Massachusetts Military Reservation

Decision Document
Study Area CS-14

FINAL
APRIL 2000

Prepared for:
AFCEE/MMR
Installation Restoration Program
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LOCKHEED MARTIN ENERGY SYSTEMS for the
U.S. DEPARTMENT OF ENERGY under contract DE-AC05-84OR21400

INSTALLATION RESTORATION PROGRAM

DECISION DOCUMENT
STUDY AREA CS-14

FINAL
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Prepared for:
Air Force Center for Environmental Excellence and
Air National Guard

Prepared by:
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Portland, Maine
Project No. 49240

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STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

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As part of the preliminary assessment conducted in 1986 for the Installation Restoration Program at the Massachusetts Military Reservation, Study Area CS-14 was identified as a potential site of past uncontrolled disposal of hazardous substances. Because of this finding, contamination in these areas was investigated and characterized during: a Phase I Site Investigation (SI) (1989, 1990); a Phase II SI (1990, 1991); a Sump Investigation Program (1991, 1992); a Phase III Confirmation SI, quarterly monitoring of monitoring well MW-1 since 1996; a drainage structure removal program (DSRP) during 1996; and additional groundwater sampling (1999). This Decision Document provides a summary of these activities, an assessment of the contaminants detected, and a preliminary risk evaluation.

Study Area CS-14 consists of the subsurface structures between Building 156 and Hangar 158 which received liquid waste material from these buildings. Wastes reportedly discharged to these structures included chlorinated solvents, and waste petroleum products. Field activities included soil-gas sampling and analysis, and soil and/or groundwater sampling and analysis from soil borings or monitoring wells installed at the study area.

Potential contaminant sources for the CS-14 Study Area consisted of:

- A leaching pit located outside the southwest corner of Building 156.
- A sand/gas trap associated with Building 156.
- An oil water separator (OWS) associated with Hangar 158 and the Building 156 sand/gas trap.
- Historical waste disposal practices.

The deposition of these potential contaminant sources is as follows:

- The leaching pit area was excavated during the DSRP. Associated contamination was not found and the area was backfilled and regraded.
- The sand/gas trap was evaluated in the DSRP Engineering Evaluation/Cost Analysis (EE/CA) and was not recommended for removal.
- The OWS associated with Hangar 158 and the Building 156 sand/gas trap was abandoned in 1989. This OWS was also evaluated in the DSRP EE/CA and was not recommended for removal. This OWS was, however, decontaminated in place and filled with concrete. A new OWS for Hangar 158 and the Building 156 sand/gas trap was installed in 1989.
- Building 156 continues to be used as an aircraft parts maintenance facility. Current waste disposal practices include routine off-site disposal of wastes via the Defense Reuse Management Office to a licensed facility. The concrete floor of Building 156 has

been treated with a sealant. The Building 156 soil/gas trap and new OWS for the gas trap and Hangar 158 are cleaned annually and the discharge from the new OWS flows to the new MMR Wastewater Treatment Plant.

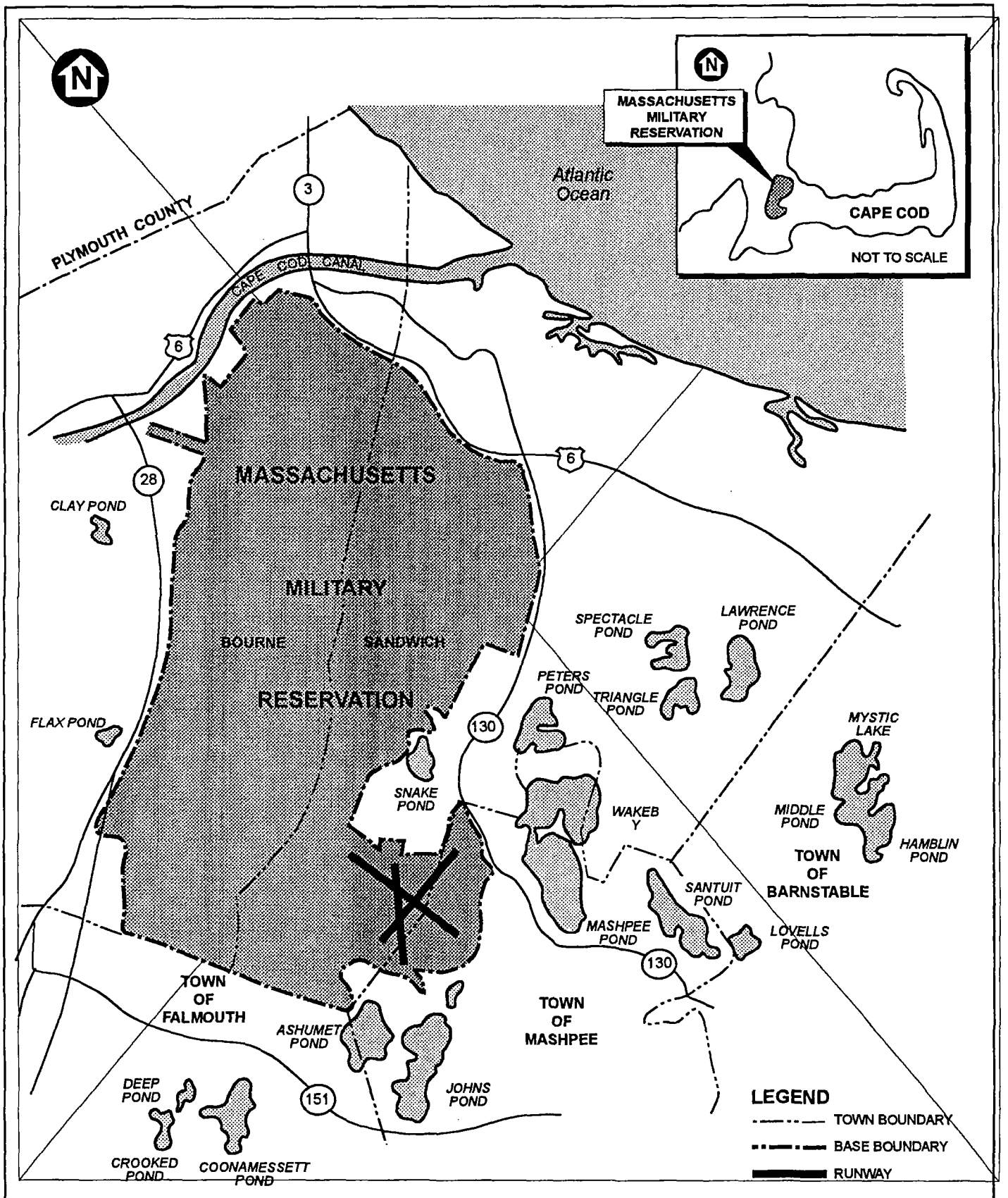
Results from the human health and ecological preliminary risk evaluation, and preliminary human health risk assessment for the only contaminant (thallium in groundwater) exceeding its Tier I hazard equivalent concentrations, suggest that unacceptable levels of risk are not anticipated. Therefore, the Air Force Center for Environmental Excellence recommends no further action for Study Area CS-14.

1.0 INTRODUCTION

The objectives of this decision document are to describe the history of Study Area Chemical Spill (CS)-14; present results of the site investigation (SI) at Study Area CS-14; present results of the human-health preliminary risk evaluations (PREs); and explain why no further action is appropriate for this site.

Study Area CS-14 is located on the Massachusetts Military Reservation (MMR) on Cape Cod, Massachusetts (Figure 1-1). The study area is situated in the southeastern portion of MMR within the secure flightline area, with access restricted to authorized personnel (Figure 1-2). The CS-14 Study Area consists of subsurface structures between Hangar 158 and Building 156 which received liquid waste material from these buildings. This study area was identified initially in the Task 6 records search preliminary assessment of MMR as part of the Installation Restoration Program (IRP) (E.C. Jordan Co., 1986). The IRP is a program at military facilities to identify, evaluate, and remediate waste disposal and spill sites that may have become contaminated through historical practices.

As part of the records search, Study Area CS-14 was ranked by the Hazard Assessment Rating Methodology (HARM) and received an overall score of 63.8. The HARM recommends further investigation for locations rated greater than 50. Consequently, a SI was conducted at the study area. Results of the SI indicate low concentrations of site-related contaminants at the study area; however, risks to human receptors caused by the presence of these contaminants appear to be minimal.



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HLA Harding Lawson Associates		SITE LOCATION MAP
INSTALLATION RESTORATION PROGRAM MASSACHUSETTS MILITARY RESERVATION	STUDY AREA CS-14 DECISION DOCUMENT	FIGURE 1-1

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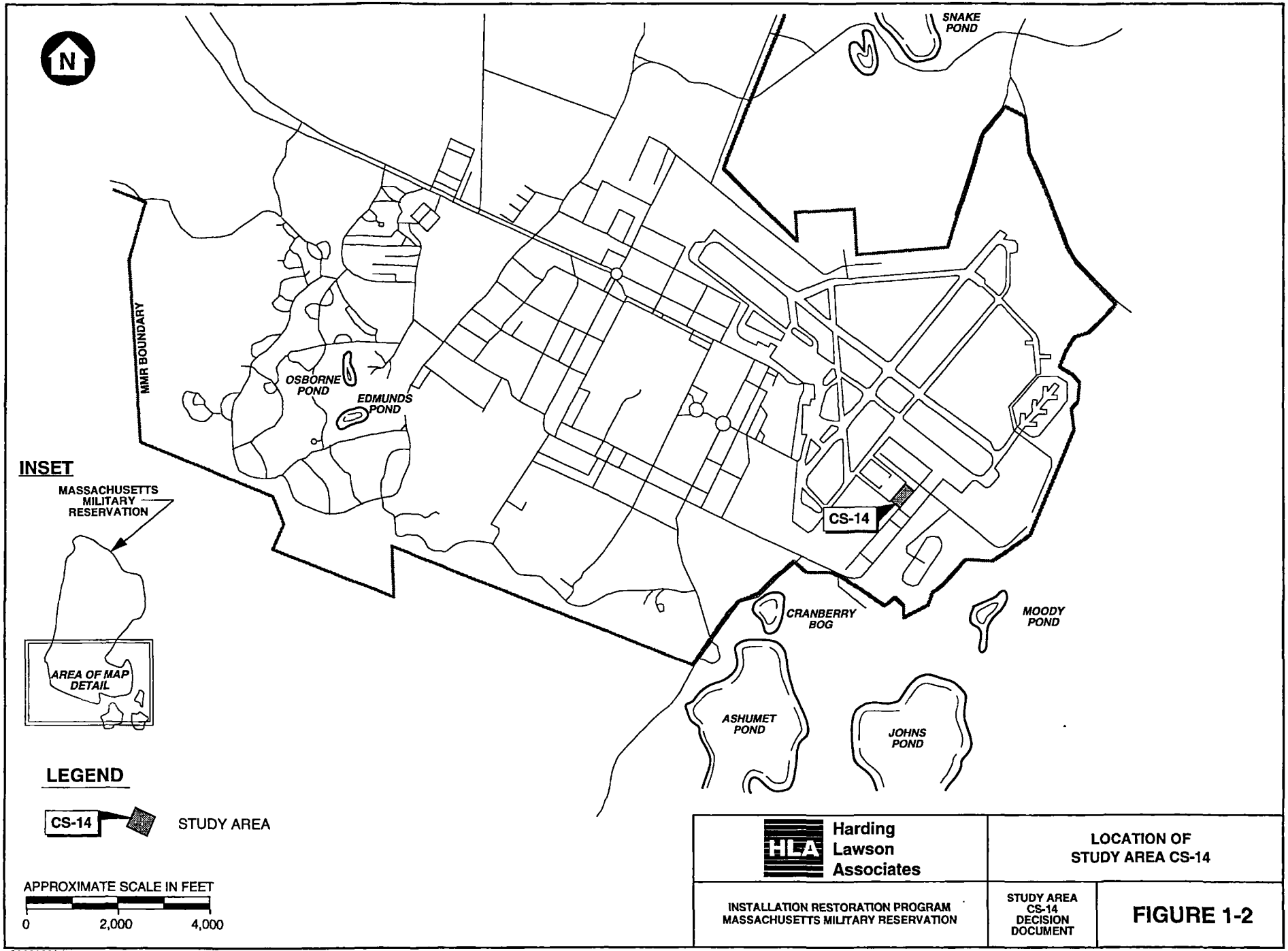

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LOCATION OF STUDY AREA CS-14

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FIGURE 1-2

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2.0 BACKGROUND AND PHYSICAL SETTING

This section describes the background and physical setting at Study Area CS-14, including history of MMR operations, geography, regional geology and hydrogeology, land use and demographics, study-area description and history, and SI activities.

2.1 HISTORY OF OPERATIONS

Military use of locations now comprising MMR began in 1911. From 1911 to 1935, the Massachusetts Army National Guard (ARNG) periodically conducted maneuvers and weapons training in portions of Shawme Crowell State Forest. In 1935, the Commonwealth of Massachusetts purchased the area now occupied by MMR for permanent training facilities. Most activity at MMR has occurred since then, including operations by the U.S. Army, U.S. Navy (USN), U.S. Coast Guard (USCG), U.S. Air Force (USAF), Massachusetts ARNG, Air National Guard (ANG), U.S. Marine Corps, and Veterans Administration (VA). In general, two different types of operations have dominated military activity at MMR: (1) mechanized Army training and maneuvers, and (2) military aircraft operations, maintenance, and support.

Intensive U.S. Army activity occurred during World War II (WWII) and demobilization after the war. During that time, large-scale motor-pool activities and troop billeting occurred in parts of the Cantonment Area, designated as the Inner Truck Road and Outer Truck Road areas. Operations were conducted in areas surrounding a central parade ground. Air operations during this time were at a relatively low level of activity. During the last two years of WWII, the USN used the MMR runways, flightline, and housing areas for flight training.

A military hospital was in operation at MMR from 1940 to 1970. Immediately following WWII, the hospital became a major orthopedic rehabilitation center. In the early 1970s, the hospital was decommissioned and demolished.

Intensive aircraft operations occurred from 1955 to 1970, when large numbers of surveillance and air defense aircraft operated from MMR. During this period, the USAF operated 45 EC-121 (Super Constellation) Airborne Early Warning and Control aircraft and

a Fighter-Interceptor Wing (FIW) from MMR. These operations occurred along the expanded flightline areas located in the southeastern portion of the Cantonment Area.

From 1962 to 1972, a Boeing Michigan Aeronautical Research Center air defense missile installation was located at MMR. During the 1970s, the Strategic Air Command also used the runways at MMR to park refueler aircraft. In 1970, the airborne surveillance activity was phased out. The air defense mission was continued by the USAF until 1973, when this mission, as well as management of the base, was transferred to the 102nd FIW of the Massachusetts ANG.

Other major operations have been ongoing at MMR. ARNG and U.S. Army Reserve training has been conducted since the early 1950s and continues at varying levels. In 1970, the USCG began operations at Air Station Cape Cod at MMR; these operations continue today. Since 1978, the USAF has operated the Precision Acquisition Vehicle Entry - Phased Array Warning System missile and space-vehicle tracking system from Cape Cod Air Force Station at the northern end of MMR. In addition, in 1978, the Veterans Administration acquired 750 acres in the western portion of MMR to develop the Massachusetts National Cemetery, which began operation in 1980.

AVCO, Inc., has operated a test-firing range at MMR since 1968, primarily for testing armor detection, weapons guidance, and anti-armor warhead systems. The U.S. Department of Agriculture has operated a laboratory since 1960 at MMR, primarily to study biological control measures for the gypsy moth.

2.2 CLIMATE

The climate at MMR is categorized as humid continental, modified by proximity to the Atlantic Ocean. Prevailing winds are from the northwest from November to March and from the southwest from April to October. Wind speeds range from an average of 9 miles per hour (mph) from July through September to an average of nearly 12 mph from October through March. Short periods of much higher wind velocities (i.e., 40 to 100 mph) occur periodically due to tropical and oceanic storms.

Precipitation is fairly evenly distributed throughout the year, with June being the driest month. Average precipitation is 4 inches per month throughout the year, with a variation from 2 to 4.8 inches per month. Average annual rainfall is 47.8 inches.

Temperature extremes are mitigated by the influence of the Atlantic Ocean, producing milder winters and cooler summers than those experienced in inland areas of Massachusetts. In February, the coldest month of the year, the daily temperature ranges from an average minimum of 23 degrees Fahrenheit (°F) to an average maximum of 38°F. In July, the warmest month of the year, the average temperature ranges from daily lows of 63°F to daily highs near 78°F.

2.3 GEOGRAPHY

MMR is located on two distinct types of terrain on the Cape Cod peninsula. The main Cantonment Area lies on a broad, flat, gently southward-sloping glacial outwash plain. Elevations in this area range from 100 to 140 feet above mean sea level (MSL). North and west of the Cantonment Area, the terrain becomes hummocky with irregular hills and greater topographic relief. This area lies in the southward extent of Wisconsinan Age recessional moraines. Elevations in this area generally range from 100 to 250 feet above MSL. The highest elevation reported at MMR is 306 feet above MSL in the vicinity of Pine Hill (U.S. Army Corps of Engineers, 1985). The entire reservation is dotted with numerous kettle holes and depressions; some contain water.

2.4 REGIONAL GEOLOGY AND HYDROGEOLOGY

The regional geology and hydrogeology of western Cape Cod are summarized in this subsection, including a description of the physical nature and conditions occurring in the subsurface environment of MMR. The regional geology and hydrogeology of Cape Cod and MMR are discussed in detail in the Task 1-8 Hydrogeologic Summary Report (E.C. Jordan Co., 1989).

2.4.1 Regional Geology

The geology of western Cape Cod where MMR is located is dominated by glacial sediments deposited during the Wisconsinan glacial epoch, approximately 7,000 to 85,000 years ago. Two moraines, the Buzzards Bay Moraine (BBM) and the Sandwich Moraine (SM), were deposited along the western and northern edges of western Cape Cod. Between them lies a broad outwash plain known as the Mashpee Pitted Plain (MPP).

Sediments associated with the BBM and SM, both ice contact deposits, are generally poorly sorted, ranging from silty till to gravel-sized material. Deposited in a glacial outwash environment, MPP sediments are characterized by well-sorted, stratified sands and gravel with only traces of silt. Fine-grained sediments and basal till are found below the MPP unconsolidated sediments. The total thickness of unconsolidated sediments is estimated to vary between 175 and 325 feet in the central and northern parts of MMR (E.C. Jordan Co., 1989).

2.4.2 Regional Hydrogeology

MMR is located over the Cape Cod aquifer, a water table or unconfined aquifer characterized by highly permeable glacial deposits. Total aquifer thickness has been estimated to range from 250 feet in the northern moraines to 80 feet in the southern MPP. The highest aquifer groundwater elevation is located in MPP sediments beneath the northern section of MMR. Groundwater flow is generally in a radial direction from this high point. The regional water table slope across the industrialized areas of MMR is southward between 0.001 and 0.003 feet per foot (ft/ft) (ABB-ES, 1993).

Hydraulic conductivities and the respective calculated groundwater seepage velocities vary with the geologic unit. Hydraulic conductivities generally range from 50 to 800 feet per day (ft/d) in outwash material, while conductivities in moraine sediments are generally only one-fifth to one-tenth as high (E.C. Jordan Co., 1989). Previous investigations have shown that, in general, under the influence of recharge from precipitation, water arriving at the water table beneath MMR sinks gradually as it moves downgradient.

Groundwater recharge is solely from precipitation and averages approximately 20 inches per year. Integrating the area from the highest groundwater elevation in the undeveloped northern areas of MMR to the industrialized southern sections, the average recharge from precipitation is approximately 7 million gallons per day (E.C. Jordan Co., 1989). Groundwater recharge, within the western and northern parts of MMR, supplies water for the towns of Bourne and Sandwich. Groundwater recharge within the southern MMR flows south toward the towns of Mashpee and Falmouth, where it is also used for water supply. In areas where town water-supply lines are nonexistent, residences use private wells for domestic water supplies.

2.5 LAND USE AND DEMOGRAPHICS

MMR has a year-round population of approximately 2,000 people, with additional 800 non-resident employees working on the reservation. Year-round residents live in a housing area operated by the USCG. Intermittent use of the area for Reserve and National Guard

activities increases the MMR population by as many as several thousand people (E.C. Jordan Co., 1986). Both the year-round and intermittent populations live on MMR and in the towns of Bourne, Falmouth, Mashpee, and Sandwich, adjacent to MMR.

Land in areas near MMR is used for residential, recreational, and agricultural purposes. Recreational land uses include golfing, swimming, boating, and other water sports. Horse stables are also present near the boundaries of MMR. The Crane Wildlife Management Area is located along the southern boundary of MMR. Many local residents pursue recreational activities in this area, including model-plane flying, bird watching, and deer hunting.

Agricultural use of land near MMR includes blueberry and other fruit and vegetable farms, as well as cultivation and harvesting of cranberries from lowland bogs of the river valleys. Many of the soil types located on MMR are federally designated as Prime Farmland. Some commercial and industrial development exists in the area, including service industries, sand and gravel pit operations, municipal landfills, and wastewater treatment facilities.

2.6 STUDY AREA DESCRIPTION AND HISTORY

In 1986, as part of the Phase 1 Records Search (E.C. Jordan, Co., 1986), the CS-14 Study Area was initially designated. CS-14 was limited to a leaching pit (98CDXX2) located outside the southwest corner of Building 156. In 1990, during the Phase 2 Site Investigation, CS-14 was expanded to include subsurface structures (a soil/gas trap [98CDXX1], an oil/water separator and associated manholes [98CDXX3/98CDXX4/ 98CDXX5]) between Building 156 and Hangar 158 which received floor drain liquids from these two buildings (ABB-ES, 1992).

2.6.1 Leaching Pit (98CDXX2)

The leaching pit was reportedly located off the southwestern corner of Building 156, adjacent to a room containing a vaporization degreaser. The single scupper drain (Figure 2-1) within this room was the only source of discharge to the leaching pit, and from 1955 to 1969, the leaching pit reportedly received waste discharge from this scupper drain. The exact quantities of wastes drained from this room into the leaching pit are unknown. The leaching pit reportedly consisted of perforated pipe to facilitate liquid infiltration of the soil. Trichloroethene (TCE) and tetrachloroethene (PCE) were reportedly used as solvents

in this room to remove cosmoline, a petroleum-based rust inhibitor, from new engines and engine parts. Cosmoline is a registered trademark of E.F. Houghton and Co, and is composed of petrolatum (e.g., white oil), which is in the aliphatic hydrocarbon chemical family. Most of the solvent waste was reportedly recycled and reused; however, a portion was probably discharged to the scupper drain and connecting leaching pit (E.C. Jordan Co., 1986).

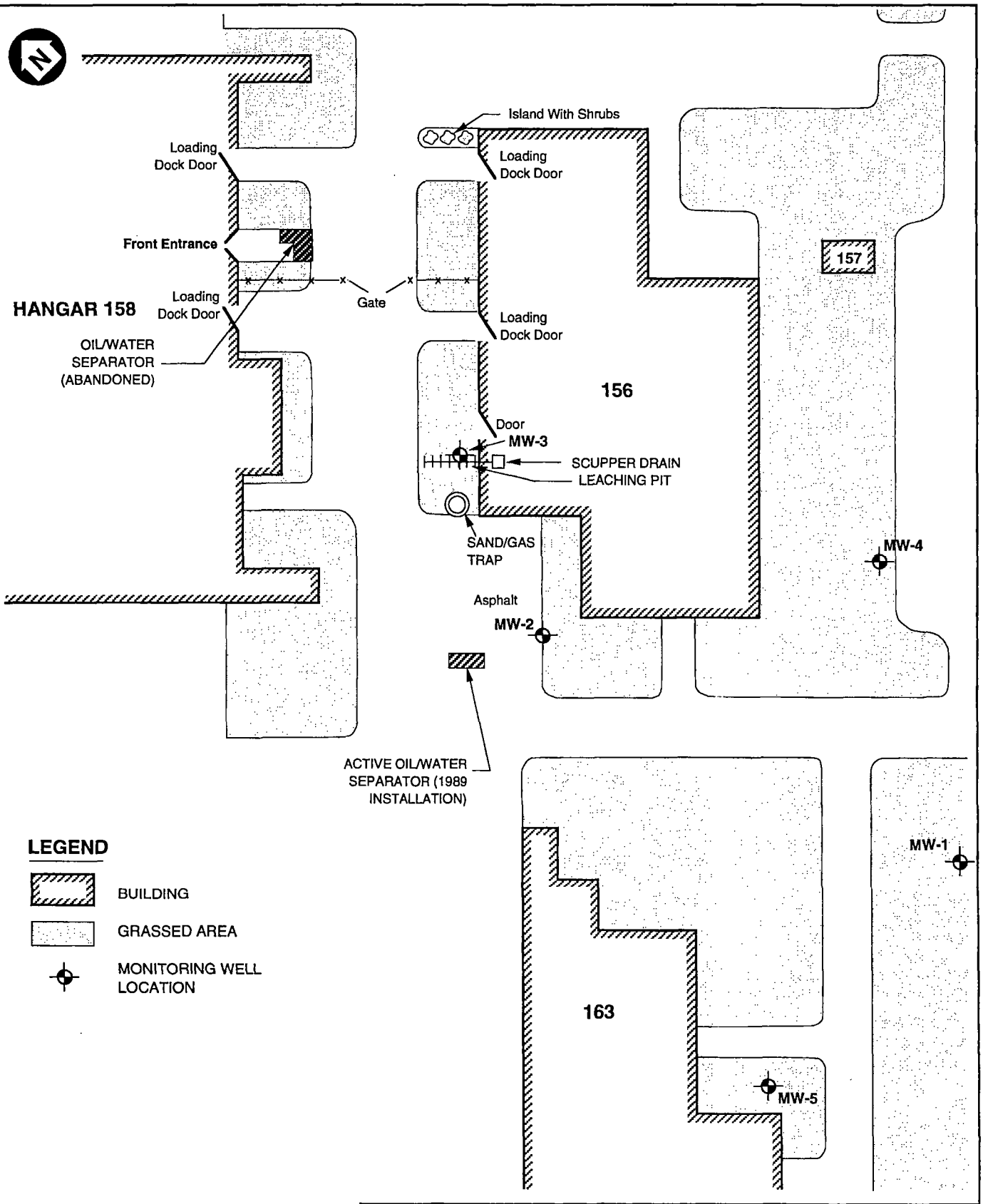
In 1968-1969, the scupper drain was rerouted to a sand/gasoline trap located 25 feet southwest of the leaching pit. During remedial investigations performed in 1996, the leaching pit was not found after test trench excavations were performed in 1996.

2.6.2 Building 156 Sand/Gas Trap (98CDXX1)

The Sand/Gas Trap southwest of Building 156 is a vented, 12-foot deep concrete subsurface settling tank, with a 30-inch diameter manhole set at grade. Until 1968-1969, the Sand/Gas Trap received industrial waste via floor drains from operations within Building 156, and discharged those wastes to a 27-inch Storm Drain line that eventually discharged to the SD-4 drainage swale (1000 feet east of CS-14 via Reilly Road). Industrial waste discharged to the Sand/Gas Trap included spent petroleum distillate solvents, and halogenated/non-halogenated solvents (TCE, PCE, methyl ethyl keytone [MEK], Toluene, Acetone). In 1968-1969, the discharge from the Sand/Gas trap was rerouted to an oil-water separator (98CDXX3/4/5) located just east of the main entrance to Hangar 158. In 1989, this line was abandoned and the discharge from the Sand/Gas trap was again rerouted to a new oil-water separator located approximately 120 feet south of the trap (ABB-ES, 1992). The Sand/Gas trap is currently in operation.

2.6.3 Hangar 158 Oil Water Separator (98CDXX3/98CDXX4/98CDXX5)

The Oil Water Separator (OWS) located just east of the main entrance to Hangar 158 historically received floor drain waste and roof drainage from Hangar 158 (Figure 2-2). Floor drain waste was similar to that received by the Building 156 Sand/Gas Trap (E.C. Jordan, 1986). Discharge from this OWS flowed to a 27-inch storm drain line that eventually discharged to the Storm Drain (SD)-4 drainage swale. The OWS was altered in



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SITE FEATURES AND LOCATION OF MONITORING WELLS STUDY AREA CS-14

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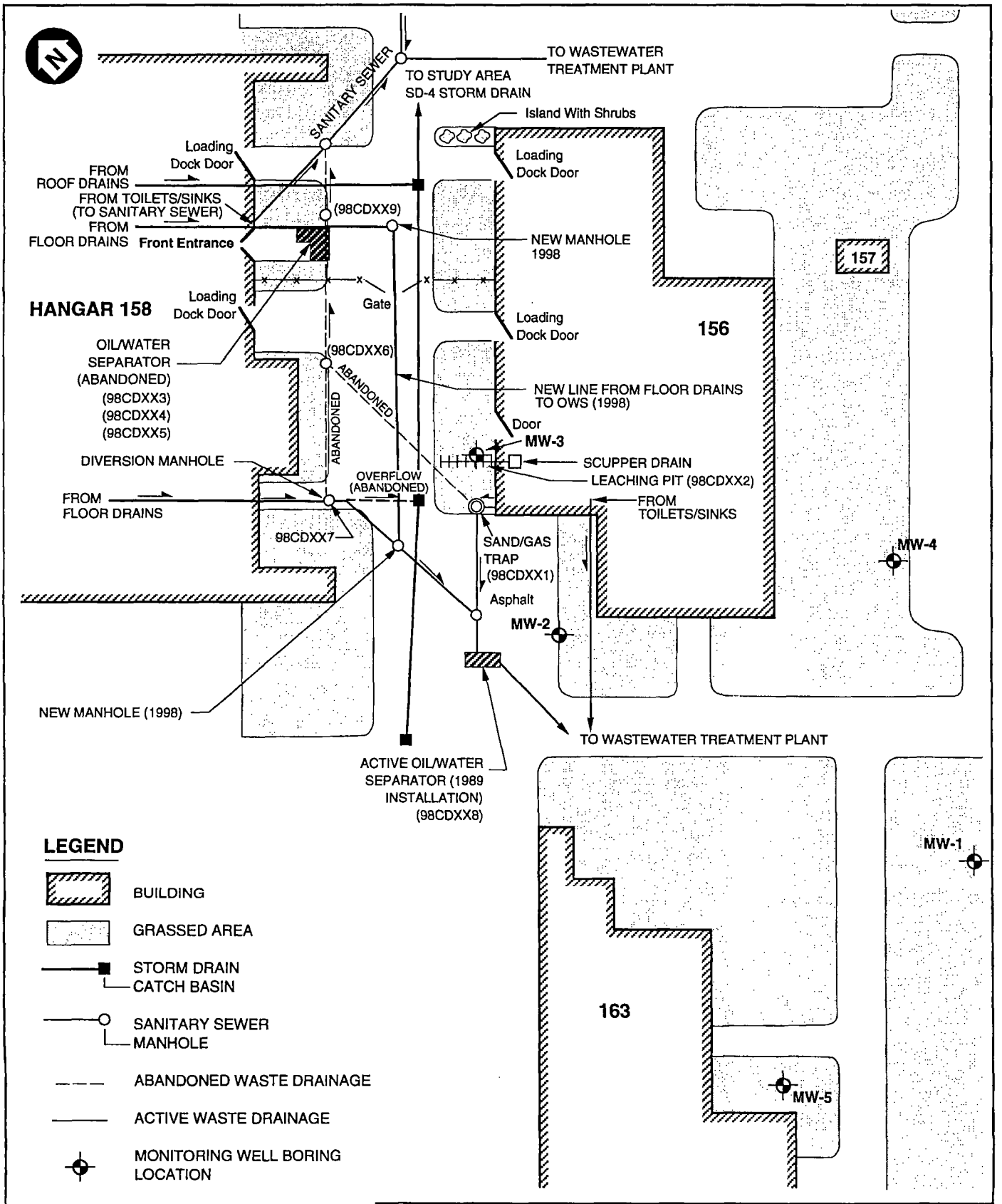
FIGURE 2-1

1968-1969 to receive waste discharged from the Sand/Gas trap from Building 156. During this time, the discharge outlet was also rerouted to an 8-inch sanitary sewer line; however, overflow from the OWS would still discharge to the 27-inch storm drain line. In 1989, the OWS was filled with sand and inlet pipes to the OWS were rerouted to a new OWS located approximately 120 feet south of the sand/gas trap (ABB-ES, 1992). In 1996, the sand originally used to backfill the Building 158 OWS in 1989 was removed and the structure was steam-cleaned and filled in place with concrete (HLA, 1999).

2.6.4 Current Waste Disposal Practices

Building 156 continues to be used as an aircraft parts maintenance facility. Aircraft parts are routinely oiled with Lube Oil and cleaned with non-chlorinated solvents (soaps/detergents). Hazardous waste is routinely shipped off-site via the Defense Reuse Management Office (DRMO) to a licensed receiving facility. Hazardous waste shipped off from Building 156 in Fiscal Year 1998 included 1150 pounds of oil/waste oil, 3914 pounds of JP-8/foam, 2267 pounds of oily rags, and 10 gallons of sodium hydroxide. Liquids not contained by buckets, rags, or speedi-dri are discharged to floor drains that flow directly to the new OWS via the gas/sand trap. A 1999 tour of Building 156 was conducted by Air Force Center for Environmental Excellence (AFCEE). The concrete floor has been treated with sealant, there was no obvious floor staining especially around the floor drains, and the maintenance crews had been educated on proper hazardous waste disposal practices. The Building 156 soil/gas trap (98CDXX1) and new OWS (98CDXX8) are under contract by the Air National Guard (ANG) to be cleaned annually. Discharge from the new OWS leads directly to the new Otis Wastewater Treatment Plant via a 6-inch line on Chaves Street to a 10-inch line on Granville Avenue.

Hangar 158 continues to be used as an aircraft maintenance facility. Aircraft are wheeled into the hangar, partially disassembled to access, clean, and maintain, and repair the aircraft. The aircraft are also hosed down in the southeast corner of the hangar. Non-chlorinated solvents (soaps/detergents) are used for cleaning the aircraft. Hazardous Waste shipped off from Hangar 158 in Fiscal Year 1998 included 288 pounds of adhesives, 130 pounds of crushed paint cans, 1602 pounds of Hydra fluid, 11312 pounds of waste JP-8 fuel, 472 pounds of oily speedi-dri, 4660 pounds of oily rags, 3460 pounds of Paint/water, 320 pounds of paint rags, and 142 pounds of paint solids. Liquids not contained by buckets, rags, or speedi-dri are discharged to floor drains that flow directly to the new OWS. A 1999



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SCHEMATIC OF UNDERGROUND UTILITIES STUDY AREA CS-14

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FIGURE 2-2

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tour of Building 156 was conducted by AFCEE. The concrete floor has been treated with sealant, there was no obvious floor staining especially around the floor drains, and the maintenance crews were educated on proper hazardous waste disposal practices.

Floor Drains on the northern half Hangar 158, which had historically discharged to the sanitary sewer, have recently been rerouted to the new OWS (1998). This had been done because maintenance activities on aircraft in the northwest of the hangar had commenced in 1998. Historically, this area had just been used to store aircraft awaiting maintenance in the southern half of the hangar.

The majority of Study Area CS-14 has historically been paved and nearly level (see Figure 2-1). Small grassy areas are present along the building perimeters and no staining was observed in these areas.

Figure 2-2 is a schematic diagram showing the location of the leaching pit and other waste-disposal structures associated with Study Area CS-14.

Based on results of the record search (E.C. Jordan, 1986), Study Area CS-14 was recommended for additional investigation. As part of the records search, the study area was ranked using the HARM system and was given an overall score of 63.8.

2.7 SITE INVESTIGATION

This subsection describes the site investigation work that was conducted at Study Area CS-14. As a result of the 1986 records search, which indicated that waste disposal activities at Study Area CS-14 were confined to the discharge of liquid waste to subsurface structures from Building 156 and Hangar 158, and on the basis of current activities at the time, the investigation concentrated on sampling subsurface soils and groundwater. Tables 2-1 and 2-2 present a summary of investigations and exploration locations respectively.

2.7.1 Phase I Site Investigation (1989/1990)

Phase I of the CS-14 Site Investigation was designed to investigate whether soil and/or groundwater at the CS-14 Study Area were significantly impacted by waste disposed of in the leaching pit. As stated in Section 2.6, at the time of the Phase I Site Investigation, the CS-14 Study Area was confined to studying the leaching pit. The Phase I field program included a soil gas survey and installation of one groundwater monitoring well (MW-1).

A monitoring well (MW-1) was located approximately 250 feet downgradient of Study Area CS-14 to provide downgradient groundwater quality data. As such, no soil samples were collected for chemical analysis or geologic logging. Details of the monitoring well installations at CS-14 are summarized in Table 2-3.

Thirty-two soil gas samples were collected to evaluate the distribution of contaminants across the study area. The sampling was concentrated near the leaching pit and at the southern corner of Hangar 158 where the potential for contamination from Hangar 158's diversion overflow drain line existed. The selection of soil gas sampling points was severely restricted in the field due to the presence of underground utilities. Soil gas sampling could not be extended to the area southwest of the leaching pit, where potential existed for contamination, because of utilities and the sensitive nature of operations in this area (inside the flightline). The samples were collected from 3-6 feet bgs due to the reported location of the leaching pit and subsurface utility (diversion overflow drain line) and to minimize atmospheric interference.

The thirty-two soil-gas samples were collected and screened for target volatile organic compounds (1,1-dichloroethene [DCE]; T-1, 2-DCE; TCE; PCE; and benzene, toluene, ethylbenzene, xylene [BTEX]) using a gas chromatograph (GC) equipped with a Flame Ionization Detector/Electron Capture Detector and packed columns (Figure 2-3). Table 2-4 summarizes samples collected for field analysis. Table 2-5 lists the target analytes and practical quantitation limit (PQL) for each analyte.

2.7.2 Phase 2 Site Investigation (1990/1991)

Phase 2 of the Site Investigation was designed to further investigate the contamination detected from the soil gas survey and evaluate the potential that groundwater directly below the leaching pit had been impacted by the leaching pit. Two additional wells (MW-2, MW-3) were installed during Phase 2 of the Site Investigation. Six soil samples were collected during the advancement of soil boring MW-3, adjacent to the leaching pit for the purpose of geologic logging and chemical analysis. All six samples were screened for volatile organic compounds (VOCs). Three of these six subsurface samples were submitted for off-site laboratory analysis. As MW-2 was installed to provide downgradient groundwater quality data, no soil samples were collected for chemical analysis or geologic logging. During Phase 2 of the Site Investigation, groundwater samples were screened for VOCs from

TABLE 2-1
SUMMARY OF INVESTIGATIONS

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	EXPLORATION TYPE	NUMBER COMPLETED	EXPLORATION IDENTIFICATION
PHASE 1 SITE INVESTIGATION	SOIL GAS	32	CS-14-1 THROUGH CS-14-32
	MONITORING WELL	1	MW-1
PHASE 2 SITE INVESTIGATION	MONITORING WELL	2	MW-2, MW-3
SUMP INVESTIGATION REMOVAL PROGRAM	TERRAPROBE BORING	12	98TRX 11-13, 21-23, 31-36
PHASE 3 CONFIRMATION STUDY	NONE	-	-
SERGOU REMEDIAL INVESTIGATION	MONITORING WELL	2	MW-4, MW-5
EASTERN BRIARWOOD GROUNDWATER MONITORING PROGRAM	NONE	-	-

NOTES:
Only groundwater samples were obtained during the Phase 3 Confirmation Study

EXPLORATIONS
CS-14-1 = Soil-gas sample location
MW = Soil boring completed as a monitoring well

TABLE 2-2
SUMMARY OF EXPLORATION LOCATIONS

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AREA	EXPLORATION ID	MEDIUM INVESTIGATED	POTENTIAL SOURCE OF CONTAMINANTS
SUBSURFACE SOILS ASSOCIATED WITH DSRP STRUCTURES	CS-14-1 THROUGH CS-14-32	SOIL GAS	RELEASES FROM DSRP STRUCTURES
INTERPRETED DOWNGRADIENT OF CS-14	MW-1	GROUNDWATER	RELEASES FROM ACTIVITIES AT CS-14
INTERPRETED DOWNGRADIENT OF SCUPPER DRAIN, LEACHING PIT, AND GAS TRAP	MW-2	GROUNDWATER	RELEASES FROM ACTIVITIES AT HANGAR 156
INTERPRETED DOWNGRADIENT OF ABANDONED OIL/WATER SEPARATOR	MW-3	SOIL AND GROUNDWATER	RELEASES FROM ACTIVITIES AT CS-14
SUBSURFACE SOILS ASSOCIATED WITH DSRP STRUCTURES	98TRX 11-13, 21-23, 31-36	SOIL	RELEASES FROM DSRP STRUCTURES
INTERPRETED DOWNGRADIENT OF CS-14	MW-4, MW-5	GROUNDWATER	RELEASES FROM ACTIVITIES AT CS-14

NOTES:

ID = identification
MW = monitoring well
DSRP = Drainage Structure Removal Program

TABLE 2-3
MONITORING WELL COMPLETION DETAILS

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WELL DESIGNATION	YEAR INSTALLED	SOIL DRILLING METHOD	EFFECTIVE SCREEN INTERVAL (bgs)	COMPLETION DEPTH (bgs)	CONSTRUCTION MATERIAL
MW-1	1989	HOLLOW-STEM AUGER	49-59	60	2.0" ID PVC
MW-2	1990	HOLLOW-STEM AUGER	51.3-61.3	62	2.0" ID PVC
MW-3	1990	HOLLOW-STEM AUGER	51.2-61.2	62	2.0" ID PVC
MW-4	1993	HOLLOW-STEM AUGER	49-59	75	2.0" ID PVC
MW-5	1993	HOLLOW-STEM AUGER	54-64	64	2.0" ID PVC

NOTES:

bgs = below ground surface (in feet)
MW = monitoring well
PVC = polyvinyl chloride
2" ID = two-inch inside diameter

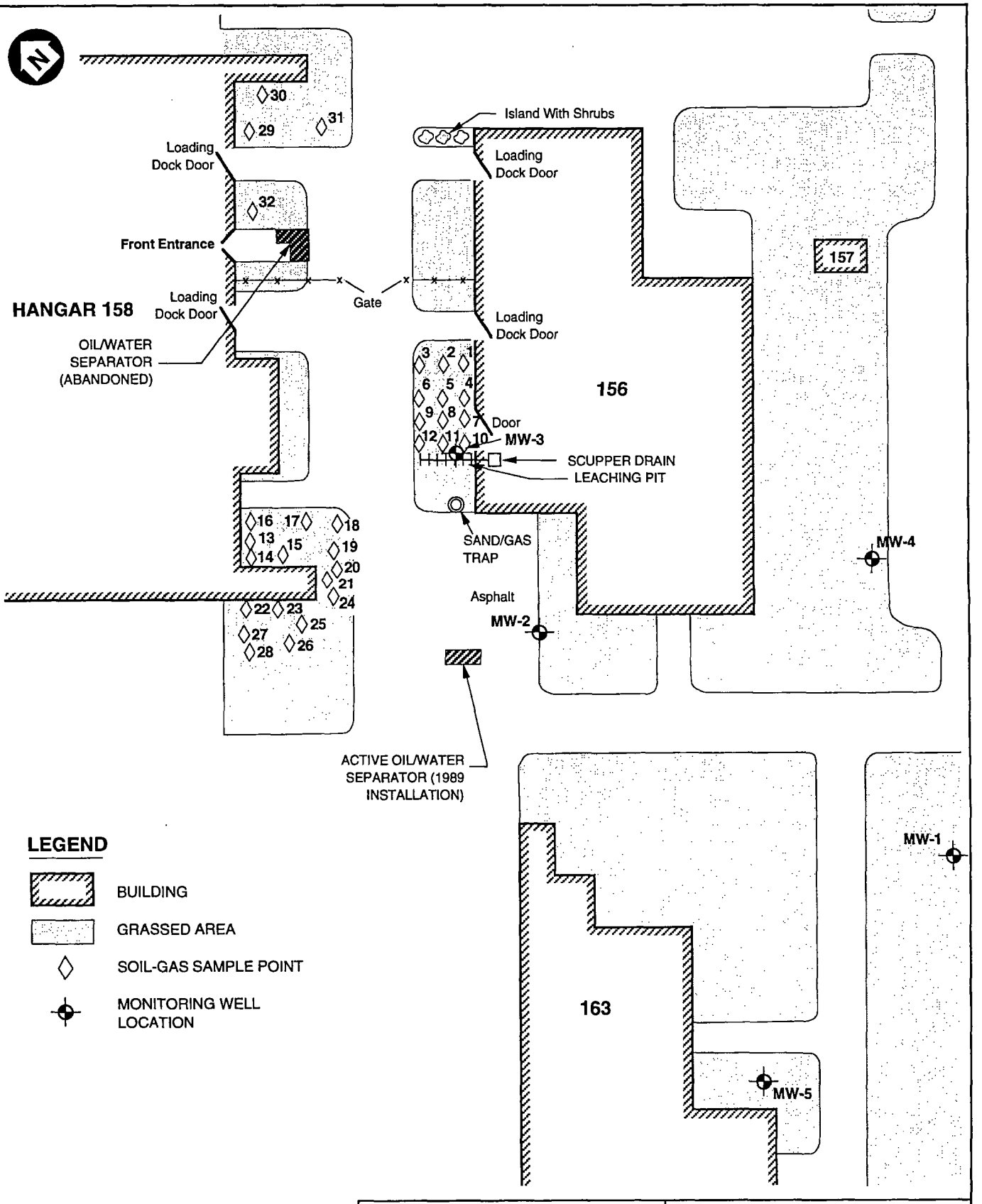
Monitoring Wells MW-1 and MW-3 and were collected from MW-1, MW-2, and MW-3 for off-site laboratory analysis. Tables 2-6 and 2-7 summarize the soil samples obtained and a summary of the off-site soil and groundwater laboratory analytical program. Table 2-4 summarizes samples collected for field analysis and Table 2-5 lists the target analytes and PQL for each analyte.

2.7.3 Sump Removal Action Program/Phase I Sump Investigation Program (1991/1992)

From November, 1991 to February 1992, an extensive subsurface soil and liquid/sediment sampling program was conducted at Study Area CS-14 in order to further characterize the nature and extent of contamination associated with the subsurface structures between Hangar 158 and Building 156. The results of this study and previous studies on CS-14 were used to develop an engineering evaluation/cost analysis (EE/CA) for the final disposition of these subsurface structures under the Drainage Structure Removal Program (DSRP). The structures studied are displayed in Figure 2-2 and are listed below:

Structure I.D.	Description of Structure
98CDXX1	Sand and Gasoline Trap
98CDXX2	Leaching Field
98CDXX3, 98CDXX4, 98CDXX5	3 Chamber of Hangar 158's OWS
98CDXX6	Manhole Inlet to Hangar 158's OWS
98CDXX7	Diversion Manhole from Hangar 158
98CDXX8	Active Oil Water Separator
98CDXX9	Manhole Outlet from Hangar 158's OWS

One liquid and sediment sample from the sand and gasoline trap (98CLXX1 and 98CDXX1, respectively) and sediment and/or liquid samples from various manholes associated with the abandoned oil/water separator (98CDXX3, 98CDXX4, 98CDXX5, 98CDXX6, 98CDXX7, and 98CDXX9) were analyzed at the field laboratory for selected VOCs, semivolatile organic compounds (SVOCs), pesticides, inorganics, and total petroleum hydrocarbons (TPH). Sediment samples consisted of either (1) sand that was



Harding Lawson Associates	LOCATION OF SOIL-GAS EXPLORATIONS STUDY AREA CS-14
INSTALLATION RESTORATION PROGRAM MASSACHUSETTS MILITARY RESERVATION	STUDY AREA CS-14 DECISION DOCUMENT
	FIGURE 2-3

9903006(b) 1 2 4

TABLE 2-4
SUMMARY OF GAS CHROMATOGRAPH SCREENING

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

EXPLORATION TYPE	PHASE	EXPLORATION ID	MEDIUM	SAMPLE INT. (FEET BGS)	TYPE OF GC ANALYSIS
SOIL GAS	1	CS-14-1 THROUGH CS-14-32	GAS	3 - 6	HS
MONITORING-WELL BORING	2	MW-3	SOIL	2 - 4 4 - 6 16 - 18 18 - 20 54 - 56 59 - 61	PT
MONITORING WELL		MW-2	GW	51 - 61	PT
		MW-3	GW	51 - 61	PT
MONITORING WELL	SERGOU	MW-4	GW	55 - 60 60 - 65 65 - 70 70 - 75	PT
		MW-5	GW	65 - 70 70 - 75 75 - 80 80 - 85	PT

NOTES:
BGS = below ground surface
GC = gas chromatograph
GW = groundwater
HS = headspace
ID = identification
INT = interval
MW = monitoring well
PT = purge and trap

TABLE 2-5
SUMMARY OF ON SITE GAS CHROMATOGRAPH SCREENING

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

EXPLORATION TYPE	PHASE	EXPLORATION ID	MEDIUM	SAMPLE INT. (FEET BGS)	TYPE OF GC ANALYSIS
SOIL GAS	1	CS-14-1 THROUGH CS-14-32	GAS	3 - 6	HS
MONITORING-WELL BORING	2	MW-3	SOIL	2 - 4 4 - 6 16 - 18 18 - 20 54 - 56 59 - 61	PT
MONITORING WELL		MW-2	GW	51 - 61	PT
		MW-3	GW	51 - 61	PT
MONITORING WELL	SERGOU	MW-4	GW	55 - 60 60 - 65 65 - 70 70 - 75	PT
		MW-5	GW	65 - 70 70 - 75 75 - 80 80 - 85	PT

NOTES:
BGS = below ground surface
GC = gas chromatograph
GW = groundwater
HS = headspace
ID = identification
INT = interval
MW = monitoring well
PT = purge and trap

TABLE 2-6
SUMMARY OF SOIL SAMPLING

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

EXPLORATION TYPE	PHASE	EXPLORATION ID	SAMPLE INTERVAL (bgs)	COMPLETION DEPTH (bgs)	METHOD OF COMPLETION
MONITORING WELL	2	MW-3	CONTINUOUS FROM 0 TO 20 FT EVERY 5 FT FROM 24 TO 61 FT	62 FT	MONITORING WELL
TERRAPROBE BORING	SIRP	98TRX 11-13, 21-23, 31-36	EVERY 4 TO 6 FT FROM 3 TO 24 FEET (Typically 4 to 5 samples per boring)	12 TO 24 FT	NA

NOTES:

This table summarizes all soil samples collected during the completion of explorations. These samples include those collected for geologic logging and/or chemical screening and analysis. For soil samples submitted for chemical screening and/or off-site chemical analysis, see Tables 2-5 and 2-7, respectively.
bgs = below ground surface (in feet)
FT = feet
ID = Identification
MW = monitoring well
Unless otherwise indicated, sample interval was 2 feet.
NA = Not Applicable
SIRP = Sump Investigation Removal Program

TABLE 2-7
SUMMARY OF ANALYTICAL PROGRAM - OFF-SITE ANLAYSIS

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

MEDIUM	PHASE	EXPLORATION IDENTIFICATION	DEPTH* (bgs)	PARAMETERS	VALIDATION LEVEL
SUBSURFACE SOIL	2	MW-3	2-4	V	D
			16-18	V	C
			54-56	V	C
GROUNDWATER	1	MW-1	49-59	MLDL-V,SV,I	D
	2	MW-1	49-59	V,SV,I	C
		MW-2	51-61	V,SV,I	C
		MW-3	51-61	V,SV,I	C
	3	MW-1	49-59	LCW-V	D
		MW-2	51-61	LCW-V	C
		MW-3	51-61	LCW-V	C
	SERGOU	MW-1	49-59	LCW-V, SV,I,TPH	C
		MW-2	51-61	LCW-V, SV,I,TPH	C
		MW-3	51-61	LCW-V, SV,I,TPH	C
		MW-4	49-59	LCW-V, SV,I,TPH	D
		MW-5	54-64	LCW-V, SV,I,TPH	C
	EASTERN BRIARWOOD GROUNDWATER MONITORING	MW-1	49-59	LCW-V	D
	CONFIRMATIONAL SAMPLING	MW-1	49-59	LCW-V, I, EDB, MTBE	D
		MW-2	51-61	LCW-V, I, EDB, MTBE	D
		MW-3	51-61	LCW-V, I, EDB, MTBE	D
	SUPPLEMENTAL SAMPLING	MW-1	49-59	THALLIUM	D
		MW-2	51-61	THALLIUM	D
		MW-3	51-61	THALLIUM	D

NOTES:

Phase 3 = Confirmation Study
bgs = below ground surface (in feet)
* = Indicates screened interval for monitoring well
TCL = Target Compound List

Parameters
MLDL = Modified Method for Low Detection Limit
V = TCL volatile organic analytes
SV = TCL semivolatile organic analytes
I = TCL inorganic
LCW = Organic Analyses for Low Concentration Water
TPH = Total Petroleum Hydrocarbons
EDB = Ethylene Dibromide

Validation Levels
C = HAZWRAP Level C
D = HAZWRAP Level D

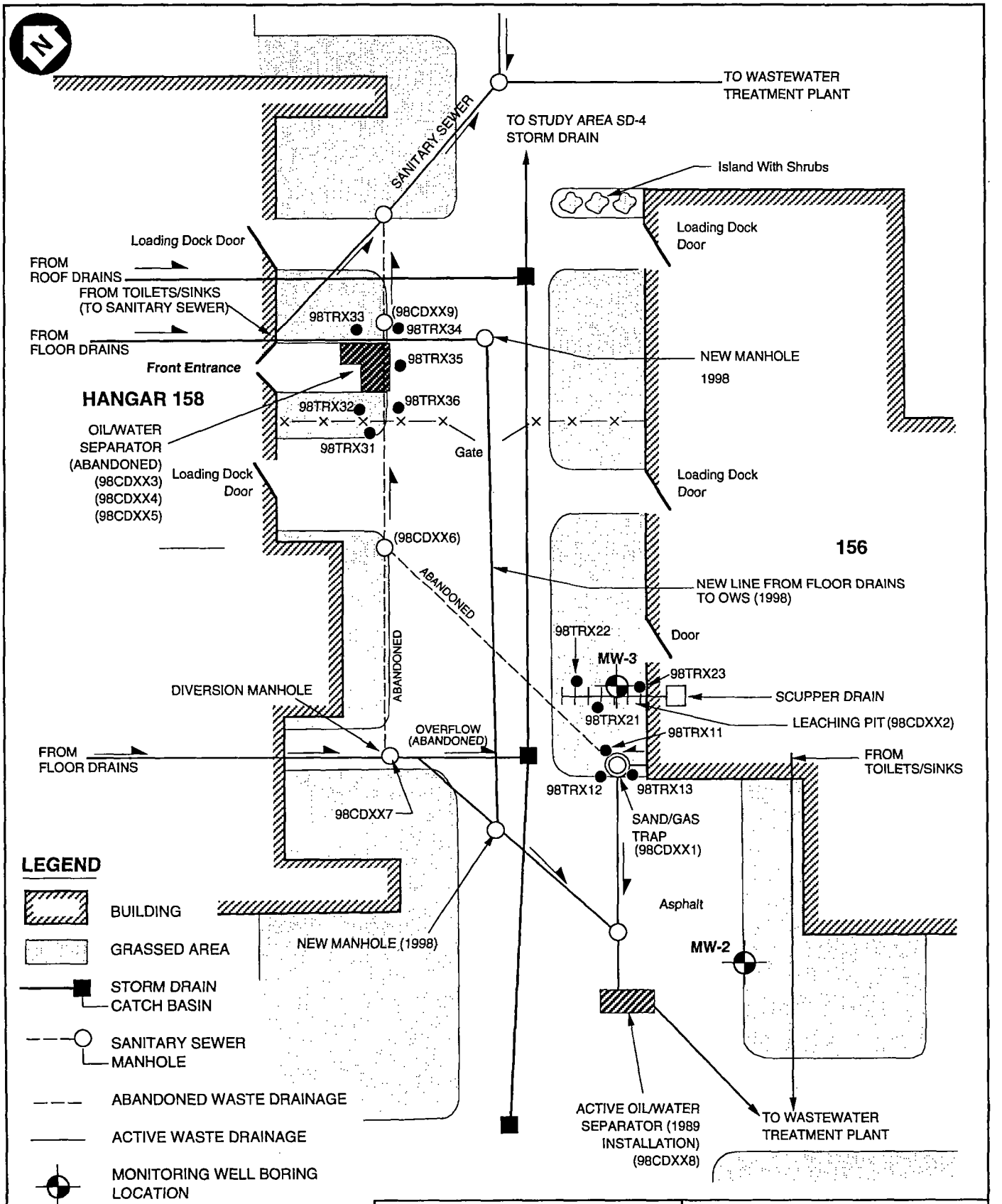
used to fill the oil/water separator in place or (2) sediment that collected in manholes that were once connected to this structure. Sampling directly from the leaching pit was not done because this structure was reportedly located beneath a paved area and adjacent to an underground gas main.

Subsurface-soil sampling at the sand and gasoline trap, leaching pit, and abandoned OWS was also conducted. Fifty-three subsurface-soil samples were collected by TerraProbe™ technique, from twelve borings, located adjacent to the structures. Locations of these borings are shown in Figure 2-4. Samples were analyzed in the field for selected VOCs, SVOCs, pesticides, inorganics, and TPH. The data quality level for the field analysis was Hazardous Waste Remedial Actions Program (HAZWRAP) Level B, which may be quantitative or semi-quantitative (HAZWRAP, 1990).

2.7.4 Site Investigation – Phase 3, Confirmation Study/Southeast Region Groundwater Operable Unit (1993)

Due to the close proximity of a number of source areas, including CS-14, in the Southeast section of the MMR, the groundwater in this area of the MMR was grouped into one operable unit – the Southeast Groundwater Operable Unit (SERGOU). The purpose of the SERGOU Remedial Investigation (RI) in 1993 was to gather geologic and hydrogeologic data needed to evaluate the long-term migration and fate of contaminated groundwater downgradient of SERGOU. In addition, the SERGOU RI included the collection and evaluation of chemical data. CS-14 is included within the Southeast (SE) MMR portion of the SERGOU data set.

In 1993, as part of the SERGOU investigation, two additional monitoring wells (i.e., MW-4 and MW-5) were installed downgradient of the study area. Monitoring wells MW-1 through MW-5 were sampled and analyzed for VOCs, SVOCs, inorganics, and TPH. A summary of the results from these analyses is contained in Section 4.2.



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LOCATION OF TERRAPROBE BORINGS STUDY AREA CS-14

INSTALLATION RESTORATION PROGRAM
MASSACHUSETTS MILITARY RESERVATION

STUDY AREA CS-14 DECISION DOCUMENT

FIGURE 2-4

9903006(c)

2.7.5 Eastern Briarwood Groundwater Monitoring Program (1996-present)

Due to the presence of chlorinated solvents detected in groundwater within the SERGOU, certain wells within the SERGOU were selected to monitor the chlorinated solvent concentrations. Monitoring Well MW-1 at Study Area CS-14 is part of this set of wells being sampled for VOCs on a quarterly basis. No other wells at CS-14 are being sampled as part of this or any other periodic monitoring program. A summary of the groundwater analytical results from MW-1, from these sampling rounds is contained in Section 4.2.

2.7.6 1999 Confirmational Sampling Rounds

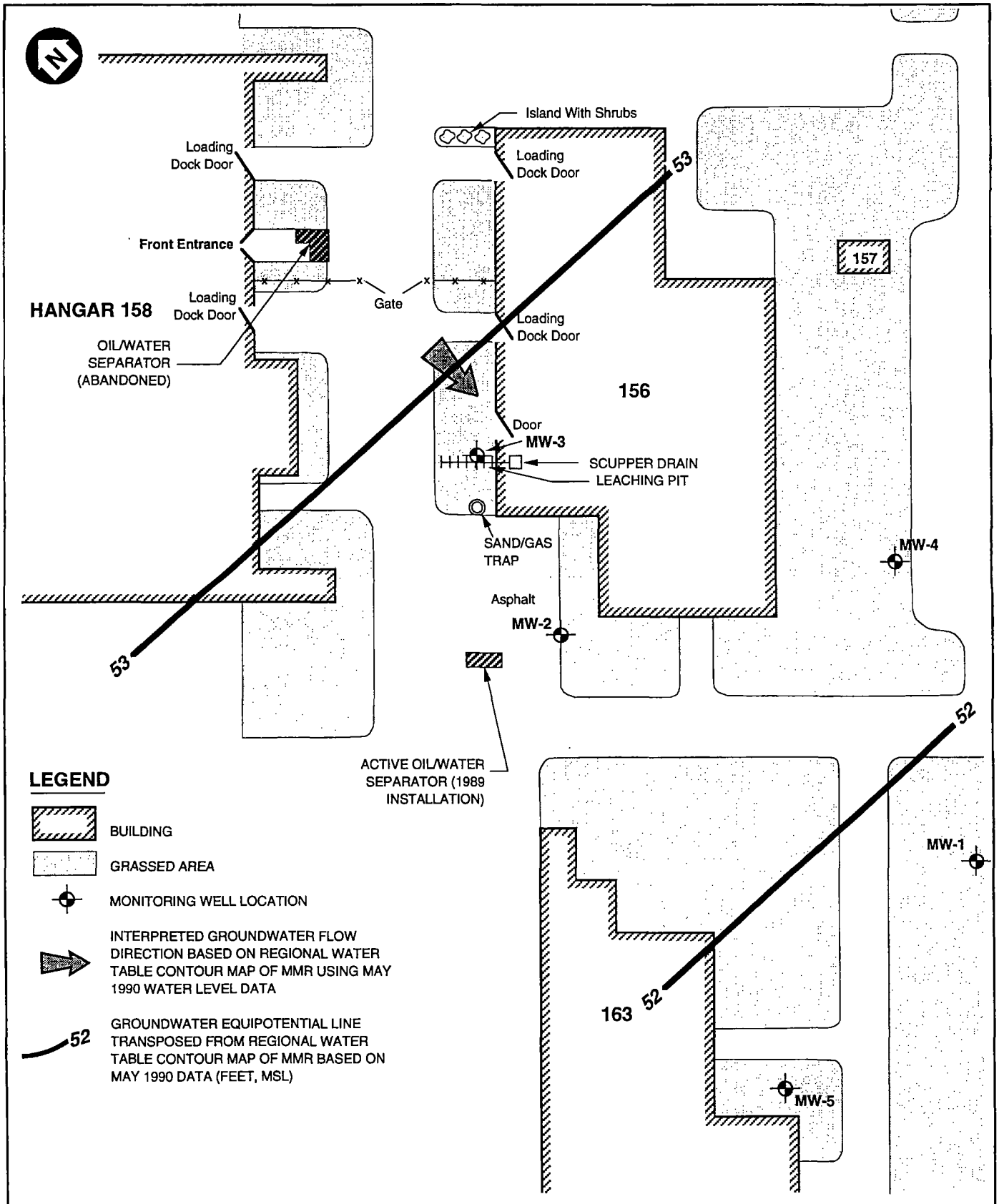
The objective of the February/March 1999 confirmational sampling round was to determine the presence or absence of groundwater contamination at certain wells. Previous data indicated that several metals in the groundwater samples on-site exceeded Tier I risk evaluation-screening values. The instances where metals concentrations exceeded Tier I values were thought to be influenced by the presence of colloids in the water samples. Colloids add suspended solids to samples that erroneously increase the metals concentrations. Therefore, three wells (MW-1 through MW-3) were redeveloped to remove as much particulate matter as possible and resampled using the low flow purge and sampling technique to minimize the influence of colloids to verify or deny the presence of metals. The objective of the October, 1999 sampling round, was to confirm an elevated concentration of Thallium in groundwater at the site detected during the February, 1999 sampling round (MW-2=5.3J ug/l). Groundwater from three wells (MW-1 through MW-3) was collected and analyzed for Thallium. A summary of the groundwater analytical results from these sampling rounds are contained in Section 4.0.

3.0 SUMMARY OF GEOLOGY AND HYDROGEOLOGY

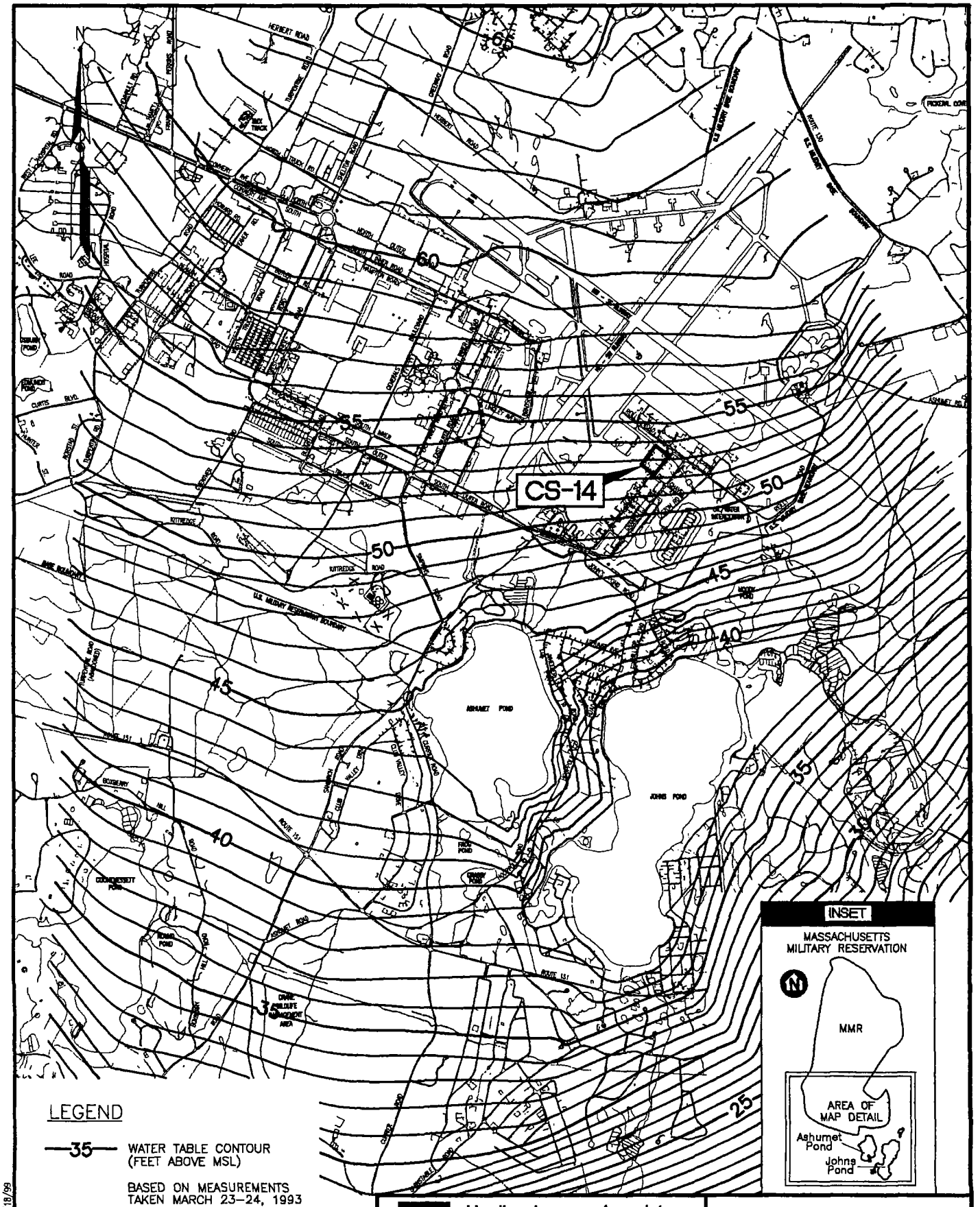
Soils underlying Study Area CS-14 consist of approximately 4 feet of silty sand and fine-to-medium sand (fill), overlying generally well-sorted, tan, fine-to-coarse sand with little to trace coarse sand and gravel.

In February 1993, the top of the groundwater surface was measured at approximately 52 to 54 feet bgs in the study area wells. The Regional Water Table Contour Map of MMR, prepared using May 1990 basewide water-level data, shows groundwater flow at Study Area CS-14 to be nearly due south (Figure 3-1). The horizontal gradient in the outwash sands is approximately 0.003 ft/ft at Study Area CS-14, with no significant vertical gradient expected. Using a hydraulic conductivity of 160 ft/d, an effective porosity of 0.3 for outwash sands at MMR (E.C. Jordan Co., 1989), and a local gradient of 0.003 ft/ft, the horizontal groundwater flow velocity beneath the study area is calculated at approximately 1.6 ft/d.

Additional groundwater elevation data was gathered during the 1993 SERGOU investigation that supported the initial SI interpretation of groundwater flow. (Figure 3-2)



Harding Lawson Associates	INTERPRETED GROUNDWATER FLOW DIRECTION STUDY AREA CS-14
INSTALLATION RESTORATION PROGRAM MASSACHUSETTS MILITARY RESERVATION	STUDY AREA CS-14 DECISION DOCUMENT — **FIGURE 3-1**



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Engineering and Environmental Services

WATER TABLE CONTOUR MAP OF SOUTHERN MMR

INSTALLATION RESTORATION PROGRAM
MASSACHUSETTS MILITARY RESERVATION

STUDY AREA CS-14 DECISION DOCUMENT

FIGURE 3-2

4.0 NATURE AND DISTRIBUTION OF DETECTED ANALYTES

As outlined in Subsection 2.6, the primary contaminants potentially released to Study Area CS-14 are TCE, PCE, and cosmoline. These constituents were reportedly discharged into a vapor degreaser leaching pit, sand and gasoline trap and/or an abandoned oil/water separator.

The following subsections describe analytes detected in various media sampled as part of the SI at Study Area CS-14, and focus on detections of solvents and petroleum-related compounds. Laboratory analytical results for the Study Area CS-14 SI are in Appendix A.

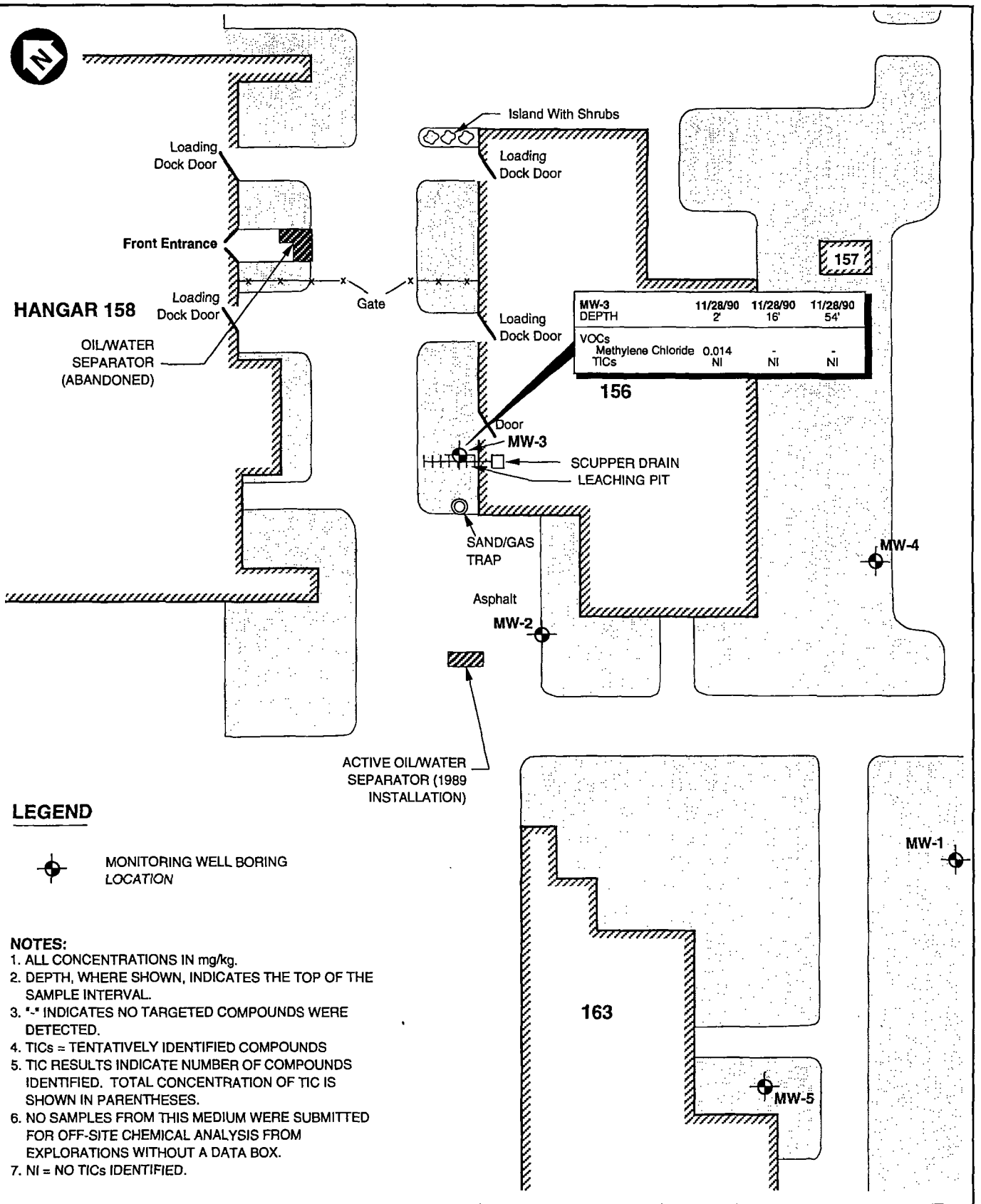
4.1 SOIL

4.1.1 Phase 1 Site Investigation: 32 Soil Gas Probes (1989)

The two VOCs, TCE and PCE, were detected at concentrations ranging from trace levels to 0.02 nanograms per microliter at soil-gas screening locations CS-14-1 through CS-14-12, CS-14-16, CS-14-29, CS-14-31, and CS-14-32. In addition, PCE was detected at trace levels in soil-gas sample locations CS-14-13 through CS-14-15. These TCE and PCE detections were most likely associated with either the leaching pit (98CDXX2), diversion manhole (98CDXX7), the abandoned OWS (98CDXX3, 4, 5), or the OWS discharge manhole (98CDXX9). The highest detection of contaminants in soil gas was in the vicinity of the leaching pit.

4.1.2 Phase 2 Site Investigation: MW-3, Leaching Pit (1990/1991)

No target VOCs were detected in the six soil samples from MW-3, which were screened by a field GC. Three of the six soil samples were submitted for analysis (Target Compound List [TCL] volatile organic analytes) to an off-site laboratory. Methylene chloride, a common laboratory contaminant, was the only TCL VOC detected (Figure 4-1 and Table 4-1a). VOC tentatively identified compounds (TICs) were not reported for the three samples submitted.



LEGEND

MONITORING WELL BORING *LOCATION*

NOTES:

1. ALL CONCENTRATIONS IN mg/kg.
2. DEPTH, WHERE SHOWN, INDICATES THE TOP OF THE SAMPLE INTERVAL.
3. "-" INDICATES NO TARGETED COMPOUNDS WERE DETECTED.
4. TICs = TENTATIVELY IDENTIFIED COMPOUNDS
5. TIC RESULTS INDICATE NUMBER OF COMPOUNDS IDENTIFIED. TOTAL CONCENTRATION OF TIC IS SHOWN IN PARENTHESES.
6. NO SAMPLES FROM THIS MEDIUM WERE SUBMITTED FOR OFF-SITE CHEMICAL ANALYSIS FROM EXPLORATIONS WITHOUT A DATA BOX.
7. NI = NO TICs IDENTIFIED.

APPROXIMATE SCALE IN FEET

0 50 100

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SUMMARY OF ANALYTES DETECTED IN SUBSURFACE SOIL STUDY AREA CS-14

INSTALLATION RESTORATION PROGRAM
MASSACHUSETTS MILITARY RESERVATION

STUDY AREA CS-14 DECISION DOCUMENT

FIGURE 4-1

9903006(b) 2 6

TABLE 4-1a
SUMMARY OF ANALYTES DETECTED IN SOIL - OFF-SITE ANALYSIS

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

EXPLORATION ID: ANALYTES SAMPLED: DEPTH:	Tier I HEC	Tier II HEC	MW-3 28-NOV-90 4 Feet	MW-3 28-NOV-90 16 Feet	MW-3 28-NOV-90 54 Feet
VOLATILE ORGANIC COMPOUNDS (mg/kg)					
Methylene Chloride	1,440	315,000	0.014	-	-

NOTES:

- = not detected
ID = identification
MW = monitoring well
mg/kg = milligrams per kilogram
HECs are the lesser of the cancer- or non-cancer-based values, Inside Security Zone.
(1994 RAH; Appendix F HEC Tables re-issued January, 1995).
Depth indicates top of sample interval.

4.1.3 *Phase I Sump Investigation Program: Sediment Sampling, TerraProbe™ Soil Borings (1991/1992)*

As part of the Phase I Sump Investigation Program conducted in 1991-1992, sediment and/or liquid samples were collected from six subsurface structures at Study Area CS-14 (sand-gas trap (98CDXX1), new OWS (98CDXX8), old OWS (98CDXX3/4/5 with 3 associated manholes (98CDXX6, 7, 9)). At the time of the sampling (1991), the old OWS had already been backfilled with sand (1989). Samples were collected of the sand. As discussed in Section 6.0, the sand originally used to backfill this structure was removed in 1996 and treated (asphalt batched), prior to the structure being backfilled with concrete.

Table 4-1b shows the analytes detected. VOC, SVOC, TPH, pesticide, and inorganic analytes were detected in samples collected within the soil/gas trap. VOC contaminants and zinc were detected in the sand sample collected within the old OWS. VOC and inorganic analytes were detected in samples collected from the manholes previously associated with the old OWS. TPH and inorganic analytes were detected within the new OWS.

Of the twelve TerraProbe™ borings advanced at the CS-14 Study Area for the collection of subsurface samples, three (98TRX11 through 98TRX13) were advanced in the vicinity of the existing soil-gas trap, three (98TRX21 through 98TRX23) were advanced in the reported vicinity of the leaching pit, and six (98TRX31 through 98TRX36) were advanced in the vicinity of the old OWS.

Field analytical results for subsurface soil samples from the area of the sand/gas trap (98CDXX1), leaching pit (98CDXX2) and abandoned OWS (98CDXX3, 4, 5) showed VOC, SVOC, and inorganic compounds at concentrations which did not exceed the Tier 1 or Tier 2 human health and ecological Risk/Hazard Equivalent Concentrations as outlined in the MMR Risk Assessment Handbook.

4.2 GROUNDWATER

4.2.1 Organic Analytes

In the groundwater sampling rounds conducted from 1990 to 1993, target VOCs (2-butanone, methylene chloride, TCE, and/or PCE) were detected from monitoring wells MW-1, MW-2, MW-3, and MW-4, at concentrations which did not exceed Maximum

TABLE 4-1b
SUMMARY OF ANALYTES DETECTED IN SOIL - ON-SITE ANALYSIS

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

EXPLORATION ID: / SAMPLED: / DEPTH:	Tier I HEC	Tier II HEC	98TRX11 04-DEC-91 4	98TRX11 04-DEC-91 8	98TRX11 04-DEC-91 12	98TRX11 04-DEC-91 16	98TRX11 04-DEC-91 24	98TRX12 04-DEC-91 4	98TRX12 04-DEC-91 8	98TRX12 04-DEC-91 12	98TRX12 04-DEC-91 16	98TRX12 04-DEC-91 24
ANALYTES												
VOCs (ug/kg)												
Trichloroethene	293	88,700	-	-	-	-	NA	-	-	NA	-	NA
Toluene	116,000	25,300,000	28	130	-	-	NA	-	-	NA	21	NA
Ethylbenzene	5,820	919,000	31	140	-	130	NA	16	-	NA	18	NA
o-Xylene	23,300	5,070,000	25	94	-	100	NA	35	7.5	NA	16	NA
m/p-Xylene	23,300	5,070,000	59	170	-	40	NA	11	-	NA	23	NA
1,1-Dichloroethane	4,780	1,040,000	-	-	-	38	NA	-	-	NA	-	NA
cis-1,2-Dichloroethene	5,820	1,270,000	-	-	-	-	NA	-	-	NA	-	NA
trans-1,2-Dichloroethene	11,600	2,530,000	35	-	-	20	NA	-	-	NA	-	NA
Tetrachloroethene	5,820	1,270,000	27	94	-	-	NA	24	-	NA	41	NA
Benzene	59.5	259,000	25	21	-	-	NA	-	-	NA	-	NA
SVOCs (mg/kg)												
2,4-Dimethylphenol	11,600	2,530,000	-	-	-	-	-	-	-	-	-	-
Phenanthrene	2,330	507,000	-	-	-	-	-	-	-	-	-	-
Fluoranthene	23,300	5,070,000	-	-	-	-	-	-	-	-	-	-
Pyrene	17,500	3,800,000	-	-	-	-	-	-	-	-	-	-
Bis(2-ethythexyl)phthalate	1,160	253,000	-	1.5	-	-	-	-	-	-	-	-
Inorganics (mg/kg)												
Lead	1,000	1,000	-	430	-	-	-	-	-	-	-	-
Zinc	17,500	3,800,000	320	340	-	400	-	320	-	320	-	-
TPH (mg/kg)	NA	NA	740	6400	3200	100	-	190	38	-	410	49

NOTES:

- = not detected
N/A = not analyzed
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
HEC = Hazard-Equivalent Concentration
HEC is the most stringent human health HEC; Inside Security Zone (1994, RAH; Appendix F HEC Tables; re-issued in January, 1995).

TABLE 4-1b
SUMMARY OF ANALYTES DETECTED IN SOIL - ON-SITE ANALYSIS

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

EXPLORATION ID: / SAMPLED: / DEPTH:	Tier II HEC	Tier I HEC	98TRX12 04-DEC-91 24	98TRX13 04-DEC-91 4	98TRX13 04-DEC-91 8	98TRX13 04-DEC-91 12	98TRX13 04-DEC-91 18	98TRX13 04-DEC-91 24	98TRX21 05-DEC-91 3	98TRX21 05-DEC-91 6	98TRX21 05-DEC-91 12	98TRX21 05-DEC-91 18
ANALYTES												
VOCs (ug/kg)												
Trichloroethene	293	88,700	NA	-	NA	NA	-	NA	NA	-	-	NA
Toluene	116,000	25,300,000	NA	-	NA	NA	-	NA	NA	36	7.4	NA
Ethylbenzene	5,820	919,000	NA	-	NA	NA	-	NA	NA	38	-	NA
o-Xylene	23,300	5,070,000	NA	-	NA	NA	-	NA	NA	61	19	NA
m/p-Xylene	23,300	5,070,000	NA	-	NA	NA	-	NA	NA	37	38	NA
1,1-Dichloroethane	4,780	1,040,000	NA	-	NA	NA	-	NA	NA	-	-	NA
cis-1,2-Dichloroethene	5,820	1,270,000	NA	-	NA	NA	-	NA	NA	-	-	NA
trans-1,2-Dichloroethene	11,600	2,530,000	NA	-	NA	NA	-	NA	NA	-	-	NA
Tetrachloroethene	5,820	1,270,000	NA	33	NA	NA	12	NA	NA	5.8	32	NA
Benzene	59.5	259,000	NA	-	NA	NA	-	NA	NA	-	-	NA
SVOCs (mg/kg)												
2,4-Dimethylphenol	11,600	2,530,000	-	-	-	-	-	-	-	-	-	-
Phenanthrene	2,330	507,000	-	-	-	-	-	-	-	-	-	-
Fluoranthene	23,300	5,070,000	-	-	-	-	-	-	-	-	-	-
Pyrene	17,500	3,800,000	-	-	-	-	-	-	-	-	-	-
Bis(2-ethythexyl)phthalate	1,160	253,000	-	-	-	-	-	-	-	-	-	-
Inorganics (mg/kg)												
Lead	1,000	1,000	-	-	-	-	-	-	-	-	-	-
Zinc	17,500	3,800,000	-	-	240	-	-	350	290	-	-	350
TPH (mg/kg)	NA	NA	49	47	250	270	290	83	210	1100	33	-

NOTES:

- = not detected
N/A = not analyzed
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
HEC = Hazard-Equivalent Concentration
HEC is the most stringent human health HEC; Inside Security Zone (1994, RAH;

TABLE 4-1b
SUMMARY OF ANALYTES DETECTED IN SOIL - ON-SITE ANALYSIS

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

EXPLORATION ID: / SAMPLED: / DEPTH:	Tier I HEC	Tier II HEC	98TRX21 05-DEC-91 24	98TRX22 05-DEC-91 3	98TRX22 05-DEC-91 6	98TRX22 05-DEC-91 12	98TRX22 05-DEC-91 12	98TRX22 05-DEC-91 18	98TRX22 05-DEC-91 24	98TRX23 09-JAN-92 3	98TRX23 09-JAN-92 6	98TRX23 09-JAN-92 12
ANALYTES												
VOCs (ug/kg)												
Trichloroethene	293	88,700	NA	-	NA	NA	NA	-	NA	-	NA	NA
Toluene	116,000	25,300,000	NA	98	NA	NA	NA	-	NA	-	NA	NA
Ethylbenzene	5,820	919,000	NA	60	NA	NA	NA	-	NA	-	NA	NA
o-Xylene	23,300	5,070,000	NA	57	NA	NA	NA	-	NA	-	NA	NA
m/p-Xylene	23,300	5,070,000	NA	24	NA	NA	NA	-	NA	-	NA	NA
1,1-Dichloroethane	4,780	1,040,000	NA	-	NA	NA	NA	-	NA	-	NA	NA
cis-1,2-Dichloroethene	5,820	1,270,000	NA	-	NA	NA	NA	-	NA	-	NA	NA
trans-1,2-Dichloroethene	11,600	2,530,000	NA	-	NA	NA	NA	-	NA	-	NA	NA
Tetrachloroethene	5,820	1,270,000	NA	37	NA	NA	NA	-	NA	-	NA	NA
Benzene	59.5	259,000	NA	25	NA	NA	NA	-	NA	-	NA	NA
SVOCs (mg/kg)												
2,4-Dimethylphenol	11,600	2,530,000	-	-	-	-	-	-	-	-	-	1.2
Phenanthrene	2,330	507,000	-	-	-	-	-	-	-	-	-	-
Fluoranthene	23,300	5,070,000	-	-	-	-	-	-	-	-	-	-
Pyrene	17,500	3,800,000	-	1.9	-	-	-	-	-	-	-	-
Bis(2-ethythexyl)phthalate	1,160	253,000	-	-	-	-	-	-	-	-	-	-
Inorganics (mg/kg)												
Lead	1,000	1,000	-	-	-	-	-	-	-	-	-	-
Zinc	17,500	3,800,000	-	320	-	-	-	-	410	-	-	-
TPH (mg/kg)	NA	NA	-	420	270	83	130	290	220	56	94	110

NOTES:

- = not detected
N/A = not analyzed
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
HEC = Hazard-Equivalent Concentration
HEC is the most stringent human health HEC; Inside Security Zone (1994, RAH;

TABLE 4-1b
SUMMARY OF ANALYTES DETECTED IN SOIL - ON-SITE ANALYSIS

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

EXPLORATION ID: / SAMPLED: / DEPTH:	Tier I HEC	Tier II HEC	98TRX23 09-JAN-92 16	98TRX23 09-JAN-92 24	98TRX31 09-JAN-92 8	98TRX31 09-JAN-92 12	98TRX31 09-JAN-92 12	98TRX31 09-JAN-92 18	98TRX31 09-JAN-92 24	98TRX32 05-DEC-91 8	98TRX32 05-DEC-91 12	98TRX32 05-DEC-91 14
ANALYTES												
VOCs (ug/kg)												
Trichloroethene	293	88,700	-	NA	-	-	-	-	-	NA	-	23
Toluene	116,000	25,300,000	-	NA	-	-	-	-	-	NA	-	12
Ethylbenzene	5,820	919,000	-	NA	-	-	-	-	-	NA	-	29
o-Xylene	23,300	5,070,000	-	NA	-	-	-	-	-	NA	-	12
m/p-Xylene	23,300	5,070,000	-	NA	-	-	-	-	-	NA	-	48
1,1-Dichloroethane	4,780	1,040,000	-	NA	-	-	-	-	-	NA	-	-
cis-1,2-Dichloroethene	5,820	1,270,000	-	NA	-	5.4	-	35	-	NA	-	7.4
trans-1,2-Dichloroethene	11,600	2,530,000	-	NA	-	-	-	-	-	NA	-	-
Tetrachloroethene	5,820	1,270,000	24	NA	2.7	-	-	13	-	NA	-	5
Benzene	59.5	259,000	-	NA	-	-	-	-	-	NA	-	-
SVOCs (mg/kg)												
2,4-Dimethylphenol	11,600	2,530,000	-	-	-	-	-	-	-	-	-	-
Phenanthrene	2,330	507,000	-	-	-	-	-	-	-	-	-	-
Fluoranthene	23,300	5,070,000	-	-	-	-	-	-	-	-	-	-
Pyrene	17,500	3,800,000	-	-	-	-	-	-	-	-	-	-
Bis(2-ethythexyl)phthalate	1,160	253,000	-	-	-	-	-	-	-	-	-	-
Inorganics (mg/kg)												
Lead	1,000	1,000	-	-	-	-	-	-	-	-	-	290
Zinc	17,500	3,800,000	-	270	-	-	-	-	-	-	-	-
TPH (mg/kg)	NA	NA	140	78	58	83	45	79	33	46	500	1100

NOTES:

- = not detected
N/A = not analyzed
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
HEC = Hazard-Equivalent Concentration
HEC is the most stringent human health HEC; Inside Security Zone (1994, RAH;

TABLE 4-1b
SUMMARY OF ANALYTES DETECTED IN SOIL - ON-SITE ANALYSIS

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

EXPLORATION ID: / SAMPLED: / DEPTH:	Tier I HEC	Tier II HEC	98TRX32 05-DEC-91 18	98TRX32 05-DEC-91 24	98TRX33 06-DEC-91 6	98TRX33 06-DEC-91 12	98TRX33 06-DEC-91 18	98TRX33 06-DEC-91 24	98TRX34 06-FEB-92 6	98TRX34 06-FEB-92 12	98TRX34 06-FEB-92 18	98TRX34 06-FEB-92 24
ANALYTES												
VOCs (ug/kg)												
Trichloroethene	293	88,700	-	-	27	NA	NA	NA	-	-	-	-
Toluene	116,000	25,300,000	-	-	6	NA	NA	NA	-	-	-	-
Ethylbenzene	5,820	919,000	28	34	41	NA	NA	NA	-	-	-	-
o-Xylene	23,300	5,070,000	-	7.2	6.8	NA	NA	NA	-	-	-	-
m/p-Xylene	23,300	5,070,000	39	49	57	NA	NA	NA	-	-	-	-
1,1-Dichloroethane	4,780	1,040,000	-	-	-	NA	NA	NA	-	-	-	-
cis-1,2-Dichloroethene	5,820	1,270,000	-	-	-	NA	NA	NA	-	-	-	-
trans-1,2-Dichloroethene	11,600	2,530,000	-	-	-	NA	NA	NA	-	-	-	-
Tetrachloroethene	5,820	1,270,000	-	-	-	NA	NA	NA	-	-	-	-
Benzene	59.5	259,000	-	-	78	NA	NA	NA	-	-	-	-
SVOCs (mg/kg)												
2,4-Dimethylphenol	11,600	2,530,000	-	-	-	-	-	-	-	-	-	-
Phenanthrene	2,330	507,000	-	-	-	3.4	-	-	-	-	-	-
Fluoranthene	23,300	5,070,000	-	-	-	3.2	-	-	-	-	-	-
Pyrene	17,500	3,800,000	-	-	-	3.1	-	-	-	-	-	-
Bis(2-ethythexyl)phthalate	1,160	253,000	-	-	-	-	-	-	-	-	-	-
Inorganics (mg/kg)												
Lead	1,000	1,000	-	-	-	-	-	-	-	-	-	-
Zinc	17,500	3,800,000	-	-	-	-	-	-	-	300	310	-
TPH (mg/kg)	NA	NA	620	-	19000	230	120	250	33	23	55	95

NOTES:

- = not detected
N/A = not analyzed
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
HEC = Hazard-Equivalent Concentration
HEC is the most stringent human health HEC; Inside Security Zone (1994, RAH;

TABLE 4-1b
SUMMARY OF ANALYTES DETECTED IN SOIL - ON-SITE ANALYSIS

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

EXPLORATION ID: SAMPLED: DEPTH:	Tier I HEC	Tier II HEC	98TRX35 06-FEB-92 8	98TRX35 06-FEB-92 12	98TRX35 06-FEB-92 16	98TRX35 06-FEB-92 18	98TRX35 06-FEB-92 24	98TRX36 06-FEB-92 8	98TRX36 06-FEB-92 12
ANALYTES									
VOCs (ug/kg)									
Trichloroethene	293	88,700	-	-	NA	-	-	-	-
Toluene	116,000	25,300,000	-	-	NA	-	-	-	-
Ethylbenzene	5,820	919,000	-	-	NA	-	-	-	-
o-Xylene	23,300	5,070,000	-	-	NA	-	-	-	-
m/p-Xylene	23,300	5,070,000	-	-	NA	-	-	-	-
1,1-Dichloroethane	4,780	1,040,000	-	-	NA	-	-	-	-
cis-1,2-Dichloroethene	5,820	1,270,000	-	-	NA	-	-	-	-
trans-1,2-Dichloroethene	11,600	2,530,000	-	-	NA	-	-	-	-
Tetrachloroethene	5,820	1,270,000	3.2	-	NA	-	-	-	4.7
Benzene	59.5	259,000	-	-	NA	-	-	-	-
SVOCs (mg/kg)									
2,4-Dimethylphenol	11,600	2,530,000	-	-	-	-	-	-	-
Phenanthrene	2,330	507,000	-	-	-	-	-	-	-
Fluoranthene	23,300	5,070,000	-	-	-	-	-	-	-
Pyrene	17,500	3,800,000	-	-	-	-	-	-	-
Bis(2-ethythexyl)phthalate	1,160	253,000	-	-	-	-	-	-	-
Inorganics (mg/kg)									
Lead	1,000	1,000	-	-	-	-	-	-	-
Zinc	17,500	3,800,000	320	-	-	-	-	-	-
TPH (mg/kg)	NA	NA	410	320	-	23	41	23	97

NOTES:

- = not detected
N/A = not analyzed
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
HEC = Hazard-Equivalent Concentration
HEC is the most stringent human health HEC; Inside Security Zone (1994, RAH;

Contaminant Levels (MCLs). TPH and SVOCs were not detected in groundwater samples collected from the five wells (MW-1 through MW-5). No target VOCs were detected in the groundwater samples which were screened by a field GC in 1990 and 1993.

Seven groundwater-sampling rounds associated with the Eastern Briarwood Groundwater Monitoring Program have been conducted from 1996 to 1998. Monitoring Well MW-1 was the only CS-14 well sampled as part of this program, and was only analyzed for VOCs. TCE, cis-1,2-dichloroethene, and xylene were sporadically detected at concentrations below MCLs. PCE was detected above MCLs (5 micrograms per liter [ug/L]) during 2 sampling rounds (October 1996: 8 ug/L, July 1997: 6.3 ug/L); however, the average PCE groundwater concentration detected in MW-1 over the seven rounds was below MCLs (4.1 ug/L).

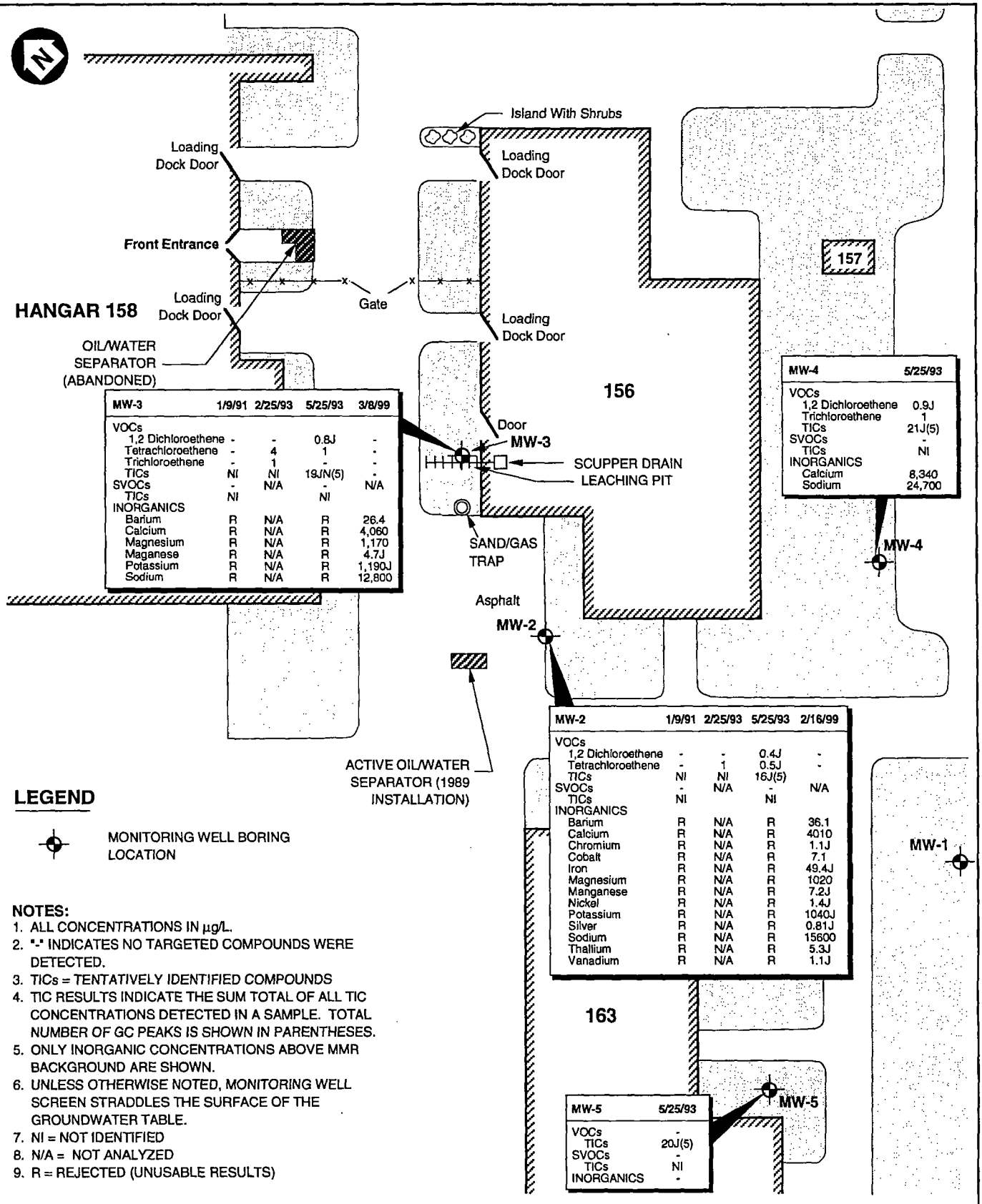
The low (trace) concentrations of VOCs detected in the groundwater monitoring wells for this site are consistent with the past history of potential contaminants. Given the industrialized nature of this area of the base, these contaminants may or many not be directly related to Study Area CS-14. The potential CS-14 sources for these contaminants; however, have been identified and investigated.

Figure 4-2 shows the distribution of analytes and compounds detected in groundwater samples from Study Area CS-14. Table 4-2 summarizes the analytes detected.

Results of the SERGOU RI and Eastern Briarwood Groundwater Monitoring Program indicated a mappable TCE plume. The head of the plume is approximately 2,000 feet southeast of CS-14 in the shallow portion of the aquifer near the water table. The specific source of this contamination is not known. TCE has been detected sporadically and below MCLs at wells (MW-1 through MW-5) associated with CS-14.

4.2.2 Inorganic Analytes

In a comprehensive study of inorganic concentrations in groundwater at the MMR conducted in 1996-1997, where 158 groundwater monitoring wells were sampled and analyzed for inorganic analytes (Jacobs, 1998), it was determined that samples collected using the EPA Region I Low Flow (Minimum Stress) Purging and Sampling Procedure (USEPA, 1996) consistently have lower concentrations of suspended solids, and therefore, lower total metals concentrations than samples collected using more traditional (high flow) sampling techniques (Jacobs, 1998). The study also found that metals data



MW-3	1/9/91	2/25/93	5/25/93	3/8/99
VOCs				
1,2 Dichloroethene	-	-	0.8J	-
Tetrachloroethene	-	4	1	-
Trichloroethene	-	1	-	-
TICs	NI	NI	19JN(5)	-
SVOCs	-	N/A	-	N/A
TICs	NI		NI	
INORGANICS				
Barium	R	N/A	R	26.4
Calcium	R	N/A	R	4,060
Magnesium	R	N/A	R	1,170
Maganese	R	N/A	R	4.7J
Potassium	R	N/A	R	1,190J
Sodium	R	N/A	R	12,800

MW-4	5/25/93
VOCs	
1,2 Dichloroethene	0.9J
Trichloroethene	1
TICs	21J(5)
SVOCs	-
TICs	NI
INORGANICS	
Calcium	8,340
Sodium	24,700

MW-2	1/9/91	2/25/93	5/25/93	2/16/99
VOCs				
1,2 Dichloroethene	-	-	0.4J	-
Tetrachloroethene	-	1	0.5J	-
TICs	NI	NI	16J(5)	
SVOCs	-	N/A	-	N/A
TICs	NI		NI	
INORGANICS				
Barium	R	N/A	R	36.1
Calcium	R	N/A	R	4010
Chromium	R	N/A	R	1.1J
Cobalt	R	N/A	R	7.1
Iron	R	N/A	R	49.4J
Magnesium	R	N/A	R	1020
Manganese	R	N/A	R	7.2J
Nickel	R	N/A	R	1.4J
Potassium	R	N/A	R	1040J
Silver	R	N/A	R	0.81J
Sodium	R	N/A	R	15600
Thallium	R	N/A	R	5.3J
Vanadium	R	N/A	R	1.1J

MW-5	5/25/93
VOCs	-
TICs	20J(5)
SVOCs	-
TICs	NI
INORGANICS	-

NOTES:

1. ALL CONCENTRATIONS IN µg/L.
2. "-" INDICATES NO TARGETED COMPOUNDS WERE DETECTED.
3. TICs = TENTATIVELY IDENTIFIED COMPOUNDS
4. TIC RESULTS INDICATE THE SUM TOTAL OF ALL TIC CONCENTRATIONS DETECTED IN A SAMPLE. TOTAL NUMBER OF GC PEAKS IS SHOWN IN PARENTHESES.
5. ONLY INORGANIC CONCENTRATIONS ABOVE MMR BACKGROUND ARE SHOWN.
6. UNLESS OTHERWISE NOTED, MONITORING WELL SCREEN STRADDLES THE SURFACE OF THE GROUNDWATER TABLE.
7. NI = NOT IDENTIFIED
8. N/A = NOT ANALYZED
9. R = REJECTED (UNUSABLE RESULTS)

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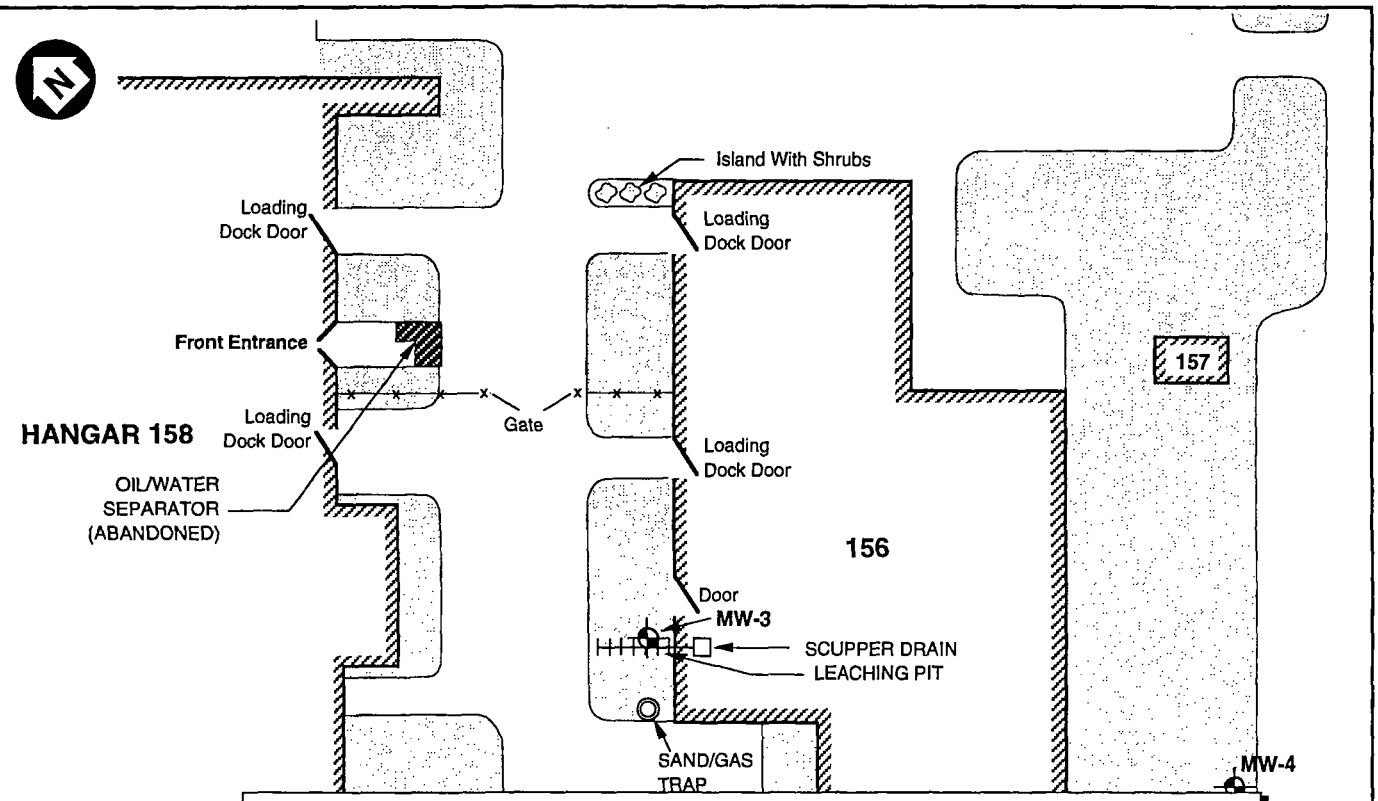
SUMMARY OF ANALYTES DETECTED IN GROUNDWATER STUDY AREA CS-14

INSTALLATION RESTORATION PROGRAM
MASSACHUSETTS MILITARY RESERVATION

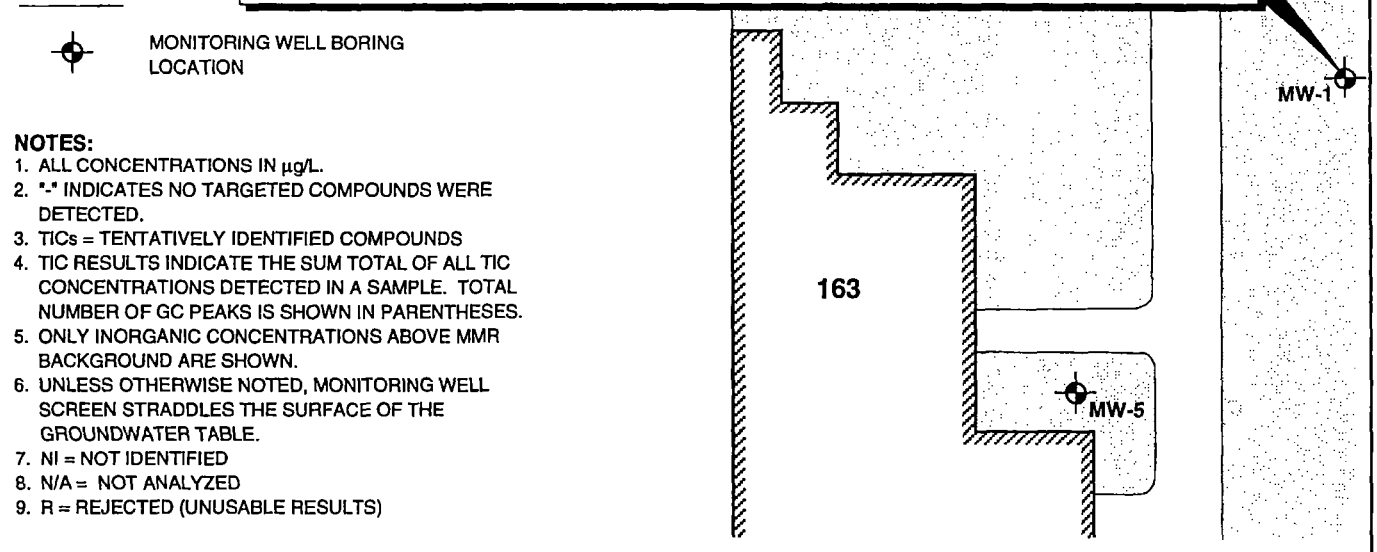
STUDY AREA CS-14 DECISION DOCUMENT

FIGURE 4-2

9903006(b) 2 9



MW-1	3/29/90	1/9/91	2/25/93	5/25/93	10/25/96	1/6/97	4/10/97	7/11/97	10/3/97	12/9/97	6/2/98	8/22/98	11/19/98	2/8/99
VOCs														
1,2 Dichloroethene	-	-	-	0.2J	-	-	-	-	-	-	-	-	-	-
2-Butanone	-	-	10J	-	-	-	-	-	-	-	-	-	-	-
Methylene Chloride	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	-	5	3	-	8	2.9	3.3	6.3	3.6	3.3	1.6	3.7	3.7	0.95J
Trichloroethene	-	-	-	2	2	0.78J	1	1.5	0.84J	-	0.57J	1.1	0.52J	-
Xylenes	-	-	-	-		-	1.9	-	-	-	-	-	-	-
TICs	-	-	NI	21J(5)										
SVOCs	-	-	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TICs	NI	NI		NI										
INORGANICS														
Barium	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	31
Calcium	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7,840
Chromium	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.4J
Copper	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2J
Magnesium	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,590
Potassium	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,090
Sodium	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	14,200



LEGEND

MONITORING WELL BORING LOCATION

NOTES:

1. ALL CONCENTRATIONS IN µg/L.
2. "-" INDICATES NO TARGETED COMPOUNDS WERE DETECTED.
3. TICs = TENTATIVELY IDENTIFIED COMPOUNDS
4. TIC RESULTS INDICATE THE SUM TOTAL OF ALL TIC CONCENTRATIONS DETECTED IN A SAMPLE. TOTAL NUMBER OF GC PEAKS IS SHOWN IN PARENTHESES.
5. ONLY INORGANIC CONCENTRATIONS ABOVE MMR BACKGROUND ARE SHOWN.
6. UNLESS OTHERWISE NOTED, MONITORING WELL SCREEN STRADDLES THE SURFACE OF THE GROUNDWATER TABLE.
7. NI = NOT IDENTIFIED
8. N/A = NOT ANALYZED
9. R = REJECTED (UNUSABLE RESULTS)

APPROXIMATE SCALE IN FEET

0 50 100

Harding Lawson Associates

INSTALLATION RESTORATION PROGRAM
MASSACHUSETTS MILITARY RESERVATION

SUMMARY OF ANALYTES DETECTED IN GROUNDWATER STUDY AREA CS-14

STUDY AREA CS-14 DECISION DOCUMENT

FIGURE 4-2 *(cont.)*

TABLE 4-2
SUMMARY OF ANALYTES DETECTED IN GROUNDWATER

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

EXPLORATION ID: / SAMPLED: / ANALYTES	Tier I HEC	Tier II HEC	MW-1 29-MAR-90	MW-1 09-JAN-91	MW-1 25-FEB-93	MW-1 25-May-93	MW-1 25-Oct-96	MW-1 06-Jan-97	MW-1 10-Apr-97	MW-1 11-Jul-97	MW-1 03-Oct-97	MW-1 08-Dec-97	MW-1 02-Jun-98	MW-1 22-Aug-98
VOLATILE ORGANIC COMPOUNDS (µg/L)														
1,2-Dichloroethene	70.7	3,530	-	-	-	0.2 J	-	-	-	-	-	-	-	-
Methyl Ethyl Ketone (2-Butanone)	493	24,700	-	-	10 J	-	-	-	-	-	-	-	-	-
Methylene Chloride	11.2	11,200	-	-	3	-	-	-	-	-	-	-	-	-
Tetrachloroethene	63.8	3,190	-	5	3	-	8	2.9	3.3	6.3	3.6	3.3	1.6	3.7
Trichloroethene	2.49	2,390	-	-	-	2	2	0.78 J	1	1.5	0.84 J	-	0.57 J	1.1
Xylenes (Total)	12,900	643,000	-	-	-	-	-	-	1.9	-	-	-	-	-
							-	-	-	-	-	-	-	-
SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)			-	-	N/A	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
INORGANIC COMPOUNDS (µg/L)														
Aluminum	7,300	365,000	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Barium	511	25,600	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Beryllium	0.0198	19.8	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calcium	NA	NA	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium	36.5	1,830	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cobalt	NA	NA	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper	NA	NA	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron	2,190	110,000	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Magnesium	NA	NA	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	36.5	1,830	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mercury	2.19	110	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel	146	7,300	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Potassium	NA	NA	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Silver	36.5	1,830	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sodium	NA	NA	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium	0.584	29.2	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	51.1	2,560	R	R	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

NOTES:

- = not detected
I = identification
J = estimated concentration
HEC = Hazard-Equivalent Concentration
MW = monitoring well
N/A = not analyzed
R = Rejected (unusable results)
µg/L = micrograms per liter
HEC is the most stringent human health HEC (1994, RAH; Appendix F HEC Tables; re-issued in January, 1995).
[a] Inorganics data collected prior to 1999 are not presented; see discussion in Section 4.2.

TABLE 4-2
SUMMARY OF ANALYTES DETECTED IN GROUNDWATER

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

EXPLORATION ID: SAMPLED: ANALYTES:	Tier I HEC	Tier II HEC	MW-1 19-Nov-98	MW-1 08-Feb-99	MW-2 09-JAN-91	MW-2 25-FEB-93	MW-2 25-May-93	MW-2 16-Feb-99	MW-3 09-JAN-91	MW-3 25-FEB-93	MW-3 25-May-93	MW-3 08-Mar-99	MW-4 25-May-93	MW-5 25-May-93
VOLATILE ORGANIC COMPOUNDS (µg/L)														
1,2-Dichloroethene	70.7	3,530	-	-	-	-	0.4J	-	-	-	0.8 J	-	0.9 J	-
Methyl Ethyl Ketone (2-Butanone)	493	24,700	-	R	-	R	-	R	-	R	-	-	-	-
Methylene Chloride	11.2	11,200	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	63.8	3,190	3.7	0.95 J	-	1	-	-	-	4	-	-	-	-
Trichloroethene	2.49	2,390	0.52 J	-	-	-	0.5J	-	-	1	1	-	1	-
Xylenes (Total)	12,900	643,000	-	-	-	-	-	-	-	-	-	-	-	-
			-	-				-				-		
SEMIVOLATILE ORGANIC COMPOUNDS (µg/L)			N/A	N/A	-	N/A	-	N/A	-	N/A	-	N/A	-	-
INORGANIC COMPOUNDS (µg/L)														
Aluminum	7,300	365,000	N/A	-	R	N/A	R	-	R	N/A	R	-	R	R
Barium	511	25,600	N/A	31	R	N/A	R	36.1	R	N/A	R	26.4	R	R
Beryllium	0.0198	19.8	N/A	-	R	N/A	R	-	R	N/A	R	-	R	R
Calcium	NA	NA	N/A	7840	R	N/A	R	4010	R	N/A	R	4060	R	R
Chromium	36.5	1,830	N/A	1.4 J	R	N/A	R	1.1 J	R	N/A	R	-	R	R
Cobalt	NA	NA	N/A	-	R	N/A	R	7.1	R	N/A	R	-	R	R
Copper	NA	NA	N/A	2 J	R	N/A	R	-	R	N/A	R	-	R	R
Iron	2,190	110,000	N/A	-	R	N/A	R	49.4 J	R	N/A	R	-	R	R
Magnesium	NA	NA	N/A	1590	R	N/A	R	1020	R	N/A	R	1170	R	R
Manganese	36.5	1,830	N/A	-	R	N/A	R	7.2 J	R	N/A	R	4.7 J	R	R
Mercury	2.19	110	N/A	-	R	N/A	R	-	R	N/A	R	-	R	R
Nickel	146	7,300	N/A	-	R	N/A	R	1.4 J	R	N/A	R	-	R	R
Potassium	NA	NA	N/A	2090	R	N/A	R	1040 J	R	N/A	R	1190 J	R	R
Silver	36.5	1,830	N/A	-	R	N/A	R	0.81 J	R	N/A	R	-	R	R
Sodium	NA	NA	N/A	14200	R	N/A	R	15600	R	N/A	R	12800	R	R
Thallium	0.584	29.2	N/A	-	R	N/A	R	5.3 J	R	N/A	R	-	R	R
Vanadium	51.1	2,560	N/A	-	R	N/A	R	1.1 J	R	N/A	R	-	R	R

NOTES:

- = not detected
I = identification
J = estimated concentration
HEC = Hazard-Equivalent Concentration
MW = monitoring well
N/A = not analyzed
R = Rejected (unusable results)
µg/L = micrograms per liter
HEC is the most stringent human health HEC (1994, RAH; Appendix F HE
[a] Inorganics data collected prior to 1999 are not presented; see discussio

representing MMR "background" conditions were probably biased on the high side by the method used to collect the groundwater samples, and that these data are suspect.

Because groundwater samples collected prior to 1999 at the site did not use the Low Flow (Minimum Stress) Purging and Sampling Procedure, this pre-1999 laboratory data was not considered reliable. Only data obtained during the 1999 sampling round which used the Low Flow (Minimum Stress) Purging and Sampling Procedure is therefore being used to
evaluate the site. In groundwater samples collected during the Febuary/March 1999 round, only Thallium was detected above Risk/Hazard Equivalent Concentrations in one well. A subsequent sampling event of this well and adjacent wells in October 1999 indicated Thallium concentrations in groundwater below laboratory detection limits.

5.0 PRELIMINARY RISK EVALUATION

This section describes how the PREs were conducted for human health and presents results for the PRE.

5.1 INTRODUCTION

A PRE was conducted at Study Area CS-14 to provide a screening-level assessment of potential human-health risks associated with exposure to environmental contaminants identified during site characterization efforts.

This PRE is based on a limited number of off-site laboratory analyses (i.e., one soil sample and groundwater samples from five monitoring wells: MW-1 through MW-5). However, 53 samples were collected and screened adjacent to the drainage structures at the study area as part of the DSRP. As this data was collected through an on-site laboratory, it could not be used as part of the PRE. The data from the DSRP soil samples were used to evaluate the need for soil removals as part of the DSRP. Concentrations detected in the soil samples were compared to risk-based Soil Target Clean-up levels (STCLs) derived for the DSRP. The need for soil remediation was based in part on this comparison.

5.1.1 Approach

This PRE followed the approach delineated in the MMR Risk Assessment Handbook (RAH) (Automated Sciences Group [ASG], 1994). This PRE is also consistent with the U.S. Environmental Protection Agency (USEPA) "Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual," "Risk Assessment Guidance for Superfund Volume 2: Environmental Evaluation Manual," (USEPA, 1989a,b), and other USEPA guidance. Two media (i.e., soil and groundwater) were investigated during the SI at Study Area CS-14. The data from the Site Investigation and related studies for Study Area CS-14 supports a human-health evaluation.

The human-health PRE involved the comparison of maximum reported analyte concentrations to hazard and risk equivalent concentrations, which represent specific risk levels for assumed land use and exposure scenarios. The two-tiered human health risk evaluation consists of comparing the maximum environmental concentrations of contaminants of potential concern (CPCs) with hazard equivalent concentrations (HECs)

presented in Appendix F of the RAH. If site concentrations did not exceed the HECs for Tier I, risks were considered insignificant and no further evaluation was required. If there were exceedances, a Tier II screening was conducted. Therefore, exceedance of Tier II HECs could be indicative of high risk and possibly the need for immediate action.

5.1.2 Study Area CS-14 PRE Objectives

The purposes of this PRE were to:

- select CPCs
- identify human exposure pathways
- identify human receptors
- screen CPCs at Study Area CS-14 against HECs and applicable or relevant and appropriate requirements
- provide a preliminary evaluation of potential threats to human health

The PRE was conducted to support the recommendation of one of the following alternatives: (1) decision document (no further action), (2) remedial investigation (RI)/feasibility study, (3) focused feasibility study/remedial measure, or (4) immediate response (imminent threat).

5.2 PRELIMINARY HUMAN HEALTH RISK EVALUATION

The human health risk evaluation for Study Area CS-14 was conducted using the tiered approach. A detailed discussion of the methodology is in the RAH (ASG, 1994). The purpose of the risk evaluation was to identify potential human-health risks associated with exposures to study-area-related CPCs. The risk evaluation was not intended to quantify study-area-specific health risks.

5.2.1 Data Evaluation

Analytical data available for Study Area CS-14 were evaluated to identify study-area and media-specific CPCs. Frequencies of detection, ranges of sample quantitation limits, and a range of minimum to maximum detected concentrations of CPCs in soil from Phase 2 of the SI are presented in Table 5-1.

Organic groundwater data are from sampling conducted at MW-1 through MW-5 from sampling performed March, 1990 through March, 1999, and are presented in Table 4-2. Inorganic groundwater data are from the 1999 re-sampling of wells MW-1, MW-2, and MW-3 using modern low-flow techniques, and are also presented in Table 4-2. Groundwater CPCs are presented in Table 5-2.

Inorganic analytes detected in soil and groundwater, at concentrations below MMR basewide media-specific background levels (soil only) and Tier I HECs, were not considered CPCs (ASG, 1994). Additionally, essential dietary nutrients (i.e., calcium, iron, magnesium, potassium, and sodium) were excluded as CPCs. Maximum concentrations detected for CPCs were used in the PRE Tier I and Tier II evaluations.

Due to the number of samples collected for off-site laboratory analyses (i.e., one soil sample), the PRE may underestimate risk. However, a comparison of on-site analysis of 53 soil samples to Risk/Hazard Equivalent Concentrations is discussed in Section 5.2.4. Results from this soil screening were used to evaluate if soil removals were warranted adjacent to the underground structures as part of the DSRP.

5.2.2 Exposure Assessment

Study Area CS-14 is located inside the Security Zone/Flightline Area; therefore, the PRE Tier I evaluation of soils assumed exposures associated with future worker activities (ASG, 1994).

Exposures to CPCs in soil may occur through incidental ingestion, dermal contact, and inhalation of VOCs, or inhalation of soil particles with sorbed SVOCs or inorganic compounds. Exposure parameters for soil were based on the worker exposure scenario described in the RAH (ASG, 1994).

Exposure to groundwater was assumed to occur through residential use and would involve ingestion, dermal contact, and inhalation of VOCs while showering. Exposure parameters for groundwater were based on the residential exposure scenario described in the RAH (ASG, 1994). Formulas and assumptions used in the exposure assessment are presented in Appendix Q of the RAH.

TABLE 5-1
CONTAMINANTS OF POTENTIAL CONCERN IN SUBSURFACE SOIL

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

CHEMICAL	FREQUENCY OF DETECTION	RANGE OF SAMPLE QUANTITATION LIMITS (mg/kg)	RANGE OF DETECTED CONCENTRATIONS (mg/kg)
VOLATILE ORGANIC COMPOUNDS			
Methylene Chloride	1/1	-	0.014-0.014

NOTES:

- Chemical was detected in all samples analyzed.
mg/kg = milligrams per kilogram

TABLE 5-2
CONTAMINANTS OF POTENTIAL CONCERN IN GROUNDWATER

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

CHEMICAL [a]	FREQUENCY OF DETECTION	RANGE OF SAMPLE QUANTITATION LIMITS (ug/L)	RANGE OF DETECTED CONCENTRATIONS (ug/L)
Volatile Organic Compounds [b]			
Tetrachloroethene	14/24	1 - 1	0.95 - 8
Inorganic Compounds [c]			
Thallium	1/6	1.7 - 2.5	5.3 - 5.3

NOTES:

[a] Table 4-2 presents a summary of the chemicals detected in CS-14 groundwater and the Tier I and II HECs for those chemicals. CPCs are organic chemicals that were detected in more than 5% of the samples and at maximum concentrations above the Tier I HECs, and inorganic analytes detected at maximum concentrations below the human health Tier I HECs (1994, RAH; Appendix F HEC Tables re-issued January, 1995). Essential nutrients (calcium, iron, magnesium, potassium, and sodium) are not selected as CPCs.

[b] Data for volatile organic compounds represent the concentrations from SI Phase I, II, and III sampling and sampling conducted May 1993 through March, 1999. Tetrachloroethene retained as CPC because it was detected at a maximum concentration above the MCL.

[c] Data for inorganic compounds represent the concentrations from low-flow sampling conducted in March and October 1999.

ug/L = mircrograms per liter

CPC - Contaminant of Potential Concern

5.2.3 Toxicity Assessment

The toxicity assessment for compounds identified at Study Area CS-14 is presented in Appendix N of the RAH (ASG, 1994). Pre-calculated, media-specific HECs used in the PRE Tier I and Tier II evaluations are based on carcinogenic or non-carcinogenic effects. HECs for the appropriate PRE tier and exposure scenario are presented in Appendix F of the RAH (ASG, 1994; HEC tables re-issued January, 1998). As data permitted, HECs were calculated for both carcinogenic and noncarcinogenic effects, with the lower (more conservative) concentration used in the PRE screen.

5.2.4 Risk Characterization

PREs characterize potential human-health risks by comparison of media-specific concentrations of CPCs to pre-calculated HECs. The PRE is a screening process to ascertain whether a CPC exceeded the HEC. Tier I of the PRE establishes a risk level of 10^{-6} for cancer risks and a hazard quotient (HQ) of 0.2 for noncancer risks. Tier II uses a cancer risk level of 10^{-3} and a HQ of 10. The PRE was constructed to be a conservative evaluation of potential health risks. HECs based on future worker exposures were used to characterize risk in Tier I.

5.2.4.1 Soil. Methylene chloride was the only CPC identified in soil samples analyzed at an off-site laboratory. The maximum concentration for methylene chloride in soil at Study Area CS-14 was compared to the PRE Tier I HEC for human health (Table 5-3). The concentration, however, did not exceed the Tier I HEC.

A qualitative comparison was conducted of field analytical results for soils adjacent to the leaching pit, soil/gas trap and Hangar 158 OWS, which were collected during the Phase I Sump Removal Program. The comparison of the soil sample results to human health Tier I HECs for both cancer and non-cancer risk shows that none of the maximum chemical concentrations exceed the Tier I HECs for exposures inside the MMR Flightline Area Security Zone. The maximum organic (i.e., VOCs, SVOCs, and pesticides) concentrations range from approximately three to five orders of magnitude less than the Tier I HECs.

Because no CPC exceeded the HECs, the potential cancer risk is estimated to be less than 10^{-6}; therefore, no Tier II evaluation is required.

TABLE 5-3
HUMAN HEALTH PRE TIER I FOR SUBSURFACE SOIL

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

CHEMICAL	MAXIMUM SOIL CONCENTRATION (mg/kg)	HUMAN HEALTH	
		HAZARD EQUIVALENT CONCENTRATION (mg/kg)	DOES CONCENTRATION EXCEED CRITERION?
VOLATILE ORGANIC COMPOUNDS			
Methylene Chloride	0.014	1,440	NO

Note:

mg/kg = milligrams per kilogram

5.2.4.2 Groundwater. Maximum concentrations for CPCs in groundwater at Study Area CS-14 were compared to PRE Tier I HECs for human health and to available MCLs (Table 5-4). CPCs that exceeded the Tier I human health HECs indicate that potential cancer risk is greater than 10^{-6} and potential noncancer risk is greater than 0.2. Thallium was detected at concentrations that exceeded its respective Tier I HEC and MCL. PCE was detected at a maximum concentration (8 ug/L) that slightly exceeded its MCL (5 ug/L). As detailed in Section 4.2, inorganic concentrations in groundwater at the site were determined using only data collected during the February/March 1999 sampling round.

Tetrachloroethene (PCE): The maximum detected concentration of PCE (8 ug/L) did not exceed the Tier I HEC (63.8 ug/L) and has only exceeded MCLs at monitoring well MW-1. In addition, in fourteen sampling rounds conducted over the past nine years at MW-1, tetrachloroethene detections in that well only exceeded the MCL on two occasions (October, 1996 (8 ug/l), and July, 1997(6.3 ug/l)). In accordance with USEPA Region I risk assessment guidance (USEPA, 1995), and the Massachusetts Contingency Plan (310 CMR 40.0926), a temporal average concentration may be used to represent the exposure point concentration at a well when there are sufficient data to adequately characterize the effects of seasonal variation over time. The fourteen rounds of groundwater data collected over a nine-year period at MW-1 are considered adequate to characterize the variation in groundwater concentration over time. Therefore, the temporal average PCE concentration of 3.31 ug/L may be used to represent the exposure point concentration (the concentration to which someone using the water over time might be exposed to) at MW-1. This concentration (3.31 ug/L) is below the MCL of 5 ug/L. Therefore, based on the average concentration of PCE detected in well MW-1, PCE does not exceed the MCL, and was not included as a CPC. MW-1 continues to be sampled semi-annually as part of the Eastern Briarwood Monitoring Program.

Thallium: Thallium was selected as a CPC by comparing Tier I HECs to the maximum detected concentration (Table 5-4). The HEC of 0.584 ug/L for thallium is based on non-carcinogenic effects. Thallium was detected during the March 1999 sampling round in monitoring well MW-2 (5.3 ug/L). In accordance with the PRE methodology, and because of the Tier I exceedance, the CPC concentrations were compared to Tier II HECs (Table 5-5). The CPC was not identified as exceeding the human health Tier II HEC. In October, 1999, MW-1, MW-2, and MW-3 were sampled for Thallium; groundwater concentrations were below laboratory detection limits (ND<1.7 ug/l). Groundwater from MW-1 and MW-3 were also analyzed for Thallium in February/March, 1999 and were below laboratory detection limits (ND<2.5 ug/l). Per the methodology described above for

TABLE 5-4
HUMAN HEALTH PRE TIER I FOR GROUNDWATER

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

CHEMICAL	MAXIMUM GROUNDWATER CONCENTRATION (ug/L)	HAZARD EQUIVALENT CONCENTRATION* (ug/L)	DOES CONCENTRATION EXCEED CRITERION	MAXIMUM CONTAMINANT LEVELS (MCLs)** (ug/L)	DOES CONCENTRATION EXCEED CRITERION
Volatile Organic Compounds					
Tetrachloroethene	8	63.8	No	5	Yes
Inorganic Compounds					
Thallium	5.3	0.584	Yes	2	Yes

NOTES:

* - Based on most stringent Tier I HEC.
** - Federal or Massachusetts MCLs (whichever is more stringent)
HEC = hazard equivalent concentration
NA = No HEC or MCL available
NE = No HEC or MCL available; therefore, not evaluated
ug/L = mircrograms per liter

TABLE 5-5
HUMAN HEALTH PRE TIER II FOR GROUNDWATER

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

CHEMICAL	MAXIMUM GROUNDWATER CONCENTRATION (ug/L)	HAZARD EQUIVALENT CONCENTRATION* (ug/L)	DOES CONCENTRATION EXCEED CRITERION	MAXIMUM CONTAMINANT LEVELS (MCLs)** (ug/L)	DOES CONCENTRATION EXCEED CRITERION
Volatile Organic Compounds					
Tetrachloroethene	8	3,190	No	5	Yes
Inorganic Compounds					
Thallium	5.3	29.2	No	2	Yes

NOTES:

* - Based on most stringent Tier II HEC.
** - Federal or Massachusetts MCLs (whichever is more stringent)
HEC = hazard equivalent concentration
NA = No HEC or MCL available
NE = No HEC or MCL available; therefore, not evaluated
ug/L = mircrograms per liter

tetrachloroethene, the temporal average thallium concentration of 3.08 ug/l ((5.3 (from March 1999) + 0.85 (from October 1999, half the detection limit of 1.7))/2) may be used to represent the average exposure point concentration at MW-2.

There are no known sources of Thallium at CS-14. Thallium is a naturally occurring element in soils, which generally sorbs to manganese or iron oxy-hydroxides. Sporadic hits of thallium in groundwater are likely generated by the reductive dissolution of iron and manganese hydroxides that have accumulated trace amounts of natural thallium (JE, 1998). It is likely an intermittent condition that generally subsides with the biodegradation of surrounding organic material in the subsurface.

Groundwater collected from MW-1 and other monitoring wells downgradient of Monitoring Well MW-2 (CS-14/MW-1, 03MW531, 00MW0567 (JE, 1998)) did not have Thallium concentrations detected above laboratory detection limits, and therefore this pulse of Thallium detected is not indicative of a larger, surrounding plume of elevated Thallium contamination. In addition, the lack of Thallium downgradient of MW-2 suggests that the soil matrix may re-adsorb the Thallium as oxidizing conditions in the aquifer increase.

5.2.4.3 Risks for Groundwater COCs Exceeding Risk/Hazard Equivalent Concentrations. Based on the guidelines presented in the RAH, risks were estimated for COCs exceeding the Tier I HECs presented in the PRE to establish whether an RI/preliminary risk assessment (PRA) was necessary. Thallium was the only groundwater COC that exceeded its Tier I HEC.

Where possible, input parameters for these risk estimates have been updated with the latest input parameters (e.g., toxicity values from the EPA IRIS database, child inhalation rates from the exposure factors handbook). In cases where the RAH specified the use of EPA Region I guidance, updated values from newer federal guidance were not used. Use of updated parameters will ensure that risk estimates are as accurate as possible, given the assumptions and constraints required by federal and state guidance.

The non-cancer HI estimated for adult residents are summarized in Table 5-6. The exposure point concentration of 3.08 ug/l for thallium, calculated in the Section 5.2.4.2 was used. The non-cancer HI for this receptor is 0.94, which is less than the EPA and MADEP criteria (i.e., HI < 1.0).

TABLE 5-6
HUMAN HEALTH RISK/HAZARD QUOTIENT/HAZARD INDEX
GROUNDWATER
INGESTION, INHALATION, AND DERMAL EXPOSURE
ADULT RESIDENT, FUTURE USE, ONSITE/OFFSITE
MAXIMUM GROUNDWATER CONCENTRATIONS - TOTAL LOW FLOW METHOD RESULTS

AOC CS-14
MASSACHUSETTS MILITARY RESERVATION

$$\text{RISK/HQ} = \frac{C \times ED \times [(EF \times TF1 \times K \times IRair) + (EFs \times TFd \times SA \times PC \times CF1 \times CF2) + (TFo \times EF \times IRw)]}{BW \times AT \times 365\ days/yr}$$

(Inhalation | Dermal | Ingestion)

COC	C (mg/L)	BW (kg)	ATc (yr)	ATnc (yr)	ED (yr)	IRair m3/day	K (L/m3)	IRw (L/d)	CF1 (L/cm3)	CF2 (h/d)	EF (d/yr)	EFs (d/yr)	SA (cm2)	TF1 (mg/kg/d)-1 carc	TF1 (mg/kg/d) noncarcin	TFo (mg/kg/d)-1 carc	TFo (mg/kg/d) noncarcin	TFd (mg/kg/d)-1 carc	TFd (mg/kg/d) noncarcin	PC (cm/h)	Cancer Inhalation	Cancer Dermal	Cancer Ingestion	**Total Cancer Risk**	HQ Inhalation	HQ Dermal	HQ Ingestion	**Total HQ**
INORGANICS																												
THALLIUM[1]	3.1E-03	70	70	30	30	15	0.5	2	0.001	24	350	2.9	1.94E+04	NA	NA	NA	1.11E+04	NA	2.22E+04	1.00E-03	NA	NA	NA	NA	NA	3.6E-03	9.4E-01	9.4E-01
																				Total Risk	NA	NA	NA	NA	**NA**	**3.6E-03**	**9.4E-01**	**9.4E-01**

[1]Assumes thallium is the most toxic form – thallium acetate

Notes:
COC = contaminant of concern
C = concentration
BW = body weight
ATc = averaging time for carcinogens
ATnc = averaging time for noncarcinogens (equal to ED
ED = exposure duration
IRair=daily indoor inhalation rate
K=volatilization factor
IRw = daily water ingestion rate
CF1 = conversion factor for water
EF = exposure frequency
EFs=showering frequency
SA = skin surface area exposed
TF1=inhalation slope factor for carcinogens or 1/inhalation reference dose for noncarcinogens
TFo = ingestion slope factor for carcinogens or 1/ingestion reference dose for noncarcinogens
TFd=dermal slope factor for carcinogens or 1/dermal reference dose for noncarcinogens
PC = dermal permeability constant

5.2.5 Uncertainty Assessment

General uncertainties associated with the human health PRE process are discussed in Section 5.0 of the RAH (ASG, 1994). Study-area-specific uncertainties associated with the PRE were identified as follows:

1. Soil data available for Study Area CS-14 are limited to only one soil sample, which was analyzed for VOCs. Therefore, the human-health PRE, which was based on this limited soil data set, may underestimate risk. However, a comparison of on-site analysis of 53 soil samples to Risk/Hazard Equivalent Concentrations is discussed and evaluated in Section 5.2.4.1.

2. The selection of CPCs in groundwater was based on comparison to HECs and MCLs.

5.3 PRELIMINARY ECOLOGICAL RISK EVALUATION

CS-14 is located inside the flightline area and the site features are primarily buildings, paved areas, and grass lawns adjacent to buildings and pavement. Lawns are mowed regularly as part of the flightline operations and the overall habitat in this area would not readily support a large variety of ecological receptors. The SI ecological exposure assessment performed in accordance with the MMR RAH, considered the detection of methylene chloride detected in the 2-foot to 4-foot sample in MW-3. HECs for the target receptors were not exceeded. Target receptors included the meadow vole, upland sandpiper (most conservative), and the red fox. As stated in the SI, it is unlikely that significant use of CS-14 by all the ecological receptors evaluated would occur, and therefore the PRE may overestimate risk. Additionally, since *the potential release mechanisms for this site are all located in the subsurface*, ecological exposure pathways would be very limited or non-existent.

5.4 SUMMARY OF PRE RESULTS

Tier I of the human-health PRE showed that the concentration of the one analyte detected in soil was below the human health HEC. The maximum detected concentration of thallium in groundwater exceeded the human health Tier I HEC and MCL. The hazard index associated with possible exposure to thallium in groundwater that is assumed to be used as drinking water is 0.94, which is less than USEPA and MADEP target HI of one.

6.0 DRAINAGE STRUCTURE REMOVAL PROGRAM ACTIVITIES

Based on the subsurface sampling conducted during the Phase 1 Sump Removal Program, an EE/CA was developed for the DSRP, which included the drainage structures at Study Area CS-14 (Metcalf & Eddy, Inc., 1994). Results of the EE/CA recommended removal of the leaching pit and a diversion manhole (i.e., 98CDXX9) associated with the abandoned OWS at Hangar 158 (see Figure 2-2). The sand/gas trap was not recommended for removal in the DSRP EE/CA.

In 1996, test trenches were excavated in the area of the leaching pit as part of the DSRP. Evidence of the presence of the leaching pit or associated contamination was not found and the area was backfilled and regraded in place. Dimensions of the two executed test pits were 14 feet-by-20-feet and 9 feet-by-20 feet and 11 feet deep in the area of the suspected drainage structure (DS). The test pit explorations were split by an asphalt walkway indicated in the SI that is underlain by a DIG-SAFE identified gas utility. On-site personnel reported no indications of typical DS construction, piping, cobblestone fill, staining, odors, or other contaminant indicators. Reportedly, some debris and rubble was removed from the test pit excavations and staged for processing through the on-site asphalt batching (OABF) facility. Discussions with regulatory agencies (MADEP and USEPA) representatives at project status meetings on April 11, 1996 and April 18, 1996 indicated DS delisting as appropriate with satisfactory evidence of search activities and findings.

The OWS was dropped from further consideration because it was not a drainage structure. However, the sand originally used to backfill the structure was removed and the structure was steam-cleaned and filled in place with concrete during the DSRP in April 1996. The inlet and outlet for two manholes (i.e., 98CDXX7 and 98CDXX9) associated with the abandoned oil/water separator were blocked with concrete as part of the DSRP.

A summary of the DSRP actions and status for CS-14 is presented on Table 6-1. Closure Reports are included in Appendix C.

TABLE 6-1
CS-14 DRAINAGE STRUCTURE STATUS LIST

STUDY AREA CS-14 DECISION DOCUMENT
MASSACHUSETTS MILITARY RESERVATION

SITE	ISIS CODE	BUILDING NO.	DS IDENTIFIED	DATE REMOVED[1]	CLOSURE REPORT SUBMITTED	COMMENT
CS-14	98CDXX1	156	GAS TRAP	N/A	N/A	ACTIVE GAS TRAP NOT RECOMMENDED FOR REMOVAL IN THE DSRP EE/CA.
	98CDXX2	156	LEACH FIELD	N/A	N/A	SUSPECTED LEACHFIELD, NOT LOCATED THROUGH TEST PITTING TO APPROX. 10' BGS IN SPECIFIED AREA "DELISTED" - SEE JUSTIFICATION REPORT APPENDIX D
	98CDXX3	158	OWS	4/29/96	Feb-97	DECONTAMINATED IN PLACE AND FILLED WITH CONCRETE
	98CDXX4	158	OWS	4/29/96	Feb-97	DECONTAMINATED IN PLACE AND FILLED WITH CONCRETE
	98CDXX5	158	OWS	4/29/96	Feb-97	DECONTAMINATED IN PLACE AND FILLED WITH CONCRETE
	98CDXX6	158	OWS	4/29/96	Feb-97	DECONTAMINATED IN PLACE AND FILLED WITH CONCRETE
	98CDXX7	158	DISCHARGE MANHOLE	N/A	N/A	NOT RECOMMENDED FOR REMOVAL IN THE DSRP EE/CA. CONNECTED TO ACTIVE OWS 98CDXX8
	98CDXX8	156	OWS	N/A	N/A	NOT RECOMMENDED FOR REMOVAL UNDER THE DSRP EE/CA, ACTIVE MAINTAINED OWS.
	98CDXX9	158	DISCHARGE MANHOLE	4/29/96	Feb-97	DECONTAMINATED IN PLACE AND FILLED WITH CONCRETE

NOTES:

1. Removal dates unless otherwise noted, indicate remediation to clean closure under DSRP guidelines. Individual DS closure reports, sealed by a Massachusetts Licensed Site Professional, prepared by Jacobs Engineering Group.

2. N/A = Not applicable relative DSRP activities. These drainage structures were not part of the DSRP due to other program impact (i.e., fuel system upgrade contract, not recommended for removal under DSRP EE/CA, found to be active sewer utility, etc.). Where possible historical information or justification has been noted in this table.

BGS = below ground surface
DS = drainage structure
DSRP = Drainage Structure Removal Program
EE/CA = Engineering Evaluation/Cost Analysis
ISIS = Integrated Site Identification system
OWS = oil-water separator

7.0 CONCLUSIONS

Since 1986, when Study Area CS-14 was designated as a site to be investigated, multiple investigations have been conducted to evaluate the nature and extent of contamination at the site, and its potential risk to human health and the environment. These included a soil gas survey, installation and multiple sampling of groundwater wells, advancement of 12 terreprobe borings and two test trenches, and on-site and off-site analysis of soils and groundwater.

Remedial efforts at the site included steam cleaning and sealing multiple subsurface drainage structures.

Results of the human-health Preliminary Risk Evaluation conducted on the data set collected from Study Area CS-14 indicated a non-carcinogenic HEC exceedance of Thallium in groundwater. The HI associated with possible exposure to Thallium in groundwater that is assumed to be used as drinking water is 0.94, which is less than the USEPA and MADEP target HI of one.

The fate of groundwater TCE and PCE detected in the study area wells has been evaluated as part of the Southeast Region Groundwater Operable Unit Remedial Investigation and Eastern Briarwood Groundwater Monitoring Program. Results of these efforts indicated a mappable TCE plume. The head of the plume is approximately 2,000 feet southeast of CS-14 in the shallow portion of the aquifer near the water table. TCE has been detected sporadically and below MCLs at wells (MW-1 through MW-5) associated with CS-14.

Based on the records search, SI soil and groundwater data, the DSRP, and the SERGOU RI, no further action is recommended for Study Area CS-14.

8.0 DECISION

On the basis of these findings, there is no evidence of significant environmental contamination or of human-health or ecological risks at Study Area CS-14. The decision has been made to remove these study areas from further consideration in the IRP process.

8 Jun 00

Gary M. Erickson, P.E. Date
Director
Air Force Center for Environmental Excellence

U.S. Environmental Protection Agency
New England Division

[V] Concur

PAULA LIA FITZSIMMONS
Associate Director
Office of Site Remediation and Restoration

June 22, 2000
Date

[ ] Non-concur (please provide reasons) _____

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_____

_____

_____

_____

_____

Commonwealth of Massachusetts
Department of Environmental Protection

[✓] Concur

Paul A. Taurasi, P.E.
Regional Director
Southeast Region

CS-14

6/28/2000
Date

[ ] Non-concur (please provide reasons) _____

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
20 RIVERSIDE DRIVE, LAKEVILLE, MA 02347 508-946-2700

ARGEO PAUL CELLUCCI
Governor

JANE SWIFT
Lieutenant Governor

BOB DURAND
Secretary

LAUREN A. LISS
Commissioner

June 30, 2000

Mr. Robert M. Gill
Remediation Program Manager
HQ AFCEE/MMR
322 East Inner Road
Otis ANG Base, Massachusetts 02542

RE: BOURNE--BWSC-4-0037
Massachusetts Military Reservation (MMR), **Study Area CS-14, Decision Document,** Concurrence

Dear Mr. Gill:

The Department of Environmental Protection (the "Department") has reviewed a document titled "**Decision Document Study Area CS-14, FINAL**" dated April 2000 and prepared by Harding Lawson Associates of Portland, Maine, for the Air Force Center for Environmental Excellence (AFCEE).

The CS-14 Study Area, located within the flight line area of the Otis Air National Guard Base at the MMR, consists of subsurface structures between Building 156 and Hangar 158. Liquid wastes from these buildings including chlorinated solvents and waste petroleum products were reportedly discharged to these structures. The oil water separator at Hangar 158 and the associated diversion manhole were decontaminated in place and filled with concrete. Soils and groundwater at the site were tested for all contaminants of concern. Based on current site conditions, the site poses no significant risk of harm to human health or the environment. The DD proposes no further action at Study Area CS-14.

The Department concurs with the DD. The Department's concurrence with this DD is based upon representations made to the Department by the AFCEE and assumes that all information provided is substantially complete and accurate. Without limitation, if the Department determines that any material omissions or misstatements exist, if new information becomes available, or if conditions at the Study Area change, resulting in potential or actual human exposure or threats to the environment, the Department reserves its authority under M.G.L. c. 21E, and the MCP, 310 CMR 40.0000 et seq., and any other applicable law or regulation to require further response actions.

Please incorporate this letter into the Administrative Record for the Study Area CS-14. The Department looks forward to working with you to expedite the cleanup of this site. If you have any questions regarding this letter, please contact Leonard J. Pinaud at (508) 946-2871.

Sincerely,

Paul Taurasi, P.E.
Regional Director

T/LP/HC
c/cs14ddapv.doc

cc: DEP-SERO
ATTN: Mildred Garcia-Surette, Deputy Regional Director
Leonard J. Pinaud, Chief, Federal Facilities Remediation Section

Distributions: SERO
SMB
Plume Containment Team
Public Information Team
Long Range Water Supply PAT
Boards of Selectmen
Boards of Health

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

AFCEE	Air Force Center for Environmental Excellence
ANG	Air National Guard
ARNG	Army National Guard
ASG	Automated Sciences Group
BBM	Buzzards Bay Moraine
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylene
CPC	contaminant of potential concern
CS	chemical spill
DCE	dichloroethene
DRMO	Defense Reuse Management Office
DS	drainage structure
DSRP	Drainage Structure Removal Program
EDB	ethylene dibromide
EE/CA	engineering evaluation/cost analysis
°F	degrees Fahrenheit
FIW	Fighter-Interceptor Wing
ft/d	feet per day
ft/ft	feet per foot
GC	gas chromatograph
HARM	Hazard Assessment Rating Methodology
HAZWRAP	Hazardous Waste Remedial Actions Program
HEC	hazard equivalent concentration
HQ	hazard quotient
IRP	Installation Restoration Program
MCL	Maximum Contaminant Level
MEK	methyl ethyl keytone
mg/kg	milligrams per kilogram
MMR	Massachusetts Military Reservation
mph	miles per hour

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

MPP	Mashpee Pitted Plain
MSL	mean sea level
OAFB	on-site asphalt batching facility
OWS	oil water separator
PCE	tetrachloroethene
PRA	preliminary risk assessment
PRE	preliminary risk evaluation
PQL	practical quantitation limit
RAH	Risk Assessment Handbook
RfD	reference dose
RI	remedial investigation
SD	storm drainage
SE	southeast
SERGOU	Southeast Regional Operable Unit
SI	site investigation
SM	Sandwich Moraine
STCL	Soil Target Clean-up Levels
SVOC	semivolatile organic compound
TCA	trichloroethane
TCE	trichloroethene
TIC	tentatively identified compound
TPH	total petroleum hydrocarbons
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
USAF	U.S. Air Force
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USN	U.S. Navy
VA	Veterans Administration
VOC	volatile organic compound
WWII	World War II

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U.S. Environmental Protection Agency (USEPA), 1989b. "Risk Assessment Guidance for Superfund"; *Vol. 2, Environmental Evaluation Manual*; Office of Emergency and Remedial Response; USEPA 540/1-89/002; Washington, DC; December 1989.

U.S. Environmental Protection Agency (USEPA), 1995. "USEPA Region I Risk Updates, Number 3, August 1995".

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APPENDIX A

LABORATORY ANALYTICAL DATA

Attachment II - Definition of Validation Qualifiers
(for Table 2 - Validation/Summary Table)

J - Estimated concentration because QC criteria were not met.

R - Results were rejected because of serious QC deficiencies.

U - Indicates that compound was analyzed but not detected. The sample quantitation limit is adjusted for dilution and percent moisture.

N - Indicates presumptive evidence of a compound. This flag is used for TICs were the identification is based on a library search and is applied to all TIC results. For general classes of compounds (hydrocarbons, etc.) this flag is not used.

UJ - Quantitation limit was estimated concentration because QC criteria were not met.

NJ - Presence of an analyte was tentatively identified and the associated result represents an estimated concentration.

B - Is used when the preparation blank concentration is > CRDL, or the preparation blank concentration is less than or equal to the CRDL when the sample result is less than or equal to 10x the preparation blank conentration.

Table 2
Validation / Summary Table

LOCATION:	MW-3	MW-3	MW-3
DEPTH:	16	54	2
ISIS ID:	98MSXX3X16X1XX	98MSXX3X54X1XX	98MSXX3XX2X1XX
LAB NUMBER:	38573	38574	38572 #
DATE SAMPLED:	11/28/90	11/28/90	11/28/90
DATE ANALYZED:	12/06/90	12/07/90	12/05/90

ANALYTE	SOW-2/88 CRQL					
Chloromethane	10	12	U	12	U	10 U
Bromomethane	10	12	U	12	U	10 U
Vinyl Chloride	10	12	U	12	U	10 U
Chloroethane	10	12	U	12	U	10 U
Methylene Chloride	5	8	U	6	U	14
Acetone	10	12	U	12	U	10 U
Carbon Disulfide	5	6	U	6	U	5 U
1,1-Dichloroethene	5	6	U	6	U	5 U
1,1-Dichloroethane	5	6	U	6	U	5 U
1,2-Dichloroethene (total)	5	6	U	6	U	5 U
Chloroform	5	6	U	6	U	5 U
1,2-Dichloroethane	5	6	U	6	U	5 U
2-Butanone	10	12	U	12	U	10 U
1,1,1-Trichloroethane	5	6	U	6	U	5 U
Carbon Tetrachloride	5	6	U	6	U	5 U
Vinyl Acetate	10	12	U	12	U	10 U
Bromodichloromethane	5	6	U	6	U	5 U
1,2-Dichloropropane	5	6	U	6	U	5 U
cis-1,3-Dichloropropene	5	6	U	6	U	5 U
Trichloroethene	5	6	U	6	U	5 U
Dibromochloromethane	5	6	U	6	U	5 U
1,1,2-Trichloroethane	5	6	U	6	U	5 U
Benzene	5	6	U	6	U	5 U
trans-1,3-Dichloropropene	5	6	U	6	U	5 U
Bromoform	5	6	U	6	U	5 U
4-Methyl-2-Pentanone	10	12	U	12	U	10 U
2-Hexanone	10	12	U	12	U	10 U
Tetrachloroethene	5	6	U	6	U	5 U
1,1,2,2-Tetrachloroethane	5	6	U	6	U	5 U
Toluene	5	6	U	6	U	5 U
Chlorobenzene	5	6	U	6	U	5 U
Ethylbenzene	5	6	U	6	U	5 U
Styrene	5	6	U	6	U	5 U
Total Xylenes	5	6	U	6	U	5 U

Dilution Factor:	1.00	1.00	1.00
Percent Solids:	86	83	96
Associated Method Blank:	U6547	U6547	U6510
Associated Equipment Blank:	-	-	-
Associated Field Blank:	-	-	-
Associated Trip Blank:	-	-	-

Study Area: CS-14
#: Level D Validation
Note: Depth indicates top of sample interval

Table 2
Validation / Summary Table

	LOCATION:	MW-1		MW-2		MW-3	
	ISIS ID:	98MWXX1XXXX2XX		98MWXX2XXXX1XX		98MWXX3XXXX1XX	
	LAB NUMBER:	41448		41446		41447	
	DATE SAMPLED:	01/09/91		01/09/91		01/09/91	
	DATE ANALYZED:	01/17/91		01/17/91		01/17/91	
ANALYTE	SOW-2/88 CRQL						
Chloromethane	10	10	U	10	U	10	U
Bromomethane	10	10	U	10	U	10	U
Vinyl Chloride	10	10	U	10	U	10	U
Chloroethane	10	10	U	10	U	10	U
Methylene Chloride	5	5	U	5	U	5	U
Acetone	10	10	U	10	U	10	U
Carbon Disulfide	5	5	U	5	U	5	U
1,1-Dichloroethene	5	5	U	5	U	5	U
1,1-Dichloroethane	5	5	U	5	U	5	U
1,2-Dichloroethene (total)	5	5	U	5	U	5	U
Chloroform	5	5	U	5	U	5	U
1,2-Dichloroethane	5	5	U	5	U	5	U
2-Butanone	10	10	U	10	U	10	U
1,1,1-Trichloroethane	5	5	U	5	U	5	U
Carbon Tetrachloride	5	5	U	5	U	5	U
Vinyl Acetate	10	10	UJ	10	U	10	U
Bromodichloromethane	5	5	U	5	U	5	U
1,2-Dichloropropane	5	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	5	U	5	U	5	U
Trichloroethene	5	5	U	5	U	5	U
Dibromochloromethane	5	5	U	5	U	5	U
1,1,2-Trichloroethane	5	5	U	5	U	5	U
Benzene	5	5	UJ	5	UJ	5	UJ
trans-1,3-Dichloropropene	5	5	U	5	U	5	U
Bromoform	5	5	U	5	U	5	U
4-Methyl-2-Pentanone	10	10	U	10	U	10	U
2-Hexanone	10	10	U	10	U	10	U
Tetrachloroethene	5	5		5	U	5	U
1,1,2,2-Tetrachloroethane	5	5	U	5	U	5	U
Toluene	5	5	UJ	5	UJ	5	UJ
Chlorobenzene	5	5	UJ	5	UJ	5	UJ
Ethylbenzene	5	5	UJ	5	UJ	5	UJ
Styrene	5	5	UJ	5	UJ	5	UJ
Total Xylenes	5	5	UJ	5	UJ	5	UJ
Dilution Factor:		1.00		1.00		1.00	

Associated Method Blank:	Y5829	V7429	V7429
Associated Equipment Blank:	00QSXXXX01X2XX	00QSXXXX01X2XX	00QSXXXX01X2XX
Associated Field Blank:	-	-	-
Associated Trip Blank:	00QTXXXX02X2XX	00QTXXXX02X2XX	00QTXXXX02X2XX

Study Area: CS-14

Table 2
Validation / Summary Table

LOCATION: MW-1
ISIS ID: 98MW1XXXXX01XX
LAB NUMBER: 12746 R #
DATE SAMPLED: 03/29/90
DATE ANALYZED: 04/11/90

ANALYTE	SOW-2/88 DL		
Chloromethane	2	2	U
Bromomethane	2	2	U
Vinyl Chloride	2	2	U
Chloroethane	2	2	U
Methylene Chloride	1	1	U
Acetone	2	2	U
Carbon Disulfide	1	1	U
1,1-Dichloroethene	1	1	U
1,1-Dichloroethane	1	1	U
1,2-Dichloroethene (total)	1	1	U
Chloroform	1	1	U
1,2-Dichloroethane	1	1	U
2-Butanone	2	2	U
1,1,1-Trichloroethane	1	1	U
Carbon Tetrachloride	1	1	U
Vinyl Acetate	2	2	U
Bromodichloromethane	1	1	U
1,2-Dichloropropane	1	1	U
cis-1,3-Dichloropropene	1	1	U
Trichloroethene	1	1	U
Dibromochloromethane	1	1	U
1,1,2-Trichloroethane	1	1	U
Benzene	1	1	UJ
trans-1,3-Dichloropropene	1	1	U
Bromoform	1	1	U
4-Methyl-2-Pentanone	2	2	U
2-Hexanone	2	2	U
Tetrachloroethene	1	1	U
1,1,2,2-Tetrachloroethane	1	1	U
Toluene	1	1	UJ
Chlorobenzene	1	1	UJ
Ethylbenzene	1	1	UJ
Styrene	1	1	UJ
Total Xylenes	1	1	UJ
Dilution Factor:		1.00	

Associated Method Blank: Y0836
Associated Equipment Blank: 00QS001XXX01XX
Associated Field Blank: -
Associated Trip Blank: 99QT001XXX01XX

Study Area: CS-14
#: Level D Validation

Table 2
Validation / Summary Table

	LOCATION:	MW-1	MW-2	MW-3
	ISIS ID:	98MWXX1XXXX3XX	98MWXX2XXXX3XX	98MWXX3XXXX3XX
	LAB NUMBER:	24160004	24160002	24160003
	DATE SAMPLED:	02/25/93	02/25/93	02/25/93
	DATE ANALYZED:	03/11/93	03/10/93	03/10/93

ANALYTE	SOW-10/92 CRQL					
Chloromethane	1	1	U	1	U	1 U
Bromomethane	1	1	U	1	U	1 U
Vinyl Chloride	1	1	U	1	U	1 U
Chloroethane	1	1	U	1	U	1 U
Methylene Chloride	2	3		2	U	2 U
Acetone	5	5	UJ	5	UJ	5 UJ
Carbon Disulfide	1	1	U	1	U	1 U
1,1-Dichloroethene	1	1	U	1	U	1 U
1,1-Dichloroethane	1	1	U	1	U	1 U
cis-1,2-Dichloroethene	1	1	U	1	U	1 U
trans-1,2-Dichloroethene	1	1	U	1	U	1 U
Chloroform	1	1	U	1	U	1 U
1,2-Dichloroethane	1	1	U	1	U	1 U
2-Butanone	5	10	J		R	R
Bromochloromethane	1	1	U	1	U	1 U
1,1,1-Trichloroethane	1	1	U	1	U	1 U
Carbon Tetrachloride	1	1	U	1	U	1 U
Bromodichloromethane	1	1	U	1	U	1 U
1,2-Dichloropropane	1	1	U	1	U	1 U
cis-1,3-Dichloropropene	1	1	U	1	U	1 U
Trichloroethene	1	1	U	1	U	1
Dibromochloromethane	1	1	U	1	U	1 U
1,1,2-Trichloroethane	1	1	U	1	U	1 U
Benzene	1	1	U	1	U	1 U
trans-1,3-Dichloropropene	1	1	U	1	U	1 U
Bromoform	1	1	U	1	U	1 U
4-Methyl-2-Pentanone	5	5	U	5	U	5 U
2-Hexanone	5	5	U	5	U	5 U
Tetrachloroethene	1	3		1		4
1,1,2,2-Tetrachloroethane	1	1	U	1	U	1 U
1,2-Dibromoethane	1	1	U	1	U	1 U
Toluene	1	1	U	1	U	1 U
Chlorobenzene	1	1	U	1	U	1 U
Ethylbenzene	1	1	U	1	U	1 U
Styrene	1	1	U	1	U	1 U
Total Xylenes	1	1	U	1	U	1 U
1,3-Dichlorobenzene	1	1	U	1	U	1 U
1,4-Dichlorobenzene	1	1	U	1	U	1 U
1,2-Dichlorobenzene	1	1	U	1	U	1 U
1,2-Dibromo-3-Chloropropane	1	1	U	1	U	1 U
Dilution Factor:		1.00		1.00		1.00

Associated Method Blank:	CBLO027751	CBLO027751	CBLO027751
Associated Equipment Blank:	MRQSXX1XXXX3XX	MRQSXX1XXXX3XX	MRQSXX1XXXX3XX
Associated Field Blank:	MRWYXX1XXXX3XX	MRWYXX1XXXX3XX	MRWYXX1XXXX3XX
Associated Trip Blank:	MRQTXX3XXXX3XX	MRQTXX3XXXX3XX	MRQTXX3XXXX3XX

Study Area: CS-14
#: Level D Validation

Table 2
Validation / Summary Table

LOCATION:	MW-1	MW-1	MW-2	MW-3
ISIS ID:	98MW1XXXXX01XX	98MWXX1XXXX2XX	98MWXX2XXXX1XX	98MWXX3XXXX1XX
LAB NUMBER:	12737 #	41459	41457	41458
DATE SAMPLED:	03/29/90	01/09/91	01/09/91	01/09/91
DATE EXTRACTED:	04/03/90	01/10/91	01/10/91	01/10/91
DATE ANALYZED:	04/12/90	01/29/91	01/26/91	01/29/91

ANALYTE	SOW-2/88 CRQL							
Phenol	10	10	U	10	U	10	U	10 U
bis(2-Chloroethyl)ether	10	10	U	10	U	10	U	10 U
2-Chlorophenol	10	10	U	10	U	10	U	10 U
1,3-Dichlorobenzene	10	10	U	10	U	10	U	10 U
1,4-Dichlorobenzene	10	10	U	10	U	10	U	10 U
Benzyl Alcohol	10	10	U	10	U	10	U	10 U
1,2-Dichlorobenzene	10	10	U	10	U	10	U	10 U
2-Methylphenol	10	10	U	10	U	10	U	10 U
bis(2-Chloroisopropyl)ether	10	10	U	10	U	10	U	10 U
4-Methylphenol	10	10	U	10	U	10	U	10 U
N-Nitroso-di-n-propylamine	10	10	U	10	U	10	U	10 U
Hexachloroethane	10	10	U	10	U	10	U	10 U
Nitrobenzene	10	10	U	10	U	10	U	10 U
Isophorone	10	10	U	10	U	10	U	10 U
2-Nitrophenol	10	10	U	10	U	10	U	10 U
2,4-Dimethylphenol	10	10	U	10	U	10	U	10 U
Benzoic Acid	50	50	U	50	U	50	UJ	50 U
bis(2-Chloroethoxy)methane	10	10	U	10	U	10	U	10 U
2,4-Dichlorophenol	10	10	U	10	U	10	U	10 U
1,2,4-Trichlorobenzene	10	10	U	10	U	10	U	10 U
Naphthalene	10	10	U	10	U	10	U	10 U
4-Chloroaniline	10	10	U	10	U	10	U	10 U
Hexachlorobutadiene	10	10	U	10	U	10	U	10 U
4-Chloro-3-Methylphenol	10	10	U	10	U	10	U	10 U
2-Methylnaphthalene	10	10	U	10	U	10	U	10 U
Hexachlorocyclopentadiene	10	10	U	10	U	10	U	10 U
2,4,6-Trichlorophenol	10	10	U	10	U	10	U	10 U
2,4,5-Trichlorophenol	50	50	U	50	U	50	U	50 U
2-Chloronaphthalene	10	10	U	10	U	10	U	10 U
2-Nitroaniline	50	50	U	50	U	50	U	50 U
Dimethylphthalate	10	10	U	10	U	10	U	10 U
Acenaphthylene	10	10	U	10	U	10	U	10 U
2,6-Dinitrotoluene	10	10	U	10	U	10	U	10 U

Study Area: CS-14
#: Level D Validation

Table 2
Validation / Summary Table

LOCATION:	MW-1	MW-1	MW-2	MW-3
ISIS ID:	98MW1XXXXX01XX	98MWXX1XXXX2XX	98MWXX2XXXX1XX	98MWXX3XXXX1XX
LAB NUMBER:	12737 #	41459	41457	41458
DATE SAMPLED:	03/29/90	01/09/91	01/09/91	01/09/91
DATE EXTRACTED:	04/03/90	01/10/91	01/10/91	01/10/91
DATE ANALYZED:	04/12/90	01/29/91	01/26/91	01/29/91

ANALYTE	SOW-2/88 CRQL							
3-Nitroaniline	50	50	U	50	U	50	U	50 U
Acenaphthene	10	10	U	10	U	10	U	10 U
2,4-Dinitrophenol	50	50	U	50	U	50	U	50 U
4-Nitrophenol	50	50	U	50	U	50	U	50 U
Dibenzofuran	10	10	U	10	U	10	U	10 U
2,4-Dinitrotoluene	10	10	U	10	U	10	U	10 U
Diethylphthalate	10	10	U	10	U	10	U	10 U
4-Chlorophenyl-phenylether	10	10	U	10	U	10	U	10 U
Fluorene	10	10	U	10	U	10	U	10 U
4-Nitroaniline	50	50	U	50	U	50	U	50 U
4,6-Dinitro-2-methylphenol	50	50	U	50	U	50	U	50 U
N-Nitrosodiphenylamine	10	10	U	10	U	10	U	10 U
4-Bromophenyl-phenylether	10	10	U	10	U	10	U	10 U
Hexachlorobenzene	10	10	U	10	U	10	U	10 U
Pentachlorophenol	50	50	U	50	U	50	U	50 U
Phenanthrene	10	10	U	10	U	10	U	10 U
Anthracene	10	10	U	10	U	10	U	10 U
Di-n-butylphthalate	10	10	U	10	U	10	U	10 U
Fluoranthene	10	10	U	10	U	10	U	10 U
Pyrene	10	10	U	10	U	10	U	10 U
Butylbenzylphthalate	10	10	U	10	U	10	U	10 U
3,3'-Dichlorobenzidine	20	20	U	20	U	20	U	20 U
Benzo(a)Anthracene	10	10	U	10	U	10	U	10 U
Chrysene	10	10	U	10	U	10	U	10 U
bis(2-Ethylhexyl)phthalate	10	10	U	10	U	10	U	10 U
Di-n-octylphthalate	10	10	U	10	U	10	U	10 U
Benzo(b)Fluoranthene	10	10	U	10	U	10	U	10 U
Benzo(k)Fluoranthene	10	10	U	10	U	10	U	10 U
Benzo(a)Pyrene	10	10	U	10	U	10	U	10 U
Indeno(1,2,3-c,d)Pyrene	10	10	U	10	U	10	U	10 U
Dibenz(a,h)Anthracene	10	10	U	10	U	10	U	10 U
Benzo(g,h,i)perylene	10	10	U	10	U	10	U	10 U
Dilution Factor:		1.00		1.00		1.00		1.00

Associated Method Blank:	T2061	Z7495	Z7495	Z7495
Associated Equipment Blank:	00QS001XXX01XX	00QSXXXX01X2XX	00QSXXXX01X2XX	00QSXXXX01X2XX
Associated Field Blank:	-	-	-	-

Study Area: CS-14
#: Level D Validation

Table 2
Validation / Summary Table

	LOCATION:	MW-1	MW-1	MW-2	MW-3
	ISIS ID:	98MW1XXXXX01XX	98MWXX1XXXX2XX	98MWXX2XXXX1XX	98MWXX3XXXX1XX
	LAB NUMBER:	12721 #	41474	41472	41473
	DATE SAMPLED:	03/29/90	01/09/91	01/09/91	01/09/91
ANALYTE	SOW-2/88 CRDL				
Aluminum	200	28.7 J	23.0 U	23.0 U	23.0 U
Antimony	60	28.0 U	30.0 U	30.0 U	30.0 U
Arsenic	10	3.0 U	3.0 U	3.0 U	3.0 U
Barium	200	47.5 J	53.9 J	74.2 J	27.9 J
Beryllium	5	1.0 U	1.0 J	1.0 U	1.0 U
Cadmium	5	2.0 U	5.0 U	5.0 U	5.0 U
Calcium	5000	5920	6350	5990	4850 J
Chromium	10	9.0 U	6.0 U	6.0 U	6.0 U
Cobalt	50	7.0 U	6.0 U	6.0 U	6.0 U
Copper	25	14.2 J	5.0 U	5.0 U	5.0 U
Iron	100	18.1 U	7.2 U	208 U	10.3 U
Lead	3	2.0 U	1.1 U	1.8 UJ	1.0 U
Magnesium	5000	2430 J	2730 J	2060 J	1810 J
Manganese	15	28.1	27.2	67.9	8.3 J
Mercury	0.2	0.20 UJ	0.36	0.20 U	0.20 U
Nickel	40	18.0 U	12.0 U	12.0 U	12.0 U
Potassium	5000	2510 U	1800 J	1850 J	1550 J
Selenium	5	3.0 U	3.0 U	3.0 U	3.0 U
Silver	10	3.0 U	5.0 U	5.0 U	5.0 U
Sodium	5000	14100	17300	8150	6010
Thallium	10	3.0 UJ	10.0 UJ	5.0 UJ	5.0 UJ
Vanadium	50	4.0 U	4.0 U	4.0 U	4.0 U
Zinc	20	6.7 U	8.4 U	15.0 U	4.6 U
Cyanide	10	10.0 UJ	10.0 U	10.0 U	10.0 U
Associated Method Blank:		MMR042190W	INBLK-4196	INBLK-4196	INBLK-4196
Associated Equipment Blank:		00QS001XXX01XX	00QSXXXX01X2XX	00QSXXXX01X2XX	00QSXXXX01X2XX
Associated Field Blank:		-	-	-	-

Study Area: CS-14
#: Level D Validation

TENTATIVELY IDENTIFIED COMPOUNDS (TICs) SUMMARY
FOR MMR - TASK 2-4 (SI-PHASE II); STUDY-AREA: CS-14
SOIL (ug/kg)

VOLATILE

NO VOLATILE TICs WERE IDENTIFIED IN THE FOLLOWING SAMPLES:

98MSXX3X16X1XX
98MSXX3X54X1XX
98MSXX3XX2X1XX

TENTATIVELY IDENTIFIED COMPOUNDS (TICs) SUMMARY
FOR MMR - TASK 2-4 (SI-PHASE II); STUDY-AREA: CS-14
AQUEOUS (ug/L)

VOLATILE

NO VOLATILE TICs WERE IDENTIFIED IN THE FOLLOWING SAMPLES:

98MWXX1XXXX2XX
98MWXX2XXXX1XX
98MWXX2XXXX1XXRE
98MWXX3XXXX1XX
98MWXX3XXXX1XXRE

SEMIVOLATILE

NO SEMIVOLATILE TICs WERE IDENTIFIED IN THE FOLLOWING SAMPLES:

98MWXX1XXXX2XX
98MWXX2XXXX1XX
98MWXX3XXXX1XX

Table 2
Validation / Summary Table

	LOCATION:	MW-1	MW-2	MW-3	MW-4	MW-5
	ISIS ID:	98MWXX1XXX93XX	98MWXX2XXX93XX	98MWXX3XXX93XX	98MWXX4XXX93XX	98MWXX5XXX93XX
	LAB NUMBER:	82254	82260	82256	82253 #	82255
	DATE SAMPLED:	05/25/93	05/25/93	05/25/93	05/25/93	05/25/93
	DATE ANALYZED:	06/08/93	06/08/93	06/08/93	06/08/93	06/08/93
ANALYTE	RL					
Total Petroleum Hydrocarbons	2.0	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ
	Dilution Factor:	1	1	1	1	1
	Sample Volume\Weight (ml\g):	1020	1030	1050	1050	970
	Associated Method Blank:	9301545-BK1a	9301545-BK1a	9301545-BK1a	9301545-BK1a	9301545-BK1a
	Associated Equipment Blank:	00QSX16XXX93XX	00QSX16XXX93XX	00QSX16XXX93XX	00QSX16XXX93XX	00QSX16XXX93XX
	Associated Field Blank:	24QDX11XXX93XX	24QDX11XXX93XX	24QDX11XXX93XX	24QDX11XXX93XX	24QDX11XXX93XX

Study Area: CS-14
#: Level D Validation

APPENDIX A
Historical Review of Analytical Results for CS-14

Well Identificatio	Sampling Period	Sampling Quarter	Date Sampled	Trichloroethene ug/L (ppb) MCL=5 ppb	Tetrachloroethene ug/L (ppb) MCL=5 ppb	cis-1,2-Dichloroethen ug/L (ppb) MCL=70 ppb	1,2-Dichloroethane ug/L (ppb) MCL=5 ppb	1,1-Dichloroethene ug/L (ppb) MCL=7 ppb	1,1,1-Trichloroethane ug/L (ppb) MCL=200	Benzene ug/L (ppb) MCL=5 ppb	Toluene ug/L (ppb) MCL=1000	Ethylbenzene ug/L (ppb) MCL=700	Xlenes (Total) ug/L (ppb) MCL=10,000	Chloroform ug/L (ppb) MCL=100	MTBE ug/L (ppb) MCL=70	1,2-Dibromoethane ug/L (ppb) MCL=0.02 ppb	Methylene Chloride ug/L (ppb) MCL=none
CS-14	Third	Second	19-Nov-98	0.52J	3.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
98MW0001	Third	First	22-Aug-98	1.1	3.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Second	Fourth	02-Jun-98	0.57J	1.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Second	Second	09-Dec-97	ND	3.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Second	First	03-Oct-87	0.84J	3.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	First	Fourth	11-Jul-97	1.5	6.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	First	Third	10-Apr-97	1	3.3	ND	ND	ND	ND	ND	ND	ND	1.9	ND	ND	ND	ND
	First	Second	06-Jan-97	0.78J	2.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	First	First	25-Oct-96	2	6.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		Historical	23-May-93	2	ND	02.J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
ND = Not Detected
= MCL Exceedence
ppb = parts per billion
ug = microgram
L = Liter
CS = Chemical Spill
MCL = Maximum Concentration Limit

APPENDIX A - ADDITIONAL GROUNDWATER SAMPLING

Location	Sample ID	Date	Depth	Type	Matrix	Test	Prep	Analyte	Result	DL	RL	Units	Qual
CS-14													
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	ALUMINUM (TOTAL)	ND	22	100	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	ANTIMONY (TOTAL)	ND	1.9	5	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	ARSENIC (TOTAL)	ND	1.9	5	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	BARIUM (TOTAL)	31	0.3	20	UG/L	
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	BERYLLIUM (TOTAL)	ND	0.4	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	CADMIUM (TOTAL)	ND	0.4	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	CALCIUM (TOTAL)	7840	28.1	500	UG/L	
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	CHROMIUM (TOTAL)	1.4	0.6	5	UG/L	J
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	COBALT (TOTAL)	ND	0.6	5	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	COPPER (TOTAL)	2	0.8	5	UG/L	J
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	IRON (TOTAL)	ND	15.6	100	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	LEAD (TOTAL)	ND	1.1	2	UG/L	UJ
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	MAGNESIUM (TOTAL)	1590	21.8	500	UG/L	
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	MANGANESE (TOTAL)	ND	0.3	24	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	NICKEL (TOTAL)	ND	1.4	20	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	POTASSIUM (TOTAL)	2090	46.3	1500	UG/L	
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	SELENIUM (TOTAL)	ND	2.7	5	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	SILVER (TOTAL)	ND	0.8	10	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	SODIUM (TOTAL)	14200	98.8	500	UG/L	
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	THALLIUM (TOTAL)	ND	2.5	10	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	VANADIUM (TOTAL)	ND	1	10	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C200.7	TOTAL	ZINC (TOTAL)	ND	1.9	112	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	C245.2	TOTAL	MERCURY (TOTAL)	ND	0.021	0.2	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	1,1,1-TRICHLOROETHANE	ND	0.21	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	1,1,2,2-TETRACHLOROETHANE	ND	0.18	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	1,1,2-TRICHLOROETHANE	ND	0.23	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	1,1-DICHLOROETHANE	ND	0.19	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	1,1-DICHLOROETHENE	ND	0.21	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	1,2,4-TRICHLOROBENZENE	ND	0.31	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	1,2-DIBROMO-3-CHLOROPROPANE	-	-	-	UG/L	R
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	1,2-DIBROMOETHANE (EDB)	ND	0.22	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	1,2-DICHLOROBENZENE	ND	0.26	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	1,2-DICHLOROETHANE	ND	0.18	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	1,2-DICHLOROPROPANE	ND	0.15	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	1,3-DICHLOROBENZENE	ND	0.24	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	1,4-DICHLOROBENZENE	ND	0.2	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	2-HEXANONE	ND	0.87	5	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	ACETONE	-	-	-	UG/L	R

APPENDIX A - ADDITIONAL GROUNDWATER SAMPLING

Location	Sample ID	Date	Depth	Type	Matrix	Test	Prep	Analyte	Result	DL	RL	Units	Qual
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	BENZENE	ND	0.19	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	BROMOCHLOROMETHANE	ND	0.23	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	BROMODICHLOROMETHANE	ND	0.19	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	BROMOFORM	ND	0.27	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	BROMOMETHANE	ND	0.16	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	CARBON DISULFIDE	ND	0.21	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	CARBON TETRACHLORIDE	ND	0.16	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	CHLOROBENZENE	ND	0.19	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	CHLOROETHANE	ND	0.19	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	CHLOROFORM	ND	0.16	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	CHLOROMETHANE	ND	0.18	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	CIS-1,2-DICHLOROETHYLENE	ND	0.2	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	CIS-1,3-DICHLOROPROPENE	ND	0.14	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	DIBROMOCHLOROMETHANE	ND	0.24	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	ETHYLBENZENE	ND	0.18	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	METHYL ETHYL KETONE (2-BUTANONE)	-	-	-	UG/L	R
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	METHYL ISOBUTYL KETONE (4-METHYL-2-	ND	0.81	5	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	METHYLENE CHLORIDE	ND	0.19	2	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	STYRENE	ND	0.17	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	TERT-BUTYL METHYL ETHER	ND	0.17	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	TETRACHLOROETHYLENE(PCE)	0.95	0.18	1	UG/L	J
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	TOLUENE	ND	0.19	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	TRANS-1,2-DICHLOROETHENE	ND	0.18	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	TRANS-1,3-DICHLOROPROPENE	ND	0.14	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	TRICHLOROETHYLENE (TCE)	ND	0.16	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	VINYL CHLORIDE	ND	0.14	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	CVOL	METHOD	XYLENES, TOTAL	ND	0.2	1	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	E504	METHOD	1,2-DIBROMO-3-CHLOROPROPANE	ND	0.0045	0.01	UG/L	U
98MW0001	98MW0001-10	2/8/99	56.9	N1	WG	E504	METHOD	1,2-DIBROMOETHANE (EDB)	ND	0.0047	0.01	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	ALUMINUM (TOTAL)	ND	62.2	151	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	ANTIMONY (TOTAL)	ND	1.9	5	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	ARSENIC (TOTAL)	ND	1.9	5	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	BARIUM (TOTAL)	36.1	0.3	20	UG/L	
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	BERYLLIUM (TOTAL)	ND	0.4	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	CADMIUM (TOTAL)	ND	0.4	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	CALCIUM (TOTAL)	4010	28.1	500	UG/L	
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	CHROMIUM (TOTAL)	1.1	0.6	5	UG/L	J
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	COBALT (TOTAL)	7.1	0.6	5	UG/L	
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	COPPER (TOTAL)	ND	0.8	5	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	IRON (TOTAL)	49.4	15.6	100	UG/L	J
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	LEAD (TOTAL)	ND	1.1	2	UG/L	U

APPENDIX A - ADDITIONAL GROUNDWATER SAMPLING

Location	Sample ID	Date	Depth	Type	Matrix	Test	Prep	Analyte	Result	DL	RL	Units	Qual
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	MAGNESIUM (TOTAL)	1020	21.8	500	UG/L	
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	MANGANESE (TOTAL)	7.2	0.3	10	UG/L	J
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	NICKEL (TOTAL)	1.4	1.4	20	UG/L	J
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	POTASSIUM (TOTAL)	1040	46.3	1500	UG/L	J
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	SELENIUM (TOTAL)	ND	2.7	5	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	SILVER (TOTAL)	0.81	0.8	10	UG/L	J
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	SODIUM (TOTAL)	15600	98.8	500	UG/L	
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	THALLIUM (TOTAL)	5.3	2.5	10	UG/L	J
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	VANADIUM (TOTAL)	1.1	1	10	UG/L	J
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C200.7	TOTAL	ZINC (TOTAL)	ND	15.3	30	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	C245.2	TOTAL	MERCURY (TOTAL)	ND	0.05	0.2	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	1,1,1-TRICHLOROETHANE	ND	0.21	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	1,1,2,2-TETRACHLOROETHANE	ND	0.18	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	1,1,2-TRICHLOROETHANE	ND	0.23	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	1,1-DICHLOROETHANE	ND	0.19	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	1,1-DICHLOROETHENE	ND	0.21	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	1,2,4-TRICHLOROBENZENE	ND	0.31	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	1,2-DIBROMO-3-CHLOROPROPANE	-	-	-	UG/L	R
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	1,2-DIBROMOETHANE (EDB)	ND	0.22	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	1,2-DICHLOROBENZENE	ND	0.26	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	1,2-DICHLOROETHANE	ND	0.18	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	1,2-DICHLOROPROPANE	ND	0.15	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	1,3-DICHLOROBENZENE	ND	0.24	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	1,4-DICHLOROBENZENE	ND	0.2	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	2-HEXANONE	ND	0.87	5	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	ACETONE	-	-	-	UG/L	R
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	BENZENE	ND	0.19	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	BROMOCHLOROMETHANE	ND	0.23	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	BROMODICHLOROMETHANE	ND	0.19	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	BROMOFORM	ND	0.27	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	BROMOMETHANE	ND	0.16	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	CARBON DISULFIDE	ND	0.21	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	CARBON TETRACHLORIDE	ND	0.16	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	CHLOROBENZENE	ND	0.19	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	CHLOROETHANE	ND	0.19	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	CHLOROFORM	ND	0.16	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	CHLOROMETHANE	ND	0.18	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	CIS-1,2-DICHLOROETHYLENE	ND	0.2	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	CIS-1,3-DICHLOROPROPENE	ND	0.14	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	DIBROMOCHLOROMETHANE	ND	0.24	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	ETHYLBENZENE	ND	0.18	1	UG/L	U

APPENDIX A - ADDITIONAL GROUNDWATER SAMPLING

Location	Sample ID	Date	Depth	Type	Matrix	Test	Prep	Analyte	Result	DL	RL	Units	Qual
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	METHYL ETHYL KETONE (2-BUTANONE)	-	-	-	UG/L	R
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	METHYL ISOBUTYL KETONE (4-METHYL-2-	ND	0.81	5	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	METHYLENE CHLORIDE	ND	0.19	2	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	STYRENE	ND	0.17	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	TERT-BUTYL METHYL ETHER	ND	0.17	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	TETRACHLOROETHYLENE(PCE)	ND	0.18	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	TOLUENE	ND	0.19	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	TRANS-1,2-DICHLOROETHENE	ND	0.18	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	TRANS-1,3-DICHLOROPROPENE	ND	0.14	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	TRICHLOROETHYLENE (TCE)	ND	0.16	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	VINYL CHLORIDE	ND	0.14	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	CVOL	METHOD	XYLENES, TOTAL	ND	0.2	1	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	E504	METHOD	1,2-DIBROMO-3-CHLOROPROPANE	ND	0.0045	0.01	UG/L	U
98MW0002	98MW0002-01	2/16/99	56	N1	WG	E504	METHOD	1,2-DIBROMOETHANE (EDB)	ND	0.0047	0.01	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	ALUMINUM (TOTAL)	ND	22	100	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	ANTIMONY (TOTAL)	ND	1.9	5	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	ARSENIC (TOTAL)	ND	1.9	5	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	BARIUM (TOTAL)	26.4	0.3	20	UG/L	
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	BERYLLIUM (TOTAL)	ND	0.4	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	CADMIUM (TOTAL)	ND	0.4	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	CALCIUM (TOTAL)	4060	28.1	500	UG/L	
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	CHROMIUM (TOTAL)	ND	0.67	5	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	COBALT (TOTAL)	ND	0.6	5	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	COPPER (TOTAL)	ND	0.8	5	UG/L	UJ
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	IRON (TOTAL)	ND	15.6	100	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	LEAD (TOTAL)	ND	1.1	2	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	MAGNESIUM (TOTAL)	1170	21.8	500	UG/L	
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	MANGANESE (TOTAL)	4.7	0.3	10	UG/L	J
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	NICKEL (TOTAL)	ND	1.4	20	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	POTASSIUM (TOTAL)	1190	46.3	1500	UG/L	J
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	SELENIUM (TOTAL)	ND	2.7	5	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	SILVER (TOTAL)	ND	0.8	10	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	SODIUM (TOTAL)	12800	98.8	500	UG/L	
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	THALLIUM (TOTAL)	ND	2.5	10	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	VANADIUM (TOTAL)	ND	1	10	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C200.7	TOTAL	ZINC (TOTAL)	ND	3.8	20	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	C245.2	TOTAL	MERCURY (TOTAL)	ND	0.02	0.2	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	1,1,1-TRICHLOROETHANE	ND	0.21	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	1,1,2,2-TETRACHLOROETHANE	ND	0.18	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	1,1,2-TRICHLOROETHANE	ND	0.23	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	1,1-DICHLOROETHANE	ND	0.19	1	UG/L	U

APPENDIX A - ADDITIONAL GROUNDWATER SAMPLING

Location	Sample ID	Date	Depth	Type	Matrix	Test	Prep	Analyte	Result	DL	RL	Units	Qual
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	1,1-DICHLOROETHENE	ND	0.21	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	1,2,4-TRICHLOROBENZENE	ND	0.31	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	1,2-DIBROMO-3-CHLOROPROPANE	ND	0.37	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	1,2-DIBROMOETHANE (EDB)	ND	0.22	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	1,2-DICHLOROBENZENE	ND	0.26	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	1,2-DICHLOROETHANE	ND	0.18	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	1,2-DICHLOROPROPANE	ND	0.15	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	1,3-DICHLOROBENZENE	ND	0.24	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	1,4-DICHLOROBENZENE	ND	0.2	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	2-HEXANONE	ND	0.87	5	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	ACETONE	ND	0.82	5	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	BENZENE	ND	0.19	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	BROMOCHLOROMETHANE	ND	0.23	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	BROMODICHLOROMETHANE	ND	0.19	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	BROMOFORM	ND	0.27	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	BROMOMETHANE	ND	0.16	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	CARBON DISULFIDE	ND	0.21	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	CARBON TETRACHLORIDE	ND	0.16	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	CHLOROBENZENE	ND	0.19	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	CHLOROETHANE	ND	0.19	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	CHLOROFORM	ND	0.16	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	CHLOROMETHANE	ND	0.18	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	CIS-1,2-DICHLOROETHYLENE	ND	0.2	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	CIS-1,3-DICHLOROPROPENE	ND	0.14	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	DIBROMOCHLOROMETHANE	ND	0.24	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	ETHYLBENZENE	ND	0.18	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	METHYL ETHYL KETONE (2-BUTANONE)	ND	0.97	5	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	METHYL ISOBUTYL KETONE (4-METHYL-2-	ND	0.81	5	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	METHYLENE CHLORIDE	ND	0.19	2	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	STYRENE	ND	0.17	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	TERT-BUTYL METHYL ETHER	ND	0.17	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	TETRACHLOROETHYLENE(PCE)	ND	0.18	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	TOLUENE	ND	0.19	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	TRANS-1,2-DICHLOROETHENE	ND	0.18	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	TRANS-1,3-DICHLOROPROPENE	ND	0.14	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	TRICHLOROETHYLENE (TCE)	ND	0.16	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	VINYL CHLORIDE	ND	0.14	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	CVOL	METHOD	XYLENES, TOTAL	ND	0.2	1	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	E504	METHOD	1,2-DIBROMO-3-CHLOROPROPANE	ND	0.0045	0.01	UG/L	U
98MW0003	98MW0003-02	3/8/99	58.14	N1	WG	E504	METHOD	1,2-DIBROMOETHANE (EDB)	ND	0.0047	0.01	UG/L	U

JACOBS ENGINEERING
Engineers and Constructors

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20 December 1999

Mr. Jim Snyder
HQ AFCEE/MMR
322 E. Inner Road, Box 41
Otis ANGB, MA 02542-5028

SUBJECT: Contract F41624-97-D-8006
MMR Plume Response Program
Delivery Order 0022 MOD 2 DCN/Project# AFC-J23-35S19607-G2-0003
Chemical Spill-14 (CS-14) Groundwater Monitoring Findings Letter (October 1999)

Dear Mr. Snyder:

This letter reports on the analytical results of groundwater sampling conducted on 5 October 1999 at monitoring wells 98MW0001, 98MW0002 and 98MW0003, located in the Chemical Spill-14 (CS-14) study area. The analytical results are presented in Attachment A (CS-14 Groundwater Monitoring Results).

The groundwater samples were collected according to the technical procedure MMR TECH-015 of the *Massachusetts Military Reservation Plume Response Program Quality Program Plan* (Air Force Center for Environmental Excellence, 1998) using a low-flow sampling method. The samples were analyzed for thallium, using method ILM04.0, at Severn Trent Envirotest in University Park, IL. The sample data were validated at Level C, which includes a review of summary information only.

As indicated in Attachment A, thallium was not detected in the groundwater from any of the monitoring wells. The full data package, including groundwater parameters and quality control elements, will be included in the comprehensive letter report for DO-22 MOD 2 scheduled for submittal by 27 December 1999.

Please feel free to contact me or Darrin Smith at (508) 564-6192, extension 290 if you have any questions or comments.

Sincerely,

Eric W. Banks, P. E.
Program Manager

EWB/cle

Attachment: Attachment A – CS-14 Groundwater Monitoring Results

Enclosure: (1 unbound)

c: Carter Fahy, AFCEE (1)
Kris Barrett, JEG (1)
Larry Pannell, JEG (1)
Darrin Smith, JEG (1)
Drew Tingley, JEG (1)
Document Control, JEG (1)

Attachment A
CS-14 Groundwater Monitoring Results

Location	Sample ID	Date	Analyte	Result	DL	RL	Units	Qualifier
98MW0001	98MW0001-23	10/05/99	THALLIUM (TOTAL)	ND	1.70	2	µg/L	U
98MW0002	98MW0002-12	10/05/99	THALLIUM (TOTAL)	ND	1.70	2	µg/L	U
98MW0003	98MW0003-13	10/05/99	THALLIUM (TOTAL)	ND	1.70	2	µg/L	U

RL = reporting limit
DL = detection limit
ND = nondetect
U = concentration of analyte is below detection limit
µg/L = micrograms per liter

APPENDIX B

PHASE I DRAINAGE STRUCTURE REMOVAL PROGRAM
FIELD ANALYTICAL DATA

Key to "Site" IDs

CS-14 / CD-1	CS-14 Oil/Gas Trap
CS-14 / CD-2	CS-14 Leaching Pit
CS-14 / CD-3	CS-14 Abandoned Oil / Water Separator (Manhole over Oil / Water Separator Tank)
CS-14 / CD-4	CS-14 Abandoned Oil / Water Separator (Manhole over Oil / Water Separator Tank)
CS-14 / CD-5	CS-14 Abandoned Oil / Water Separator (Square manhole ~ 20' south of OWS manholes)
CS-14 / CD-6	CS-14 Abandoned Oil / Water Separator (Round Manhole ~ 30' south of OWS manholes)
CS-14 / CD-7	CS-14 Abandoned Oil / Water Separator (Diversion Manhole ~ 60' south of CD-6)
CS-14 / CD-8	CS-14 Active Oil / Water Separator
CS-14 / CD-9	CS-14 Abandoned Oil / Water Separator (Manhole 10' north of OWS)

Key to Matrix Types

Sediment	Sediment from inside drainage disposal stucture
Liquid	Liquid from inside drainage disposal stucture
Soil	Soil collected outside and adjacent to drainage disposal structure

PHASE I SUMP REMOVAL ACTION PROGRAM - MASSACHUSETTS MILITARY RESERVATION

Parameter	Site: CS-14/CD-1 Matr: SEDIMENT Dpth: 0 ISIS: 98CDXX1XXXX1XF Date: 21-NOV-91	CS-14/CD-3 SEDIMENT 0 98CDXX3XXXX1XF 21-NOV-91	CS-14/CD-4 SEDIMENT 0 98CDXX4XXXX1XF 21-NOV-91	CS-14/CD-5 SEDIMENT 0 98CDXX5XXXX1XF 21-NOV-91	CS-14/CD-6 SEDIMENT 0 98CDXX6XXXX1XF 21-NOV-91	CS-14/CD-6 SEDIMENT 0 98CDXX6XXXX2XF 09-JAN-92	CS-14/CD-7 SEDIMENT 0 98CDXX7XXXX1XF 09-JAN-92	CS-14/CD-9 SEDIMENT 0 98CDXX9XXXX1XF 21-JAN-92
PI meter reading (ppm)	83	0.0	0.0	0.0	370	370	56	0.0
VOCs (ug/kg)								
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	1600	ND
Trichloroethene	ND	ND	ND	ND	18000	40000	ND	ND
Vinyl chloride	38000	ND	ND	ND	ND	1600	ND	ND
Dibromoethane	ND	ND	ND	ND	78000	ND	ND	ND
Toluene	ND	ND	ND	ND	23000	17000	ND	ND
Ethylbenzene	ND	ND	ND	ND	1900	4600	ND	ND
o-Xylene	ND	ND	ND	ND	3900	3500	ND	ND
m/p-Xylene	ND	ND	ND	ND	13000	19000	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	44000	ND	22	27	25000	140000	2100	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND	2400	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND	4800	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	ND	ND
SVOCs (mg/kg)								
Phenol	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	3.3	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	28	ND	ND	ND	2.5	ND	ND	ND
1,2-Dichlorobenzene	170	ND	ND	ND	5.0	3.0	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	15	ND	ND	ND	ND	5.3	ND	ND
2-Methylnaphthalene	46	ND	ND	ND	ND	ND	ND	ND
Acenapthene	3.0	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	11	ND	ND	ND	ND	ND	ND	ND
Anthracene	2.1	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	14	ND	ND	ND	ND	ND	ND	ND
Pyrene	10	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	8.0	ND	ND	ND	ND	ND	ND	ND
Chrysene	10	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	32	ND	ND	ND	ND	5.8	4.6	ND
Benzo(b)fluoranthene	8.7	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	3.3	ND	ND	ND	ND	ND	ND	ND
Pest/PCBs (ug/kg)								
Delta-BHC	100	ND	ND	ND	ND	ND	450	ND
Gamma-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	480	ND	ND	ND	770	120	2500	ND
Inorganics (mg/kg)								
Lead	3400	ND	ND	ND	900	3900	2900	430
Copper	670	ND	ND	ND	ND	980	410	240
Zinc	780	280	270	260	580	800	1800	900
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	2000	ND	ND
TPH (mg/kg)	12000	370	83	110	4000	21000	9100	3600

PHASE I SUMP REMOVAL ACTION PROGRAM - MASSACHUSETTS MILITARY RESERVATION

Parameter	Site: CS-14/CD-1 Matr: LIQUID Dpth: 0 ISIS: 98CLXX1XXXX1XF Date: 21-NOV-91	CS-14/CD-7 LIQUID 0 98CLXX7XXXX1XF 09-JAN-92	CS-14/CD-8 LIQUID 0 98CLXX8XXXX1XF 09-JAN-92	CS-14/CD-1 SOIL 4 98TRX11XX4X1XF 04-DEC-91	CS-14/CD-1 SOIL 8 98TRX11XX8X1XF 04-DEC-91	CS-14/CD-1 SOIL 12 98TRX11X12X1XF 04-DEC-91	CS-14/CD-1 SOIL 18 98TRX11X18X1XF 04-DEC-91	CS-14/CD-1 SOIL 24 98TRX11X24X1XF 04-DEC-91
PI meter reading (ppm)	11	77	0.0	64	96	28	21	1.6
VOCs (ug/kg)								
1,1,1-Trichloroethane	ND	1800	7100	ND	ND	ND	ND	NA
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	NA
Vinyl chloride	4700	ND	ND	ND	ND	ND	ND	NA
Dibromoethane	ND	ND	ND	ND	ND	ND	ND	NA
Toluene	ND	ND	ND	28	130	ND	ND	NA
Ethylbenzene	ND	ND	ND	31	140	ND	130	NA
o-Xylene	ND	ND	ND	25	94	ND	100	NA
m/p-Xylene	ND	ND	ND	59	170	ND	40	NA
1,1-Dichloroethane	340	ND	ND	ND	ND	ND	38	NA
cis-1,2-Dichloroethene	3900	ND	ND	ND	ND	ND	ND	NA
trans-1,2-Dichloroethene	ND	ND	ND	35	ND	ND	20	NA
Tetrachloroethene	250	ND	ND	27	94	ND	ND	NA
Benzene	ND	ND	ND	25	21	ND	ND	NA
SVOCs (mg/kg)								
Phenol	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
Acenapthene	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	1.5	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Pest/PCBs (ug/kg)								
Delta-BHC	ND	ND	34	ND	ND	ND	ND	ND
Gamma-BHC	1100	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	200	ND	310	ND	ND	ND	ND	ND
Inorganics (mg/kg)								
Lead	NA	NA	NA	ND	430	ND	ND	ND
Copper	NA	NA	NA	ND	ND	ND	ND	ND
Zinc	NA	NA	NA	320	340	ND	400	ND
Arsenic	NA	NA	NA	ND	ND	ND	ND	ND
Chromium	NA	NA	NA	ND	ND	ND	ND	ND
TPH (mg/kg)	480	950	150	740	6400	3200	100	ND

PHASE I SUMP REMOVAL ACTION PROGRAM - MASSACHUSETTS MILITARY RESERVATION

Parameter	Site: CS-14/CD-1 Matr: SOIL Dpth: 4 ISIS: 98TRX12XX4X1XF Date: 04-DEC-91	CS-14/CD-1 SOIL 8 98TRX12XX8X1XF 04-DEC-91	CS-14/CD-1 SOIL 12 98TRX12X12X1XF 04-DEC-91	CS-14/CD-1 SOIL 18 98TRX12X18X1XF 04-DEC-91	CS-14/CD-1 SOIL 24 98TRX12X24X1DF 04-DEC-91	CS-14/CD-1 SOIL 24 98TRX12X24X1XF 04-DEC-91	CS-14/CD-1 SOIL 4 98TRX13XX4X1XF 04-DEC-91	CS-14/CD-1 SOIL 8 98TRX13XX8X1XF 04-DEC-91
PI meter reading (ppm)	2.3	1.3	0.8	0.5	0.0	0.0	0.5	0.0
VOCs (ug/kg)								
1,1,1-Trichloroethane	ND	ND	NA	ND	NA	NA	ND	NA
Trichloroethene	ND	ND	NA	ND	NA	NA	ND	NA
Vinyl chloride	ND	ND	NA	ND	NA	NA	ND	NA
Dibromoethane	ND	ND	NA	ND	NA	NA	ND	NA
Toluene	ND	ND	NA	21	NA	NA	ND	NA
Ethylbenzene	16	ND	NA	18	NA	NA	ND	NA
o-Xylene	35	7.5	NA	16	NA	NA	ND	NA
m/p-Xylene	11	ND	NA	23	NA	NA	ND	NA
1,1-Dichloroethane	ND	ND	NA	ND	NA	NA	ND	NA
cis-1,2-Dichloroethene	ND	ND	NA	ND	NA	NA	ND	NA
trans-1,2-Dichloroethene	ND	ND	NA	ND	NA	NA	ND	NA
Tetrachloroethene	24	ND	NA	41	NA	NA	33	NA
Benzene	ND	ND	NA	ND	NA	NA	ND	NA
SVOCs (mg/kg)								
Phenol	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
Acenapthene	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Pest/PCBs (ug/kg)								
Delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND
Inorganics (mg/kg)								
Lead	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	320	ND	320	ND	ND	ND	ND	240
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND	ND	ND
TPH (mg/kg)	190	38	ND	410	49	49	47	250

PHASE I SUMP REMOVAL ACTION PROGRAM - MASSACHUSETTS MILITARY RESERVATION

Parameter	Site: CS-14/CD-1 Matr: SOIL Dpth: 12 ISIS: 98TRX13X12X1XF Date: 04-DEC-91	CS-14/CD-1 SOIL 18 98TRX13X18X1XF 04-DEC-91	CS-14/CD-1 SOIL 24 98TRX13X24X1XF 04-DEC-91	CS-14/CD-2 SOIL 3 98TRX21XX3X1XF 05-DEC-91	CS-14/CD-2 SOIL 6 98TRX21XX6X1XF 05-DEC-91	CS-14/CD-2 SOIL 12 98TRX21X12X1XF 05-DEC-91	CS-14/CD-2 SOIL 18 98TRX21X18X1XF 05-DEC-91	CS-14/CD-2 SOIL 24 98TRX21X24X1XF 05-DEC-91
PI meter reading (ppm)	0.8	1.2	0.0	0.0	0.1	6.5	1.7	0.0
VOCs (ug/kg)								
1,1,1-Trichloroethane	NA	ND	NA	NA	ND	ND	NA	NA
Trichloroethene	NA	ND	NA	NA	ND	ND	NA	NA
Vinyl chloride	NA	ND	NA	NA	ND	ND	NA	NA
Dibromoethane	NA	ND	NA	NA	ND	ND	NA	NA
Toluene	NA	ND	NA	NA	36	7.4	NA	NA
Ethylbenzene	NA	ND	NA	NA	38	ND	NA	NA
o-Xylene	NA	ND	NA	NA	61	19	NA	NA
m/p-Xylene	NA	ND	NA	NA	37	38	NA	NA
1,1-Dichloroethane	NA	ND	NA	NA	ND	ND	NA	NA
cis-1,2-Dichloroethene	NA	ND	NA	NA	ND	ND	NA	NA
trans-1,2-Dichloroethene	NA	ND	NA	NA	ND	ND	NA	NA
Tetrachloroethene	NA	12	NA	NA	5.8	32	NA	NA
Benzene	NA	ND	NA	NA	ND	ND	NA	NA
SVOCs (mg/kg)								
Phenol	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
Acenapthene	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Pest/PCBs (ug/kg)								
Delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND
Inorganics (mg/kg)								
Lead	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	ND	ND	350	290	ND	ND	350	ND
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND	ND	ND
TPH (mg/kg)	270	290	83	210	1100	33	ND	ND

PHASE I SUMP REMOVAL ACTION PROGRAM - MASSACHUSETTS MILITARY RESERVATION

Parameter	Site: CS-14/CD-2 Matr: SOIL Dpth: 3 ISIS: 98TRX22XX3X1XF Date: 05-DEC-91	CS-14/CD-2 SOIL 6 98TRX22XX6X1XF 05-DEC-91	CS-14/CD-2 SOIL 12 98TRX22X12X1DF 05-DEC-91	CS-14/CD-2 SOIL 12 98TRX22X12X1XF 05-DEC-91	CS-1 2 SOIL 18 98TRX22X18X1XF 05-DEC-91	CS-14/CD-2 SOIL 24 98TRX22X24X1XF 05-DEC-91	CS-14/CD-2 SOIL 3 98TRX[illegible]X3X1XF 09-JAN-92	CS-14/CD-2 SOIL 6 98TRX23XX6X1XF 09-JAN-92
PI meter reading (ppm)	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VOCs (ug/kg)								
1,1,1-Trichloroethane	ND	NA	NA	NA	ND	NA	ND	NA
Trichloroethene	ND	NA	NA	NA	ND	NA	ND	NA
Vinyl chloride	ND	NA	NA	NA	ND	NA	ND	NA
Dibromoethane	ND	NA	NA	NA	ND	NA	ND	NA
Toluene	98	NA	NA	NA	ND	NA	ND	NA
Ethylbenzene	60	NA	NA	NA	ND	NA	ND	NA
o-Xylene	57	NA	NA	NA	ND	NA	ND	NA
m/p-Xylene	24	NA	NA	NA	ND	NA	ND	NA
1,1-Dichloroethane	ND	NA	NA	NA	ND	NA	ND	NA
cis-1,2-Dichloroethene	ND	NA	NA	NA	ND	NA	ND	NA
trans-1,2-Dichloroethene	ND	NA	NA	NA	ND	NA	ND	NA
Tetrachloroethene	37	NA	NA	NA	ND	NA	ND	NA
Benzene	25	NA	NA	NA	ND	NA	ND	NA
SVOCs (mg/kg)								
Phenol	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
Acenapthene	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	1.9	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Pest/PCBs (ug/kg)								
Delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND
Inorganics (mg/kg)								
Lead	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	320	ND	ND	ND	ND	410	ND	ND
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND	ND	ND
TPH (mg/kg)	420	270	83	130	290	220	56	94

PHASE I SUMP REMOVAL ACTION PROGRAM - MASSACHUSETTS MILITARY RESERVATION

Parameter	Site: CS-14/CD-2 Matr: SOIL Dpth: 12 ISIS: 98TRX23X12X1XF Date: 09-JAN-92	CS-14/CD-2 SOIL 18 98TRX23X18X1XF 09-JAN-92	CS-14/CD-2 SOIL 24 98TRX23X24X1XF 09-JAN-92	CS-14/CD-3 SOIL 8 98TRX31XX8X1XF 09-JAN-92	CS-14/CD-3 SOIL 12 98TRX31X12X1DF 09-JAN-92	CS-14/CD-3 SOIL 12 98TRX31X12X1XF 09-JAN-92	CS-14/CD-3 SOIL 18 98TRX31X18X1XF 09-JAN-92	CS-14/CD-3 SOIL 24 98TRX31X24X1XF 09-JAN-92
PI meter reading (ppm)	1.2	1.6	1.1	0.3	1.5	1.5	0.8	0.5
VOCs (ug/kg)								
1,1,1-Trichloroethane	NA	ND	NA	ND	ND	ND	ND	ND
Trichloroethene	NA	ND	NA	ND	ND	ND	ND	ND
Vinyl chloride	NA	ND	NA	ND	ND	ND	ND	ND
Dibromoethane	NA	ND	NA	ND	ND	ND	ND	ND
Toluene	NA	ND	NA	ND	ND	ND	ND	ND
Ethylbenzene	NA	ND	NA	ND	ND	ND	ND	ND
o-Xylene	NA	ND	NA	ND	ND	ND	ND	ND
m/p-Xylene	NA	ND	NA	ND	ND	ND	ND	ND
1,1-Dichloroethane	NA	ND	NA	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	NA	ND	NA	ND	5.4	ND	35	ND
trans-1,2-Dichloroethene	NA	ND	NA	ND	ND	ND	ND	ND
Tetrachloroethene	NA	24	NA	2.7	ND	ND	13	ND
Benzene	NA	ND	NA	ND	ND	ND	ND	ND
SVOCs (mg/kg)								
Phenol	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	1.2	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
Acenapthene	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Pest/PCBs (ug/kg)								
Delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND
Inorganics (mg/kg)								
Lead	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	ND	ND	270	ND	ND	ND	ND	ND
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND	ND	ND
TPH (mg/kg)	110	140	78	58	83	45	79	33

PHASE I SUMP REMOVAL ACTION PROGRAM - MASSACHUSETTS MILITARY RESERVATION

Parameter	Site: CS-14/CD-3 Matr: SOIL Dpth: 8 ISIS: 98TRX32XX8X1XF Date: 05-DEC-91	CS-14/CD-3 SOIL 12 98TRX32X12X1XF 05-DEC-91	CS-14/CD-3 SOIL 14 98TRX32X14X1XF 05-DEC-91	CS-14/CD-3 SOIL 18 98TRX32X18X1XF 05-DEC-91	CS-14/CD-3 SOIL 24 98TRX32X24X1XF 05-DEC-91	CS-14/CD-3 SOIL 8 98TRX33XX8X1XF 06-DEC-91	CS-14/CD-3 SOIL 12 98TRX33X12X1XF 06-DEC-91	CS-14/CD-3 SOIL 18 98TRX33X18X1XF 06-DEC-91
PI meter reading (ppm)	0.0	2.7	25	2.1	0.5	0.6	0.6	6.1
VOCs (ug/kg)								
1,1,1-Trichloroethane	NA	ND	ND	ND	ND	ND	NA	NA
Trichloroethene	NA	ND	23	ND	ND	27	NA	NA
Vinyl chloride	NA	ND	ND	ND	ND	ND	NA	NA
Dibromoethane	NA	ND	ND	ND	ND	ND	NA	NA
Toluene	NA	ND	12	ND	ND	6.0	NA	NA
Ethylbenzene	NA	ND	29	28	34	41	NA	NA
o-Xylene	NA	ND	12	ND	7.2	6.8	NA	NA
m/p-Xylene	NA	ND	48	39	49	57	NA	NA
1,1-Dichloroethane	NA	ND	ND	ND	ND	ND	NA	NA
cis-1,2-Dichloroethene	NA	ND	7.4	ND	ND	ND	NA	NA
trans-1,2-Dichloroethene	NA	ND	ND	ND	ND	ND	NA	NA
Tetrachloroethene	NA	ND	5.0	ND	ND	ND	NA	NA
Benzene	NA	ND	ND	ND	ND	78	NA	NA
SVOCs (mg/kg)								
Phenol	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
Acenapthene	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	3.4	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	3.2	ND
Pyrene	ND	ND	ND	ND	ND	ND	3.1	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Pest/PCBs (ug/kg)								
Delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND
Inorganics (mg/kg)								
Lead	ND	ND	290	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND	ND	ND
TPH (mg/kg)	46	500	1100	620	ND	19000	230	120

PHASE I SUMP REMOVAL ACTION PROGRAM - MASSACHUSETTS MILITARY RESERVATION

Parameter	Site: CS-14/CD-3 Matr: SOIL Dpth: 24 ISIS: 98TRX33X24X1XF Date: 06-DEC-91	CS-14/CD-3 SOIL 8 98TRX34XX8X1XF 06-FEB-92	CS-14/CD-3 SOIL 12 98TRX34X12X1XF 06-FEB-92	CS-14/CD-3 SOIL 18 98TRX34X18X1XF 06-FEB-92	CS-14/CD-3 SOIL 24 98TRX34X24X1XF 06-FEB-92	CS-14/CD-3 SOIL 8 98TRX35XX8X1XF 06-FEB-92	CS-14/CD-3 SOIL 12 98TRX35X12X1XF 06-FEB-92	CS-14/CD-3 SOIL 18 98TRX35X18X1DF 06-FEB-92
PI meter reading (ppm)	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VOCs (ug/kg)								
1,1,1-Trichloroethane	NA	ND	ND	ND	ND	ND	ND	NA
Trichloroethene	NA	ND	ND	ND	ND	ND	ND	NA
Vinyl chloride	NA	ND	ND	ND	ND	ND	ND	NA
Dibromoethane	NA	ND	ND	ND	ND	ND	ND	NA
Toluene	NA	ND	ND	ND	ND	ND	ND	NA
Ethylbenzene	NA	ND	ND	ND	ND	ND	ND	NA
o-Xylene	NA	ND	ND	ND	ND	ND	ND	NA
m/p-Xylene	NA	ND	ND	ND	ND	ND	ND	NA
1,1-Dichloroethane	NA	ND	ND	ND	ND	ND	ND	NA
cis-1,2-Dichloroethene	NA	ND	ND	ND	ND	ND	ND	NA
trans-1,2-Dichloroethene	NA	ND	ND	ND	ND	ND	ND	NA
Tetrachloroethene	NA	ND	ND	ND	ND	3.2	ND	NA
Benzene	NA	ND	ND	ND	ND	ND	ND	NA
SVOCs (mg/kg)								
Phenol	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
Acenapthene	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Pest/PCBs (ug/kg)								
Delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND
Inorganics (mg/kg)								
Lead	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	ND	ND	300	310	ND	320	ND	ND
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND	ND	ND
TPH (mg/kg)	250	33	23	55	95	410	320	ND

PHASE I SUMP REMOVAL ACTION PROGRAM - MASSACHUSETTS MILITARY RESERVATION

Parameter	Site: CS-14/CD-3 Matr: SOIL Dpth: 18 ISIS: 98TRX35X18X1XF Date: 06-FEB-92	CS-14/CD-3 SOIL 24 98TRX35X24X1XF 06-FEB-92	CS-14/CD-3 SOIL 8 98TRX36XX8X1XF 06-FEB-92	CS-14/CD-3 SOIL 12 98TRX36X12X1XF 06-FEB-92
PI meter reading (ppm)	0.0	0.0	2.2	0.0
VOCs (ug/kg)				
1,1,1-Trichloroethane	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND
Dibromoethane	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND
m/p-Xylene	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	4.7
Benzene	ND	ND	ND	ND
SVOCs (mg/kg)				
Phenol	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND
Acenapthene	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND
Pest/PCBs (ug/kg)				
Delta-BHC	ND	ND	ND	ND
Gamma-BHC	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND
Inorganics (mg/kg)				
Lead	ND	ND	ND	ND
Copper	ND	ND	ND	ND
Zinc	ND	ND	ND	ND
Arsenic	ND	ND	ND	ND
Chromium	ND	ND	ND	ND
TPH (mg/kg)	23	41	23	97

APPENDIX C

CLOSURE REPORTS

98CDXX2

DRAINAGE STRUCTURE REMOVAL PROGRAM
ALTERNATE ACTIVITY JUSTIFICATION REPORT

MASSACHUSETTS MILITARY RESERVATION

This report is intended to provide historical information, data and justification or clarification of alternate approach (i.e., delisting from DSRP program, closure in place, etc.) encountered or executed during construction activities as listed for the subject drainage structures (DS).

DS ISIS CODE AND LOCATION: 98CDXX2, Riley Road, Northwest of Bldg. 156, controlled access flightline area.

ALTERNATE ACTION IMPLEMENTED / CURRENT STATUS: Delisted

TYPE OF STRUCTURE: Leaching Field

HISTORICAL ACTIVITIES: Phase I Sump Investigation (SI) Work completion Report (Final, ABB-ES 1992); Jacobs Engineering Group (JEG) performed DS verification efforts for the subject DS (JEG, 1996);

JUSTIFICATION NARRATIVE: Efforts to locate 98CDXX2 were implemented by JEG on 5/15/96 no DS was located. Test pitting activity was performed at the suspected location. Dimensions of the two executed test pits were 14 feet-by-20 feet and 9 feet deep and 9 feet-by-20 feet and 11 feet deep in the area of the suspected DS, the test pit explorations were split by an asphalt walkway indicated in the SI which is underlain by a DIG-SAFE identified gas utility.

No indications of typical DS construction, piping , cobble stone fill, staining, odors, or other contaminant indicators were reported by on-site personnel. Reportedly some debris and rubble was removed from the test pit excavations and staged for processing through the OABF facility. Discussions with regulatory agency representatives at project status meetings on 4/11/96 and 4/18/96 indicated DS delisting as appropriate with satisfactory evidence of search activities and findings.

Based on the attached SI narrative and terraprobe data for VOC, SVOC, inorganics, pesticides/PCB, and TPH analysis, this inside flightline DS failed DSRP STCLs for benzene (25 μg/kg) for human and ecological receptors at 2 to 15 bgs. However this compound is less the MCP S1/G1 value (10,000 μg/kg) for leachability to groundwater.

SUPPORTING DATA ATTACHMENTS: JEG DSRP Verification Form (attached); ABB-ES SI analytical data and narrative.

JE® REMEDIATION TECHNOLOGIES, INC.

DRAINAGE VERIFICATION FORM

Today's Weather: WINDY/FAIR **Yesterdays Weather:** WINDY/FAIR

Date: 5/15/96 **Time:** 4:00 PM

ISIS CODE: 98CDXX2 **Building Number:** 156

Type of Drainage Structure: LEACH FIELD

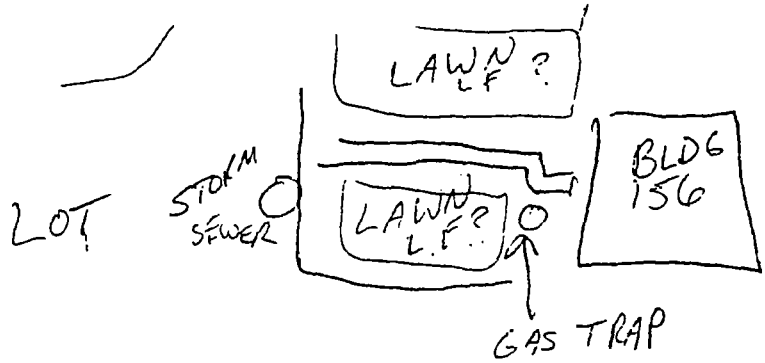
Is The Drainage Structure Visible: NO

Utility Clearances: YES

Other Overhead Obstructions: NA

Apparent Water/Sewer Connections: NA

General Topography and Physical Layout Sketch:



Any Indications of spill/leaks: NO

Type of manhole cover: NA

INTERIOR OF DRAINAGE STRUCTURE

Today's Weather: WINDY / FAIR **Yesterdays Weather:** WINDY / FA

Date: 5/15/96 **Time:** 4:00 PM

Initial PID/OVA reading: NA **Secondary PID/OVA reading:** _____

Sketch of interior with depth to inlet pipe, outlet pipe and bottom indicated:

NA

Material sidewalls are constructed of: NA

Material bottom is constructed of (if visible): NA

Approximate volume of liquid present: NA

Apparent liquid characteristics: NA

Approximate volume of sediment present: NA

Apparent sediment characteristics: NA

What type of soil is present: SAND

Is early sampling of pay limit soil possible: NO

Any apparent difficulties with the sump removal? NA

General comments: DOUG AREAS AS INDICATED BY ABB NOTHING FOUND IN ALL AREAS APPEARS THAT SOIL HAD BEEN DISTURBED IN PAST DUG AREAS ON BOTH SIDES OF WALKWAY ONE WAS 9'D X 14'W X 20'L THE OTHER WAS 11'D 20'L X 9'W BACKFILLED AREAS

from the neutralization pit. Only one VOC, PCE (13 μg/kg), was detected in the sediment sample.

Four TerraProbe borings (03TR221, 03TR222, 03TR223, and 03TR224) were completed at Neutralization Pit 03CDX22 to investigate the extent of possible soil contamination. Boring 03TR223 was drilled at an angle toward the pit; the others were drilled vertically. Soil samples were collected at 8, 12, 18, and 24 feet bgs from each boring. PI meter readings of soil samples ranged from zero to 13 ppm; detected TPH concentrations ranged from 24 to 380 mg/kg. VOCs, SVOCs, pesticides, and PCBs were not detected in any of the samples. TerraProbe sampling was not completed at Acid Pump Pit 03CLX21 because the structure was not originally slated for investigation.

3.1.11 Study Area CS-14

Study Area CS-14, as described in the Task 6 Records Search, is the location of a leachfield (Leaching Field 98CDXX2) associated with a former vapor degreaser unit at Building 156. TCA and tetrachloroethane, used to remove cosmoline from new engines and spare parts, were reportedly discharged to the former vapor degreaser from 1955 to 1969 (E.C. Jordan Co., 1986). Wastes generated from degreasing were possibly drained out through a scupper drain beneath the degreaser to Leaching Field 98CDXX2. In addition to the vapor degreaser, a second degreaser unit (currently used) is located in Building 156. This unit, and building floor drains, discharge to Gas Trap 98CDXX1 located adjacent to the vapor degreaser leachfield. This gas trap formerly discharged to a waste separation tank (98CDXX3) located on the eastern side of Building 158 (located directly west of Building 156). Starting in 1989, the gas trap discharged to a new oil/water separator located off the southeastern side of Building 156. This new separator discharges to the sanitary sewer system.

Because structures in the Building 156/158 area are interconnected, the description of Study Area CS-14 was expanded to include Gas Trap 98CDXX1 at Building 156 and the Waste Oil Tank 98CDXX3 and associated structures at Building 158. The area of these three structures was investigated during the Task 2-4 SI studies. In addition, at the request of HAZWRAP, sampling and analysis of the contents of active Oil/Water Separator 98CDXX8 and associated Diversion Manhole 98CDXX7 was performed to determine the presence of the VOC EDB.

benzo(a)pyrene (3.3 mg/kg). Pesticides detected were D-BHC (100 µg/kg) and heptachlor epoxide (480 µg/kg). Inorganics detected in sediment were lead (3,400 mg/kg), copper (670 mg/kg), and zinc (780 mg/kg).

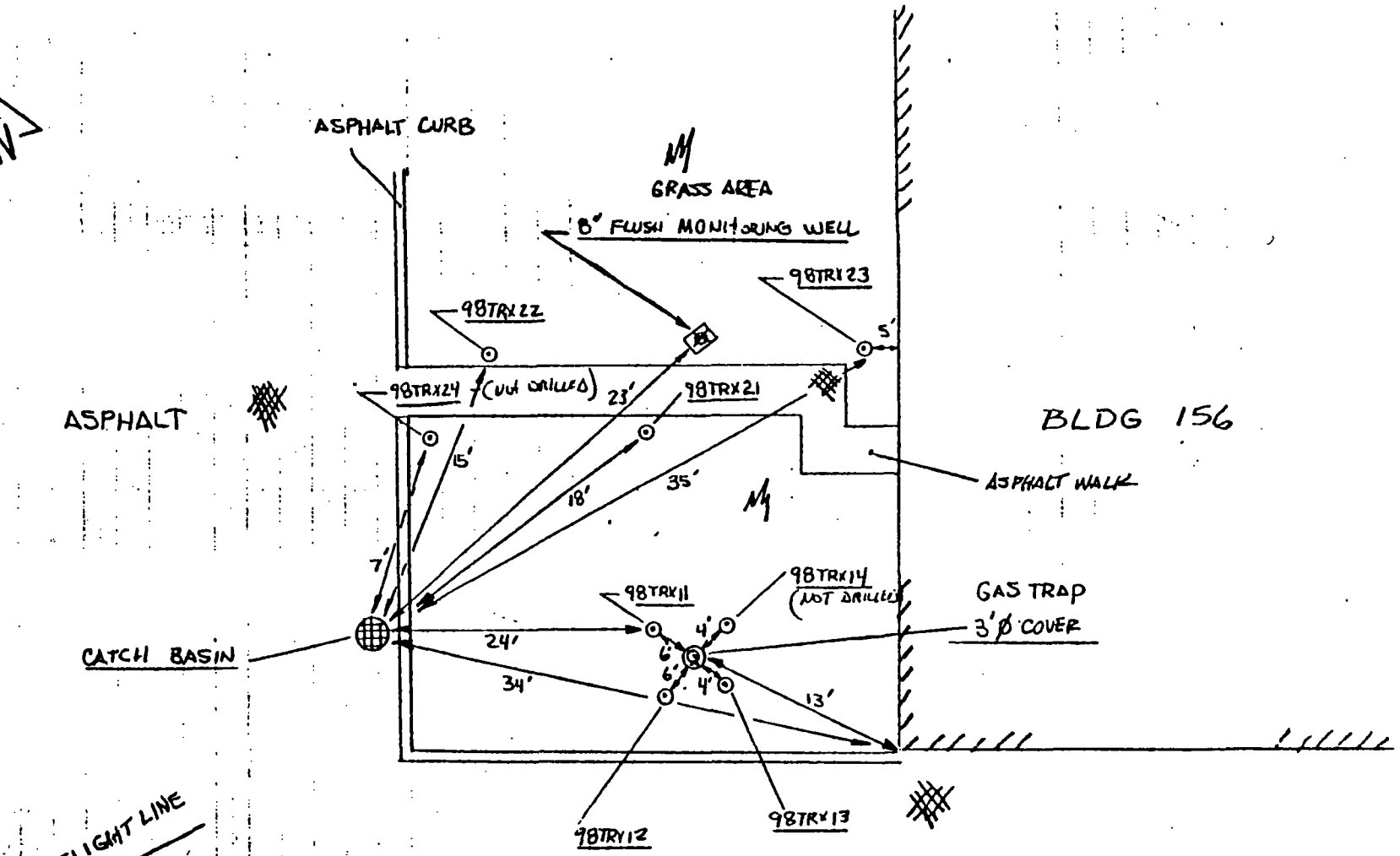
Three TerraProbe borings (98TRX11, 98TRX12, and 98TRX13) were drilled at Gas Trap 98CDXX1 to evaluate the presence of contamination. Boring 98TRX11 was drilled at an angle to sample soils beneath the structure; the other two borings were drilled vertically. Samples were collected at 4, 8, 12, 18, and 24 feet bgs from each boring. PI meter readings from the samples ranged from zero to 96.2 ppm. Detected TPH concentrations ranged from 38 to 6,400 mg/kg. VOCs detected in the soil samples were trans-1,2-DCE (35 µg/kg), 1,1-dichloroethane (38 µg/kg), tetrachloroethane (94 µg/kg), benzene (25 µg/kg), toluene (130 µg/kg), ethylbenzene (140 µg/kg), m/p-xylene (170 µg/kg), and o-xylene (100 µg/kg). The only SVOC detected was bis(2-ethylhexyl)phthalate (1.5 mg/kg). The inorganics lead (430 mg/kg in one sample) and zinc (up to 400 mg/kg) were also detected.

Leaching Field 98CDXX2. Because the leaching field drainpipe is located beneath a paved walkway, a sample of the pipe contents could not be obtained. Three TerraProbe borings were drilled along the length of the pipe to determine whether contamination was present. Samples were collected at 3, 6, 12, 18, and 24 feet bgs. PI meter readings from the samples ranged from zero to 6.5 ppm. Detected TPH concentrations varied from 33 to 1,100 mg/kg. VOCs detected in the samples were tetrachloroethane (up to 37 µg/kg), benzene (25 µg/kg), toluene (98 µg/kg), ethylbenzene (60 µg/kg), m/p-xylene (38 µg/kg), and o-xylene (61 µg/kg). The SVOCs pyrene (1.9 mg/kg) and 2,4-dimethylphenol (1.2 mg/kg) were also detected. The only inorganic detected was zinc, at concentrations up to 410 mg/kg.

Waste Oil Tank - 98CDXX3, 98CDXX4, 98CDXX5, 98CDXX6, and 98CDXX9. The contents of the former waste oil tank consisted of backfilled sand used for abandonment. PI meter readings and solvent odors encountered by the sampling crew when one of the access covers was removed indicated the potential for contamination in the structure. Due to this evidence, a sample of the sand backfill was obtained from each of three access holes for field laboratory analysis. The fourth sample (98CDXX6) was collected from the former manhole inlet, which had also been backfilled with sand. A fifth sample associated with the waste oil tank was collected from a former manhole outlet (98CDXX9) where tank discharge once flowed. The manhole outlet was not backfilled. Piping for the inlet and outlet manholes was reportedly plugged off to prevent flow from entering or leaving the waste oil tank when the tank was abandoned in place. Of the five samples collected

JOB NO. 6984-02	DATE 3/16/92
COMP. BY N.B.	CHK. BY

PROJECT Study Area CS-14 - Building 156
Gas Trap + Leachfield



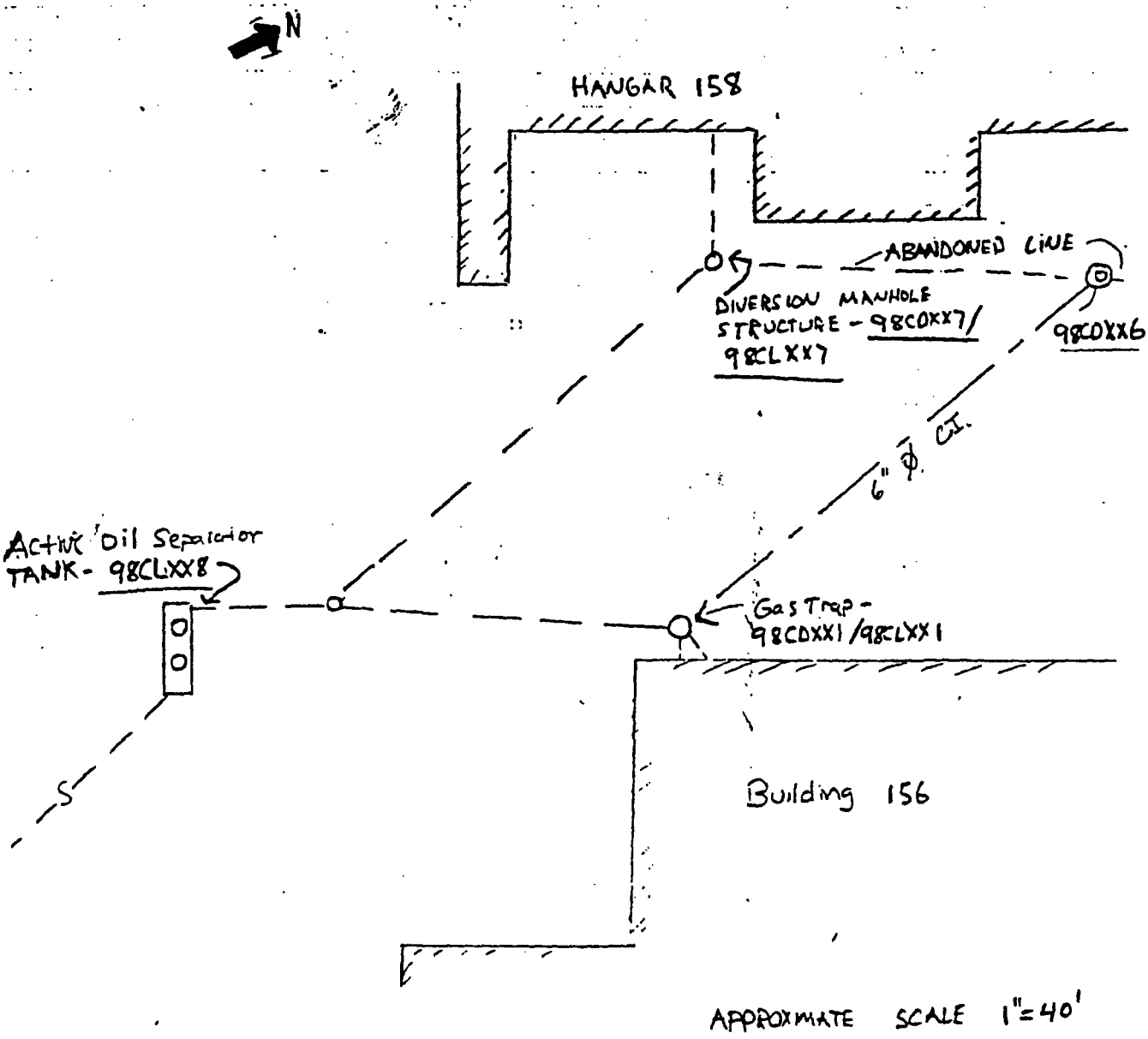
CS-14 STUDY AREA / GAS TRAP & LEACH FIELD

N.T.S.

ABB Environmental Services, Inc.

FORM 00.01 REV. 4/91

PROJECT	COMP. BY	JOB NO.
STUDY AREA CS-14 BUILDING 156/158 ACTIVE OIL SEPARATOR TANK AND DIVERSION MANHOLE STRUCTURE	N.B	6984-02
	CHK. BY	DATE 3/16/92



APPROXIMATE SCALE 1"=40'

PHASE I SUMP REMOVAL ACTION PROGRAM - MASSACHUSETTS MILITARY RESERVATION

Parameter	Site: CS-14/CD-1 Matr: SOIL Dpth: 12 ISIS: 98TRX13X12X1XF Date: 04-DEC-91	CS-14/CD-1 SOIL 18 98TRX13X18X1XF 04-DEC-91	CS-14/CD-1 SOIL 24 98TRX13X24X1XF 04-DEC-91	CS-14/CD-2 SOIL 3 98TRX21XX3X1XF 05-DEC-91	CS-14/CD-2 SOIL 6 98TRX21XX6X1XF 05-DEC-91	CS-14/CD-2 SOIL 12 98TRX21X12X1XF 05-DEC-91	CS-14/CD-2 SOIL 18 98TRX21X18X1XF 05-DEC-91	CS-14/CD-2 SOIL 24 98TRX21X24X1XF 05-DEC-91
PI meter reading (ppm)	0.8	1.2	0.0	0.0	0.1	6.5	1.7	0.0
VOCs (ug/kg)								
1,1,1-Trichloroethane	NA	ND	NA	NA	ND	ND	NA	NA
Trichloroethene	NA	ND	NA	NA	ND	ND	NA	NA
Vinyl chloride	NA	ND	NA	NA	ND	ND	NA	NA
Dibromoethane	NA	ND	NA	NA	ND	ND	NA	NA
Toluene	NA	ND	NA	NA	36	7.4	NA	NA
Ethylbenzene	NA	ND	NA	NA	38	ND	NA	NA
o-Xylene	NA	ND	NA	NA	61	19	NA	NA
m/p-Xylene	NA	ND	NA	NA	37	38	NA	NA
1,1-Dichloroethane	NA	ND	NA	NA	ND	ND	NA	NA
cis-1,2-Dichloroethene	NA	ND	NA	NA	ND	ND	NA	NA
trans-1,2-Dichloroethene	NA	ND	NA	NA	ND	ND	NA	NA
Tetrachloroethene	NA	12	NA	NA	5.8	32	NA	NA
Benzene	NA	ND	NA	NA	ND	ND	NA	NA
SVOCs (mg/kg)								
Phenol	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
Acenapthene	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Pest/PCBs (ug/kg)								
Delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND
Inorganics (mg/kg)								
Lead	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	ND	ND	350	290	ND	ND	350	ND
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND	ND	ND
TPH (mg/kg)	270	290	83	210	1100	33	ND	ND

PHASE I SUMP REMOVAL ACTION PROGRAM - MASSACHUSETTS MILITARY RESERVATION

Parameter	Site: CS-14/CD-2 Matr: SOIL Dpth: 3 ISIS: 98TRX22XX3X1XF Date: 05-DEC-91	CS-14/CD-2 SOIL 6 98TRX22XX6X1XF 05-DEC-91	CS-14/CD-2 SOIL 12 98TRX22X12X1DF 05-DEC-91	CS-14/CD-2 SOIL 12 98TRX22X12X1XF 05-DEC-91	CS-14/CD-2 SOIL 18 98TRX22X18X1XF 05-DEC-91	CS-14/CD-2 SOIL 24 98TRX22X24X1XF 05-DEC-91	CS-14/CD-2 SOIL 3 98TRX23XX3X1XF 09-JAN-92	CS-14/CD-2 SOIL 6 98TRX23XX6X1XF 09-JAN-92
PI meter reading (ppm)	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VOCs (ug/kg)								
1,1,1-Trichloroethane	ND	NA	NA	NA	ND	NA	ND	NA
Trichloroethene	ND	NA	NA	NA	ND	NA	ND	NA
Vinyl chloride	ND	NA	NA	NA	ND	NA	ND	NA
Dibromoethane	ND	NA	NA	NA	ND	NA	ND	NA
Toluene	98	NA	NA	NA	ND	NA	ND	NA
Ethylbenzene	60	NA	NA	NA	ND	NA	ND	NA
o-Xylene	57	NA	NA	NA	ND	NA	ND	NA
m/p-Xylene	24	NA	NA	NA	ND	NA	ND	NA
1,1-Dichloroethane	ND	NA	NA	NA	ND	NA	ND	NA
cis-1,2-Dichloroethene	ND	NA	NA	NA	ND	NA	ND	NA
trans-1,2-Dichloroethene	ND	NA	NA	NA	ND	NA	ND	NA
Tetrachloroethene	37	NA	NA	NA	ND	NA	ND	NA
Benzene	25	NA	NA	NA	ND	NA	ND	NA
SVOCs (mg/kg)								
Phenol	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
Acenapthene	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	1.9	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Pest/PCBs (ug/kg)								
Delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND
Inorganics (mg/kg)								
Lead	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	320	ND	ND	ND	ND	410	ND	ND
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND	ND	ND
TPH (mg/kg)	420	270	83	130	290	220	56	94

PHASE I SUMP REMOVAL ACTION PROGRAM - MASSACHUSETTS MILITARY RESERVATION

Parameter	Site: CS-14/CD-2 Matr: SOIL Dpth: 12 ISIS: 98TRX23X12X1XF Date: 09-JAN-92	CS-14/CD-2 SOIL 18 98TRX23X18X1XF 09-JAN-92	CS-14/CD-2 SOIL 24 98TRX23X24X1XF 09-JAN-92	CS-14/CD-3 SOIL 8 98TRX31XX8X1XF 09-JAN-92	CS-14/CD-3 SOIL 12 98TRX31X12X1DF 09-JAN-92	CS-14/CD-3 SOIL 12 98TRX31X12X1XF 09-JAN-92	CS-14/CD-3 SOIL 18 98TRX31X18X1XF 09-JAN-92	CS-14/CD-3 SOIL 24 98TRX31X24X1XF 09-JAN-92
PI meter reading (ppm)	1.2	1.6	1.1	0.3	1.5	1.5	0.8	0.5
VOCs (ug/kg)								
1,1,1-Trichloroethane	NA	ND	NA	ND	ND	ND	ND	ND
Trichloroethene	NA	ND	NA	ND	ND	ND	ND	ND
Vinyl chloride	NA	ND	NA	ND	ND	ND	ND	ND
Dibromoethane	NA	ND	NA	ND	ND	ND	ND	ND
Toluene	NA	ND	NA	ND	ND	ND	ND	ND
Ethylbenzene	NA	ND	NA	ND	ND	ND	ND	ND
o-Xylene	NA	ND	NA	ND	ND	ND	ND	ND
m/p-Xylene	NA	ND	NA	ND	ND	ND	ND	ND
1,1-Dichloroethane	NA	ND	NA	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	NA	ND	NA	ND	5.4	ND	35	ND
trans-1,2-Dichloroethene	NA	ND	NA	ND	ND	ND	ND	ND
Tetrachloroethene	NA	24	NA	2.7	ND	ND	13	ND
Benzene	NA	ND	NA	ND	ND	ND	ND	ND
SVOCs (mg/kg)								
Phenol	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	1.2	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
Acenapthene	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND
Pest/PCBs (ug/kg)								
Delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Gamma-BHC	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND
Inorganics (mg/kg)								
Lead	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	ND	ND	270	ND	ND	ND	ND	ND
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND	ND	ND
TPH (mg/kg)	110	140	78	58	83	45	79	33

CLOSURE REPORT

1. INTRODUCTION

1.1 DRAINAGE STRUCTURE REMOVAL PROGRAM

Massachusetts Military Reservation (MMR) is listed on the U.S. Environmental Protection Agency (EPA) National Priority List. Remedial studies and activities are currently being conducted at MMR in accordance with guidelines and procedures of the EPA Superfund program and the National Contingency Plan (NCP). Two types of action can be initiated under the NCP: remedial actions and removal actions. Remedial actions are long-term, permanent remediation of hazardous waste sites. Removal actions are short-term actions to abate or eliminate the release of contamination. The drainage structure removal program is a removal action program.

The National Guard Bureau (NGB) evaluated the drainage structure in a separate basewide program because of the similarity in operations and contaminants. The drainage structure removal program is based on the Phase I Sump Investigation Program conducted by ABB Environmental Services Inc. (ABB) and the Phase II Sump Investigation Program conducted by Metcalf and Eddy for the NGB. ABB characterized approximately 100 drainage structures. This characterization included sampling to identify potential contaminant sources. Also during this phase an additional 161 drainage structures were identified. Fifteen of these structures were characterized by Metcalf and Eddy as a high priority.

A total of 185 drainage structures are included in the program. One hundred sixty-five of these structures are funded for removal. Currently, Jacobs Engineering Group is under contract through the Air Force Center for Environmental Excellence for the following work under the drainage structure removal program. The scope of work includes:

- The removal or abandonment in place of approximately 165 existing drainage structures on the Massachusetts Military Reservation and the associated liquid and sediment contents.
- Demolition of 12 existing vehicle maintenance slabs and foundations.
- Testing soil, liquid, sludge and sediment for contamination.
- Stockpiling and treatment or disposal of excavated drainage structure debris and surrounding soil.
- Backfilling and restoring excavations as specified.
- Preparing closure reports.

The work Jacobs is performing on the drainage structure removal program is governed by the "Final Drainage Structure Removal Program Specifications," July 1995, prepared for Massachusetts Military Reservation by Metcalf and Eddy; and the approved Jacobs' Plans (Drainage Structure Removal Program Volume I - Quality Project Plan and Volume II - Remedial Action Work Plan, January 1996, prepared for Massachusetts Military Reservation). These documents detail the procedures utilized by Jacobs during the removal of drainage structures.

1.2 CLEAN-UP LEVELS

The clean-up levels for the drainage structure removal program (DSRP) are determined by the MMR specific soil target clean-up levels (STCLs) as developed by HAZWRAP and presented in their letter: "Soil Target Clean Up Levels," dated January 30, 1996. The STCLs are risk based standards. The depth utilized for the DSRP is the 2 to 15 foot depth. Additionally, the STCLs are divided into several sub-categories: inside the flightline, outside the flightline, and clean fill. The inside and outside the flightline STCLs are based upon future use as well as risk. These standards apply to the bottom, inlet, and outlet samples and are used to determine that the drainage structure removal is a clean closure.

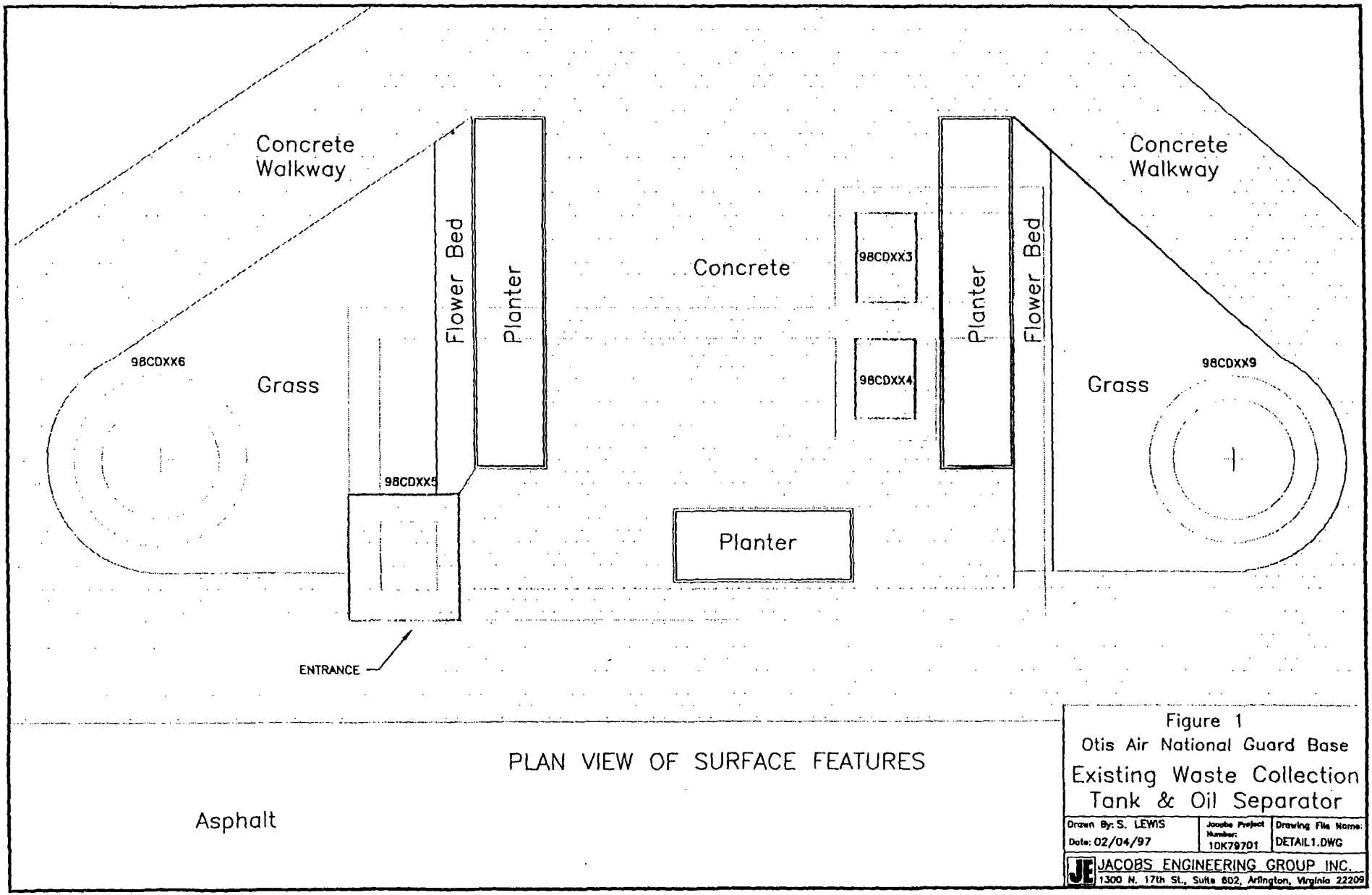
The clean fill STCLs apply to the paylimit sample. These data determine if the paylimit can be used for clean fill or requires treatment. The soil will be treated in the OABF if any of the contaminants tested are above the STCLs for clean fill. Additionally, if the soil fails the "twenty times" rule as defined in specification 01410, a paylimit sample will be analyzed for TCLP. If the soil passes the TCLP, it will be treated in the OABF. Any soil failing TCLP limits will be disposed off-site at a RCRA-regulated facility.

1.3 DRAINAGE STRUCTURE DESCRIPTION AND LOCATION

The oil-water separator (OWS) is located on the eastern side of Building 158 inside the flightline area on the south end of Reilly Road (see Figure 1 and Figure 2). The OWS is located 6 feet below ground surface with inside dimensions of 6 feet deep, 9 feet wide, and 22 feet long. The OWS had 5 associated manhole accesses: 98CDXX3, 98CDXX4, 98CDXX5, 98CDXX6, and 98CDXX9.

- 98CDXX3 opened to the oil removal tank. The oil removal tank (98CDXX3) is 12 feet deep, 3 feet wide, and 6 feet long. The survey coordinates are 238,127.5 North and 867,520.1 East.
- 98CDXX4 opened directly to the OWS. The survey coordinates are 238,124.5 North and 867,523.6 East.
- 98CDXX5 opened directly to the OWS. The survey coordinates are 238,108.4 North and 867,518.4 East.
- The inlet manhole 98CDXX6, located approximately 8 feet south of 98CDXX5, is 12.5 feet deep and 4 feet in diameter. It provides access to the inlet pipe of the OWS. The survey coordinates are 238,103.7 North and 867,511.1 East.
- The outlet manhole 98CDXX9, located approximately 10 feet north from 98CDXX4, is 9 feet deep and 4 feet in diameter. This manhole also contained had a 4-inch inlet pipe. It was determined that this pipe drained the walkway in front of the main entrance to Building 158. The survey coordinates are 238,131.5 North and 867,533.2 East.

According to the specifications, the OWS had been filled with sand during an initial abandonment. During the final abandonment, theOWS was found to contain substantial amounts of rock, contruction debris, and chunks of concrete and asphalt in addition to wet, silty sand.


Concrete Walkway
Flower Bed
Planter
Concrete
98CDXX3
98CDXX4
Planter
Flower Bed
Concrete Walkway
98CDXX6
Grass
98CDXX5
Planter
Grass
98CDXX9
ENTRANCE
PLAN VIEW OF SURFACE FEATURES
Asphalt
Figure 1
Otis Air National Guard Base
Existing Waste Collection Tank & Oil Separator
Drawn By: S. LEWIS
Date: 02/04/97
Jacobs Project Number: 10K79701
Drawing File Name: DETAIL1.DWG
JACOBS ENGINEERING GROUP INC.
1300 N. 17th St., Suite 802, Arlington, Virginia 22209

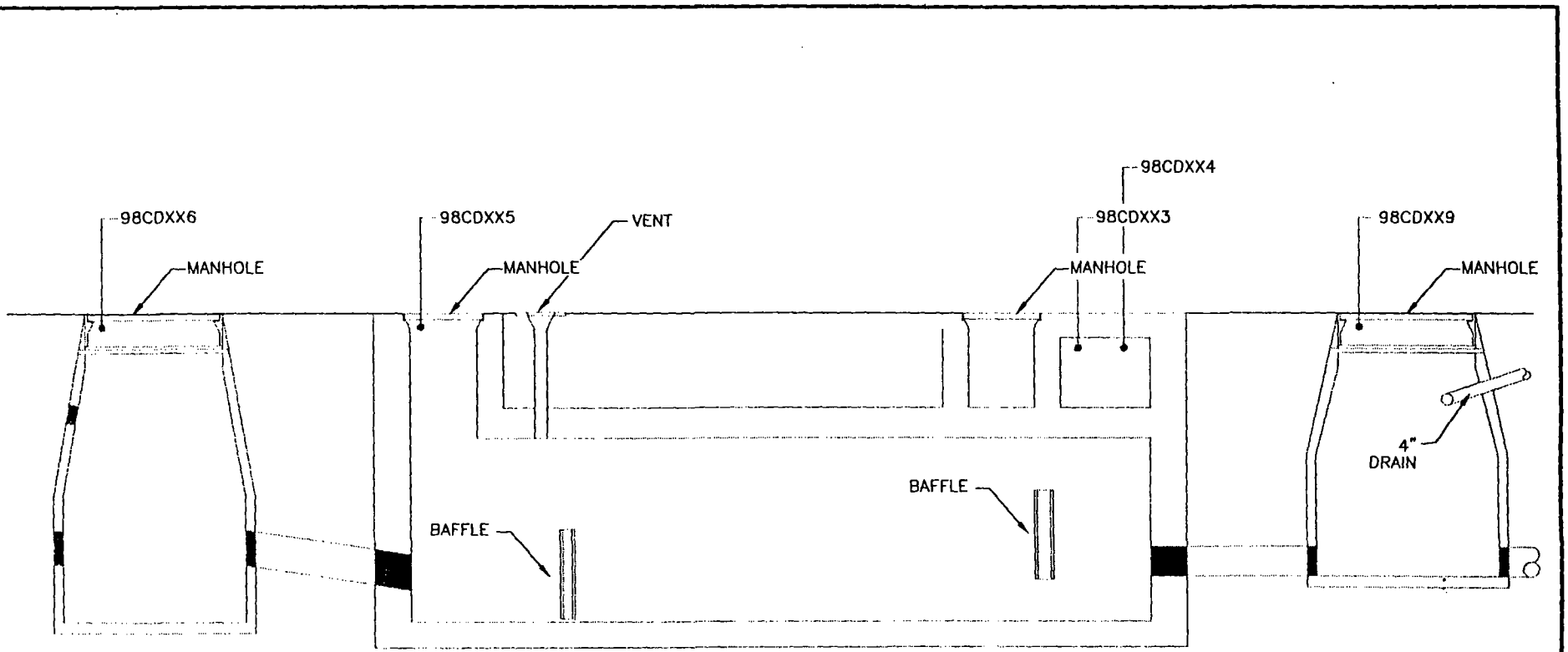


Figure 2
Otis Air National Guard Base
Existing Waste Collection Tank & Oil Separator

Drawn By: S. LEWIS	Jacobs Project Number: 10K79701	Drawing File Name: DETAIL2.DWG
Date: 02/04/97		

JACOBS ENGINEERING GROUP INC.
1300 N. 17th St., Suite 802, Arlington, Virginia 22209

1.4 PREVIOUS INVESTIGATION HISTORY

1.4.1 CHEMICAL SPILL 14 (CS-14) STUDY AREA

Seven individual structures were investigated at Study Area CS-14. Gas trap 98CDXX1 is located off the southeastern corner of Building 156. The vapor degreaser Leaching Field 98CDXX2 is located on the western side of Building 156, directly beneath a paved walkway. Abandoned Waste Oil Tank 98CDXX3 is located at the main entrance to Building 158. The waste oil tank was abandoned by backfilling with sand. The structure has three chambers (designated 98CDXX3, 98CDXX4, and 98CDXX5) that were sampled and accessed through separate steel covers. In addition, a manhole inlet (Manhole Inlet 98CDXX6) and outlet (Manhole Outlet 98CDXX9), once both connected in line to the waste oil tank, were sampled (Sump Removal Action Program, Phase I Sump Investigation Program Work Completion Report, October 1992).

1.4.2 PHASE I INVESTIGATION SUMMARY

At the time of ABB investigation (Sump Removal Action Program, Phase I Sump Investigation Program Work Completion Report, October 1992), the OWS tank had been abandoned by filling it in place with sand. A sample of the fill material was obtained from each of the three access holes for field lab analysis. A fourth sample was collected from the former manhole inlet, which had also been backfilled with sand. A fifth sample was collected from the former outlet manhole (98CDXX9) where tank discharge once flowed. The manhole outlet was not backfilled. Piping from the inlet and outlet manholes was reportedly plugged off to prevent flow from entering or leaving the OWS tank when the tank was abandoned in place. Of the five samples collected, one sample, from the former manhole inlet (98CDXX6), contained evidence of contamination. The other four samples (98CDXX3, 98CDXX4, 98CDXX5, 98CDXX9) were basically "clean." TPH, cis-1,2-DCE, lead, and zinc were the only contaminants detected at low concentrations in the "clean" samples. The sediment from manhole inlet 98CDXX6 contained TPH, DCE, EDB, PCE, BTEX, dichlorobenzenes, heptachlor epoxide, lead, and zinc.

2. LIQUID REMOVAL AND DISPOSAL

During the removal of the backfilled sand, pockets of liquids were found in the oil removal tank (98CDXX3) and the OWS tank (98CDXX4 and 98CDXX5). Approximately 300 gallons of liquid from 98CDXX3 and 700 gallons of liquid from 98CDXX4 and 98CDXX5 were removed by a vacuum truck. Additionally, 30 gallons of wastewater from steam cleaning the inside of the structures were collected. The liquids were disposed by the subcontractor as industrial wastewater with waste oil contamination.

3. STRUCTURE CONTENT REMOVAL AND DISPOSAL

On April 26, 1996, a vactor truck (for solids) and a vacuum truck (for liquids) were used to remove the contents of the OWS tank and associated structures. According to the specifications, this structure had been filled with sand. However, liquids and general debris including rocks, concrete chunks, and asphalt were encountered in the OWS and associated drainage structures. Content removal began in the oil removal tank (98CDXX3). Approximately four cubic yards of material were removed including very wet sand (clay-like silty material), general debris, and liquids. Next, contents from the OWS were removed beginning with 98CDXX4. Removal from this structure continued through April 28, 1996. Approximately 18 cubic yards of material were removed from the OWS tank (98CDXX4 and 98CDXX5), 2.5 cubic yards of material from the manhole inlet

98CDXX6, and 1 cubic yard of material from the manhole outlet 98CDXX9. Material removed consisted of wet silty sand, general debris, and liquids.

During the removal of material from the OWS tank, the wooden baffle was cut to allow easier removal of the materials. As specified, the baffle was left inside the structure. In addition, a 4-inch PVC pipe, not identified in the specifications, was found entering the manhole outlet 98CDXX9 extending directly into the outlet pipe and continuing into the active sewer line. This pipe drains the entrance walkway area of Building 158.

4. DRAINAGE STRUCTURE REMOVAL AND DISPOSAL

4.1 PROCEDURES USED TO REMOVE PAYLIMIT

4.1.1 ABANDONMENT IN PLACE

After content removal was complete, the empty structures were pressure steam cleaned. On April 29, 1996, approximately 60 cubic yards of concrete slurry was placed in the structures. Inlet and outlet pipes from manhole 98CDXX6 and the OWS tank, and the inlet pipe from manhole 98CDXX9 were plugged with concrete from a previous effort. The outlet pipe for manhole 98CDXX9 was sealed with a concrete plug around the 4-inch PVC walkway drainage pipe. The 4-inch PVC pipe was extended through the drainage structure and connected to the outlet pipe to permit drainage. Approximately 10 feet of PVC pipe and two elbow joints were used to lengthen the pipe.

Structure closure was observed by ABB Environmental, the Title II subcontractor to IRP. Photographs of the remediation of these structures are located in Appendix C.

4.1.2 FIELD SCREENING

Field screening for volatile organic compounds was conducted throughout the removal activities. PID results were non-detect in the breathing zone. An LEL and oxygen meter were used throughout the confined space entry. No explosive levels were detected; sufficient oxygen levels were maintained.

4.1.3 BACKFILL

No backfill was required, because the structure was abandoned in place.

4.1.4 FINAL RESTORATION

The lawn in front of Building 158 was impacted by the removal of the manhole covers at 98CDXX6 and 98CDXX9 and was regraded and reseeded. The manhole covers to the OWS tank were removed and the concrete slurry finished to match the existing concrete walkway.

4.2 ANALYTICAL RESULTS

The off-site laboratories analyzed the samples according to the Quality Assurance Plan and the laboratory specification (Section 01410 of the Specifications). All data were validated in accordance with HAZWRAP and DOE guidelines. The samples were analyzed for volatile compounds by EPA methods 8010/8020 and EDB, semivolatile compounds by EPA method 8270, pesticides and PCBs by EPA method 8080, metals by EPA method series 6000 and 7000, and

TPH by EPA method 8015 modified as diesel and gasoline. The off-site laboratory has established analyte detection levels which are below the method required quantitation levels. The concentrations reported for those analytes detected below the laboratory quantitation limits are estimated and are noted as such in the following tables.
A sample was collected from the paylimit only. The sample was sent to the off-site laboratory for proper disposal. The complete off-site analytical data is in Appendix B. Due to the structures being abandoned in place, structures 98CDXX3, 98CDXX4, 98CDXX5, 98CDXX6, and 98CDXX9 are considered to be clean closures.

4.3 ANALYTICAL QA

The analytical data were validated in accordance with DOE/HWP - 65/R1: "Requirements for Quality Control of Analytical Data." The validation was a Level C DQO validation and found the data to be usable.

The paylimit sample from this structure was collected in duplicate as a measure of sampling precision. There was good agreement between the samples for the analytes detected in both samples, except for copper, lead, and TPH as diesel. The most likely cause of the disagreement is the nonhomogeneous nature of soil samples. The impact on data quality is assessed to be minimal.

The paylimit sample from this structure was analyzed at a secondary dilution for pesticides/PCBs. There is no impact on data usability as no compound method detection limits were raised above the applicable STCLs.

Low levels of metallic analytes were detected in the preparation blank associated with the samples from this structure. No data for this structure required qualification.

4.4 SOIL FINAL DISPOSITION

The analytical results for the paylimit from this drainage structure were reviewed and are summarized in Tables 4-1 and 4-2. Based on these results, the paylimit was stockpiled to be treated in the OABF. STCL's for the paylimit were exceeded for chromium, lead, and zinc.

4.5 DEBRIS FINAL DISPOSITION

The debris removed from this structure was decontaminated. It will be sorted into suitable and non-suitable debris. The suitable debris will be used for aggregate in the OABF. The unsuitable debris will be sent to a construction debris landfill.

5. APPENDICES

A. ON-SITE ANALYTICAL DATA
B. OFF-SITE ANALYTICAL DATA
C. PHOTOGRAPHS

Table 4-1 - Paylimit Sample BLDG158SOPLOF1

Analyte	Result	Units	Estimated Quantitation	Exceeds Limits	STCL Clean Fill	Federally Regulated Limits	20x Rule
TPH as Diesel	310	MG/KG			500		
Aluminum	2760	MG/KG			26400		
Arsenic	2.3	MG/KG			3.6	5	100
Barium	13.9	MG/KG			3800	100	2000
Beryllium	0.27	MG/KG			1		
Cadmium	0.95	MG/KG			1.5	1	20
Calcium	284	MG/KG					
Chromium	6.6	MG/KG			6.8	5	120
Cobalt	2.0	MG/KG			333		
Copper	4.7	MG/KG			19.3		
Iron	4510	MG/KG					
Lead	19.2	MG/KG		YES	15.8	5	100
Magnesium	692	MG/KG					
Manganese	64.4	MG/KG			274		
Nickel	2.8	MG/KG			955		
Potassium	342	MG/KG					
Vanadium	8.5	MG/KG			15.2		
Zinc	22.5	MG/KG		YES	16		
2-Methylnaphthalene	270	UG/KG	YES		700		
Acenaphthene	43	UG/KG	YES		10900		
Anthracene	41	UG/KG	YES		62400		
Benzo(a)anthracene	140	UG/KG	YES		5000		
Benzo(a)pyrene	140	UG/KG	YES		5000		
Benzo(b)fluoranthene	210	UG/KG	YES		5000		
Benzo(g,h,i)perylene	87	UG/KG	YES		5000		
Benzo(k)fluoranthene	110	UG/KG	YES		5000		
bis(2-Ethylhexyl) phthalate	530	UG/KG			812		
Chrysene	140	UG/KG	YES		625		
Di-n-butylphthalate	51	UG/KG	YES		3900		
Fluoranthene	670	UG/KG			7810		
Fluorene	47	UG/KG	YES		7810		
Indeno(1,2,3-cd)pyrene	82	UG/KG	YES		5000		
Naphthalene	79	UG/KG	YES		1640		
Phenanthrene	200	UG/KG	YES		625		
Pyrene	280	UG/KG	YES		4690		

Table 4-2 - Paylimit Sample Duplicate BLDG158SOPLOFD

Analyte	Result	Units	Estimated Quantitation	Exceeds Limits	STCL Clean Fill	Federally Regulated Limits	20x Rule
TPH as Diesel	130	MG/KG			500		
TPH as Gasoline	8.2	MG/KG			500		
Dieldrin	0.0049	MG/KG			0.035		
Aluminum	2700	MG/KG			26400		
Arsenic	2.8	MG/KG			3.6	5	100
Barium	11.3	MG/KG			3800	100	2000
Beryllium	0.26	MG/KG			1		
Cadmium	1.5	MG/KG			1.5	1	20
Calcium	311	MG/KG					
Chromium	7.7	MG/KG		YES	6.8	5	120
Cobalt	1.8	MG/KG			333		
Copper	6.9	MG/KG			19.3		
Iron	4510	MG/KG					
Lead	30.8	MG/KG		YES	15.8	5	100
Magnesium	699	MG/KG					
Manganese	61.2	MG/KG			274		
Nickel	3.2	MG/KG			955		
Potassium	379	MG/KG					
Vanadium	8.6	MG/KG			15.2		
Zinc	21.7	MG/KG		YES	16		
2-Methylnaphthalene	150	UG/KG	YES		700		
Acenaphthene	36	UG/KG	YES		10900		
Anthracene	39	UG/KG	YES		62400		
Benzo(a)anthracene	160	UG/KG	YES		5000		
Benzo(a)pyrene	130	UG/KG	YES		5000		
Benzo(b)fluoranthene	190	UG/KG	YES		5000		
Benzo(g,h,i)perylene	79	UG/KG	YES		5000		
Benzo(k)fluoranthene	87	UG/KG	YES		5000		
bis(2-Ethylhexyl) phthalate	460	UG/KG			812		
Chrysene	140	UG/KG	YES		625		
Fluoranthene	600	UG/KG			7810		
Fluorene	41	UG/KG	YES		7810		
Indeno(1,2,3-cd)pyrene	71	UG/KG	YES		5000		
Naphthalene	79	UG/KG	YES		1640		
Phenanthrene	240	UG/KG	YES		625		
Pyrene	310	UG/KG	YES		4690		

APPENDIX A

ON-SITE ANALYTICAL DATA

No on-site samples were collected from these structures

APPENDIX B

OFF-SITE ANALYTICAL DATA

OFF-SITE ANALYTICAL DATA
PAYLIMIT SAMPLE

TEST CODE :SPH_0C1 JOB NUMBER :9600.834
ELAP ID : 10486

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : JG-4000 OTIS AIR FORCE BASE
RESULTS IN DRY WEIGHT %SOLIDS : 93 %
TEST NAME : 8010 VOA +EDB (JE) UNITS : UG/KG
SAMPLE ID LAB : EE-96-43404 MATRIX : SOLID
SAMPLE ID CLIENT: BLDG158SOPLOF1 DATE RECEIVED : 04/30/96
SDG # : 43394 DATE ANALYZED : 05/02/96
DILUTION FACTOR : 1.0

SAMPLE VOLUME: 5.0 g

PARAMETER	RESULTS	Q	QNT. LIMIT
Dichlorodifluoromethane	ND		5.4
Chloromethane	ND		5.4
Vinyl chloride	ND		1.1
Bromomethane	ND		0.54
Chloroethane	ND		0.86
Trichlorofluoromethane	ND		0.64
1,1-Dichloroethene	ND		0.54
Methylene chloride	ND		2.7
trans-1,2-Dichloroethene	ND		0.54
1,1-Dichloroethane	ND		0.54
cis-1,2-Dichloroethene	ND		0.54
Chloroform	ND		5.4
1,1,1-Trichloroethane	ND		0.54
Carbon tetrachloride	ND		0.54
1,2-Dichloroethane	ND		0.54
Trichloroethene	ND		1.1
1,2-Dichloropropane	ND		3.2
Bromodichloromethane	ND		2.2
2-Chloroethylvinylether	ND		2.2
cis-1,3-Dichloropropene	ND		0.75
trans-1,3-Dichloropropene	ND		1.6
1,1,2-Trichloroethane	ND		0.54
Tetrachloroethene	ND		2.2
Dibromochloromethane	ND		0.54
Chlorobenzene	ND		0.86
Bromoform	ND		0.54
1,1,2,2-Tetrachloroethane	ND		5.4
1,3-Dichlorobenzene	ND		0.86
1,4-Dichlorobenzene	ND		0.86
1,2-Dichlorobenzene	ND		0.86
Ethylene dibromide	ND		1.1

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
X = EXCEEDS CALIBRATION LIMIT
N = ANALYTE WAS NOT CONFIRMED BY ALTERNATE PROCEDURE
A = PHENOMENON OF METHODOLOGY WITH ACID PRESERVATION

TEST CODE :SPA_0C1 JOB NUMBER :9600.834
ELAP ID : 10486

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : JG-4000 OTIS AIR FORCE BASE
RESULTS IN DRY WEIGHT %SOLIDS : 93 %
TEST NAME : 8020 VOA (JE) UNITS : UG/KG
SAMPLE ID LAB : EE-96-43404 MATRIX : SOLID
SAMPLE ID CLIENT: BLDG158SOPLOF1 DATE RECEIVED : 04/30/96
SDG # : 43394 DATE ANALYZED : 05/02/96
DILUTION FACTOR : 1.0

SAMPLE VOLUME: 5.0 g

PARAMETER	RESULTS	Q	QNT. LIMIT
MTBE	ND		1.6
Benzene	ND		0.64
Toluene	ND		11
Ethylbenzene	ND		11
Chlorobenzene	ND		1.5
1,3-Dichlorobenzene	ND		1.5
1,4-Dichlorobenzene	ND		1.3
1,2-Dichlorobenzene	ND		1.3
Total Xylenes	ND		11

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
X = EXCEEDS CALIBRATION LIMIT
N = ANALYTE WAS NOT CONFIRMED BY ALTERNATE PROCEDURE
A = PHENOMENON OF METHODOLOGY WITH ACID PRESERVATION

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

BL158SOPLOF1

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 834 SAS No.: SDG No.: 43394

Matrix: (soil/water) SOIL Lab Sample ID: 43404

Sample wt/vol: 30.0 (g/mL) G Lab File ID: I4459

Level: (low/med) LOW Date Received: 04/30/96

% Moisture: 7 decanted: (Y/N) N Date Extracted: 04/30/96

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 05/02/96

Injection Volume: 2.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
108-95-2	Phenol	350	U
111-44-4	bis(2-Chloroethyl)Ether	350	U
95-57-8	2-Chlorophenol	350	U
541-73-1	1,3-Dichlorobenzene	350	U
106-46-7	1,4-Dichlorobenzene	350	U
100-51-6	Benzyl Alcohol	350	U
95-50-1	1,2-Dichlorobenzene	350	U
95-48-7	2-Methylphenol	350	U
108-60-1	2,2'-oxybis(1-Chloropropane)	350	U
106-44-5	4-Methylphenol	350	U
621-64-7	N-Nitroso-Di-n-Propylamine	350	U
67-72-1	Hexachloroethane	350	U
98-95-3	Nitrobenzene	350	U
78-59-1	Isophorone	350	U
88-75-5	2-Nitrophenol	350	U
105-67-9	2,4-Dimethylphenol	350	U
65-85-0	Benzoic Acid	1700	U
111-91-1	bis(2-Chloroethoxy)Methane	350	U
120-83-2	2,4-Dichlorophenol	350	U
120-82-1	1,2,4-Trichlorobenzene	350	U
91-20-3	Naphthalene	79	J
106-47-8	4-Chloroaniline	350	U
87-68-3	Hexachlorobutadiene	350	U
59-50-7	4-Chloro-3-Methylphenol	350	U
91-57-6	2-Methylnaphthalene	270	J
77-47-4	Hexachlorocyclopentadiene	350	U
88-06-2	2,4,6-Trichlorophenol	350	U
95-95-4	2,4,5-Trichlorophenol	1700	U
91-58-7	2-Chloronaphthalene	350	U
88-74-4	2-Nitroaniline	1700	U
131-11-3	Dimethylphthalate	350	U
208-96-8	Acenaphthylene	350	U
606-20-2	2,6-Dinitrotoluene	350	U
99-09-2	3-Nitroaniline	1700	U
83-32-9	Acenaphthene	43	J

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.: BL158SOPLOF1

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 834 SAS No.: SDG No.: 43394

Matrix: (soil/water) SOIL Lab Sample ID: 43404

Sample wt/vol: 30.0 (g/mL) G Lab File ID: I4459

Level: (low/med) LOW Date Received: 04/30/96

% Moisture: 7 decanted: (Y/N) N Date Extracted: 04/30/96

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 05/02/96

Injection Volume: 2.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
51-28-5	2,4-Dinitrophenol	1700	U
100-02-7	4-Nitrophenol	1700	U
132-64-9	Dibenzofuran	350	U
121-14-2	2,4-Dinitrotoluene	350	U
84-66-2	Diethylphthalate	350	U
7005-72-3	4-Chlorophenyl-phenylether	350	U
86-73-7	Fluorene	47	J
100-01-6	4-Nitroaniline	1700	U
534-52-1	4,6-Dinitro-2-methylphenol	1700	U
86-30-6	N-Nitrosodiphenylamine (1)	350	U
101-55-3	4-Bromophenyl-phenylether	350	U
118-74-1	Hexachlorobenzene	350	U
87-86-5	Pentachlorophenol	1700	U
85-01-8	Phenanthrene	200	J
120-12-7	Anthracene	41	J
86-74-8	Carbazole	350	U
84-74-2	Di-n-Butylphthalate	51	J
206-44-0	Fluoranthene	670	
92-87-5	Benzidine	1700	U
129-00-0	Pyrene	280	J
85-68-7	Butylbenzylphthalate	350	U
91-94-1	3,3'-Dichlorobenzidine	710	U
56-55-3	Benzo(a)Anthracene	140	J
218-01-9	Chrysene	140	J
117-81-7	bis(2-Ethylhexyl)Phthalate	530	
117-84-0	Di-n-Octyl Phthalate	350	U
205-99-2	Benzo(b)Fluoranthene	210	J
207-08-9	Benzo(k)Fluoranthene	110	J
50-32-8	Benzo(a)Pyrene	140	J
193-39-5	Indeno(1,2,3-cd)Pyrene	82	J
53-70-3	Dibenz(a,h)Anthracene	350	U
191-24-2	Benzo(g,h,i)Perylene	87	J

(1) - Cannot be separated from Diphenylamine

TEST CODE :SP&PCB1 JOB NUMBER :9600.834
ELAP ID : 10486

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : JG-4000 OTIS AIR FORCE BASE
RESULTS IN DRY WEIGHT %SOLIDS : 93 %
TEST NAME : PESTICIDE-PCB UNITS : MG/KG
SAMPLE ID LAB : EE-96-43404 MATRIX : SOLID
SAMPLE ID CLIENT: BLDG158SOPLOF1 DATE RECEIVED : 04/30/96
SDG # : 43394 DATE ANALYZED : 05/02/96
DILUTION FACTOR : 5.0

SAMPLE VOLUME: 30 g DATE EXTRACTED: 04/30/96
FINAL VOLUME: 10 mL INJECTION VOLUME: 2.0 uL

PARAMETER	RESULTS	Q	QNT. LIMIT
Aldrin	ND		0.005
alpha-BHC	ND		0.005
beta-BHC	ND		0.005
gamma-BHC (Lindane)	ND		0.005
delta-BHC	ND		0.005
Chlordane	ND		0.043
4,4'-DDD	ND		0.011
4,4'-DDE	ND		0.011
4,4'-DDT	ND		0.027
Dieldrin	ND		0.011
Endosulfan I	ND		0.011
Endosulfan II	ND		0.011
Endosulfan sulfate	ND		0.027
Endrin	ND		0.011
Endrin aldehyde	ND		0.027
Heptachlor	ND		0.005
Heptachlor epoxide	ND		0.005
Toxaphene	ND		0.27
Methoxychlor	ND		0.086
PCB-1016	ND		0.11
PCB-1221	ND		0.11
PCB-1232	ND		0.11
PCB-1242	ND		0.11
PCB-1248	ND		0.11
PCB-1254	ND		0.11
PCB-1260	ND		0.11

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
X = EXCEEDS CALIBRATION LIMIT
N = ANALYTE WAS NOT CONFIRMED BY ALTERNATE PROCEDURE
A = PHENOMENON OF METHODOLOGY WITH ACID PRESERVATION

TEST CODE :SCTPH 1 JOB NUMBER :9600.834
ELAP ID : 10486

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : JG-4000 OTIS AIR FORCE BASE
RESULTS IN DRY WEIGHT %SOLIDS : 93 %
TEST NAME : TPH AS DIESEL UNITS : MG/KG
SAMPLE ID LAB : EE-96-43404 MATRIX : SOLID
SAMPLE ID CLIENT: BLDG158SOPLOF1 DATE RECEIVED : 04/30/96
SDG # : 43394 DATE ANALYZED : 05/02/96
DILUTION FACTOR : 5.0
SAMPLE VOLUME: 25 g DATE EXTRACTED: 04/30/96
FINAL VOLUME: 1.0 mL INJECTION VOLUME: 2.0 uL

PARAMETER	RESULTS	Q	QNT. LIMIT
TPH as Diesel	310		27

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
X = EXCEEDS CALIBRATION LIMIT
N = ANALYTE WAS NOT CONFIRMED BY ALTERNATE PROCEDURE
A = PHENOMENON OF METHODOLOGY WITH ACID PRESERVATION

OFF-SITE ANALYTICAL DATA
DUPLICATE PAYLIMIT SAMPLE

TEST CODE :SPH_0C1 JOB NUMBER :9600.834
ELAP ID : 10486

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : JG-4000 OTIS AIR FORCE BASE
RESULTS IN DRY WEIGHT %SOLIDS : 94 %
TEST NAME : 8010 VOA +EDB (JE) UNITS : UG/KG
SAMPLE ID LAB : EE-96-43405 MATRIX : SOLID
SAMPLE ID CLIENT: BLDG158SOPLOFD DATE RECEIVED : 04/30/96
SDG # : 43394 DATE ANALYZED : 05/02/96
DILUTION FACTOR : 1.0

SAMPLE VOLUME: 5.0 g

PARAMETER	RESULTS	Q	QNT. LIMIT
Dichlorodifluoromethane	ND		5.3
Chloromethane	ND		5.3
Vinyl chloride	ND		1.1
Bromomethane	ND		0.53
Chloroethane	ND		0.85
Trichlorofluoromethane	ND		0.64
1,1-Dichloroethene	ND		0.53
Methylene chloride	ND		2.6
trans-1,2-Dichloroethene	ND		0.53
1,1-Dichloroethane	ND		0.53
cis-1,2-Dichloroethene	ND		0.53
Chloroform	ND		5.3
1,1,1-Trichloroethane	ND		0.53
Carbon tetrachloride	ND		0.53
1,2-Dichloroethane	ND		0.53
Trichloroethene	ND		1.1
1,2-Dichloropropane	ND		3.2
Bromodichloromethane	ND		2.1
2-Chloroethylvinylether	ND		2.1
cis-1,3-Dichloropropene	ND		0.74
trans-1,3-Dichloropropene	ND		1.6
1,1,2-Trichloroethane	ND		0.53
Tetrachloroethene	ND		2.1
Dibromochloromethane	ND		0.53
Chlorobenzene	ND		0.85
Bromoform	ND		0.53
1,1,2,2-Tetrachloroethane	ND		5.3
1,3-Dichlorobenzene	ND		0.85
1,4-Dichlorobenzene	ND		0.85
1,2-Dichlorobenzene	ND		0.85
Ethylene dibromide	ND		1.1

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
X = EXCEEDS CALIBRATION LIMIT
N = ANALYTE WAS NOT CONFIRMED BY ALTERNATE PROCEDURE
A = PHENOMENON OF METHODOLOGY WITH ACID PRESERVATION

TEST CODE :SPA_0C1 JOB NUMBER :9600.834
ELAP ID : 10486

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : JG-4000 OTIS AIR FORCE BASE
RESULTS IN DRY WEIGHT %SOLIDS : 94 %
TEST NAME : 8020 VOA (JE) UNITS : UG/KG
SAMPLE ID LAB : EE-96-43405 MATRIX : SOLID
SAMPLE ID CLIENT: BLDG158SOPLOFD DATE RECEIVED : 04/30/96
SDG # : 43394 DATE ANALYZED : 05/02/96
DILUTION FACTOR : 1.0

SAMPLE VOLUME: 5.0 g

PARAMETER	RESULTS	Q	QNT. LIMIT
MTBE	ND		1.6
Benzene	ND		0.64
Toluene	ND		11
Ethylbenzene	ND		11
Chlorobenzene	ND		1.5
1,3-Dichlorobenzene	ND		1.5
1,4-Dichlorobenzene	ND		1.3
1,2-Dichlorobenzene	ND		1.3
Total Xylenes	ND		11

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
X = EXCEEDS CALIBRATION LIMIT
N = ANALYTE WAS NOT CONFIRMED BY ALTERNATE PROCEDURE
A = PHENOMENON OF METHODOLOGY WITH ACID PRESERVATION

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

BL158SOPLOFD

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 834 SAS No.: SDG No.: 43394

Matrix: (soil/water) SOIL Lab Sample ID: 43405

Sample wt/vol: 30.0 (g/mL) G Lab File ID: I4460

Level: (low/med) LOW Date Received: 04/30/96

% Moisture: 6 decanted: (Y/N) N Date Extracted: 04/30/96

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 05/02/96

Injection Volume: 2.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
108-95-2	Phenol	350	U
111-44-4	bis(2-Chloroethyl)Ether	350	U
95-57-8	2-Chlorophenol	350	U
541-73-1	1,3-Dichlorobenzene	350	U
106-46-7	1,4-Dichlorobenzene	350	U
100-51-6	Benzyl Alcohol	350	U
95-50-1	1,2-Dichlorobenzene	350	U
95-48-7	2-Methylphenol	350	U
108-60-1	2,2'-oxybis(1-Chloropropane)	350	U
106-44-5	4-Methylphenol	350	U
621-64-7	N-Nitroso-Di-n-Propylamine	350	U
67-72-1	Hexachloroethane	350	U
98-95-3	Nitrobenzene	350	U
78-59-1	Isophorone	350	U
88-75-5	2-Nitrophenol	350	U
105-67-9	2,4-Dimethylphenol	350	U
65-85-0	Benzoic Acid	1700	U
111-91-1	bis(2-Chloroethoxy)Methane	350	U
120-83-2	2,4-Dichlorophenol	350	U
120-82-1	1,2,4-Trichlorobenzene	350	U
91-20-3	Naphthalene	350	U
106-47-8	4-Chloroaniline	350	U
87-68-3	Hexachlorobutadiene	350	U
59-50-7	4-Chloro-3-Methylphenol	350	U
91-57-6	2-Methylnaphthalene	150	J
77-47-4	Hexachlorocyclopentadiene	350	U
88-06-2	2,4,6-Trichlorophenol	350	U
95-95-4	2,4,5-Trichlorophenol	1700	U
91-58-7	2-Chloronaphthalene	350	U
88-74-4	2-Nitroaniline	1700	U
131-11-3	Dimethylphthalate	350	U
208-96-8	Acenaphthylene	350	U
606-20-2	2,6-Dinitrotoluene	350	U
99-09-2	3-Nitroaniline	1700	U
83-32-9	Acenaphthene	36	J

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

BL158SOPLOFD

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 834 SAS No.: SDG No.: 43394

Matrix: (soil/water) SOIL Lab Sample ID: 43405

Sample wt/vol: 30.0 (g/mL) G Lab File ID: I4460

Level: (low/med) LOW Date Received: 04/30/96

% Moisture: 6 decanted: (Y/N) N Date Extracted: 04/30/96

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 05/02/96

Injection Volume: 2.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
51-28-5	2,4-Dinitrophenol	1700	U
100-02-7	4-Nitrophenol	1700	U
132-64-9	Dibenzofuran	350	U
121-14-2	2,4-Dinitrotoluene	350	U
84-66-2	Diethylphthalate	350	U
7005-72-3	4-Chlorophenyl-phenylether	350	U
86-73-7	Fluorene	41	J
100-01-6	4-Nitroaniline	1700	U
534-52-1	4,6-Dinitro-2-methylphenol	1700	U
86-30-6	N-Nitrosodiphenylamine (1)	350	U
101-55-3	4-Bromophenyl-phenylether	350	U
118-74-1	Hexachlorobenzene	350	U
87-86-5	Pentachlorophenol	1700	U
85-01-8	Phenanthrene	240	J
120-12-7	Anthracene	39	J
86-74-8	Carbazole	350	U
84-74-2	Di-n-Butylphthalate	350	U
206-44-0	Fluoranthene	600	
92-87-5	Benzidine	1700	U
129-00-0	Pyrene	310	J
85-68-7	Butylbenzylphthalate	350	U
91-94-1	3,3'-Dichlorobenzidine	700	U
56-55-3	Benzo(a)Anthracene	160	J
218-01-9	Chrysene	140	J
117-81-7	bis(2-Ethylhexyl)Phthalate	460	
117-84-0	Di-n-Octyl Phthalate	350	U
205-99-2	Benzo(b)Fluoranthene	190	J
207-08-9	Benzo(k)Fluoranthene	87	J
50-32-8	Benzo(a)Pyrene	130	J
193-39-5	Indeno(1,2,3-cd)Pyrene	71	J
53-70-3	Dibenz(a,h)Anthracene	350	U
191-24-2	Benzo(g,h,i)Perylene	79	J

(1) - Cannot be separated from Diphenylamine

TEST CODE :SP&PCB1 JOB NUMBER :9600.834
ELAP ID : 10486

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : JG-4000 OTIS AIR FORCE BASE
RESULTS IN DRY WEIGHT %SOLIDS : 94 %
TEST NAME : PESTICIDE-PCB UNITS : MG/KG
SAMPLE ID LAB : EE-96-43405 MATRIX : SOLID
SAMPLE ID CLIENT: BLDG158SOPLOFD DATE RECEIVED : 04/30/96
SDG # : 43394 DATE ANALYZED : 05/02/96
DILUTION FACTOR : 1.0
SAMPLE VOLUME: 30 g DATE EXTRACTED: 04/30/96
FINAL VOLUME: 10 mL INJECTION VOLUME: 2.0 uL

PARAMETER	RESULTS	Q	QNT. LIMIT
Aldrin	ND		0.001
alpha-BHC	ND		0.001
beta-BHC	ND		0.001
gamma-BHC (Lindane)	ND		0.001
delta-BHC	ND		0.001
Chlordane	ND		0.008
4,4'-DDD	ND		0.002
4,4'-DDE	ND		0.002
4,4'-DDT	ND		0.005
Dieldrin	0.0049		0.002
Endosulfan I	ND		0.002
Endosulfan II	ND		0.002
Endosulfan sulfate	ND		0.005
Endrin	ND		0.002
Endrin aldehyde	ND		0.005
Heptachlor	ND		0.001
Heptachlor epoxide	ND		0.001
Toxaphene	ND		0.053
Methoxychlor	ND		0.017
PCB-1016	ND		0.021
PCB-1221	ND		0.021
PCB-1232	ND		0.021
PCB-1242	ND		0.021
PCB-1248	ND		0.021
PCB-1254	ND		0.021
PCB-1260	ND		0.021

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
X = EXCEEDS CALIBRATION LIMIT
N = ANALYTE WAS NOT CONFIRMED BY ALTERNATE PROCEDURE
A = PHENOMENON OF METHODOLOGY WITH ACID PRESERVATION

TEST CODE :SCTPH 1 JOB NUMBER :9600.834
ELAP ID : 10486

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : JG-4000 OTIS AIR FORCE BASE
RESULTS IN DRY WEIGHT %SOLIDS : 94 %
TEST NAME : TPH AS DIESEL UNITS : MG/KG
SAMPLE ID LAB : EE-96-43405 MATRIX : SOLID
SAMPLE ID CLIENT: BLDG158SOPLOFD DATE RECEIVED : 04/30/96
SDG # : 43394 DATE ANALYZED : 05/02/96
DILUTION FACTOR : 5.0
SAMPLE VOLUME: 25 g DATE EXTRACTED: 04/30/96
FINAL VOLUME: 1.0 mL INJECTION VOLUME: 2.0 uL

PARAMETER	RESULTS	Q	QNT. LIMIT
TPH as Diesel	130		26

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
X = EXCEEDS CALIBRATION LIMIT
N = ANALYTE WAS NOT CONFIRMED BY ALTERNATE PROCEDURE
A = PHENOMENON OF METHODOLOGY WITH ACID PRESERVATION

TEST CODE :SPPH 1 JOB NUMBER :9600.834
ELAP ID : 10486

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : JG-4000 OTIS AIR FORCE BASE
RESULTS IN DRY WEIGHT %SOLIDS : 94 %
TEST NAME : TPH AS GASOLINE UNITS : MG/KG
SAMPLE ID LAB : EE-96-43405 MATRIX : SOLID
SAMPLE ID CLIENT: BLDG158SOPLOFD DATE RECEIVED : 04/30/96
SDG # : 43394 DATE ANALYZED : 05/01/96
DILUTION FACTOR : 1.0

SAMPLE VOLUME: 7.0 g
FINAL VOLUME: 10 mL INJECTION VOLUME: 100 uL

PARAMETER	RESULTS	Q	QNT. LIMIT
TPH as Gasoline	8.2		5.3

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
X = EXCEEDS CALIBRATION LIMIT
N = ANALYTE WAS NOT CONFIRMED BY ALTERNATE PROCEDURE
A = PHENOMENON OF METHODOLOGY WITH ACID PRESERVATION

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
43405

Lab Name: ECOLOGY_AND_ENVIRONMENT__ Contract: _____

Lab Code: EANDE_ Case No.: 9600.834 SAS No.: _____ SDG No.: 43394_

Matrix (soil/water): SOIL_ Lab Sample ID: 43405

Level (low/med): LOW__ Date Received: 04/30/96

% Solids: _93.7

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	2700			P
7440-36-0	Antimony	6.1	U		P
7440-38-2	Arsenic	2.8			P
7440-39-3	Barium	11.3	B		P
7440-41-7	Beryllium	0.26	B		P
7440-43-9	Cadmium	1.5			P
7440-70-2	Calcium	311	B		P
7440-47-3	Chromium	7.7			P
7440-48-4	Cobalt	1.8	B		P
7440-50-8	Copper	6.9			P
7439-89-6	Iron	4510			P
7439-92-1	Lead	30.8			P
7439-95-4	Magnesium	699			P
7439-96-5	Manganese	61.2			P
7439-97-6	Mercury	0.11	U		CV
7440-02-0	Nickel	3.2	B		P
7440-09-7	Potassium	379	B		P
7782-49-2	Selenium	0.52	U		P
7440-22-4	Silver	0.58	U	N	P
7440-23-5	Sodium	69.5	U		P
7440-28-0	Thallium	0.41	U		P
7440-62-2	Vanadium	8.6			P
7440-66-6	Zinc	21.7			P
	Cyanide				NR

Color Before: _____ Clarity Before: _____ Texture: SAND__

Color After: Y_____ Clarity After: C_____ Artifacts: YES___

Comments:

_____CLIENT_SAMPLE_ID:__BLDG158SOPLOFD_____

APPENDIX C

PHOTOGRAPHS