	c	a,c	c	c		
BEQ			a,b				
1,1,1-Trichloroethane	c	c,d			c		
1,1-Dichloroethane	c,d	c,d					
1,1-Dichloroethene	c,d	c,d	c,d		c,d		
1,2-Dichloroethene (total)		c,d	d		c,d		
Cadmium	c	c			c,d		
Chloroform		c	c,d		c,d		
Copper	c	c					
Lead		c					
Manganese	c	c					
Tetrachloroethene		c	c,d		c		
Trichloroethene	c,d	c,d	c,d		c,d		
Vanadium	c	c			c		
Vinyl chloride			c,d		c,d		
Zinc	c	c					

Notes:

a = Identified as a COC for the surface soil ingestion exposure pathway

b = Identified as a COC for the dermal contact with surface soil exposure pathway.

c = Identified as a COC for the groundwater ingestion exposure pathway.

d = Identified as a COC for the inhalation of chemicals in groundwater exposure pathway.

Table 10-22
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Trespasser Adolescent ILCR	Site Trespasser Adolescent HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,2-Dichloroethene (total)	036S080C02	0.01	U								
Aluminum (Al)	036S080C02	292			4.00E-03		1.11E-04		2.01E-04		5.590%
Antimony (Sb)	036S080C02	2.2	U								
Aroclor-1254	036S080C02	0.034	U								
Arsenic (As)	036S080C02	1.3	J	3.40E-06	5.94E-02	1.06E-07	1.65E-03	4.80E-07	2.99E-03	100.000%	82.964%
Cadmium (Cd)	036S080C02	0.47	U								
Chromium (Cr)	036S080C02	2.1			2.88E-05		8.01E-07		1.45E-06		0.040%
Copper (Cu)	036S080C02	8			2.74E-03		7.63E-05		1.38E-04		3.829%
Manganese (Mn)	036S080C02	18.6			5.43E-03		1.51E-04		2.73E-04		7.577%
gamma-Chlordane	036S080C02	0.0018	U								
Sum ILCR/HI:				3.40E-06	7.16E-02	1.06E-07	1.99E-03	4.80E-07	3.60E-03		
1,2-Dichloroethene (total)	036S080S02	0.011	U								
Aluminum (Al)	036S080S02	1100			1.51E-02		4.20E-04		7.59E-04		0.767%
Antimony (Sb)	036S080S02	2.7	J		9.26E-02		2.58E-03		4.66E-03		4.708%
Aroclor-1254	036S080S02	0.034	U								
Arsenic (As)	036S080S02	0.47	J	1.23E-06	2.15E-02	3.84E-08	5.98E-04	1.74E-07	1.08E-03	100.000%	1.093%
Cadmium (Cd)	036S080S02	0.42	U								
Chromium (Cr)	036S080S02	3.4			4.66E-05		1.30E-06		2.35E-06		0.002%
Copper (Cu)	036S080S02	5340			1.83E+00		5.09E-02		9.21E-02		93.119%
Manganese (Mn)	036S080S02	20.9			6.10E-03		1.70E-04		3.07E-04		0.310%
gamma-Chlordane	036S080S02	0.0018	U								
Sum ILCR/HI:				1.23E-06	1.97E+00	3.84E-08	5.47E-02	1.74E-07	9.89E-02		
1,2-Dichloroethene (total)	036S081C02	0.01	U								
Aluminum (Al)	036S081C02	1920			2.63E-02		7.32E-04		1.32E-03		34.234%
Antimony (Sb)	036S081C02	2.1	U								
Aroclor-1254	036S081C02	0.034	U								
Arsenic (As)	036S081C02	0.72	J	1.88E-06	3.29E-02	5.89E-08	9.16E-04	2.66E-07	1.66E-03	100.000%	42.792%
Cadmium (Cd)	036S081C02	0.45	U								
Chromium (Cr)	036S081C02	12.3			1.69E-04		4.69E-06		8.48E-06		0.219%
Copper (Cu)	036S081C02	17.6			6.03E-03		1.68E-04		3.04E-04		7.845%
Manganese (Mn)	036S081C02	39.3	J		1.15E-02		3.19E-04		5.77E-04		14.909%
gamma-Chlordane	036S081C02	0.0018	U								
Sum ILCR/HI:				1.88E-06	7.69E-02	5.89E-08	2.14E-03	2.66E-07	3.87E-03		
1,2-Dichloroethene (total)	036S081S03	0.009	U								
Aluminum (Al)	036S081S03	14	J		1.92E-04		5.34E-06		9.66E-06		16.884%
Antimony (Sb)	036S081S03	2.6	U								
Aroclor-1254	036S081S03	0.033	U								
Arsenic (As)	036S081S03	0.21	U								
Cadmium (Cd)	036S081S03	0.56	U								

Table 10-22
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

				Site Resident		*Site Trespasser*		*Site Worker*			
				LWA	*Child*	*Adolescent*		*Adult*			
COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	ILCR	HQ	ILCR	HQ	ILCR	HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Chromium (Cr)	036S081S03	1.1	J		1.51E-05		4.20E-07		7.59E-07		1.327%
Copper (Cu)	036S081S03	2.5	J		8.57E-04		2.38E-05		4.31E-05		75.375%
Manganese (Mn)	036S081S03	0.25	J		7.29E-05		2.03E-06		3.67E-06		6.415%
gamma-Chlordane	036S081S03	0.0017	U								
Sum ILCR/HI:					1.14E-03		3.16E-05		5.72E-05		
1,2-Dichloroethene (total)	036S081W02	0.01	U								
Aluminum (Al)	036S081W02	44.7			6.13E-04		1.71E-05		3.08E-05		30.020%
Antimony (Sb)	036S081W02	2.5	U								
Aroclor-1254	036S081W02	0.033	U								
Arsenic (As)	036S081W02	0.17	U								
Cadmium (Cd)	036S081W02	0.54	U								
Chromium (Cr)	036S081W02	0.54	U								
Copper (Cu)	036S081W02	1.7	J		5.83E-04		1.62E-05		2.93E-05		28.542%
Manganese (Mn)	036S081W02	2.9			8.46E-04		2.35E-05		4.26E-05		41.438%
gamma-Chlordane	036S081W02	0.0017	U								
Sum ILCR/HI:					2.04E-03		5.68E-05		1.03E-04		
1,2-Dichloroethene (total)	038S000102	0.011	U								
Aluminum (Al)	038S000102	13500			1.85E-01		5.15E-03		9.31E-03		51.418%
Antimony (Sb)	038S000102	6.4	U								
Aroclor-1254	038S000102	0.035	U								
Arsenic (As)	038S000102	1.6		4.18E-06	7.31E-02	1.31E-07	2.03E-03	5.91E-07	3.68E-03	32.278%	20.313%
BEQ	038S000102	0.3684		6.10E-06		2.21E-07		1.24E-06		67.722%	
Cadmium (Cd)	038S000102	1.1	U								
Chromium (Cr)	038S000102	22.1			3.03E-04		8.43E-06		1.52E-05		0.084%
Copper (Cu)	038S000102	9.2			3.15E-03		8.77E-05		1.59E-04		0.876%
Manganese (Mn)	038S000102	337			9.83E-02		2.74E-03		4.95E-03		27.309%
gamma-Chlordane	038S000102	0.0018	U								
Sum ILCR/HI:				1.03E-05	3.60E-01	3.52E-07	1.00E-02	1.83E-06	1.81E-02		
1,2-Dichloroethene (total)	038S000301	0.01	U								
Aluminum (Al)	038S000301	121			1.66E-03		4.62E-05		8.35E-05		2.739%
Antimony (Sb)	038S000301	6.2	U								
Aroclor-1254	038S000301	0.034	U								
Arsenic (As)	038S000301	1.2		3.13E-06	5.48E-02	9.81E-08	1.53E-03	4.43E-07	2.76E-03	100.000%	90.552%
Cadmium (Cd)	038S000301	1	U								
Chromium (Cr)	038S000301	3.7			5.07E-05		1.41E-06		2.55E-06		0.084%
Copper (Cu)	038S000301	10.6			3.63E-03		1.01E-04		1.83E-04		5.999%
Manganese (Mn)	038S000301	1.3			3.79E-04		1.06E-05		1.91E-05		0.626%
gamma-Chlordane	038S000301	0.0017	U								
Sum ILCR/HI:				3.13E-06	6.06E-02	9.81E-08	1.69E-03	4.43E-07	3.05E-03		

Table 10-22
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

				Site Resident		*Site Trespasser*		*Site Worker*			
				LWA	*Child*	*Adolescent*		*Adult*			
COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	ILCR	HQ	ILCR	HQ	ILCR	HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,2-Dichloroethene (total)	038S000402	0.012	U								
Aluminum (Al)	038S000402	339			4.65E-03		1.29E-04		2.34E-04		38.253%
Antimony (Sb)	038S000402	6.1	U								
Aroclor-1254	038S000402	0.034	U								
Arsenic (As)	038S000402	0.57	U								
Cadmium (Cd)	038S000402	1	U								
Chromium (Cr)	038S000402	4.7			6.44E-05		1.79E-06		3.24E-06		0.530%
Copper (Cu)	038S000402	21.7			7.44E-03		2.07E-04		3.74E-04		61.216%
Manganese (Mn)	038S000402	5.1	U								
gamma-Chlordane	038S000402	0.0017	U								
Sum ILCR/HI:					1.22E-02		3.38E-04		6.11E-04		
1,2-Dichloroethene (total)	038S000501	0.011	U								
Aluminum (Al)	038S000501	661			9.06E-03		2.52E-04		4.56E-04		39.065%
Antimony (Sb)	038S000501	6.6	U								
Aroclor-1254	038S000501	0.036	U								
Arsenic (As)	038S000501	1.6	U								
Cadmium (Cd)	038S000501	1.1	U								
Chromium (Cr)	038S000501	10			1.37E-04		3.81E-06		6.90E-06		0.591%
Copper (Cu)	038S000501	30.8			1.06E-02		2.94E-04		5.31E-04		45.507%
Manganese (Mn)	038S000501	11.8			3.44E-03		9.58E-05		1.73E-04		14.838%
gamma-Chlordane	038S000501	0.0019	U								
Sum ILCR/HI:					2.32E-02		6.46E-04		1.17E-03		
1,2-Dichloroethene (total)	038S000701	0.056			9.40E-05		2.98E-06		6.16E-06		0.053%
Aluminum (Al)	038S000701	800			1.10E-02		3.05E-04		5.52E-04		4.702%
Antimony (Sb)	038S000701	3.2	U								
Aroclor-1254	038S000701	0.035	U								
Arsenic (As)	038S000701	2.4		6.27E-06	1.10E-01	1.96E-07	3.05E-03	8.87E-07	5.52E-03	74.680%	47.018%
BEQ	038S000701	0.0893		1.48E-06		5.37E-08		3.01E-07		25.320%	
Cadmium (Cd)	038S000701	3.4			9.32E-02		2.59E-03		4.69E-03		39.965%
Chromium (Cr)	038S000701	28.6			3.92E-04		1.09E-05		1.97E-05		0.168%
Copper (Cu)	038S000701	31.6			1.08E-02		3.01E-04		5.45E-04		4.643%
Manganese (Mn)	038S000701	27.6			8.05E-03		2.24E-04		4.05E-04		3.451%
gamma-Chlordane	038S000701	0.0018	U								
Sum ILCR/HI:				7.75E-06	2.33E-01	2.50E-07	6.49E-03	1.19E-06	1.17E-02		
1,2-Dichloroethene (total)	038S000801	0.01	U								
Aluminum (Al)	038S000801	139			1.91E-03		5.30E-05		9.59E-05		44.898%
Antimony (Sb)	038S000801	3.1	U								
Aroclor-1254	038S000801	0.034	U								
Arsenic (As)	038S000801	0.41	U								
BEQ	038S000801	0.0583		9.65E-07		3.50E-08		1.96E-07		100.000%	

Table 10-22
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

				Site Resident		*Site Trespasser*		*Site Worker*			
				LWA	*Child*	*Adolescent*		*Adult*			
COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	ILCR	HQ	ILCR	HQ	ILCR	HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Cadmium (Cd)	038S000801	0.51	U								
Chromium (Cr)	038S000801	2.4			3.29E-05		9.16E-07		1.66E-06		0.775%
Copper (Cu)	038S000801	4.6			1.58E-03		4.39E-05		7.93E-05		37.146%
Manganese (Mn)	038S000801	2.5			7.29E-04		2.03E-05		3.67E-05		17.181%
gamma-Chlordane	038S000801	0.0018	U								
Sum ILCR/HI:				9.65E-07	4.25E-03	3.50E-08	1.18E-04	1.96E-07	2.14E-04		
1,2-Dichloroethene (total)	038S000901	0.021			3.52E-05		1.12E-06		2.31E-06		0.143%
Aluminum (Al)	038S000901	132			1.81E-03		5.04E-05		9.11E-05		5.616%
Antimony (Sb)	038S000901	3.1	U								
Aroclor-1254	038S000901	0.033	U								
Arsenic (As)	038S000901	0.52		1.36E-06	2.38E-02	4.25E-08	6.61E-04	1.92E-07	1.20E-03	100.000%	73.741%
Cadmium (Cd)	038S000901	0.51	U								
Chromium (Cr)	038S000901	6.9			9.46E-05		2.63E-06		4.76E-06		0.294%
Copper (Cu)	038S000901	19			6.51E-03		1.81E-04		3.28E-04		20.208%
Manganese (Mn)	038S000901	9.6	U								
gamma-Chlordane	038S000901	0.0017	U								
Sum ILCR/HI:				1.36E-06	3.22E-02	4.25E-08	8.97E-04	1.92E-07	1.62E-03		
1,2-Dichloroethene (total)	038S001001	0.054	U								
Aluminum (Al)	038S001001	435			5.96E-03		1.66E-04		3.00E-04		4.901%
Antimony (Sb)	038S001001	3.2	U								
Aroclor-1254	038S001001	0.035	U								
Arsenic (As)	038S001001	1.2	U								
BEQ	038S001001	0.064		1.06E-06		3.85E-08		2.16E-07		100.000%	
Cadmium (Cd)	038S001001	4			1.10E-01		3.05E-03		5.52E-03		90.136%
Chromium (Cr)	038S001001	103			1.41E-03		3.93E-05		7.11E-05		1.160%
Copper (Cu)	038S001001	13.5			4.63E-03		1.29E-04		2.33E-04		3.803%
Manganese (Mn)	038S001001	9.5	U								
gamma-Chlordane	038S001001	0.0018	U								
Sum ILCR/HI:				1.06E-06	1.22E-01	3.85E-08	3.39E-03	2.16E-07	6.12E-03		
1,2-Dichloroethene (total)	038S001101	0.01	U								
Aluminum (Al)	038S001101	71.2			9.76E-04		2.72E-05		4.91E-05		88.337%
Antimony (Sb)	038S001101	3.1	U								
Aroclor-1254	038S001101	0.034	U								
Arsenic (As)	038S001101	0.21	U								
Cadmium (Cd)	038S001101	0.52	U								
Chromium (Cr)	038S001101	9.4			1.29E-04		3.59E-06		6.48E-06		11.663%
Copper (Cu)	038S001101	1	U								
Manganese (Mn)	038S001101	0.87	U								
gamma-Chlordane	038S001101	0.0018	U								
Sum ILCR/HI:					1.11E-03		3.07E-05		5.56E-05		

Table 10-22
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Trespasser Adolescent ILCR	Site Trespasser Adolescent HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,2-Dichloroethene (total)	038S001201	0.01	U								
Aluminum (Al)	038S001201	305			4.18E-03		1.16E-04		2.10E-04		4.348%
Antimony (Sb)	038S001201	6.1	U								
Aroclor-1254	038S001201	0.034	U								
Arsenic (As)	038S001201	0.81	J	2.12E-06	3.70E-02	6.62E-08	1.03E-03	2.99E-07	1.86E-03	100.000%	38.488%
Cadmium (Cd)	038S001201	1.8			4.94E-02		1.37E-03		2.48E-03		51.317%
Chromium (Cr)	038S001201	80.2			1.10E-03		3.06E-05		5.53E-05		1.143%
Copper (Cu)	038S001201	13.2			4.53E-03		1.26E-04		2.28E-04		4.704%
Manganese (Mn)	038S001201	4.8	U								
gamma-Chlordane	038S001201	0.0017	U								
Sum ILCR/HI:				2.12E-06	9.62E-02	6.62E-08	2.68E-03	2.99E-07	4.84E-03		
1,2-Dichloroethene (total)	038S001301	0.001	J		1.68E-06		5.32E-08		1.10E-07		0.002%
Aluminum (Al)	038S001301	148			2.03E-03		5.65E-05		1.02E-04		1.583%
Antimony (Sb)	038S001301	6.2	U								
Aroclor-1254	038S001301	0.034	U								
Arsenic (As)	038S001301	0.72		1.88E-06	3.29E-02	5.89E-08	9.16E-04	2.66E-07	1.66E-03	100.000%	25.678%
Cadmium (Cd)	038S001301	2.9			7.95E-02		2.21E-03		4.00E-03		62.055%
Chromium (Cr)	038S001301	713			9.78E-03		2.72E-04		4.92E-04		7.628%
Copper (Cu)	038S001301	9.8			3.36E-03		9.35E-05		1.69E-04		2.621%
Manganese (Mn)	038S001301	1.9			5.54E-04		1.54E-05		2.79E-05		0.433%
gamma-Chlordane	038S001301	0.0017	U								
Sum ILCR/HI:				1.88E-06	1.28E-01	5.89E-08	3.57E-03	2.66E-07	6.45E-03		
1,2-Dichloroethene (total)	038S001401	0.001	U								
Aluminum (Al)	038S001401	784			1.08E-02		2.99E-04		5.41E-04		1.597%
Antimony (Sb)	038S001401	3.2	U								
Aroclor-1254	038S001401	0.035	U								
Arsenic (As)	038S001401	1.9		4.96E-06	8.68E-02	1.55E-07	2.42E-03	7.02E-07	4.37E-03	57.094%	12.900%
BEQ	038S001401	0.1567		2.59E-06		9.42E-08		5.28E-07		42.906%	
Cadmium (Cd)	038S001401	18.6			5.10E-01		1.42E-02		2.57E-02		75.770%
Chromium (Cr)	038S001401	665			9.12E-03		2.54E-04		4.59E-04		1.354%
Copper (Cu)	038S001401	155			5.31E-02		1.48E-03		2.67E-03		7.893%
Manganese (Mn)	038S001401	11.2			3.27E-03		9.09E-05		1.64E-04		0.485%
gamma-Chlordane	038S001401	0.0018	U								
Sum ILCR/HI:				7.56E-06	6.73E-01	2.49E-07	1.87E-02	1.23E-06	3.39E-02		
1,2-Dichloroethene (total)	038S001501	0.011	U								
Aluminum (Al)	038S001501	450			6.17E-03		1.72E-04		3.10E-04		9.946%
Antimony (Sb)	038S001501	3.2	U								
Aroclor-1254	038S001501	0.035	U								
Arsenic (As)	038S001501	0.28		7.31E-07	1.28E-02	2.29E-08	3.56E-04	1.03E-07	6.44E-04	100.000%	20.629%

Table 10-22
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Trespasser Adolescent ILCR	Site Trespasser Adolescent HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Cadmium (Cd)	038S002501	0.95	U								
Chromium (Cr)	038S002501	7			9.60E-05		2.67E-06		4.83E-06		2.090%
Copper (Cu)	038S002501	3			1.03E-03		2.86E-05		5.17E-05		22.392%
Manganese (Mn)	038S002501	7			2.04E-03		5.68E-05		1.03E-04		44.467%
gamma-Chlordane	038S002501	0.0018	U								
Sum ILCR/HI:					4.59E-03		1.28E-04		2.31E-04		
1,2-Dichloroethene (total)	038S002702	0.01	U								
Aluminum (Al)	038S002702	81			1.11E-03		3.09E-05		5.59E-05		13.398%
Antimony (Sb)	038S002702	6	U								
Aroclor-1254	038S002702	0.034	U								
Arsenic (As)	038S002702	0.38	U								
BEQ	038S002702	0.0573		9.49E-07		3.44E-08		1.93E-07		100.000%	
Cadmium (Cd)	038S002702	1	U								
Chromium (Cr)	038S002702	6			8.23E-05		2.29E-06		4.14E-06		0.992%
Copper (Cu)	038S002702	19			6.51E-03		1.81E-04		3.28E-04		78.570%
Manganese (Mn)	038S002702	2			5.84E-04		1.62E-05		2.94E-05		7.039%
gamma-Chlordane	038S002702	0.0018	U								
Sum ILCR/HI:				9.49E-07	8.29E-03	3.44E-08	2.31E-04	1.93E-07	4.17E-04		
1,2-Dichloroethene (total)	038S002901	0.01	U								
Aluminum (Al)	038S002901	1540			2.11E-02		5.87E-04		1.06E-03		15.522%
Antimony (Sb)	038S002901	6	U								
Aroclor-1254	038S002901	0.034	U								
Arsenic (As)	038S002901	1		2.61E-06	4.57E-02	8.17E-08	1.27E-03	3.70E-07	2.30E-03	19.571%	33.598%
BEQ	038S002901	0.451		7.47E-06		2.71E-07		1.52E-06		80.429%	
Cadmium (Cd)	038S002901	2			5.48E-02		1.53E-03		2.76E-03		40.317%
Chromium (Cr)	038S002901	15			2.06E-04		5.72E-06		1.03E-05		0.151%
Copper (Cu)	038S002901	26			8.91E-03		2.48E-04		4.48E-04		6.552%
Manganese (Mn)	038S002901	18			5.25E-03		1.46E-04		2.64E-04		3.860%
gamma-Chlordane	038S002901	0.0018	U								
Sum ILCR/HI:				1.01E-05	1.36E-01	3.53E-07	3.78E-03	1.89E-06	6.84E-03		
1,2-Dichloroethene (total)	038S003001	0.01	U								
Aluminum (Al)	038S003001	214	J		2.93E-03		8.16E-05		1.48E-04		67.769%
Antimony (Sb)	038S003001	6.2	UJ								
Aroclor-1254	038S003001	0.034	U								
Arsenic (As)	038S003001	0.4	UJ								
Cadmium (Cd)	038S003001	1	U								
Chromium (Cr)	038S003001	2.1	J		2.88E-05		8.01E-07		1.45E-06		0.665%
Copper (Cu)	038S003001	2.2			7.54E-04		2.10E-05		3.79E-05		17.417%
Manganese (Mn)	038S003001	2.1	J		6.13E-04		1.70E-05		3.08E-05		14.149%
gamma-Chlordane	038S003001	0.0017	U								

Table 10-22
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Trespasser Adolescent ILCR	Site Trespasser Adolescent HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Sum ILCR/HI:					4.33E-03		1.20E-04		2.18E-04		
1,2-Dichloroethene (total)	038S003101	0.01	U								
Aluminum (Al)	038S003101	207	J		2.84E-03		7.90E-05		1.43E-04		21.436%
Antimony (Sb)	038S003101	4.6	UJ								
Aroclor-1254	038S003101	0.034	U								
Arsenic (As)	038S003101	0.38	U								
BEQ	038S003101	0.059		9.77E-07		3.55E-08		1.99E-07		100.000%	
Cadmium (Cd)	038S003101	0.77	U								
Chromium (Cr)	038S003101	4.2	J		5.76E-05		1.60E-06		2.90E-06		0.435%
Copper (Cu)	038S003101	27.2			9.32E-03		2.59E-04		4.69E-04		70.418%
Manganese (Mn)	038S003101	3.5	J		1.02E-03		2.84E-05		5.14E-05		7.712%
gamma-Chlordane	038S003101	0.0018	U								
Sum ILCR/HI:				9.77E-07	1.32E-02	3.55E-08	3.68E-04	1.99E-07	6.66E-04		
1,2-Dichloroethene (total)	038S003201	0.011	U								
Aluminum (Al)	038S003201	858			1.18E-02		3.27E-04		5.92E-04		5.832%
Antimony (Sb)	038S003201	6	U								
Aroclor-1254	038S003201	0.037	U								
Arsenic (As)	038S003201	3		7.84E-06	1.37E-01	2.45E-07	3.81E-03	1.11E-06	6.90E-03	23.187%	67.970%
BEQ	038S003201	1.0907		1.81E-05		6.55E-07		3.67E-06		76.813%	
Cadmium (Cd)	038S003201	1	U								
Chromium (Cr)	038S003201	5			6.86E-05		1.91E-06		3.45E-06		0.034%
Copper (Cu)	038S003201	131			4.49E-02		1.25E-03		2.26E-03		22.260%
Manganese (Mn)	038S003201	27			7.88E-03		2.19E-04		3.96E-04		3.905%
gamma-Chlordane	038S003201	0.0019	U								
Sum ILCR/HI:				2.59E-05	2.02E-01	9.01E-07	5.61E-03	4.78E-06	1.01E-02		
1,2-Dichloroethene (total)	038S003301	0.011	U								
Aluminum (Al)	038S003301	21200	J		2.91E-01		8.09E-03		1.46E-02		56.046%
Antimony (Sb)	038S003301	6.5	UJ								
Aroclor-1254	038S003301	0.036	U								
Arsenic (As)	038S003301	3.9		1.02E-05	1.78E-01	3.19E-07	4.96E-03	1.44E-06	8.97E-03	84.070%	34.368%
BEQ	038S003301	0.0811		1.34E-06		4.87E-08		2.73E-07		15.930%	
Cadmium (Cd)	038S003301	1.2			3.29E-02		9.16E-04		1.66E-03		6.345%
Chromium (Cr)	038S003301	18.3	J		2.51E-04		6.98E-06		1.26E-05		0.048%
Copper (Cu)	038S003301	22			7.54E-03		2.10E-04		3.79E-04		1.454%
Manganese (Mn)	038S003301	30.9	J		9.02E-03		2.51E-04		4.54E-04		1.738%
gamma-Chlordane	038S003301	0.0018	U								
Sum ILCR/HI:				1.15E-05	5.19E-01	3.68E-07	1.44E-02	1.71E-06	2.61E-02		
1,2-Dichloroethene (total)	038S003401	0.011	U								
Aluminum (Al)	038S003401	19000	J		2.61E-01		7.25E-03		1.31E-02		68.238%

Table 10-22
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

COPC	Sample Designat.on	Reported Concentration (mg/kg)	VQUAL	*Site Resident* *LWA* ILCR	*Site Resident* *Child* HQ	*Site Trespasser* *Adolescent* ILCR	*Site Trespasser* *Adolescent* HQ	*Site Worker* *Adult* ILCR	*Site Worker* *Adult* HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Cadmium (Cd)	038S001501	1.4			3.84E-02		1.07E-03		1.93E-03		61.886%
Chromium (Cr)	038S001501	17.5			2.40E-04		6.68E-06		1.21E-05		0.387%
Copper (Cu)	038S001501	9.2			3.15E-03		8.77E-05		1.59E-04		5.083%
Manganese (Mn)	038S001501	4.4			1.28E-03		3.57E-05		6.46E-05		2.069%
gamma-Chlordane	038S001501	0.0018	U								
Sum ILCR/HI:				7.31E-07	6.20E-02	2.29E-08	1.73E-03	1.03E-07	3.12E-03		
1,2-Dichloroethene (total)	038S001601	0.011	U								
Aluminum (Al)	038S001601	9860			1.35E-01		3.76E-03		6.80E-03		51.869%
Antimony (Sb)	038S001601	3.2	U								
Aroclor-1254	038S001601	0.035	U								
Arsenic (As)	038S001601	2.2		5.75E-06	1.01E-01	1.80E-07	2.80E-03	8.13E-07	5.06E-03	100.000%	38.577%
Cadmium (Cd)	038S001601	0.6			1.65E-02		4.58E-04		8.28E-04		6.313%
Chromium (Cr)	038S001601	12.6			1.73E-04		4.81E-06		8.69E-06		0.066%
Copper (Cu)	038S001601	11.8			4.05E-03		1.13E-04		2.03E-04		1.552%
Manganese (Mn)	038S001601	14.5			4.23E-03		1.18E-04		2.13E-04		1.623%
gamma-Chlordane	038S001601	0.0018	U								
Sum ILCR/HI:				5.75E-06	2.61E-01	1.80E-07	7.25E-03	8.13E-07	1.31E-02		
1,2-Dichloroethene (total)	038S001701	0.01	U								
Aluminum (Al)	038S001701	4220			5.79E-02		1.61E-03		2.91E-03		23.384%
Antimony (Sb)	038S001701	3.1	U								
Aroclor-1254	038S001701	0.1		4.54E-07	8.25E-02	1.65E-08	2.88E-03	9.23E-08	6.46E-03	19.889%	51.876%
Arsenic (As)	038S001701	1		2.61E-06	4.57E-02	8.17E-08	1.27E-03	3.70E-07	2.30E-03	79.671%	18.471%
Cadmium (Cd)	038S001701	0.52	U								
Chromium (Cr)	038S001701	53.4			7.32E-04		2.04E-05		3.68E-05		0.296%
Copper (Cu)	038S001701	9.6			3.29E-03		9.16E-05		1.66E-04		1.330%
Manganese (Mn)	038S001701	34.4			1.00E-02		2.79E-04		5.05E-04		4.056%
gamma-Chlordane	038S001701	0.0034	J	1.00E-08	9.35E-04	3.64E-10	3.27E-05	2.04E-09	7.32E-05	0.440%	0.588%
Sum ILCR/HI:				3.08E-06	2.01E-01	9.86E-08	6.19E-03	4.64E-07	1.24E-02		
1,2-Dichloroethene (total)	038S001801	0.01	U								
Aluminum (Al)	038S001801	4180			5.73E-02		1.59E-03		2.88E-03		0.274%
Antimony (Sb)	038S001801	3.1	U								
Aroclor-1254	038S001801	16	J	7.26E-05	1.32E+01	2.63E-06	4.61E-01	1.48E-05	1.03E+00	97.504%	98.062%
Arsenic (As)	038S001801	0.42	U								
Cadmium (Cd)	038S001801	2.1			5.76E-02		1.60E-03		2.90E-03		0.275%
Chromium (Cr)	038S001801	291			3.99E-03		1.11E-04		2.01E-04		0.019%
Copper (Cu)	038S001801	41.2			1.41E-02		3.93E-04		7.11E-04		0.067%
Manganese (Mn)	038S001801	11.7			3.41E-03		9.50E-05		1.72E-04		0.016%
gamma-Chlordane	038S001801	0.63	J	1.86E-06	1.73E-01	6.74E-08	6.05E-03	3.78E-07	1.36E-02	2.496%	1.287%
Sum ILCR/HI:				7.44E-05	1.35E+01	2.70E-06	4.71E-01	1.51E-05	1.05E+00		

Table 10-22
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	*Site Resident* *LWA* ILCR	*Site Resident* *Child* HQ	*Site Trespasser* *Adolescent* ILCR	*Site Trespasser* *Adolescent* HQ	*Site Worker* *Adult* ILCR	*Site Worker* *Adult* HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,2-Dichloroethene (total)	038S001901	0.01	U								
Aluminum (Al)	038S001901	4580			6.28E-02		1.75E-03		3.16E-03		37.812%
Antimony (Sb)	038S001901	3.1	U								
Aroclor-1254	038S001901	0.034	U								
Arsenic (As)	038S001901	1.9		4.96E-06	8.68E-02	1.55E-07	2.42E-03	7.02E-07	4.37E-03	60.489%	52.287%
BEQ	038S001901	0.1362		2.26E-06		8.18E-08		4.59E-07		39.511%	
Cadmium (Cd)	038S001901	0.52	U								
Chromium (Cr)	038S001901	6.6			9.05E-05		2.52E-06		4.55E-06		0.054%
Copper (Cu)	038S001901	23.2			7.95E-03		2.21E-04		4.00E-04		4.788%
Manganese (Mn)	038S001901	28.8			8.40E-03		2.34E-04		4.23E-04		5.059%
gamma-Chlordane	038S001901	0.0018	U								
Sum ILCR/HI:				7.22E-06	1.66E-01	2.37E-07	4.62E-03	1.16E-06	8.36E-03		
1,2-Dichloroethene (total)	038S002201	0.011	U								
Aluminum (Al)	038S002201	1000			1.37E-02		3.81E-04		6.90E-04		5.341%
Antimony (Sb)	038S002201	3.8			1.30E-01		3.62E-03		6.55E-03		50.738%
Aroclor-1254	038S002201	0.035	U								
Arsenic (As)	038S002201	1.6		4.18E-06	7.31E-02	1.31E-07	2.03E-03	5.91E-07	3.68E-03	75.689%	28.485%
BEQ	038S002201	0.0564		9.34E-07		3.39E-08		1.90E-07		24.311%	
Cadmium (Cd)	038S002201	0.63			1.73E-02		4.81E-04		8.69E-04		6.730%
Chromium (Cr)	038S002201	10.2			1.40E-04		3.89E-06		7.04E-06		0.054%
Copper (Cu)	038S002201	6.5			2.23E-03		6.20E-05		1.12E-04		0.868%
Manganese (Mn)	038S002201	68.5			2.00E-02		5.56E-04		1.01E-03		7.784%
gamma-Chlordane	038S002201	0.0018	U								
Sum ILCR/HI:				5.11E-06	2.57E-01	1.65E-07	7.14E-03	7.81E-07	1.29E-02		
1,2-Dichloroethene (total)	038S002403	0.011	U								
Aluminum (Al)	038S002403	684			9.38E-03		2.61E-04		4.72E-04		60.615%
Antimony (Sb)	038S002403	6	U								
Aroclor-1254	038S002403	0.037	U								
Arsenic (As)	038S002403	0.88	U								
Cadmium (Cd)	038S002403	1	U								
Chromium (Cr)	038S002403	4			5.48E-05		1.53E-06		2.76E-06		0.354%
Copper (Cu)	038S002403	4			1.37E-03		3.81E-05		6.90E-05		8.862%
Manganese (Mn)	038S002403	16			4.67E-03		1.30E-04		2.35E-04		30.168%
gamma-Chlordane	038S002403	0.0019	U								
Sum ILCR/HI:					1.55E-02		4.30E-04		7.78E-04		
1,2-Dichloroethene (total)	038S002501	0.01	U								
Aluminum (Al)	038S002501	104			1.43E-03		3.97E-05		7.17E-05		31.051%
Antimony (Sb)	038S002501	5	U								
Aroclor-1254	038S002501	0.034	U								
Arsenic (As)	038S002501	0.37	U								

Table 10-22
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

				Site Resident		*Site Trespasser*		*Site Worker*			
				LWA	*Child*	*Adolescent*		*Adult*			
COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	ILCR	HQ	ILCR	HQ	ILCR	HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Antimony (Sb)	038S003401	6.1	UJ								
Aroclor-1254	038S003401	0.036	U								
Arsenic (As)	038S003401	2.4		6.27E-06	1.10E-01	1.96E-07	3.05E-03	8.87E-07	5.52E-03	55.911%	28.732%
BEQ	038S003401	0.2077		3.44E-06		1.25E-07		6.99E-07		44.089%	
Cadmium (Cd)	038S003401	1	U								
Chromium (Cr)	038S003401	21.1	J		2.89E-04		8.05E-06		1.46E-05		0.076%
Copper (Cu)	038S003401	6.6			2.26E-03		6.29E-05		1.14E-04		0.593%
Manganese (Mn)	038S003401	30.9	J		9.02E-03		2.51E-04		4.54E-04		2.361%
gamma-Chlordane	038S003401	0.0018	U								
Sum ILCR/HI:				9.71E-06	3.82E-01	3.21E-07	1.06E-02	1.59E-06	1.92E-02		
BEQ	038S080S02	0.0742		1.23E-06		4.46E-08		2.50E-07		100.000%	
Sum ILCR/HI:				1.23E-06		4.46E-08		2.50E-07			
Aluminum (Al)	038S0I1002	33			4.53E-04		1.26E-05		2.28E-05		0.730%
Antimony (Sb)	038S0I1002	3	U								
Aroclor-1254	038S0I1002	0.5	U								
Arsenic (As)	038S0I1002	3	U								
Cadmium (Cd)	038S0I1002	2.2			6.03E-02		1.68E-03		3.04E-03		97.281%
Chromium (Cr)	038S0I1002	20			2.74E-04		7.63E-06		1.38E-05		0.442%
Copper (Cu)	038S0I1002	2.8			9.60E-04		2.67E-05		4.83E-05		1.548%
Manganese (Mn)	038S0I1002	1	U								
Sum ILCR/HI:					6.20E-02		1.73E-03		3.12E-03		
Aluminum (Al)	038S0S2301	930			1.28E-02		3.55E-04		6.42E-04		8.371%
Antimony (Sb)	038S0S2301	3	U								
Aroclor-1254	038S0S2301	0.081	J	3.67E-07	6.68E-02	1.33E-08	2.33E-03	7.47E-08	5.23E-03	100.000%	68.254%
Arsenic (As)	038S0S2301	3	U								
Cadmium (Cd)	038S0S2301	1.2			3.29E-02		9.16E-04		1.66E-03		21.602%
Chromium (Cr)	038S0S2301	3			4.11E-05		1.14E-06		2.07E-06		0.027%
Copper (Cu)	038S0S2301	4.1			1.41E-03		3.91E-05		7.07E-05		0.923%
Manganese (Mn)	038S0S2301	4.3			1.25E-03		3.49E-05		6.31E-05		0.823%
Sum ILCR/HI:				3.67E-07	1.15E-01	1.33E-08	3.68E-03	7.47E-08	7.66E-03		
Aluminum (Al)	038S0T0501	18			2.47E-04		6.87E-06		1.24E-05		100.000%
Antimony (Sb)	038S0T0501	3	U								
Arsenic (As)	038S0T0501	3	U								
Cadmium (Cd)	038S0T0501	0.5	U								
Chromium (Cr)	038S0T0501	1	U								
Copper (Cu)	038S0T0501	1	U								
Manganese (Mn)	038S0T0501	1	U								
Sum ILCR/HI:					2.47E-04		6.87E-06		1.24E-05		

Table 10-22
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

				Site Resident		*Site Trespasser*		*Site Worker*			
				LWA	*Child*	*Adolescent*		*Adult*			
COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	ILCR	HQ	ILCR	HQ	ILCR	HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI

Notes:

COPC = Chemical of potential concern
VQUAL = Validation qualifier
LWA = Lifetime weighted average
ILCR = Incremental Lifetime excess cancer risk
HQ = Hazard quotient
HI = Hazard index
mg/kg = milligrams per kilogram
BEQ = Benzo(a)pyrene equivalent
J = The associated numerical value is an estimated quantity.
U = The material was analyzed for, but not detected; the associated value is the lesser of one half of the sample quantitation limit, or one half of the lowest detected concentration.

The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would double the manganese hazard quotient shown in this table.

Table 10-23
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	*Site Resident* *LWA* ILCR	*Site Resident* *Child* HQ	*Site Worker* *Adult* ILCR	*Site Worker* *Adult* HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,1,1-Trichloroethane	036GR80C01	0.01	U						
1,1-Dichloroethane	036GR80C01	0.01	U						
1,1-Dichloroethene	036GR80C01	0.01	U						
1,2-Dichloroethane	036GR80C01	0.01	U						
1,2-Dichloroethene (total)	036GR80C01	0.01	U						
1,4-Dichlorobenzene	036GR80C01	0.011	U						
Aluminum (Al)	036GR80C01	7.08			4.52E-01		6.92E-02		24.960%
Arsenic (As)	036GR80C01	0.0043	J	9.61E-05	9.16E-01	2.25E-05	1.40E-01	100.000%	50.531%
Bromomethane	036GR80C01	0.01	U						
Cadmium (Cd)	036GR80C01	0.003	U						
Chlorobenzene	036GR80C01	0.01	U						
Chloroform	036GR80C01	0.01	U						
Chromium (Cr)	036GR80C01	0.0249			1.59E-03		2.44E-04		0.088%
Copper (Cu)	036GR80C01	0.0623			9.95E-02		1.52E-02		5.491%
Manganese (Mn)	036GR80C01	0.0987			1.34E-01		2.05E-02		7.403%
Tetrachloroethene	036GR80C01	0.01	U						
Trichloroethene	036GR80C01	0.01	U						
Vanadium (V)	036GR80C01	0.0192	J		1.75E-01		2.68E-02		9.670%
Vinyl chloride	036GR80C01	0.01	U						
Zinc (Zn)	036GR80C01	0.158			3.37E-02		5.15E-03		1.857%
Sum ILCR/HI:				9.61E-05	1.81E+00	2.25E-05	2.77E-01		
1,1,1-Trichloroethane	036GR81C01	0.01	U						
1,1-Dichloroethane	036GR81C01	0.01	U						
1,1-Dichloroethene	036GR81C01	0.01	U						
1,2-Dichloroethane	036GR81C01	0.01	U						
1,2-Dichloroethene (total)	036GR81C01	0.01	U						
1,4-Dichlorobenzene	036GR81C01	0.011	U						
Aluminum (Al)	036GR81C01	1.16			7.41E-02		1.13E-02		10.981%
Arsenic (As)	036GR81C01	0.0021	J	4.69E-05	4.47E-01	1.10E-05	6.85E-02	100.000%	66.267%
Bromomethane	036GR81C01	0.01	U						
Cadmium (Cd)	036GR81C01	0.003	U						
Chlorobenzene	036GR81C01	0.01	U						
Chloroform	036GR81C01	0.01	U						
Chromium (Cr)	036GR81C01	0.0064	J		4.09E-04		6.26E-05		0.061%
Copper (Cu)	036GR81C01	0.0171	J		2.73E-02		4.18E-03		4.047%
Manganese (Mn)	036GR81C01	0.0572			7.78E-02		1.19E-02		11.521%
Tetrachloroethene	036GR81C01	0.01	U						
Trichloroethene	036GR81C01	0.01	U						
Vanadium (V)	036GR81C01	0.0047	J		4.29E-02		6.57E-03		6.356%
Vinyl chloride	036GR81C01	0.01	U						
Zinc (Zn)	036GR81C01	0.0243			5.18E-03		7.92E-04		0.767%

Table 10-23
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Sum ILCR/HI:				4.69E-05	6.75E-01	1.10E-05	1.03E-01		
1,1,1-Trichloroethane	038G0I1001	0.0006	J		1.23E-03		1.88E-04		0.082%
1,1-Dichloroethane	038G0I1001	0.005	U						
1,1-Dichloroethene	038G0I1001	0.005	U						
1,2-Dichloroethane	038G0I1001	0.005	U						
1,4-Dichlorobenzene	038G0I1001	0.005	U						
Aluminum (Al)	038G0I1001	2.6			1.66E-01		2.54E-02		11.068%
Arsenic (As)	038G0I1001	0.015	U						
Bromomethane	038G0I1001	0.005	U						
Cadmium (Cd)	038G0I1001	0.0025	U						
Chlorobenzene	038G0I1001	0.005	U						
Chloroform	038G0I1001	0.005	U						
Chromium (Cr)	038G0I1001	0.055			3.51E-03		5.38E-04		0.234%
Copper (Cu)	038G0I1001	0.005	U						
Manganese (Mn)	038G0I1001	0.03			4.08E-02		6.24E-03		2.717%
Tetrachloroethene	038G0I1001	0.0008	J	6.44E-07	1.02E-02	1.51E-07	1.56E-03	100.000%	0.681%
Trichloroethene	038G0I1001	0.005	U						
Vanadium (V)	038G0I1001	0.14			1.28E+00		1.96E-01		85.138%
Vinyl chloride	038G0I1001	0.001	U						
Zinc (Zn)	038G0I1001	0.0056			1.19E-03		1.83E-04		0.079%
Sum ILCR/HI:				6.44E-07	1.50E+00	1.51E-07	2.30E-01		
1,1,1-Trichloroethane	038G0S2301	0.005	U						
1,1-Dichloroethane	038G0S2301	0.0098	A		1.06E-02		1.63E-03		3.467%
1,1-Dichloroethene	038G0S2301	0.005	U						
1,2-Dichloroethane	038G0S2301	0.005	U						
1,4-Dichlorobenzene	038G0S2301	0.0007	AJ	2.50E-07	1.95E-04	5.86E-08	2.99E-05	100.000%	0.064%
Aluminum (Al)	038G0S2301	0.26			1.66E-02		2.54E-03		5.412%
Arsenic (As)	038G0S2301	0.03	U						
Bromomethane	038G0S2301	0.005	U						
Cadmium (Cd)	038G0S2301	0.005	U						
Chlorobenzene	038G0S2301	0.0052	A		7.48E-02		1.14E-02		24.369%
Chloroform	038G0S2301	0.005	U						
Chromium (Cr)	038G0S2301	0.01	U						
Copper (Cu)	038G0S2301	0.01	U						
Manganese (Mn)	038G0S2301	0.023			3.13E-02		4.79E-03		10.187%
Tetrachloroethene	038G0S2301	0.005	U						
Trichloroethene	038G0S2301	0.005	U						
Vanadium (V)	038G0S2301	0.019			1.73E-01		2.65E-02		56.501%
Vinyl chloride	038G0S2301	0.002	U						
Zinc (Zn)	038G0S2301	0.01	U						
Sum ILCR/HI:				2.50E-07	3.07E-01	5.86E-08	4.70E-02		

Table 10-23
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,1,1-Trichloroethane	038G0T0501	0.0024	J		4.92E-03		7.53E-04		0.211%
1,1-Dichloroethane	038G0T0501	0.0012	J		1.30E-03		1.99E-04		0.056%
1,1-Dichloroethene	038G0T0501	0.005	U						
1,2-Dichloroethane	038G0T0501	0.005	U						
1,4-Dichlorobenzene	038G0T0501	0.005	U						
Aluminum (Al)	038G0T0501	1.8			1.15E-01		1.76E-02		4.932%
Arsenic (As)	038G0T0501	0.03	U						
Bromomethane	038G0T0501	0.005	U						
Cadmium (Cd)	038G0T0501	0.0025	U						
Chlorobenzene	038G0T0501	0.005	U						
Chloroform	038G0T0501	0.005	U						
Chromium (Cr)	038G0T0501	0.087			5.56E-03		8.51E-04		0.238%
Copper (Cu)	038G0T0501	0.005	U						
Manganese (Mn)	038G0T0501	0.02			2.72E-02		4.16E-03		1.166%
Tetrachloroethene	038G0T0501	0.0028	J	2.25E-06	3.58E-02	5.28E-07	5.48E-03	81.650%	1.535%
Trichloroethene	038G0T0501	0.002	J	5.07E-07	4.26E-02	1.19E-07	6.52E-03	18.350%	1.827%
Vanadium (V)	038G0T0501	0.23			2.10E+00		3.21E-01		90.035%
Vinyl chloride	038G0T0501	0.001	U						
Zinc (Zn)	038G0T0501	0.005	U						
Sum ILCR/HI:				2.76E-06	2.33E+00	6.47E-07	3.57E-01		
1,1,1-Trichloroethane	038GGI0101	0.1	U						
1,1-Dichloroethane	038GGI0101	0.1	U						
1,1-Dichloroethene	038GGI0101	0.1	U						
1,2-Dichloroethane	038GGI0101	0.1	U						
1,2-Dichloroethene (total)	038GGI0101	0.1	U						
1,4-Dichlorobenzene	038GGI0101	0.01	U						
Aluminum (Al)	038GGI0101	1.41	J		9.01E-02		1.38E-02		42.437%
Arsenic (As)	038GGI0101	0.002	U						
Bromomethane	038GGI0101	0.1	U						
Cadmium (Cd)	038GGI0101	0.003	U						
Chlorobenzene	038GGI0101	0.1	U						
Chloroform	038GGI0101	0.1	U						
Chromium (Cr)	038GGI0101	0.004			2.56E-04		3.91E-05		0.120%
Copper (Cu)	038GGI0101	0.0061			9.74E-03		1.49E-03		4.590%
Manganese (Mn)	038GGI0101	0.0431	J		5.86E-02		8.97E-03		27.600%
Tetrachloroethene	038GGI0101	0.1	U						
Trichloroethene	038GGI0101	0.1	U						
Vanadium (V)	038GGI0101	0.0055			5.02E-02		7.68E-03		23.648%
Vinyl chloride	038GGI0101	0.1	U						
Zinc (Zn)	038GGI0101	0.016			3.41E-03		5.22E-04		1.605%
Sum ILCR/HI:					2.12E-01		3.25E-02		

Table 10-23
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,1,1-Trichloroethane	038GGI0201	0.01	U						
1,1-Dichloroethane	038GGI0201	0.01	U						
1,1-Dichloroethene	038GGI0201	0.01	U						
1,2-Dichloroethane	038GGI0201	0.01	U						
1,2-Dichloroethene (total)	038GGI0201	0.01	U						
1,4-Dichlorobenzene	038GGI0201	0.011	U						
Aluminum (Al)	038GGI0201	1.09	J		6.97E-02		1.07E-02		23.357%
Arsenic (As)	038GGI0201	0.002	U						
Bromomethane	038GGI0201	0.01	U						
Cadmium (Cd)	038GGI0201	0.003	U						
Chlorobenzene	038GGI0201	0.01	U						
Chloroform	038GGI0201	0.01	U						
Chromium (Cr)	038GGI0201	0.011	J		7.03E-04		1.08E-04		0.236%
Copper (Cu)	038GGI0201	0.0125			2.00E-02		3.06E-03		6.696%
Manganese (Mn)	038GGI0201	0.038	J		5.17E-02		7.91E-03		17.325%
Tetrachloroethene	038GGI0201	0.01	U						
Trichloroethene	038GGI0201	0.01	U						
Vanadium (V)	038GGI0201	0.0138			1.26E-01		1.93E-02		42.244%
Vinyl chloride	038GGI0201	0.01	U						
Zinc (Zn)	038GGI0201	0.142	J		3.02E-02		4.63E-03		10.143%
Sum ILCR/HI:					2.98E-01		4.56E-02		
1,1,1-Trichloroethane	038GGI0301	0.01	U						
1,1-Dichloroethane	038GGI0301	0.01	U						
1,1-Dichloroethene	038GGI0301	0.01	U						
1,2-Dichloroethane	038GGI0301	0.01	U						
1,2-Dichloroethene (total)	038GGI0301	0.01	U						
1,4-Dichlorobenzene	038GGI0301	0.01	U						
Aluminum (Al)	038GGI0301	0.895	J		5.72E-02		8.75E-03		1.762%
Arsenic (As)	038GGI0301	0.0039	J	8.72E-05	8.31E-01	2.04E-05	1.27E-01	100.000%	25.594%
Bromomethane	038GGI0301	0.003	J		2.71E-01		4.15E-02		8.349%
Cadmium (Cd)	038GGI0301	0.003	U						
Chlorobenzene	038GGI0301	0.01	U						
Chloroform	038GGI0301	0.01	U						
Chromium (Cr)	038GGI0301	0.0706			4.51E-03		6.90E-04		0.139%
Copper (Cu)	038GGI0301	0.0085			1.36E-02		2.08E-03		0.418%
Manganese (Mn)	038GGI0301	0.0284	J		3.86E-02		5.91E-03		1.190%
Tetrachloroethene	038GGI0301	0.01	U						
Trichloroethene	038GGI0301	0.01	U						
Vanadium (V)	038GGI0301	0.222	J		2.03E+00		3.10E-01		62.437%
Vinyl chloride	038GGI0301	0.01	U						
Zinc (Zn)	038GGI0301	0.017			3.62E-03		5.54E-04		0.112%

Table 10-23
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	*Site Resident* *LWA* ILCR	*Site Resident* *Child* HQ	*Site Worker* *Adult* ILCR	*Site Worker* *Adult* HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Sum ILCR/HI:				8.72E-05	3.25E+00	2.04E-05	4.97E-01		
1,1,1-Trichloroethane	038GGS0101	0.01	U						
1,1-Dichloroethane	038GGS0101	0.01	U						
1,1-Dichloroethene	038GGS0101	0.01	U						
1,2-Dichloroethane	038GGS0101	0.01	U						
1,2-Dichloroethene (total)	038GGS0101	0.01	U						
1,4-Dichlorobenzene	038GGS0101	0.01	U						
Aluminum (Al)	038GGS0101	6.42			4.10E-01		6.28E-02		7.167%
Arsenic (As)	038GGS0101	0.0218		4.87E-04	4.64E+00	1.14E-04	7.11E-01	100.000%	81.116%
Bromomethane	038GGS0101	0.01	U						
Cadmium (Cd)	038GGS0101	0.003	U						
Chlorobenzene	038GGS0101	0.01	U						
Chloroform	038GGS0101	0.01	U						
Chromium (Cr)	038GGS0101	0.0188			1.20E-03		1.84E-04		0.021%
Copper (Cu)	038GGS0101	0.0911			1.46E-01		2.23E-02		2.542%
Manganese (Mn)	038GGS0101	0.174			2.37E-01		3.62E-02		4.133%
Tetrachloroethene	038GGS0101	0.01	U						
Trichloroethene	038GGS0101	0.01	U						
Vanadium (V)	038GGS0101	0.0159			1.45E-01		2.22E-02		2.536%
Vinyl chloride	038GGS0101	0.01	U						
Zinc (Zn)	038GGS0101	0.668			1.42E-01		2.18E-02		2.486%
Sum ILCR/HI:				4.87E-04	5.72E+00	1.14E-04	8.76E-01		
1,1,1-Trichloroethane	038GGS0201	0.02	U						
1,1-Dichloroethane	038GGS0201	0.044			4.78E-02		7.31E-03		1.507%
1,1-Dichloroethene	038GGS0201	0.02	U						
1,2-Dichloroethane	038GGS0201	0.02	U						
1,2-Dichloroethene (total)	038GGS0201	0.002	J		2.84E-02		4.35E-03		0.896%
1,4-Dichlorobenzene	038GGS0201	0.01	U						
Aluminum (Al)	038GGS0201	1.33			8.50E-02		1.30E-02		2.681%
Arsenic (As)	038GGS0201	0.0108		2.41E-04	2.30E+00	5.65E-05	3.52E-01	38.028%	72.557%
Bromomethane	038GGS0201	0.02	U						
Cadmium (Cd)	038GGS0201	0.003	U						
Chlorobenzene	038GGS0201	0.004	J		5.75E-02		8.81E-03		1.815%
Chloroform	038GGS0201	0.02	U						
Chromium (Cr)	038GGS0201	0.0111			7.09E-04		1.09E-04		0.022%
Copper (Cu)	038GGS0201	0.311			4.97E-01		7.60E-02		15.670%
Manganese (Mn)	038GGS0201	0.0265			3.60E-02		5.51E-03		1.136%
Tetrachloroethene	038GGS0201	0.02	U						
Trichloroethene	038GGS0201	0.02	U						
Vanadium (V)	038GGS0201	0.0098			8.95E-02		1.37E-02		2.822%
Vinyl chloride	038GGS0201	0.012	J	3.93E-04		9.21E-05		61.972%	

Table 10-23
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Zinc (Zn)	038GGS0201	0.133			2.83E-02		4.34E-03		0.894%
Sum ILCR/HI:				6.35E-04	3.17E+00	1.49E-04	4.85E-01		
1,1,1-Trichloroethane	038GGS0301	0.01	U						
1,1-Dichloroethane	038GGS0301	0.01	U						
1,1-Dichloroethene	038GGS0301	0.01	U						
1,2-Dichloroethane	038GGS0301	0.01	U						
1,2-Dichloroethene (total)	038GGS0301	0.002	J		2.84E-02		4.35E-03		1.533%
1,4-Dichlorobenzene	038GGS0301	0.011	U						
Aluminum (Al)	038GGS0301	2.7			1.73E-01		2.64E-02		9.310%
Arsenic (As)	038GGS0301	0.0057		1.27E-04	1.21E+00	2.98E-05	1.86E-01	99.802%	65.516%
Bromomethane	038GGS0301	0.01	U						
Cadmium (Cd)	038GGS0301	0.003	U						
Chlorobenzene	038GGS0301	0.01	U						
Chloroform	038GGS0301	0.01	U						
Chromium (Cr)	038GGS0301	0.0748			4.78E-03		7.32E-04		0.258%
Copper (Cu)	038GGS0301	0.0456			7.28E-02		1.11E-02		3.931%
Manganese (Mn)	038GGS0301	0.0406			5.52E-02		8.45E-03		2.979%
Tetrachloroethene	038GGS0301	0.01	U						
Trichloroethene	038GGS0301	0.001	J	2.53E-07	2.13E-02	5.93E-08	3.26E-03	0.198%	1.149%
Vanadium (V)	038GGS0301	0.012			1.10E-01		1.68E-02		5.911%
Vinyl chloride	038GGS0301	0.01	U						
Zinc (Zn)	038GGS0301	0.819			1.74E-01		2.67E-02		9.414%
Sum ILCR/HI:				1.28E-04	1.85E+00	2.99E-05	2.84E-01		
1,1,1-Trichloroethane	038GGS0401	0.01	U						
1,1-Dichloroethane	038GGS0401	0.018	U						
1,1-Dichloroethene	038GGS0401	0.01	U						
1,2-Dichloroethane	038GGS0401	0.01	U						
1,2-Dichloroethene (total)	038GGS0401	0.003	U						
1,4-Dichlorobenzene	038GGS0401	0.11	U						
Aluminum (Al)	038GGS0401	0.658			4.20E-02		6.44E-03		1.442%
Arsenic (As)	038GGS0401	0.013		2.91E-04	2.77E+00	6.81E-05	4.24E-01	100.000%	94.962%
Bromomethane	038GGS0401	0.01	U						
Cadmium (Cd)	038GGS0401	0.002	U						
Chlorobenzene	038GGS0401	0.001	U						
Chloroform	038GGS0401	0.01	U						
Chromium (Cr)	038GGS0401	0.003	U						
Copper (Cu)	038GGS0401	0.012			1.92E-02		2.93E-03		0.657%
Manganese (Mn)	038GGS0401	0.041			5.57E-02		8.53E-03		1.912%
Tetrachloroethene	038GGS0401	0.01	U						
Trichloroethene	038GGS0401	0.01	U						
Vanadium (V)	038GGS0401	0.003			2.74E-02		4.19E-03		0.939%

Table 10-23
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Vinyl chloride	038GGS0401	0.01	U						
Zinc (Zn)	038GGS0401	0.012			2.56E-03		3.91E-04		0.088%
Sum ILCR/HI:				2.91E-04	2.92E+00	6.81E-05	4.46E-01		
1,1,1-Trichloroethane	038GGS0501	0.024			4.92E-02		7.53E-03		1.447%
1,1-Dichloroethane	038GGS0501	0.012			1.30E-02		1.99E-03		0.383%
1,1-Dichloroethene	038GGS0501	0.01	U						
1,2-Dichloroethane	038GGS0501	0.01	U						
1,2-Dichloroethene (total)	038GGS0501	0.01	U						
1,4-Dichlorobenzene	038GGS0501	0.01	U						
Aluminum (Al)	038GGS0501	3.21			2.05E-01		3.14E-02		6.035%
Arsenic (As)	038GGS0501	0.0073		1.63E-04	1.55E+00	3.82E-05	2.38E-01	99.202%	45.745%
Bromomethane	038GGS0501	0.01	U						
Cadmium (Cd)	038GGS0501	0.0097			1.24E+00		1.90E-01		36.471%
Chlorobenzene	038GGS0501	0.01	U						
Chloroform	038GGS0501	0.01	U						
Chromium (Cr)	038GGS0501	0.0303	U						
Copper (Cu)	038GGS0501	0.0324			5.18E-02		7.92E-03		1.523%
Manganese (Mn)	038GGS0501	0.0872	U						
Tetrachloroethene	038GGS0501	0.001	J	8.05E-07	1.28E-02	1.89E-07	1.96E-03	0.489%	0.376%
Trichloroethene	038GGS0501	0.002	J	5.07E-07	4.26E-02	1.19E-07	6.52E-03	0.308%	1.253%
Vanadium (V)	038GGS0501	0.0129			1.18E-01		1.80E-02		3.464%
Vinyl chloride	038GGS0501	0.01	U						
Zinc (Zn)	038GGS0501	0.527			1.12E-01		1.72E-02		3.302%
Sum ILCR/HI:				1.64E-04	3.40E+00	3.85E-05	5.20E-01		
1,1,1-Trichloroethane	038GGS0601	0.01	U						
1,1-Dichloroethane	038GGS0601	0.01	U						
1,1-Dichloroethene	038GGS0601	0.01	U						
1,2-Dichloroethane	038GGS0601	0.01	U						
1,2-Dichloroethene (total)	038GGS0601	0.01	U						
1,4-Dichlorobenzene	038GGS0601	0.011	U						
Aluminum (Al)	038GGS0601	0.0309			1.97E-03		3.02E-04		0.025%
Arsenic (As)	038GGS0601	0.0357		7.98E-04	7.60E+00	1.87E-04	1.16E+00	100.000%	97.077%
Bromomethane	038GGS0601	0.01	U						
Cadmium (Cd)	038GGS0601	0.003	U						
Chlorobenzene	038GGS0601	0.01	U						
Chloroform	038GGS0601	0.01	U						
Chromium (Cr)	038GGS0601	0.004			2.56E-04		3.91E-05		0.003%
Copper (Cu)	038GGS0601	0.0061			9.74E-03		1.49E-03		0.124%
Manganese (Mn)	038GGS0601	0.0978			1.33E-01		2.04E-02		1.697%
Tetrachloroethene	038GGS0601	0.01	U						
Trichloroethene	038GGS0601	0.01	U						

Table 10-23
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Vanadium (V)	038GGS0601	0.0044			4.02E-02		6.15E-03		0.513%
Vinyl chloride	038GGS0601	0.01	U						
Zinc (Zn)	038GGS0601	0.206			4.39E-02		6.72E-03		0.560%
Sum ILCR/HI:				7.98E-04	7.83E+00	1.87E-04	1.20E+00		
1,1,1-Trichloroethane	038GGS1001	0.01	U						
1,1-Dichloroethane	038GGS1001	0.01	U						
1,1-Dichloroethene	038GGS1001	0.01	U						
1,2-Dichloroethane	038GGS1001	0.01	U						
1,2-Dichloroethene (total)	038GGS1001	0.01	U						
1,4-Dichlorobenzene	038GGS1001	0.01	U						
Aluminum (Al)	038GGS1001	8.94			5.71E-01		8.74E-02		9.145%
Arsenic (As)	038GGS1001	0.024		5.36E-04	5.11E+00	1.26E-04	7.82E-01	100.000%	81.836%
Bromomethane	038GGS1001	0.01	U						
Cadmium (Cd)	038GGS1001	0.002	U						
Chlorobenzene	038GGS1001	0.01	U						
Chloroform	038GGS1001	0.01	U						
Chromium (Cr)	038GGS1001	0.03			1.92E-03		2.93E-04		0.031%
Copper (Cu)	038GGS1001	0.07			1.12E-01		1.71E-02		1.790%
Manganese (Mn)	038GGS1001	0.101			1.37E-01		2.10E-02		2.198%
Tetrachloroethene	038GGS1001	0.01	U						
Trichloroethene	038GGS1001	0.01	U						
Vanadium (V)	038GGS1001	0.033			3.01E-01		4.61E-02		4.822%
Vinyl chloride	038GGS1001	0.01	U						
Zinc (Zn)	038GGS1001	0.052			1.11E-02		1.70E-03		0.177%
Sum ILCR/HI:				5.36E-04	6.25E+00	1.26E-04	9.56E-01		
1,1,1-Trichloroethane	038GGS1101	0.002	J		4.10E-03		6.27E-04		1.986%
1,1-Dichloroethane	038GGS1101	0.01	U						
1,1-Dichloroethene	038GGS1101	0.01	U						
1,2-Dichloroethane	038GGS1101	0.01	U						
1,2-Dichloroethene (total)	038GGS1101	0.01	U						
1,4-Dichlorobenzene	038GGS1101	0.01	U						
Aluminum (Al)	038GGS1101	0.991			6.33E-02		9.69E-03		30.685%
Arsenic (As)	038GGS1101	0.002	UJ						
Bromomethane	038GGS1101	0.01	U						
Cadmium (Cd)	038GGS1101	0.003	U						
Chlorobenzene	038GGS1101	0.01	U						
Chloroform	038GGS1101	0.006	J	7.74E-06	7.67E-02	1.81E-06	1.17E-02	100.000%	37.156%
Chromium (Cr)	038GGS1101	0.0228			1.46E-03		2.23E-04		0.706%
Copper (Cu)	038GGS1101	0.0176			2.81E-02		4.30E-03		13.624%
Manganese (Mn)	038GGS1101	0.0167			2.27E-02		3.48E-03		11.002%
Tetrachloroethene	038GGS1101	0.01	U						

Table 10-23
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

				Site Resident		*Site Worker*			
				LWA	*Child*	*Adult*		Percent Contribution to Industrial	Percent Contribution to Industrial
COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	ILCR	HQ	ILCR	HQ	ILCR	HI
Trichloroethene	038GGS1101	0.01	U						
Vanadium (V)	038GGS1101	0.003	U						
Vinyl chloride	038GGS1101	0.01	U						
Zinc (Zn)	038GGS1101	0.0469			9.99E-03		1.53E-03		4.841%
Sum ILCR/HI:				7.74E-06	2.06E-01	1.81E-06	3.16E-02		
1,1,1-Trichloroethane	038GGS1201	0.77	J		1.58E+00		2.41E-01		5.413%
1,1-Dichloroethane	038GGS1201	0.64	J		6.95E-01		1.06E-01		2.384%
1,1-Dichloroethene	038GGS1201	0.042		4.85E-04	5.96E-01	1.14E-04	9.13E-02	17.071%	2.046%
1,2-Dichloroethane	038GGS1201	0.002	J	5.42E-06	8.94E-02	1.27E-06	1.37E-02	0.191%	0.307%
1,2-Dichloroethene (total)	038GGS1201	0.014			1.99E-01		3.04E-02		0.682%
1,4-Dichlorobenzene	038GGS1201	0.01	U						
Aluminum (Al)	038GGS1201	11.4			7.28E-01		1.11E-01		2.499%
Arsenic (As)	038GGS1201	0.102		2.28E-03	2.17E+01	5.34E-04	3.33E+00	80.241%	74.531%
Bromomethane	038GGS1201	0.01	U						
Cadmium (Cd)	038GGS1201	0.003			3.83E-01		5.87E-02		1.315%
Chlorobenzene	038GGS1201	0.01	U						
Chloroform	038GGS1201	0.024		3.10E-05	3.07E-01	7.25E-06	4.69E-02	1.090%	1.052%
Chromium (Cr)	038GGS1201	0.326			2.08E-02		3.19E-03		0.071%
Copper (Cu)	038GGS1201	0.1			1.60E-01		2.45E-02		0.548%
Manganese (Mn)	038GGS1201	0.128			1.74E-01		2.66E-02		0.597%
Tetrachloroethene	038GGS1201	0.033	J	2.66E-05	4.22E-01	6.22E-06	6.45E-02	0.935%	1.447%
Trichloroethene	038GGS1201	0.053		1.34E-05	1.13E+00	3.14E-06	1.73E-01	0.473%	3.873%
Vanadium (V)	038GGS1201	0.0746			6.81E-01		1.04E-01		2.336%
Vinyl chloride	038GGS1201	0.01	U						
Zinc (Zn)	038GGS1201	1.23			2.62E-01		4.01E-02		0.899%
Sum ILCR/HI:				2.84E-03	2.92E+01	6.65E-04	4.46E+00		
1,1,1-Trichloroethane	038GGS1301	0.008	J		1.64E-02		2.51E-03		0.393%
1,1-Dichloroethane	038GGS1301	0.02			2.17E-02		3.32E-03		0.521%
1,1-Dichloroethene	038GGS1301	0.02	U						
1,2-Dichloroethane	038GGS1301	0.02	U						
1,2-Dichloroethene (total)	038GGS1301	0.02	U						
1,4-Dichlorobenzene	038GGS1301	0.01	U						
Aluminum (Al)	038GGS1301	2.32			1.48E-01		2.27E-02		3.553%
Arsenic (As)	038GGS1301	0.0079		1.77E-04	1.68E+00	4.14E-05	2.58E-01	32.663%	40.331%
Bromomethane	038GGS1301	0.02	U						
Cadmium (Cd)	038GGS1301	0.011			1.41E+00		2.15E-01		33.694%
Chlorobenzene	038GGS1301	0.02	U						
Chloroform	038GGS1301	0.02	U						
Chromium (Cr)	038GGS1301	0.184			1.18E-02		1.80E-03		0.282%
Copper (Cu)	038GGS1301	0.319			5.10E-01		7.80E-02		12.214%
Manganese (Mn)	038GGS1301	0.0457	U						

Table 10-23
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 71 Area
NAS Pensacola

				Site Resident		*Site Worker*			
				LWA	*Child*	*Adult*			
COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	ILCR	HQ	ILCR	HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Tetrachloroethene	038GGS1301	0.003	J	2.42E-06	3.83E-02	5.66E-07	5.87E-03	0.447%	0.919%
Trichloroethene	038GGS1301	0.004	J	1.01E-06	8.52E-02	2.37E-07	1.30E-02	0.187%	2.042%
Vanadium (V)	038GGS1301	0.0117			1.07E-01		1.63E-02		2.560%
Vinyl chloride	038GGS1301	0.011	J	3.61E-04		8.45E-05		66.703%	
Zinc (Zn)	038GGS1301	0.684			1.46E-01		2.23E-02		3.492%
Sum ILCR/HI:				5.41E-04	4.17E+00	1.27E-04	6.39E-01		

Notes:

COPC = Chemical of potential concern
VQUAL = Validation qualifier
LWA = Lifetime weighted average
ILCR = Incremental Lifetime excess cancer risk
HQ = Hazard quotient
HI = Hazard index
mg/L = milligrams per liter
BEQ = Benzo(a)pyrene equivalent
J = The associated numerical value is an estimated quantity.
U = The material was analyzed for, but not detected; the associated value is the lesser of one half of the sample quantitation limit, or one half of the lowest detected concentration.

The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would double the manganese hazard quotient shown in this table.

Table 10-24
CT Hazard Quotients and Incremental Lifetime Cancer Risks
Site 38 - Building 71 Area
NAS Pensacola

				Site Resident			*Site Worker*	
				Adult	*Child*	*LWA*	*Adult*	
Chemical	**EPC (mg/kg)**	**Oral RfD mg/kg-day**	**Oral SF kg-day/mg**	**HQ**	**HQ**	**ILCR**	**HQ**	**ILCR**
Aluminum	9936.7	1	NA	0.0045	0.041	NA	0.0049	NA
Antimony	2.53	0.0004	NA	0.0029	NA	NA	0.0031	NA
Aroclor 1254	0.0891	0.00002	2	0.0020	0.018	3.0E-08	0.0022	6.2E-09
Arsenic	1.861	0.0003	1.5	0.0028	0.026	4.6E-07	0.0030	9.8E-08
BEQ	0.392	NA	7.3	NA	NA	4.7E-07	NA	1.0E-07
Cadmium	1.799	0.0005	NA	0.0016	0.0149	NA	0.001760	NA
Chromium	134.11	1	NA	0.000061	0.00056	NA	0.000066	NA
Copper	116.48	0.04	NA	0.0013	0.012	NA	0.001425	NA
1,2-Dichloroethene	0.01	0.009	NA	0.00000050	0.0000046	NA	0.00000054	NA
gamma-Chlordane	0.004	0.00006	1.3	0.000030	0.00028	8.6E-10	0.000033	1.8E-10
Manganese[1]	58.33	0.047	NA	0.00056	0.005	NA	0.0006	NA
Cumulative HI or ILCR:				0.02	0.1	1E-06	0.02	2E-07

Dermal Contact With Surface Soil

				Site Resident			*Site Worker*	
				Adult	*Child*	*LWA*	*Adult*	
Chemical	**EPC (mg/kg)**	**Dermal RfD mg/kg-day**	**Dermal SF kg-day/mg**	**HQ**	**HQ**	**ILCR**	**HQ**	**ILCR**
Aluminum	9936.7	0.2	NA	0.0019	0.006	NA	0.0020	NA
Antimony	2.53	NA	10	NA	NA	1.8E-06	NA	NA
Aroclor 1254	0.0891	0.00015	3	0.000022	0.000074	1.9E-09	0.0002	7.7E-09
Arsenic	1.861	NA	36.5	NA	NA	4.9E-06	NA	1.9E-07
BEQ	0.392	0.00025	NA	0.000059	0.0002	NA	NA	NA
Cadmium	1.799	0.2	NA	0.0000003	0.000001	NA	0.0000	NA
Chromium	134.11	0.008	NA	0.00063	0.0021	NA	0.00067	NA
Copper	116.48	0.00001	80	4.38	14.5	6.7E-04	0.4673	2.7E-05
1,2-Dichloroethene	0.01	NA	NA	NA	NA	NA	NA	NA
gamma-Chlordane	0.004	0.0235	NA	0.0000000064	0.0000000211	NA	0.000000068	NA
Manganese[1]	58.33	0.0014	NA	0.00157	0.0052	NA	0.0017	NA
Cumulative HI or ILCR:				4.4	14.5	7E-04	0.47	3E-05

Notes:

LWA = Lifetime weighted average
EPC = Exposure point concentration
RfD = Reference Dose
SF = Slope factor
HQ = Hazard quotient
ILCR = Incremental lifetime excess cancer risk
HI = Hazard Index
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
kg-day/mg = kilograms per day per milligram

[1]The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would double the manganese hazard quotient shown.

Table 10-25
CT Hazard Quotients and Incremental Lifetime Cancer Risks
Ingestion of Groundwater
Site 38 - Building 71 Area
NAS Pensacola

				Site Resident			Site Worker	
				Adult	Child	LWA	Adult	
Chemical	EPC (mg/L)	Oral RfD mg/kg-day	Oral SF kg-day/mg	HQ	HQ	ILCR	HQ	ILCR
1,1,1-Trichloroethane	0.5775	0.035	NA	0.45	1.05	NA	0.16	NA
1,1-Dichloroethane	0.48	0.1	NA	0.13	0.31	NA	0.05	NA
1,1-Dichloroethene	0.0315	0.009	0.6	0.10	0.22	2.8E-04	0.03	1.3E-04
1,2-Dichloroethene (total)	0.0105	0.009	NA	0.03	0.07	NA	0.01	NA
Aluminum	8.55	1	NA	0.23	0.55	NA	0.08	NA
Arsenic	0.0765	0.0003	1.5	6.99	16.29	1.7E-03	2.50	8.0E-04
Cadmium	0.00825	0.0005	NA	0.45	1.05	NA	0.16	NA
Chlorobenzene	0.0039	0.02	NA	0.0053	0.0125	NA	0.0019	NA
Chloroform	0.018	0.01	0.0061	0.0493	0.1150	1.6E-06	0.0176	7.7E-07
Chromium	0.2445	1	NA	0.01	0.02	NA	0.002	NA
Copper	0.23925	0.0371	NA	0.18	0.41	NA	0.06	NA
Manganese[1]	0.1305	0.047	NA	0.08	0.18	NA	0.03	NA
Tetrachloroethene	0.02475	0.01	0.052	0.07	0.16	1.9E-05	0.02	9.0E-06
Trichloroethene	0.03975	0.006	0.011	0.18	0.42	6.5E-06	0.06	3.1E-06
Vanadium	0.1725	0.007	NA	0.68	1.57	NA	0.24	NA
Vinyl chloride	0.009	NA	1.9	NA	NA	2.5E-04	NA	1.2E-04
Zinc	0.9225	0.3	NA	0.08	0.20	NA	0.03	NA
Cumulative HI or ILCR:				9.71	22.64	2.3E-03	3.47	1.1E-03

Inhalation of Groundwater COPCs

				Site Resident			Site Worker	
				Adult	Child	LWA	Adult	
Chemical	EPC (mg/L)	Inhalation RfD mg/kg-day	Inhalation SF kg-day/mg	HQ	HQ	ILCR	HQ	ILCR
1,1,1-Trichloroethane	0.77	0.286	NA	0.03	0.11	NA	0.03	NA
1,1-Dichloroethane	0.64	0.143	0.175	0.06	0.19	2.8E-04	0.04	7.8E-04
1,1-Dichloroethene	0.042	0.009	0.175	0.06	0.20	1.8E-05	0.05	5.1E-05
1,2-Dichloroethene (total)	0.014	0.009	0.091	0.02	0.07	3.2E-06	0.02	8.9E-06
Aluminum	11.4	NA	NA	NA	NA	NA	NA	NA
Arsenic	0.102	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.011	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	0.0052	NA	NA	NA	NA	NA	NA	NA
Chloroform	0.024	NA	0.0805	NA	NA	4.8E-06	NA	1.4E-05
Chromium	0.326	NA	NA	NA	NA	NA	NA	NA
Copper	0.319	NA	NA	NA	NA	NA	NA	NA
Manganese	0.174	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	0.033	0.01	0.00203	0.04	0.14	1.7E-07	0.03	4.7E-07
Trichloroethene	0.053	0.006	0.006	0.11	0.38	8.0E-07	0.09	2.2E-06
Vanadium	0.23	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.012	NA	0.3	NA	NA	9.0E-06	NA	2.5E-05
Zinc	1.23	NA	NA	NA	NA	NA	NA	NA
Cumulative HI or ILCR:				0.33	1.09	3.2E-04	0.25	8.8E-04

Notes:

LWA = Lifetime weighted average
EPC = Exposure point concentration
RfD = Reference Dose
SF = Slope factor
HQ = Hazard quotient
ILCR = Incremental lifetime excess cancer risk
HI = Hazard Index
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
kg-day/mg = kilograms per day per milligram

[1]The managanese reference dose of 0.023 mg/kg-day recommended by FDEP would double the manganese hazard quotient shown in this table.

Table 10-26
Surface Soil Remedial Goal Options
Calculated in Accordance with RAGS including the Site Worker and Site Resident
Incidental Ingestion and Dermal Contact Exposure Pathways
Site 38 - Building 71 Area
NAS Pensacola

			Site Worker						
Chemical	**EPC (mg/kg)**	**HI**	**HI = 0.1**	**HI = 1.0**	**HI = 3.0**	**ILCR**	**ILCR = 1E-6**	**ILCR = 1E-5**	**ILCR = 1E-4**
Arsenic	1.861	0.00424	43.9	439	1317	1.6.E-06	1.16	11.6	116
BEQ	0.392	NA	NA	NA	NA	7.7.E-06	0.051	0.51	5.1

			Site Resident						
Chemical	**EPC (mg/kg)**	**HI**	**HI = 0.1**	**HI = 1.0**	**HI = 3.0**	**ILCR**	**ILCR = 1E-6**	**ILCR = 1E-5**	**ILCR = 1E-4**
Aluminum	9936.7	0.14	7286	72860	218579	NA	NA	NA	NA
Arsenic	1.861	0.085	2.20	22	65.9	1.1.E-05	0.17	1.69	16.9
BEQ	0.392	NA	NA	NA	NA	3.8.E-05	0.010	0.10	1.0

Notes:

RGO = Remedial Goal Option, calculated in accordance with RAGS, based on the child receptor for site resident
EPC = Exposure Point Concentration
HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
mg/L = milligrams per liter
NA = Not applicable

[1]The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would decrease the manganese RGO shown in this table by one half.

Table 10-27
Groundwater Remedial Goal Options
Calculated in Accordance with RAGS including the Site Worker and Site Resident
Incidental Ingestion and Inhalation Exposure Pathways
Site 38 - Building 71 Area
NAS Pensacola

			Site Worker						
Chemical	**EPC (mg/L)**	**HI**	**HI = 0.1**	**HI = 1.0**	**HI = 3.0**	**ILCR**	**ILCR = 1E-6**	**ILCR = 1E-5**	**ILCR = 1E-4**
1,1,1-Trichloroethane	0.77	0.24	0.32	3.20	9.61	NA	NA	NA	NA
1,1-Dichloroethane	0.64	0.11	0.60	6.05	18.14	NA	NA	NA	NA
1,1-Dichloroethene	0.042	0.09	0.046	0.46	1.39	1.E-04	4.E-04	4E-03	4E-02
1,2-Dichloroethene (total)	0.014	0.03	0.046	0.46	1.39	4.E-06	3.E-03	3E-02	3E-01
Aluminum	11.4	0.11	10.28	102.77	308.32	NA	NA	NA	NA
Arsenic	0.102	3.31	0.0031	0.031	0.09	5.E-04	2.E-04	2E-03	2E-02
Cadmium	0.011	0.21	0.01	0.05	0.15	NA	NA	NA	NA
Chlorobenzene	0.0052	0.0025	0.21	2.06	6.17	NA	NA	NA	NA
Chloroform	0.024	0.0234	0.10	1.03	3.08	5.E-07	5.E-02	5E-01	5E+00
Chromium	0.326	0.0032	10.28	102.8	308.3	NA	NA	NA	NA
Copper	0.319	0.08	0.38	3.81	11.44	NA	NA	NA	NA
Manganese[1]	0.174	0.04	0.48	4.83	14.49	NA	NA	NA	NA
Tetrachloroethene	0.033	0.03	0.10	1.03	3.08	6.E-06	NA	NA	NA
Trichloroethene	0.053	0.17	0.03	0.31	0.92	1.E-06	5.E-02	5E-01	5E+00
Vanadium	0.23	0.32	0.07	0.72	2.16	NA	NA	NA	NA
Vinyl chloride	0.012	NA	NA	NA	NA	9.E-05	1.E-04	1E-03	1E-02
Zinc	1.23	0.04	3.08	30.8	92.5	NA	NA	NA	NA

			Site Resident						
Chemical	**EPC (mg/L)**	**HI**	**HI = 0.1**	**HI = 1.0**	**HI = 3.0**	**ILCR**	**ILCR = 1E-6**	**ILCR = 1E-5**	**ILCR = 1E-4**
1,1,1-Trichloroethane	0.77	1.58	0.05	0.49	1.5	NA	NA	NA	NA
1,1-Dichloroethane	0.64	0.69	0.09	0.92	2.8	NA	NA	NA	NA
1,1-Dichloroethene	0.042	0.60	0.007	0.07	0.21	5.E-04	9.E-05	9E-04	9E-03
1,2-Dichloroethene (total)	0.014	0.20	0.007	0.07	0.21	2.E-05	7.E-04	7E-03	7E-02
Aluminum	11.4	0.73	1.56	15.65	47	NA	NA	NA	NA
Arsenic	0.102	21.73	0.0005	0.005	0.01	2.E-03	4.E-05	4E-04	4E-03
Cadmium	0.011	1.41	0.0008	0.01	0.02	NA	NA	NA	NA
Chlorobenzene	0.0052	0.017	0.03	0.31	0.94	NA	NA	NA	NA
Chloroform	0.024	0.153	0.02	0.16	0.47	3.E-05	8.E-04	8E-03	8E-02
Chromium	0.326	0.02	1.56	15.65	47	NA	NA	NA	NA
Copper	0.319	0.55	0.06	0.58	1.7	NA	NA	NA	NA
Manganese	0.174	0.24	0.07	0.74	2.2	NA	NA	NA	NA
Tetrachloroethene	0.033	0.21	0.02	0.16	0.47	3.E-05	NA	NA	NA
Trichloroethene	0.053	1.13	0.005	0.05	0.14	1.E-05	4.E-03	4E-02	4E-01
Vanadium	0.23	2.10	0.01	0.11	0.33	NA	NA	NA	NA
Vinyl chloride	0.012	NA	NA	NA	NA	4.E-04	3.E-05	3E-04	3E-03
Zinc	1.23	0.26	0.47	4.69	14	NA	NA	NA	NA

Notes:

RGO = Remedial Goal Option, calculated in accordance with RAGS, based on the child receptor for site resident
EPC = Exposure Point Concentration
HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
mg/L = milligrams per liter
NA = Not applicable

[1]The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would decrease the manganese RGO shown in this table by one half.

Table 10-28
Analytical Methods
Building 604 Area Surface Soil Samples
Site 38 — NAS Pensacola RI

Sample	Metal	Pest	SVOA	VOA
036S073C02	X	X	X	X
036S074C02	X	X	X	X
036S074N02	X	X	X	X
036S074W02	X	X	X	X
036S075C02	X	X	X	X
036S075E02	X	X	X	X
036S076C02	X	X	X	X
036S076E02	X	X	X	X
036S076S02	X	X	X	X
036S076W02	X	X	X	X
036S077C02	X	X	X	X
036S077N02	X	X	X	X
036S077S02	X	X	X	X
036S077W02	X	X	X	X
036S078C02	X	X	X	X
036S078E02	X	X	X	X
036S078S02	X	X	X	X
036S078W02	X	X	X	X
036S079C02	X	X	X	X
036S079W02	X	X	X	X
038S002601	X	X	X	X
038S002801	X	X	X	X
038S003501	X	X	X	X
038S003601	X	X	X	X
038S003701	X	X	X	X
038S004102	X	X	X	X
038S004202	X	X	X	X

Table 10-28
Analytical Methods
Building 604 Area Surface Soil Samples
Site 38 — NAS Pensacola RI

Sample	Metal	Pest	SVOA	VOA
038S0T0101	X	X	X	X
038S0T0301	X	X	X	X
038S0T0601	X	X	X	X
038S0T0701	X	X	X	X
038S0T0801	X		X	X
038S0T0901	X		X	X
038S0T1001	X	X	X	X
038S0T1101	X	X	X	X
038S0T1201	X	X	X	X
038S0T1301	X		X	X
038S0T1401	X		X	X
038S0T1501	X	X	X	X
038S0T1601	X	X	X	X
038S0T1701	X		X	X
038S0T1801	X	X	X	X
038S0T1901	X		X	X
038S0T2001	X		X	X
038S0T2201	X		X	X
038S0T2301	X	X	X	X
038S0T2501	X	X	X	X
038S0T2601	X		X	X
038S0T2701	X		X	X
038S0T2801	X		X	X
038S0T2901	X		X	X
038S0T3002	X		X	X
038S0T3101	X	X	X	X
038S0T3201	X		X	X

Table 10-28
Analytical Methods
Building 604 Area Surface Soil Samples
Site 38 — NAS Pensacola RI

Sample	Metal	Pest	SVOA	VOA
038S0T3301	X		X	X
038S0T3401	X	X	X	X
038S0T3501	X	X	X	X
038S0T3601	X	X	X	X
038S0T3701	X	X	X	X
038S0T3801	X	X	X	X
038S0T3901	X	X	X	X
038S0T4001	X	X	X	X
038S0T4101	X	X	X	X
038S0T4201	X	X	X	X

Notes:

Metal = TAL (Target Analyte List) metals plus tin:
Method: CLP ILMO4.0

Pest = Chlorinated Pesticides: Method: CLP OLMO3.2

SVOA = Semi-volatile Organics: Method: CLP OLMO3.2

VOA = Volatile Organics: Method: CLP OLMO3.2

Table 10-29
Analytical Methods
Building 604 Area Groundwater Samples
Site 38 — NAS Pensacola RI

Sample	CLP VOA	Metal	Pest	RCRA Metal	SVOA	VOA
036GR73C01		X	X		X	X
036GR74C01		X	X		X	X
036GR75C01		X	X		X	X
036GR76C01		X	X		X	X
036GR77C01		X	X		X	X
036GR78C01		X	X		X	X
036GR79C01		X	X		X	X
038G0I0401		X	X		X	X
038G0I0701		X	X		X	X
038G0I0801		X	X		X	X
038G0I0901		X	X		X	X
038G0S0701		X	X		X	X
038G0S0901		X	X		X	X
038G0S1701		X	X		X	X
038G0S1801		X	X		X	X
038G0S2201		X	X		X	X
038G0S2401		X	X		X	X
038G0S2501		X	X		X	X
038G0S2601		X	X		X	X
038G0S2701		X	X		X	X
038G0S2801		X	X		X	X
038G0S2901		X	X		X	X
038G0S3001		X	X		X	X
038G0S3101		X	X		X	X
038G0S3201		X	X		X	X
038G0T0101	X			X		

Table 10-29
Analytical Methods
Building 604 Area Groundwater Samples
Site 38 — NAS Pensacola RI

Sample	CLP VOA	Metal	Pest	RCRA Metal	SVOA	VOA
038G0T0301	X			X		
038G0T0601	X			X		
038G0T0701	X			X		
038G0T0801	X			X		
038G0T0901	X			X		
038G0T1001	X			X		
038G0T1101	X			X		
038G0T1201	X			X		
038G0T1301	X			X		
038G0T1401	X			X		
038G0T1501	X			X		
038G0T1601	X			X		
038G0T1701	X			X		
038G0T1801	X			X		
038G0T1901	X			X		
038G0T2001	X			X		
038G0T2201	X			X		
038G0T2301	X			X		
038G0T2501	X			X		
038G0T2601	X			X		
038G0T2701	X			X		
038G0T2801	X			X		
038G0T2901	X			X		
038G0T3001	X			X		
038G0T3101	X			X		
038GGI0401		X	X		X	X

Table 10-29
Analytical Methods
Building 604 Area Groundwater Samples
Site 38 — NAS Pensacola RI

Sample	CLP VOA	Metal	Pest	RCRA Metal	SVOA	VOA
038GGI0701		X	X		X	X
038GGI0801		X	X		X	X
038GGI0901		X	X		X	X
038GGS0701		X	X		X	X
038GGS0801		X	X		X	X
038GGS0901		X	X		X	X
038GGS1401		X	X		X	X
038GGS1501		X	X		X	X
038GGS1601		X	X		X	X
038GGS1701		X	X		X	X
038GGS1801		X	X		X	X
038GGS1901		X	X		X	X
038GGS2001		X	X		X	X
038GGS2101		X	X		X	X

Notes:

CLP VOA = Volatile Organics: Method: CLP OLMO3.2
Metal = TAL (Target Analyte List) metals
Method: CLP ILMO4.0
Pest = Chlorinated Pesticides: Method: CLP OLMO3.2
RCRA Metal = TAL metals plus tin: Methods: 6000/7000 Series
SVOA = Semi-volatile organics: Method: 8270
VOA = Volatile organics: Method: 8240

Table 10-30
Chemicals Present in Site Samples
Building 604 Area — Organics in Soil (μg/kg)
Site 38 — NAS Pensacola RI

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	FDEP CG	Number over FDEP CG	COPC?
1,1,1-Trichloroethane	1 / 64	2	2	10 - 1,300	2,700,000	a,n		610,000		
4,4'-DDD	1 / 49	3.5	3.5	3.3 - 50	2,700	a,c		4,500		
4,4'-DDE	9 / 49	4.9 - 120	35.8	3.3 - 57	1,900	a,c		3,000		
4,4'-DDT	5 / 49	1.3 - 56	26.1	3.3 - 69	1,900	a,c		3,100		
Acenaphthylene	3 / 64	89 - 370	233	330 - 20,000	470,000	a,n		670,000		
Acetone	6 / 64	35 - 8,600	1,760	13 - 1,300	7,800,000	a,n		260,000		
Anthracene	2 / 64	100 - 180	140	330 - 20,000	2,300,000	a,n		2,000,000		
Aroclor-1260	3 / 49	83 - 810	487.7	0.5 - 500	320	a,c	2	900		Y
Benzo(a)anthracene	9 / 64	140 - 2,600	536.7	330 - 20,000	880	a,c	1	1,400	1	Y
Benzo(a)pyrene	10 / 64	160 - 2,200	483	330 - 20,000	88	a,c	10	100	10	Y
Benzo(b)fluoranthene	11 / 64	55 - 3,800	780.5	330 - 20,000	880	a,c	1	1,400	1	Y
Benzo(g,h,i)perylene	6 / 64	140 - 1,000	410	330 - 20,000	2,300,000	a,n		14,000		
Benzo(k)fluoranthene	3 / 27	190 - 480	343.3	330 - 1,800	8,800	a,c		14,000		
Carbazole	1 / 64	38	38	330 - 20,000	32,000	a,c		42,000		
Chrysene	10 / 64	160 - 2,200	494	330 - 20,000	88,000	a,c		140,000		
Dieldrin	9 / 49	0.94 - 84	20.1	3.3 - 50	40	a,c	2	70	1	Y
Endosulfan I	1 / 49	7.4	7.4	1.8 - 50	470,000	a,n		390,000		
Endosulfan II	1 / 49	11	11	3.3 - 99	470,000	a,n		390,000		
Endosulfan sulfate	1 / 49	70	70	1.7 - 50	470,000	a,n		390,000		
Endrin	8 / 49	1.4 - 9.9	4.7	3.3 - 67	23,000	a,n		23,000		

Table 10-30
Chemicals Present in Site Samples
Building 604 Area — Organics in Soil (μg/kg)
Site 38 — NAS Pensacola RI

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	FDEP CG	Number over FDEP CG	COPC?
Endrin aldehyde	1 / 7	29	29	3.5 - 4.4	DNE	N/A	N/A	DNE	N/A	
Fluoranthene	10 / 64	170 - 3,700	667	330 - 20,000	3,100,000	a,n		2,900,000		
Heptachlor epoxide	1 / 49	0.58	0.58	1.7- 50	70	a,c		100		
Indeno(1,2,3-cd)pyrene	5 / 64	130 - 1,000	402	330 - 20,000	880	a,c	1	1,400		Y
Methylene chloride	9 / 64	4 - 730	85.7	4 - 820	85,000	a,c		16,000		
Phenanthrene	3 / 64	49 - 340	199.7	330 - 20,000	2,300,000	a,n		1,700,000		
Pyrene	10 / 64	190 - 3,500	675	330 - 20,000	2,300,000	a,n		2,200,000		
Tetrachloroethene	4 / 64	3 - 27	11.2	10 - 1,300	12,000	a,c		12,000		
Toluene	12 / 64	2 - 21	7.2	10 - 1,300	1,600,000	a,n		520,000		
Trichloroethene	4 / 64	5 - 10	8	10 - 1,300	58,000	a,c		6,500		
Xylene (Total)	1 / 27	1	1	10 - 1,300	1,600,000	a,n		1,300,000		
alpha-Chlordane	1 / 27	0.46	0.5	1.7 - 2.3	470	a,c		800		
beta-BHC	1 / 49	56	56	1.7 - 50	350	a,c		600		
delta-BHC	1 / 49	300	300	1.7 - 50	490	a,c		23,000		

Notes:

μg/kg	= micrograms per kilogram
a	= Screening concentration based on residential soil ingestion from June 3, 1996 Region III RBC tables
c	= Carcinogen
n	= Noncarcinogen; comparison was made to one-tenth this concentraion, in accordance with Supplemental Guidance to RAGS, Bulletin 1, Data Collection and Evaluation
RBC	= Risk-based concentration
FDEP-CG	= Based on Florida Department of Environmental Protection's screening concentration for surface soil
COPC	= Chemical of potential concern
DNE	= Does not exist
N/A	= Not Applicable
Y	= Yes, the chemical is considered a COPC

Table 10-31
Chemicals Present in Site Samples
Building 604 Area — Inorganics in Soil (mg/kg)
Site 38 — NAS Pensacola RI

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	FDEP CG	Number over FDEP CG	BG	Number over BG	COPC?
Antimony	2 / 64	1.8 - 2.6	2.2	1.4 - 12	31	a,n		26		2.91		
Selenium	4 / 64	0.15 - 4.1	1.2	0.11 - 16	390	a,n		390		0.62	1	
Thallium	2 / 64	0.28 - 0.38	0.3	0.22 - 40	6.30	a,n		DNE	N/A	0.82		
Aluminum	63 / 64	17.2 - 35,000	6,310.6	667 - 667	78,000	a,n	20	75,000		1,661	38	Y
Arsenic	31 / 64	0.21 - 21.1	3.6	0.14 - 12	0.43	a,c	29	1	27	1.56	17	Y
Boron	64 / 129	0.12 - 102	18.7	0 - 20.1	7,000	a,n		7,000		ND	64	
Cadmium	26 / 64	0.50 - 21	3.1	0.41 - 2	39	a,n	4	37		1	20	Y
Calcium	62 / 64	20.3 - 60,400	3,929.8	200 - 827	DNE	b	N/A	DNE	N/A	912.37	37	
Chromium	55 / 64	1.1 - 48	12.9	0.5 - 2.6	39	a,n	46	66,000		6.13	40	Y
Cobalt	19 / 64	0.25 - 37	3.1	0.25 - 5.2	4,700	a,n		4,700		1.87	4	
Copper	59 / 64	0.79 - 607	56.9	1 - 1	3,100	a,n	2	DNE	N/A	5.74	47	Y
Cyanide	7 / 63	0.22 - 9.7	1.8	0.17 - 8.2	1,600	a,n		1,600		0.52	3	
Iron	63 / 64	34 - 24,900	4,449.2	1,950 - 1,950	23,000	a,b,n	32	DNE	N/A	2,745	30	
Lead	59 / 64	2 - 949	117.8	4 - 158	400	d	3	500	2	7.32	50	Y
Magnesium	60 / 64	16 - 14,400	589.5	1.7 - 15	DNE	b	N/A	DNE	N/A	133.33	43	
Manganese	62 / 64	1.4 - 380	69.7	1 - 1	1,800	a,n	6	370	1	21.36	42	Y
Mercury	28 / 64	0.06 - 0.85	0.2	0.04 - 0.14	23	a,n		23		0.1	18	
Molybdenum	2 / 37	1.7 - 2.1	1.9	1 - 4	390	a,n		390		ND	2	
Nickel	28 / 64	1 - 18	4.5	1.2 - 8	1,600	a,n		1,500		6.38	4	
Potassium	18 / 64	31.7 - 484	129.4	22.5 - 800	DNE	b	N/A	DNE	N/A	460.67	1	

Table 10-31
Chemicals Present in Site Samples
Building 604 Area — Inorganics in Soil (mg/kg)
Site 38 — NAS Pensacola RI

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	FDEP CG	Number over FDEP CG	BG	Number over BG	COPC?
Sodium	35 / 64	8.1 - 660	135.3	37 - 400	DNE	b	N/A	DNE	N/A	107.85	12	
Strontium	29 / 37	1.4 - 69	10.2	1 - 4	47,000	a,n		47,000		ND	29	
Tin	4 / 37	9.7 - 30	17.9	2.5 - 20	4,700	a,n		44,000		ND	4	
Titanium	37 / 37	1.6 - 130	63.1	-	DNE	N/A	N/A	DNE	N/A	ND		
Vanadium	52 / 64	0.51 - 55	12.6	0.42 - 2.6	550	a,n	1	490		5.83	31	Y
Yttrium	19 / 37	1.1 - 4.8	2.2	1 - 4	DNE	N/A	N/A	DNE	N/A	ND		
Zinc	59 / 64	0.8 - 1,180	99	1 - 4	23,000	a,n		23,000		16.87	46	
Silver	1 / 44	1.3	1.3	0.95 - 4	390	a,n		390		2.07		

Notes:
mg/kg = milligrams per kilogram
a = Screening concentration based on residential soil ingestion from June 3, 1996 Region III RBC tables
b = Essential nutrient
c = Carcinogen
d = Screening based on 400 mg/kg lead in soil
n = Noncarcinogen; comparison was made to one-tenth this concentraion, in accordance with Supplemental Guidance to RAGS, Bulletin 1, Data Collection and Evaluation
RBC = Risk-based concentration
FDEP-CG = Based on Florida Department of Environmental Protection's screening concentration for surface soil
BG = Background concentration
COPC = Chemical of potential concern
DNE = Does not exist
N/A = Not Applicable
ND = Not determined due to lack of information
Y = Yes, the chemical is considered a COPC

Table 10-32
BEQ Concentrations per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

Sample ID	Chemical	Reported Result (µg/kg)	VQUAL	TEF	Adjusted (a) Concentration (µg/kg)
036S073C02	Benzo(a)anthracene	210	J	0.1	21
	Benzo(a)pyrene	210	J	1	210
	Benzo(b)fluoranthene	450		0.1	45
	Benzo(k)fluoranthene	340	U	0.01	0.95
	Chrysene	210	J	0.001	0.21
	Dibenzo(a,h)anthracene	340	U	1	170
	Indeno(1,2,3-cd)pyrene	340	U	0.1	6.5
	BEQ				453.66
036S074C02	Benzo(a)anthracene	270	J	0.1	27
	Benzo(a)pyrene	270	J	1	270
	Benzo(b)fluoranthene	530		0.1	53
	Benzo(k)fluoranthene	330	U	0.01	0.95
	Chrysene	290	J	0.001	0.29
	Dibenzo(a,h)anthracene	330	U	1	165
	Indeno(1,2,3-cd)pyrene	330	U	0.1	6.5
	BEQ				522.74
036S074W02	Benzo(a)anthracene	280	J	0.1	28
	Benzo(a)pyrene	350	J	1	350
	Benzo(b)fluoranthene	600		0.1	60
	Benzo(k)fluoranthene	410	U	0.01	0.95
	Chrysene	290	J	0.001	0.29
	Dibenzo(a,h)anthracene	410	U	1	205
	Indeno(1,2,3-cd)pyrene	410	U	0.1	6.5
	BEQ				650.74
036S075C02	Benzo(a)anthracene	360	J	0.1	36
	Benzo(a)pyrene	310	J	1	310
	Benzo(b)fluoranthene	410	U	0.1	2.75
	Benzo(k)fluoranthene	410	U	0.01	0.95
	Chrysene	330	J	0.001	0.33
	Dibenzo(a,h)anthracene	410	U	1	205
	Indeno(1,2,3-cd)pyrene	410	U	0.1	6.5
	BEQ				561.53
036S076W02	Benzo(a)anthracene	340	U	0.1	7
	Benzo(a)pyrene	180	J	1	180
	Benzo(b)fluoranthene	410		0.1	41
	Benzo(k)fluoranthene	340	U	0.01	0.95
	Chrysene	340	U	0.001	0.08
	Dibenzo(a,h)anthracene	340	U	1	170

Table 10-32
BEQ Concentrations per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

Sample ID	Chemical	Reported Result (µg/kg)	VQUAL	TEF	Adjusted (a) Concentration (µg/kg)
	Indeno(1,2,3-cd)pyrene	340	U	0.1	6.5
	BEQ				405.53
036S077W02	Benzo(a)anthracene	370		0.1	37
	Benzo(a)pyrene	510		1	510
	Benzo(b)fluoranthene	870		0.1	87
	Benzo(k)fluoranthene	340	U	0.01	0.95
	Chrysene	330	J	0.001	0.33
	Dibenzo(a,h)anthracene	340	U	1	170
	Indeno(1,2,3-cd)pyrene	380		0.1	38
	BEQ				843.28
038S002601	Benzo(a)anthracene	140	J	0.1	14
	Benzo(a)pyrene	160	J	1	160
	Benzo(b)fluoranthene	350	U	0.1	2.75
	Benzo(k)fluoranthene	190	J	0.01	1.9
	Chrysene	160	J	0.001	0.16
	Dibenzo(a,h)anthracene	350	U	1	175
	Indeno(1,2,3-cd)pyrene	130	J	0.1	13
	BEQ				366.81
038S003501	Benzo(a)anthracene	230	J	0.1	23
	Benzo(a)pyrene	380	J	1	380
	Benzo(b)fluoranthene	2,200	U	0.1	2.75
	Benzo(k)fluoranthene	480	J	0.01	4.8
	Chrysene	420	J	0.001	0.42
	Dibenzo(a,h)anthracene	2,200	U	1	1,100
	Indeno(1,2,3-cd)pyrene	290	J	0.1	29
	BEQ				1,539.97
038S003701	Benzo(a)anthracene	1,800	U	0.1	7
	Benzo(a)pyrene	260	J	1	260
	Benzo(b)fluoranthene	500	J	0.1	50
	Benzo(k)fluoranthene	360	J	0.01	3.6
	Chrysene	240	J	0.001	0.24
	Dibenzo(a,h)anthracene	1,800	U	1	900
	Indeno(1,2,3-cd)pyrene	210	J	0.1	21
	BEQ				1,241.84
038S004202	Benzo(a)anthracene	350	U	0.1	7
	Benzo(a)pyrene	350	U	1	80
	Benzo(b)fluoranthene	55	J	0.1	5.5

Table 10-32
BEQ Concentrations per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

Sample ID	Chemical	Reported Result (µg/kg)	VQUAL	TEF	Adjusted (a) Concentration (µg/kg)
	Benzo(k)fluoranthene	350	U	0.01	0.95
	Chrysene	350	U	0.001	0.08
	Dibenzo(a,h)anthracene	350	U	1	175
	Indeno(1,2,3-cd)pyrene	350	U	0.1	6.5
	BEQ				275.03
038S0T1101	Benzo(a)anthracene	370	J	0.1	37
	Benzo(a)pyrene	3,500	U	1	80
	Benzo(b)fluoranthene	670	J	0.1	67
	Chrysene	470	J	0.001	0.47
	Dibenzo(a,h)anthracene	3,500	U	1	1,750
	Indeno(1,2,3-cd)pyrene	3,500	U	0.1	6.5
	BEQ				1,940.97
038S0T1701	Benzo(a)anthracene	3,800	U	0.1	7
	Benzo(a)pyrene	3,800	U	1	80
	Benzo(b)fluoranthene	470	J	0.1	47
	Chrysene	3,800	U	0.001	0.08
	Dibenzo(a,h)anthracene	3,800	U	1	1,900
	Indeno(1,2,3-cd)pyrene	3,800	U	0.1	6.5
	BEQ				2,040.58
038S0T2701	Benzo(a)anthracene	2,600	J	0.1	260
	Benzo(a)pyrene	2,200	J	1	2,200
	Benzo(b)fluoranthene	3,800		0.1	380
	Chrysene	2,200	J	0.001	2.2
	Dibenzo(a,h)anthracene	3,100	U	1	1,550
	Indeno(1,2,3-cd)pyrene	1,000	J	0.1	100
	BEQ				4,492.20

Table 10-32
BEQ Concentrations per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

Sample ID	Chemical	Reported Result (µg/kg)	VQUAL	TEF	Adjusted (a) Concentration (µg/kg)
038S0T3801	Benzo(a)anthracene	4,200	U	0.1	7
	Benzo(a)pyrene	4,200	U	1	80
	Benzo(b)fluoranthene	230	J	0.1	23
	Chrysene	4,200	U	0.001	0.08
	Dibenzo(a,h)anthracene	4,200	U	1	2,100
	Indeno(1,2,3-cd)pyrene	4,200	U	0.1	6.5
	BEQ				2,216.58

Notes:

(a) = As discussed in Section 10.2.4, the lesser of one-half the lowest hit and one-half the SQL was the concentration assumed to be present, unless no BEQ compounds were detected at a given location; the adjusted value equals the reported or assumed concentration times the TEF.

BEQ = Benzo(a)pyrene equivalent

VQUAL = Validation qualifier

TEF = Toxicity equivalence factor

J = The associated numerical value is an estimated quantity.

U = The material was analyzed for, but not detected; the associated value is the lesser of one half of the sample quantitation limit, or one half of the lowest detected concentration.

µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

Table 10-33
Chemicals Present in Site Samples
Building 604 Area — Organics in Groundwater (μg/L)
Site 38 — NAS Pensacola RI

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	COPC?
1,1,1-Trichloroethane	8 / 40	0.94 - 16	5.5	5 - 100	790	a,n		
1,1-Dichloroethane	10 / 40	0.68 - 180	24.3	5 - 100	810	a,n	1	Y
1,1-Dichloroethene	6 / 40	0.66 - 21	5.7	5 - 75	0.044	a,c	6	Y
1,2-Dichloroethane	2 / 40	19 - 70	44.5	5 - 100	0.12	a,c	2	Y
1,2-Dichloroethene (total)	10 / 22	2 - 970	133.7	10 - 50	55	a,n	9	Y
2,4-Dinitrotoluene	1 / 40	2	2	10 - 11	73	a,n		
2-Butanone (MEK)	2 / 40	8 - 150	79	10 - 1,000	1,900	a,n		
2-Methylnaphthalene	5 / 40	1 - 14	7.6	10 - 11	1,500	a,n		
Acenaphthene	2 / 40	1.8 - 4	2.9	10 - 11	2,200	a,n		
Acetone	4 / 40	6 - 500	132.5	10 - 1,000	3,700	a,n	1	Y
Anthracene	1 / 40	17	17	10 - 11	11,000	a,n		
Benzo(a)anthracene	1 / 40	8	8	10 - 11	0.092	a,c	1	b
Benzo(a)pyrene	1 / 40	7	7	10 - 11	0.0092	a,c	1	b
Benzo(b)fluoranthene	1 / 40	6	6	10 - 11	0.092	a,c	1	b
Benzo(k)fluoranthene	1 / 22	6	6	10 - 11	0.92	a,c	1	b
Carbazole	1 / 40	2	2	10 - 11	3.4	a,c		
Carbon disulfide	1 / 40	2	2	10 - 250	1,000	a,n		
Chloroethane	1 / 40	3	3	5 - 100	8,600	a,n		
Chloroform	1 / 40	1.2	1.2	5 - 100	0.15	a,c	1	b
Chrysene	1 / 40	7	7	10 - 11	9.2	a,c		
Dibenzofuran	1 / 40	14	14	10 - 11	150	a,n		

Table 10-33
Chemicals Present in Site Samples
Building 604 Area — Organics in Groundwater (μg/L)
Site 38 — NAS Pensacola RI

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	COPC?
Ethylbenzene	2 / 40	2 - 89	45.5	5 - 100	1,300	a,n		
Fluoranthene	3 / 40	7 - 23	16.3	10 - 11	1,500	a,n		
Naphthalene	4 / 40	7 - 140	46.5	10 - 11	1,500	a,n		
Phenanthrene	2 / 40	10 - 170	90	10 - 11	1,100	a,n		
Pyrene	3 / 40	8.8 - 15	11.6	10 - 11	1,100	a,n		
Tetrachloroethene	25 / 66	0.96 - 820	75.1	5 - 50	1.1	a,c	22	Y
Toluene	1 / 40	2	2	5 - 100	750	a,n		
Trichloroethene	22 / 66	2 - 340	30.3	5 - 50	1.6	a,c	22	Y
Vinyl chloride	18 / 65	0.99 - 3,700	379.2	1 - 50	0.019	a,c	18	Y
Xylene (Total)	3 / 22	1 - 11	6.7	10 - 50	12,000	a,n		
bis(2-Ethylhexyl)phthalate (BEHP)	2 / 40	11 - 22	16.5	1 - 11	4.8	a,c	2	b
cis-1,2-Dichloroethene	12 / 43	0.59 - 640	102.4	5 - 5	61	a,n	8	Y
trans-1,2-Dichloroethene	7 / 43	1.4 - 43	11.6	5 - 5	120	a,n	2	Y

Notes:
μg/L = micrograms per liter
a = Screening concentration based on residential groundwater ingestion from June 3, 1996 Region III RBC tables
b = Excluded from area-wide assessment due to low detection frequency; included in point risk estimates
c = Carcinogen
n = Noncarcinogen; comparison was made to one-tenth this concentraion, in accordance with Supplemental Guidance to RAGS, Bulletin 1, Data Collection and Evaluation
RBC = Risk-based concentration
COPC = Chemical of potential concern
Y = Yes, the chemical is considered a COPC

Table 10-34
Chemicals Present in Site Samples
Building 604 — Inorganics in Groundwater (μg/L)
Site 38 — NAS Pensacola RI

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	BG	Number over BG	COPC?
Aluminum	39 / 40	52 - 20,000	2,105	50 - 50	37,000	a,n	6	3,883	6	Y
Arsenic	18 / 40	1.5 - 17	6.4	2 - 15	0.045	a,c	18	2.8	16	Y
Barium	32 / 40	5.6 - 196	72.4	2.5 - 76.2	2,600	a,n		13.2	29	
Cadmium	15 / 66	1.1 - 382	63.4	1 - 5	18	a,n	13	3.4	13	Y
Calcium	40 / 40	13- 66,100	23,445	-	DNE	b	N/A	17,560	22	
Chromium	25 / 66	4.4 - 544	136.7	2 - 50	180	a,n	8	35	12	Y
Cobalt	4 / 40	2 - 4.3	3.2	2 - 5	2,200	a,n		4.1	1	
Copper	27 / 40	3.7 - 389	86.7	2 - 5	1,500	a,n	8	16.2	17	Y
Cyanide	5 / 40	2.1 - 18.8	11.9	1.8 - 31.8	730	a,n		ND	5	
Iron	37 / 40	0.04 - 24,900	2,143	0.03 - 15,100	11,000	a,b,n	13	1,707	10	
Lead	34 / 66	2.7 - 639	92.1	2 - 15	DNE	d	N/A	1.6	34	Y
Magnesium	40 / 40	0.91 - 28,400	3,585	-	DNE	b	N/A	2,872	20	
Manganese	33 / 40	4.8 - 217	58.2	5 - 27.8	840	a,n	9	22	22	Y
Mercury	7 / 40	0.2 - 1	0.5	0.2 - 0.58	11	a,n		0.2	7	
Molybdenum	1 / 18	2.3	2.3	2 - 5	180	a,n		ND		
Nickel	6 / 40	4 - 46.6	15.8	4 - 22.1	730	a,n		39.9	1	
Potassium	39 / 40	0.89 - 20,500	3,173	1 - 1	DNE	b	N/A	12,167	1	
Selenium	6 / 40	1.4 - 3.1	2	1 - 20	180	a,n		3.9		
Sodium	39 / 40	4.3 - 219,000	12,710	35,000 - 35,000	DNE	b	N/A	18,345	3	
Strontium	18 / 18	48 - 430	164.2	-	22,000	a,n		ND		
Thallium	1 / 40	2	2	2 - 50	2.9	a,n		3.6		

Table 10-34
Chemicals Present in Site Samples
Building 604 — Inorganics in Groundwater (μg/L)
Site 38 — NAS Pensacola RI

Chemical	Frequency of Detection	Range of Detection	Mean	Range of Nondetects	Residential RBC	Notes	Number over RBC	BG	Number over BG	COPC?
Titanium	4 / 18	2.2 - 2.6	2.4	2 - 5	DNE	N/A	N/A	ND		
Vanadium	15 / 40	3.1 - 65.8	12.2	2 - 21.5	260	a,n	2	9.6	4	Y
Zinc	35 / 40	6.6 - 804	154.3	2.50 - 5	11,000	a,n		153.2	11	

Notes:

μg/L = micrograms per liter
a = Screening concentration based on residential groundwater ingestion from June 3, 1996 Region III RBC tables
b = Essential nutrient
c = Carcinogen
d = Screening based on 15 μg/L lead in groundwater
n = Noncarcinogen; comparison was made to one-tenth this concentraion, in accordance with Supplemental Guidance to RAGS, Bulletin 1, Data Collection and Evaluation
RBC = Risk-based concentration
BG = Background concentration
COPC = Chemical of potential concern
DNE = Does not exist
N/A = Not Applicable
ND = Not determined due to lack of information
Y = Yes, the chemical is considered a COPC

Table 10 - 35
COPC Summary
Site 38 - Building 604 Area
NAS Pensacola

Chemical	COPC in Surface Soil?	COPC in Groundwater
1,1-Dichloroethane	No	Yes
1,1-Dichloroethene	No	Yes
1,2-Dichlorothane	No	Yes
1,2-Dichloroethene (total)	No	Yes
Acetone	No	Yes
Aluminum	Yes	Yes
Aroclor-1260	Yes	No
Arsenic	Yes	Yes
BEQ	Yes	No
bis(2-Ethyhexyl)phthalate	No	Yes
Cadmium	Yes	Yes
Chloroform	No	Yes
Chromium	Yes	Yes
Copper	Yes	Yes
Dieldrin	Yes	No
Lead	Yes	No
Manganese	Yes	Yes
Tetrachloroethene	No	Yes
Trichloroethene	No	Yes
Vanadium	Yes	Yes
Vinyl Chloride	No	Yes

Notes:

COPC = Chemical of potential concern
BEQ = Benzo(a)pyrene equivalent

Table 10-36
Unpaved Soil Locations
Site 38
NAS Pensacola

Sample Designations
038S0T01
038S0T02
038S0T03
038S0T04
038S0T06
038S0T07
038S0T10
038S0T11
038S0T12
038S0T15
038S0T16
038S0T17
038S0T18
038S0T23
038S0T25
038S0T31
038S0T34
038S0T35
038S0T36
038S0T37
038S0026
038S0035
038S0037

Table 10 - 37
Statistical Analysis of COPCs in Surface Soil
Site 38 - Building 604 Area
NAS Pensacola

COPC	n	Natural Log Transformed Mean	SD	H-stat	UCL (mg/kg)	MAX (mg/kg)	EPC	
Aluminum	64	7.596	1.89	3.386	26568.7	35000	26568.7	UCL used
Aroclor 1260	49	-3.588	1.027	2.348	0.0664	0.81	0.0664	UCL used
Arsenic	64	0.513	1.09	2.404	4.207	21.1	4.207	UCL used
BEQ	14	6.8014	0.8317	2.534	2.279	4.49	2.279	UCL used
Cadmium	64	-0.426	1.07	2.383	1.596	21	1.596	UCL used
Chromium	64	1.809	1.296	2.635	21.743	48	21.743	UCL used
Copper	64	2.671	1.707	3.145	122.121	607	122.121	UCL used
Dieldrin	49	-7.073	1.275	2.626	0.0031	0.084	0.0031	UCL used
Lead	64	3.83	1.571	2.971	284.7	949	284.7	UCL used
Manganese	64	3.452	1.528	2.917	177.88	380	177.88	UCL used
Vanadium	64	1.446	1.525	2.913	23.77	55	23.77	UCL used

Notes:

COPC = Chemical of potential concern
n = Number of samples analyzed
MEAN = Arithmetic mean of the log transformed data
SD = Standard deviation
H-stat = "H" statistic from Gilbert 1987' cuboidal interpolation was used to determine the value in accordance with USEPA Supplemental Guidance to RAGS, Calculating the Concentration Term
UCL = 95th percentile upper confidence level mean
MAX = Maximum reported concentration
EPC = Exposure point concentration
mg/kg = milligrams per kilograms

Table 10-38
Summary Risk Estimates for All Exposure Pathways
Building 604 Area - Site 38
NAS Pensacola

	Site Resident			*Site Worker*		*Site Trespasser*	
	Adult	*Child*	*LWA*	*Adult*		*Adolescent*	
Medium and Exposure Pathway	**HI**	**HI**	**ILCR**	**HI**	**ILCR**	**HI**	**ILCR**
Soil - Incidental Ingestion	0.07	0.65	4E-05	0.02	4E-06	0.02	1E-06
Soil - Dermal Contact	0.015	0.05	1E-05	0.011	5E-06	0.004	7E-07
Sum of Soil Pathway	0.085	0.70	5.E-05	0.04	9.E-06	0.020	2.E-06
Groundwater - Ingestion	33.2	77.4	1.E-01	11.8	2.E-02	NA	NA
Groundwater - Inhalation of VOCs	9.3	21.8	2.E-02	3.3	4.E-03	NA	NA
Sum of Groundwater Pathway	42.5	99.2	1.E-01	15.1	3.E-02	NA	NA
Sum of Soil and Groundwater Pathways	42.6	99.9	1.E-01	15.1	3.E-02	0.020	2.E-06

Notes:

LWA = Lifetime weighted average
HI = Hazard index
ILCR = Incremental lifetime excess cancer risk

Table 10-39
Hazard Quotients and Incremental Lifetime Cancer Risks
Incidental Soil Ingestion
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident			*Site Worker*		*Site Trespasser*	
				Adult	*Child*	*LWA*	*Adult*		*Adolescent*	
Chemical	**EPC (mg/kg)**	**Oral RfD mg/kg-day**	**Oral SF kg-day/mg**	**HQ**	**HQ**	**ILCR**	**HQ**	**ILCR**	**HQ**	**ILCR**
Aluminum	26568.7	1	NA	0.036	0.340	NA	0.0130	NA	0.0084	NA
Aroclor 1260	0.0664	NA	2	NA	NA	2.1E-07	NA	2.3E-08	NA	6.0E-09
Arsenic	4.207	0.0003	1.5	0.019	0.179	9.9E-06	0.0069	1.1E-06	0.0044	2.9E-07
BEQ	2.279	NA	7.3	NA	NA	2.6E-05	NA	2.9E-06	NA	7.5E-07
Cadmium	1.596	0.0005	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	21.743	1	NA	0.000030	0.00028	NA	0.000011	NA	0.000007	NA
Copper	122.121	0.04	NA	0.00418	0.0391	NA	0.001493	NA	0.000968	NA
Dieldrin	0.0031	0.00005	16	0.000085	0.00079	7.8E-08	0.000030	8.7E-09	0.00002	2.2E-09
Lead	284.7	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese[1]	177.88	0.047	NA	0.005185	0.04844	NA	0.001851	NA	0.001200	NA
Vanadium	23.77	0.007	NA	0.00465	0.043	NA	0.0017	NA	0.00108	NA
Cumulative HI or ILCR:				0.07	0.7	4E-05	0.02	4E-06	0.02	1E-06

Notes:

LWA = Lifetime weighted average
EPC = Exposure point concentration
RfD = Reference Dose
SF = Slope factor
HQ = Hazard quotient
ILCR = Incremental lifetime excess cancer risk
HI = Hazard Index
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
kg-day/mg = kilograms per day per milligram

[1]The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would double the manganese hazard quotient shown.

Table 10-40
Hazard Quotients and Incremental Lifetime Cancer Risks
Dermal Contact with Surface Soil
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident			*Site Worker*		*Site Trespasser*	
				Adult	*Child*	*LWA*	*Adult*		*Adolescent*	
Chemical	**EPC (mg/kg)**	**Dermal RfD mg/kg-day**	**Dermal SF kg-day/mg**	**HQ**	**HQ**	**ILCR**	**HQ**	**ILCR**	**HQ**	**ILCR**
Aluminum	26568.7	0.2	NA	0.0075	0.025	NA	0.00533	NA	0.0017	NA
Aroclor 1260	0.0664	NA	4	NA	NA	9.3E-08	NA	3.8E-08	NA	4.9E-09
Arsenic	4.207	0.00006	7.5	0.004	0.013	1.1E-06	0.0028	4.5E-07	0.00091	5.8E-08
BEQ	2.2797	NA	14.6	NA	NA	1.2E-05	NA	4.8E-06	NA	6.2E-07
Cadmium	1.596	0.0001	NA	0.001	0.0030	NA	0.00064	NA	0.00021	NA
Chromium	21.743	0.2	NA	0.0000061	0.000020	NA	0.0000044	NA	0.0000014	NA
Copper	122.121	0.008	NA	0.00086	0.0028	NA	0.00061	NA	0.00020	NA
Dieldrin	0.0031	0.000025	32	0.000070	0.000229	3.5E-08	0.000050	1.4E-08	0.000016	1.8E-09
Lead	284.7	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese[1]	177.88	0.0094	NA	0.001	0.004	NA	0.00076	NA	0.00025	NA
Vanadium	23.77	0.0014	NA	0.00095	0.0031	NA	0.00068	NA	0.00022	NA
Cumulative HI or ILCR:				0.015	0.05	1E-05	0.011	5E-06	0.004	7E-07

Notes:

LWA = Lifetime weighted average
EPC = Exposure point concentration
RfD = Reference Dose
SF = Slope factor
HQ = Hazard quotient
ILCR = Incremental lifetime excess cancer risk
HI = Hazard Index
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
kg-day/mg = kilograms per day per milligram

[1]The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would double the manganese hazard quotient shown.

Table 10-41
Hazard Quotients and Incremental Lifetime Cancer Risks
Ingestion of Groundwater
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident			Site Worker	
				Adult	Child	LWA	Adult	
Chemical	**EPC (mg/L)**	**Oral RfD mg/kg-day**	**Oral SF kg-day/mg**	**HQ**	**HQ**	**ILCR**	**HQ**	**ILCR**
1,1-Dichloroethane	0.18	0.1	NA	0.05	0.12	NA	0.02	NA
1,1-Dichloroethene	0.021	0.009	0.6	0.06	0.15	1.9E-04	0.023	4.4E-05
1,2-Dichloroethane	0.07	0.00286	0.091	0.67	1.56	9.5E-05	0.24	2.2E-05
1,2-Dichloroethene (total)	0.97	0.009	NA	2.95	6.89	NA	1.05	NA
Acetone	0.5	0.1	NA	0.14	0.32	NA	0.05	NA
Aluminum	20	1	NA	0.55	1.28	NA	0.19	NA
Arsenic	0.017	0.0003	1.5	1.55	3.62	3.8E-04	0.55	8.9E-05
Cadmium	0.382	0.0005	NA	20.93	48.82	NA	7.43	NA
Chromium	0.544	1	NA	0.015	0.03	NA	0.01	NA
cis-1,2-Dichloroethene	0.64	0.01	NA	1.75	4.09	NA	0.62	NA
Copper	0.389	0.0371	NA	0.29	0.67	NA	0.10	NA
Manganese[1]	0.217	0.047	NA	0.13	0.30	NA	0.04	NA
Tetrachloroethene	0.82	0.01	0.052	2.25	5.24	6.4E-04	0.80	1.5E-04
trans-1,2-Dichloroethene	0.043	0.02	NA	0.06	0.14	NA	0.02	NA
Trichloroethene	0.34	0.006	0.011	1.55	3.62	5.6E-05	0.55	1.3E-05
Vanadium	0.0658	0.007	NA	0.26	0.60	NA	0.09	NA
Vinyl chloride	3.7	NA	1.9	NA	NA	1.0E-01	NA	2.5E-02
Cumulative HI or ILCR:				33.21	77.44	1.E-01	11.79	2.E-02

Notes:

LWA = Lifetime weighted average
EPC = Exposure point concentration
RfD = Reference Dose
SF = Slope factor
HQ = Hazard quotient
ILCR = Incremental lifetime excess cancer risk
HI = Hazard Index
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
kg-day/mg = kilograms per day per milligram

[1]The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would double the manganese hazard quotient shown in this table.

Table 10-42
Hazard Quotients and Incremental Lifetime Cancer Risks
Inhalation of Groundwater
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident			Site Worker	
				Adult	Child	LWA	Adult	
Chemical	**EPC (mg/L)**	**Inhalation RfD mg/kg-day**	**Inhalation SF kg-day/mg**	**HQ**	**HQ**	**ILCR**	**HQ**	**ILCR**
1,1-Dichloroethane	0.18	0.143	NA	0.03	0.08	NA	0.01	NA
1,1-Dichloroethene	0.021	0.009	0.175	0.06	0.15	5.5E-05	0.02	1.3E-05
1,2-Dichloroethane	0.07	0.00286	0.091	0.67	1.56	9.5E-05	0.24	2.2E-05
1,2-Dichloroethene (total)	0.97	0.009	NA	2.95	6.89	NA	1.05	NA
Acetone	0.5	NA	NA	NA	NA	NA	NA	NA
Aluminum	20	NA	NA	NA	NA	NA	NA	NA
Arsenic	0.017	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.382	NA	NA	NA	NA	NA	NA	NA
Chromium	0.544	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	0.64	0.01	NA	1.75	4.09	NA	0.6	NA
Copper	0.389	NA	NA	NA	NA	NA	NA	NA
Manganese	0.217	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	0.82	0.01	0.00203	2.25	5.24	2.5E-05	0.80	5.8E-06
trans-1,2-Dichloroethene	0.043	0.02	NA	0.06	0.14	NA	0.02	NA
Trichloroethene	0.34	0.006	0.006	1.55	3.62	3.0E-05	0.55	7.1E-06
Vanadium	0.0658	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	3.7	NA	0.3	NA	NA	1.7E-02	NA	3.9E-03
Cumulative HI or ILCR:				9.33	21.77	2.E-02	3.31	4.E-03

Notes:

LWA = Lifetime weighted average
EPC = Exposure point concentration
RfD = Reference Dose
SF = Slope factor
HQ = Hazard quotient
ILCR = Incremental lifetime excess cancer risk
HI = Hazard Index
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
kg-day/mg = kilograms per day per milligram

Table 10-43
LEAD MODEL Version 0.99d

AIR CONCENTRATION: 0.100 ug Pb/m3 DEFAULT
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 106.20 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	117.8	117.8
1-2	117.8	117.8
2-3	117.8	117.8
3-4	117.8	117.8
4-5	117.8	117.8
5-6	117.8	117.8
6-7	117.8	117.8

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 2.50 ug Pb/dL

Table 10-43
LEAD MODEL Version 0.99d

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	7.4	13.96	2.56
1-2:	10.6	26.87	3.74
2-3:	10.4	28.67	3.83
3-4:	10.2	29.75	3.93
4-5:	9.8	30.24	2.98
5-6:	9.5	31.82	2.72
6-7:	9.1	32.70	2.59

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.35	9.03	0.00	0.02
1-2:	2.27	20.82	0.00	0.03
2-3:	2.61	22.17	0.00	0.06
3-4:	2.57	23.18	0.00	0.07
4-5:	2.54	24.65	0.00	0.07
5-6:	2.71	26.30	0.00	0.09
6-7:	3.02	27.00	0.00	0.09

Table 10-44
COC Summary
Building 604 - Site 38
NAS Pensacola

	Residential Scenario			Worker Scenario		Trespasser Scenario	
COC	**HQ (adult)**	**HQ (child)**	**ILCR (LWA)**	**HQ**	**ILCR**	**HQ**	**ILCR**
Arsenic	c	c	a,b,c	c	a,c		
BEQ			a,b				a,b
1,1-Dichloroethane		c					
1,1-Dichloroethene		c,d	c,d		c,d		
1,2-Dichloroethane	c,d	c,d	c,d	c,d	c,d		
1,2-Dichloroethene (total)	c,d	c,d		c,d			
cis-1,2-Dichloroethene	c,d	c,d		c,d			
Acetone	c	c					
Aluminum	c	c		c			
Cadmium	c	c		c			
Copper	c	c		c			
Manganese	c	c					
Tetrachloroethene	c,d	c,d	c,d	c,d	c,d		
trans-1,2-Dichloroethene		c,d					
Trichloroethene	c,d	c,d	c,d	c,d	c,d		
Vanadium	c	c					
Vinyl chloride			c,d		c,d		

Notes:

a = Identified as a COC for the surface soil ingestion exposure pathway

b = Identified as a COC for the dermal contact with surface soil exposure pathway.

c = Identified as a COC for the groundwater ingestion exposure pathway.

d = Identified as a COC for the inhalation of chemicals in groundwater exposure pathway.

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident		*Site Trespasser*		*Site Worker*			
				LWA	*Child*	*Adolescent*		*Adult*		Percent Contribution to Industrial	Percent Contribution to Industrial
COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	ILCR	HQ	ILCR	HQ	ILCR	HQ	ILCR	HI
Aluminum (Al)	036S073C02	297			4.07E-03		1.13E-04		2.05E-04		8.662%
Aroclor-1260	036S073C02	0.034	U								
Arsenic (As)	036S073C02	0.63	J	1.65E-06	2.88E-02	5.15E-08	8.01E-04	2.33E-07	1.45E-03	13.224%	61.245%
BEQ	036S073C02	0.4537		7.51E-06		2.73E-07		1.53E-06		86.776%	
Cadmium (Cd)	036S073C02	0.44	U								
Chromium (Cr)	036S073C02	1.7			2.33E-05		6.49E-07		1.17E-06		0.050%
Copper (Cu)	036S073C02	21.4			7.34E-03		2.04E-04		3.69E-04		15.603%
Dieldrin	036S073C02	0.0034	U								
Lead (Pb)	036S073C02	103									
Manganese (Mn)	036S073C02	13.2			3.85E-03		1.07E-04		1.94E-04		8.191%
Vanadium (V)	036S073C02	1.5	J		2.94E-03		8.17E-05		1.48E-04		6.250%
Sum ILCR/HI:				9.16E-06	4.70E-02	3.24E-07	1.31E-03	1.76E-06	2.37E-03		
Aluminum (Al)	036S074C02	649			8.90E-03		2.48E-04		4.48E-04		8.271%
Aroclor-1260	036S074C02	0.033	U								
Arsenic (As)	036S074C02	1.2		3.13E-06	5.48E-02	9.81E-08	1.53E-03	4.43E-07	2.76E-03	20.125%	50.980%
BEQ	036S074C02	0.5227		8.66E-06		3.14E-07		1.76E-06		79.875%	
Cadmium (Cd)	036S074C02	0.64			1.76E-02		4.88E-04		8.83E-04		16.314%
Chromium (Cr)	036S074C02	2.4			3.29E-05		9.16E-07		1.66E-06		0.031%
Copper (Cu)	036S074C02	15.9			5.45E-03		1.52E-04		2.74E-04		5.066%
Dieldrin	036S074C02	0.0034	U								
Lead (Pb)	036S074C02	146									
Manganese (Mn)	036S074C02	59.9			1.75E-02		4.86E-04		8.79E-04		16.243%
Vanadium (V)	036S074C02	1.7	J		3.33E-03		9.26E-05		1.68E-04		3.095%
Sum ILCR/HI:				1.18E-05	1.08E-01	4.12E-07	2.99E-03	2.20E-06	5.41E-03		
Aluminum (Al)	036S074N02	2030			2.78E-02		7.74E-04		1.40E-03		4.385%
Aroclor-1260	036S074N02	0.035	U								
Arsenic (As)	036S074N02	6.4		1.67E-05	2.93E-01	5.23E-07	8.14E-03	2.37E-06	1.47E-02	100.000%	46.081%
Cadmium (Cd)	036S074N02	1.2			3.29E-02		9.16E-04		1.66E-03		5.184%
Chromium (Cr)	036S074N02	6.7			9.19E-05		2.56E-06		4.62E-06		0.014%
Copper (Cu)	036S074N02	607			2.08E-01		5.79E-03		1.05E-02		32.779%
Dieldrin	036S074N02	0.0035	U								
Lead (Pb)	036S074N02	949									
Manganese (Mn)	036S074N02	185			5.40E-02		1.50E-03		2.72E-03		8.502%
Vanadium (V)	036S074N02	9.9			1.94E-02		5.40E-04		9.76E-04		3.055%
Sum ILCR/HI:				1.67E-05	6.35E-01	5.23E-07	1.77E-02	2.37E-06	3.19E-02		
Aluminum (Al)	036S074W02	4500			6.17E-02		1.72E-03		3.10E-03		17.708%
Aroclor-1260	036S074W02	0.041	U								
Arsenic (As)	036S074W02	3.6		9.40E-06	1.65E-01	2.94E-07	4.58E-03	1.33E-06	8.28E-03	37.779%	47.220%
BEQ	036S074W02	0.6507		1.08E-05		3.91E-07		2.19E-06		62.221%	

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Trespasser Adolescent ILCR	Site Trespasser Adolescent HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Cadmium (Cd)	036S074W02	0.52	U								
Chromium (Cr)	036S074W02	8.7			1.19E-04		3.32E-06		6.00E-06		0.034%
Copper (Cu)	036S074W02	117			4.01E-02		1.12E-03		2.02E-03		11.510%
Dieldrin	036S074W02	0.0041	U								
Lead (Pb)	036S074W02	408									
Manganese (Mn)	036S074W02	232			6.77E-02		1.88E-03		3.41E-03		19.424%
Vanadium (V)	036S074W02	7.3	J		1.43E-02		3.98E-04		7.19E-04		4.104%
Sum ILCR/HI:				2.02E-05	3.48E-01	6.85E-07	9.69E-03	3.52E-06	1.75E-02		
Aluminum (Al)	036S075C02	1330	J		1.82E-02		5.07E-04		9.17E-04		12.999%
Aroclor-1260	036S075C02	0.034	U								
Arsenic (As)	036S075C02	0.85	J	2.22E-06	3.89E-02	6.95E-08	1.08E-03	3.14E-07	1.95E-03	14.246%	27.691%
BEQ	036S075C02	0.5615		9.30E-06		3.37E-07		1.89E-06		85.754%	
Cadmium (Cd)	036S075C02	1.7			4.66E-02		1.30E-03		2.35E-03		33.229%
Chromium (Cr)	036S075C02	29.5	J		4.05E-04		1.13E-05		2.03E-05		0.288%
Copper (Cu)	036S075C02	12.3			4.22E-03		1.17E-04		2.12E-04		3.005%
Dieldrin	036S075C02	0.0042	U								
Lead (Pb)	036S075C02	56.5	J								
Manganese (Mn)	036S075C02	97.5			2.84E-02		7.91E-04		1.43E-03		20.274%
Vanadium (V)	036S075C02	1.8	J		3.53E-03		9.81E-05		1.77E-04		2.513%
Sum ILCR/HI:				1.15E-05	1.40E-01	4.07E-07	3.90E-03	2.20E-06	7.06E-03		
Aluminum (Al)	036S075E02	1440	J		1.97E-02		5.49E-04		9.93E-04		4.062%
Aroclor-1260	036S075E02	0.042	U								
Arsenic (As)	036S075E02	5.1	J	1.33E-05	2.33E-01	4.17E-07	6.49E-03	1.88E-06	1.17E-02	99.455%	47.950%
Cadmium (Cd)	036S075E02	2.6			7.13E-02		1.98E-03		3.59E-03		14.667%
Chromium (Cr)	036S075E02	6.6	J		9.05E-05		2.52E-06		4.55E-06		0.019%
Copper (Cu)	036S075E02	391			1.34E-01		3.73E-03		6.74E-03		27.571%
Dieldrin	036S075E02	0.0014	J	5.08E-08	4.62E-04	1.84E-09	1.61E-05	1.03E-08	3.62E-05	0.545%	0.148%
Lead (Pb)	036S075E02	579	J								
Manganese (Mn)	036S075E02	63.5			1.85E-02		5.15E-04		9.32E-04		3.811%
Vanadium (V)	036S075E02	4.4	J		8.62E-03		2.40E-04		4.34E-04		1.773%
Sum ILCR/HI:				1.34E-05	4.86E-01	4.19E-07	1.35E-02	1.90E-06	2.45E-02		
Aluminum (Al)	036S076C02	3130	J		4.29E-02		1.19E-03		2.16E-03		14.610%
Aroclor-1260	036S076C02	0.034	U								
Arsenic (As)	036S076C02	2	J	5.22E-06	9.14E-02	1.63E-07	2.54E-03	7.39E-07	4.60E-03	100.000%	31.117%
Cadmium (Cd)	036S076C02	3.2			8.78E-02		2.44E-03		4.41E-03		29.873%
Chromium (Cr)	036S076C02	4.4	J		6.03E-05		1.68E-06		3.04E-06		0.021%
Copper (Cu)	036S076C02	28.9			9.91E-03		2.76E-04		4.98E-04		3.372%
Dieldrin	036S076C02	0.0035	U								
Lead (Pb)	036S076C02	104	J								
Manganese (Mn)	036S076C02	184			5.37E-02		1.49E-03		2.70E-03		18.273%

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Trespasser Adolescent ILCR	Site Trespasser Adolescent HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Vanadium (V)	036S076C02	4.1	J		8.03E-03		2.23E-04		4.04E-04		2.734%
Sum ILCR/HI:				5.22E-06	2.94E-01	1.63E-07	8.17E-03	7.39E-07	1.48E-02		
Aluminum (Al)	036S076E02	388	J		5.32E-03		1.48E-04		2.68E-04		12.856%
Aroclor-1260	036S076E02	0.034	U								
Arsenic (As)	036S076E02	0.46	J	1.20E-06	2.10E-02	3.76E-08	5.85E-04	1.70E-07	1.06E-03	100.000%	50.804%
Cadmium (Cd)	036S076E02	0.42	U								
Chromium (Cr)	036S076E02	1.1	J		1.51E-05		4.20E-07		7.59E-07		0.036%
Copper (Cu)	036S076E02	32.6			1.12E-02		3.11E-04		5.62E-04		27.003%
Dieldrin	036S076E02	0.0034	U								
Lead (Pb)	036S076E02	73.5	J								
Manganese (Mn)	036S076E02	9.5			2.77E-03		7.71E-05		1.39E-04		6.697%
Vanadium (V)	036S076E02	0.55	J		1.08E-03		3.00E-05		5.42E-05		2.603%
Sum ILCR/HI:				1.20E-06	4.14E-02	3.76E-08	1.15E-03	1.70E-07	2.08E-03		
Aluminum (Al)	036S076S02	409	J		5.61E-03		1.56E-04		2.82E-04		5.240%
Aroclor-1260	036S076S02	0.034	U								
Arsenic (As)	036S076S02	1.3	J	3.40E-06	5.94E-02	1.06E-07	1.65E-03	4.80E-07	2.99E-03	100.000%	55.522%
Cadmium (Cd)	036S076S02	0.97			2.66E-02		7.40E-04		1.34E-03		24.857%
Chromium (Cr)	036S076S02	3.1	J		4.25E-05		1.18E-06		2.14E-06		0.040%
Copper (Cu)	036S076S02	12.7			4.35E-03		1.21E-04		2.19E-04		4.068%
Dieldrin	036S076S02	0.0034	U								
Lead (Pb)	036S076S02	128	J								
Manganese (Mn)	036S076S02	30.3			8.84E-03		2.46E-04		4.45E-04		8.260%
Vanadium (V)	036S076S02	1.1	J		2.15E-03		5.99E-05		1.08E-04		2.013%
Sum ILCR/HI:				3.40E-06	1.07E-01	1.06E-07	2.98E-03	4.80E-07	5.38E-03		
Aluminum (Al)	036S076W02	200	J		2.74E-03		7.63E-05		1.38E-04		1.676%
Aroclor-1260	036S076W02	0.034	U								
Arsenic (As)	036S076W02	0.7	J	1.83E-06	3.20E-02	5.72E-08	8.90E-04	2.59E-07	1.61E-03	15.927%	19.558%
BEQ	036S076W02	0.4055		6.72E-06		2.44E-07		1.37E-06		84.073%	
Cadmium (Cd)	036S076W02	4.4			1.21E-01		3.36E-03		6.07E-03		73.763%
Chromium (Cr)	036S076W02	8.8	J		1.21E-04		3.36E-06		6.07E-06		0.074%
Copper (Cu)	036S076W02	16.2			5.55E-03		1.55E-04		2.79E-04		3.395%
Dieldrin	036S076W02	0.0034	U								
Lead (Pb)	036S076W02	32.7	J								
Manganese (Mn)	036S076W02	8.6			2.51E-03		6.98E-05		1.26E-04		1.534%
Vanadium (V)	036S076W02	0.42	U								
Sum ILCR/HI:				8.54E-06	1.64E-01	3.01E-07	4.55E-03	1.62E-06	8.23E-03		
Aluminum (Al)	036S077C02	273			3.74E-03		1.04E-04		1.88E-04		10.060%
Aroclor-1260	036S077C02	0.035	U								
Arsenic (As)	036S077C02	0.33	J	8.62E-07	1.51E-02	2.70E-08	4.20E-04	1.22E-07	7.59E-04	100.000%	40.535%

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident		*Site Trespasser*		*Site Worker*			
				LWA	*Child*	*Adolescent*		*Adult*		Percent Contribution to Industrial	Percent Contribution to Industrial
COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	ILCR	HQ	ILCR	HQ	ILCR	HQ	ILCR	HI
Cadmium (Cd)	036S077C02	0.45	U								
Chromium (Cr)	036S077C02	1.7			2.33E-05		6.49E-07		1.17E-06		0.063%
Copper (Cu)	036S077C02	16.1			5.52E-03		1.54E-04		2.78E-04		14.832%
Dieldrin	036S077C02	0.0035	U								
Lead (Pb)	036S077C02	91.1	J								
Manganese (Mn)	036S077C02	37.3	J		1.09E-02		3.03E-04		5.47E-04		29.245%
Vanadium (V)	036S077C02	1	J		1.96E-03		5.45E-05		9.85E-05		5.264%
Sum ILCR/HI:				8.62E-07	3.72E-02	2.70E-08	1.04E-03	1.22E-07	1.87E-03		
Aluminum (Al)	036S077N02	17.2	J		2.36E-04		6.56E-06		1.19E-05		10.778%
Aroclor-1260	036S077N02	0.033	U								
Arsenic (As)	036S077N02	0.17	U								
Cadmium (Cd)	036S077N02	0.51	U								
Chromium (Cr)	036S077N02	5.1			6.99E-05		1.95E-06		3.52E-06		3.196%
Copper (Cu)	036S077N02	0.79	J		2.71E-04		7.53E-06		1.36E-05		12.376%
Dieldrin	036S077N02	0.0033	U								
Lead (Pb)	036S077N02	2	J								
Manganese (Mn)	036S077N02	2.1	J		6.13E-04		1.70E-05		3.08E-05		27.998%
Vanadium (V)	036S077N02	0.51	J		9.99E-04		2.78E-05		5.03E-05		45.653%
Sum ILCR/HI:					2.19E-03		6.09E-05		1.10E-04		
Aluminum (Al)	036S077S02	1710			2.34E-02		6.52E-04		1.18E-03		21.323%
Aroclor-1260	036S077S02	0.039	U								
Arsenic (As)	036S077S02	1.3	J	3.40E-06	5.94E-02	1.06E-07	1.65E-03	4.80E-07	2.99E-03	100.000%	54.035%
Cadmium (Cd)	036S077S02	0.55	U								
Chromium (Cr)	036S077S02	18.5			2.54E-04		7.06E-06		1.28E-05		0.231%
Copper (Cu)	036S077S02	2.6	J		8.91E-04		2.48E-05		4.48E-05		0.811%
Dieldrin	036S077S02	0.0039	U								
Lead (Pb)	036S077S02	6.6	J								
Manganese (Mn)	036S077S02	71.5	J		2.09E-02		5.80E-04		1.05E-03		18.970%
Vanadium (V)	036S077S02	2.6	J		5.09E-03		1.42E-04		2.56E-04		4.632%
Sum ILCR/HI:				3.40E-06	1.10E-01	1.06E-07	3.06E-03	4.80E-07	5.53E-03		
Aluminum (Al)	036S077W02	890	J		1.22E-02		3.40E-04		6.14E-04		18.218%
Aroclor-1260	036S077W02	0.0005	U								
Arsenic (As)	036S077W02	0.91	J	2.38E-06	4.16E-02	7.44E-08	1.16E-03	3.36E-07	2.09E-03	10.589%	62.091%
BEQ	036S077W02	0.8433		1.40E-05		5.07E-07		2.84E-06		89.411%	
Cadmium (Cd)	036S077W02	0.43	U								
Chromium (Cr)	036S077W02	2.1			2.88E-05		8.01E-07		1.45E-06		0.043%
Copper (Cu)	036S077W02	4.4			1.51E-03		4.20E-05		7.59E-05		2.252%
Dieldrin	036S077W02	0.0034	U								
Lead (Pb)	036S077W02	35.3	J								
Manganese (Mn)	036S077W02	19.8			5.78E-03		1.61E-04		2.91E-04		8.623%

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident		*Site Trespasser*		*Site Worker*			
				LWA	*Child*	*Adolescent*		*Adult*		Percent Contribution to Industrial	Percent Contribution to Industrial
COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	ILCR	HQ	ILCR	HQ	ILCR	HQ	ILCR	HI
Vanadium (V)	036S077W02	3	J		5.88E-03		1.63E-04		2.96E-04		8.773%
Sum ILCR/HI:				1.63E-05	6.70E-02	5.81E-07	1.86E-03	3.18E-06	3.37E-03		
Aluminum (Al)	036S078C02	524			7.19E-03		2.00E-04		3.61E-04		11.389%
Aroclor-1260	036S078C02	0.033	U								
Arsenic (As)	036S078C02	0.9	J	2.35E-06	4.11E-02	7.36E-08	1.14E-03	3.33E-07	2.07E-03	100.000%	65.203%
Cadmium (Cd)	036S078C02	0.55	U								
Chromium (Cr)	036S078C02	2.2			3.02E-05		8.39E-07		1.52E-06		0.048%
Copper (Cu)	036S078C02	15.6			5.35E-03		1.49E-04		2.69E-04		8.476%
Dieldrin	036S078C02	0.0034	U								
Lead (Pb)	036S078C02	74.6									
Manganese (Mn)	036S078C02	20.1			5.86E-03		1.63E-04		2.95E-04		9.295%
Vanadium (V)	036S078C02	1.8	J		3.53E-03		9.81E-05		1.77E-04		5.589%
Sum ILCR/HI:				2.35E-06	6.31E-02	7.36E-08	1.76E-03	3.33E-07	3.17E-03		
Aluminum (Al)	036S078E02	667	U								
Aroclor-1260	036S078E02	0.034	U								
Arsenic (As)	036S078E02	3.2	J	8.36E-06	1.46E-01	2.62E-07	4.07E-03	1.18E-06	7.36E-03	99.441%	59.039%
Cadmium (Cd)	036S078E02	0.43	U								
Chromium (Cr)	036S078E02	1.5	U								
Copper (Cu)	036S078E02	264			9.05E-02		2.52E-03		4.55E-03		36.530%
Dieldrin	036S078E02	0.0009	J	3.27E-08	2.97E-04	1.19E-09	1.04E-05	6.64E-09	2.32E-05	0.559%	0.187%
Lead (Pb)	036S078E02	158	U								
Manganese (Mn)	036S078E02	25.3			7.38E-03		2.05E-04		3.71E-04		2.979%
Vanadium (V)	036S078E02	1.6	J		3.13E-03		8.72E-05		1.58E-04		1.265%
Sum ILCR/HI:				8.39E-06	2.48E-01	2.63E-07	6.89E-03	1.19E-06	1.25E-02		
Aluminum (Al)	036S078S02	1150			1.58E-02		4.39E-04		7.93E-04		13.049%
Aroclor-1260	036S078S02	0.035	U								
Arsenic (As)	036S078S02	1.1	J	2.87E-06	5.03E-02	8.99E-08	1.40E-03	4.07E-07	2.53E-03	100.000%	41.606%
Cadmium (Cd)	036S078S02	0.56	U								
Chromium (Cr)	036S078S02	8.8			1.21E-04		3.36E-06		6.07E-06		0.100%
Copper (Cu)	036S078S02	75.9			2.60E-02		7.24E-04		1.31E-03		21.531%
Dieldrin	036S078S02	0.0035	U								
Lead (Pb)	036S078S02	120									
Manganese (Mn)	036S078S02	84.8			2.47E-02		6.88E-04		1.24E 03		20.473%
Vanadium (V)	036S078S02	2	J		3.92E-03		1.09E-04		1.97E-04		3.242%
Sum ILCR/HI:				2.87E-06	1.21E-01	8.99E-08	3.36E-03	4.07E-07	6.08E-03		
Aluminum (Al)	036S078W02	5010			6.87E-02		1.91E-03		3.46E-03		58.188%
Aroclor-1260	036S078W02	0.033	U								
Arsenic (As)	036S078W02	0.21	J	5.49E-07	9.60E-03	1.72E-08	2.67E-04	7.76E-08	4.83E-04	41.211%	8.130%
Cadmium (Cd)	036S078W02	0.41	U								

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident		*Site Trespasser*		*Site Worker*			
				LWA	*Child*	*Adolescent*		*Adult*		Percent Contribution to Industrial	Percent Contribution to Industrial
COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	ILCR	HQ	ILCR	HQ	ILCR	HQ	ILCR	HI
Chromium (Cr)	036S078W02	8.6			1.18E-04		3.28E-06		5.93E-06		0.100%
Copper (Cu)	036S078W02	1.2	J		4.11E-04		1.14E-05		2.07E-05		0.348%
Dieldrin	036S078W02	0.015	J	5.44E-07	4.95E-03	1.98E-08	1.73E-04	1.11E-07	3.87E-04	58.789%	6.524%
Lead (Pb)	036S078W02	2.5	J								
Manganese (Mn)	036S078W02	6.7			1.95E-03		5.44E-05		9.83E-05		1.656%
Vanadium (V)	036S078W02	15.1	J		2.96E-02		8.23E-04		1.49E-03		25.054%
Sum ILCR/HI:				1.09E-06	1.15E-01	3.69E-08	3.24E-03	1.88E-07	5.94E-03		
Aluminum (Al)	036S079C02	82.2			1.13E-03		3.14E-05		5.67E-05		13.728%
Aroclor-1260	036S079C02	0.033	U								
Arsenic (As)	036S079C02	0.16	U								
Cadmium (Cd)	036S079C02	0.5	U								
Chromium (Cr)	036S079C02	0.5	U								
Copper (Cu)	036S079C02	13.6			4.66E-03		1.30E-04		2.35E-04		56.781%
Dieldrin	036S079C02	0.0033	U								
Lead (Pb)	036S079C02	16.6	J								
Manganese (Mn)	036S079C02	8.3	J		2.42E-03		6.74E-05		1.22E-04		29.492%
Vanadium (V)	036S079C02	0.5	U								
Sum ILCR/HI:					8.21E-03		2.28E-04		4.13E-04		
Aluminum (Al)	036S079W02	963			1.32E-02		3.67E-04		6.64E-04		45.347%
Aroclor-1260	036S079W02	0.033	U								
Arsenic (As)	036S079W02	0.14	U								
Cadmium (Cd)	036S079W02	0.57	U								
Chromium (Cr)	036S079W02	7.5			1.03E-04		2.86E-06		5.17E-06		0.353%
Copper (Cu)	036S079W02	5.7			1.95E-03		5.44E-05		9.83E-05		6.710%
Dieldrin	036S079W02	0.0033	U								
Lead (Pb)	036S079W02	29	J								
Manganese (Mn)	036S079W02	47.5	J		1.39E-02		3.86E-04		6.97E-04		47.590%
Vanadium (V)	036S079W02	0.57	U								
Sum ILCR/HI:					2.91E-02		8.10E-04		1.46E-03		
Aluminum (Al)	038S002601	10300			1.41E-01		3.93E-03		7.11E-03		31.531%
Aroclor-1260	038S002601	0.035	U								
Arsenic (As)	038S002601	4.2		1.10E-05	1.92E-01	3.43E-07	5.34E-03	1.55E-06	9.66E-03	55.686%	42.857%
BEQ	038S002601	0.3668		6.07E-06		2.20E-07		1.24E-06		44.314%	
Cadmium (Cd)	038S002601	1.1	U								
Chromium (Cr)	038S002601	11.5			1.58E-04		4.39E-06		7.93E-06		0.035%
Copper (Cu)	038S002601	33.4			1.14E-02		3.19E-04		5.76E-04		2.556%
Dieldrin	038S002601	0.0035	U								
Lead (Pb)	038S002601	119									
Manganese (Mn)	038S002601	244			7.12E-02		1.98E-03		3.58E-03		15.892%
Vanadium (V)	038S002601	16.3			3.19E-02		8.88E-04		1.61E-03		7.128%

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	*Site Resident* *LWA* ILCR	*Site Resident* *Child* HQ	*Site Trespasser* *Adolescent* ILCR	*Site Trespasser* *Adolescent* HQ	*Site Worker* *Adult* ILCR	*Site Worker* *Adult* HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Sum ILCR/HI:				1.70E-05	4.48E-01	5.64E-07	1.25E-02	2.79E-06	2.25E-02		
Aluminum (Al)	038S002801	921			1.26E-02		3.51E-04		6.35E-04		66.821%
Aroclor-1260	038S002801	0.035	U								
Arsenic (As)	038S002801	0.4	U								
Cadmium (Cd)	038S002801	0.95	U								
Chromium (Cr)	038S002801	2			2.74E-05		7.63E-07		1.38E-06		0.145%
Copper (Cu)	038S002801	8			2.74E-03		7.63E-05		1.38E-04		14.510%
Dieldrin	038S002801	0.0035	U								
Lead (Pb)	038S002801	23									
Manganese (Mn)	038S002801	12			3.50E-03		9.74E-05		1.76E-04		18.524%
Vanadium (V)	038S002801	1	U								
Sum ILCR/HI:					1.89E-02		5.26E-04		9.51E-04		
Aluminum (Al)	038S003501	12100			1.66E-01		4.62E-03		8.35E-03		13.479%
Aroclor-1260	038S003501	0.044	U								
Arsenic (As)	038S003501	21.1		5.51E-05	9.64E-01	1.72E-06	2.68E-02	7.80E-06	4.85E-02	60.058%	78.346%
BEQ	038S003501	1.54		2.55E-05		9.25E-07		5.19E-06		39.942%	
Cadmium (Cd)	038S003501	1.3	U								
Chromium (Cr)	038S003501	11.9			1.63E-04		4.54E-06		8.21E-06		0.013%
Copper (Cu)	038S003501	46.4			1.59E-02		4.43E-04		8.00E-04		1.292%
Dieldrin	038S003501	0.0044	U								
Lead (Pb)	038S003501	125									
Manganese (Mn)	038S003501	169			4.93E-02		1.37E-03		2.48E-03		4.005%
Vanadium (V)	038S003501	18			3.53E-02		9.81E-04		1.77E-03		2.864%
Sum ILCR/HI:				8.06E-05	1.23E+00	2.65E-06	3.42E-02	1.30E-05	6.19E-02		
Aluminum (Al)	038S003601	24300			3.33E-01		9.27E-03		1.68E-02		43.584%
Aroclor-1260	038S003601	0.036	U								
Arsenic (As)	038S003601	7.2		1.88E-05	3.29E-01	5.89E-07	9.16E-03	2.66E-06	1.66E-02	100.000%	43.046%
Cadmium (Cd)	038S003601	0.96	U								
Chromium (Cr)	038S003601	25.4			3.48E-04		9.69E-06		1.75E-05		0.046%
Copper (Cu)	038S003601	10.6			3.63E-03		1.01E-04		1.83E-04		0.475%
Dieldrin	038S003601	0.0036	U								
Lead (Pb)	038S003601	38.3									
Manganese (Mn)	038S003601	69.5			2.03E-02		5.64E-04		1.02E-03		2.652%
Vanadium (V)	038S003601	39.8			7.80E-02		2.17E-03		3.92E-03		10.198%
Sum ILCR/HI:				1.88E-05	7.65E-01	5.89E-07	2.13E-02	2.66E-06	3.85E-02		
Aluminum (Al)	038S003701	16200			2.22E-01		6.18E-03		1.12E-02		44.471%
Aroclor-1260	038S003701	0.57	J	2.59E-06		9.38E-08		5.26E-07		8.600%	
Arsenic (As)	038S003701	3.7	J	9.66E-06	1.69E-01	3.02E-07	4.71E-03	1.37E-06	8.51E-03	22.362%	33.857%
BEQ	038S003701	1.2418		2.06E-05		7.46E-07		4.18E-06		68.386%	

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Trespasser Adolescent ILCR	Site Trespasser Adolescent HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Cadmium (Cd)	038S003701	1	U								
Chromium (Cr)	038S003701	15			2.06E-04		5.72E-06		1.03E-05		0.041%
Copper (Cu)	038S003701	9.3			3.19E-03		8.87E-05		1.60E-04		0.638%
Dieldrin	038S003701	0.0054		1.96E-07	1.78E-03	7.11E-09	6.22E-05	3.99E-08	1.39E-04	0.652%	0.555%
Lead (Pb)	038S003701	51.9									
Manganese (Mn)	038S003701	174			5.08E-02		1.41E-03		2.55E-03		10.163%
Vanadium (V)	038S003701	26.2			5.13E-02		1.43E-03		2.58E-03		10.275%
Sum ILCR/HI:				3.30E-05	4.99E-01	1.15E-06	1.39E-02	6.11E-06	2.51E-02		
Aluminum (Al)	038S004102	179			2.45E-03		6.83E-05		1.23E-04		1.417%
Aroclor-1260	038S004102	0.043	U								
Arsenic (As)	038S004102	1.4		3.66E-06	6.40E-02	1.14E-07	1.78E-03	5.17E-07	3.22E-03	100.000%	36.947%
Cadmium (Cd)	038S004102	1.3	U								
Chromium (Cr)	038S004102	2.6	U								
Copper (Cu)	038S004102	308			1.06E-01		2.94E-03		5.31E-03		60.962%
Dieldrin	038S004102	0.0043	U								
Lead (Pb)	038S004102	5.2									
Manganese (Mn)	038S004102	4			1.17E-03		3.25E-05		5.87E-05		0.674%
Vanadium (V)	038S004102	2.6	U								
Sum ILCR/HI:				3.66E-06	1.73E-01	1.14E-07	4.82E-03	5.17E-07	8.71E-03		
Aluminum (Al)	038S004202	1330			1.82E-02		5.07E-04		9.17E-04		15.532%
Aroclor-1260	038S004202	0.035	U								
Arsenic (As)	038S004202	0.91		2.38E-06	4.16E-02	7.44E-08	1.16E-03	3.36E-07	2.09E-03	100.000%	35.425%
Cadmium (Cd)	038S004202	1.4			3.84E-02		1.07E-03		1.93E-03		32.700%
Chromium (Cr)	038S004202	6.2			8.50E-05		2.37E-06		4.28E-06		0.072%
Copper (Cu)	038S004202	14.9			5.11E-03		1.42E-04		2.57E-04		4.350%
Dieldrin	038S004202	0.0035	U								
Lead (Pb)	038S004202	70									
Manganese (Mn)	038S004202	28.5			8.31E-03		2.31E-04		4.18E-04		7.082%
Vanadium (V)	038S004202	2.9			5.68E-03		1.58E-04		2.86E-04		4.838%
Sum ILCR/HI:				2.38E-06	1.17E-01	7.44E-08	3.27E-03	3.36E-07	5.91E-03		
Aluminum (Al)	038S0T0101	17000			2.33E-01		6.49E-03		1.17E-02		39.652%
Aroclor-1260	038S0T0101	0.81		3.67E-06		1.33E-07		7.47E-07		28.392%	
Arsenic (As)	038S0T0101	5.1		1.33E-05	2.33E-01	4.17E-07	6.49E-03	1.88E-06	1.17E-02	71.608%	39.652%
Cadmium (Cd)	038S0T0101	1	U								
Chromium (Cr)	038S0T0101	17			2.33E-04		6.49E-06		1.17E-05		0.040%
Copper (Cu)	038S0T0101	9.8			3.36E-03		9.35E-05		1.69E-04		0.571%
Dieldrin	038S0T0101	0.05	U								
Lead (Pb)	038S0T0101	58									
Manganese (Mn)	038S0T0101	210			6.13E-02		1.70E-03		3.08E-03		10.422%
Vanadium (V)	038S0T0101	29			5.68E-02		1.58E-03		2.86E-03		9.663%

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Trespasser Adolescent ILCR	Site Trespasser Adolescent HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Sum ILCR/HI:				1.70E-05	5.88E-01	5.50E-07	1.64E-02	2.63E-06	2.96E-02		
Aluminum (Al)	038S0T0301	3700			5.07E-02		1.41E-03		2.55E-03		40.401%
Aroclor-1260	038S0T0301	0.5	U								
Arsenic (As)	038S0T0301	5	U								
Cadmium (Cd)	038S0T0301	0.72			1.97E-02		5.49E-04		9.93E-04		15.724%
Chromium (Cr)	038S0T0301	11			1.51E-04		4.20E-06		7.59E-06		0.120%
Copper (Cu)	038S0T0301	35			1.20E-02		3.34E-04		6.04E-04		9.554%
Dieldrin	038S0T0301	0.02	J	7.26E-07	6.60E-03	2.63E-08	2.30E-04	1.48E-07	5.17E-04	100.000%	8.178%
Lead (Pb)	038S0T0301	210									
Manganese (Mn)	038S0T0301	63			1.84E-02		5.11E-04		9.25E-04		14.636%
Vanadium (V)	038S0T0301	7.3			1.43E-02		3.98E-04		7.19E-04		11.387%
Sum ILCR/HI:				7.26E-07	1.22E-01	2.63E-08	3.44E-03	1.48E-07	6.32E-03		
Aluminum (Al)	038S0T0601	1700			2.33E-02		6.49E-04		1.17E-03		49.989%
Aroclor-1260	038S0T0601	0.5	U								
Arsenic (As)	038S0T0601	3	U								
Cadmium (Cd)	038S0T0601	0.5	U								
Chromium (Cr)	038S0T0601	4.8			6.58E-05		1.83E-06		3.31E-06		0.141%
Copper (Cu)	038S0T0601	7			2.40E-03		6.68E-05		1.21E-04		5.146%
Dieldrin	038S0T0601	0.05	U								
Lead (Pb)	038S0T0601	74									
Manganese (Mn)	038S0T0601	50			1.46E-02		4.06E-04		7.34E-04		31.282%
Vanadium (V)	038S0T0601	3.2			6.27E-03		1.74E-04		3.15E-04		13.442%
Sum ILCR/HI:					4.66E-02		1.30E-03		2.35E-03		
Aluminum (Al)	038S0T0701	4700			6.44E-02		1.79E-03		3.24E-03		41.490%
Aroclor-1260	038S0T0701	0.5	U								
Arsenic (As)	038S0T0701	3	U								
Cadmium (Cd)	038S0T0701	1.2			3.29E-02		9.16E-04		1.66E-03		21.187%
Chromium (Cr)	038S0T0701	9.7			1.33E-04		3.70E-06		6.69E-06		0.086%
Copper (Cu)	038S0T0701	21			7.20E-03		2.00E-04		3.62E-04		4.635%
Dieldrin	038S0T0701	0.009	JN	3.27E-07	2.97E-03	1.19E-08	1.04E-04	6.64E-08	2.32E-04	100.000%	2.975%
Lead (Pb)	038S0T0701	93									
Manganese (Mn)	038S0T0701	100			2.92E-02		8.12E-04		1.47E-03		18.782%
Vanadium (V)	038S0T0701	8.6			1.68E-02		4.69E-04		8.47E-04		10.845%
Sum ILCR/HI:				3.27E-07	1.54E-01	1.19E-08	4.30E-03	6.64E-08	7.81E-03		
Aluminum (Al)	038S0T0801	14000			1.92E-01		5.34E-03		9.66E-03		79.560%
Arsenic (As)	038S0T0801	6	U								
Cadmium (Cd)	038S0T0801	1	U								
Chromium (Cr)	038S0T0801	12			1.65E-04		4.58E-06		8.28E-06		0.068%
Copper (Cu)	038S0T0801	2.6			8.91E-04		2.48E-05		4.48E-05		0.369%

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident		*Site Trespasser*		*Site Worker*			
				LWA	*Child*	*Adolescent*		*Adult*		Percent Contribution to Industrial	Percent Contribution to Industrial
COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	ILCR	HQ	ILCR	HQ	ILCR	HQ	ILCR	HI
Lead (Pb)	038S0T0801	3.3									
Manganese (Mn)	038S0T0801	11			3.21E-03		8.93E-05		1.61E-04		1.330%
Vanadium (V)	038S0T0801	23			4.51E-02		1.25E-03		2.27E-03		18.672%
Sum ILCR/HI:					2.41E-01		6.71E-03		1.21E-02		
Aluminum (Al)	038S0T0901	21000			2.88E-01		8.01E-03		1.45E-02		72.637%
Arsenic (As)	038S0T0901	6	U								
Cadmium (Cd)	038S0T0901	1.3			3.57E-02		9.92E-04		1.79E-03		8.993%
Chromium (Cr)	038S0T0901	21			2.88E-04		8.01E-06		1.45E-05		0.073%
Copper (Cu)	038S0T0901	5.4			1.85E-03		5.15E-05		9.31E-05		0.467%
Lead (Pb)	038S0T0901	5.8									
Manganese (Mn)	038S0T0901	14			4.08E-03		1.14E-04		2.05E-04		1.030%
Vanadium (V)	038S0T0901	34			6.66E-02		1.85E-03		3.35E-03		16.800%
Sum ILCR/HI:					3.96E-01		1.10E-02		1.99E-02		
Aluminum (Al)	038S0T1001	8700			1.19E-01		3.32E-03		6.00E-03		63.455%
Aroclor-1260	038S0T1001	0.5	U								
Arsenic (As)	038S0T1001	3	U								
Cadmium (Cd)	038S0T1001	0.5			1.37E-02		3.81E-04		6.90E-04		7.294%
Chromium (Cr)	038S0T1001	11			1.51E-04		4.20E-06		7.59E-06		0.080%
Copper (Cu)	038S0T1001	6.3			2.16E-03		6.01E-05		1.09E-04		1.149%
Dieldrin	038S0T1001	0.05	U								
Lead (Pb)	038S0T1001	23									
Manganese (Mn)	038S0T1001	100			2.92E-02		8.12E-04		1.47E-03		15.519%
Vanadium (V)	038S0T1001	12			2.35E-02		6.54E-04		1.18E-03		12.504%
Sum ILCR/HI:					1.88E-01		5.23E-03		9.46E-03		
Aluminum (Al)	038S0T1101	6900			9.46E-02		2.63E-03		4.76E-03		23.426%
Aroclor-1260	038S0T1101	0.5	U								
Arsenic (As)	038S0T1101	4		1.04E-05	1.83E-01	3.27E-07	5.09E-03	1.48E-06	9.20E-03	18.445%	45.267%
BEQ	038S0T1101	1.941		3.21E-05		1.17E-06		6.54E-06		81.555%	
Cadmium (Cd)	038S0T1101	0.92			2.52E-02		7.02E-04		1.27E-03		6.247%
Chromium (Cr)	038S0T1101	9.3			1.28E-04		3.55E-06		6.42E-06		0.032%
Copper (Cu)	038S0T1101	140			4.80E-02		1.34E-03		2.41E-03		11.883%
Dieldrin	038S0T1101	0.05	U								
Lead (Pb)	038S0T1101	240									
Manganese (Mn)	038S0T1101	88			2.57E-02		7.14E-04		1.29E-03		6.357%
Vanadium (V)	038S0T1101	14			2.74E-02		7.63E-04		1.38E-03		6.790%
Sum ILCR/HI:				4.26E-05	4.04E-01	1.49E-06	1.12E-02	8.01E-06	2.03E-02		
Aluminum (Al)	038S0T1201	3900			5.35E-02		1.49E-03		2.69E-03		69.213%
Aroclor-1260	038S0T1201	0.5	U								
Arsenic (As)	038S0T1201	3	U								

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Trespasser Adolescent ILCR	Site Trespasser Adolescent HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Cadmium (Cd)	038S0T1201	0.5	U								
Chromium (Cr)	038S0T1201	4.5			6.17E-05		1.72E-06		3.10E-06		0.080%
Copper (Cu)	038S0T1201	7.4			2.54E-03		7.06E-05		1.28E-04		3.283%
Dieldrin	038S0T1201	0.05	U								
Lead (Pb)	038S0T1201	46									
Manganese (Mn)	038S0T1201	31			9.04E-03		2.52E-04		4.55E-04		11.705%
Vanadium (V)	038S0T1201	6.2			1.21E-02		3.38E-04		6.11E-04		15.719%
Sum ILCR/HI:					7.73E-02		2.15E-03		3.89E-03		
Aluminum (Al)	038S0T1301	15000			2.06E-01		5.72E-03		1.03E-02		61.836%
Arsenic (As)	038S0T1301	6	U								
Cadmium (Cd)	038S0T1301	1.3			3.57E-02		9.92E-04		1.79E-03		10.718%
Chromium (Cr)	038S0T1301	13			1.78E-04		4.96E-06		8.97E-06		0.054%
Copper (Cu)	038S0T1301	76			2.61E-02		7.25E-04		1.31E-03		7.833%
Lead (Pb)	038S0T1301	110									
Manganese (Mn)	038S0T1301	82			2.39E-02		6.66E-04		1.20E-03		7.192%
Vanadium (V)	038S0T1301	21			4.11E-02		1.14E-03		2.07E-03		12.367%
Sum ILCR/HI:					3.33E-01		9.25E-03		1.67E-02		
Aluminum (Al)	038S0T1401	35000			4.80E-01		1.34E-02		2.41E-02		48.454%
Arsenic (As)	038S0T1401	8.7		2.27E-05	3.98E-01	7.11E-07	1.11E-02	3.22E-06	2.00E-02	100.000%	40.147%
Cadmium (Cd)	038S0T1401	2	U								
Chromium (Cr)	038S0T1401	34			4.66E-04		1.30E-05		2.35E-05		0.047%
Copper (Cu)	038S0T1401	5.2			1.78E-03		4.96E-05		8.97E-05		0.180%
Lead (Pb)	038S0T1401	6.7									
Manganese (Mn)	038S0T1401	10			2.92E-03		8.12E-05		1.47E-04		0.295%
Vanadium (V)	038S0T1401	55			1.08E-01		3.00E-03		5.42E-03		10.877%
Sum ILCR/HI:				2.27E-05	9.90E-01	7.11E-07	2.76E-02	3.22E-06	4.98E-02		
Aluminum (Al)	038S0T1501	1800			2.47E-02		6.87E-04		1.24E-03		7.226%
Aroclor-1260	038S0T1501	0.5	U								
Arsenic (As)	038S0T1501	5.7		1.49E-05	2.61E-01	4.66E-07	7.25E-03	2.11E-06	1.31E-02	87.708%	76.279%
Cadmium (Cd)	038S0T1501	0.5	U								
Chromium (Cr)	038S0T1501	6.7			9.19E-05		2.56E-06		4.62E-06		0.027%
Copper (Cu)	038S0T1501	43			1.47E-02		4.10E-04		7.42E-04		4.316%
Dieldrin	038S0T1501	0.04	J	1.45E-06	1.32E-02	5.27E-08	4.61E-04	2.95E-07	1.03E-03	12.292%	6.014%
Lead (Pb)	038S0T1501	200									
Manganese (Mn)	038S0T1501	45			1.31E-02		3.65E-04		6.60E-04		3.844%
Vanadium (V)	038S0T1501	4			7.84E-03		2.18E-04		3.94E-04		2.294%
Sum ILCR/HI:				1.63E-05	3.34E-01	5.19E-07	9.39E-03	2.40E-06	1.72E-02		
Aluminum (Al)	038S0T1601	10000			1.37E-01		3.81E-03		6.90E-03		26.330%
Aroclor-1260	038S0T1601	0.5	U								

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Trespasser Adolescent ILCR	Site Trespasser Adolescent HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Arsenic (As)	038S0T1601	5.6		1.46E-05	2.56E-01	4.58E-07	7.12E-03	2.07E-06	1.29E-02	100.000%	49.150%
Cadmium (Cd)	038S0T1601	1.5			4.11E-02		1.14E-03		2.07E-03		7.899%
Chromium (Cr)	038S0T1601	11			1.51E-04		4.20E-06		7.59E-06		0.029%
Copper (Cu)	038S0T1601	67			2.30E-02		6.39E-04		1.16E-03		4.410%
Dieldrin	038S0T1601	0.05	U								
Lead (Pb)	038S0T1601	170									
Manganese (Mn)	038S0T1601	110			3.21E-02		8.93E-04		1.61E-03		6.162%
Vanadium (V)	038S0T1601	16			3.13E-02		8.72E-04		1.58E-03		6.018%
Sum ILCR/HI:				1.46E-05	5.21E-01	4.58E-07	1.45E-02	2.07E-06	2.62E-02		
Aluminum (Al)	038S0T1701	7800			1.07E-01		2.98E-03		5.38E-03		21.163%
Arsenic (As)	038S0T1701	6.3		1.65E-05	2.88E-01	5.15E-07	8.01E-03	2.33E-06	1.45E-02	25.307%	56.976%
BEQ	038S0T1701	2.0406		3.38E-05		1.23E-06		6.87E-06		74.693%	
Cadmium (Cd)	038S0T1701	1.4			3.84E-02		1.07E-03		1.93E-03		7.597%
Chromium (Cr)	038S0T1701	9.3			1.28E-04		3.55E-06		6.42E-06		0.025%
Copper (Cu)	038S0T1701	25			8.57E-03		2.38E-04		4.31E-04		1.696%
Lead (Pb)	038S0T1701	180									
Manganese (Mn)	038S0T1701	130			3.79E-02		1.06E-03		1.91E-03		7.504%
Vanadium (V)	038S0T1701	13			2.55E-02		7.08E-04		1.28E-03		5.039%
Sum ILCR/HI:				5.02E-05	5.05E-01	1.74E-06	1.41E-02	9.20E-06	2.54E-02		
Aluminum (Al)	038S0T1801	13000			1.78E-01		4.96E-03		8.97E-03		52.821%
Aroclor-1260	038S0T1801	0.083	J	3.77E-07		1.37E-08		7.66E-08		100.000%	
Arsenic (As)	038S0T1801	6	U								
Cadmium (Cd)	038S0T1801	1	U								
Chromium (Cr)	038S0T1801	12			1.65E-04		4.58E-06		8.28E-06		0.049%
Copper (Cu)	038S0T1801	32			1.10E-02		3.05E-04		5.52E-04		3.251%
Dieldrin	038S0T1801	0.05	U								
Lead (Pb)	038S0T1801	320									
Manganese (Mn)	038S0T1801	380			1.11E-01		3.08E-03		5.58E-03		32.851%
Vanadium (V)	038S0T1801	19			3.72E-02		1.04E-03		1.87E-03		11.029%
Sum ILCR/HI:				3.77E-07	3.37E-01	1.37E-08	9.39E-03	7.66E-08	1.70E-02		
Aluminum (Al)	038S0T1901	32000			4.39E-01		1.22E-02		2.21E-02		80.439%
Arsenic (As)	038S0T1901	12	U								
Cadmium (Cd)	038S0T1901	2	U								
Chromium (Cr)	038S0T1901	33			4.53E-04		1.26E-05		2.28E-05		0.083%
Copper (Cu)	038S0T1901	4.8			1.65E-03		4.58E-05		8.28E-05		0.302%
Lead (Pb)	038S0T1901	4									
Manganese (Mn)	038S0T1901	9.4			2.74E-03		7.63E-05		1.38E-04		0.503%
Vanadium (V)	038S0T1901	52			1.02E-01		2.83E-03		5.12E-03		18.673%
Sum ILCR/HI:					5.45E-01		1.52E-02		2.74E-02		

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Trespasser Adolescent ILCR	Site Trespasser Adolescent HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Aluminum (Al)	038S0T2001	28000			3.84E-01		1.07E-02		1.93E-02		77.507%
Arsenic (As)	038S0T2001	12	U								
Cadmium (Cd)	038S0T2001	2	U								
Chromium (Cr)	038S0T2001	30			4.11E-04		1.14E-05		2.07E-05		0.083%
Copper (Cu)	038S0T2001	7			2.40E-03		6.68E-05		1.21E-04		0.484%
Lead (Pb)	038S0T2001	22									
Manganese (Mn)	038S0T2001	50			1.46E-02		4.06E-04		7.34E-04		2.945%
Vanadium (V)	038S0T2001	48			9.40E-02		2.62E-03		4.73E-03		18.981%
Sum ILCR/HI:					4.95E-01		1.38E-02		2.49E-02		
Aluminum (Al)	038S0T2201	44			6.03E-04		1.68E-05		3.04E-05		59.631%
Arsenic (As)	038S0T2201	3	U								
Cadmium (Cd)	038S0T2201	0.5	U								
Chromium (Cr)	038S0T2201	1	U								
Copper (Cu)	038S0T2201	1	U								
Lead (Pb)	038S0T2201	4	U								
Manganese (Mn)	038S0T2201	1.4			4.08E-04		1.14E-05		2.05E-05		40.369%
Vanadium (V)	038S0T2201	1	U								
Sum ILCR/HI:					1.01E-03		2.81E-05		5.09E-05		
Aluminum (Al)	038S0T2301	11000			1.51E-01		4.20E-03		7.59E-03		36.685%
Aroclor-1260	038S0T2301	0.5	U								
Arsenic (As)	038S0T2301	3.2		8.36E-06	1.46E-01	2.62E-07	4.07E-03	1.18E-06	7.36E-03	100.000%	35.573%
Cadmium (Cd)	038S0T2301	1.3			3.57E-02		9.92E-04		1.79E-03		8.671%
Chromium (Cr)	038S0T2301	12			1.65E-04		4.58E-06		8.28E-06		0.040%
Copper (Cu)	038S0T2301	46			1.58E-02		4.39E-04		7.93E-04		3.835%
Dieldrin	038S0T2301	0.05	U								
Lead (Pb)	038S0T2301	110									
Manganese (Mn)	038S0T2301	100			2.92E-02		8.12E-04		1.47E-03		7.096%
Vanadium (V)	038S0T2301	17			3.33E-02		9.26E-04		1.68E-03		8.099%
Sum ILCR/HI:				8.36E-06	4.11E-01	2.62E-07	1.14E-02	1.18E-06	2.07E-02		
Aluminum (Al)	038S0T2501	8700			1.19E-01		3.32E-03		6.00E-03		36.994%
Aroclor-1260	038S0T2501	0.5	U								
Arsenic (As)	038S0T2501	3.1		8.10E-06	1.42E-01	2.53E-07	3.94E-03	1.15E-06	7.13E-03	100.000%	43.939%
Cadmium (Cd)	038S0T2501	0.5	U								
Chromium (Cr)	038S0T2501	13			1.78E-04		4.96E-06		8.97E-06		0.055%
Copper (Cu)	038S0T2501	7.3			2.50E-03		6.96E-05		1.26E-04		0.776%
Dieldrin	038S0T2501	0.05	U								
Lead (Pb)	038S0T2501	160	A								
Manganese (Mn)	038S0T2501	74			2.16E-02		6.01E-04		1.09E-03		6.695%
Vanadium (V)	038S0T2501	19			3.72E-02		1.04E-03		1.87E-03		11.542%
Sum ILCR/HI:				8.10E-06	3.22E-01	2.53E-07	8.97E-03	1.15E-06	1.62E-02		

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Trespasser Adolescent ILCR	Site Trespasser Adolescent HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Aluminum (Al)	038S0T2601	230			3.15E-03		8.77E-05		1.59E-04		52.298%
Arsenic (As)	038S0T2601	3	U								
Cadmium (Cd)	038S0T2601	0.5	U								
Chromium (Cr)	038S0T2601	1	U								
Copper (Cu)	038S0T2601	3.2			1.10E-03		3.05E-05		5.52E-05		18.191%
Lead (Pb)	038S0T2601	43									
Manganese (Mn)	038S0T2601	6.1			1.78E-03		4.95E-05		8.95E-05		29.511%
Vanadium (V)	038S0T2601	1	U								
Sum ILCR/HI:					6.03E-03		1.68E-04		3.03E-04		
Aluminum (Al)	038S0T2701	190			2.61E-03		7.25E-05		1.31E-04		74.853%
Arsenic (As)	038S0T2701	3	U								
BEQ	038S0T2701	4.4922		7.44E-05		2.70E-06		1.51E-05		100.000%	
Cadmium (Cd)	038S0T2701	0.5	U								
Chromium (Cr)	038S0T2701	1	U								
Copper (Cu)	038S0T2701	1	U								
Lead (Pb)	038S0T2701	9.8									
Manganese (Mn)	038S0T2701	3			8.75E-04		2.44E-05		4.40E-05		25.147%
Vanadium (V)	038S0T2701	1	U								
Sum ILCR/HI:				7.44E-05	3.48E-03	2.70E-06	9.68E-05	1.51E-05	1.75E-04		
Aluminum (Al)	038S0T2801	39			5.35E-04		1.49E-05		2.69E-05		100.000%
Arsenic (As)	038S0T2801	3	U								
Cadmium (Cd)	038S0T2801	0.5	U								
Chromium (Cr)	038S0T2801	1	U								
Copper (Cu)	038S0T2801	1	U								
Lead (Pb)	038S0T2801	4	U								
Manganese (Mn)	038S0T2801	1	U								
Vanadium (V)	038S0T2801	1	U								
Sum ILCR/HI:					5.35E-04		1.49E-05		2.69E-05		
Aluminum (Al)	038S0T2901	3200			4.39E-02		1.22E-03		2.21E-03		77.276%
Arsenic (As)	038S0T2901	3	U								
Cadmium (Cd)	038S0T2901	0.5	U								
Chromium (Cr)	038S0T2901	3.6			4.94E-05		1.37E-06		2.48E-06		0.087%
Copper (Cu)	038S0T2901	1	U								
Lead (Pb)	038S0T2901	4	U								
Manganese (Mn)	038S0T2901	3.1			9.04E-04		2.52E-05		4.55E-05		1.593%
Vanadium (V)	038S0T2901	6.1			1.19E-02		3.32E-04		6.01E-04		21.044%
Sum ILCR/HI:					5.68E-02		1.58E-03		2.86E-03		
Aluminum (Al)	038S0T3002	87			1.19E-03		3.32E-05		6.00E-05		37.110%

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	Site Resident LWA Child ILCR	Site Resident LWA Child HQ	Site Trespasser Adolescent ILCR	Site Trespasser Adolescent HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Arsenic (As)	038S0T3002	3	U								
Cadmium (Cd)	038S0T3002	0.5	U								
Chromium (Cr)	038S0T3002	6			8.23E-05		2.29E-06		4.14E-06		2.559%
Copper (Cu)	038S0T3002	3.7			1.27E-03		3.53E-05		6.38E-05		39.456%
Lead (Pb)	038S0T3002	6.8									
Manganese (Mn)	038S0T3002	2.3			6.71E-04		1.87E-05		3.38E-05		20.874%
Vanadium (V)	038S0T3002	1	U								
Sum ILCR/HI:					3.21E-03		8.94E-05		1.62E-04		
Aluminum (Al)	038S0T3101	2200			3.02E-02		8.39E-04		1.52E-03		20.052%
Aroclor-1260	038S0T3101	0.5	U								
Arsenic (As)	038S0T3101	3	U								
Cadmium (Cd)	038S0T3101	2			5.48E-02		1.53E-03		2.76E-03		36.459%
Chromium (Cr)	038S0T3101	4.5			6.17E-05		1.72E-06		3.10E-06		0.041%
Copper (Cu)	038S0T3101	140			4.80E-02		1.34E-03		2.41E-03		31.901%
Dieldrin	038S0T3101	0.05	U								
Lead (Pb)	038S0T3101	31									
Manganese (Mn)	038S0T3101	30			8.75E-03		2.44E-04		4.40E-04		5.818%
Vanadium (V)	038S0T3101	4.4			8.62E-03		2.40E-04		4.34E-04		5.729%
Sum ILCR/HI:					1.50E-01		4.19E-03		7.57E-03		
Aluminum (Al)	038S0T3201	36			4.94E-04		1.37E-05		2.48E-05		100.000%
Arsenic (As)	038S0T3201	3	U								
Cadmium (Cd)	038S0T3201	0.5	U								
Chromium (Cr)	038S0T3201	1	U								
Copper (Cu)	038S0T3201	1	U								
Lead (Pb)	038S0T3201	4	U								
Manganese (Mn)	038S0T3201	1	U								
Vanadium (V)	038S0T3201	1	U								
Sum ILCR/HI:					4.94E-04		1.37E-05		2.48E-05		
Aluminum (Al)	038S0T3301	320			4.39E-03		1.22E-04		2.21E-04		62.621%
Arsenic (As)	038S0T3301	3	U								
Cadmium (Cd)	038S0T3301	0.5	U								
Chromium (Cr)	038S0T3301	1	U								
Copper (Cu)	038S0T3301	3.3			1.13E-03		3.15E-05		5.69E-05		16.144%
Lead (Pb)	038S0T3301	78									
Manganese (Mn)	038S0T3301	5.1			1.49E-03		4.14E-05		7.49E-05		21.235%
Vanadium (V)	038S0T3301	1	U								
Sum ILCR/HI:					7.01E-03		1.95E-04		3.53E-04		
Aluminum (Al)	038S0T3401	5400			7.40E-02		2.06E-03		3.73E-03		57.066%
Aroclor-1260	038S0T3401	0.5	U								

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident		*Site Trespasser*		*Site Worker*			
				LWA	*Child*	*Adolescent*		*Adult*		Percent Contribution to Industrial	Percent Contribution to Industrial
COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	ILCR	HQ	ILCR	HQ	ILCR	HQ	ILCR	HI
Arsenic (As)	038S0T3401	3	U								
Cadmium (Cd)	038S0T3401	0.56			1.54E-02		4.27E-04		7.73E-04		11.836%
Chromium (Cr)	038S0T3401	6.6			9.05E-05		2.52E-06		4.55E-06		0.070%
Copper (Cu)	038S0T3401	6.5			2.23E-03		6.20E-05		1.12E-04		1.717%
Dieldrin	038S0T3401	0.05	U								
Lead (Pb)	038S0T3401	53									
Manganese (Mn)	038S0T3401	80			2.33E-02		6.49E-04		1.17E-03		17.988%
Vanadium (V)	038S0T3401	7.5			1.47E-02		4.09E-04		7.39E-04		11.323%
Sum ILCR/HI:					1.30E-01		3.61E-03		6.53E-03		
Aluminum (Al)	038S0T3501	5400			7.40E-02		2.06E-03		3.73E-03		48.651%
Aroclor-1260	038S0T3501	0.5	U								
Arsenic (As)	038S0T3501	3	U								
Cadmium (Cd)	038S0T3501	1.1			3.02E-02		8.39E-04		1.52E-03		19.821%
Chromium (Cr)	038S0T3501	9.9			1.36E-04		3.78E-06		6.83E-06		0.089%
Copper (Cu)	038S0T3501	11			3.77E-03		1.05E-04		1.90E-04		2.478%
Dieldrin	038S0T3501	0.05	U								
Lead (Pb)	038S0T3501	75									
Manganese (Mn)	038S0T3501	92			2.68E-02		7.47E-04		1.35E-03		17.635%
Vanadium (V)	038S0T3501	8.8			1.72E-02		4.80E-04		8.67E-04		11.326%
Sum ILCR/HI:					1.52E-01		4.23E-03		7.66E-03		
Aluminum (Al)	038S0T3601	2800			3.84E-02		1.07E-03		1.93E-03		29.878%
Aroclor-1260	038S0T3601	0.5	U								
Arsenic (As)	038S0T3601	3	U								
Cadmium (Cd)	038S0T3601	2			5.48E-02		1.53E-03		2.76E-03		42.682%
Chromium (Cr)	038S0T3601	30			4.11E-04		1.14E-05		2.07E-05		0.320%
Copper (Cu)	038S0T3601	11			3.77E-03		1.05E-04		1.90E-04		2.934%
Dieldrin	038S0T3601	0.05	U								
Lead (Pb)	038S0T3601	240									
Manganese (Mn)	038S0T3601	79			2.30E-02		6.41E-04		1.16E-03		17.936%
Vanadium (V)	038S0T3601	4.1			8.03E-03		2.23E-04		4.04E-04		6.250%
Sum ILCR/HI:					1.29E-01		3.58E-03		6.46E-03		
Aluminum (Al)	038S0T3701	6700			9.19E-02		2.56E-03		4.62E-03		48.327%
Aroclor-1260	038S0T3701	0.5	U								
Arsenic (As)	038S0T3701	3	U								
Cadmium (Cd)	038S0T3701	0.5	U								
Chromium (Cr)	038S0T3701	12			1.65E-04		4.58E-06		8.28E-06		0.087%
Copper (Cu)	038S0T3701	18			6.17E-03		1.72E-04		3.10E-04		3.246%
Dieldrin	038S0T3701	0.084		3.05E-06	2.77E-02	1.11E-07	9.68E-04	6.20E-07	2.17E-03	100.000%	22.689%
Lead (Pb)	038S0T3701	80									
Manganese (Mn)	038S0T3701	100			2.92E-02		8.12E-04		1.47E-03		15.347%

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Trespasser Adolescent ILCR	Site Trespasser Adolescent HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Vanadium (V)	038S0T3701	10			1.96E-02		5.45E-04		9.85E-04		10.304%
Sum ILCR/HI:				3.05E-06	1.75E-01	1.11E-07	5.06E-03	6.20E-07	9.56E-03		
Aluminum (Al)	038S0T3801	5900			8.09E-02		2.25E-03		4.07E-03		30.687%
Aroclor-1260	038S0T3801	0.5	U								
Arsenic (As)	038S0T3801	3	U								
BEQ	038S0T3801	2.2166		3.67E-05		1.33E-06		7.46E-06		99.479%	
Cadmium (Cd)	038S0T3801	4.6			1.26E-01		3.51E-03		6.35E-03		47.852%
Chromium (Cr)	038S0T3801	48			6.58E-04		1.83E-05		3.31E-05		0.250%
Copper (Cu)	038S0T3801	28			9.60E-03		2.67E-04		4.83E-04		3.641%
Dieldrin	038S0T3801	0.0053	J	1.92E-07	1.75E-03	6.98E-09	6.11E-05	3.91E-08	1.37E-04	0.521%	1.032%
Lead (Pb)	038S0T3801	110									
Manganese (Mn)	038S0T3801	87			2.54E-02		7.06E-04		1.28E-03		9.628%
Vanadium (V)	038S0T3801	9.3			1.82E-02		5.07E-04		9.16E-04		6.910%
Sum ILCR/HI:				3.69E-05	2.63E-01	1.34E-06	7.32E-03	7.50E-06	1.33E-02		
Aluminum (Al)	038S0T3901	13000			1.78E-01		4.96E-03		8.97E-03		53.953%
Aroclor-1260	038S0T3901	0.5	U								
Arsenic (As)	038S0T3901	6	U								
Cadmium (Cd)	038S0T3901	2.5			6.86E-02		1.91E-03		3.45E-03		20.751%
Chromium (Cr)	038S0T3901	20			2.74E-04		7.63E-06		1.38E-05		0.083%
Copper (Cu)	038S0T3901	43			1.47E-02		4.10E-04		7.42E-04		4.462%
Dieldrin	038S0T3901	0.05	U								
Lead (Pb)	038S0T3901	110									
Manganese (Mn)	038S0T3901	94			2.74E-02		7.63E-04		1.38E-03		8.300%
Vanadium (V)	038S0T3901	21			4.11E-02		1.14E-03		2.07E-03		12.451%
Sum ILCR/HI:					3.30E-01		9.19E-03		1.66E-02		
Aluminum (Al)	038S0T4001	8200			1.12E-01		3.13E-03		5.66E-03		46.007%
Aroclor-1260	038S0T4001	0.5	U								
Arsenic (As)	038S0T4001	3	U								
Cadmium (Cd)	038S0T4001	2.4			6.58E-02		1.83E-03		3.31E-03		26.931%
Chromium (Cr)	038S0T4001	17			2.33E-04		6.49E-06		1.17E-05		0.095%
Copper (Cu)	038S0T4001	59			2.02E-02		5.63E-04		1.02E-03		8.276%
Dieldrin	038S0T4001	0.05	U								
Lead (Pb)	038S0T4001	57									
Manganese (Mn)	038S0T4001	76			2.22E-02		6.17E-04		1.12E-03		9.073%
Vanadium (V)	038S0T4001	12			2.35E-02		6.54E-04		1.18E-03		9.618%
Sum ILCR/HI:					2.44E-01		6.80E-03		1.23E-02		
Aluminum (Al)	038S0T4101	8000			1.10E-01		3.05E-03		5.52E-03		16.169%
Aroclor-1260	038S0T4101	0.5	U								
Arsenic (As)	038S0T4101	3	U								

Table 10-45
Surface Soil Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident		*Site Trespasser*		*Site Worker*			
				LWA	*Child*	*Adolescent*		*Adult*		Percent Contribution to Industrial	Percent Contribution to Industrial
COPC	Sample Designation	Reported Concentration (mg/kg)	VQUAL	ILCR	HQ	ILCR	HQ	ILCR	HQ	ILCR	HI
Cadmium (Cd)	038S0T4101	17			4.66E-01		1.30E-02		2.35E-02		68.720%
Chromium (Cr)	038S0T4101	36			4.94E-04		1.37E-05		2.48E-05		0.073%
Copper (Cu)	038S0T4101	210			7.20E-02		2.00E-03		3.62E-03		10.611%
Dieldrin	038S0T4101	0.05	U								
Lead (Pb)	038S0T4101	360									
Manganese (Mn)	038S0T4101	66			1.93E-02		5.36E-04		9.69E-04		2.838%
Vanadium (V)	038S0T4101	5.5			1.08E-02		3.00E-04		5.42E-04		1.588%
Sum ILCR/HI:					6.78E-01		1.89E-02		3.41E-02		
Aluminum (Al)	038S0T4201	1600			2.19E-02		6.10E-04		1.10E-03		3.231%
Aroclor-1260	038S0T4201	0.5	U								
Arsenic (As)	038S0T4201	3	U								
BEQ	038S0T4201	0.275		4.55E-06		1.65E-07		9.26E-07		100.000%	
Cadmium (Cd)	038S0T4201	21			5.76E-01		1.60E-02		2.90E-02		84.826%
Chromium (Cr)	038S0T4201	40			5.48E-04		1.53E-05		2.76E-05		0.081%
Copper (Cu)	038S0T4201	190	A		6.51E-02		1.81E-03		3.28E-03		9.593%
Dieldrin	038S0T4201	0.05	U								
Lead (Pb)	038S0T4201	270									
Manganese (Mn)	038S0T4201	34			9.92E-03		2.76E-04		4.99E-04		1.461%
Vanadium (V)	038S0T4201	2.8			5.48E-03		1.53E-04		2.76E-04		0.808%
Sum ILCR/HI:				4.55E-06	6.79E-01	1.65E-07	1.89E-02	9.26E-07	3.42E-02		

Notes:

COPC = Chemical of potential concern
VQUAL = Validation qualifier
LWA = Lifetime weighted average
ILCR = Incremental lifetime excess cancer risk
HQ = Hazard quotient
HI = Hazard index
mg/kg = milligrams per kilogram
BEQ = Benzo(a)pyrene equivalent
J = The associated numerical value is an estimated quantity.
U = The material was analyzed for, but not detected; the associated value is the lesser of one half of the sample quantitation limit, or one half of the lowest detected concentration.
N = There is presumptive evidence of presence of material (tentative identification).

The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would double the manganese hazard quotient shown in this table.

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,1-Dichloroethane	036GR73C01	0.01	U						
1,1-Dichloroethene	036GR73C01	0.01	U						
1,2-Dichloroethane	036GR73C01	0.01	U						
1,2-Dichloroethene (total)	036GR73C01	0.01	U						
Acetone	036GR73C01	0.01	U						
Aluminum (Al)	036GR73C01	14			8.95E-01		1.37E-01		51.589%
Arsenic (As)	036GR73C01	0.0018	J	4.02E-05	3.83E-01	9.42E-06	5.87E-02	100.000%	22.110%
Cadmium (Cd)	036GR73C01	0.003	U						
Chloroform	036GR73C01	0.01	U						
Chromium (Cr)	036GR73C01	0.0193			1.23E-03		1.89E-04		0.071%
Copper (Cu)	036GR73C01	0.0359			5.74E-02		8.78E-03		3.307%
Manganese (Mn)	036GR73C01	0.0614			8.35E-02		1.28E-02		4.814%
Tetrachloroethene	036GR73C01	0.01	U						
Trichloroethene	036GR73C01	0.01	U						
Vanadium (V)	036GR73C01	0.0344	J		3.14E-01		4.81E-02		18.109%
Vinyl chloride	036GR73C01	0.01	U						
bis(2-Ethylhexyl)phthalate (BEHP)	036GR73C01	0.01	U						
Sum ILCR/HI:				4.02E-05	1.73E+00	9.42E-06	2.65E-01		
1,1-Dichloroethane	036GR74C01	0.01	U						
1,1-Dichloroethene	036GR74C01	0.01	U						
1,2-Dichloroethane	036GR74C01	0.01	U						
1,2-Dichloroethene (total)	036GR74C01	0.01	U						
Acetone	036GR74C01	0.01	U						
Aluminum (Al)	036GR74C01	1.53			9.78E-02		1.50E-02		7.966%
Arsenic (As)	036GR74C01	0.0046	J	1.03E-04	9.80E-01	2.41E-05	1.50E-01	97.705%	79.836%
Cadmium (Cd)	036GR74C01	0.003	U						
Chloroform	036GR74C01	0.01	U						
Chromium (Cr)	036GR74C01	0.0209			1.34E-03		2.04E-04		0.109%
Copper (Cu)	036GR74C01	0.0447			7.14E-02		1.09E-02		5.818%
Manganese (Mn)	036GR74C01	0.0284			3.86E-02		5.91E-03		3.146%
Tetrachloroethene	036GR74C01	0.003	J	2.42E-06	3.83E-02	5.66E-07	5.87E-03	2.295%	3.124%
Trichloroethene	036GR74C01	0.01	U						
Vanadium (V)	036GR74C01	0.003	U						
Vinyl chloride	036GR74C01	0.01	U						
bis(2-Ethylhexyl)phthalate (BEHP)	036GR74C01	0.011	U						
Sum ILCR/HI:				1.05E-04	1.23E+00	2.46E-05	1.88E-01		

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,1-Dichloroethane	036GR75C01	0.01	U						
1,1-Dichloroethene	036GR75C01	0.01	U						
1,2-Dichloroethane	036GR75C01	0.07		1.90E-04	3.13E+00	4.45E-05	4.79E-01	12.335%	55.662%
1,2-Dichloroethene (total)	036GR75C01	0.01	U						
Acetone	036GR75C01	0.01	U						
Aluminum (Al)	036GR75C01	0.811			5.18E-02		7.93E-03		0.922%
Arsenic (As)	036GR75C01	0.0043	J	9.61E-05	9.16E-01	2.25E-05	1.40E-01	6.245%	16.298%
Cadmium (Cd)	036GR75C01	0.0081			1.04E+00		1.58E-01		18.421%
Chloroform	036GR75C01	0.01	U						
Chromium (Cr)	036GR75C01	0.0811			5.18E-03		7.93E-04		0.092%
Copper (Cu)	036GR75C01	0.0446			7.12E-02		1.09E-02		1.268%
Manganese (Mn)	036GR75C01	0.0526			7.15E-02		1.09E-02		1.273%
Tetrachloroethene	036GR75C01	0.005	J	4.03E-06	6.39E-02	9.43E-07	9.78E-03	0.262%	1.137%
Trichloroethene	036GR75C01	0.013		3.29E-06	2.77E-01	7.71E-07	4.24E-02	0.214%	4.927%
Vanadium (V)	036GR75C01	0.003	U						
Vinyl chloride	036GR75C01	0.038		1.25E-03		2.92E-04		80.944%	
bis(2-Ethylhexyl)phthalate (BEHP)	036GR75C01	0.011	U						
Sum ILCR/HI:				1.54E-03	5.62E+00	3.60E-04	8.60E-01		
1,1-Dichloroethane	036GR76C01	0.007	J		7.60E-03		1.16E-03		0.072%
1,1-Dichloroethene	036GR76C01	0.01	U						
1,2-Dichloroethane	036GR76C01	0.019		5.15E-05	8.49E-01	1.21E-05	1.30E-01	5.212%	8.024%
1,2-Dichloroethene (total)	036GR76C01	0.01	U						
Acetone	036GR76C01	0.01	U						
Aluminum (Al)	036GR76C01	9.12			5.83E-01		8.92E-02		5.507%
Arsenic (As)	036GR76C01	0.011		2.46E-04	2.34E+00	5.76E-05	3.59E-01	24.870%	22.142%
Cadmium (Cd)	036GR76C01	0.0459			5.87E+00		8.98E-01		55.436%
Chloroform	036GR76C01	0.01	U						
Chromium (Cr)	036GR76C01	0.472			3.02E-02		4.62E-03		0.285%
Copper (Cu)	036GR76C01	0.216			3.45E-01		5.28E-02		3.261%
Manganese (Mn)	036GR76C01	0.132			1.79E-01		2.75E-02		1.696%
Tetrachloroethene	036GR76C01	0.01	U						
Trichloroethene	036GR76C01	0.011		2.79E-06	2.34E-01	6.53E-07	3.59E-02	0.282%	2.214%
Vanadium (V)	036GR76C01	0.0158	J		1.44E-01		2.21E-02		1.363%
Vinyl chloride	036GR76C01	0.021		6.88E-04		1.61E-04		69.636%	
bis(2-Ethylhexyl)phthalate (BEHP)	036GR76C01	0.011	U						
Sum ILCR/HI:				9.89E-04	1.06E+01	2.31E-04	1.62E+00		
1,1-Dichloroethane	036GR77C01	0.01	U						

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,1-Dichloroethene	036GR77C01	0.01	U						
1,2-Dichloroethane	036GR77C01	0.01	U						
1,2-Dichloroethene (total)	036GR77C01	0.01	U						
Acetone	036GR77C01	0.01	U						
Aluminum (Al)	036GR77C01	4.1			2.62E-01		4.01E-02		12.438%
Arsenic (As)	036GR77C01	0.0038	J	8.49E-05	8.09E-01	1.99E-05	1.24E-01	4.738%	38.427%
BEQ	036GR77C01	0.0157		1.71E-03		4.00E-04		95.262%	
Cadmium (Cd)	036GR77C01	0.0045	J		5.75E-01		8.80E-02		27.303%
Chloroform	036GR77C01	0.01	U						
Chromium (Cr)	036GR77C01	0.156			9.97E-03		1.53E-03		0.473%
Copper (Cu)	036GR77C01	0.195			3.12E-01		4.77E-02		14.789%
Manganese (Mn)	036GR77C01	0.0776			1.06E-01		1.61E-02		5.009%
Tetrachloroethene	036GR77C01	0.01	U						
Trichloroethene	036GR77C01	0.01	U						
Vanadium (V)	036GR77C01	0.0036	J		3.29E-02		5.03E-03		1.560%
Vinyl chloride	036GR77C01	0.01	U						
bis(2-Ethylhexyl)phthalate (BEHP)	036GR77C01	0.011	UR						
Sum ILCR/HI:				1.79E-03	2.11E+00	4.20E-04	3.22E-01		
1,1-Dichloroethane	036GR78C01	0.01	U						
1,1-Dichloroethene	036GR78C01	0.01	U						
1,2-Dichloroethane	036GR78C01	0.01	U						
1,2-Dichloroethene (total)	036GR78C01	0.01	U						
Acetone	036GR78C01	0.01	U						
Aluminum (Al)	036GR78C01	1.03			6.58E-02		1.01E-02		14.051%
Arsenic (As)	036GR78C01	0.0015	J	3.35E-05	3.20E-01	7.85E-06	4.89E-02	100.000%	68.209%
Cadmium (Cd)	036GR78C01	0.003	U						
Chloroform	036GR78C01	0.01	U						
Chromium (Cr)	036GR78C01	0.0052	J		3.32E-04		5.09E-05		0.071%
Copper (Cu)	036GR78C01	0.0107	J		1.71E-02		2.62E-03		3.649%
Manganese (Mn)	036GR78C01	0.0483			6.57E-02		1.01E-02		14.019%
Tetrachloroethene	036GR78C01	0.01	U						
Trichloroethene	036GR78C01	0.01	U						
Vanadium (V)	036GR78C01	0.003	U						
Vinyl chloride	036GR78C01	0.01	U						
bis(2-Ethylhexyl)phthalate (BEHP)	036GR78C01	0.011	U						
Sum ILCR/HI:				3.35E-05	4.68E-01	7.85E-06	7.17E-02		
1,1-Dichloroethane	036GR79C01	0.01	U						

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,1-Dichloroethene	036GR79C01	0.01	U						
1,2-Dichloroethane	036GR79C01	0.01	U						
1,2-Dichloroethene (total)	036GR79C01	0.01	U						
Acetone	036GR79C01	0.01	U						
Aluminum (Al)	036GR79C01	7.82			5.00E-01		7.65E-02		29.602%
Arsenic (As)	036GR79C01	0.0032	J	7.15E-05	6.82E-01	1.68E-05	1.04E-01	100.000%	40.377%
Cadmium (Cd)	036GR79C01	0.003	U						
Chloroform	036GR79C01	0.01	U						
Chromium (Cr)	036GR79C01	0.0198			1.27E-03		1.94E-04		0.075%
Copper (Cu)	036GR79C01	0.0609			9.73E-02		1.49E-02		5.763%
Manganese (Mn)	036GR79C01	0.217			2.95E-01		4.52E-02		17.477%
Tetrachloroethene	036GR79C01	0.01	U						
Trichloroethene	036GR79C01	0.01	U						
Vanadium (V)	036GR79C01	0.0124	J		1.13E-01		1.73E-02		6.706%
Vinyl chloride	036GR79C01	0.01	U						
bis(2-Ethylhexyl)phthalate (BEHP)	036GR79C01	0.011	U						
Sum ILCR/HI:				7.15E-05	1.69E+00	1.68E-05	2.58E-01		
1,1-Dichloroethane	038G0I0401	0.005	U						
1,1-Dichloroethene	038G0I0401	0.005	U						
1,2-Dichloroethane	038G0I0401	0.005	U						
Acetone	038G0I0401	0.05	U						
Aluminum (Al)	038G0I0401	0.078			4.98E-03		7.63E-04		13.251%
Arsenic (As)	038G0I0401	0.015	U						
Cadmium (Cd)	038G0I0401	0.0025	U						
Chloroform	038G0I0401	0.005	U						
Chromium (Cr)	038G0I0401	0.005	U						
Copper (Cu)	038G0I0401	0.005	U						
Manganese (Mn)	038G0I0401	0.024			3.26E-02		4.99E-03		86.749%
Tetrachloroethene	038G0I0401	0.005	U						
Trichloroethene	038G0I0401	0.005	U						
Vanadium (V)	038G0I0401	0.005	U						
Vinyl chloride	038G0I0401	0.0042		1.38E-04		3.22E-05		100.000%	
bis(2-Ethylhexyl)phthalate (BEHP)	038G0I0401	0.01	U						
cis-1,2-Dichloroethene	038G0I0401	0.005	U						
trans-1,2-Dichloroethene	038G0I0401	0.005	U						
Sum ILCR/HI:				1.38E-04	3.76E-02	3.22E-05	5.76E-03		
1,1-Dichloroethane	038G0I0701	0.005	U						

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,1-Dichloroethene	038G0I0701	0.005	U						
1,2-Dichloroethane	038G0I0701	0.005	U						
Acetone	038G0I0701	0.05	U						
Aluminum (Al)	038G0I0701	0.074			4.73E-03		7.24E-04		19.899%
Arsenic (As)	038G0I0701	0.015	U						
Cadmium (Cd)	038G0I0701	0.0025	U						
Chloroform	038G0I0701	0.005	U						
Chromium (Cr)	038G0I0701	0.005	U						
Copper (Cu)	038G0I0701	0.005	U						
Manganese (Mn)	038G0I0701	0.014			1.90E-02		2.91E-03		80.101%
Tetrachloroethene	038G0I0701	0.005	U						
Trichloroethene	038G0I0701	0.005	U						
Vanadium (V)	038G0I0701	0.005	U						
Vinyl chloride	038G0I0701	0.001	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038G0I0701	0.01	U						
cis-1,2-Dichloroethene	038G0I0701	0.005	U						
trans-1,2-Dichloroethene	038G0I0701	0.005	U						
Sum ILCR/HI:					2.38E-02		3.64E-03		
1,1-Dichloroethane	038G0I0801	0.005	U						
1,1-Dichloroethene	038G0I0801	0.005	U						
1,2-Dichloroethane	038G0I0801	0.005	U						
Acetone	038G0I0801	0.05	U						
Aluminum (Al)	038G0I0801	0.056			3.58E-03		5.48E-04		29.801%
Arsenic (As)	038G0I0801	0.0075	U						
Cadmium (Cd)	038G0I0801	0.0012	U						
Chloroform	038G0I0801	0.005	U						
Chromium (Cr)	038G0I0801	0.0025	U						
Copper (Cu)	038G0I0801	0.0025	U						
Manganese (Mn)	038G0I0801	0.0062			8.43E-03		1.29E-03		70.199%
Tetrachloroethene	038G0I0801	0.005	U						
Trichloroethene	038G0I0801	0.005	U						
Vanadium (V)	038G0I0801	0.0025	U						
Vinyl chloride	038G0I0801	0.0019		6.23E-05		1.46E-05		100.000%	
bis(2-Ethylhexyl)phthalate (BEHP)	038G0I0801	0.01	U						
cis-1,2-Dichloroethene	038G0I0801	0.005	U						
trans-1,2-Dichloroethene	038G0I0801	0.005	U						
Sum ILCR/HI:				6.23E-05	1.20E-02	1.46E-05	1.84E-03		

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident		*Site Worker*			
				LWA	*Child*	*Adult*			
COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	ILCR	HQ	ILCR	HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,1-Dichloroethane	038G0I0901	0.005	U						
1,1-Dichloroethene	038G0I0901	0.005	U						
1,2-Dichloroethane	038G0I0901	0.005	U						
Acetone	038G0I0901	0.05	U						
Aluminum (Al)	038G0I0901	0.075			4.79E-03		7.34E-04		18.054%
Arsenic (As)	038G0I0901	0.015	U						
Cadmium (Cd)	038G0I0901	0.0025	U						
Chloroform	038G0I0901	0.005	U						
Chromium (Cr)	038G0I0901	0.005	U						
Copper (Cu)	038G0I0901	0.005	U						
Manganese (Mn)	038G0I0901	0.016			2.18E-02		3.33E-03		81.946%
Tetrachloroethene	038G0I0901	0.005	U						
Trichloroethene	038G0I0901	0.005	U						
Vanadium (V)	038G0I0901	0.005	U						
Vinyl chloride	038G0I0901	0.001	J	3.28E-05		7.68E-06		100.000%	
bis(2-Ethylhexyl)phthalate (BEHP)	038G0I0901	0.01	U						
cis-1,2-Dichloroethene	038G0I0901	0.005	U						
trans-1,2-Dichloroethene	038G0I0901	0.005	U						
Sum ILCR/HI:				3.28E-05	2.65E-02	7.68E-06	4.06E-03		
1,1-Dichloroethane	038G0S0701	0.0007	AJ		7.60E-04		1.16E-04		0.888%
1,1-Dichloroethene	038G0S0701	0.005	U						
1,2-Dichloroethane	038G0S0701	0.005	U						
Acetone	038G0S0701	0.05	U						
Aluminum (Al)	038G0S0701	0.057			3.64E-03		5.57E-04		4.255%
Arsenic (As)	038G0S0701	0.015	U						
Cadmium (Cd)	038G0S0701	0.0025	U						
Chloroform	038G0S0701	0.005	U						
Chromium (Cr)	038G0S0701	0.005	U						
Copper (Cu)	038G0S0701	0.005	U						
Manganese (Mn)	038G0S0701	0.024			3.26E-02		4.99E-03		38.121%
Tetrachloroethene	038G0S0701	0.005	U						
Trichloroethene	038G0S0701	0.005	U						
Vanadium (V)	038G0S0701	0.005	U						
Vinyl chloride	038G0S0701	0.0062		2.03E-04		4.76E-05		100.000%	
bis(2-Ethylhexyl)phthalate (BEHP)	038G0S0701	0.01	U						
cis-1,2-Dichloroethene	038G0S0701	0.0026	AJ		3.32E-02		5.09E-03		38.819%
trans-1,2-Dichloroethene	038G0S0701	0.0024	AJ		1.53E-02		2.35E-03		17.917%
Sum ILCR/HI:				2.03E-04	8.56E-02	4.76E-05	1.31E-02		

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,1-Dichloroethane	038G0S0901	0.005	U						
1,1-Dichloroethene	038G0S0901	0.005	U						
1,2-Dichloroethane	038G0S0901	0.005	U						
Acetone	038G0S0901	0.05	U						
Aluminum (Al)	038G0S0901	0.05	U						
Arsenic (As)	038G0S0901	0.015	U						
Cadmium (Cd)	038G0S0901	0.0025	U						
Chloroform	038G0S0901	0.005	U						
Chromium (Cr)	038G0S0901	0.005	U						
Copper (Cu)	038G0S0901	0.005	U						
Manganese (Mn)	038G0S0901	0.024			3.26E-02		4.99E-03		6.674%
Tetrachloroethene	038G0S0901	0.0028	AJ	2.25E-06	3.58E-02	5.28E-07	5.48E-03	1.011%	7.320%
Trichloroethene	038G0S0901	0.0084		2.13E-06	1.79E-01	4.98E-07	2.74E-02	0.954%	36.598%
Vanadium (V)	038G0S0901	0.005	U						
Vinyl chloride	038G0S0901	0.0066		2.16E-04		5.07E-05		97.006%	
bis(2-Ethylhexyl)phthalate (BEHP)	038G0S0901	0.011		2.29E-06	3.51E-02	5.37E-07	5.38E-03	1.029%	7.189%
cis-1,2-Dichloroethene	038G0S0901	0.012	A		1.53E-01		2.35E-02		31.370%
trans-1,2-Dichloroethene	038G0S0901	0.0083	A		5.30E-02		8.12E-03		10.849%
Sum ILCR/HIs				2.23E-04	4.89E-01	5.22E-05	7.48E-02		
1,1-Dichloroethane	038G0S1701	0.1	U						
1,1-Dichloroethene	038G0S1701	0.021	J	2.42E-04	2.98E-01	5.68E-05	4.56E-02	0.199%	3.670%
1,2-Dichloroethane	038G0S1701	0.1	U						
Acetone	038G0S1701	1	U						
Aluminum (Al)	038G0S1701	0.055			3.51E-03		5.38E-04		0.043%
Arsenic (As)	038G0S1701	0.0075	U						
Cadmium (Cd)	038G0S1701	0.0012	U						
Chloroform	038G0S1701	0.1	U						
Chromium (Cr)	038G0S1701	0.0044			2.81E-04		4.30E-05		0.003%
Copper (Cu)	038G0S1701	0.0025	U						
Manganese (Mn)	038G0S1701	0.033			4.49E-02		6.87E-03		0.552%
Tetrachloroethene	038G0S1701	0.11		8.86E-05	1.41E+00	2.07E-05	2.15E-01	0.073%	17.301%
Trichloroethene	038G0S1701	0.019	J	4.81E-06	4.05E-01	1.13E-06	6.19E-02	0.004%	4.981%
Vanadium (V)	038G0S1701	0.0025	U						
Vinyl chloride	038G0S1701	3.7		1.21E-01		2.84E-02		99.724%	
bis(2-Ethylhexyl)phthalate (BEHP)	038G0S1701	0.01	U						
cis-1,2-Dichloroethene	038G0S1701	0.46			5.88E+00		9.00E-01		72.349%
trans-1,2-Dichloroethene	038G0S1701	0.014	J		8.95E-02		1.37E-02		1.101%

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Sum ILCR/HI:				1.22E-01	8.13E+00	2.85E-02	1.24E+00		
1,1-Dichloroethane	038G0S1801	0.0011	J		1.19E-03		1.83E-04		0.336%
1,1-Dichloroethene	038G0S1801	0.0007	J	8.08E-06	9.94E-03	1.89E-06	1.52E-03	44.761%	2.796%
1,2-Dichloroethane	038G0S1801	0.005	U						
Acetone	038G0S1801	0.05	U						
Aluminum (Al)	038G0S1801	0.064			4.09E-03		6.26E-04		1.150%
Arsenic (As)	038G0S1801	0.015	U						
Cadmium (Cd)	038G0S1801	0.0025	U						
Chloroform	038G0S1801	0.005	U						
Chromium (Cr)	038G0S1801	0.005	U						
Copper (Cu)	038G0S1801	0.0053			8.47E-03		1.30E-03		2.382%
Manganese (Mn)	038G0S1801	0.015			2.04E-02		3.12E-03		5.737%
Tetrachloroethene	038G0S1801	0.01		8.05E-06	1.28E-01	1.89E-06	1.96E-02	44.579%	35.950%
Trichloroethene	038G0S1801	0.0076		1.93E-06	1.62E-01	4.51E-07	2.48E-02	10.660%	45.537%
Vanadium (V)	038G0S1801	0.005	U						
Vinyl chloride	038G0S1801	0.001	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038G0S1801	0.01	U						
cis-1,2-Dichloroethene	038G0S1801	0.0017	J		2.17E-02		3.33E-03		6.112%
trans-1,2-Dichloroethene	038G0S1801	0.005	U						
Sum ILCR/HI:				1.81E-05	3.55E-01	4.23E-06	5.44E-02		
1,1-Dichloroethane	038G0S2201	0.032	A		3.47E-02		5.32E-03		6.792%
1,1-Dichloroethene	038G0S2201	0.0013	AJ	1.50E-05	1.85E-02	3.52E-06	2.83E-03	0.648%	3.608%
1,2-Dichloroethane	038G0S2201	0.005	U						
Acetone	038G0S2201	0.05	U						
Aluminum (Al)	038G0S2201	0.052			3.32E-03		5.09E-04		0.649%
Arsenic (As)	038G0S2201	0.015	U						
Cadmium (Cd)	038G0S2201	0.0025	U						
Chloroform	038G0S2201	0.005	U						
Chromium (Cr)	038G0S2201	0.022			1.41E-03		2.15E-04		0.275%
Copper (Cu)	038G0S2201	0.005	U						
Manganese (Mn)	038G0S2201	0.005	U						
Tetrachloroethene	038G0S2201	0.007	A	5.64E-06	8.95E-02	1.32E-06	1.37E-02	0.243%	17.485%
Trichloroethene	038G0S2201	0.009	A	2.28E-06	1.92E-01	5.34E-07	2.93E-02	0.098%	37.469%
Vanadium (V)	038G0S2201	0.005	U						
Vinyl chloride	038G0S2201	0.07		2.29E-03		5.37E-04		99.011%	
bis(2-Ethylhexyl)phthalate (BEHP)	038G0S2201	0.01	U						
cis-1,2-Dichloroethene	038G0S2201	0.012	A		1.53E-01		2.35E-02		29.975%

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
trans-1,2-Dichloroethene	038G0S2201	0.003	AJ		1.92E-02		2.93E-03		3.747%
Sum ILCR/HI:				2.32E-03	5.12E-01	5.43E-04	7.83E-02		
1,1-Dichloroethane	038G0S2401	0.005	U						
1,1-Dichloroethene	038G0S2401	0.005	U						
1,2-Dichloroethane	038G0S2401	0.005	U						
Acetone	038G0S2401	0.05	U						
Aluminum (Al)	038G0S2401	0.055			3.51E-03		5.38E-04		0.227%
Arsenic (As)	038G0S2401	0.015	U						
Cadmium (Cd)	038G0S2401	0.011			1.41E+00		2.15E-01		90.724%
Chloroform	038G0S2401	0.005	U						
Chromium (Cr)	038G0S2401	0.005	U						
Copper (Cu)	038G0S2401	0.005	U						
Manganese (Mn)	038G0S2401	0.027			3.67E-02		5.62E-03		2.369%
Tetrachloroethene	038G0S2401	0.005	U						
Trichloroethene	038G0S2401	0.0036	J	9.12E-07	7.67E-02	2.14E-07	1.17E-02	100.000%	4.949%
Vanadium (V)	038G0S2401	0.005	U						
Vinyl chloride	038G0S2401	0.001	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038G0S2401	0.01	U						
cis-1,2-Dichloroethene	038G0S2401	0.0014	J		1.79E-02		2.74E-03		1.155%
trans-1,2-Dichloroethene	038G0S2401	0.0014	J		8.95E-03		1.37E-03		0.577%
Sum ILCR/HI:				9.12E-07	1.55E+00	2.14E-07	2.37E-01		
1,1-Dichloroethane	038G0S2501	0.005	U						
1,1-Dichloroethene	038G0S2501	0.005	U						
1,2-Dichloroethane	038G0S2501	0.005	U						
Acetone	038G0S2501	0.05	U						
Aluminum (Al)	038G0S2501	0.23			1.47E-02		2.25E-03		41.989%
Arsenic (As)	038G0S2501	0.0075	U						
Cadmium (Cd)	038G0S2501	0.0012	U						
Chloroform	038G0S2501	0.005	U						
Chromium (Cr)	038G0S2501	0.0025	U						
Copper (Cu)	038G0S2501	0.0082			1.31E-02		2.00E-03		37.425%
Manganese (Mn)	038G0S2501	0.0053			7.21E-03		1.10E-03		20.587%
Tetrachloroethene	038G0S2501	0.005	U						
Trichloroethene	038G0S2501	0.005	U						
Vanadium (V)	038G0S2501	0.0025	U						
Vinyl chloride	038G0S2501	0.005	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038G0S2501	0.01	U						

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
cis-1,2-Dichloroethene	038G0S2501	0.005	U						
trans-1,2-Dichloroethene	038G0S2501	0.005	U						
Sum ILCR/HI:					3.50E-02		5.36E-03		
1,1-Dichloroethane	038G0S2601	0.005	U						
1,1-Dichloroethene	038G0S2601	0.005	U						
1,2-Dichloroethane	038G0S2601	0.005	U						
Acetone	038G0S2601	0.05	U						
Aluminum (Al)	038G0S2601	0.062			3.96E-03		6.06E-04		2.371%
Arsenic (As)	038G0S2601	0.015	U						
Cadmium (Cd)	038G0S2601	0.0025	U						
Chloroform	038G0S2601	0.005	U						
Chromium (Cr)	038G0S2601	0.005	U						
Copper (Cu)	038G0S2601	0.005	U						
Manganese (Mn)	038G0S2601	0.12			1.63E-01		2.50E-02		97.629%
Tetrachloroethene	038G0S2601	0.005	U						
Trichloroethene	038G0S2601	0.005	U						
Vanadium (V)	038G0S2601	0.005	U						
Vinyl chloride	038G0S2601	0.005	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038G0S2601	0.01	U						
cis-1,2-Dichloroethene	038G0S2601	0.005	U						
trans-1,2-Dichloroethene	038G0S2601	0.005	U						
Sum ILCR/HI:					1.67E-01		2.50E-02		
1,1-Dichloroethane	038G0S2701	0.005	U						
1,1-Dichloroethene	038G0S2701	0.005	U						
1,2-Dichloroethane	038G0S2701	0.005	U						
Acetone	038G0S2701	0.05	U						
Aluminum (Al)	038G0S2701	0.25			1.60E-02		2.45E-03		7.687%
Arsenic (As)	038G0S2701	0.006	U						
Cadmium (Cd)	038G0S2701	0.0011			1.41E-01		2.15E-02		67.648%
Chloroform	038G0S2701	0.005	U						
Chromium (Cr)	038G0S2701	0.002	U						
Copper (Cu)	038G0S2701	0.002	U						
Manganese (Mn)	038G0S2701	0.0048			6.53E-03		9.99E-04		3.140%
Tetrachloroethene	038G0S2701	0.001	J	8.05E-07	1.28E-02	1.89E-07	1.96E-03	100.000%	6.150%
Trichloroethene	038G0S2701	0.005	U						
Vanadium (V)	038G0S2701	0.0035			3.20E-02		4.89E-03		15.375%
Vinyl chloride	038G0S2701	0.001	U						

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
bis(2-Ethylhexyl)phthalate (BEHP)	038G0S2701	0.01	U						
cis-1,2-Dichloroethene	038G0S2701	0.005	U						
trans-1,2-Dichloroethene	038G0S2701	0.005	U						
Sum ILCR/HI:				8.05E-07	2.08E-01	1.89E-07	3.18E-02		
1,1-Dichloroethane	038G0S2801	0.005	U						
1,1-Dichloroethene	038G0S2801	0.005	U						
1,2-Dichloroethane	038G0S2801	0.005	U						
Acetone	038G0S2801	0.05	U						
Aluminum (Al)	038G0S2801	0.24			1.53E-02		2.35E-03		15.499%
Arsenic (As)	038G0S2801	0.006	U						
Cadmium (Cd)	038G0S2801	0.001	U						
Chloroform	038G0S2801	0.0012	J	1.55E-06	1.53E-02	3.63E-07	2.35E-03	100.000%	15.499%
Chromium (Cr)	038G0S2801	0.002	U						
Copper (Cu)	038G0S2801	0.0041			6.55E-03		1.00E-03		6.619%
Manganese (Mn)	038G0S2801	0.0078			1.06E-02		1.62E-03		10.718%
Tetrachloroethene	038G0S2801	0.005	U						
Trichloroethene	038G0S2801	0.005	U						
Vanadium (V)	038G0S2801	0.0056			5.11E-02		7.82E-03		51.664%
Vinyl chloride	038G0S2801	0.001	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038G0S2801	0.01	U						
cis-1,2-Dichloroethene	038G0S2801	0.005	U						
trans-1,2-Dichloroethene	038G0S2801	0.005	U						
Sum ILCR/HI:				1.55E-06	9.89E-02	3.63E-07	1.51E-02		
1,1-Dichloroethane	038G0S2901	0.005	U						
1,1-Dichloroethene	038G0S2901	0.005	U						
1,2-Dichloroethane	038G0S2901	0.005	U						
Acetone	038G0S2901	0.05	U						
Aluminum (Al)	038G0S2901	0.19			1.21E-02		1.86E-03		0.345%
Arsenic (As)	038G0S2901	0.012		2.68E-04	2.56E+00	6.28E-05	3.91E-01	15.968%	72.626%
Cadmium (Cd)	038G0S2901	0.0017			2.17E-01		3.33E-02		6.173%
Chloroform	038G0S2901	0.005	U						
Chromium (Cr)	038G0S2901	0.0076			4.86E-04		7.43E-05		0.014%
Copper (Cu)	038G0S2901	0.026			4.15E-02		6.36E-03		1.180%
Manganese (Mn)	038G0S2901	0.13			1.77E-01		2.71E-02		5.022%
Tetrachloroethene	038G0S2901	0.001	AJ	8.05E-07	1.28E-02	1.89E-07	1.96E-03	0.048%	0.363%
Trichloroethene	038G0S2901	0.004	AJ	1.01E-06	8.52E-02	2.37E-07	1.30E-02	0.060%	2.421%
Vanadium (V)	038G0S2901	0.002	U						

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Vinyl chloride	038G0S2901	0.043		1.41E-03		3.30E-04		83.923%	
bis(2-Ethylhexyl)phthalate (BEHP)	038G0S2901	0.01	U						
cis-1,2-Dichloroethene	038G0S2901	0.028	A		3.58E-01		5.48E-02		10.168%
trans-1,2-Dichloroethene	038G0S2901	0.0093	A		5.94E-02		9.10E-03		1.689%
Sum ILCR/HI:				1.68E-03	3.52E+00	3.93E-04	5.39E-01		
1,1-Dichloroethane	038G0S3001	0.005	U						
1,1-Dichloroethene	038G0S3001	0.005	U						
1,2-Dichloroethane	038G0S3001	0.005	U						
Acetone	038G0S3001	0.05	U						
Aluminum (Al)	038G0S3001	0.28			1.79E-02		2.74E-03		0.486%
Arsenic (As)	038G0S3001	0.017		3.80E-04	3.62E+00	8.90E-05	5.54E-01	99.683%	98.406%
Cadmium (Cd)	038G0S3001	0.001	U						
Chloroform	038G0S3001	0.005	U						
Chromium (Cr)	038G0S3001	0.002	U						
Copper (Cu)	038G0S3001	0.0037			5.91E-03		9.05E-04		0.161%
Manganese (Mn)	038G0S3001	0.0059			8.02E-03		1.23E-03		0.218%
Tetrachloroethene	038G0S3001	0.0015	AJ	1.21E-06	1.92E-02	2.83E-07	2.93E-03	0.317%	0.521%
Trichloroethene	038G0S3001	0.005	U						
Vanadium (V)	038G0S3001	0.002	U						
Vinyl chloride	038G0S3001	0.001	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038G0S3001	0.01	U						
cis-1,2-Dichloroethene	038G0S3001	0.0006	AJ		7.67E-03		1.17E-03		0.208%
trans-1,2-Dichloroethene	038G0S3001	0.005	U						
Sum ILCR/HI:				3.81E-04	3.68E+00	8.93E-05	5.63E-01		
1,1-Dichloroethane	038G0S3101	0.005	U						
1,1-Dichloroethene	038G0S3101	0.005	U						
1,2-Dichloroethane	038G0S3101	0.005	U						
Acetone	038G0S3101	0.05	U						
Aluminum (Al)	038G0S3101	0.32			2.04E-02		3.13E-03		100.000%
Arsenic (As)	038G0S3101	0.015	U						
Cadmium (Cd)	038G0S3101	0.0025	U						
Chloroform	038G0S3101	0.005	U						
Chromium (Cr)	038G0S3101	0.005	U						
Copper (Cu)	038G0S3101	0.005	U						
Manganese (Mn)	038G0S3101	0.005	U						
Tetrachloroethene	038G0S3101	0.005	U						
Trichloroethene	038G0S3101	0.005	U						

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COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Vanadium (V)	038G0S3101	0.005	U						
Vinyl chloride	038G0S3101	0.001	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038G0S3101	0.01	U						
cis-1,2-Dichloroethene	038G0S3101	0.005	U						
trans-1,2-Dichloroethene	038G0S3101	0.005	U						
Sum ILCR/HI:					2.04E-02		3.13E-03		
1,1-Dichloroethane	038G0S3201	0.075	U						
1,1-Dichloroethene	038G0S3201	0.075	U						
1,2-Dichloroethane	038G0S3201	0.075	U						
Acetone	038G0S3201	0.75	U						
Aluminum (Al)	038G0S3201	0.074			4.73E-03		7.24E-04		0.017%
Arsenic (As)	038G0S3201	0.0084		1.88E-04	1.79E+00	4.40E-05	2.74E-01	3.610%	6.359%
Cadmium (Cd)	038G0S3201	0.002	U						
Chloroform	038G0S3201	0.075	U						
Chromium (Cr)	038G0S3201	0.004	U						
Copper (Cu)	038G0S3201	0.004	U						
Manganese (Mn)	038G0S3201	0.026			3.53E-02		5.41E-03		0.126%
Tetrachloroethene	038G0S3201	0.82		6.60E-04	1.05E+01	1.55E-04	1.60E+00	12.695%	37.248%
Trichloroethene	038G0S3201	0.34		8.61E-05	7.24E+00	2.02E-05	1.11E+00	1.656%	25.741%
Vanadium (V)	038G0S3201	0.0065			5.93E-02		9.08E-03		0.211%
Vinyl chloride	038G0S3201	0.13		4.26E-03		9.98E-04		81.950%	
bis(2-Ethylhexyl)phthalate (BEHP)	038G0S3201	0.022		4.59E-06	7.03E-02	1.07E-06	1.08E-02	0.088%	0.250%
cis-1,2-Dichloroethene	038G0S3201	0.64			8.18E+00		1.25E+00		29.072%
trans-1,2-Dichloroethene	038G0S3201	0.043	J		2.75E-01		4.21E-02		0.977%
Sum ILCR/HI:				5.20E-03	2.81E+01	1.22E-03	4.31E+00		
Cadmium (Cd)	038G0T0101	0.005	U						
Chromium (Cr)	038G0T0101	0.05	U						
Tetrachloroethene	038G0T0101	0.005	U						
Trichloroethene	038G0T0101	0.005	U						
Vinyl chloride	038G0T0101	0.05	U						
cis-1,2-Dichloroethene	038G0T0101	0.005	U						
trans-1,2-Dichloroethene	038G0T0101	0.005	U						
Sum ILCR/HI:									
Cadmium (Cd)	038G0T0301	0.005	U						
Chromium (Cr)	038G0T0301	0.05	U						
Tetrachloroethene	038G0T0301	0.1	JN	8.05E-05	1.28E+00	1.89E-05	1.96E-01	84.120%	40.816%

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COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Trichloroethene	038G0T0301	0.06	JN	1.52E-05	1.28E+00	3.56E-06	1.96E-01	15.880%	40.816%
Vinyl chloride	038G0T0301	0.05	U						
cis-1,2-Dichloroethene	038G0T0301	0.045	JN		5.75E-01		8.80E-02		18.367%
trans-1,2-Dichloroethene	038G0T0301	0.005	U						
Sum ILCR/HI:				9.57E-05	3.13E+00	2.24E-05	4.79E-01		
Cadmium (Cd)	038G0T0601	0.005	U						
Chromium (Cr)	038G0T0601	0.05	U						
Tetrachloroethene	038G0T0601	0.005	U						
Trichloroethene	038G0T0601	0.005	U						
Vinyl chloride	038G0T0601	0.05	U						
cis-1,2-Dichloroethene	038G0T0601	0.005	U						
trans-1,2-Dichloroethene	038G0T0601	0.005	U						
Sum ILCR/HI:									
Cadmium (Cd)	038G0T0701	0.005	U						
Chromium (Cr)	038G0T0701	0.05	U						
Tetrachloroethene	038G0T0701	0.005	U						
Trichloroethene	038G0T0701	0.005	U						
Vinyl chloride	038G0T0701	0.05	U						
cis-1,2-Dichloroethene	038G0T0701	0.005	U						
trans-1,2-Dichloroethene	038G0T0701	0.005	U						
Sum ILCR/HI:									
Cadmium (Cd)	038G0T0801	0.068			8.69E+00		1.33E+00		100.000%
Chromium (Cr)	038G0T0801	0.05	U						
Tetrachloroethene	038G0T0801	0.005	U						
Trichloroethene	038G0T0801	0.005	U						
Vinyl chloride	038G0T0801	0.05	U						
cis-1,2-Dichloroethene	038G0T0801	0.005	U						
trans-1,2-Dichloroethene	038G0T0801	0.005	U						
Sum ILCR/HI:					8.69E+00		1.33E+00		
Cadmium (Cd)	038G0T0901	0.005	U						
Chromium (Cr)	038G0T0901	0.05	U						
Tetrachloroethene	038G0T0901	0.005	U						
Trichloroethene	038G0T0901	0.005	U						
Vinyl chloride	038G0T0901	0.05	U						
cis-1,2-Dichloroethene	038G0T0901	0.005	U						

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				Site Resident		*Site Worker*			
				LWA	*Child*	*Adult*			
COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	ILCR	HQ	ILCR	HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
trans-1,2-Dichloroethene	038G0T0901	0.005	U						
Sum ILCR/HI:									
Cadmium (Cd)	038G0T1001	0.011			1.41E+00		2.15E-01		98.876%
Chromium (Cr)	038G0T1001	0.25			1.60E-02		2.45E-03		1.124%
Tetrachloroethene	038G0T1001	0.005	U						
Trichloroethene	038G0T1001	0.005	U						
Vinyl chloride	038G0T1001	0.05	U						
cis-1,2-Dichloroethene	038G0T1001	0.005	U						
trans-1,2-Dichloroethene	038G0T1001	0.005	U						
Sum ILCR/HI:					1.42E+00		2.18E-01		
Cadmium (Cd)	038G0T1101	0.005	U						
Chromium (Cr)	038G0T1101	0.05	U						
Tetrachloroethene	038G0T1101	0.005	U						
Trichloroethene	038G0T1101	0.005	U						
Vinyl chloride	038G0T1101	0.05	U						
cis-1,2-Dichloroethene	038G0T1101	0.005	U						
trans-1,2-Dichloroethene	038G0T1101	0.005	U						
Sum ILCR/HI:									
Cadmium (Cd)	038G0T1201	0.005	U						
Chromium (Cr)	038G0T1201	0.05	U						
Tetrachloroethene	038G0T1201	0.005	U						
Trichloroethene	038G0T1201	0.005	U						
Vinyl chloride	038G0T1201	0.05	U						
cis-1,2-Dichloroethene	038G0T1201	0.005	U						
trans-1,2-Dichloroethene	038G0T1201	0.005	U						
Sum ILCR/HI:									
Cadmium (Cd)	038G0T1301	0.005	U						
Chromium (Cr)	038G0T1301	0.05	U						
Tetrachloroethene	038G0T1301	0.005	U						
Trichloroethene	038G0T1301	0.005	U						
Vinyl chloride	038G0T1301	0.05	U						
cis-1,2-Dichloroethene	038G0T1301	0.005	U						
trans-1,2-Dichloroethene	038G0T1301	0.005	U						
Sum ILCR/HI:									

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COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Cadmium (Cd)	038G0T1401	0.005	U						
Chromium (Cr)	038G0T1401	0.05	U						
Tetrachloroethene	038G0T1401	0.005	U						
Trichloroethene	038G0T1401	0.005	JN	1.27E-06	1.07E-01	2.97E-07	1.63E-02	100.000%	37.313%
Vinyl chloride	038G0T1401	0.05	U						
cis-1,2-Dichloroethene	038G0T1401	0.014	JN		1.79E-01		2.74E-02		62.687%
trans-1,2-Dichloroethene	038G0T1401	0.005	U						
Sum ILCR/HI:				1.27E-06	2.85E-01	2.97E-07	4.37E-02		
Cadmium (Cd)	038G0T1501	0.005	U						
Chromium (Cr)	038G0T1501	0.05	U						
Tetrachloroethene	038G0T1501	0.005	U						
Trichloroethene	038G0T1501	0.005	U						
Vinyl chloride	038G0T1501	0.05	U						
cis-1,2-Dichloroethene	038G0T1501	0.005	U						
trans-1,2-Dichloroethene	038G0T1501	0.005	U						
Sum ILCR/HI:									
Cadmium (Cd)	038G0T1601	0.005	U						
Chromium (Cr)	038G0T1601	0.05	U						
Tetrachloroethene	038G0T1601	0.005	U						
Trichloroethene	038G0T1601	0.005	U						
Vinyl chloride	038G0T1601	0.05	U						
cis-1,2-Dichloroethene	038G0T1601	0.005	U						
trans-1,2-Dichloroethene	038G0T1601	0.005	U						
Sum ILCR/HI:									
Cadmium (Cd)	038G0T1701	0.005	U						
Chromium (Cr)	038G0T1701	0.05	U						
Tetrachloroethene	038G0T1701	0.005	U						
Trichloroethene	038G0T1701	0.005	U						
Vinyl chloride	038G0T1701	0.05	U						
cis-1,2-Dichloroethene	038G0T1701	0.005	U						
trans-1,2-Dichloroethene	038G0T1701	0.005	U						
Sum ILCR/HI:									
Cadmium (Cd)	038G0T1801	0.005	U						
Chromium (Cr)	038G0T1801	0.05	U						
Tetrachloroethene	038G0T1801	0.005	U						

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COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Trichloroethene	038G0T1801	0.005	U						
Vinyl chloride	038G0T1801	0.05	U						
cis-1,2-Dichloroethene	038G0T1801	0.005	U						
trans-1,2-Dichloroethene	038G0T1801	0.005	U						
Sum ILCR/HIs									
Cadmium (Cd)	038G0T1901	0.005	U						
Chromium (Cr)	038G0T1901	0.05	U						
Tetrachloroethene	038G0T1901	0.005	U						
Trichloroethene	038G0T1901	0.005	U						
Vinyl chloride	038G0T1901	0.05	U						
cis-1,2-Dichloroethene	038G0T1901	0.005	U						
trans-1,2-Dichloroethene	038G0T1901	0.005	U						
Sum ILCR/HIs									
Cadmium (Cd)	038G0T2001	0.005	U						
Chromium (Cr)	038G0T2001	0.05	U						
Tetrachloroethene	038G0T2001	0.005	U						
Trichloroethene	038G0T2001	0.005	U						
Vinyl chloride	038G0T2001	0.05	U						
cis-1,2-Dichloroethene	038G0T2001	0.005	U						
trans-1,2-Dichloroethene	038G0T2001	0.005	U						
Sum ILCR/HIs									
Cadmium (Cd)	038G0T2201	0.005	U						
Chromium (Cr)	038G0T2201	0.05	U						
Tetrachloroethene	038G0T2201	0.005	U						
Trichloroethene	038G0T2201	0.005	U						
Vinyl chloride	038G0T2201	0.05	U						
cis-1,2-Dichloroethene	038G0T2201	0.005	U						
trans-1,2-Dichloroethene	038G0T2201	0.005	U						
Sum ILCR/HIs									
Cadmium (Cd)	038G0T2301	0.005	U						
Chromium (Cr)	038G0T2301	0.05	U						
Tetrachloroethene	038G0T2301	0.005	U						
Trichloroethene	038G0T2301	0.005	U						
Vinyl chloride	038G0T2301	0.05	U						
cis-1,2-Dichloroethene	038G0T2301	0.005	U						

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COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
trans-1,2-Dichloroethene	038G0T2301	0.005	U						
Sum ILCR/HI:									
Cadmium (Cd)	038G0T2501	0.005	U						
Chromium (Cr)	038G0T2501	0.05	U						
Tetrachloroethene	038G0T2501	0.005	U						
Trichloroethene	038G0T2501	0.005	U						
Vinyl chloride	038G0T2501	0.05	U						
cis-1,2-Dichloroethene	038G0T2501	0.005	U						
trans-1,2-Dichloroethene	038G0T2501	0.005	U						
Sum ILCR/HI:									
Cadmium (Cd)	038G0T2601	0.005	U						
Chromium (Cr)	038G0T2601	0.05	U						
Tetrachloroethene	038G0T2601	0.005	U						
Trichloroethene	038G0T2601	0.005	U						
Vinyl chloride	038G0T2601	0.05	U						
cis-1,2-Dichloroethene	038G0T2601	0.005	U						
trans-1,2-Dichloroethene	038G0T2601	0.005	U						
Sum ILCR/HI:									
Cadmium (Cd)	038G0T2701	0.005	U						
Chromium (Cr)	038G0T2701	0.05	U						
Tetrachloroethene	038G0T2701	0.006	JN	4.83E-06	7.67E-02	1.13E-06	1.17E-02	50.091%	15.929%
Trichloroethene	038G0T2701	0.019	JN	4.81E-06	4.05E-01	1.13E-06	6.19E-02	49.909%	84.071%
Vinyl chloride	038G0T2701	0.05	U						
cis-1,2-Dichloroethene	038G0T2701	0.005	U						
trans-1,2-Dichloroethene	038G0T2701	0.005	U						
Sum ILCR/HI:				9.64E-06	4.81E-01	2.26E-06	7.37E-02		
Cadmium (Cd)	038G0T2801	0.005	U						
Chromium (Cr)	038G0T2801	0.05	U						
Tetrachloroethene	038G0T2801	0.015	JN	1.21E-05	1.92E-01	2.83E-06	2.93E-02	84.120%	35.714%
Trichloroethene	038G0T2801	0.009	JN	2.28E-06	1.92E-01	5.34E-07	2.93E-02	15.880%	35.714%
Vinyl chloride	038G0T2801	0.05	U						
cis-1,2-Dichloroethene	038G0T2801	0.012	JN		1.53E-01		2.35E-02		28.571%
trans-1,2-Dichloroethene	038G0T2801	0.005	U						
Sum ILCR/HI:				1.44E-05	5.37E-01	3.36E-06	8.22E-02		

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COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Cadmium (Cd)	038G0T2901	0.005	U						
Chromium (Cr)	038G0T2901	0.05	U						
Tetrachloroethene	038G0T2901	0.033	JN	2.66E-05	4.22E-01	6.22E-06	6.45E-02	89.733%	62.264%
Trichloroethene	038G0T2901	0.012	JN	3.04E-06	2.56E-01	7.12E-07	3.91E-02	10.267%	37.736%
Sum ILCR/HI:				2.96E-05	6.77E-01	6.93E-06	1.04E-01		
Cadmium (Cd)	038G0T3001	0.005	U						
Chromium (Cr)	038G0T3001	0.28			1.79E-02		2.74E-03		3.494%
Tetrachloroethene	038G0T3001	0.017	JN	1.37E-05	2.17E-01	3.21E-06	3.33E-02	80.606%	42.429%
Trichloroethene	038G0T3001	0.013	JN	3.29E-06	2.77E-01	7.71E-07	4.24E-02	19.394%	54.077%
Vinyl chloride	038G0T3001	0.05	U						
cis-1,2-Dichloroethene	038G0T3001	0.005	U						
trans-1,2-Dichloroethene	038G0T3001	0.005	U						
Sum ILCR/HI:				1.70E-05	5.12E-01	3.98E-06	7.84E-02		
Cadmium (Cd)	038G0T3101	0.005	U						
Chromium (Cr)	038G0T3101	0.05	U						
Tetrachloroethene	038G0T3101	0.13	JNE	1.05E-04	1.66E+00	2.45E-05	2.54E-01	100.000%	100.000%
Trichloroethene	038G0T3101	0.005	U						
Vinyl chloride	038G0T3101	0.05	U						
cis-1,2-Dichloroethene	038G0T3101	0.005	U						
trans-1,2-Dichloroethene	038G0T3101	0.005	U						
Sum ILCR/HI:				1.05E-04	1.66E+00	2.45E-05	2.54E-01		
1,1-Dichloroethane	038GGI0401	0.01	U						
1,1-Dichloroethene	038GGI0401	0.01	U						
1,2-Dichloroethane	038GGI0401	0.01	U						
1,2-Dichloroethene (total)	038GGI0401	0.01	U						
Acetone	038GGI0401	0.006	J		3.83E-03		5.87E-04		0.103%
Aluminum (Al)	038GGI0401	9.11	J		5.82E-01		8.91E-02		15.655%
Arsenic (As)	038GGI0401	0.0048		1.07E-04	1.02E+00	2.51E-05	1.56E-01	100.000%	27.496%
Cadmium (Cd)	038GGI0401	0.0145			1.85E+00		2.84E-01		49.836%
Chloroform	038GGI0401	0.01	U						
Chromium (Cr)	038GGI0401	0.37			2.36E-02		3.62E-03		0.636%
Copper (Cu)	038GGI0401	0.0269			4.30E-02		6.58E-03		1.156%
Manganese (Mn)	038GGI0401	0.14			1.90E-01		2.91E-02		5.119%
Tetrachloroethene	038GGI0401	0.01	U						
Trichloroethene	038GGI0401	0.01	U						
Vanadium (V)	038GGI0401	0.0215	UJ						

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Vinyl chloride	038GGI0401	0.01	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038GGI0401	0.001	U						
Sum ILCR/HI:				1.07E-04	3.72E+00	2.51E-05	5.69E-01		
1,1-Dichloroethane	038GGI0701	0.01	U						
1,1-Dichloroethene	038GGI0701	0.01	U						
1,2-Dichloroethane	038GGI0701	0.01	U						
1,2-Dichloroethene (total)	038GGI0701	0.01	U						
Acetone	038GGI0701	0.015	J		9.59E-03		1.47E-03		7.516%
Aluminum (Al)	038GGI0701	0.223			1.42E-02		2.18E-03		11.173%
Arsenic (As)	038GGI0701	0.002	UJ						
Cadmium (Cd)	038GGI0701	0.003	U						
Chloroform	038GGI0701	0.01	U						
Chromium (Cr)	038GGI0701	0.0062			3.96E-04		6.06E-05		0.311%
Copper (Cu)	038GGI0701	0.0061			9.74E-03		1.49E-03		7.641%
Manganese (Mn)	038GGI0701	0.048			6.53E-02		9.99E-03		51.170%
Tetrachloroethene	038GGI0701	0.01	U						
Trichloroethene	038GGI0701	0.01	U						
Vanadium (V)	038GGI0701	0.0031			2.83E-02		4.33E-03		22.189%
Vinyl chloride	038GGI0701	0.01	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038GGI0701	0.004	U						
Sum ILCR/HI:					1.28E-01		1.95E-02		
1,1-Dichloroethane	038GGI0801	0.01	U						
1,1-Dichloroethene	038GGI0801	0.01	U						
1,2-Dichloroethane	038GGI0801	0.01	U						
1,2-Dichloroethene (total)	038GGI0801	0.01	U						
Acetone	038GGI0801	0.04	U						
Aluminum (Al)	038GGI0801	0.101	J		6.45E-03		9.88E-04		16.118%
Arsenic (As)	038GGI0801	0.002	U						
Cadmium (Cd)	038GGI0801	0.003	U						
Chloroform	038GGI0801	0.01	U						
Chromium (Cr)	038GGI0801	0.004	U						
Copper (Cu)	038GGI0801	0.0046			7.35E-03		1.12E-03		18.352%
Manganese (Mn)	038GGI0801	0.0193			2.62E-02		4.02E-03		65.530%
Tetrachloroethene	038GGI0801	0.01	U						
Trichloroethene	038GGI0801	0.01	U						
Vanadium (V)	038GGI0801	0.003	U						
Vinyl chloride	038GGI0801	0.01	U						

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
bis(2-Ethylhexyl)phthalate (BEHP)	038GGI0801	0.002	U						
Sum ILCR/HI:					4.00E-02		6.13E-03		
1,1-Dichloroethane	038GGI0901	0.05	U						
1,1-Dichloroethene	038GGI0901	0.05	U						
1,2-Dichloroethane	038GGI0901	0.05	U						
1,2-Dichloroethene (total)	038GGI0901	0.05	U						
Acetone	038GGI0901	0.5	J		3.20E-01		4.89E-02		76.271%
Aluminum (Al)	038GGI0901	0.241	J		1.54E-02		2.36E-03		3.676%
Arsenic (As)	038GGI0901	0.002	U						
Cadmium (Cd)	038GGI0901	0.003	U						
Chloroform	038GGI0901	0.05	U						
Chromium (Cr)	038GGI0901	0.0054			3.45E-04		5.28E-05		0.082%
Copper (Cu)	038GGI0901	0.0085			1.36E-02		2.08E-03		3.242%
Manganese (Mn)	038GGI0901	0.0173			2.35E-02		3.60E-03		5.615%
Tetrachloroethene	038GGI0901	0.05	U						
Trichloroethene	038GGI0901	0.05	U						
Vanadium (V)	038GGI0901	0.0051			4.66E-02		7.13E-03		11.114%
Vinyl chloride	038GGI0901	0.05	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038GGI0901	0.002	U						
Sum ILCR/HI:					4.19E-01		6.41E-02		
1,1-Dichloroethane	038GGS0701	0.003	J		3.26E-03		4.99E-04		0.901%
1,1-Dichloroethene	038GGS0701	0.01	U						
1,2-Dichloroethane	038GGS0701	0.01	U						
1,2-Dichloroethene (total)	038GGS0701	0.022			3.12E-01		4.78E-02		86.444%
Acetone	038GGS0701	0.01	U						
Aluminum (Al)	038GGS0701	0.32			2.04E-02		3.13E-03		5.658%
Arsenic (As)	038GGS0701	0.002	U						
Cadmium (Cd)	038GGS0701	0.003	U						
Chloroform	038GGS0701	0.01	U						
Chromium (Cr)	038GGS0701	0.004	U						
Copper (Cu)	038GGS0701	0.0057			9.11E-03		1.39E-03		2.520%
Manganese (Mn)	038GGS0701	0.0119			1.62E-02		2.48E-03		4.477%
Tetrachloroethene	038GGS0701	0.01	U						
Trichloroethene	038GGS0701	0.01	U						
Vanadium (V)	038GGS0701	0.003	U						
Vinyl chloride	038GGS0701	0.01	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038GGS0701	0.01	U						

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
Sum ILCR/HI:					3.61E-01		5.53E-02		
1,1-Dichloroethane	038GGS0801	0.01	U						
1,1-Dichloroethene	038GGS0801	0.01	U						
1,2-Dichloroethane	038GGS0801	0.01	U						
1,2-Dichloroethene (total)	038GGS0801	0.036			5.11E-01		7.82E-02		10.707%
Acetone	038GGS0801	0.01	U						
Aluminum (Al)	038GGS0801	0.792			5.06E-02		7.75E-03		1.060%
Arsenic (As)	038GGS0801	0.004		8.94E-05	8.52E-01	2.09E-05	1.30E-01	29.243%	17.845%
Cadmium (Cd)	038GGS0801	0.0147			1.88E+00		2.88E-01		39.348%
Chloroform	038GGS0801	0.01	U						
Chromium (Cr)	038GGS0801	0.233			1.49E-02		2.28E-03		0.312%
Copper (Cu)	038GGS0801	0.171			2.73E-01		4.18E-02		5.722%
Manganese (Mn)	038GGS0801	0.194			2.64E-01		4.04E-02		5.524%
Tetrachloroethene	038GGS0801	0.014		1.13E-05	1.79E-01	2.64E-06	2.74E-02	3.687%	3.747%
Trichloroethene	038GGS0801	0.033		8.36E-06	7.03E-01	1.96E-06	1.08E-01	2.734%	14.722%
Vanadium (V)	038GGS0801	0.0053			4.84E-02		7.40E-03		1.013%
Vinyl chloride	038GGS0801	0.006	J	1.97E-04		4.61E-05		64.336%	
bis(2-Ethylhexyl)phthalate (BEHP)	038GGS0801	0.01	U						
Sum ILCR/HI:				3.06E-04	4.77E+00	7.16E-05	7.31E-01		
1,1-Dichloroethane	038GGS0901	0.01	U						
1,1-Dichloroethene	038GGS0901	0.01	U						
1,2-Dichloroethane	038GGS0901	0.01	U						
1,2-Dichloroethene (total)	038GGS0901	0.049			6.96E-01		1.06E-01		24.610%
Acetone	038GGS0901	0.02	U						
Aluminum (Al)	038GGS0901	3.05			1.95E-01		2.98E-02		6.893%
Arsenic (As)	038GGS0901	0.0058		1.30E-04	1.24E+00	3.04E-05	1.89E-01	24.639%	43.696%
Cadmium (Cd)	038GGS0901	0.003	U						
Chloroform	038GGS0901	0.01	U						
Chromium (Cr)	038GGS0901	0.0235			1.50E-03		2.30E-04		0.053%
Copper (Cu)	038GGS0901	0.288			4.60E-01		7.04E-02		16.273%
Manganese (Mn)	038GGS0901	0.0332			4.51E-02		6.91E-03		1.597%
Tetrachloroethene	038GGS0901	0.002	J	1.61E-06	2.56E-02	3.77E-07	3.91E-03	0.306%	0.904%
Trichloroethene	038GGS0901	0.006	J	1.52E-06	1.28E-01	3.56E-07	1.96E-02	0.289%	4.520%
Vanadium (V)	038GGS0901	0.0045			4.11E-02		6.29E-03		1.453%
Vinyl chloride	038GGS0901	0.012		3.93E-04		9.21E-05		74.766%	
bis(2-Ethylhexyl)phthalate (BEHP)	038GGS0901	0.01	U						
Sum ILCR/HI:				5.26E-04	2.83E+00	1.23E-04	4.33E-01		

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,1-Dichloroethane	038GGS1401	0.005	J		5.43E-03		8.31E-04		0.136%
1,1-Dichloroethene	038GGS1401	0.005	J	5.77E-05	7.10E-02	1.35E-05	1.09E-02	34.357%	1.781%
1,2-Dichloroethane	038GGS1401	0.01	U						
1,2-Dichloroethene (total)	038GGS1401	0.008	J		1.14E-01		1.74E-02		2.849%
Acetone	038GGS1401	0.01	U						
Aluminum (Al)	038GGS1401	0.688			4.40E-02		6.73E-03		1.103%
Arsenic (As)	038GGS1401	0.004		8.94E-05	8.52E-01	2.09E-05	1.30E-01	53.198%	21.369%
Cadmium (Cd)	038GGS1401	0.0145			1.85E+00		2.84E-01		46.478%
Chloroform	038GGS1401	0.01	U						
Chromium (Cr)	038GGS1401	0.0776			4.96E-03		7.59E-04		0.124%
Copper (Cu)	038GGS1401	0.219			3.50E-01		5.35E-02		8.775%
Manganese (Mn)	038GGS1401	0.0276	U						
Tetrachloroethene	038GGS1401	0.02		1.61E-05	2.56E-01	3.77E-06	3.91E-02	9.581%	6.411%
Trichloroethene	038GGS1401	0.019		4.81E-06	4.05E-01	1.13E-06	6.19E-02	2.864%	10.150%
Vanadium (V)	038GGS1401	0.0036			3.29E-02		5.03E-03		0.824%
Vinyl chloride	038GGS1401	0.01	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038GGS1401	0.01	U						
Sum ILCR/HI:				1.68E-04	3.99E+00	3.94E-05	6.10E-01		
1,1-Dichloroethane	038GGS1501	0.18	DJ		1.95E-01		2.99E-02		39.939%
1,1-Dichloroethene	038GGS1501	0.002	J	2.31E-05	2.84E-02	5.41E-06	4.35E-03	1.689%	5.803%
1,2-Dichloroethane	038GGS1501	0.01	U						
1,2-Dichloroethene (total)	038GGS1501	0.014			1.99E-01		3.04E-02		40.622%
Acetone	038GGS1501	0.01	U						
Aluminum (Al)	038GGS1501	0.3			1.92E-02		2.93E-03		3.917%
Arsenic (As)	038GGS1501	0.002	U						
Cadmium (Cd)	038GGS1501	0.003	U						
Chloroform	038GGS1501	0.01	U						
Chromium (Cr)	038GGS1501	0.0318			2.03E-03		3.11E-04		0.415%
Copper (Cu)	038GGS1501	0.0285			4.55E-02		6.97E-03		9.303%
Manganese (Mn)	038GGS1501	0.0207	U						
Tetrachloroethene	038GGS1501	0.01	U						
Trichloroethene	038GGS1501	0.01	U						
Vanadium (V)	038GGS1501	0.003	U						
Vinyl chloride	038GGS1501	0.041	J	1.34E-03		3.15E-04		98.311%	
bis(2-Ethylhexyl)phthalate (BEHP)	038GGS1501	0.01	U						
Sum ILCR/HI:				1.37E-03	4.89E-01	3.20E-04	7.49E-02		

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,1-Dichloroethane	038GGS1601	0.004	J		4.34E-03		6.65E-04		0.209%
1,1-Dichloroethene	038GGS1601	0.01	U						
1,2-Dichloroethane	038GGS1601	0.01	U						
1,2-Dichloroethene (total)	038GGS1601	0.002	J		2.84E-02		4.35E-03		1.366%
Acetone	038GGS1601	0.01	U						
Aluminum (Al)	038GGS1601	0.877			5.60E-02		8.58E-03		2.695%
Arsenic (As)	038GGS1601	0.0061		1.36E-04	1.30E+00	3.19E-05	1.99E-01	99.047%	62.493%
Cadmium (Cd)	038GGS1601	0.0045			5.75E-01		8.80E-02		27.661%
Chloroform	038GGS1601	0.01	U						
Chromium (Cr)	038GGS1601	0.0152			9.71E-04		1.49E-04		0.047%
Copper (Cu)	038GGS1601	0.0373			5.96E-02		9.12E-03		2.866%
Manganese (Mn)	038GGS1601	0.0278	U						
Tetrachloroethene	038GGS1601	0.001	J	8.05E-07	1.28E-02	1.89E-07	1.96E-03	0.585%	0.615%
Trichloroethene	038GGS1601	0.002	J	5.07E-07	4.26E-02	1.19E-07	6.52E-03	0.368%	2.049%
Vanadium (V)	038GGS1601	0.003	U						
Vinyl chloride	038GGS1601	0.01	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038GGS1601	0.01	U						
Sum ILCR/HI:				1.38E-04	2.08E+00	3.22E-05	3.18E-01		
1,1-Dichloroethane	038GGS1701	0.006	J		6.52E-03		9.97E-04		7.367%
1,1-Dichloroethene	038GGS1701	0.01	U						
1,2-Dichloroethane	038GGS1701	0.01	U						
1,2-Dichloroethene (total)	038GGS1701	0.01	U						
Acetone	038GGS1701	0.024	U						
Aluminum (Al)	038GGS1701	0.18			1.15E-02		1.76E-03		13.006%
Arsenic (As)	038GGS1701	0.002	U						
Cadmium (Cd)	038GGS1701	0.003	U						
Chloroform	038GGS1701	0.01	U						
Chromium (Cr)	038GGS1701	0.0745			4.76E-03		7.29E-04		5.383%
Copper (Cu)	038GGS1701	0.0091			1.45E-02		2.22E-03		16.438%
Manganese (Mn)	038GGS1701	0.015	U						
Tetrachloroethene	038GGS1701	0.004	J	3.22E-06	5.11E-02	7.54E-07	7.82E-03	0.006%	57.805%
Trichloroethene	038GGS1701	0.01	U						
Vanadium (V)	038GGS1701	0.003	U						
Vinyl chloride	038GGS1701	1.6	D	5.24E-02		1.23E-02		99.994%	
bis(2-Ethylhexyl)phthalate (BEHP)	038GGS1701	0.01	U						
Sum ILCR/HI:				5.25E-02	8.84E-02	1.23E-02	1.35E-02		
1,1-Dichloroethane	038GGS1801	0.004	J		4.34E-03		6.65E-04		0.164%

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,1-Dichloroethene	038GGS1801	0.004	J	4.62E-05	5.68E-02	1.08E-05	8.69E-03	22.785%	2.146%
1,2-Dichloroethane	038GGS1801	0.01	U						
1,2-Dichloroethene (total)	038GGS1801	0.006	J		8.52E-02		1.30E-02		3.219%
Acetone	038GGS1801	0.01	U						
Aluminum (Al)	038GGS1801	1.02			6.52E-02		9.98E-03		2.463%
Arsenic (As)	038GGS1801	0.0053		1.18E-04	1.13E+00	2.77E-05	1.73E-01	58.433%	42.656%
Cadmium (Cd)	038GGS1801	0.003	U						
Chloroform	038GGS1801	0.01	U						
Chromium (Cr)	038GGS1801	0.0232			1.48E-03		2.27E-04		0.056%
Copper (Cu)	038GGS1801	0.222			3.55E-01		5.43E-02		13.400%
Manganese (Mn)	038GGS1801	0.0059	U						
Tetrachloroethene	038GGS1801	0.041		3.30E-05	5.24E-01	7.73E-06	8.02E-02	16.282%	19.799%
Trichloroethene	038GGS1801	0.02		5.07E-06	4.26E-01	1.19E-06	6.52E-02	2.499%	16.097%
Vanadium (V)	038GGS1801	0.0037	U						
Vinyl chloride	038GGS1801	0.01	U						
bis(2-Ethylhexyl)phthalate (BEHP)	038GGS1801	0.01	U						
Sum ILCR/HI:				2.03E-04	2.65E+00	4.75E-05	4.05E-01		
1,1-Dichloroethane	038GGS1901	0.02	U						
1,1-Dichloroethene	038GGS1901	0.02	U						
1,2-Dichloroethane	038GGS1901	0.02	U						
1,2-Dichloroethene (total)	038GGS1901	0.13	J		1.85E+00		2.83E-01		3.183%
Acetone	038GGS1901	0.02	U						
Aluminum (Al)	038GGS1901	1.86			1.19E-01		1.82E-02		0.205%
Arsenic (As)	038GGS1901	0.0125		2.79E-04	2.66E+00	6.54E-05	4.08E-01	19.488%	4.591%
Cadmium (Cd)	038GGS1901	0.382			4.88E+01		7.47E+00		84.177%
Chloroform	038GGS1901	0.02	U						
Chromium (Cr)	038GGS1901	0.544			3.48E-02		5.32E-03		0.060%
Copper (Cu)	038GGS1901	0.195			3.12E-01		4.77E-02		0.537%
Manganese (Mn)	038GGS1901	0.155			2.11E-01		3.23E-02		0.363%
Tetrachloroethene	038GGS1901	0.24		1.93E-04	3.07E+00	4.53E-05	4.69E-01	13.477%	5.289%
Trichloroethene	038GGS1901	0.041		1.04E-05	8.73E-01	2.43E-06	1.34E-01	0.724%	1.506%
Vanadium (V)	038GGS1901	0.0057			5.20E-02		7.96E-03		0.090%
Vinyl chloride	038GGS1901	0.029		9.51E-04		2.23E-04		66.310%	
bis(2-Ethylhexyl)phthalate (BEHP)	038GGS1901	0.002	U						
Sum ILCR/HI:				1.43E-03	5.80E+01	3.36E-04	8.88E+00		
1,1-Dichloroethane	038GGS2001	0.05	U						
1,1-Dichloroethene	038GGS2001	0.05	U						

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	Site Resident LWA ILCR	Site Resident Child HQ	Site Worker Adult ILCR	Site Worker Adult HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI
1,2-Dichloroethane	038GGS2001	0.05	U						
1,2-Dichloroethene (total)	038GGS2001	0.97	D		1.38E+01		2.11E+00		67.274%
Acetone	038GGS2001	0.009	J		5.75E-03		8.80E-04		0.028%
Aluminum (Al)	038GGS2001	20			1.28E+00		1.96E-01		6.242%
Arsenic (As)	038GGS2001	0.002	U						
Cadmium (Cd)	038GGS2001	0.0341			4.36E+00		6.67E-01		21.285%
Chloroform	038GGS2001	0.05	U						
Chromium (Cr)	038GGS2001	0.378			2.42E-02		3.70E-03		0.118%
Copper (Cu)	038GGS2001	0.0761			1.22E-01		1.86E-02		0.594%
Manganese (Mn)	038GGS2001	0.0981			1.33E-01		2.04E-02		0.651%
Tetrachloroethene	038GGS2001	0.014	J	1.13E-05	1.79E-01	2.64E-06	2.74E-02	0.031%	0.874%
Trichloroethene	038GGS2001	0.05	U						
Vanadium (V)	038GGS2001	0.0658			6.01E-01		9.19E-02		2.934%
Vinyl chloride	038GGS2001	1.1	D	3.61E-02		8.45E-03		99.969%	
bis(2-Ethylhexyl)phthalate (BEHP)	038GGS2001	0.01	U						
Sum ILCR/HI:				3.61E-02	2.05E+01	8.45E-03	3.13E+00		
1,1-Dichloroethane	038GGS2101	0.02	U						
1,1-Dichloroethene	038GGS2101	0.02	U						
1,2-Dichloroethane	038GGS2101	0.02	U						
1,2-Dichloroethene (total)	038GGS2101	0.1	J		1.42E+00		2.17E-01		2.814%
Acetone	038GGS2101	0.02	U						
Aluminum (Al)	038GGS2101	2.71			1.73E-01		2.65E-02		0.343%
Arsenic (As)	038GGS2101	0.0057		1.27E-04	1.21E+00	2.98E-05	1.86E-01	15.027%	2.406%
Cadmium (Cd)	038GGS2101	0.336			4.29E+01		6.57E+00		85.103%
Chloroform	038GGS2101	0.02	U						
Chromium (Cr)	038GGS2101	0.297			1.90E-02		2.90E-03		0.038%
Copper (Cu)	038GGS2101	0.389			6.21E-01		9.51E-02		1.232%
Manganese (Mn)	038GGS2101	0.104			1.41E-01		2.16E-02		0.280%
Tetrachloroethene	038GGS2101	0.28		2.25E-04	3.58E+00	5.28E-05	5.48E-01	26.588%	7.092%
Trichloroethene	038GGS2101	0.013	J	3.29E-06	2.77E-01	7.71E-07	4.24E-02	0.388%	0.549%
Vanadium (V)	038GGS2101	0.0079			7.21E-02		1.10E-02		0.143%
Vinyl chloride	038GGS2101	0.015	J	4.92E-04		1.15E-04		57.997%	
bis(2-Ethylhexyl)phthalate (BEHP)	038GGS2101	0.004	U						
Sum ILCR/HI:				8.48E-04	5.05E+01	1.99E-04	7.72E+00		

Notes:
COPC = Chemical of potential concern
VQUAL = Validation qualifier

Table 10-46
Groundwater Risk and Hazard Estimates per Sample Location
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident		*Site Worker*			
				LWA	*Child*	*Adult*			
COPC	Sample Designation	Reported Concentration (mg/L)	VQUAL	ILCR	HQ	ILCR	HQ	Percent Contribution to Industrial ILCR	Percent Contribution to Industrial HI

LWA = Lifetime weighted average
ILCR = Incremental Lifetime excess cancer risk
HQ = Hazard quotient
HI = Hazard index
mg/L = milligrams per liter
BEQ = Benzo(a)pyrene equivalent
J = The associated numerical value is an estimated quantity.
U = The material was analyzed for, but not detected; the associated value is the lesser of one half of the sample quantitation limit, or one half of the lowest detected concentration.
N = There is presumptive evidence of presence of material (tentative identification).
D = The result was obtained from a diluted sample.
R = One or more QC parameters grossly exceeded control limits
E = Concentration exceeds calibration range of GC/MS instrument.

The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would double the manganese hazard quotient shown in this table.

Table 10-47
CT Hazard Quotients and Incremental Lifetime Cancer Risks
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident			*Site Worker*	
				Adult	*Child*	*LWA*	*Adult*	
Chemical	**EPC (mg/kg)**	**Oral RfD mg/kg-day**	**Oral SF kg-day/mg**	**HQ**	**HQ**	**ILCR**	**HQ**	**ILCR**
Aluminum	26568.7	1	NA	0.012	0.110	NA	0.0130	NA
Aroclor 1260	0.0664	NA	2	NA	NA	2.2E-08	NA	4.6E-09
Arsenic	4.207	0.0003	1.5	0.0063	0.058	1.0E-06	0.0069	2.2E-07
BEQ	2.2797	NA	7.3	NA	NA	2.8E-06	NA	5.8E-07
Cadmium	1.596	0.0005	NA	NA	NA	NA	0.0016	NA
Chromium	21.743	1	NA	0.000010	0.000090	NA	0.000011	NA
Copper	122.121	0.04	NA	0.0014	0.013	NA	0.001494	NA
Dieldrin	0.0031	0.00005	16	0.000028	0.00026	8.2E-09	0.000030	1.7E-09
Lead	284.7	NA	NA	NA	NA	NA	NA	NA
Manganese[1]	177.88	0.047	NA	0.0017	0.016	NA	0.001852	NA
Vanadium	23.77	0.007	NA	0.0015	0.014	NA	0.0017	NA
Cumulative HI or ILCR:				0.023	0.21	4E-06	0.03	8E-07

Dermal Contact With Surface Soil

				Site Resident			*Site Worker*	
				Adult	*Child*	*LWA*	*Adult*	
Chemical	**EPC (mg/kg)**	**Dermal RfD mg/kg-day**	**Dermal SF kg-day/mg**	**HQ**	**HQ**	**ILCR**	**HQ**	**ILCR**
Aluminum	26568.7	0.2	NA	0.0050	0.017	NA	0.0053	NA
Aroclor 1260	0.0664	NA	4	NA	NA	1.9E-08	NA	7.6E-09
Arsenic	4.207	0.00006	7.5	0.0026	0.009	2.3E-07	0.0028	9.0E-08
BEQ	2.2797	NA	14.6	NA	NA	2.4E-06	NA	9.5E-07
Cadmium	1.596	0.0001	NA	0.00060	0.0020	NA	0.00064	NA
Chromium	21.743	0.2	NA	0.0000041	0.000014	NA	0.0000044	NA
Copper	122.121	0.008	NA	0.00057	0.0019	NA	0.00061	NA
Dieldrin	0.0031	0.000025	32	0.000047	0.000154	7.1E-09	0.000050	2.8E-09
Lead	284.7	NA	NA	NA	NA	NA	NA	NA
Manganese[1]	177.88	0.0094	NA	0.00071	0.0024	NA	0.00076	NA
Vanadium	23.77	0.0014	NA	0.00064	0.0021	NA	0.00068	NA
Cumulative HI or ILCR:				0.010	0.03	3E-06	0.011	1E-06

Notes:

LWA = Lifetime weighted average
EPC = Exposure point concentration
RfD = Reference Dose
SF = Slope factor
HQ = Hazard quotient
ILCR = Incremental lifetime excess cancer risk
HI = Hazard Index
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
kg-day/mg = kilograms per day per milligram

[1]The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would double the manganese hazard quotient shown.

Table 10-48
CT Hazard Quotients and Incremental Lifetime Cancer Risks
Ingestion of Groundwater
Site 38 - Building 604 Area
NAS Pensacola

				Site Resident			Site Worker	
				Adult	Child	LWA	Adult	
Chemical	EPC (mg/L)	Oral RfD mg/kg-day	Oral SF kg-day/mg	HQ	HQ	ILCR	HQ	ILCR
1,1-Dichloroethane	0.135	0.1	NA	0.02	0.06	NA	0.01	NA
1,1-Dichloroethene	0.01575	0.009	0.6	0.022	0.07	2.4E-05	0.017	6.6E-05
1,2-Dichloroethane	0.0525	0.00286	0.091	0.23	0.78	1.2E-05	0.18	3.3E-05
1,2-Dichloroethene (total)	0.7275	0.009	NA	1.03	3.45	NA	0.79	NA
Acetone	0.375	0.1	NA	0.05	0.16	NA	0.04	NA
Aluminum	15	1	NA	0.19	0.64	NA	0.15	NA
Arsenic	0.01275	0.0003	1.5	0.54	1.81	4.8E-05	0.42	1.3E-04
Cadmium	0.2865	0.0005	NA	7.33	24.47	NA	5.61	NA
Chromium	0.408	1	NA	0.01	0.02	NA	0.00	NA
cis-1,2-Dichloroethene	0.48	0.01	NA	0.61	2.05	NA	0.47	NA
Copper	0.29175	0.0371	NA	0.10	0.34	NA	0.08	NA
Manganese[1]	0.16275	0.047	NA	0.04	0.15	NA	0.03	NA
Tetrachloroethene	0.615	0.01	0.052	0.79	2.63	8.0E-05	0.60	2.2E-04
trans-1,2-Dichloroethene	0.03225	0.02	NA	0.02	0.07	NA	0.02	NA
Trichloroethene	0.255	0.006	0.011	0.54	1.81	7.0E-06	0.42	2.0E-05
Vanadium	0.04935	0.007	NA	0.09	0.30	NA	0.07	NA
Vinyl chloride	2.775	NA	1.9	NA	NA	1.3E-02	NA	3.7E-02
Cumulative HI or ILCR:				11.63	38.81	1.3E-02	8.89	3.7E-02

halation of Groundwater COPCs

				Site Resident			Site Worker	
				Adult	Child	LWA	Adult	
Chemical	EPC (mg/L)	Inhalation RfD mg/kg-day	Inhalation SF kg-day/mg	HQ	HQ	ILCR	HQ	ILCR
1,1-Dichloroethane	0.18	0.143	NA	0.016	0.05	NA	0.012	NA
1,1-Dichloroethene	0.021	0.009	0.175	0.03	0.10	9.2E-06	0.023	2.6E-05
1,2-Dichloroethane	0.07	0.00286	0.091	0.31	1.05	1.6E-05	0.24	4.5E-05
1,2-Dichloroethene (total)	0.97	0.009	NA	1.38	4.60	NA	1.05	NA
Acetone	0.5	NA	NA	NA	NA	NA	NA	NA
Aluminum	20	NA	NA	NA	NA	NA	NA	NA
Arsenic	0.017	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.382	NA	6.3	NA	NA	NA	NA	NA
Chromium	0.544	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	0.64	0.01	NA	0.82	2.73	NA	0.6	NA
Copper	0.389	NA	NA	NA	NA	NA	NA	NA
Manganese	0.217	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	0.82	0.01	0.00203	1.05	3.50	4.2E-06	0.80	1.2E-05
trans-1,2-Dichloroethene	0.043	0.02	NA	0.03	0.09	NA	0.021	NA
Trichloroethene	0.34	0.006	0.006	0.73	2.42	5.1E-06	0.55	1.4E-05
Vanadium	0.0658	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	3.7	NA	0.3	NA	NA	2.8E-03	NA	7.8E-03
Cumulative HI or ILCR:				4.36	14.55	2.8E-03	3.33	7.9E-03
Sum HI or ILCR:				15.99	53.36	1.6E-02	12.23	4.5E-02

Notes:

LWA = Lifetime weighted average
EPC = Exposure point concentration
RfD = Reference Dose
SF = Slope factor
HQ = Hazard quotient
ILCR = Incremental lifetime excess cancer risk
HI = Hazard Index
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
kg-day/mg = kilograms per day per milligram

[1]The managanese reference dose of 0.023 mg/kg-day recommended by FDEP would double the manganese hazard quotient shown in this table.

Table 10-49
Surface Soil Remedial Goal Options
Calculated in Accordance with RAGS including the Site Worker and Site Resident
Incidental Ingestion and Dermal Contact Exposure Pathways
Site 38 - Building 604 Area
NAS Pensacola

			Site Worker						
Chemical	**EPC (mg/kg)**	**HI**	**HI = 0.1**	**HI = 1.0**	**HI = 3.0**	**ILCR**	**ILCR = 1E-6**	**ILCR = 1E-5**	**ILCR = 1E-4**
Aluminum	26568.7	0.01	NA	NA	NA	NA	NA	NA	NA
Arsenic	4.207	0.01	43.3	433	1300	1.6.E-06	2.63	26.3	263
BEQ	2.2797	NA	NA	NA	NA	7.7.E-06	0.296	2.96	29.6

			Site Resident						
Chemical	**EPC (mg/kg)**	**HI**	**HI = 0.1**	**HI = 1.0**	**HI = 3.0**	**ILCR**	**ILCR = 1E-6**	**ILCR = 1E-5**	**ILCR = 1E-4**
Aluminum	26568.7	0.36	7286	72860	218579	NA	NA	NA	NA
Arsenic	4.207	0.193	2.18	21.8	65.4	1.1.E-05	0.38	3.82	38.2
BEQ	2.2797	NA	NA	NA	NA	3.8.E-05	0.060	0.60	6.0

Notes:

RGO = Remedial Goal Option, calculated in accordance with RAGS, based on the child receptor for site resident
EPC = Exposure Point Concentration
HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
mg/L = milligrams per liter
NA = Not applicable

[1]The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would decrease the manganese RGO shown in this table by one half.

Table 10-50
Groundwater Remedial Goal Options
Calculated in Accordance with RAGS including the Site Worker and Site Resident
Incidental Ingestion and Inhalation Exposure Pathways
Site 38 - Building 604 Area
NAS Pensacola

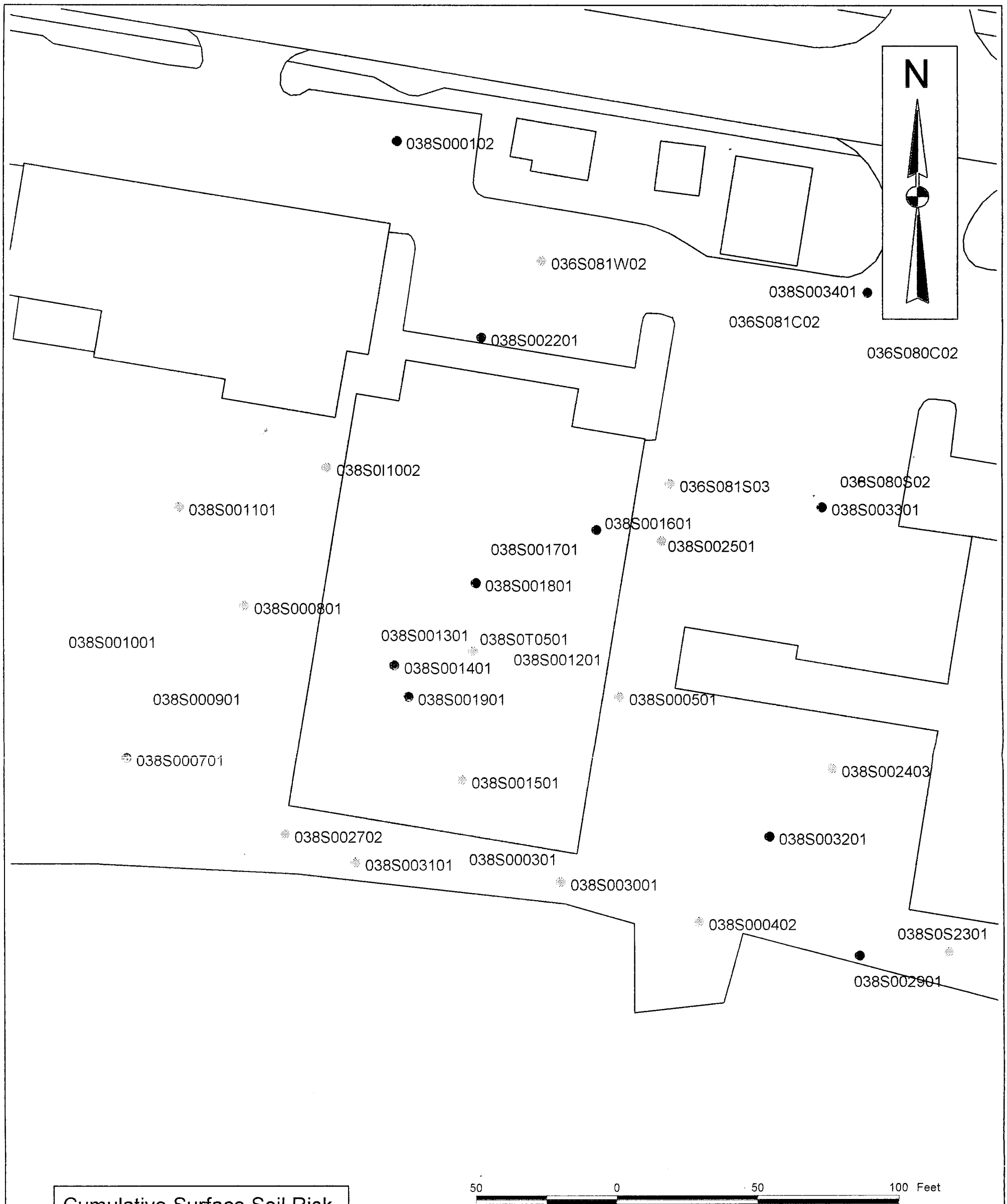
			Site Worker						
Chemical	**EPC (mg/L)**	**HI**	**HI = 0.1**	**HI = 1.0**	**HI = 3.0**	**ILCR**	**ILCR = 1E-6**	**ILCR = 1E-5**	**ILCR = 1E-4**
1,1-Dichloroethane	0.18	0.03	0.60	6.05	18.14	NA	NA	NA	NA
1,1-Dichloroethene	0.021	0.05	0.05	0.46	1.39	6.E-05	4.E-04	4E-03	4E-02
1,2-Dichloroethane	0.07	0.48	0.01	0.15	0.44	4.E-05	2.E-03	2E-02	2E-01
1,2-Dichloroethene (total)	0.97	2.10	0.05	0.46	1.39	NA	NA	NA	NA
Acetone	0.5	0.05	1.03	10	31	NA	NA	NA	NA
Aluminum	20	0.19	10.28	103	308	NA	NA	NA	NA
Arsenic	0.017	0.55	0.0031	0.03	0.09	9.E-05	2E-04	2E-03	2E-02
Cadmium	0.382	7.43	0.01	0.05	0.15	NA	NA	NA	NA
Chromium	0.544	0.01	10.28	103	308	NA	NA	NA	NA
cis-1,2-Dichloroethene	0.64	1.25	0.05	0.51	1.54	NA	NA	NA	NA
Copper	0.389	0.10	0.38	4	11	NA	NA	NA	NA
Manganese[1]	0.217	0.04	0.48	5	14	NA	NA	NA	NA
Tetrachloroethene	0.82	1.60	0.05	0.51	1.54	2.E-04	5E-03	5E-02	5E-01
trans-1,2-Dichloroethene	0.043	0.04	0.10	1.03	3.08	NA	NA	NA	NA
Trichloroethene	0.34	1.10	0.03	0.31	0.92	2.E-05	2.E-02	2E-01	2E+00
Vanadium	0.0658	0.09	0.07	0.72	2.16	NA	NA	NA	NA
Vinyl chloride	3.7	NA	NA	NA	NA	3.E-02	1.E-04	1E-03	1E-02

			Site Resident						
Chemical	**EPC (mg/L)**	**HI**	**HI = 0.1**	**HI = 1.0**	**HI = 3.0**	**ILCR**	**ILCR = 1E-6**	**ILCR = 1E-5**	**ILCR = 1E-4**
1,1-Dichloroethane	0.18	0.20	0.092	0.92	2.8	NA	NA	NA	NA
1,1-Dichloroethene	0.021	0.30	0.007	0.070	0.21	2.E-04	9.E-05	9E-04	9E-03
1,2-Dichloroethane	0.07	3.13	0.002	0.022	0.067	2.E-04	4.E-04	4E-03	4E-02
1,2-Dichloroethene (total)	0.97	13.77	0.007	0.070	0.21	NA	NA	NA	NA
Acetone	0.5	0.32	0.16	1.56	5	NA	NA	NA	NA
Aluminum	20	1.28	1.56	15.6	46.9	NA	NA	NA	NA
Arsenic	0.017	3.62	0.000469	0.005	0.014	4.E-04	4.E-05	4E-04	4E-03
Cadmium	0.382	48.82	0.0008	0.008	0.023	NA	NA	NA	NA
Chromium	0.544	0.03	1.56	15.6	46.9	NA	NA	NA	NA
cis-1,2-Dichloroethene	0.64	8.18	0.0078	0.078	0.23	NA	NA	NA	NA
Copper	0.389	0.67	0.058	0.58	1.7	NA	NA	NA	NA
Manganese	0.217	0.30	0.074	0.74	2.2	NA	NA	NA	NA
Tetrachloroethene	0.82	10.48	0.0078	0.078	0.23	7.E-04	1.24.E-03	1E-02	1E-01
trans-1,2-Dichloroethene	0.043	0.27	0.016	0.16	0.47	NA	NA	NA	NA
Trichloroethene	0.34	7.24	0.0047	0.0469	0.14	9.E-05	4.E-03	4E-02	4E-01
Vanadium	0.0658	0.60	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	3.7	NA	NA	NA	NA	1.E-01	4.E-05	4E-04	4E-03

Notes:

RGO = Remedial Goal Option, calculated in accordance with RAGS, based on the child receptor for site resident
EPC = Exposure Point Concentration
HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk
mg/L = milligrams per liter
NA = Not applicable

[1]The manganese reference dose of 0.023 mg/kg-day recommended by FDEP would decrease the manganese RGO shown in this table by one half.



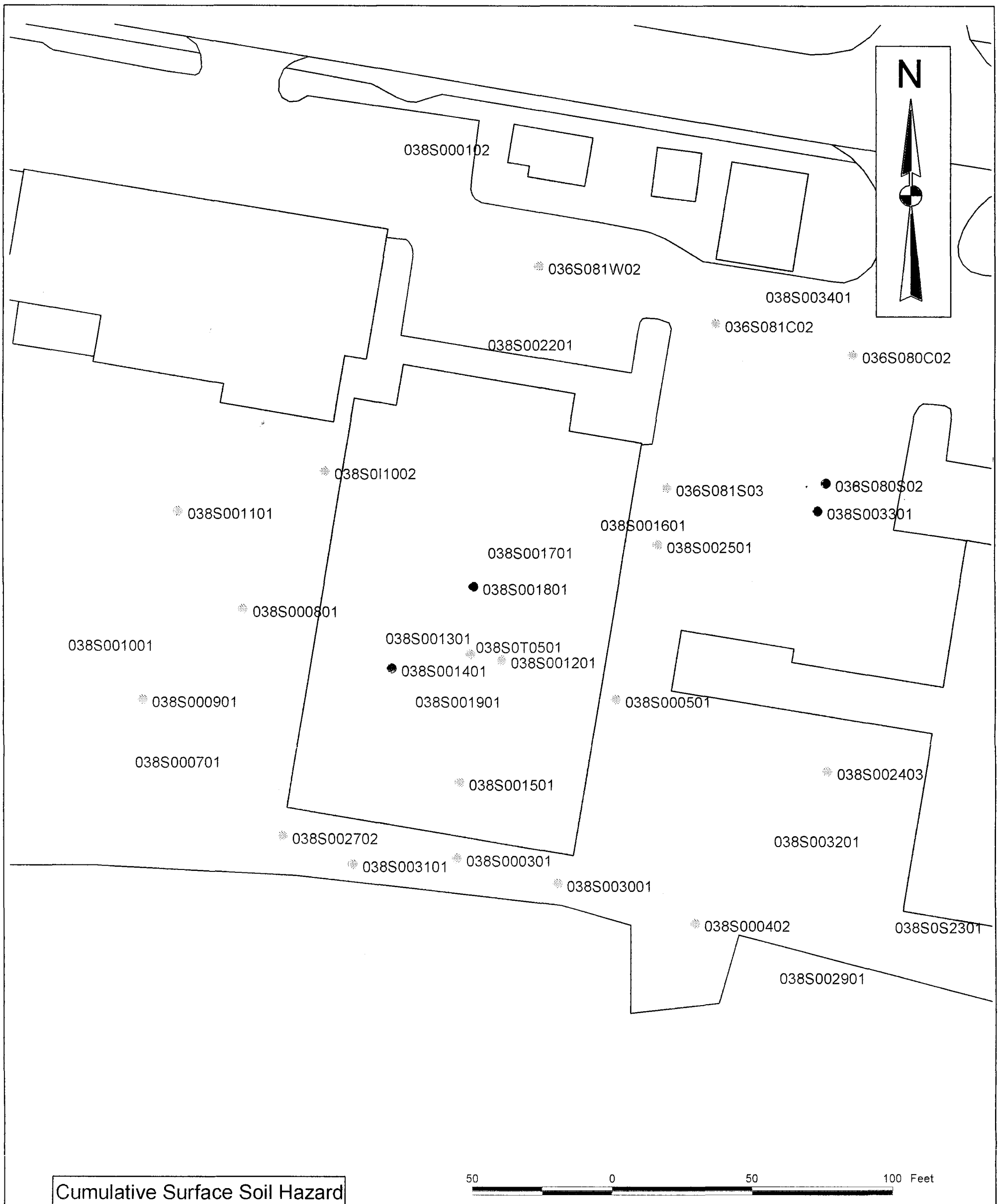
Cumulative Surface Soil Risk

- < 1E-6
- 1E-6 - 5E-6
- 5E-6 - 1E-5
- 1E-5 - 1E-4
- > 1E-4

Roads
Buildings

SITE 38 REMEDIAL INVESTIGATION
NAVAL AIR STATION
PENSACOLA, FLORIDA

FIGURE 10-1
CUMULATIVE SURFACE SOIL RISK
BUILDING 71 AREA



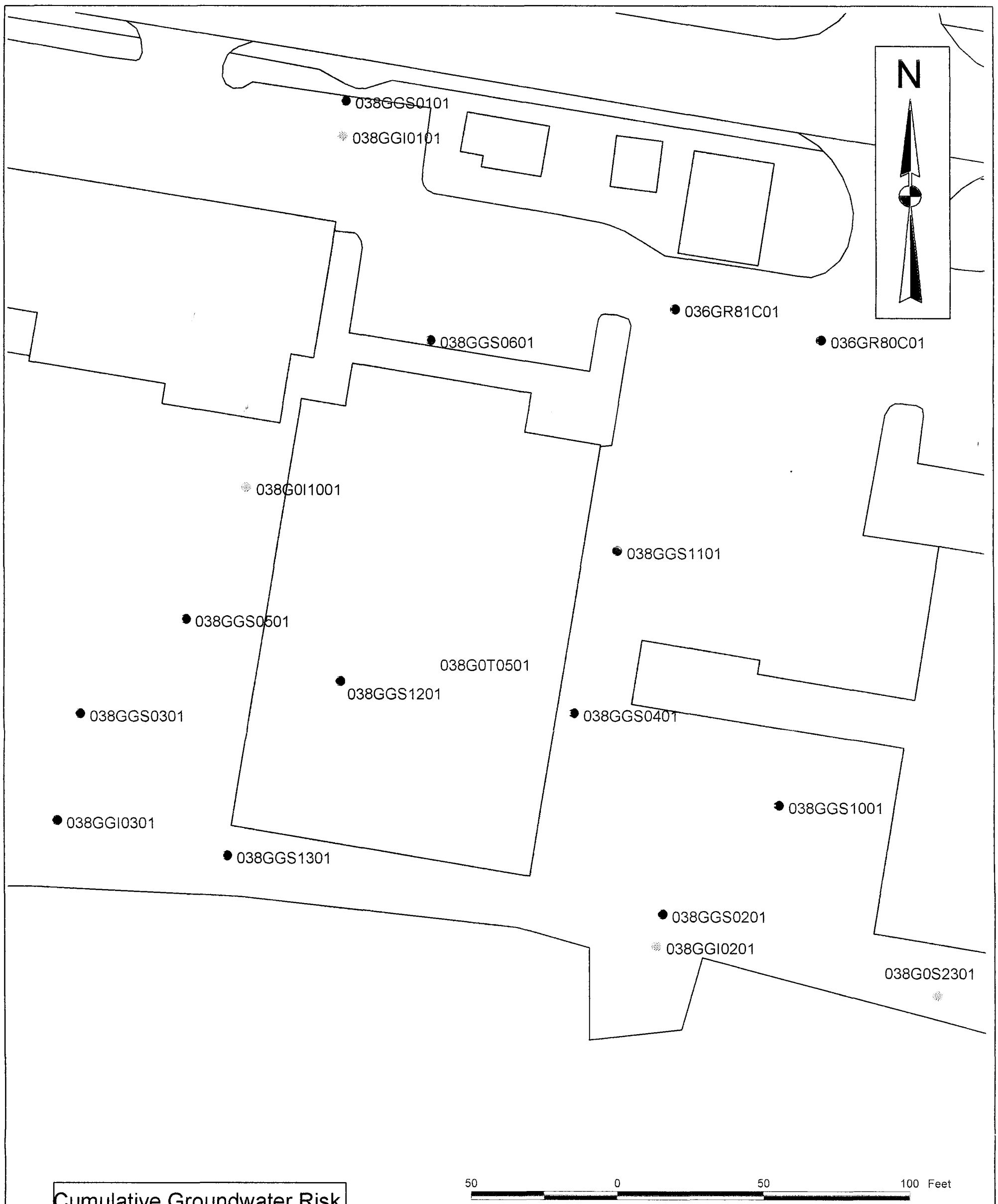
Cumulative Surface Soil Hazard

- 0 - 0.1
- 0.1 - 0.5
- 0.5 - 1.0
- 1.0 - 3.0
- > 3.0

Roadshp.shp
Bldgshp.shp

SITE 38 REMEDIAL INVESTIGATION
NAVAL AIR STATION
PENSACOLA, FLORIDA

FIGURE 10-2
CUMULATIVE SURFACE SOIL HAZARD
BUILDING 71 AREA



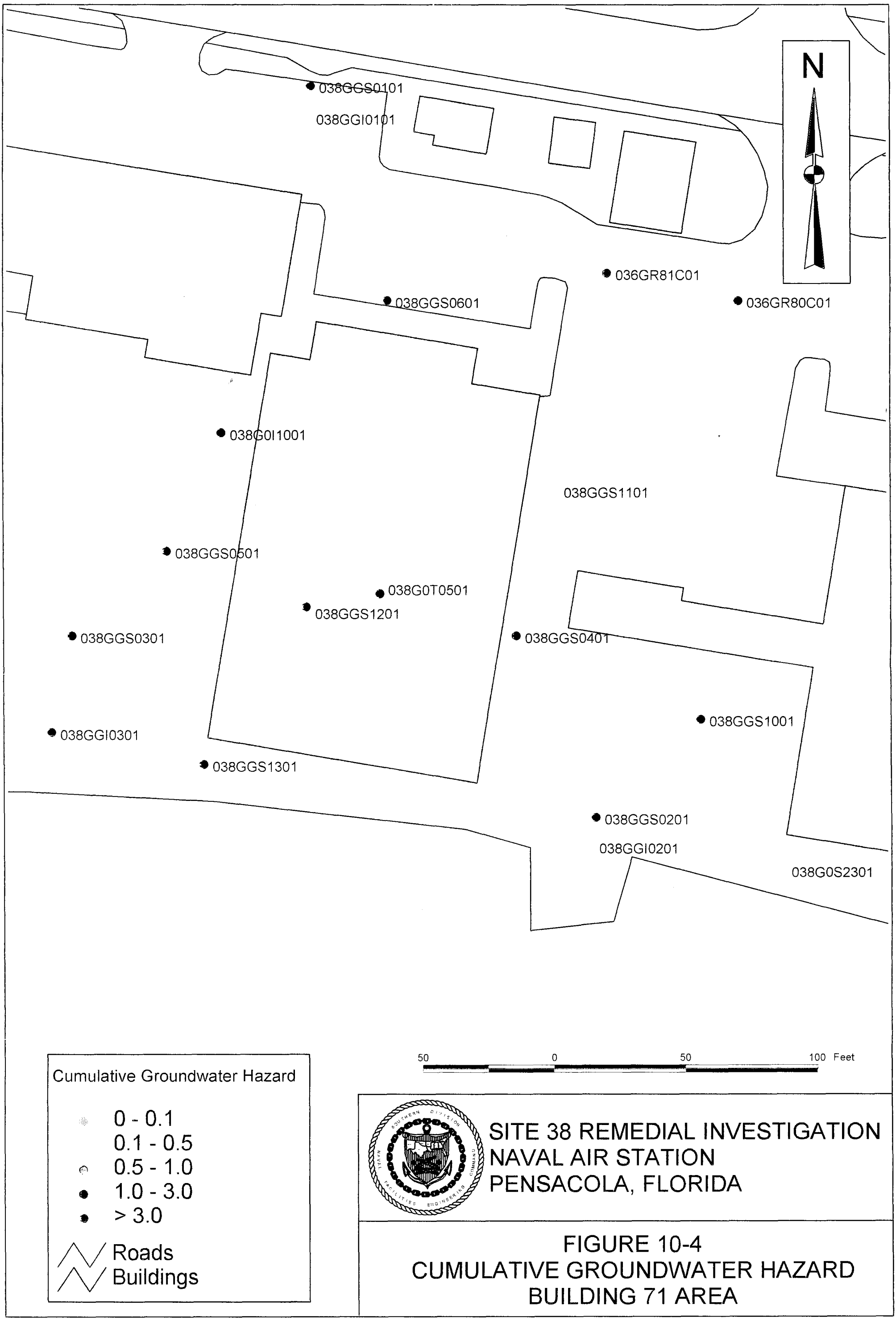
Cumulative Groundwater Risk

- < 1E-6
- 1E-6 - 5E-6
- 5E-6 - 1E-5
- 1E-5 - 1E-4
- > 1E-4

Roads
Buildings

SITE 38 REMEDIAL INVESTIGATION
NAVAL AIR STATION
PENSACOLA, FLORIDA

FIGURE 10-3
CUMULATIVE GROUNDWATER RISK
BUILDING 71 AREA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038GGS0101
038GGI0101
036GR81C01
036GR80C01
038GGS0601
038G0I1001
038GGS1101
038GGS0501
038G0T0501
038GGS1201
038GGS0301
038GGS0401
038GGS1001
038GGI0301
038GGS1301
038GGS0201
038GGI0201
038G0S2301
Cumulative Groundwater Hazard
0 - 0.1
0.1 - 0.5
0.5 - 1.0
1.0 - 3.0
> 3.0
Roads
Buildings
50 0 50 100 Feet
SITE 38 REMEDIAL INVESTIGATION
NAVAL AIR STATION
PENSACOLA, FLORIDA
FIGURE 10-4
CUMULATIVE GROUNDWATER HAZARD
BUILDING 71 AREA

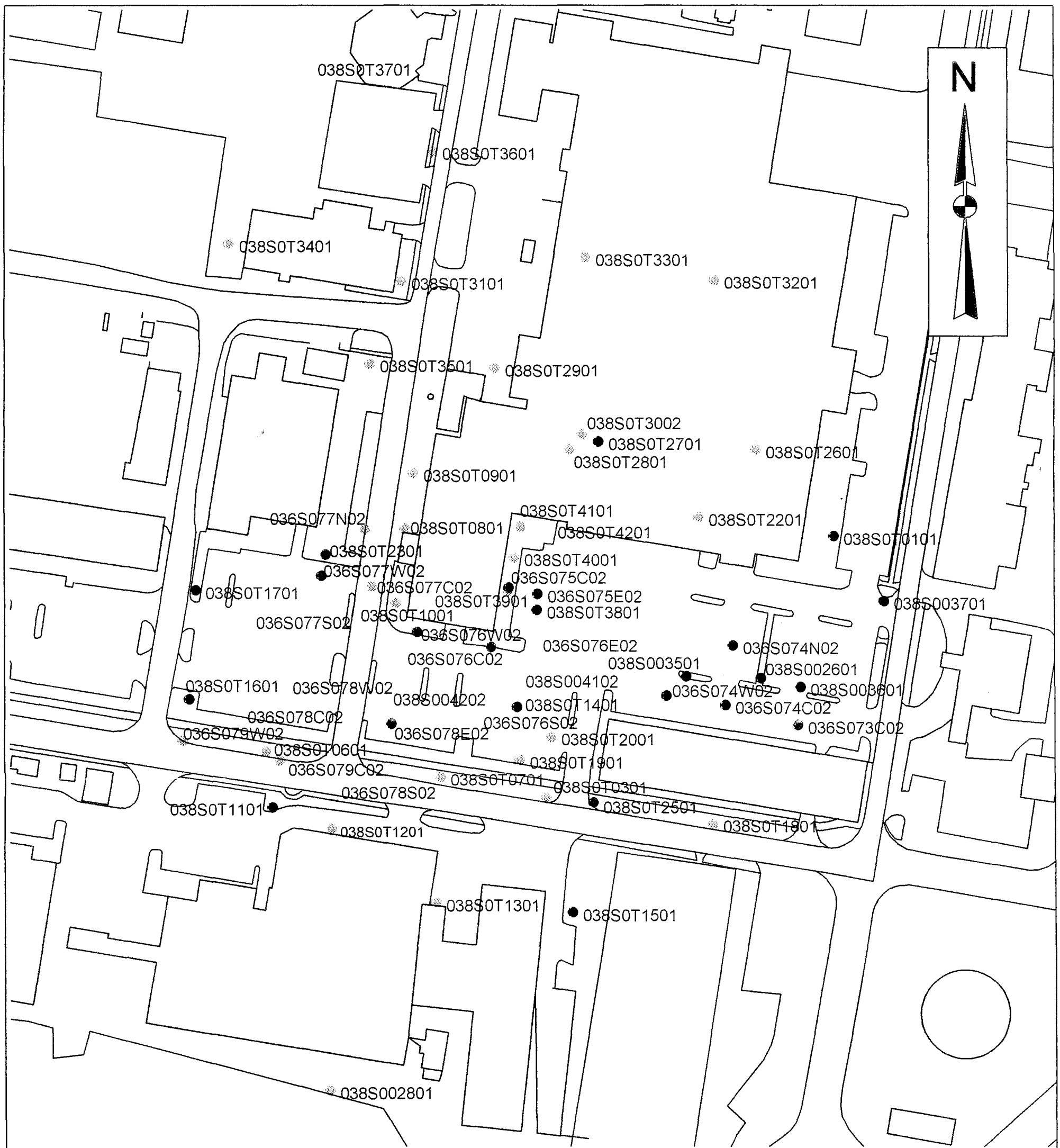

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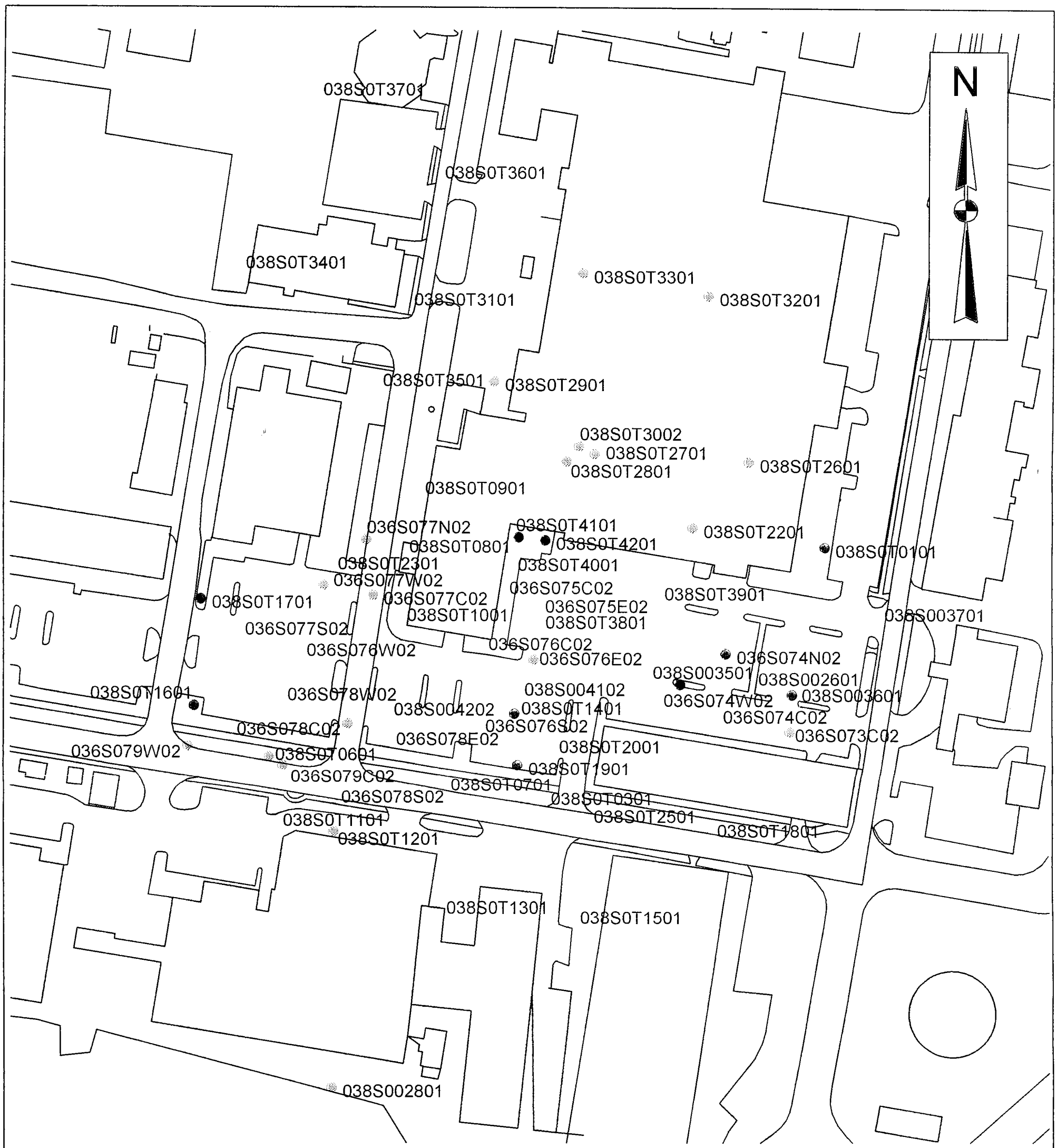
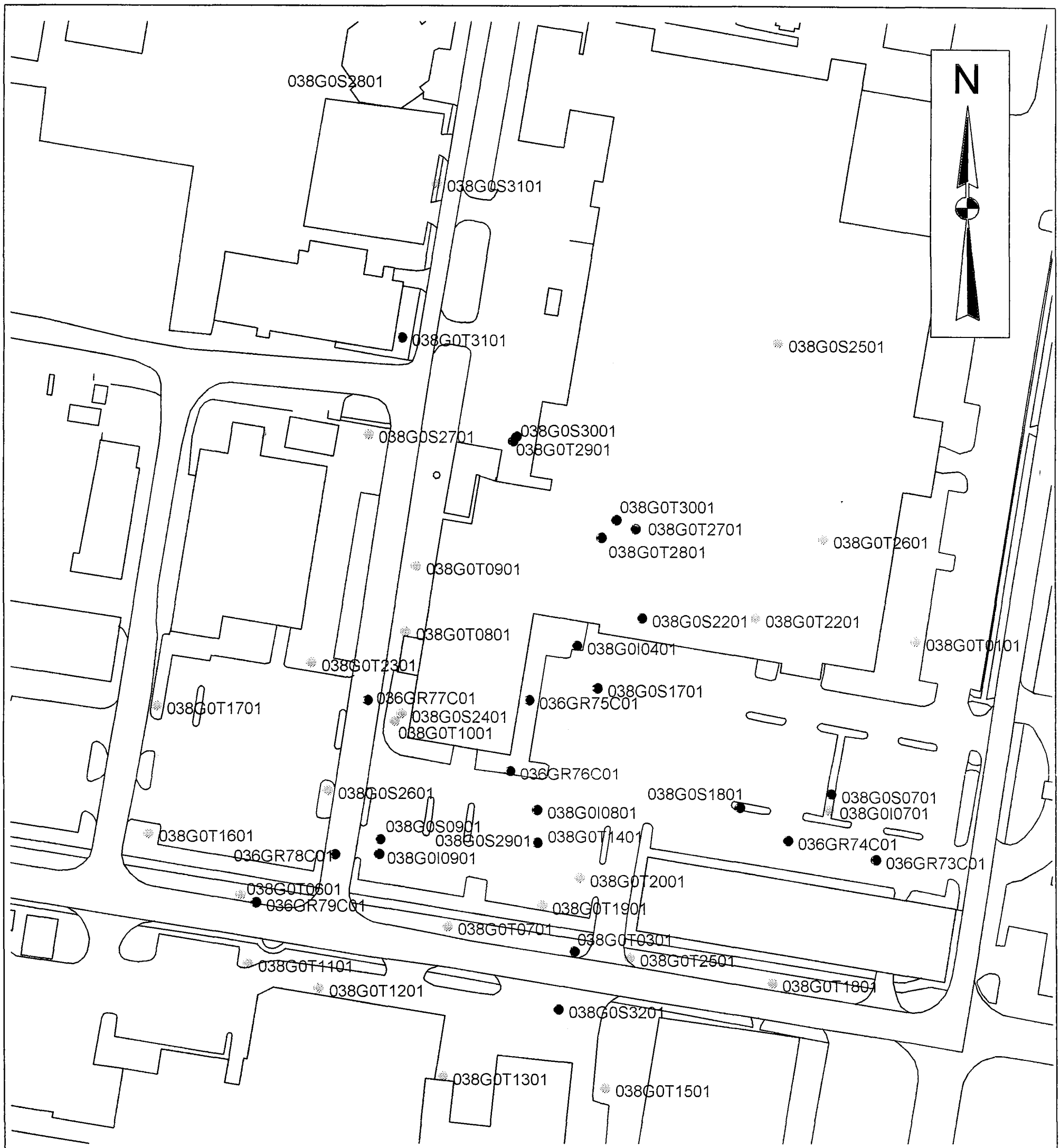
FIGURE 10-5
CUMULATIVE SURFACE SOIL RISK
BUILDING 604 AREA



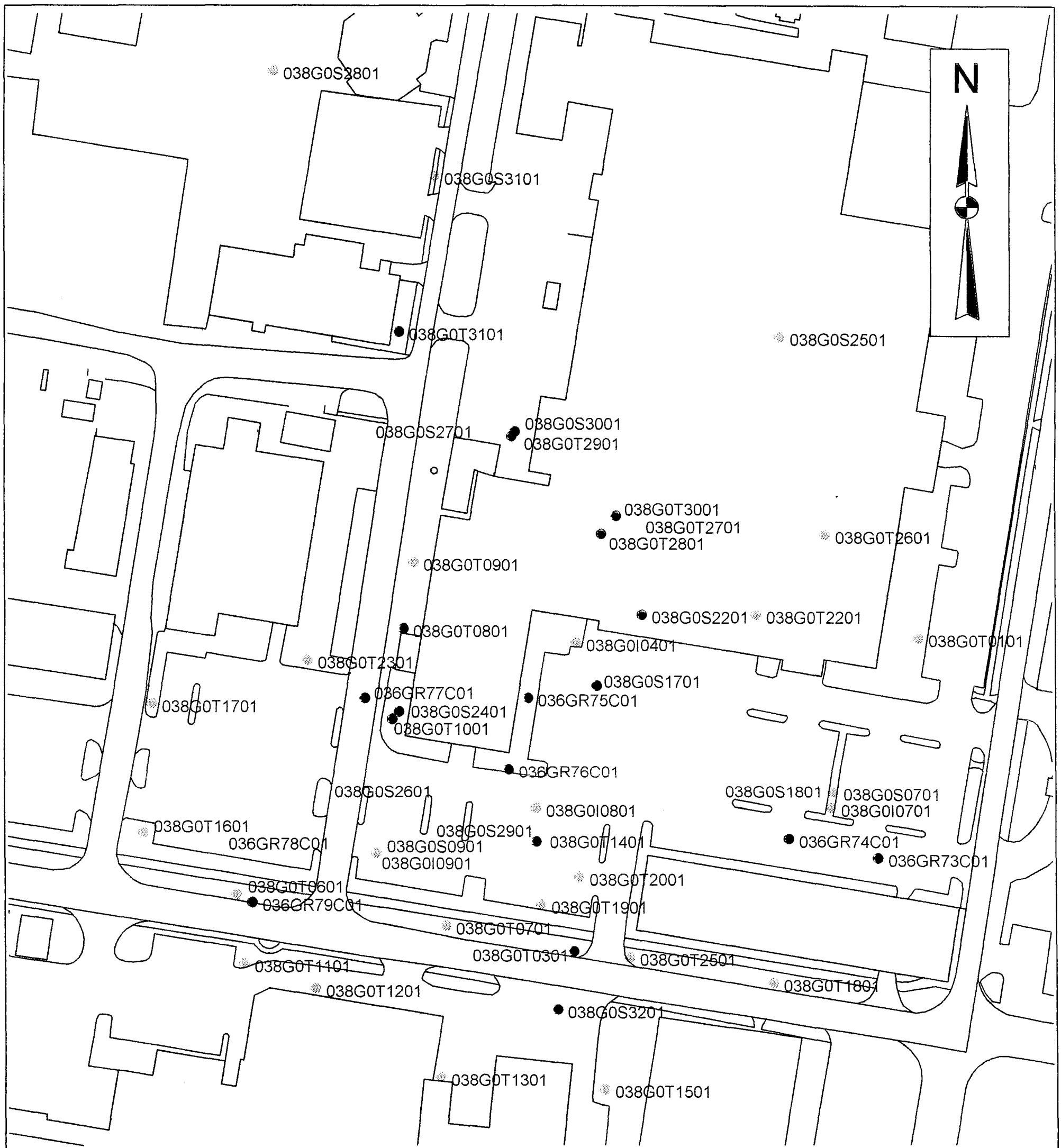
SITE 38 REMEDIAL INVESTIGATION
NAVAL AIR STATION
PENSACOLA, FLORIDA

FIGURE 10-6
CUMULATIVE SURFACE SOIL HAZARD
BUILDING 604 AREA



SITE 38 REMEDIAL INVESTIGATION
NAVAL AIR STATION
PENSACOLA, FLORIDA

FIGURE 10-7
CUMULATIVE GROUNDWATER RISK
BUILDING 604 AREA


N
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038G0T0801
038G0I0401
038G0T0101
038G0T2301
038G0S1701
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036GR75C01
038G0T1701
038G0S2401
038G0T1001
036GR76C01
038G0S2601
038G0S1801
038G0S0701
038G0I0701
038G0I0801
038G0T1601
038G0S2901
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038G0S0901
038G0T1401
036GR74C01
038G0I0901
036GR73C01
038G0T2001
038G0T0601
036GR79C01
038G0T1901
038G0T0701
038G0T0301
038G0T2501
038G0T1101
038G0T1801
038G0T1201
038G0S3201
038G0T1301
038G0T1501
50 0 50 100 150 200 250 300 Feet
Cumulative Groundwater Hazard
0 - 0.1
0.1 - 0.5
0.5 - 1.0
1.0 - 3.0
> 3.0
Roads
Buildings
SITE 38 REMEDIAL INVESTIGATION
NAVAL AIR STATION
PENSACOLA, FLORIDA
FIGURE 10-8
CUMULATIVE GROUNDWATER HAZARD
BUILDING 604 AREA

11.0 ECOLOGICAL RISK ASSESSMENT

As described in Section 4, natural terrestrial habitat features in and around Site 38 are absent. The only terrestrial receptors that appear to be present onsite are shorebirds which periodically frequent the area. Minimal soil contamination (including aluminum, arsenic, and aroclor-1260), detected from the few exposed locations, does not warrant further pathway uptake analyses.

Marine/estuarine receptors are potentially at risk due to groundwater migration from Site 38 into Pensacola Bay. Section 7.3 compares shoreline groundwater to surface water criteria. This comparison identifies the contaminants which are likely to enter the marine environment due to groundwater discharge. The impact of these parameters on the marine ecosystem were discussed in the Site 2 RI (E/A&H, 1996a).

Data from the Site 2 RI indicate that benthic communities in the nearshore environment adjacent to Site 38 have been impacted. Sediments contained metals and SVOCs similar to those found in shoreline groundwater. No VOCs, consistent with those found in Site 38 groundwater, were detected in any surface water or sediment samples collected during the Site 2 investigation (E/A&H, 1996a).

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12.0 CONCLUSIONS AND RECOMMENDATIONS

The Site 38 RI has assessed the nature and extent of soil and groundwater contamination and provides sufficient data for a feasibility study. A feasibility study is recommended to evaluate alternatives for future site management decisions. Based on the investigation results, at least three potential sources of contamination were identified: the paint stripping operations at former Building 71, the former UST solvent tank and plating shop at Building 604, and the former dry cleaners at Building 636. Other small, localized areas of contamination were also identified along the IWTP sewer line. The following conclusions are based on the findings of this investigation.

Past activities at Building 71 included aircraft painting, paint stripping and metal refinishing between 1935 and the late 1970s. From 1980 to 1989, the facility stored hazardous waste. Building 604 housed a primary metal plating shop for NADEP from approximately 1960 to the spring of 1996. Historically, paint solvent and metal plating waste were discharged from these areas to Pensacola Bay via the storm drainage system. In 1973, these wastes were diverted to the newly constructed IWTP via the IWTP sewer line. These previous operations are likely the primary sources of contamination at Site 38.

Surface soil contaminants detected in the Building 71 study area above PRGs included inorganics, SVOCs, pesticides, and PCBs. No VOCs were detected above PRGs in surface soil. Inorganic contamination exceeding RCs and PRGs were observed in the soil beneath Building 71 and in surrounding areas. Semivolatile exceedances were associated with samples along the IWTP line with no exceedances in the soil beneath Building 71. Pesticide and PCB exceedances were limited to two locations beneath Building 71. The pesticide contamination is likely a result of the pretreatment during building construction.

Subsurface soil contained SVOCs, pesticides, and VOCs exceeding the PRG and inorganics which exceed the RC and PRG. Much of the contamination appeared to be centered beneath Building 71.

Inorganic and pesticide exceedances were consistent with exceedances in surface soil. SVOC and VOC exceedances were extensive in subsurface soil beneath Building 71. Notably, no surface soil SVOC and VOC exceedances occurred in this area. In general, the contaminants present include heavy metals, chlorinated solvents, and petroleum solvents likely related to the past activities of paint stripping and metal refinishing at Building 71. Soil in the Building 71 study area is completely covered with concrete or asphalt, thus limiting rainfall percolation and subsequent soil leaching.

The Building 604 study area surface soil exceedances included inorganics, SVOCs, pesticides, and PCBs. Many of the inorganic parameters, including aluminum, arsenic, and iron, were fairly ubiquitous across the site and may indicate, in part, local ambient concentrations. Heavy metals related to past plating activities exceeded RCs and PRGs in the surface soil surrounding the former plating facility at the southwest extension of Building 604. SVOC contaminant exceedances were primarily associated with the IWTP line except for one location beneath the southern part of Building 604. Parts cleaning took place in the general vicinity of this sample. Pesticide and PCB exceedances occurred in samples from grassy areas onsite. Pesticide detections in these areas are likely the result residuals remaining from routine spraying.

Building 604 subsurface soil contaminants exceeding the RC or PRG included inorganics, SVOCs, pesticides, and VOCs. Heavy metals, including barium, chromium and cadmium, were detected above PRGs and RCs near the former plating facility. SVOC exceedances included PAHs at one location along the IWTP line. Dieldrin was the only pesticide detected. Its occurrence is likely a result of routine application of pesticides in the area. Only TCE and tetrachloroethene were detected above PRGs. Both of these detections are associated with solvent exceedances in the groundwater and may reflect sampling of the capillary zone and not true soil contamination. However, the sample from boring 38S42 could be related to exfiltration from the IWTP line.

Contaminants detected above PRGs in shallow groundwater in the Building 71 study area included inorganics, SVOCs, and VOCs. No pesticides or PCBs were detected above PRGs. Detected heavy metals potentially related to past paint stripping and metal refinishing processes included cadmium and chromium. These elements exceeded PRGs and RCs in wells 38GS05 and 38GS12 in the southwest part of the study area beneath former Building 71 and in downgradient well 39GS13. Aluminum, iron, manganese, and lead exceeding the RC or PRG were widespread across the site. Concentrations of these metals from well 38GS01, upgradient of the site, were among the highest detected. The highest total inorganic concentrations were detected in the sample from well 38GS12, beneath former Building 71. Naphthalene was the only SVOC detected above a PRG. It exceeded the PRG in samples from wells 38GS12 and 38GS02. VOC contamination centered around the sample from 38GS12, beneath Building 71, and in downgradient locations along the seawall south and east of the former building. These VOCs included several halogenated aliphatic hydrocarbons and their presence is likely the result of past paint stripping and parts cleaning operations at Building 71.

Contaminants detected in the shallow groundwater were not present above the RC or PRG in intermediate groundwater with the exception of aluminum, iron, and vanadium. Aluminum and iron appeared to be representative of ambient conditions; however, vanadium exceeded the PRG and RC in the three locations it was detected. The occurrence of these metals exceedances was consistent with exceedances in shallow groundwater.

Inorganics, SVOCs, and VOCs were also detected in the shallow groundwater in the Building 604 study area. Aluminum, iron, manganese, and lead were detected frequently across the site at concentrations exceeding the PRGs; however, many of these exceedances were below their respective RCs. Heavy metals, including cadmium and chromium, were detected above PRGs surrounding the former plating shop and are likely a result of past plating operations. Naphthalene was detected above the PRG in the area and downgradient of the former solvent tank. Several

PAHs also exceeded the PRG in the sample from well 36MW77C. This well is adjacent to the IWTP line. No exceedances were noted in surrounding and/or downgradient wells. Several halogenated aliphatic hydrocarbons, including tetrachloroethene, TCE, and vinyl chloride, were detected above the PRG. The area most impacted was the former solvent UST east of the former plating shop. VOC concentrations appeared to diminish in samples farther downgradient to the south and east. Two other areas where VOCs exceedances occurred were at a temporary well adjacent to Building 636 and north of the Port Operations, Building 38. Tetrachloroethene was detected in a well east of Building 636, a former dry cleaning facility. These dry cleaning operations may likely be the source of the tetrachloroethene. No other surrounding wells had detections above the PRG. The other VOC detection was in a well north of Building 38. This well is adjacent to the storm drain system leading from Building 604. Historically, solvent and metal waste were discharged through this system to the bay. Possible leaks in the storm drain system may be responsible for the detections of chlorinated solvents in this well. In general, contamination in the Building 604 study areas centers around the former plating shop and former solvent UST areas and in downgradient areas to the southeast. Notably, contaminants were not detected in the temporary wells near the seawall downgradient of the site or in bay surface water samples collected during the Site 2 investigation.

In intermediate groundwater at Building 604, only samples analyzed from well 38GI04 detected any contaminants above both the PRG and RC. Aluminum, cadmium, and chromium were the inorganics detected. The only organic compound detected above a PRG in intermediate groundwater was vinyl chloride in 38GI04 at 4.2 μg/L.

Potential receptors of contaminants detected at Site 38 include the main producing zone of the Sand-and-Gravel Aquifer and Pensacola Bay. Water from the main producing zone is not considered potable because of its naturally occurring high aluminum and iron content, but is used as a supplementary water source for the base. The main producing zone is separated from the

surficial zone by a low-permeability clay layer and potential for migration through this zone is considered to be extremely low. Groundwater from the main producing zone was not sampled as part of the RI. The proximity of Site 38 to Pensacola Bay, coupled with the short travel times calculated for migration of site contaminants, indicates that some impact to the bay may have occurred. This area of the bay is being investigated as part of the Site 2 RI.

The primary ecological risk includes the marine/estuarine receptors in Pensacola Bay due to groundwater to surface water migration from Site 38. Data from the Site 2 RI indicate significant metal contaminants in bay sediments adjacent to Site 38. Comparison of the groundwater data from adjacent shoreline monitoring wells to surface water criteria identified seven inorganics and three organic compounds which could potentially impact receptors.

Human health risk was determined using USEPA's acceptable risk range of 1E-6 to 1E-4, and FDEP's risk goal of 1E-6. For the hypothetical exposure pathways included in this report, the site resident and site worker soil risk estimates for Building 71 and Building 604 exceed FDEP's threshold, assuming the soil exposure pathways will be completed. The primary contributor to soil risk is arsenic, while secondary contributors are dependent upon the sample location. Consequently, chemicals of concern have been identified for the site residents and workers. Neither Building 71 nor Building 604 trespasser risk estimates exceed FDEP's threshold.

At Building 71, soil hazard estimates are less than the USEPA and FDEP threshold of 1.0 for site residents, site workers, or site trespassers. The hazard estimate for Building 604 exceeds the threshold of 1.0 due to copper. All chemicals of concern have been identified for soil based on the hazard index.

Drinking water is supplied by Corry Station, and the water-bearing zone beneath NAS Pensacola would not be expected to be used as a drinking water source. Assuming groundwater exposure

pathways would be completed, risk estimates for both areas would exceed USEPA and FDEP risk and hazard thresholds. In groundwater near Building 71, arsenic is the primary contributor to risk and hazard estimates, while VOCs and arsenic primarily account for risk and hazard estimates near Building 604. The arithmetic mean and geometric mean of the arsenic concentrations reported in groundwater did not exceed the MCL or FPDWS.

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