INSTALLATION RESTORATION PROGRAM (IRP)
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

STAGE 1

JOINT RESOURCES PROJECT
Fort Richardson, Fort Wainwright, and Fort Greely, Alaska

FINAL REPORT
FOR
SITE 2, ROOSEVELT ROAD TRANSMITTER SITE

Alaskan Air Command
HQ AAC/DEP
Elmendorf AFB, Alaska 99506

and

U. S. Army Directorate of
Engineering and Housing AFVR-DE
Fort Richardson, Alaska 99505

February 1990

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Four sites at three U.S. Army bases in Alaska were investigated under the U.S. Air Force Phase I, Installation Restoration Program. The sites have serviced both the Army and Air Force during different periods of facility operation. The sites include the Anchorage Fuel Terminal and the Roosevelt Road transmitter site, Fort Richardson; Fort Wainwright Landfill, Fort Wainwright; and four Fire Training Pits (two at Fort Richardson, one at Fort Wainwright, and one at Fort Greely).

The Anchorage Fuel Terminal (AFT) is a tank farm on the southwest portion of Government Hill, just east of the Knick Arm of Cook Inlet. The area has a long history of fuel leaks and spills dating to the 1940s when the facility was first established. The investigation included an oil/water separation pilot test, a vapor extraction pilot test, a bioremediation bench scale test, drilling and well installation for groundwater sampling and monitoring, surface water sampling and assessment, and development of preliminary conceptual designs for two water treatment options including an air stripping system and a rotating biological

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contactor. The geology and hydrogeology at the facility are complex due to the presence of landslide deposits. Several potential remediation techniques were identified for use at the facility and further evaluation recommended. Additional characterization studies were not recommended.

The Roosevelt Road transmitter site is the location of a large PCB spill in the late 1970s. The spill occurred from large transformers that remained from an underground bunker utilized as a communication center. The soil around the transformer pad was contaminated with to 85,000 ppm PCB. Approximately 105 cubic yards of material were removed from the site and confirmation testing conducted to verify the removal effort. The transmitter pad and surface soils were cleaned up: however, the concentration of PCB-contaminated soil near the base of the excavation remained above the action level. As a result, the excavation was lined and backfilled for later remediation.

Fort Wainwright Landfill - An active landfill site, used by the military at Fort Wainwright, was investigated as a result of previous analyses which had identified the pesticides endrin and toxaphene at concentrations above the allowable for drinking water standards. The investigation included a geophyscial survey to evaluate the presence of a contaminant plume and the drilling and installation of three wells for a pump test. The purpose of the investigation was to evaluate potential contaminant migration from the landfill and model the large scale hydrologic properties of the unconfined aquifer the vicinity of the landfill. Additional data needs were identified and additional investigations recommended.

Fire Training Pits - Four fire training pits were investigated using soil gas techniques in an effort to define the limit of contaminant migration from combustion products and unburned fuel used in fire training exercises. The investigation identified methane gas at one location where the fire training pit was located partially on top of an old landfill and provided information on the contaminant migration at the other three sites. As a result of the investigation, preliminary remedial actions were recommended to prevent the spread of contaminants outside the burn pit are by wildlife, and further studies were recommended to quantify the type and extent of contamination present.

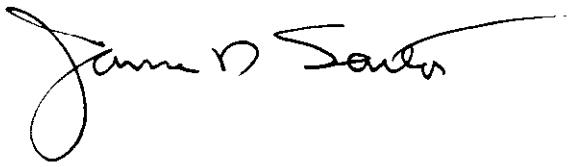
PREFACE

This 6-volume report describes the methods used and the results obtained from an Installation Restoration Program, Stage 1 investigation of four U.S. Army Bases in Alaska. The investigation and analyses were conducted by Woodward-Clyde Consultants under Contract F33615-85-D-4544, Work Order No. 9, Modification 1. The work was accomplished between August 1988 and May 1989. Capt. Franz Schmidt was the Technical Monitor for the Technical Services Division, USAF Occupational and Environmental Health Laboratory (USAFOEHL).

This document has been prepared in a modified version of the USAFOEHL format for Installation Restoration Program - Phase II reports. Modification of the prescribed format was necessary as a result of limitations in the scope of work and in order to provide clarity when discussing the sites investigated.

The present format allows each of the four sites defined in the statement of work to be discussed in a separate volume. Each volume is intended to stand alone as an independent report. Background material on the four sites is contained in the appendices and is presented in Volumes 5 and 6. To the extent possible, the volumes incorporate the format provided by USAFOEHL with slight modifications suggested by the U.S. Army, Directorate of Engineering and Housing.

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EXECUTIVE SUMMARY

The U.S. Air Force contracted with Woodward-Clyde Consultants to conduct a Stage 1 investigation under the Installation Restoration Program at seven localities identified as four sites at three U.S. Army Bases in Alaska. The three bases were:

- Fort Richardson
- Fort Wainwright
- Fort Greely.

One or more sites were investigated at each of the three bases. The objectives of this investigation were site specific and varied with each site. For each site, a qualitative assessment was made of public health or environmental hazards associated with the contamination. Where appropriate, alternative remedial actions were evaluated and the need for further investigations identified.

The localities investigated include the following:

Site 1 The Anchorage Fuel Terminal (AFT), an area of about 52 acres located on the east side of Cook Inlet just north of the city of Anchorage, Alaska. The property is a tank farm for handling, temporary storage, and transmission of fuel for military operations at several U.S. Army and U.S. Air Force facilities in Alaska. The facility has been utilized since the 1940s and is operated and maintained by the U.S. Army. A number of fuel leaks and spills have occurred at the facility during operation over the years and

both the soil and shallow groundwater at the facility contain fuel-related compounds. The investigation objectives included an estimate of the magnitude and approximate extent of contaminants and assessment of potential remediation techniques.

Site 2 The Roosevelt Road Transmitter Site, an area of about 20 acres located within the boundary of Fort Richardson, about 2 miles east of Elmendorf Air Force Base and 2 miles north of the Fort Richardson cantonment area. The site is the location of a polychlorinated biphenyl (PCB) spill which occurred about 1978. PCB contaminated debris and soil from spilled transformer fluid occurs on and adjacent to a large concrete transmitter pad and additional PCB laden transformer fluid was disposed of in an underground bunker adjacent to the spill locality. Significant contamination remained both in the soil and on a concrete pad where the transformers were located after the clean-up activities were completed. The area has been utilized by both military and civilian personnel for maneuvers and camping. The task objectives included sealing of the exposed portions of the transmitter pad where contaminated by PCBs and removal of up to 100 cubic yards of PCB contaminated soil and debris to achieve a clean-up level of less than 10 ppm PCB.

Site 3 The Fort Wainwright Landfill is an area of about 74 acres located within the boundary of Fort Wainwright about two-thirds of a mile northwest of the main cantonment area on the north side of the Chena River. The site is the location of a solid waste landfill utilized by the military since about the mid 1950s. Material disposed of in the landfill includes household wastes from personnel stationed at the base and waste from normal operations which include some asbestos and small arms ammunition. There is no record that the landfill was used to dispose of hazardous wastes. The landfill is located in an area of shallow groundwater and was not designed with a liner to prevent the migration of leachate from the landfill into the underlying aquifer. Previous investigations

have identified the compounds Endrin and Toxaphene in the groundwater in levels above those allowed in drinking water. The site is located upgradient from the city of Fairbanks, Alaska which utilizes groundwater as a source of drinking water. The objective was to estimate the large-scale hydraulic conductivity of the underlying aquifer and estimate contaminant transport in the aquifer.

Site 4 The Fire Training Pits (FTPs) include four sites, each less than one-quarter acre in size. Two of the pits are located within the boundary of Fort Richardson, one is located within the boundary of Fort Wainwright, and the fourth is located within the boundary of Fort Greely. The pits were utilized for fire training exercises associated with military operations for nearby airfields. The exercises included the burning of petroleum products, mainly fuel or waste products including fuel and oil. All of the pits are accessible but located in areas not normally utilized by base personnel. The objectives included an estimate of the presence and lateral extent of residual petroleum products and other combustion products from the training exercises.

The investigative procedures utilized at the sites included literature searches, the installation of borings and groundwater monitoring wells, pump test, surface and groundwater assessment, geophysical surveys, analyses of soil and water, soil gas surveys, pilot tests at the sites, a bench scale laboratory test, and development of preliminary conceptual designs for water treatment.

All investigations were conducted during the period from August 1988 to January 1989. During this period, a total of eight wells were installed, approximately 200 soil samples analyzed, approximately 175 water samples analyzed, and 58 soil gas probes installed. In addition, two pilot tests and one bench scale test were conducted and approximately 100 cubic yards of contaminated material removed.

As a result of the investigations for this study, preliminary alternative remedial actions are recommended at sites 1 and 4 and further investigations are recommended at all four sites. The following is a summary of the recommendations.

Site 1 Implementation of a long-range program to include surface water and soil remediation and groundwater monitoring. Surface water remediation would include the removal of benzene, ethylbenzene, toluene and xylene (BETX) and/or a reduction in the biological oxygen demand (BOD) from surface water leaving the AFT via drainage ditches and water flowing from the AFT in the abandoned sewer line. Preliminary conceptual designs were completed for two treatment alternatives, an air stripping system and a rotating biological contactor. Soil remediation should be further evaluated and tested on-site. Techniques considered feasible as a result of this investigation include landfarming, vapor extraction, and in-situ bioremediation. Groundwater monitoring should be continued on a periodic basis using the existing wells at the AFT.

Site 2 The implementation of a phased Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) type Remedial Investigation/ Feasibility Study (RI/FS) to evaluate the risk associated with the contaminated soil and long-term storge of PCBs in an underground bunker.

Site 3 Evaluation of the new rules under Resource Conversation and Recovery Act of 1976 (RCRA) Subtitle D, including implementation of a corrective action plan under the new rules and the implementation of a broader based groundwater monitoring program. The groundwater monitoring program should include development of a data base adequate to evaluate the seasonal variations in groundwater gradient at the landfill and additional sampling to assess groundwater quality in the down gradient direction. The latter may require the installation of additional wells.

Site 4 An immediate stop to all fire training exercises at existing pits and design and construction of new fire training pits for future exercises. The inclusion of all fire training pits as sites for further evaluation as part of a base-wide environmental assessment or installation restoration

program. An assessment of the relationship of FTP-1 to an existing landfill that underlies a portion of the fire pit. The removal of contaminated soil at the surface of FTP-1 (the portion not underlain by landfill material), FTP-2, and FTP-3 and replacement with clean soil or gravel to eliminate the potential for tracking of contaminants to other areas. Construction of a minimum of three groundwater monitoring wells at both FTP-3 and FTP-4 to establish groundwater gradient and sampling and analyses of the groundwater at those locations to evaluate groundwater quality. Evaluation of soil remediation techniques at FTP-4 to include vapor extraction and in-situ bioremediation.

1.0
INTRODUCTION

The U.S. Air Force contracted Woodward-Clyde Consultants (WCC) to conduct Stage 1 investigations under the Installation Restoration Program (IRP) for the U.S. Army, Directorate of Engineering and Housing (DEH) at three Army Posts in Alaska. The sites include the Anchorage Fuel Terminal near Fort Richardson, the Roosevelt Road Transmitter Site on Fort Richardson, the Fort Wainwright Landfill on Fort Wainwright, and four Fire Training Pits, two at Fort Richardson, one at Fort Wainwright, and one at Fort Greely (see Figure 1-1). This volume addresses the results of investigations conducted at the Roosevelt Road Transmitter Site.

1.1 PURPOSE OF THE INSTALLATION RESTORATION PROGRAM

1.1.1 Program Objectives

The objectives of the IRP are to assess sites where potentially hazardous material may exist, and to develop and recommend remedial actions for those sites that pose a threat to human health and welfare or the environment. Although the IRP is specifically for United States Air Force facilities, for this project the resources of both the Air Force and the U.S. Army have been combined through the Directorate of Engineering at Fort Richardson, Alaska. This was appropriate because a number of the sites investigated have been either operated or shared by the Air Force and the Army.

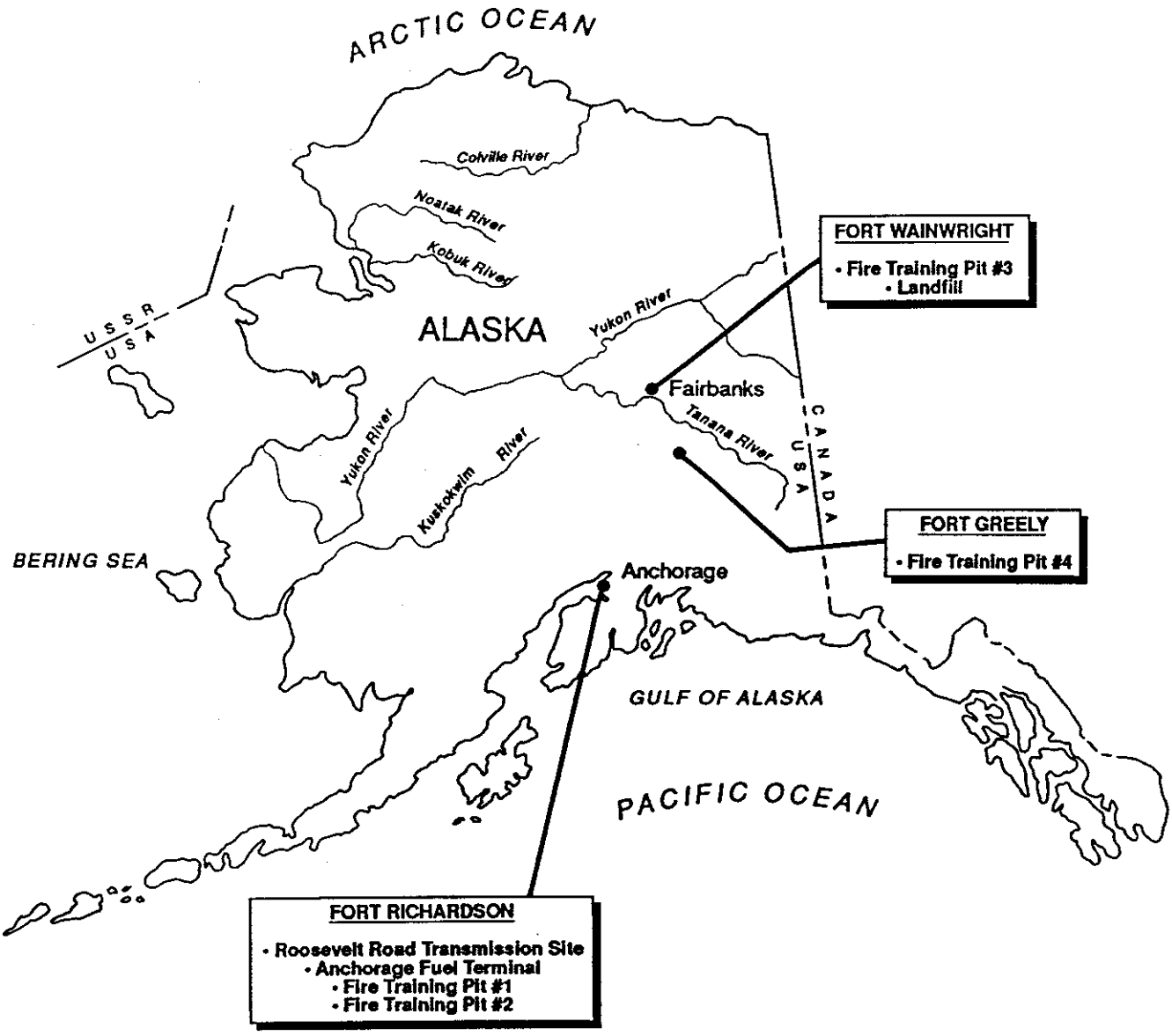


Figure 1-1 Regional Location Map

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1.1.2 Program Origins

Due to their primary mission of defense of the United States, the United States Air Force and the United States Army have long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations that require the identification and characterization of locations where potentially hazardous materials may exist and for responsible parties to take action to eliminate hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of RCRA, Federal agencies are directed to assist the Environmental Protection Agency (EPA); and under Section 3012, state agencies are required to inventory previously used disposal sites, and Federal agencies are required to make the information available to the requesting agencies.

To ensure compliance with these hazardous waste regulations, the Department of Defense (DOD) developed the IRP. The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the IRP. DOD policy is to identify and fully evaluate suspected problems associated with hazardous waste contamination, and to implement remedial actions which will minimize hazards to health and welfare that resulted from these past operations. The IRP is the basis for response actions on Air Force bases under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, clarified by Executive Order 12316. CERCLA and the Superfund Amendments and Reauthorization Act (SARA) of 1986 are the primary legislation governing remedial action at past hazardous waste disposal sites.

1.2 PROJECT PHASES

The IRP is a program designed to identify those sites which may be contaminated with hazardous materials, identify the degree and extent of contamination, evaluate appropriate treatment technologies, and recommend remedial actions. The Air Force

has developed the IRP to comply with Federal regulations. In the past the IRP was a sequential four-phased program. Each phase is briefly described below:

- Phase I -- Records Search. In this phase, previously used sites which may contain hazardous materials were identified. This phase constituted a preliminary assessment of the hazards at each installation. Sites were identified from a review of installation records and interviews with current and former installation employees. Hazards and potential hazards were assessed based on material disposed and a review of regional geological and hydrogeological factors. Sites were then ranked and those with the highest hazard potential were recommended for additional investigation in Phase II. Phase I did not include sampling and analysis.

- Phase II -- Confirmation. In this phase, field and laboratory data were collected and analyzed to identify the nature and extent of the contamination at sites identified in Phase I. Sites requiring remedial action were identified and programmed for further work.

- Phase III -- Technology Base Development. Contaminants identified in Phase II were further evaluated to determine if they could be treated with known technologies. If no existing treatments were identified, new treatment technologies were developed in this phase.

- Phase IV -- Operations. This was the action phase of the IRP. Remedial actions were recommended, then designed, built, and implemented.

The Air Force has modified its IRP to make it similar to the EPA's Remedial Investigation/Feasibility Study (RI/FS) program. It has combined Phase II and a portion of Phase IV in order to conduct the remedial investigation and feasibility study in parallel, where practical, instead of doing so in serial fashion. With the modified approach, preliminary remedial alternatives can be identified and screened as information on the nature and extent of contamination is obtained. The early identification of remedial alternatives that are potentially applicable contributes to the definition of further data requirements, including data required to assess the

feasibility of the preliminary remedial alternatives (e.g., treatability or incineration characteristics).

The investigation described in this report is a combination of Phase I, Phase II and a portion of Phase IV of the Installation Restoration Program for the site.

1.3 HISTORY OF THE SITE

1.3.1 History of Fort Richardson

Fort Richardson was established in 1940 under the command of the Alaskan Defense Force (ADF) to protect Alaska against foreign attack. The on-post airfield was named after Captain Hugh M. Elmendorf. In 1941, ADF was redesignated the Alaskan Defense Command (ADC) and the post had 7,800 stationed Army personnel. Fort Richardson was a staging and supply area during World War II, and the troop size varied from 7,800 to more than 15,500. In 1943, ADC was renamed Alaskan Department, and, in 1947, the Alaskan Department was reorganized as U.S. Army, Alaska (USARAL).

In 1950, Fort Richardson was divided between the Army and Air Force. On the northern part of the installation, the Army established a new cantonment area and land was released to the Air Force where they formed Elmendorf Air Force Base. Three Nike missiles sites were established on base in 1959. In 1963, USARAL was reorganized into the 172nd Infantry Brigade. The 1964 Good Friday earthquake caused $17 million in damages to Fort Richardson. Most damage was incurred at the Site Point Nike Hercules battery. In 1973, FORSCOM assumed control of the base.

1.3.2 Roosevelt Road Transmitter Site History

A limited amount of information has been made available to WCC regarding the site history and previous clean-up operations. The EPA has been contacted and does not have any records pertaining to the previous clean-up operation conducted under their direction. The following is a description of the site history based upon best available information.

The Roosevelt Road (RR) site (see Figure 1-2) was the location of a bomb proof communications center, apparently from World War II through the Korean War era. The site was established as a joint Army/Air Force facility, and it is probable that the Air Force maintained some facility usage after 1947. The final date of operation is not known at this time. The Army has always been the owner of the site.

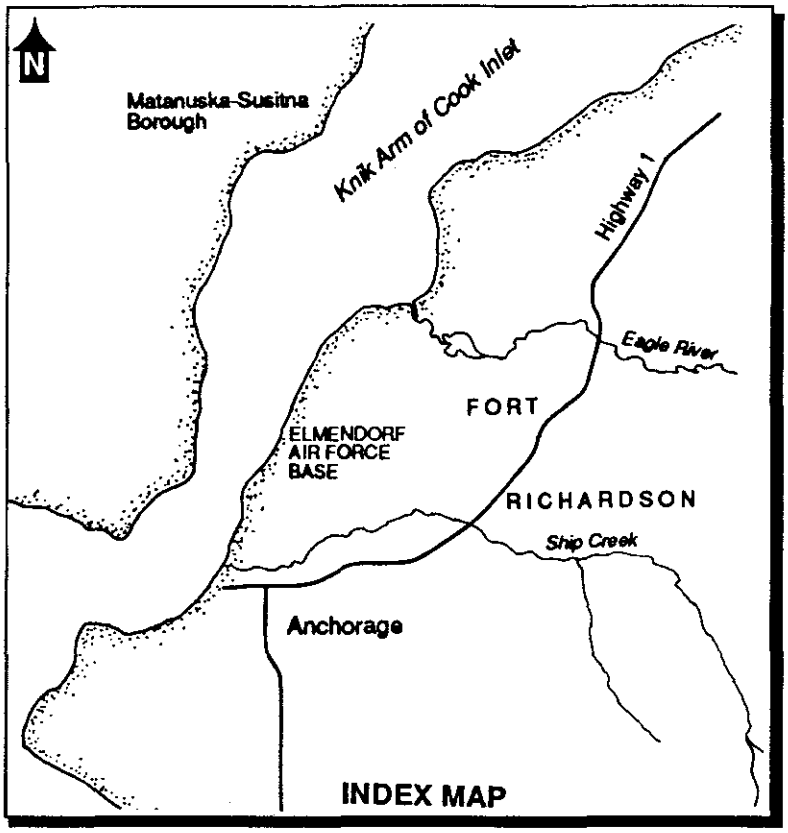
An initial spill of polychlorinated biphenyls (PCBs) occurred in the late 1970s when PCB-laden transformers were apparently vandalized for the recovery value of copper. The date of this release is unknown, but initial recovery was performed under the guidance or with technical assistance of the EPA. The actual clean-up was performed by Crowley Environmental. Although records are incomplete, it is believed that the contaminated area was triple washed with diesel and the materials and oils were placed in the bunker on site and the bunker was sealed. Additional wastes at the site include diesel from the 1970s clean-up and trichlorobenzene, originally present in the transformers as a solvent to keep the PCBs mobile.

1.4 SITE DESCRIPTION

The RR site is located more than one mile north of the main installation facilities and approximately 1000 feet north of the intersection where Roosevelt Road turns west toward Otter Lake. The site lies at the end of the dirt road which continues north at this intersection. The area is situated just south of a bluff overlooking the Eagle River drainage and approximately 1000 feet south of an existing railroad line.

1.5 SITE CONTAMINATION

Very little site-specific data are available on the RR site. Excavation and drilling at the site have revealed that the shallow subsurface consists of sands and gravels, with some silty sands and organics near the surface. Soil testing programs have identified PCB contamination above 10 ppm as deep as 14.5 ft. Maximum detected levels on the site are near 80,000 ppm. Prior to the 1988 investigations, the vertical extent of the contamination was unknown.



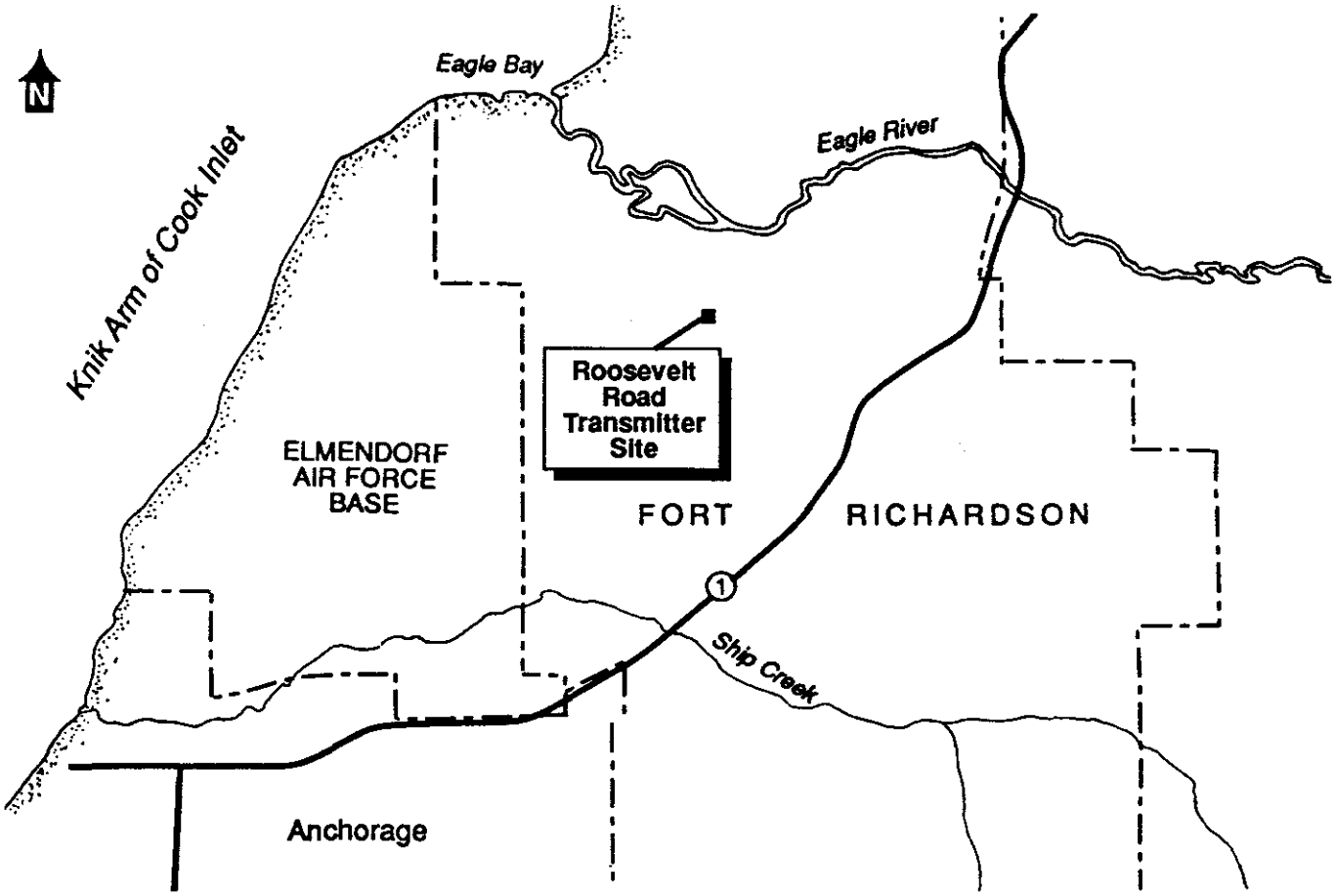


Figure 1-2 Roosevelt Road Site

Woodward-Clyde Consultants

1.6 IDENTIFICATION OF THE FIELD TEAM

Kelly Susewind of WCC directed on-site remedial removal operations. Martech Construction, Inc. was contracted by WCC to perform the excavation activities associated with remedial removal operations.

1.7 ORGANIZATION OF THE REPORT

The report for the Joint Resources Project (JRP) is organized into volumes reflecting the four sites identified in the Statement of Work. These sites included the Anchorage Fuel Terminal, Anchorage, Alaska (Volume 1); the Roosevelt Road Transmitter site, Fort Richardson, near Anchorage, Alaska (Volume 2); the Fort Wainwright Landfill, Fort Wainwright, near Fairbanks, Alaska (Volume 3); and the Fire Training Pits, FTP-1 and FTP-2 at Fort Richardson, FTP-3 at Fort Wainwright, and FTP-4 at Fort Greely, near Delta Junction, Alaska (Volume 4).

Each of the volumes includes an Executive Summary that provides information on all of the sites evaluated for the JRP. The individual volumes are site specific. Volume 2's (Roosevelt Road Transmitter Site) sections include an introduction with the history, description, and discussion of contamination previously identified; a discussion on the environmental setting which includes geography, geology, hydrogeology, air quality, biology and ecology, and climatology/meteorology; a description of the field investigation program carried out at the site including organization and development of the program, data quality objectives, and the various elements of the field and laboratory program; the results and significance of findings at the site including a risk assessment; and recommendations for further work where appropriate.

The JRP report also includes two volumes which contain a set of appendices. The appendices in Volume 5 include a glossary of definitions, nomenclature, and units of measure (Appendix A); project statement of work (Appendix B); well data lithologic logs (Appendix C); the raw field data (Appendix D); surveying data (Appendix E); and chain-of-custody forms (Appendix F). The appendices in Volume 6 include analytical data (Appendix G); correspondence with government agencies other than

those contracting the work (Appendix H); selected data from previous investigations (Appendix I); and biographies of key project personnel (Appendix J).

2.0
ENVIRONMENTAL SETTING

2.1 GEOGRAPHIC SETTING

2.1.1 Physiography

The Roosevelt Road Transmitter Site is located within the installation boundaries of Fort Richardson. Fort Richardson is located within two major physiographic provinces of Alaska: the Coastal Trough province, and the Pacific Border Range Province. The Cook Inlet-Susitna Lowland section is within the Coastal Trough province and encompasses the northern and eastern areas of Fort Richardson.

The site is within the Cook Inlet-Susitna Lowland areas of Fort Richardson. This lowland area typically has elevations of less than 500 feet above mean sea level (MSL) with reliefs of 50 to 200 feet. The region is characterized by flat lowlands and gently rolling hills, open-low spruce forests, numerous streams, ponds and treeless wetlands.

The main drainages of the installation are Eagle River and Ship Creek. These drainages traverse the installation from east to west and drain into Knik Arm of Cook Inlet. Eagle River forms Eagle Flats and Eagle Bay at the mouth in the northern area of Fort Richardson. This tidal flat is the largest and ecologically most important tidal marsh of the area.

Ship Creek drains the main cantonment area of Fort Richardson and is contributed to by groundwater and surface drainage areas of the fire training pits. Ship Creek flows westward through Fort Richardson, Elmendorf Air Force Base, and parts of the Municipality of Anchorage to Cook Inlet.

The site is situated in the northern margin of the outwash plains of the Anchorage Plain Deposits. The broad flat plains of alluvial and glacio-alluvial deposition extend to Cook Inlet and underlie the main cantonment area of Fort Richardson.

2.1.2 Cultural Geography

Fort Richardson, headquarters of the 172nd Infantry Brigade (Alaska), is located within the boundaries of the Municipality of Anchorage. Although entirely separate from nearby Elmendorf Air Force Base, Fort Richardson is generally regarded by area residents as part of a single, military presence in the area. Estimates indicate that roughly one-third of assigned military personnel live off-base in the Anchorage area.

The military population of Fort Richardson is 5,300, while civilian employees and military dependents total about 10,690 (DEH, 1989). Anchorage is the largest city in Alaska with a population of about 211,000; Anchorage accounts for about 50 percent of Alaska's total population, which now surpasses 426,000 (Comm. and Reg. Affairs, 1988).

Drinking water at Fort Richardson is provided by a combination of the Fort Richardson Military Dam near the headwaters of Ship Creek and several wells at the installation. Water from the dam is also allotted to Elmendorf Air Force Base and the Municipality of Anchorage. Water storage is provided by a permanent 2.5 million gallon reservoir located on the base and by the Ship Creek Dam Impoundment. A water treatment plant located near the dam provides treatment for drinking water used at Fort Richardson and Elmendorf Air Force Base.

2.2 GEOLOGY

The northern and central portions of Fort Richardson are within a structural trough of the Cook Inlet-Susitna Lowlands. This part of Fort Richardson is characterized by glacial features resulting from a series of five glacial periods in recent geologic history. The south-central and southern extent of Fort Richardson consists of outcrops and mountains of metamorphic bedrock of the Kenai Formation (Figure 2-1). The mountains and lowlands of Fort Richardson are mantled by glacial till from the Wisconsin period.

Prominent topographical features were left by the most recent glacial event, the Naptowne glaciation. The main feature near the site is the Elmendorf Moraine, which forms the high ridges just north of the main cantonment area at Fort Richardson. The Anchorage Plain deposits are a broad, flat outwash plain extending southwest, parallel to the Elmendorf Moraine. These broad flat alluvial deposits include the main cantonment area of Fort Richardson, most of Elmendorf Air Force Base, and the greater Anchorage area.

Surface soils at Fort Richardson are mainly of two types (Figure 2-2): a rocky gravelly soil predominant throughout the Kenai-Chugach Mountains, and a silt-loam glacial material found on lower slopes, moraine hills, and glacial outwash plains. The silt-loam is well drained and generally overlies a gravelly or sandy loam. Soils of the Anchorage Plain deposits are similar, but tend to contain more gravels grading into sand to the west. Peat occurs in depressions, and silty soils occupy small drainages and depressions.

The RR site is situated directly atop the Elmendorf Moraine. The Elmendorf Moraine consists of unconsolidated glacial till and poorly sorted boulders, gravel, sands, and silts.

2.3 HYDROGEOLOGY

2.3.1 Groundwater

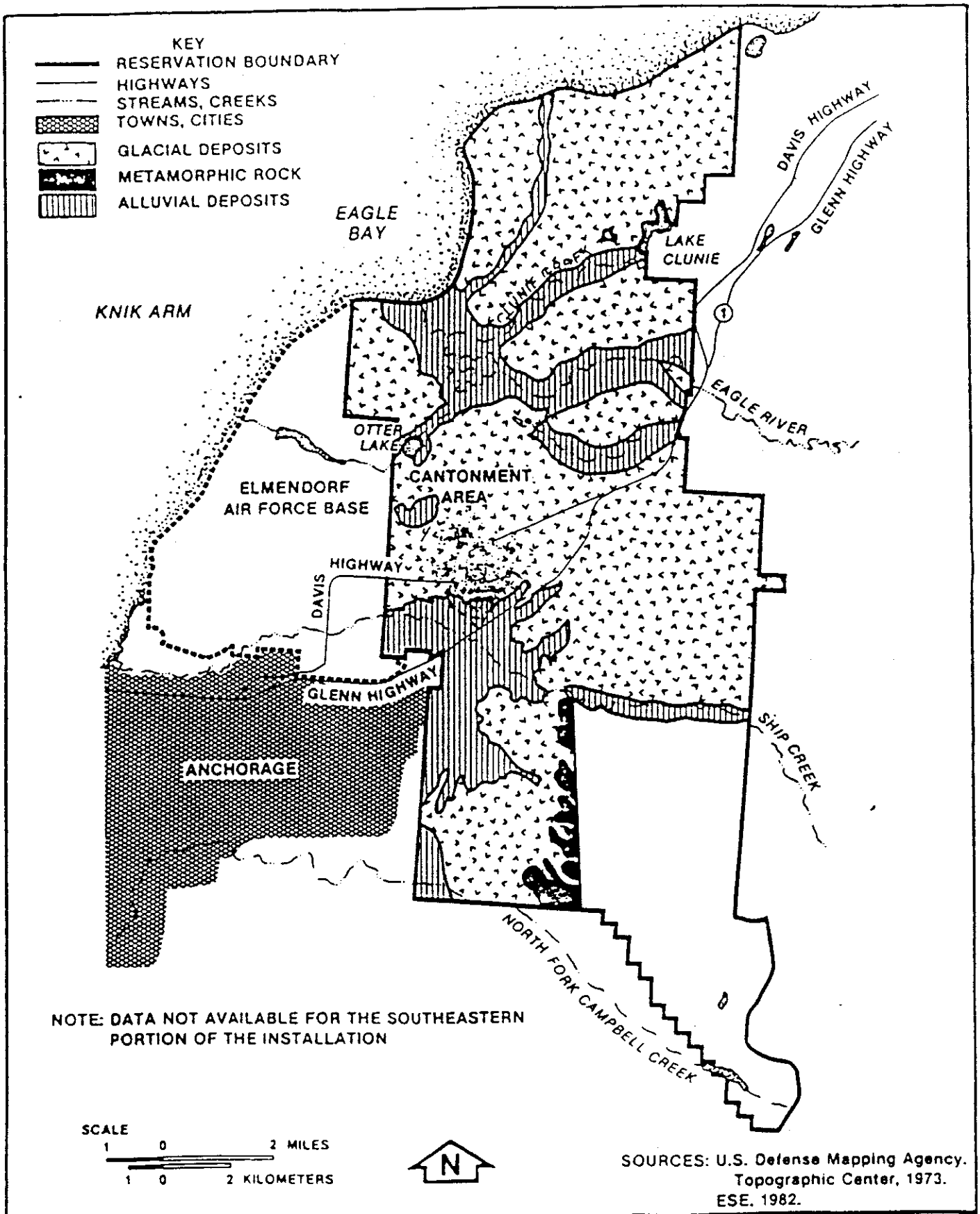
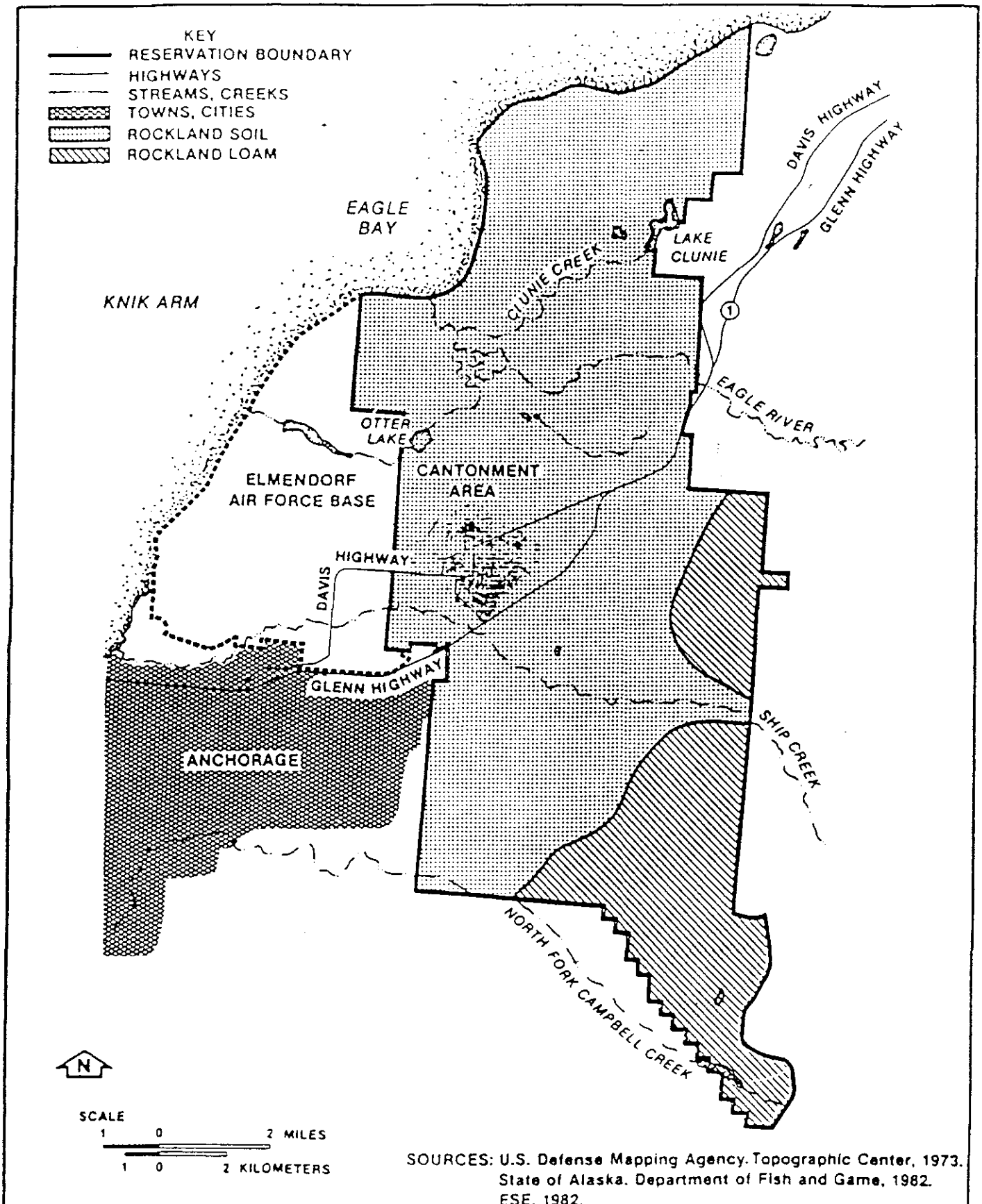


Figure 2-1
GEOLOGIC MAP OF FORT RICHARDSON

from: ESE Report "Ft. Richardson Installation Assessment", 1983

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SOURCES: U.S. Defense Mapping Agency. Topographic Center, 1973.
State of Alaska. Department of Fish and Game, 1982.
ESE, 1982.

Figure 2-2
SOILS MAP OF FORT RICHARDSON

from: ESE Report "Ft Richardson Installation Assessment" 1983

Woodward-Clyde Consultants

Fort Richardson is located in the south-central hydrologic subregion of Alaska. Groundwater reservoirs are replenished by direct infiltration of precipitation and percolation from surface waters; therefore, groundwater availability is dependent upon the amount of precipitation (Zenone and Anderson, 1978). Fort Richardson overlies a major portion of the recharge area for the confined aquifer.

The Chugach Mountains and Ship Creek are considered to be the major source of recharge for the confined groundwater conditions at Fort Richardson and the surrounding area. This aquifer yields large quantities of water to Fort Richardson, Elmendorf Air Force Base, and Anchorage (ES&E, 1983b). During times of heavy pumpage the well field in Anchorage forms a cone of depression which extends under Fort Richardson (ES&E, 1983b). Regional groundwater flow is toward the southwest. Shallow groundwater is discharged naturally as seeps or springs along the bluffs of Government Hill. Artificial discharge for shallow groundwater is accomplished by excavated ditches for drainage and pumping from wells. Average depth to groundwater at Fort Richardson is 22 feet.

The RR site is located atop a natural water divide. The groundwater on the south side of the Elmendorf Moraine flows southwesterly to contribute to the Ship Creek aquifer system. The groundwater on the north side of the moraine flows northwesterly into the Eagle River aquifer system. It has not been ascertained into which system groundwater from the RR site flows. The water table is probably fairly deep in this area.

2.3.2 Surface Water

The primary surface drainage features in the area are Eagle River and Ship Creek. Both originate in the Chugach Mountains and flow westerly across the installation into Knik Arm. Eagle River is fed by turbid glacial melt waters, and Ship Creek is sustained by snowmelt and rain water runoff. The closest major body of surface water is Eagle River, more than a mile to the north. Fort Richardson receives domestic water from an impoundment reservoir at Ship Creek in the Chugach Mountains. Figure 2-3 illustrates the surface drainage of Fort Richardson.

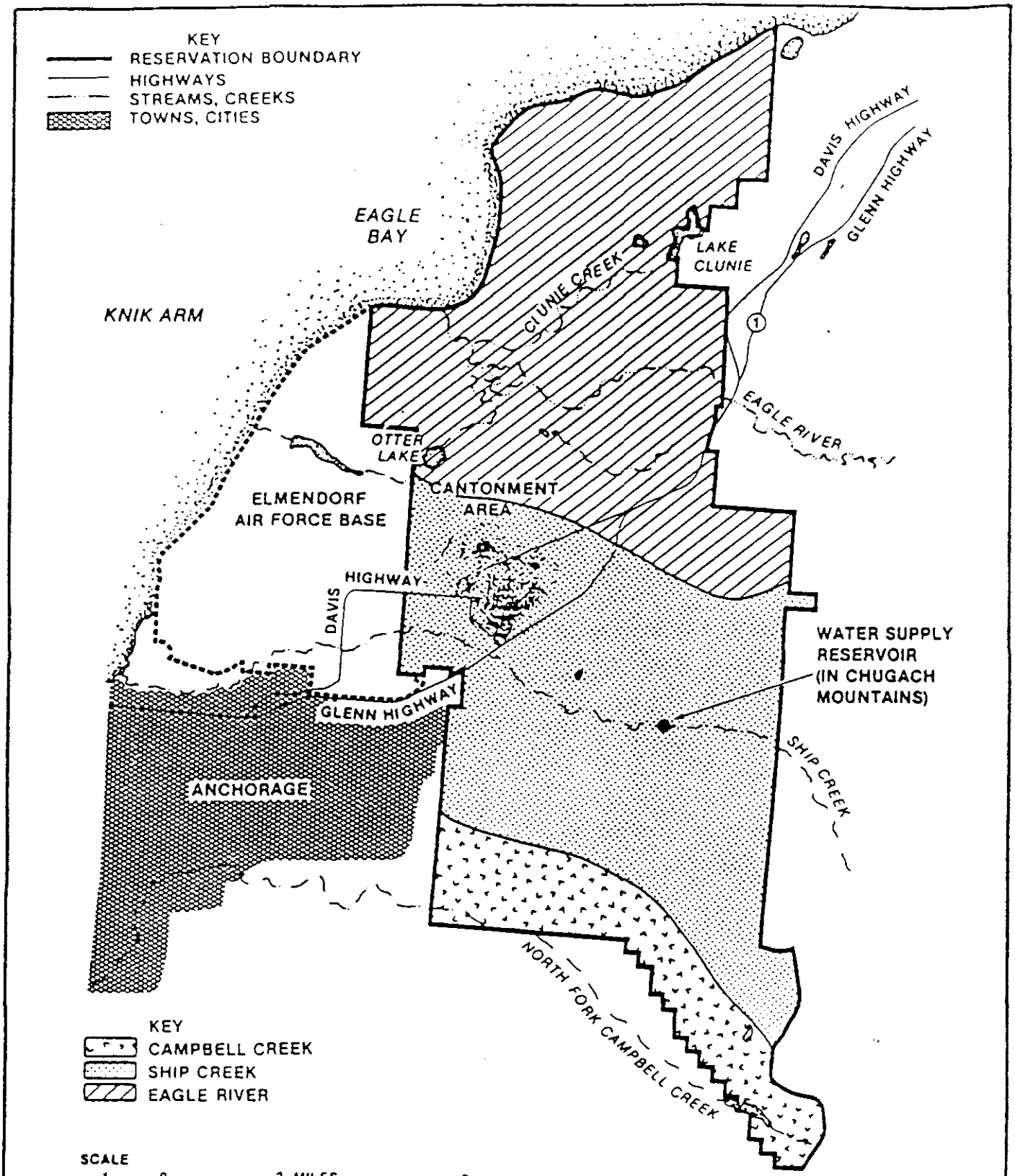


Figure 2-3
SURFACE DRAINAGE OF FORT RICHARDSON

from: ESE Report "Ft. Richardson Installation Assessment", 1983

Woodward-Clyde Consultants

Low stream discharge occurs in the winter, reaching a minimum in February-March. Peak stream discharge occurs in Eagle River in August, while peak discharge occurs in Ship Creek in June. The RR site is not near any major tributaries of Eagle River or Ship Creek.

2.4 AIR QUALITY

Air quality information for Fort Richardson is provided in the 1983 Environmental Science and Engineering, Inc. report. Based on this report, Fort Richardson is located in the Cook Inlet Intrastate Air Quality Control Region (AQCR), which is classified as Priority I for Total Suspended Particulates and Carbon Monoxide. Several stationary emission sources are present on Fort Richardson; however, emissions from Fort Richardson are small when compared to sources in surrounding areas. Proposed work described in Section 5.0 should not impact air quality.

2.5 NATURAL RESOURCES

WCC did not investigate natural resources present on Fort Richardson or in vicinity of the RR site.

2.6 BIOLOGY AND ECOLOGY

WCC did not investigate natural resources at Fort Richardson. The 1983 Environmental Engineering and Science, Inc. report provides a description of wildlife and vegetation present on-site. No threatened or endangered plant or animal species are known to reside on Fort Richardson.

2.7 CLIMATOLOGY/METEOROLOGY

Fort Richardson and the surrounding region is in a climatic transition zone between the maritime climate of the coast and the continental climate of interior Alaska. Table 2-1 provides temperature and precipitation data for Fort Richardson.

Table 2-1 Fort Richardson Climate Data

Month		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average Annual
	mean max	5.3	15	27.6	47	61.9	73.2	72.6	67.9	57.5	37.5	18.3	7.4	-
Temperature (degrees F)	mean min	-15.7	-8.7	-1.3	19.6	31.8	42.7	44.6	41.1	32.4	17.3	0.0	-10.8	-
	avg mean	-5.2	3.2	13.2	33.3	46.9	57.9	58.6	54.6	44.9	27.4	9.1	-1.7	40.9
Precipitation	mean month total	0.96	0.29	0.22	0.27	0.79	1.87	2.79	2.22	1.12	0.71	0.92	0.49	12.65
Snowfall (inches)	mean month total	12.8	5.8	3.8	4.1	0.3	0.0	0.0	0.0	0.9	6.6	14	7.2	55.6

Source: Alaska Climate Summaries - 1986
Arctic Environmental Information Data Center

3.0
FIELD PROGRAM

3.1 ORGANIZATION AND DEVELOPMENT OF THE FIELD PROGRAM

The objective of WCC's 1988 field program was to supervise an Expedited Response Action consisting of the removal of the most highly PCB-contaminated material on site, as determined by a U.S. Army Corps of Engineers (COE) field investigation conducted earlier in the year, in order to reduce the risk of accidental and incidental public exposure to high levels of contamination. The scope of the project limited removal of materials to 150 tons based on an estimate from work completed previously by the COE. The work consisted of: removing approximately 105 cubic yards of PCB-contaminated soil and debris from the site, sampling the surfaces exposed by these removals, lining the excavations, backfilling the lined excavations with clean material, cleaning the contaminated portion of the surface of the concrete pad located at the site including the cable trenches in the pad, backfilling the trenches located in the pad, encapsulating the pad and trenches, and shipping all materials collected to the Defense Reutilization and Marketing Office (DRMO) on Elmendorf Air Force Base, Anchorage, Alaska. Details are presented in Sections 3.2 and 3.4 of this report.

3.2 FIELD PROGRAM

WCC subcontracted Martech Construction of Anchorage, Alaska to conduct a PCB clean-up operation at the Roosevelt Road Transmitter site from 24 Sept to 28 Oct

1988, under WCC guidance. Details of this clean-up effort are presented in this section.

3.2.1 Delineation of Excavations

WCC used information contained in the "Roosevelt Road Transmitter Site Cleanup" statement of work and drawings (Project #XX00021/8/P, Drawing #FR35-19-01) to determine the limits of the excavations. Based on this work by the COE, the United States Air Force (USAF) established a maximum of 150 tons of hazardous materials to be delivered to DRMO. This limiting weight was used to estimate that approximately 100 cubic yards of material could be excavated and delivered. Since this volume was not large enough to remove all materials with PCB concentrations greater than 10 ppm (the designated clean-up level), the program was designed to target: (1) removal of the most highly contaminated material; and (2) removal of material within the 10 ppm isoconcentration line where possible.

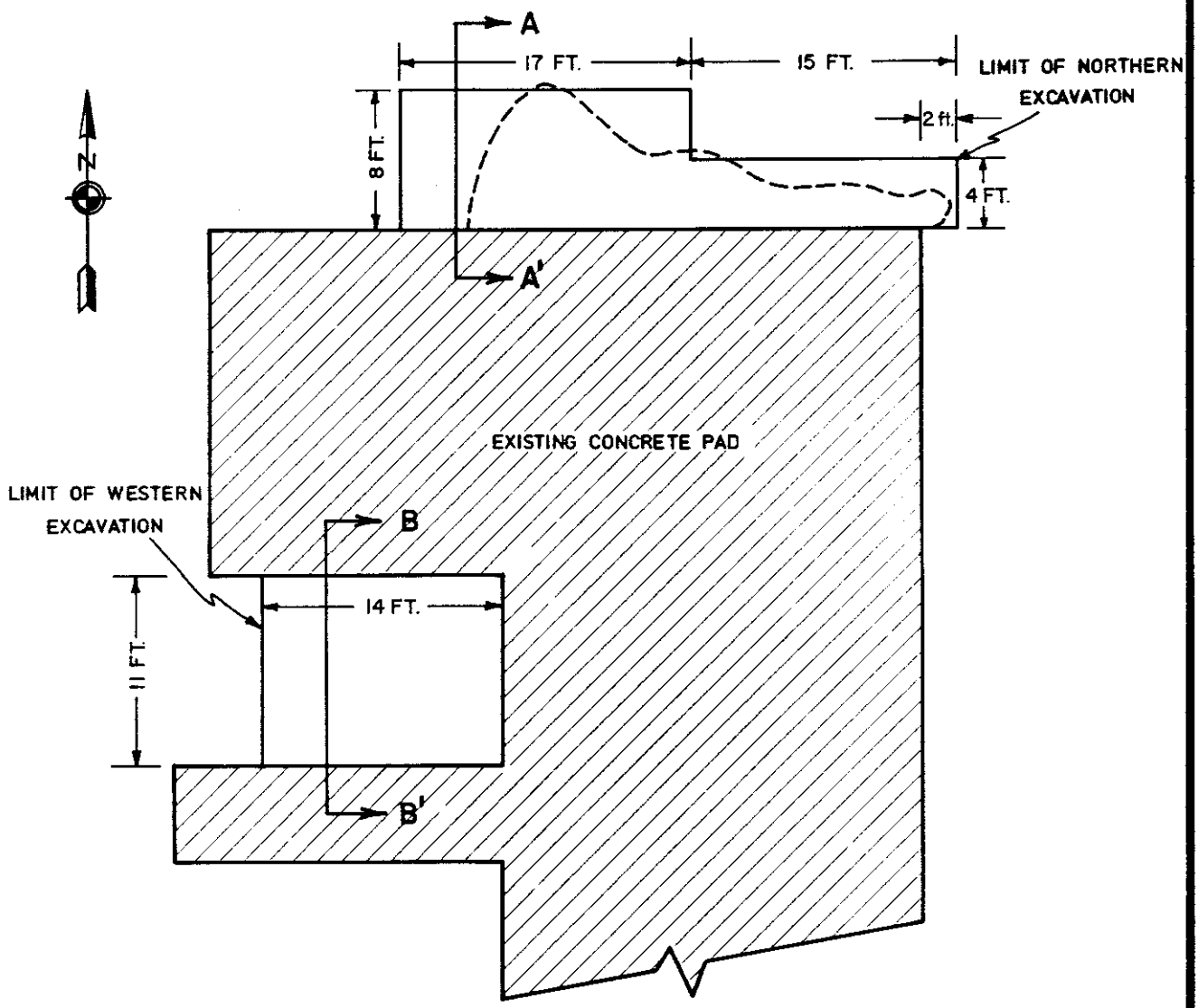
The excavations which resulted from this approach are shown in Figures 3-1, 3-2, 3-3, 3-4, and 3-5. Work zone bounderies and COE sampling points are shown on Figure 3-6.

3.2.2 Methodology

3.2.2.1 Establishment of Work Zones

Field work began by establishing an exclusion zone, a contamination reduction zone, and a clean zone at the site (see Figure 3-6). These zones were established to meet the requirements of Section 8.2 of the WCC Health and Safety Plan for the Joint Resources Project to minimize personnel exposure to PCB-contaminated airborne dust.

The exclusion zone included the areas to be excavated as well as that portion of the concrete pad which was to be cleaned and encapsulated. Personnel entering this zone were required to use EPA Level "C" protective equipment and have adequate training to work in a Level "C" environment. Level "C" protection in this case consisted of: neoprene safety boots, Tyvek coveralls, latex inner gloves, nitrile outer gloves, a hard hat, and an air purifying respirator with appropriate cartridges as determined by the



1 INCH = 10 FEET

0 10 20

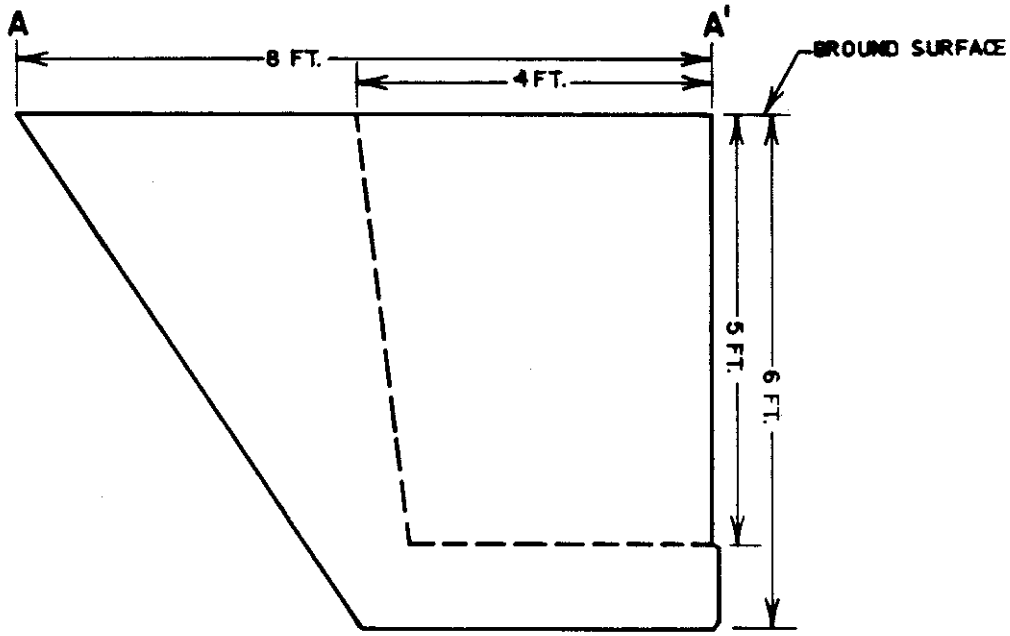
Legend:

Approximate 10ppm Isoconcentration Line

LOCATION OF EXCAVATIONS

Woodward-Clyde Consultants

Figure 3-1





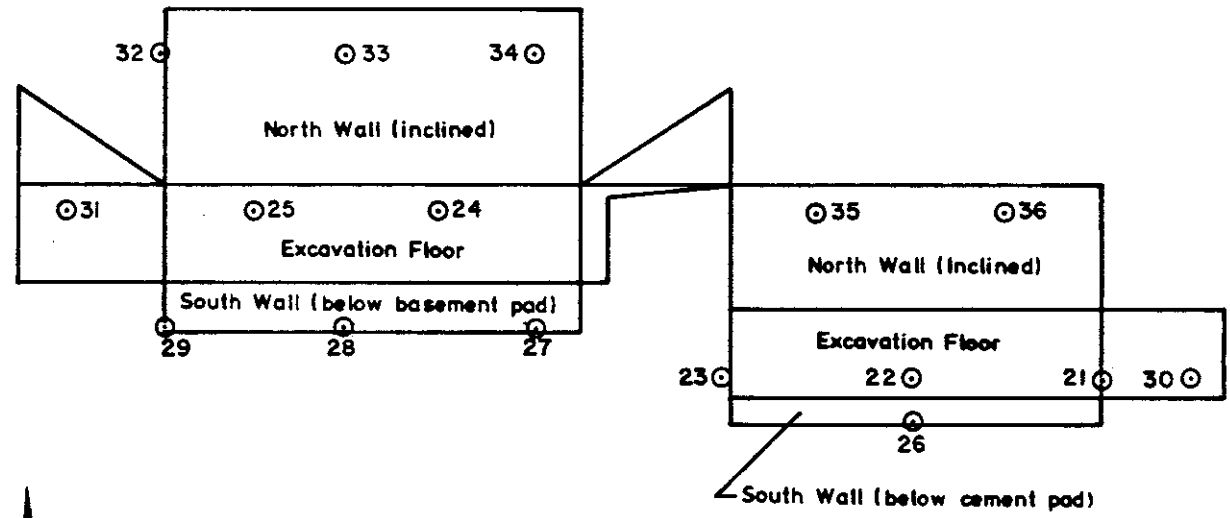
Note: Volume of soil removed from Northern excavation = 32.5 cubic yards

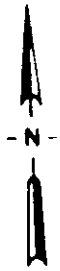
SECTION A - A'
NORTHERN EXCAVATION

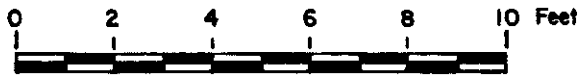
Woodward-Clyde Consultants

Figure
3-2

NOTE: Two additional wipe samples (19,20) taken from cement face







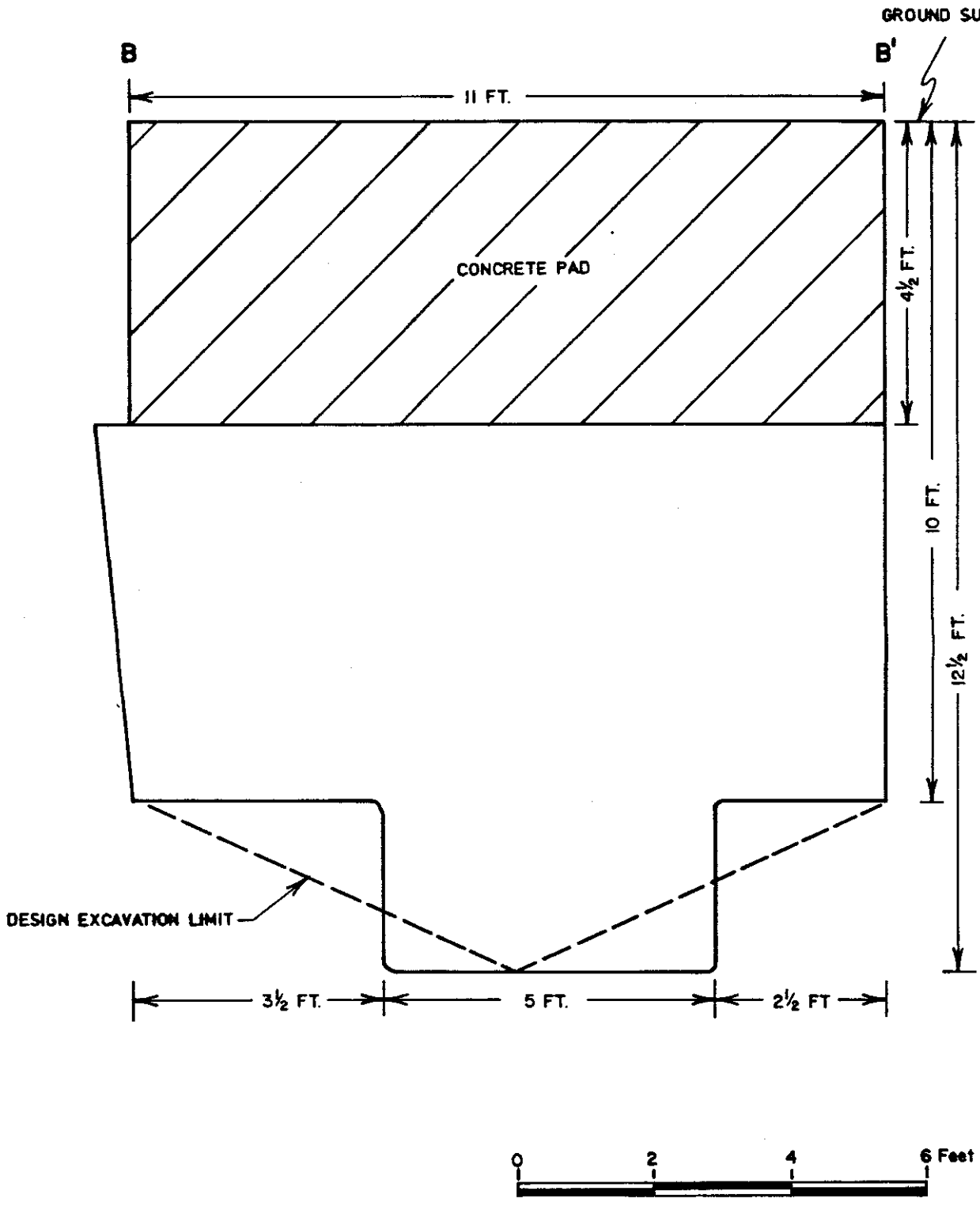
LEGEND

⊙ WCC Sampling Point

WCC SAMPLING POINTS LOCATED ON FOLD-OUT FOR NORTHERN DESIGN EXCAVATION

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Figure 3-3

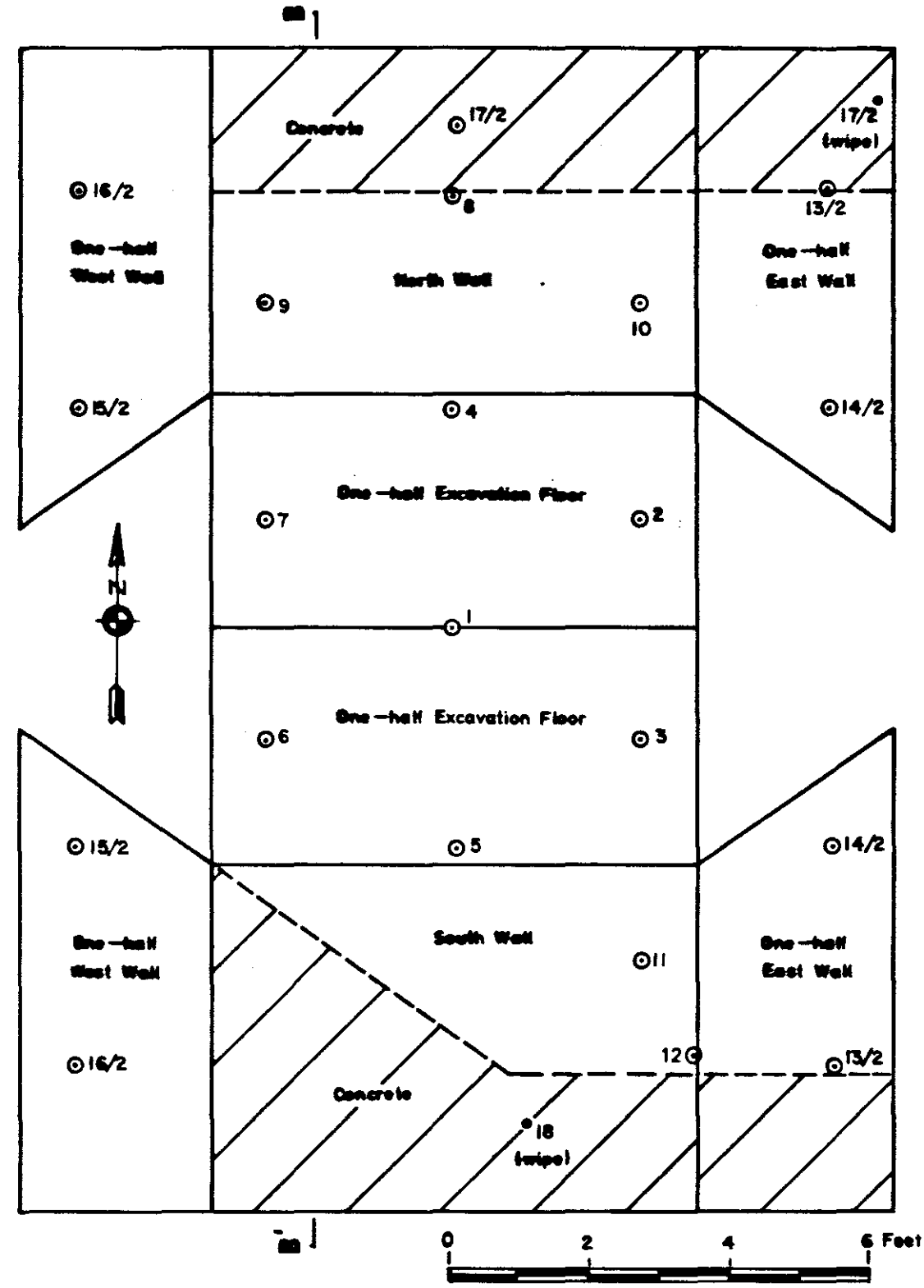


Note: Volume of soil removed from Western excavation = 63 cubic yards.

SECTION B – B'
WESTERN EXCAVATION

Woodward-Clyde Consultants

Figure
3-4



LEGEND

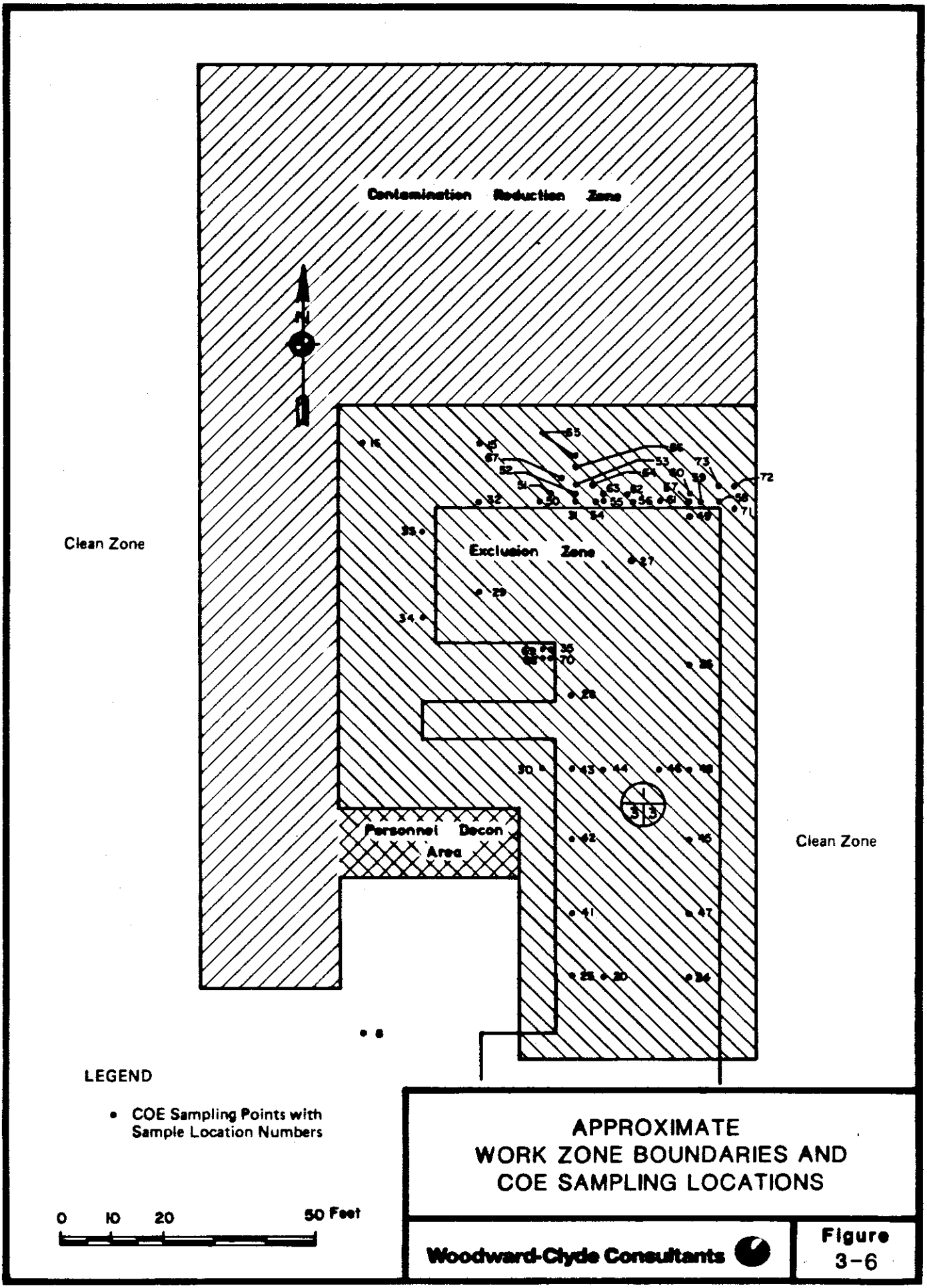
⊙ WCC Sampling Point

/2 Composite Sample

WCC SAMPLING POINTS LOCATED ON FOLD-OUT FOR WESTERN DESIGN EXCAVATION

Woodward-Clyde Consultants

Figure 3-5



APPROXIMATE
WORK ZONE BOUNDARIES AND
COE SAMPLING LOCATIONS

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Figure
3-6

site safety officer. In addition, tape was used to seal the coveralls to both the boots and the outer gloves.

The contamination reduction zone was the area which separated the exclusion and clean zones. This area was used for decontamination of personnel leaving the exclusion zone as well as for a staging area to temporarily store bags of excavated material before shipping them off site. Personnel entering the reduction zone without continuing into the exclusion zone were required to wear tyvek coveralls and neoprene safety boots.

The clean zone consisted of all areas not within the exclusion or reduction zones; no protective equipment was required in the clean zone.

3.2.2.2 Excavation and Removal of Soil

Equipment used to excavate and contain the soil included a trackhoe (Takeuchi TB68) with a one-half yard bucket and a forklift with a telescoping boom (JCB 530B Loadall). A bag approved for transporting PCB contaminated soil (manufactured by Bag Corp, Houston, Texas) was used to contain and ship the soil. This bag consisted of a woven polypropylene outer bag and a polyethylene inner bag, each of which were sealed prior to being transported.

The bags were suspended by the forklift, which stayed in the contamination reduction zone, with only the forks and the bag entering the exclusion zone via the telescoping boom. The trackhoe was used to excavate soil under the guidance of a WCC engineer who had previously established the limits of excavation and marked them. The soil, consisting of gravelly medium to coarse sand and sandy gravel, was transferred directly from the trackhoe bucket into the bag. The bag was then retracted by the forklift and taken to the staging area where it was placed on six-mil polyethylene sheeting for temporary storage prior to shipment off site. Upon completing excavations, the bags were individually weighed, properly labeled in accordance with 49 CFR 172, loaded onto low-boy trailers, and trucked to DRMO with the appropriate documents. The geometry of the excavations is shown in plan view on Figure 3-1; vertical cross sections are shown on Figures 3-2 and 3-4. A total of approximately 95

1/2 cubic yards of soil were removed, 63 cubic yards from the western excavation and 32 1/2 from the northern excavation.

3.2.2.3 Cleaning and Encapsulation of the Concrete Pad

Martech personnel removed all debris from the top of that portion of the concrete pad, and the gridded cable trenches located in the pad, within the exclusion zone (see Figure 3-6). The debris was removed using hand tools and was placed in the same type of bag used for the excavations. The material consisted of soil, vegetative matter, ceramic tile, and a few pieces of iron pipe. The forklift was used to remove the bags from the exclusion zone and transport them to the staging area where the bags were weighed and processed. Approximately 10 1/2 cubic yards of material were removed from the concrete pad and trenches.

After the pad had been cleaned, the top of it was encapsulated using an epoxy resin (Scotchkote by the 3M Company). The gridded cable routing trenches along the surface of the pad were sealed in one of two ways. Approximately 40 percent of the trenches were sealed with the epoxy resin brushed on and were then backfilled with clean soil. This method proved to be labor intensive and expensive.

The remainder of the trenches were filled with gravel to a level approximately three inches below the top of the pad and the remaining three inches were filled with cast-in-place concrete. This method was found to be cost effective, and it provided the added benefits of a solid walking surface and a protective cap to prevent the gravel from being displaced from the trenches.

3.2.2.4 Backfilling of Excavations

Analysis of the clean-up verification samples indicated that all material with greater than 10 ppm PCB had not been removed (see Section 4.1.3). Therefore, it was decided to line each excavation prior to backfilling. This would prevent the backfill from being contaminated and allow it to be handled as clean material in any future remedial efforts. The liner consisted of two 16-mil layers of a solvent and oil resistant synthetic fabric (Permalon 200) prefabricated to fit each of the excavations. The liners utilized heat-welded seams and fabricated corners. The liners were placed

in the excavations followed by approximately 100 cubic yards of clean gravel backfill.

3.2.2.5 Demobilization

All equipment used on site for the excavations was decontaminated using a steam cleaner per procedures outlined in the USAFOEHL-TS Handbook, Version 2.0, April 1988, and was then removed from the site. All wash water was put in containers and shipped to DRMO with the other waste material removed from the site.

A total of 144.1 tons of contaminated material was trucked to DRMO. This consisted of 141.9 tons of excavated soil, 0.6 tons of debris generated by the clean-up effort (coveralls, polyethylene sheeting, etc.), and 1.6 tons of wash water from decontamination operations.

3.3 FIELD INVESTIGATION PROGRAM

The investigative portion of this program was limited to clean-up verification sampling. A complete description of this activity is presented in Section 3.4 of this report.

3.4 SAMPLING PROGRAM

The sampling program for this site was limited to the collection of clean-up verification samples. These samples were intended to determine the presence or absence of soils contaminated with greater than 10 ppm PCBs following completion of the excavations. This section of the report discusses: types and numbers of samples taken; sampling methodology and protocols; sample preservation; and the field Quality Assurance (QA) program.

3.4.1 Types and Numbers of Samples Taken

Two types of samples were collected - soil and wipe samples - and analyzed for PCBs. A total of 32 soil samples, 16 from each excavation, and 4 wipe samples, 2 from each excavation, were collected. All samples were analyzed by EPA Method 8080 within the

specified holding time of 14 days. Sample locations are presented on Figures 3-3 and 3-5.

3.4.2 Sampling Methodology and Protocols

3.4.2.1 Sample Locations

WCC personnel sampled 36 locations in the exposed surfaces of the excavation using USEPA Report #560/5-86-017, "Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup," as a guideline (Figures 3-3 and 3-5). This method utilizes a hexagonal grid placed over the surfaces of the excavation which have been diagrammed in a single plane. Constructing this diagram is analogous to cutting and flattening a cardboard box; the resulting diagram is referred to as a fold-out. This approach was used when applicable; the following modifications were implemented to better address this specific site:

- The grid was placed over a fold-out of the design western excavation rather than a fold-out of the actual excavation. The actual excavation differed only slightly from the design, and the somewhat irregular excavation surface would have greatly complicated the fold-out while changing the sample locations an insignificant amount.

- Not all grid points which fell on the vertical face of the concrete pad to the east of western excavation were sampled, but a reduced number of samples and composite samples were taken from the pad. The purpose of sampling the excavations was to determine if all contaminated soil (greater than 10 ppm) had been removed by the excavation, and it was our opinion that a reduced number of samples from the concrete would adequately determine the level of contamination on the pad while allowing additional samples to be taken in the soil.

- Following the same logic as the argument just given, the concrete face was not included in the fold-out for the northern excavation. This had the effect of concentrating sample points in the soil. Two wipe samples were taken from

the vertical face of the pad, in addition to all grid points located using the fold-out for just the soil faces of the excavation.

o Grid points which fell in non-existent space for the northern excavation were adjusted to fall within the excavation.

These modifications were minor and allowed for better coverage without significant departure from the procedure.

3.4.2.2 Sample Collection and Preservation

Soil Samples

Soil samples were taken using a stainless steel hand auger. This apparatus allowed sampling to be conducted from the top of the excavation and did not require personnel to enter the excavation. The device consists of two cutting blades attached to a nine-inch core basket which is connected to a metal shaft with a handle perpendicular to the shaft.

The auger was advanced by turning it while exerting a downward pressure until the core basket was full. The auger was then retrieved and the contents of the basket were transferred, using clean stainless steel spoons, directly into sample jars supplied by the laboratory. The jars were then placed in a cooler with ice to preserve the samples.

Prior to the shipment to the laboratory for analysis by EPA Method 8080, a headspace reading for volalite organic compounds was taken using an HNu meter with a 10.2 eV probe on all soil samples. All samples were at a uniform temperature when the readings were taken.

Wipe Samples

Wipe samples of the cement surfaces were collected by first applying a sheetmetal template to the area of interest. This template allowed an area of one square foot to be wiped using a sterilized absorbent gauze saturated in solvent (hexane). The gauze

was then placed in a sample jar and placed in a cooler with ice to preserve the sample.

After completing sampling, all samples (chilled to approximately $4^{o}C$) were delivered to the lab with a completed chain-of-custody form.

Decontamination Procedure

Because it contacts the sample, sampling equipment requires different decontamination procedures than equipment used in the excavations. All sampling equipment was decontaminated per procedures outlined in the USAFOEHL-TS Handbook, Version 2, April 1988, prior to collecting each sample. This consisted of washing the apparatus (hand auger, template, stainless steel spoons, etc.) in laboratory-grade detergent followed by rinses with drinking quality water, high purity liquid chromatography water, pesticide-grade methanol, and pesticide grade hexane dispensed from teflon bottles. Rinse liquids were collected and disposed of with the decon wash water. Clothing, gloves, etc. used by personnel during sampling were included in the contaminated materials drummed and trucked to DRMO.

3.4.3 Field Quality Assurance Program

A specific field quality assurance/quality control (QA/QC) plan was not developed for the site. WCC performed all site work in a manner consistent with the current professional state of the practice. Quality assurance measures used included but were not limited to:

- EPA grid method for selection of sample locations as discussed in Section 3.4.2.1
- sample collection and preservation, decontamination of equipment, taking field measurements, maintaining a safe work environment, avoiding the additional spread of contamination, and protocols as discussed in the previous section
- preparing chain-of-custody documents covering all samples taken

- o accurately documenting field procedures, and
- o meeting all applicable regulations concerning materials handling, packaging, and shipping.

3.5 DATA QUALITY OBJECTIVES

The purpose of QA/QC procedures is to produce data of a known high quality that meet or exceed program requirements. Chemical data collected in this program were limited to analytical results of clean-up verification samples. These samples were intended to verify the presence or absence of PCB contamination in excess of the clean-up requirements. Because no quality control samples were collected (replicates, trip blanks, rinsate blanks, etc.), no quantitative data quality objectives were established. Qualitative objectives were established to provide high quality data by following the field quality assurance program discussed in Section 3.4.3.

3.6 LABORATORY PROGRAM

3.6.1 Identification of Laboratory

Chemical and Geological Laboratory of Anchorage, Alaska analyzed all clean-up verification samples taken at the Roosevelt Road Transmitter Site. All samples were analyzed by EPA Method 8080 within the specified holding time of 14 days.

3.6.2 Description of Analytical Parameters

Aroclor 1260, a PCB, was the only PCB detected in the 1988 WCC field investigation program. Instrumentation used, analytes detected, analytical interference and other factors which affect method reliability, etc. are presented in Appendix G, analytical data.

3.6.3 Laboratory QA/QC Program

The laboratory QA/QC program is discussed in Appendix G.

4.0
RESULTS AND SIGNIFICANCE OF FINDINGS

4.1 PRESENTATION OF RESULTS

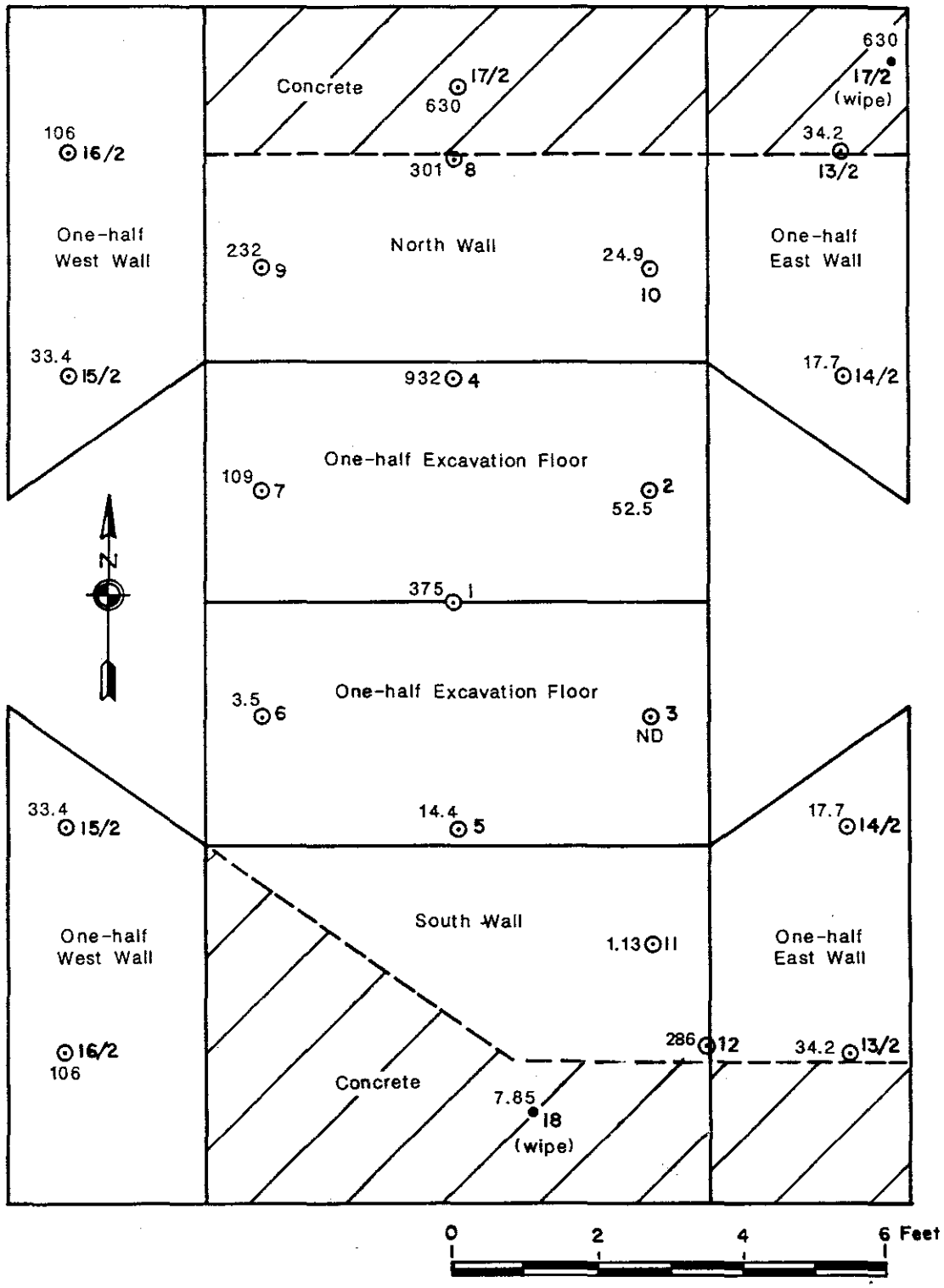
This section presents the results of the clean-up verification sampling performed following completion of the excavations as well as information gathered during the excavations.

The two excavations encountered brown gravelly sand fill with a trace silt extending from the surface to the maximum depth excavated (12.5 ft). The location of each excavation is shown in Figure 3-1. The excavations made at the site did not encounter groundwater to a depth of 12.5 feet.

The only chemical constituents analyzed for were PCBs (Aroclor 1260). Concentrations ranged from below the limit of detection (0.6 ug/l) for one sample (No. 3) to 23,400 ppm (Sample No. 24). Figures 4-1 and 4-2 present WCC sample locations with corresponding PCB concentrations. Table 4-1 also presents analytical results.

4.2 SAMPLING OR ANALYTICAL PROBLEMS

No sampling or analytical problems were encountered. All samples were collected from their designated positions in accordance with the sampling protocols discussed in Section 3.4.



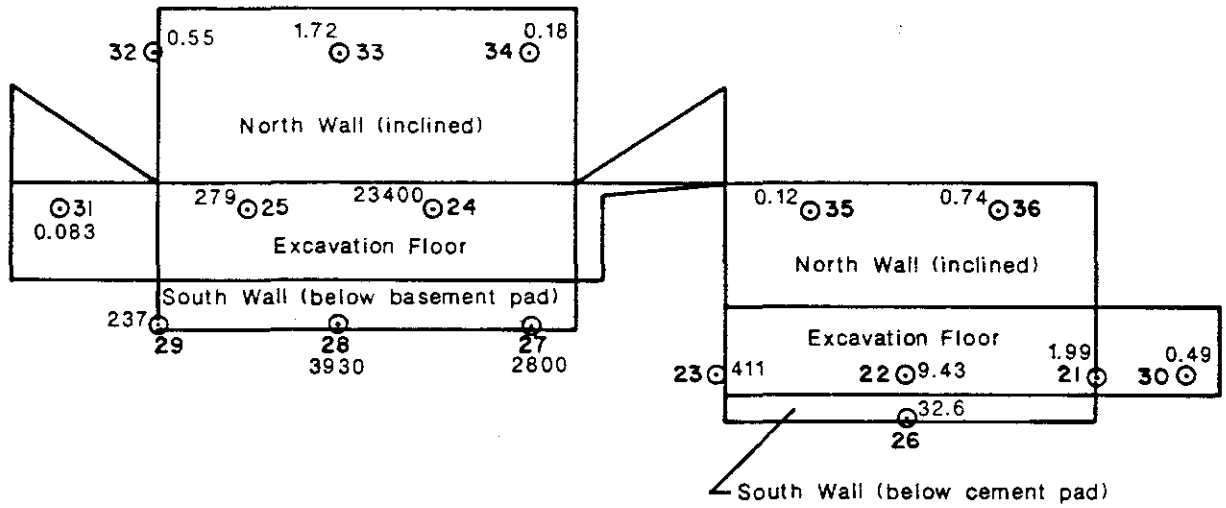
LEGEND

⊙	Sampling Point
10	Sample Location Number
/2	Composite Sample
24.9	PCB Concentration in ppm

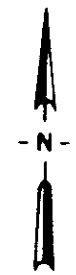
PCB CONCENTRATION (IN ppm)
AT WESTERN EXCAVATION SITE

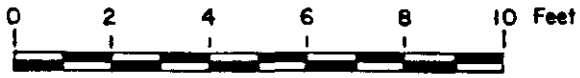
Woodward-Clyde Consultants

Figure
4-1



Note: Two additional wipe samples (19, 20) taken from cement face.





LEGEND

- ⊙ WCC Sampling Point
- **33** WCC Sample Location Number
- 1.72 PCB Concentration in ppm

PCB CONCENTRATIONS (IN ppm) AT NORTHERN EXCAVATION SITE

Woodward-Clyde Consultants

Figure 4-2

TABLE 4-1 PCB FIELD SAMPLING RESULTS -WOODWARD-CLYDE CONSULTANTS 1988 FIELD INVESTIGATION

SAMPLE NO.	TYPE	PCB CONCENTRATION (ppm) Lab Results	VOLATILE ORGANIC COMPOUNDS ** (ppm) Field Results
1	Soil	375	24
2	Soil	52.5	4
3	Soil	ND	2
4	Soil	932	9
5	Soil	14.4	2
6	Soil	3.5	<1
7	Soil	109	19
8	Soil	301	6
9	Soil	232	2
10	Soil	24.9	75
11	Soil	1.13	3
12	Soil	286	NM
13	Soil	34.2	5
14	Soil	17.7	NM
15	Soil	33.4	4
16	Soil	106	140
17	Wipe	630*	NA
18	Wipe	7.85*	NA
19	Wipe	128*	NA
20	Wipe	119*	NA
21	Soil	1.99	5
22	Soil	9.43	5
23	Soil	411	150
24	Soil	23400	26
25	Soil	279	9
26	Soil	32.6	2
27	Soil	2800	130
28	Soil	3930	100
29	Soil	237	4
30	Soil	0.49	ND
31	Soil	0.083	0.1
32	Soil	0.55	ND
33	Soil	1.72	ND
34	Soil	0.18	ND
35	Soil	0.12	ND
36	Soil	0.74	ND

* Surface wipe concentrations are total micrograms per 100 sq. cm.
** Analyzed using an HNu Meter
NM = Not Measured
NA = Not Applicable
ND = Not Detected

4.3 SIGNIFICANCE OF FINDINGS

Clean-up verification sampling found 20 out of a total of 32 soil samples exceeded the 10 ppm clean-up level for soils and three out of four wipe samples exceeded 100 micrograms per 100 square centimeters, the maximum concentration allowable on low-contact outdoor, non-impervious surfaces prior to encapsulation (clean-up levels specified in 40 CFR Part 761).

These findings indicate that PCB contamination remains at the site and further remedial action is required.

4.3.1 Zones of Contamination

This section discusses the location and distribution of samples which exceeded the recommended clean-up levels.

4.3.1.1 Northern Excavation

Nine of 16 soil samples and both wipe samples collected from the northern excavation exceeded the recommended clean-up levels. All soil samples exceeding the clean-up level were located within three feet of the pad. The highest concentration (23,400 ppm) was found in sample number 24, which was located at a depth of six feet, approximately 19 feet west of the eastern edge of the pad (see Figure 4-2). Other areas of high concentration were located directly under the bottom edge of the pad for nearly the entire length of the excavation; this may indicate that contamination extends beneath the pad. The north wall was below 10 ppm in all cases.

4.3.1.2 Western Excavation

Thirteen of 16 soil samples and one of two wipe samples collected from the western excavation exceeded the recommended clean-up levels. The highest concentrations were located in the northern side of the excavation and extended to the depth excavated. All samples taken on the southern side of the excavation were in

compliance with 40 CFR Part 761 (<10ppm). Other areas of high concentration were directly under the east and west edge of the pad near the northern end indicating that contamination may exist beneath the pad (see Figure 4-1).

4.3.2 Contaminant Migration

The scope of work for the project did not include an investigation to determine contaminant migration; however, contaminated soil was found at the lower limits of the excavations, and, as a result, the limit of contamination in the subsurface soils is not known. Contamination at the surface beyond the area included in this investigation is unknown.

4.3.3 Alternative Remedial Actions

Under CERCLA-SARA, the normal process in arriving at alternative remedial actions for National Priority List (NPL) sites begins with a remedial investigation and ends with a feasibility study. The two are independent in that the remedial investigation develops data on treatability of the waste and the feasibility study utilizes the data in selecting and screening remedial technologies. While a number of discrete phases can usually be identified, the process is iterative. Thus, as data gaps are identified during the investigation or screening process, additional studies are conducted to assure that all of the appropriate technologies are included and properly evaluated.

For the statement of work for the JRP, the requirement for literal adherence to the complete format defined in the USAF Occupational and Environmental Health Laboratory (OEHL) Handbook for CERCLA and SARA sites was revised because these requirements generally do nor apply to non-NPL sites. As a result, the risk assessment was made to be qualitative with the intent that it would be primarily used to determine the need for further action. This is in keeping with the intent of a Stage 1 investigation under the IRP. In addition, the intent of the Preliminary Alternative Remedial Actions task is to identify practical and permanent solutions to contamination problems. The approach used is intended to be streamlined and pragmatic, yet defensible in terms of the degree of protectiveness, the implementability, and cost effectiveness of the alterntives selected.

The evaluation of the Roosevelt Road Transmitter site for this project was limited to the results of a previous investigation completed by the COE and the confirmation testing completed after the 1988 removal. The confirmation testing was completed after the transmitter pad surface was sealed and a predetermined volume of contaminated soil was removed. The removal program was based on information from drilling and sampling by the COE and the need to prevent the spreading of contaminants.

The confirmation testing completed after the removal action indicated that target clean-up levels were not achieved and that significant contamination still existed in the subsurface soils near the transmitter pad. The removal action did eliminate the potential for further spread of PCB contamination by wildlife and eliminated the potential for exposure at the ground surface near the transmitter pad. However, the information required to evaluate alternative remedial actions was not available. As a result, no alternative remedial actions were identified for the Roosevelt Road Transmitter site. Instead, further investigations are recommended.

The contaminants still present at Roosevelt Road Transmitter site are the result of a clean-up action supervised by the EPA due to a spill in 1978. This action resulted in PCB-laden transmitter oil and PCB-contaminated soil being placed in an underground bunker adjacent to the transmitter pad where the spill occurred. Information regarding the amount and method of placement for the contaminants as part of the clean-up actions was not available. Due to this lack of information and the presence of both a water well in the bunker and a leach field adjacent to the bunker, there is a potential that contamination could be introduced to the local groundwater. Therefore, a complete CERCLA-type RI/FS is recommended for the site. In addition, the entire area around the bunker and transmitter pad should be listed as a site for inclusion in a base-wide environmental assessment or installation restoration program that may be conducted at Fort Richardson. Although the surface area does not present the potential for exposure, the site is considered as posing a significant risk based on the incomplete data base and the PCBs still present. No further removal or remedial action is recommended at this time.

4.4 RISK ASSESSMENT

This section describes the methods used in the performance of a qualitative risk screening process and presents the results of the process. The risk screening process was developed to rapidly identify chemically contaminated sites at military facilities that could have a significant impact on human health, welfare, and the environment. The process uses a decision analysis approach whereby yes or no answers to certain questions allow conclusions to be drawn as to whether or not the chemicals at the site present significant risk.

Figure 4-3 is a flow diagram describing the risk screening process. A two-tiered hierarchical decision scheme is employed. For Tier I, two criteria were established: (1) proximity of the site to sensitive biological receptors and (2) evidence of chemical contamination at the site. If it is determined that the site is in close proximity to sensitive receptors or if there is evidence that chemicals have been released to the environment, screening proceeds to Tier II. Only one criterion must be satisfied to proceed to Tier II. If neither criterion is satisfied, the no action alternative is recommended.

In Tier II, the screening process involves assessing exposure potential and the probable consequences of exposure. Exposure is considered possible when (1) contaminant release mechanisms are judged significant, (2) contaminant migration is judged significant, or (3) one or more contaminants are environmentally persistent. The likelihood that the toxicity threshold could be exceeded (i.e., that exposure could produce toxic effects) is considered high when (1) one or more contaminants exhibits high or extremely high acute toxicity, or (2) the quantity or concentration of one or more contaminants exceeds Federal or state criteria or standards protecting health and the environment, and (3) the duration or frequency of exposure is sufficient to cause health or environmental effects. Risk is classified as significant when at least one of the criteria for receptor exposure and at least two of the criteria for threshold exceedance, with one being the exposure duration frequency criterion, are satisfied. When the data were incomplete and an estimate was not practical, the term "unknown" was used and the criterion considered the same as a "yes" in the risk screening.

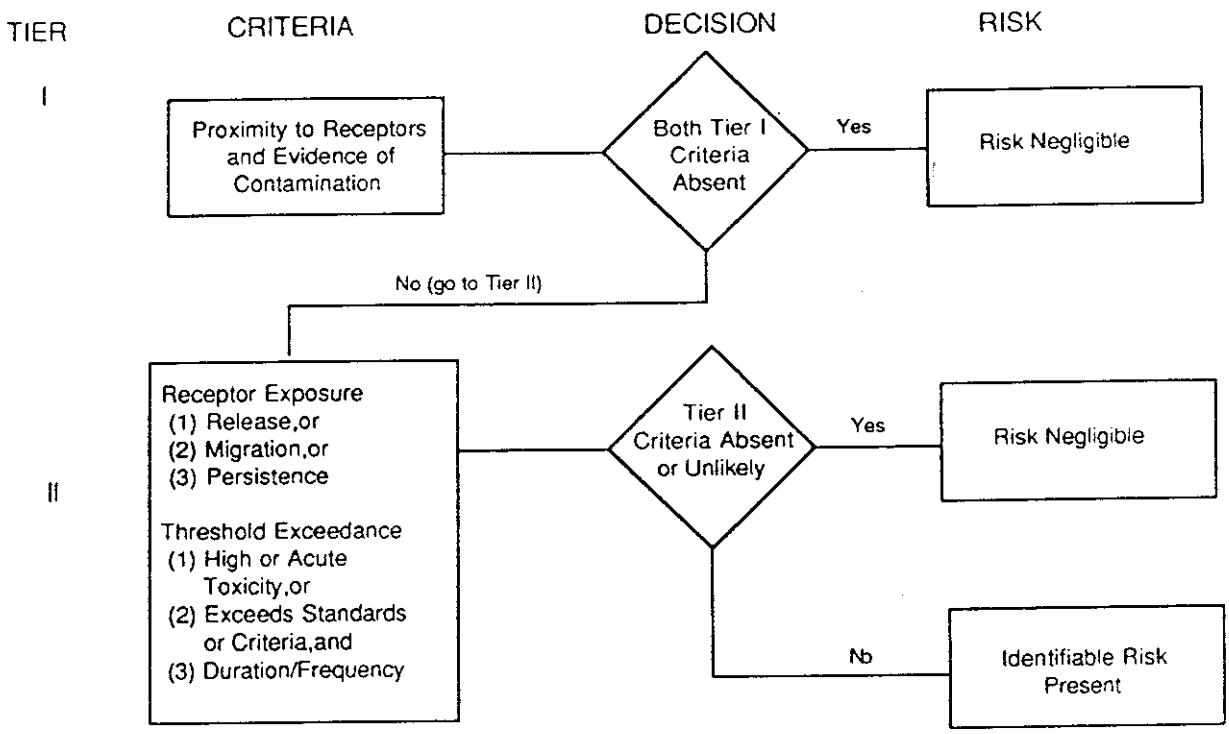


FIGURE 4-3
FLOW DIAGRAM SHOWING TWO LEVELS OF RISK SCREENING

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The potential for contaminant release and migration was judged to be significant when investigations by the Army or WCC produced evidence of release and/or migration. When no evidence was available, the potential for release and migration was estimated by evaluating selected physical properties of the contaminants, primarily aqueous solubility, vapor pressure, and octanol-water partition coefficient (Log P). High aqueous solubility and vapor pressure promote contaminant release and migration. Log P values provide a reasonable estimate of the propensity of a chemical to bind to soil containing organic material as well as to bioaccumulate. The propensity to bind to soil and to bioaccumulate increases with the value of Log P.

The National Institute for Occupational Safety and Health (NIOSH) toxicity rating system (NIOSH, 1975) was used to identify contaminants highly to extremely toxic to mammals. The system ranks substances according to acute toxicity estimates (i.e., LD50s and LC50s; see Appendix A for definition), which is the customary method used to compare chemicals with respect to toxicity. Highly toxic substances are those with an oral LD50 equal to or less than 50 mg/kg, dermal LD50 equal to or less than 100 mg/kg, or inhalation LC50 equal to or less than 43 ppm. A similar ranking system has not been developed for aquatic organisms; however, 1 mg/liter is often the LC50 value used as a criterion for identifying highly toxic chemicals.

Measured contaminant concentrations were compared with health and environmental standards and criteria for the contaminants to determine standard and criteria exceedances. When only human populations were at risk, only health criteria were used. When the only populations at risk were non-human (e.g., fish, wildlife, vegetation), only environmental criteria and standards were used. Exposure duration or frequency was considered significant when site contaminants were found in drinking water, ambient air, or surface water inhabited by important aquatic organisms or when there was evidence of toxic effects. It may also be considered significant when contamination of drinking water, ambient air, or surface water inhabited by important aquatic organisms was judged to be likely at a site.

4.4.1 Tier I Screening

4.4.1.1 Evidence of Contamination

Aroclor 1260, a PCB, was detected in concentrations as high as 24,300 ppm in on-site soil, and trichlorobenzene has been detected in a soil head space analysis at concentrations greater than 10,000 ppm. No samples were analyzed for petroleum hydrocarbons which may be present in soil as a result of previous clean-up operations. Until further information is obtained, it is assumed that petroleum hydrocarbons are present in soils.

4.4.1.2 Proximity to Receptors

According to the risk screening criteria, the proximity of a site to a biological population of concern is considered significant if the distance between the site and the population is one mile or less. The nearest human population is located at the National Guard Camp Carrol, 2 miles southeast of the site. Most of this population is transient or employees of the camp. Land adjacent to the site is or has apparently been used for Army maneuvers and recreational activities such as hiking, camping, and small game hunting. Therefore, the proximity of the site is not considered significant to a residing population, but is significant to occasional human contact.

4.4.1.3 Summary of Tier I Screening

The Roosevelt Road Transmitter site meets both Tier I screening criteria; there is evidence of chemical contamination and the site is in close proximity to human receptors. Therefore, the risk screening process proceeds to Tier II. A summary is provided on Tables 4-2 and 4-3.

4.4.2 Tier II Screening

4.4.2.1 Potential for Release and Migration

Contaminated dust generation or contaminant volatilization appears to be the major pathway by which chemicals found at the site would migrate to areas adjacent to the site. The groundwater pathway may be significant if contaminants are able to leach out of the soils or from the bunker through floor drains or other release mechanisms.

Table 4-2 Tier I Screening Process

TIER I CRITERIA	
Is Site in Close Proximity to Sensitive Receptors?	Yes
Is Evidence of Contamination Present at Site?	Yes
Both Criteria Absent?	No
Risk	Go to Tier II

Table 4-3 Tier II Screening For PCB Transmitter Site

TIER II CRITERIA	RESPONSE
EXPOSURE Significant Release Mechanisms?	Unknown
Significant Migration Pathways?	Unknown
High Persistence?	Yes
THRESHOLD EXCEEDANCE Highly to Extremely Toxic?	No
Quantity/Concentration Sufficient to Exceed Health/Environmental Standards or Criteria?	Yes
Duration and Frequency of Exposure Sufficient to Cause Adverse Effects?	Unknown
NUMBER OF EXPOSURE CRITERIA SATISFIED	1 Plus 2 Unknowns
NUMBER OF THRESHOLD CRITERIA SATISFIED	1 Plus 1 Unknown
	Potentially Significant Risk

However, the data base required to evaluate the potential for this pathway is incomplete.

The aqueous solubilities, vapor pressures, and logarithms of the octanol-water partition coefficients (Log P) of the chemical contaminants identified at the site are shown in Table 4-4. These physical properties have the greatest influence on the release and migration of chemicals in the environment. Chemicals with high solubilities have a greater propensity than chemicals with low solubilities to desorb from soil (a release mechanism) as water passes through. Such chemicals will tend to migrate to off-site areas via groundwater and surface water. Those with high vapor pressures tend to volatilize from soil and water and enter the atmosphere.

While information on the solubility of the contaminants provides an idea of the propensity of each contaminant to migrate with water relative to other contaminants, it is difficult to establish a cut-off point that would separate contaminants that would migrate appreciably from those that would not. Aroclor 1260 has a high Log P value (>6.11) and low water solubility (0.0027 mg/l) indicating a high affinity to adsorb to soil or sediment. This compound has been detected as deep as 14.5 feet adjacent to the slab and, at the surface, over 200 feet south of the slab. This apparent migration may be the result of diesel fuel which was reported as a solvent used during the 1978 clean-up activities and tracking by wildlife, respectively.

4.4.2.2 Persistence

Volatilization of solvents is probably the primary route of removal of compounds used to clean the area. Since the site was originally contaminated over ten years ago, the presence of detectable concentrations of these solvents is an indication of their persistence. In addition, Aroclor 1260, the only PCB contaminant, has a low vapor pressure and a half-life in soil of several years.

4.4.2.3 Toxicity

Oral, dermal, and inhalational acute toxicity estimates for mammals and 48- or 96-hour acute toxicity estimates for freshwater organisms available in the literature are

Table 4-4 Physical and Toxicological Properties of Soil and Water Contaminants

CONTAMINANT	AQUEOUS SOLUBILITY (mg/L)	VAPOR PRESSURE (torr)	LOG P	ORAL LD50 IN RATS (mg/kg)	DERMAL LD50 IN RABBITS (mg/kg)	INHAL LC50 IN RATS (PPM, V-V)	48-/96-HOUR LC50 IN AQUATIC ORGANISMS (mg/L)
Aroclor 1260 (PCB)	0.0027	4.05E-05	>6.11	1315	NI	110000	
Trichlorobenzene	30	0.42	4.26	756	NI	NI	

NI=No Information Found in Literature

shown in Table 4-4 PCBs meet the criteria for acute toxicity to aquatic organisms. However, no aquatic organisms are present in the vicinity of the site.

4.4.2.4 Contaminant Quantity and Concentration

The EPA PCB spill clean-up policy (40 CFR Part 761) for soil for non-restricted access areas is 10 ppm PCBs by weight. Concentrations detected in soil exceed this standard.

4.4.2.5 Duration and Frequency of Exposure

The 1988 removal action has significantly reduced the potential for exposure at the surface. No surface soils or exposed areas on the transmitter pad with high PCB concentrations are known to remain. However, confirmation testing of the surface soils beyond the limits of the 1988 removal was not conducted. The site may continue to be frequented by Army personnel during maneuvers or by individuals walking over the site for non-military activities such as hiking, camping and hunting. As a result, the duration and frequency of direct exposure are unknown.

4.4.2.6 Summary of Tier II Screening

A summary of the results of the Tier II screening process is presented in Table 4-3. Risk may be significant at the site; the data required for a complete risk screening are not available. Additional site investigation and risk screening are required.

5.0
RECOMMENDATIONS

Based on the results of the risk screening, the Roosevelt Road Transmitter Site is designated Category 2 (see USAFOEHL Handbook, Version 2.0 (1988), Section VI), requiring additional IRP investigations. We recommend the development and implementation of a program that will comply with regulations outlined in CERCLA for RI/FS investigations. The recommendation is a result of the level of uncertainty that still exists in regards to the cleanup and disposal of PCBs from the spill in the late 1970s and the level of contamination that still exists in the soils underneath the transformer pad. The 1988 removal effort has reduced the immediate health and safety threat from PCBs at the site location.

Data obtained from the cleanup verification sampling conducted by WCC indicate that PCB contamination is still extensive at the Roosevelt Road Transmitter site. A remedial investigation and feasibility study should be conducted. The objective of the RI/FS should be to characterize and delineate the contamination at the site and to develop and evaluate remediation measures through a feasibility study so that a remedial design and response action can be developed to achieve the site cleanup goals. The investigation should include:

- Documentation of all past cleanup efforts to include the disposition of contaminated soil and debris. Such documentation may require interviews with the personnel involved in past cleanup efforts as the EPA no longer has records for the initial cleanup and subsequent disposal of the PCBs in the bunker (D. Johnson, 1988, personal communication).

- Characterization of all abandoned facilities at the Roosevelt Road site to include the bunker, transmitter pad, cableways, support facility locations, septic field area, and wells. This should include a geophysical survey to help characterize soil conditions at the site as well as locate the bunker (maps and blueprints currently available do not provide adequate definition of the bunker) and any secondary exits which may exist.

- Characterization of the soil contamination in the vicinity of the site through a comprehensive soil sampling/analysis program. This should include drilling and sampling boreholes to characterize and delineate subsurface contamination.

- Conducting an extensive sampling/analysis program to characterize surface contamination, locate hot spots, and identify surface mechanisms that may have spread contamination.

- Implementation of a groundwater testing and monitoring program in the vicinity of the site to include installation and sampling of both upgradient and downgradient monitoring wells.

- Characterization of the interior of the bunker at the site to include an inventory of all equipment and estimate of contaminated material that may have been deposited in the bunker. This may be accomplished by entering the bunker to inspect its condition, identify possible contamination exit points, and collect samples to characterize the extent and concentration of contamination within the bunker.

- Collecting and analyzing water samples from the well located within the bunker (designated well A on 1944 as-builts).

- Completion of a feasibility study to evaluate alternatives for site remediation.

The attached Sampling and Analysis Plan presents an expanded outline which provides greater detail concerning the recommended investigation.

6.0
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INSTALLATION RESTORATION PROGRAM
STAGE 1

Joint Resources Project
Fort Richardson, Fort Wainwright and Fort Greely, Alaska

Roosevelt Road Transmitter Site

SAMPLING AND ANALYSIS PLAN

United States Air Force
Occupational and Environmental Health Laboratory (USAFOEHL)
Brooks Air Force Base, Texas 78235-5501

SAMPLING AND ANALYSIS PLAIN
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SAMPLING AND ANALYSIS PLAN

1.0
INTRODUCTION

This Sampling and Analysis Plan (SAP) is being proposed as a planning tool for future investigative work to be performed at the Fort Richardson, Alaska, Roosevelt Road Transmitter Site (RR). The site is located on the northernmost section of Roosevelt Loop Road, approximately 2 miles north of the main cantonment area. Principal features of concern at the site include a concrete slab and a bombproof transmitter building (referred to in this report as the "bunker"). Polychlorinated biphenyl (PCB)-contaminated soils are known to exist within the bunker and around the concrete slab.

The primary purpose of this field investigation will be to obtain and categorize the site information necessary to identify, select and evaluate remedial action alternatives for the RR area. The site investigation will encompass soil sampling, groundwater monitoring, and an assessment of hydrogeology beneath the site. The field investigation will ultimately lead to development of a corrective action program.

The SAP, when accepted as a guidance document for field investigations, will describe the grid method used to locate potentially contaminated surface soils, methods used to conduct bunker sampling, monitoring well installation, and collection and analysis of soil and water samples to characterize site contamination. This plan is divided into sections that contain descriptions of the following topics: 1) background information on the site; 2) an overview of the field investigation planned for the site; 3) a program that consists of establishment of soil, groundwater, and bunker sampling locations; 4) installation of new monitoring wells; 5) measurement

and sampling methods for soils and groundwater, and 6) chemical analysis of soil and water samples.

2.0
BACKGROUND INFORMATION

2.1 SITE HISTORY

The Roosevelt Road Transmitter Site was used as a bomb proof communications center, apparently from World War II through the Korean War era. The site was established as a joint Army/Army Air Force facility, and it is probable that the Air Force maintained some facility usage after 1947. The final date of operation is not known at this time. The Army has always been the owner of the site.

The history of the releases at the site are clouded by a lack of documentation and a paucity of knowledgeable parties to discuss the site history. An initial spill of PCB occurred when PCB-laden transformers were apparently vandalized for the recovery value of copper. The date of this release is unknown, but initial recovery and cleanup of the PCB oil probably occurred in 1976 or 1978. This initial recovery was performed under the guidance and with technical assistance of the Environmental Protection Agency (EPA). The actual cleanup was performed by Crowley Environmental. The contaminated area was triple washed with diesel and the materials and oils were placed in the bunker on site and the bunker was sealed.

Additional wastes at the site include diesel from the 1970s cleanup and trichlorobenzene, originally present in the transformers as a solvent to keep the PCBs mobile. PCBs have low solubility in water, are chemically stable, and are relatively immobile in the environment.

2.2 CURRENT SITE STATUS

Very little site-specific data are available on the Roosevelt Road site. Excavation and drilling at the site have revealed that the shallow subsurface consists of sands and gravels, with some silty sands and organics near the surface. Soil testing programs have identified contamination above 10 ppm as deep as 14.5 ft. Maximum detected levels on the site are near 80,000 ppm. Prior to the 1988 investigations, the vertical extent of the contamination was unknown.

The aquifer that underlies the site is relatively deep. No data are available on either the precise depth to the aquifer or whether shallower water tables exist. Two wells are noted on the 1944 as-builts, one within the bunker (well "A") and one to the east (unlabeled). Another well (well "B") is off-site, and a waterline runs west to the well.

2.3 SURFACE WATER

The primary surface drainage features in the area are Eagle River and Ship Creek. Both streams originate in the Chugach Mountains and flow westerly across the installation into Knik Arm. Eagle River is fed by turbid glacial melt waters, and Ship Creek is sustained by snowmelt and rain water runoff. The closest major body of surface water is Eagle River, more than a mile to the north. Fort Richardson receives domestic water from an impoundment reservoir at Ship Creek in the Chugach Mountains. Figure 2-1 illustrates the surface drainage of Ft. Richardson.

Low stream discharge occurs in the winter, reaching a minimum in February-March. Peak stream discharge occurs in Eagle River in August, while peak discharge occurs in Ship Creek in June. The RR site is not near any major tributaries of Eagle River or Ship Creek.

2.4 GROUNDWATER

Fort Richardson is located in the south-central hydrologic subregion of Alaska. Groundwater reservoirs are replenished by direct infiltration of precipitation and percolation from surface waters; therefore, groundwater availability is dependent

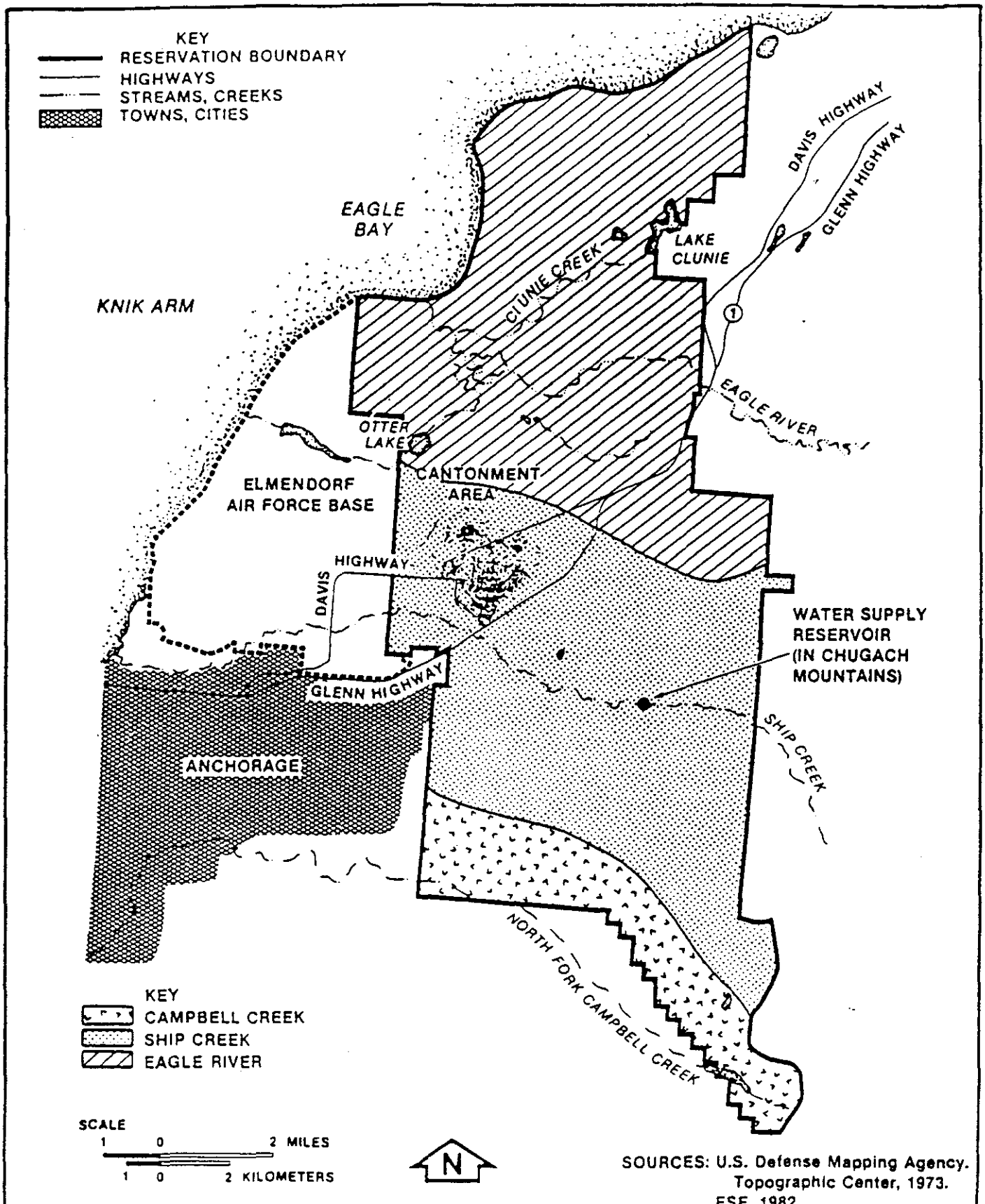


Figure 2-1
SURFACE DRAINAGE OF FORT RICHARDSON

from: ESE Report "Ft. Richardson Installation Assessment", 1983

Woodward-Clyde Consultants

upon the amount of precipitation (Zenone and Anderson, 1978). Fort Richardson overlies a major portion of the recharge area for the confined aquifer.

The Chugach Mountains and Ship Creek are considered to be the major sources of recharge for the confined groundwater conditions at Fort Richardson and the surrounding area. This aquifer yields large quantities of water to Fort Richardson, Elmendorf Air Force Base, and Anchorage. During times of heavy pumpage, the well field in Anchorage forms a cone of depression which extends under Fort Richardson. Regional groundwater flow is towards the southwest. Shallow groundwater is discharged naturally as seeps or springs along the bluff of Government Hill. Artifical discharge for shallow groundwater is accomplished by excavated ditches for drainage and pumping from wells. Average depth to groundwater at Fort Richardson is 22 feet.

The RR site is located atop a natural water divide. The groundwater on the south side of the Elmendorf Moraine flows southwesterly to contribute to the Ship Creek aquifer system. The groundwater on the north side of the moraine flows northwesterly into the Eagle River aquifer system. More information is needed to determine into which system groundwater from the RR site flows. The water table is probably fairly deep in this area.

2.5 GEOLOGY AND SOILS

The northern and central portions of Fort Richardson are within a structural trough of the Cook Inlet-Susitna Lowlands. This part of Fort Richardson is characterized by glacial features resulting from a series of five glacial periods in recent geologic history. The south-central and southern extent of Fort Richardson consists of outcrops and mountains of metamorphic bedrock of the Kenai Formation. The mountains and lowlands of Fort Richardson are mantled by glacial till from the Wisconsin period.

Prominent topographical features were left by the most recent glacial event, the Naptowne glaciation. The main feature near the site is the Elmendorf Moraine, which forms the high ridges just north of the main cantonment area at Fort Richardson. The Anchorage Plain deposits are a broad, flat outwash plain extending

southwest, parallel to the Elmendorf Moraine. These broad flat alluvial deposits include the main cantonment area of Fort Richardson, most of Elmendorf Air Force Base, and the greater Anchorage area. Figure 2-2 depicts geologic formations in the Fort Richardson Area.

Soils at Fort Richardson are considered to be of two types: a rocky gravelly soil predominant throughout the Kenai-Chugach Mountains, and a silt-loam glacial material found on lower slopes, moraine hills, and glacial outwash plains. The silt-loam is well drained and generally overlies a gravelly or sandy loam. Soils of the Anchorage Plain deposits are similar, but tend to contain more gravels grading into sand to the west. Peat occurs in depressions, and silty soils occupy small drainages and depressions.

The RR site is situated directly atop the Elmendorf Moraine. The Elmendorf Moraine consists of unconsolidated glacial till and poorly sorted boulders, gravel, sands and silts. Figure 2-3 depicts soil types in the area of Ft. Richardson.

2.6 RESULTS OF SITE INVESTIGATIONS

The U.S. Army Corps of Engineers (COE), under the direction of the EPA, conducted a surface soil and drill hole testing program in 1988 to determine the extent of contamination at the RR site. A total of 21 soil samples were collected on the concrete pad itself. Of these, 18 sites showed PCB contamination at levels ranging from 1.3 ppm at the southern end of the pad to 76,900 ppm in the middle section. PCB concentrations in surface soil samples collected in the area ranged from 0.34 ppm to 11,000 ppm. Ten sites were reported as less than detected. Fifteen drill hole profiles were done to determine if PCB contamination occurred at depth. While most drill holes showed contaminant levels in the top one to three feet (from <1 ppm to 15,000 ppm), high levels (>2000 ppm) were seen in at least two holes in the eight to ten feet depth range, suggesting that some vertical migration of PCBs is occurring.

The results of the COE investigation became the basis on which contaminant removal operations were performed by Woodward-Clyde Consultants in October 1988 as an Expedited Response Action. Details of the removal activities are described in Section 3 of this report. Following completion of excavationof material on the west and

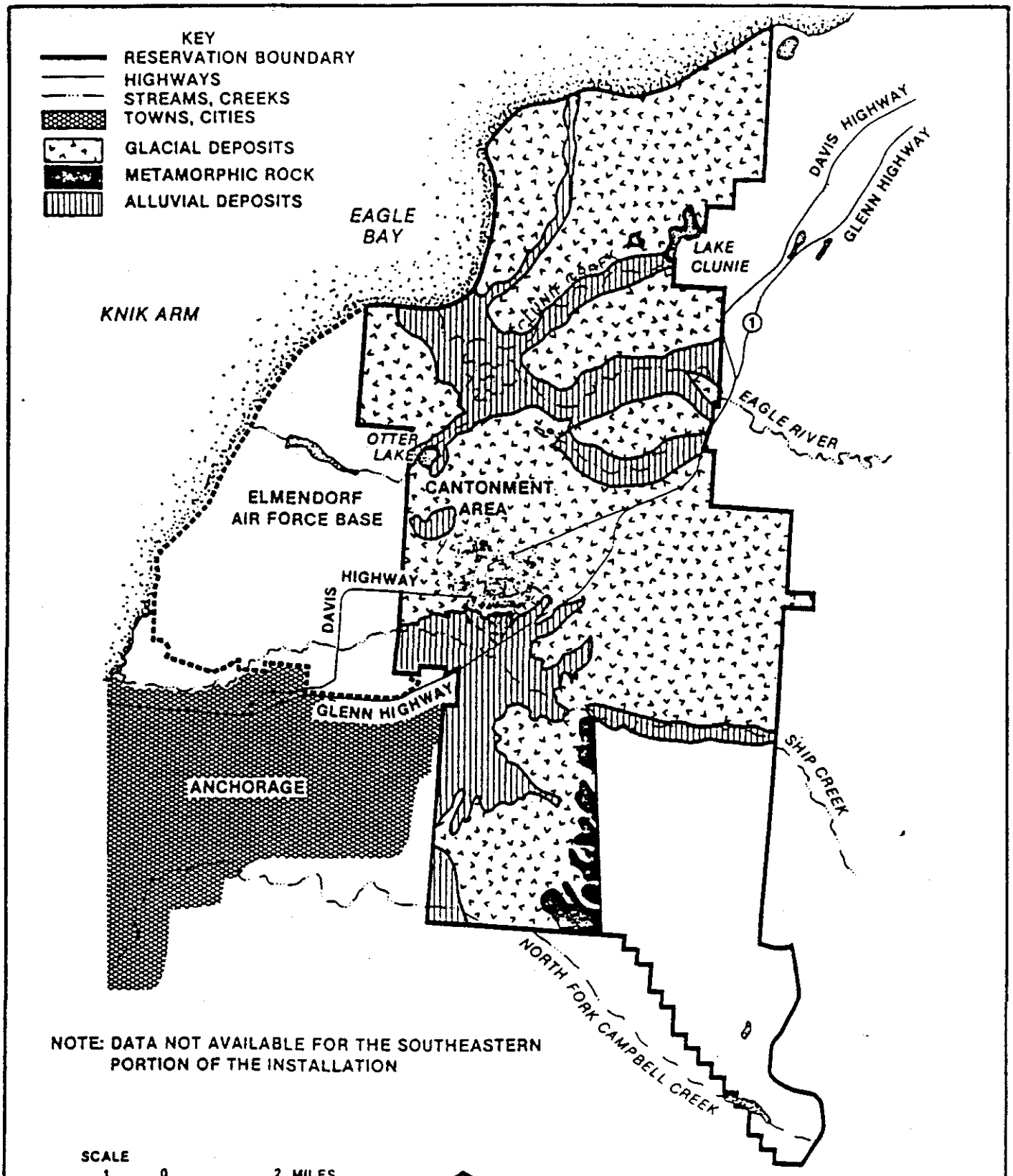
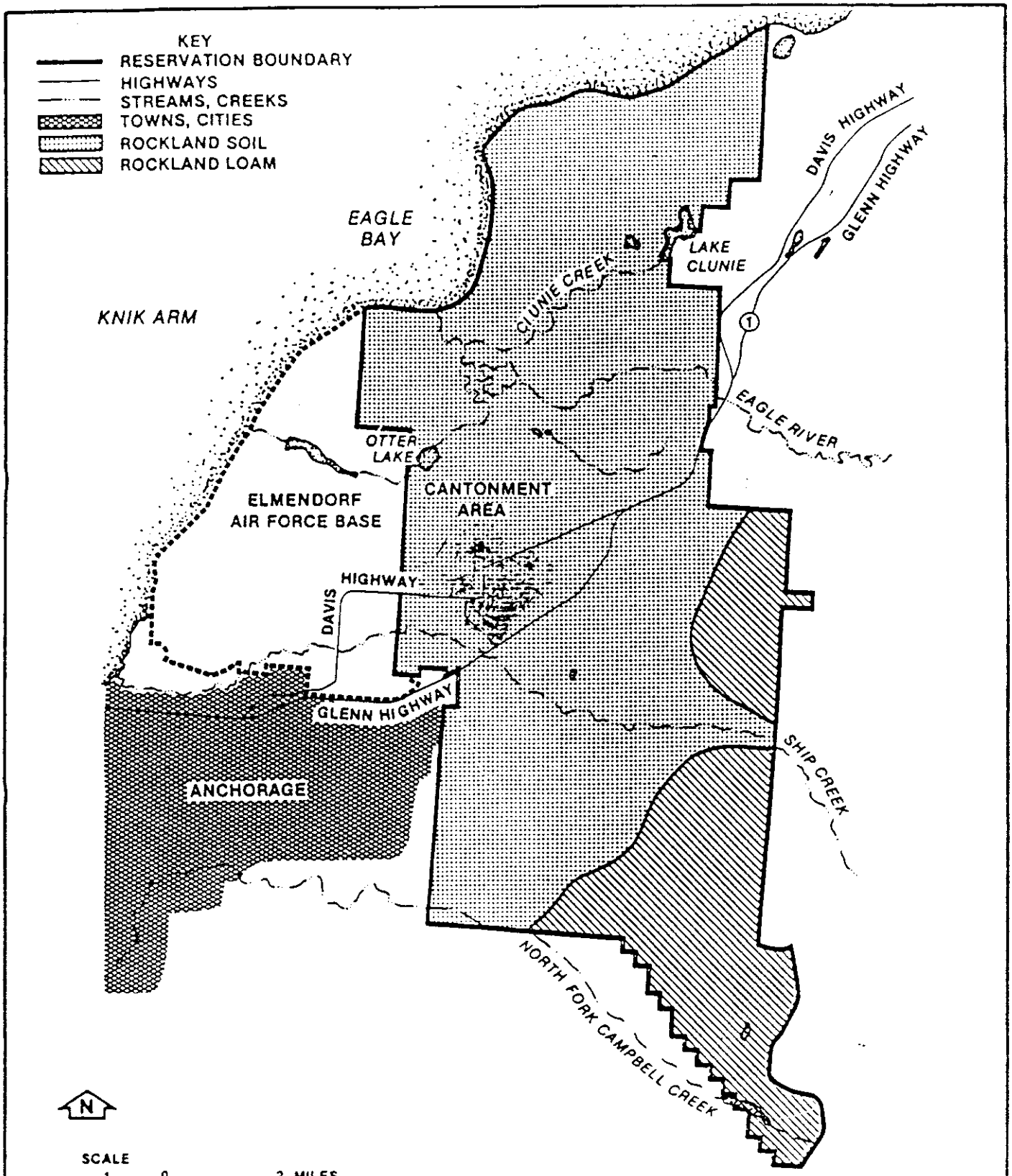


Figure 2-2
GEOLOGIC MAP OF FORT RICHARDSON

from: ESE Report "Ft. Richardson Installation Assessment", 1983

Woodward-Clyde Consultants



SOURCES: U.S. Defense Mapping Agency. Topographic Center, 1973.
State of Alaska. Department of Fish and Game, 1982.
ESE, 1982.

Figure 2-3
SOILS MAP OF FORT RICHARDSON

from: ESE Report "Ft Richardson Installation Assessment", 1983

Woodward-Clyde Consultants

north ends of the pad, soil samples were collected to determine if the PCB remaining in the soil was below 10 ppm. Of the 32 samples collected, 20 showed PCB concentration above 10 ppm, and 3 of 4 wipe samples (taken from the concrete pad) were above 10 ug/100 cm^2. These results confirm the potential need for further soil excavations and a more extensive field investigation. See Appendix G for analytical results and Section 4.0 of this report for sampling locations.

3.0 FIELD INVESTIGATION PROGRAM

In order to characterize the nature and extent of contamination at the Roosevelt Road Transmitter site, a field investigation should be conducted which includes a minimum of the following: surface soil sampling; a geophysical survey; installation and sampling of new monitoring wells; and borehole drilling and sampling. The bombproof transmitter building should be entered, inspected, and sampled for suspected contaminants. The contaminants of concern for this investigation include PCBs, dioxin, diesel fuel (previously used to "wash" the concrete pad of PCBs), and 1,2,4-Trichlorobenzene, a component of PCB oils. The following sections outline each activity. Table 3-1 lists the approximate number of samples that should be collected at each sampling location.

3.1 SURFACE SOIL SAMPLING

An extensive soil sampling program should be conducted to determine the extent of PCB contamination in the surface soils around the existing concrete pad and bunker. Identification should be made of possible contaminant pathways made by either human or animal traffic through the area which could show locally high contaminant concentrations. A maximum of 450 surface soil samples should be collected for PCB analysis from three general locations: the area surrounding the concrete pad, previously identified contaminated areas, and the pathway extending from the northwest corner of the pad to the northern entrance of the bunker.

TABLE 3-1 FIELD MONITORING PROGRAM PARAMETERS

PARAMETERS	SAMPLE LOCATION	NUMBER OF SAMPLES
PCBs	Surface Soil	450
	Soil Borings	310
	Bunker Samples:	
	-Wipes	30
	-Liquid	5
	-Solids/Soil	5
	Monitoring Wells (new and existing)	3
1,2,4-Trichlorobenzene	Soil Borings	270
	Bunker Samples:	
	-Liquid	5
	-Solids/Soil	5
	Monitoring Wells (new and existing)	3
Total Petroleum Hydrocarbons (TPH)	Soil Borings	50
	Bunker Samples:	
	-Liquid	5
	-Solids/Soil	5
	Monitoring Wells (new and existing)	3
Dioxin	Bunker Samples:	
	-Composite wipes	15
	-Liquid	5
	-Solids/Soil	5
Temperature, pH, Specific Conductance	Groundwater	As needed

3.1.1 Concrete Pad Area

A gridded network should be established around the concrete pad for sampling of PCBs. The grid should be rectangular in nature with 10-foot spacings between adjacent grid lines and should extend 30 feet beyond the pad in both east and west directions and 40 feet beyond the pad to the north and south. Surface soil samples should be collected at points where grid lines intersect each other or the edge of the pad. A maximum of 215 samples should be collected here.

3.1.2 Previously Identified "Hot Spots"

Additional soil sampling should occur in areas previously found to have PCB concentrations greater than one ppm in the 1988 U.S. Army Corps of Engineers field investigation (see Appendix I, Table F-1 for results summary). Ten locations (at sample site Nos. 1, 2, 4, 10, 14, 15, 16, 33, 34, and 39) should be investigated using a seven-point hexagonal grid system as described in USEPA Report 560/5-86-017 "Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup." The area directly outside of the northern entrance to the transmitter building should be investigated using a 37-point EPA hexagonal grid. A maximum of 110 samples should be collected from this area and analyzed for PCBs.

3.1.3 Pathway Between Building Entrances

The area between the northwest corner of the existing concrete pad and the northern entrance to the bunker should be investigated for PCB contamination, since this was most likely a heavy-usage traffic area during site operations, in which spilled PCBs were probably tracked between the bunker and concrete pad. A rectangular sampling grid should be used here with gridlines spaced 10 feet apart. The grid should measure 15 lines by 6 lines, with samples collected at the intersection of these lines. A maximum of 90 surface samples should be collected and analyzed for PCBs.

3.1.4 Discretionary Samples

A maximum of 35 additional surface soils samples should be taken, at the discretion of the sampling team, at any locations which appear to be contaminated. This may

include visual observation, through odors, or from air quality monitoring equipment results. Aerial photographs should also be used to locate potential human or animal trails for possible sampling locations.

3.2 BUNKER SAMPLING

3.2.1 Bunker Entry

The existing bombproof transmitter bunker is thought to contain refuse material that was used in the previous cleanup effort by the EPA and Crowley Environmental. It is not known to what extent or in what quantities these materials may exist in the bunker. For this reason, a visual inspection of the bunker interior should be done before any sampling occurs. The inspection should include: determination of the bunker dimensions, including floor/ceiling elevations; location of possible contaminant exit points; integrity of the bunker itself (check for cracks/holes in floor, etc.); and an inventory of the contents of the bunker. Since the nature of potential contaminants is unknown, the bunker should be entered by field personnel using Level B personnel protection, and should include checking for structural safety.

3.2.2 Bunker Sampling

Based upon findings from the bunker entry described in the above section, a sampling program should be designed to determine the presence or absence of contaminants and to characterize the extent of the contamination. Sampling should include, but may not be limited to, the following parameters.

3.2.2.1 Wipe Samples

Past reports of fires within the bunker suggest that dioxin compounds may be present as a by-product of PCB combustion. Because dioxin is a suspected contaminant inside the bunker, a qualitative determination should be made for the presence of dioxin. A maximum of 15 composite wipe samples should be collected from the floor, ceiling, and walls of the bunker. Each wipe sample should be composited from no more than four distinct locations. Also, a quantitative analysis should be made for the presence

of PCBs inside the bunker. A maximum of 30 discrete wipe samples is suggested at points of known or suspected PCB contamination.

3.2.2.2 Solid Waste/Soil Samples

Any soils or solid wastes, such as sorbent pads, which may have been used during the previous cleanup effort, should be sampled for the full suite of parameters of concern. These include: PCBs, dioxin compounds, 1,2,4-Trichlorobenzene, and total petroleum hydrocarbons. A maximum of 5 samples should be collected for these analyses.

3.2.2.3 Liquid Samples

Any liquids present in the bunker should be sampled for the same suite of analyses as described above for solid waste and soils.

3.3 GEOPHYSICAL SURVEY

A geophysical survey should be included as part of the site investigation for several reasons. It can be used to delineate the extent of the bunker, to identify secondary contaminant exit routes (such as the 4' x 4' duct leading from the northeast corner of the bunker), and possibly to define the limits of the septic drainfield.

3.3.1 Methods

In order to detect reinforcement bars in the concrete bunker, terrain conductivity is the recommended geophysical method, as it is for determining the limits of the septic drainfield. At least two methods should be available for conducting a geophysical investigation. These may include terrain conductivity, ground-penetrating-radar (GPR), resistivity, or seismic refraction. A Geonics EM-31 terrain conductivity meter is suggested for determining terrain conductivity to depths of approximately 20 feet. GPR is the second method of choice, but the actual method selection should be made at the contractor's discretion and with approval of the responsible government monitoring agency.

3.4 BOREHOLE DRILLING AND SAMPLING

A borehole sampling and drilling program should be undertaken as part of the field investigation to further define and characterize the extent of contamination. A maximum of about 290 borehole samples should be collected for PCB and 1,2,4-Trichlorobenzene analyses. Actual sample locations will be determined at a later date, based on information gathered from other site work. Some general guidelines are given here for sampling locations.

3.4.1 Septic Drainfield

The septic drainfield may act as a contaminant receptor via the sewer line pathway leading from the bunker. An estimated 7 borings should be advanced near the sewer lines which discharge to the septic drain field. Soil samples should be collected for PCB and trichlorobenzene analyses at 5-foot intervals, or at any change of lithology, to a depth of about 30 feet, for a total of approximately 50 samples.

3.4.2 Control Cable Duct

An estimated 5 borings should be advanced along the 4' x 4' duct that is located at the northeast corner of the bunker. This is a potential pathway for contaminants within the bunker to migrate off-site. These borings should be advanced to a maximum of 40 feet, with sampling at 5-foot intervals or at any change in lithology. Of the five borings suggested, two should be drilled close to the bunker, and three along the length of the duct. Soil samples should be collected for PCB and trichlorobenzene analyses, for a total of approximately 45 samples.

3.4.3 Secondary Exits

Secondary exit routes should be sampled for potential contaminant pathways. A maximum of 10 borings is recommended, advanced to a depth of 40 feet. Samples should be collected at 5-foot intervals or at any change in lithology. Samples should be collected for PCB and trichlorobenzene analyses, for a total of approximately 90 samples.

3.4.4 Previous Site Cleanup

Because previous clean-up efforts did not meet the objectives of the cleanup goals of 10 ppm PCBs, six additional borings, located near the concrete pad, should be advanced to delineate the limits of contamination. Three borings should be advanced near each excavation site (see Figure 3-1 in the preceding main body of this report for location of excavation sites), to a depth of 20 feet, with samples collected every 5 feet for PCB analysis, for a total of approximately 30 samples. Extreme caution should be taken during these boring efforts not to damage the existing liner that was placed around the concrete pad during the 1988 WCC excavation effort.

3.4.5 Angle Borings

In order to determine to what extent, if any, contamination exists beneath the bunker, two borings should be drilled at an angle to sample materials under the bunker. These borings should be drilled to a maximum depth of 50 feet along the axis of the boring with samples collected at 5-foot intervals or any change in lithology. A total of 22 samples should be collected for PCBs, total petroleum hydrocarbons, and trichlorobenzene analyses. The selection of the boring locations should be made based upon information gathered from other borings in the area. The actual drilling method used will be determined at a later date at the discretion of the contractor.

Two additional angle borings should be placed under the existing concrete pad, with samples collected and analyzed for PCBs, trichlorobenzene, and total petroleum hydrocarbons. The borings should extend 25 feet, with samples collected continuously to a depth of about 15 feet, for a total of 165 samples. The sampling location for these borings should be along the north and northwest edges of the concrete pad, in the area of prior site cleanup efforts.

3.4.6 Previously Identified "Hot Spots"

Three borings should be advanced at each location where the surface soil was found to be out of compliance for acceptable PCB levels during the 1988 COE field investigation. These are sampling sites #10, #4, and between sites #40 and #75 at the

bunker entrance. The borings should be advanced to a maximum of 8 feet, with continuous sampling, for a total of 12 PCB analyses.

3.4.7 Discretionary Samples

A total of approximately 28 samples may be collected and analyzed for PCBs and trichlorobenzene at changes in lithology. Approximately one-half of these should also be analyzed for diesel components (total petroleum hydrocarbons) as diesel was reportedly used as a solvent during the initial cleanup.

3.5 MONITORING WELL INSTALLATION AND SAMPLING

Three monitoring wells should be installed to characterize the extent, if any, of contamination to groundwater from previous PCB spills, cleanup efforts, and routine operations. The wells should be installed to a depth of approximately 100 feet, with the well screen extending about 15 feet below the water table. Soil samples should be collected at 5-foot intervals, to a depth of 40 feet, and analyzed for PCBs and Trichlorobenzene for a total of 18 samples. One well should be installed between the bunker and the concrete pad (approximately NE of the bunker). The other wells should be installed northwest and southwest of the bunker to define groundwater gradient.

3.5.1 Monitoring Well Sampling

All of the new wells, plus the existing well inside the bunker, if accessible, should be sampled for the full suite of contaminants of concern. These include PCB, dioxin compounds, total petroleum hydrocarbons, and 1,2,4-Trichlorobenzene.

4.0 FIELD MEASUREMENTS AND SAMPLING METHODS

This section of the Sampling and Analysis Plan contains a description of the measurements that should be taken for soils, water, and wipe samples at the Roosevelt Road Transmitter Site. It includes procedures that should be used for sampling, preservation, and sample shipment to the analytical laboratories. Selection of test parameters is based on existing knowledge of the site gained from previous site investigations. These parameters include PCBs, 1,2,4-Trichlorobenzene (a compound known to exist in PCB oils), total petroleum hydrocarbons (from suspected diesel contamination which occurred in past (cleanups), and dioxin compounds. The grid method for soil sampling and wipe test methods are taken from EPA designed or approved methods.

4.1 SOILS

Information on the extent of soil contamination at the site should be obtained through collection and analysis of surface soils, soil borings, angle borings beneath the existing concrete pad, and samples collected during monitoring well installation. Table 3-1 gives a list of analytical parameters that should be tested for and the sampling locations for each.

4.1.1 Sampling Equipment

Routine field instruments and equipment that may be used for obtaining groundwater and soil samples are listed in Table 4-1. The major equipment items that might be used for soil sample collection are described below.

4.1.1.1 Surface Sample Collection

Surface samples should be collected with pre-cleaned stainless steel spoons and placed directly into the appropriate sample container. Samples should be taken at the surface to a depth of approximately 3 inches. Spoons should be decontaminated between sampling sites.

4.1.1.2 Borehole/Angle Borings

Soil boring samples maybe collected with a split spoon sampler or other device. The pre-cleaned split spoon should be lowered into the auger at the desired sampling depth, retrieved, and placed into pre-cleaned sample containers. The sampling device should be decontaminated before each use, and sampling equipment should be decontaminated between distinct sampling locations.

4.1.1.3 Bunker Samples

Any soils or solid materials found in the bunker should be sampled for the applicable parameters, listed in Table 3-1. Each discrete sample should be placed directly into the appropriate sample container, and any sampling equipment used should be decontaminated between uses.

4.1.2 Sample Containers

The sample containers that should be used for each of the sample types are listed in Table 4-2. Pre-cleaned containers that meet EPA specifications should be used. Coolers used to transport sampling containers from the field to the laboratory should be cleaned with laboratory-grade non-phosphate detergent, rinsed, and dried prior to filling with samples.

TABLE 4-1 FIELD INSTRUMENTS & EQUIPMENT

Water Level Sounder
pH Meter and buffer solutions
Specific Conductance Meter & calibration standards
Organic Vapor Analyzer (OVA) & calibration gasses
Combustible Gas Indicator (CGI), and calibration equipment and supplies
Pump assembly, compressor, motor, manual operator, air lines
Teflon tubing
55 gallon drums
Laboratory-grade detergent
Garbage bags
Kimwipes
Deionized water
Sample containers (see Table 6-3 for complete list)
Ziploc bags
Ice
Vermiculite
Coolers
Field maps
Log books
Boring logs
Preservatives
Hardhat
Eye protection
Gloves
Strapping tape
Steam cleaner
First Aid Kit
Steel tape
Roll of Plastic
Standard tool kit
Soil Sampling Equipment (split spoon sampler, stainless steel spoons, etc.), Sample Labels Chain-of-Custody forms, Health & Safety Level C Requirements (tyvek suits, raingear, respirators, rubber boots) See Site Specific Health & Safety Plan

TABLE 4-2 SAMPLE CONTAINERS FOR SOIL, GROUNDWATER & WIPE SAMPLES

PARAMETER	BOTTLE TYPE	SIZE	PRESERVATION METHOD	# PER WELL
SOIL/WIPES				
PCBs	Wide-mouth glass with teflon liner	8 0z.	Cool, 4 degrees C	1
1,2,4 Trichlorobenzene	Amber glass vial teflon lined septum	40 ml	None	1
TPH/Diesel	Wide-mouth amber glass teflon lined septum	8 oz.	Cool, 4 degrees C	1
Dioxin	Wide-mouth glass with teflon liner	8 oz.	Cool, 4 degrees C	1
WATER				
PCBs	Amber glass with teflon liner	1-liter	Cool, 4 degrees C	1
1,2,4 Trichlorobenzene	Amber glass vial teflon lined septum	40 ml	Cool ,4 degrees C HCl to pH<2	2
TPH/Diesel	Glass, teflon lined cap	1-liter	Cool, 4 degrees C	2
Dioxin	Glass, teflon lined cap	1-liter	Cool, 4 degrees C	1

All preservation methods from SW-846 or other approved EPA methods.

4.2 WATER SAMPLING

The extent, if any, of groundwater contamination by PCBs, dioxin, diesel fuel, or trichlorobenzene should be determined through sampling of three new monitoring wells and, if possible, sampling of the existing well on site (inside the bunker).

4.2.1 Frequency and Parameters

Each of the groundwater monitoring wells should be sampled during the field investigation. Field analyses of the water samples should be conducted for pH, temperature, and specific conductance. These analyses are done in the field because they are sensitive to environmental change and the water cannot be preserved for later analysis. Groundwater samples should be collected for determination of PCBs (EPA Method 8080), 1,2,4-Trichlorobenzene (EPA Method 8010 or 8240), dioxin (EPA 8280), and total petroleum hydrocarbons (GC/FID Scan). In addition to the field samples collected at each monitoring well, field control samples should be collected as part of the QA Program. This program should be described in detail in a separate document that covers the Quality Assurance Program Plan. The field control samples that should be part of this program are as follows:

a) Travel blanks are containers of each type of sample bottle, filled with reagent water, transported to the sampling site, handled like a sample, and returned to the laboratory for analysis. One travel blank should be prepared per day of sampling in bottles provided by the contract laboratory and should be submitted for analysis for each day of sampling.

b) Sampling blanks are used to assess potential contamination from the sampling method at the sampling site. Bottles used for sampling blanks should be obtained from the contract laboratory. Sampling blanks should be produced each day of sampling by subjecting deionized water to the exact same procedures used for collecting groundwater samples. A sampling blank should be produced for each of the types of bottles used.

c) Field Duplicates are water samples collected from the same well at the same time. The analytical data from these samples are used to evaluate the precision of the

sampling method. From each of the wells sampled, the volume of water collected for one sample should be split in two. Both samples should be identified separately and sent to the contract laboratory as field duplicates.

4.2.2 Sampling Equipment

Routine field instruments and equipment shall be used for obtaining groundwater sampling. Table 4-1 contains a list of equipment and materials that should be used for sampling. The major equipment items that may be used for water sample collection are described below as well as calibration procedures used for field measurements.

4.2.2.1 Sample Withdrawal Equipment

Water samples from the monitoring wells can be obtained from dedicated pumps or teflon bailers. If dedicated pumps are used in each of the new monitoring wells, the only device that needs to be lowered down each of the holes for routine measurements is the water-level sounder. This minimizes the potential for cross-contamination of the wells. Sampling personnel may use an air compressor and drive motor to operate the pump and obtain the sample. The pump parts that come into contact with the water sample are made of rigid PVC, Teflon or stainless steel. Tubing on the surface used to transfer water to measure field parameters should be made of Teflon. Teflon bailers, if used, should be thoroughly decontaminated between well samplings with a minimum of: soapy water and rinse, methanol, and deionized water.

4.2.3 Sample Containers

The sample containers used for each of the sample types are listed in Table 4-2. Pre-cleaned containers may be supplied by the laboratories conducting the analyses. Rinsate should be collected and analyzed from randomly selected cleaned bottles at the laboratory. The results of the analyses should be included in the quality assurance/quality control (QA/QC) documentation. The coolers used to transport the sampling containers from the field to the laboratory should be cleaned with laboratory-grade non-phosphate detergent, rinsed and dried prior to filling with samples.

4.2.4 Measuring Equipment

Temperature, pH, and specific conductance measurements should be performed in the field. In addition, the gas vapors from each well should be monitored using an organic vapor analyzer (OVA) or a Combustible Gas Indicator (CGI). The field thermometer should be calibrated against a lab grade thermometer before going into the field. The specific conductance and pH meters should be calibrated prior to sample measurement in accordance with the instructions provided below. Gas standards should be used to calibrate the OVA and CGI.

4.2.5 Instrument Calibration

Several of the field instruments require calibrations. These include the water level sounder, pH meter, specific conductance meter, OVA, and the CGI. Operation, calibration, and maintenance of these instruments should be performed by members of the sampling team who have been properly trained in these procedures. Calibration procedures for these instruments are described below.

4.2.5.1 Calibration of Water Level Sounder

At the commencement of field work each day that water levels will be measured, the sounder should be calibrated by measuring the distance between the electrode and the 50 and 100 foot markers on the cable with a steel measuring tape. The results should be recorded in the field logbook. The condition of the sounder, including battery charge, physical integrity, and probe condition should also be checked. At the end of the field day the sounder should be recalibrated and the results also entered in the field logbook.

4.2.5.2 Calibration of pH Meter.

The pH meter and combination electrode with temperature compensator should be calibrated prior to measurement at each sampling station using the procedures described in the instruments' operation manual. Typically, a two-point calibration is done using pH buffer solutions of 7.0 and either 4.0 or 10.0, whichever is most likely to "bracket" the pH of the sample.

4.2.5.3 Calibration of Specific Conductance Meter and Probe

Prior to measurements each day the specific conductance meter and probe should be calibrated using a two-point method. They should also be calibrated before use at each well using a single-point method. These calibration methods should follow those given in the manufacturer's instruction manual. Generally, calibration standards of 10, 100, 1000 or 10,000 micromhos per centimeter are used.

4.2.5.4 Calibration of Organic Vapor Analyzer and Combustible Gas Indicator

These instruments should be calibrated according to the manufacturer's recommended method. At a minimum, these instruments should be calibrated at the beginning and end of each work day and at any time determined necessary based on instrument response. A certified calibration gas as specified in the manufacturer's instructions should be used for calibrating the instruments. Only ultra-pure hydrogen (99.999% pure) should be used as a source gas for the OVA. All gases should be labeled with the laboratory measured values.

4.2.6 Measurement of Static Water Level Elevation

Static water levels should be measured in each monitoring well prior to any other groundwater sampling activity. Measurements should be performed consecutively for all monitoring wells in as short a time interval as is feasible. In addition, the depth to the bottom of the monitoring well should be measured to determine if significant silting has occurred and to calculate the volume of stagnant water in the well. Water-level measurements may be performed with an electrical water-level indicator (sounder). The sounder should be calibrated prior to commencing field work according to the method specified (in Section 4.2.5.1). Decontamination of the sounder should occur between all well sampling with a minimum of soapy wash and rinse, and methanol and deionized water rinse. Measurements of groundwater elevation and well depth should be made to the nearest hundredth of a foot. The water level elevation in feet above mean sea level should be calculated by subtracting the depth to water from the elevation of an established benchmark. The groundwater elevation and well depth, as well as pertinent descriptive information, including the time and ambient weather conditions, may be recorded on a field water sampling

form (see example in Figure 4-1). For safety purposes and for qualitative data, an OVA, or CGI, should be used to monitor the borehole headspace and the breathing zone of the individual in closest proximity to the source. The measurements should be recorded on the sampling form.

4.2.7 Well Purging

After water-level measurements have been made for all wells in the monitoring network, standing water in the wells must be purged to ensure that sampled water is representative of formation water. Three well volumes of static water should be purged before sampling commences. If a well is pumped dry, samples should be collected as soon as a sufficient volume of water has moved into the well.

4.2.8 Water Sample Collection

This section contains a discussion of the equipment and procedures that will be used to obtain groundwater samples from the monitoring wells. A schedule will be developed to determine the parameters to be measured and the sample types to be collected at each well.

4.2.8.1 Sampling Preparation

All sampling personnel should wear disposable, surgical-type gloves. They should change the gloves for each sampling location and each time duties change during sampling. Gloves to be used for sampling should not be used to touch surfaces which may not be clean. Ensure that the exhaust of any engines is as far away as possible and downwind of the sampling location. Fumes and vapors from exhaust systems may contaminate water samples with organic compounds.

4.2.8.2 Measurement of Field Parameters

The temperature, pH, and specific conductance of the water should have been monitored during well purging. The final measurement of these parameters should be made as follows:

Ground-Water Sampling Form Sample Location ID: _____ Sampling Date: _____

Project Name: _____ Project Number: _____

Sampling Personnel: _____

Weather Conditions: _____

Observations/Comments: _____

Quality Assurance Sampling Method:

Water Level Sounder Number: _____ Calibration Date: _____

pH Meter Number: _____ Calibration Date: _____

Specific Conductance Meter No.: _____ Calibration Date: _____

Organic Vapor Analyzer Serial No.: _____ Calibration Date: _____

Comments: _____

Well Bore Information Date & Time of Measurement: _____ OVA Reading: _____

Condition of Surface Casing: _____

Depth to Water (ft.): _____ Depth to Bottom of Well (DBW, ft.): _____

Original Well Depth (OWD, ft.): _____ Silt Height in Hole (OWD-DBW, ft.) _____

Height of Standing Water (h, ft.): _____ Vol. of Standing Water (gals.): _____

Reference Point Elevation: _____ Ground-water Elevation: _____

Sampling Measurements Purging Method: _____

Time	Discharge (gallons)	pH	Sp. Conductance (umhos/cm)	Temp (C)	Comments

Total Discharge: _____ (gals) Casing Volumes Removed: _____

Comments: _____

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EXAMPLE OF A TYPICAL GROUND-WATER SAMPLING FORM

FIGURE 4-1

If dedicated pumps are used:

1) Flow rates should be measured prior to sampling.

2) Temperature, pH, and specific conductance should be monitored until these parameters stabilize as follows: temperature is stable within plus/minus 0.1°C, pH is stable within plus/minus 0.1 standard unit, and specific conductance is stable within plus/minus 25 micromhos/cm. Readings should be taken after approximately each well volume has been removed. Record readings on a sampling form or field notebook. After measurements are completed, rinse the pH electrode and conductance cell in deionized water, pat dry, and store. Store the pH electrode according to manufacturer's instructions.

If teflon bailers are used:

1) Record temperature, pH, and specific conductance for every well volume removed prior to sampling. After measurements are completed, rinse the pH electrode and conductance cell in deionized water, pat dry, and store. Store the pH electrode according to manufacturer's instructions.

4.2.8.3 Sample Collection

Table 4-2 lists the type of sample bottle to use for each parameter. Sampling procedures may be followed as described below:

1) Commence sample collection.

2) After each sample is placed in its bottle a sample label should be completed. At a minimum the sample label shall contain the following information:

Location identification
Sample number
Sample type
Name of collector(s)

Date and time of collection
Parameter(s) requested or general class of parameters (e.g., VOAs)

3) As these samples are collected and labeled they should be preserved as soon as possible using the methods given in Table 4-2. Glass bottles should be protected by either wrapping the container in protective material (e.g. bubblepack) or adding padding to the shipping container. All sample bottles should be placed in a cooler with ice. The ice should be in a plastic bag so that the inside of the cooler does not become wet. During winter sampling events, care should be taken to ensure that samples do not freeze prior to shipment.

4.2.9 Bunker Samples

Any liquid found in the bunker should be sampled for the parameters listed in Table 3-1. Depending on the depth of the liquid in the bunker, samples may be collected directly into the appropriate sample containers or a beaker may be used to fill sample bottles. Sample collection should proceed as described in Section 4.2.8.3.

4.3 WIPE SAMPLES

4.3.1 Composite Wipe Samples

In order to determine the presence or absence of dioxin on the surfaces inside the bunker, approximately 15 composite wipe samples should be taken. EPA-approved wipe procedures should be followed in collecting these samples. A standard size template (i.e. 10cm x 10cm) should be used to delineate the area of cleanup. The wipe medium should be a gauze pad or glass wool or known size that has been saturated with hexane. A maximum of four locations should be wiped per composite, with samples collected as quickly as possible to avoid volatilization of the hexane.

4.3.2 Discrete Wipe Samples

Approximately 30 discrete wipe samples should be collected throughout the bunker for PCB analyses. Sampling locations should include the floor, walls, and any other surface suspected of being contaminated with PCBs. Again, a known size of gauze or glass wool saturated with hexane should be used to wipe the surfaces. Samples should be collected as quickly as possible to avoid excessive volatilization of hexane. Sample containers and preservation methods are listed for wipe samples in Table 4-2.

4.4 SHIPPING PROCEDURES

Shipping coolers should be sealed with strapping tape, and a signed and dated custody seal should be placed on each cooler. The coolers should be kept in a secured on-site loction until shipment to the laboratory. They sould be labeled with the address of the analyzing laboratory and shipped to the lab by a member of the sampling crew at the end of each day of sampling.

4.4.1 Chain-of-Custody

The following chain-of-custody procedures allow for tracing of possession and handling of samples from the time they are collected in the field through analysis in the laboratory. Additional information should be provided in the Quality Assurance Plan for the study.

4.4.1.1 Sample Custody

A sample will be considered under custody if it is:

- in the sampler's actual possession;
- in the sampler's view, after being in his/her possession;
- in the sampler's physical possession and is then locked up to prevent tampering; and
- in a designated and identified secure area.

4.4.1.2 Field Custody Considerations

As few people as possible should handle the samples. The field sampler must be personally responsible for the care and custody of the samples until they are transferred or properly dispatched to the analytical laboratory.

4.4.1.3 Transfer of Custody and Shipment

Samples should be accompanied by the Chain-of-Custody Record (Figure 4-2). When transferring the possession of samples, the individuals relinquishing and receiving should sign, date and note the time on the Record. This Record will document transfer of custody of samples from the sampler to the laboratory. The Chain-of-Custody Record should include an analysis request section. This section should identify the parameters that are to be analyzed, which sample containers have been designated for each requested parameter, and any preservatives used. One Chain-of-Custody Record should be used for each cooler. The original Record should be sealed inside a plastic (ziploc-type) bag and taped inside the lid of the cooler. A copy should be retained by the field sampler. Signed and dated custody seal should be placed on the right front and left sides of each cooler sealing the lid to the body to insure against tampering.

4.4.1.4 Laboratory Custody

A designated sample custodian at the laboratory should accept custody of the shipped samples. The custodian should check that the custody seals are intact, record the signature and date on the custody seal, inspect the sample containers for leakage, breakage, or other damage, and verify that the sample identification numbers on the bottle labels match those on the Chain-of-Custody Record. If any bottles are broken the field crew should be notified immediately so that additional samples may be collected. The Chain-of-Custody Record should be signed and dated, and a copy immediately returned to the originator.

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One Walnut Creek Center, 100 Pringle Avenue
Walnut Creek, CA 94596 (415) 945-3000

Chain of Custody Record

PROJECT NO.

SAMPLERS: (Signature)

DATE	TIME	SAMPLE NUMBER	ANALYSES: General Mineral	Priority Pollutant Metals	EPA Method 624	EPA Method 625	EPA Method 608							NUMBER OF CONTAINERS	REMARKS (Sample preservation, handling procedures, etc.)
TOTAL NUMBER OF CONTAINERS															

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)

METHOD OF SHIPMENT:	SHIPPED BY: (Signature)	COURIER: (Signature)	RECEIVED FOR LAB BY: (Signature)	DATE/TIME

FIGURE 4-2 Chain-of-Custody

5.0
ANALYTICAL PROCEDURES

The analytical procedures and maximum holding times for the parameters that will be measured in the laboratory for groundwater and soil samples are listed in Table 5-1. These procedures are taken from SW-846 and other EPA-approved methods. The estimated detection limits for various dioxin compounds are listed in Table 5-2.

TABLE 5-1 TESTING PARAMETER METHODS, DETECTION LIMITS, AND HOLDING TIMES

PARAMETERS	Analytical Method (1)	Detection Limit	Holding Time (2)
1,2,4-Trichlorobenzene	EPA 5030/8240	10 ug/L	14 d
PCB's	EPA 3510/8080	0.6 ug/L	7 d
Dioxin	EPA 8280	See Table 7-2	30 d
Total Petroleum Hydrocarbons(TPH)	GC/FID Scan	Varies with matrix	14 d (soil) 7 d (water)

(1) All Methods are taken from SW-846, 3rd Edition (1986) unless otherwise noted.
(2) Holding times shown are to analysis or extraction where applicable. Samples will be analyzed as soon as possible after collection. The times listed are the maximum that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the monitoring laboratory has data on file to show that the specific types of samples are stable for a longer time. Some samples may not be stable for the maximum time period. A shorter holding time will be observed by the laboratory if knowledge exists to so indicate.

TABLE 5-2 METHOD DETECTION LIMITS OF $^{13}C_{12}$ - LABELED PCDD'S and PCDF'S

IN REAGENT WATER (PPT) AND ENVIRONMENTAL SAMPLES (PPB)

$^{13}C_{12}$-Labeled Analyte	Reagent Water[a]	Missouri Soil[b]	Fly-Ash[b]	Industrial Sludge[c]	Still-Bottom[d]	Fuel Oil[d]	Fuel Oil/Sawdust[b]
2,3,7,8-TCDD	0.44	0.17	0.07	0.82	1.81	0.75	0.13
1,2,3,7,8-PeCDD	1.27	0.70	0.25	1.34	2.46	2.09	0.18
1,2,3,6,7,8-HxCDD	2.21	1.25	0.55	2.30	6.21	5.02	0.36
1,2,3,4,6,7,8-HpCDD	2.77	1.87	1.41	4.65	4.59	8.14	0.51
OCDD	3.93	2.35	2.27	6.44	10.1	23.2	1.48
2,3,7,8-TCDF	0.63	0.11	0.06	0.46	0.26	0.48	0.40
1,2,3,7,8-PeCDF	1.64	0.33	0.16	0.92	1.61	0.80	0.43
1,2,3,4,7,8-HxCDF	2.53	0.83	0.30	2.17	2.27	2.09	2.22

[a]Sample size 1,000 mL.
[b]Sample size 10 g.
[c]Sample size 2 g.
[d]Sample size 1 g.
Note: The final sample-extract volume was 100 uL for all samples.

Matrix types used in MDL Study:

- Reagent water: distilled, deionized laboratory water.
- Missouri soil: soil blended to form a homogeneous sample.
- Fly-ash: alkaline ash recovered from the electrostatic precipitator of a coal-burning power plant.
- Industrial sludge: sludge from cooling tower which received creosotic and pentachlorophenolic wastewaters. Sample was ca. 70 percent water, mixed with oil and sludge.
- Still-bottom: distillation bottoms (tar) from 2,4-dichlorophenol production.
- Fuel oil: wood-preservative solution from the modified Thermal Process tanks. Sample was an oily liquid (>90 percent oil) containing no water.
- Fuel oil/Sawdust: sawdust was obtained as a very fine powder from the local lumber yard. Fuel oil (described above) was mixed at the 4 percent (w/w) level.

Procedure used for the Determination of Method Detection Limits was obtained from "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater" Appendix A, EPA-600/4-82-057, July 1982. Using this procedure, the method detection limit is defined as the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the value is above zero.

taken from: SW-846, 1986

6.0
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INSTALLATION RESTORATION PROGRAM
STAGE 1

Joint Resources Project
Fort Richardson, Fort Wainwright
and Fort Greely, Alaska

Roosevelt Road Transmitter Site

PROJECT PLAN SUMMARIES

United States Air Force
Occupational and Environmental Health Laboratory (USAFOEHL)
Brooks Air Force Base, Texas 78235-5501

PROJECT MANAGEMENT PLAN

PROJECT MANAGEMENT PLAN

The Project Management Plan (PMP) is the guidance document for developing and conducting tasks to be carried out during the project. The objectives of the PMP are:

- Provide a project management structure that is responsive and flexible to ensure all project deliverables are produced and issued in accordance with the Scope of Work.

- Develop lines of communication that keep the contractor and client appraised of current project status and all on-going work.

- Develop a project plan that can be maintained and updated easily such that progress can be evaluated periodically for both reporting and management requirements.

- Provide methods for revising project plans to ensure all project team members are utilizing the latest and most up-to-date procedures for conducting their work.

The PMP will also provide a description of the project organization and a detailed schedule, including milestones.

WORK PLAN

WORK PLAN

The Work Plan (WP) will contain a detailed discussion of the technical approach including equipment, methods and procedures used in conducting a Remedial Investigation (RI) and Feasibility Study (FS). An RI consists of the tasks described below.

Description of the Current Situation

This task will include a description of the regional location, site boundaries and the relationship of the site to adjacent entities. The site physiography, hydrology, geology and the nature of the contamination problem will be summarized. Existing contamination information will be summarized and used to evaluate the potential threat to human health and the environment.

Development of Management Program

The Work Plan will be part of a comprehensive Management Plan. The Management Plan will define relationships and responsibilities for tasks to be performed in the Work Plan.

Site Investigation

Investigation activities will be designed to focus on problem definition and data collection to support the screening of remedial technologies, alternative development and screening and the detailed evaluation of alternatives.

Site Investigation Analysis

All site investigation data will be reviewed and analyzed to establish the level and extent of contamination. After the contaminant data are evaluated, the potential threat to human health and the environment will be evaluated.

Remedial Investigation Report

A Remedial Investigation report will be prepared using the data collected, reviewed and analyzed during the site investigation.

Community Relations Plan

A Community Relations Plan (CRP) will be developed as part of the management program. The CRP will address methods to involve citizens and local officials in the study and allow them to express their concerns and suggestions.

The FS will be prepared in accordance with the most recent FS technical guidance made available by the EPA. The objective of the FS is to identify and analyze remediations that address contamination problems in the study area. The FS will consist of the tasks described below.

Description of the Current Situation

The results of the RI will be used to prepare a baseline risk assessment. The assessment will evaluate the potential risk posed by the site to human health and the environment.

Preliminary Remedial Technologies

This task will develop and screen remedial technologies which address site-specific contamination problems identified by the baseline risk assessment. This will be accomplished by: identifying general response actions; identifying remedial technologies and disposal options for each response action; and technology pre-screening.

Development of Alternatives

This task involves analyzing remedial response objectives and identifying remedial alternatives. To analyze remedial response objectives, they must first satisfy two requirements. One, the remedial measure must be protective of public health, welfare and the environment. Two, remedial actions must comply with Applicable or Relevant and Appropriate Requirements (ARARs) that apply to the contaminants at the site. After remedial response objectives have been established, the technologies considered feasible will be combined, as appropriate, into a set of remedial alternatives.

Initial Screening of Alternatives

The remedial alternatives will be screened to eliminate those which are clearly not feasible or appropriate. Each alternative will be screened with respect to effectiveness, technological maturity, practical aspects of implementation, protection of public health and the environment, and cost.

Evaluation of Alternatives

The remedial alternatives which pass the screening process will be evaluated in detail and compared, with the no-action alternative serving as a baseline for comparison. The detailed evaluation will include the following:

- Technical analysis
- Environmental analysis
- Public Health analysis
- Institutional analysis
- Cost analysis

This information will then be used to compare the alternatives.

Preparation of FS Report

The tasks described above will be used to prepare a Draft FS Report for Army and public review and comment. After comments have been received, the Final Draft FS Report will be prepared which includes a responsiveness summary addressing the comments.

DATA MANAGEMENT PLAN

DATA MANAGEMENT PLAN

The Roosevelt Road Transmitter Site investigation can be expected to generate considerable data of broadly diverse form, nature, and content. The purpose of a Data Management Plan (DMP) is to describe the procedures the contractor will use to document and track investigation data and results. These data will generally fall into two types: data required to perform a specific activity or data generated by the activity. The scope of the DMP encompasses all data gathering, analysis, control, inventory, and filing processes associated with the site.

OBJECTIVE

The objective of the DMP is to assure that all information (data) collected during the remedial investigation/feasibility study (RI/FS) project is processed and archived in a manner that assures data quality, security, and retrievability, thereby assuring information integrity.

The DMP will describe the following items:

- Document control, file inventory, and filing system;
- Procedures for recording field observations, labelling samples, and recording chain-of-custody documents;
- Management of project data from laboratory and mathematical analyses;
- Data management for health and safety monitoring;
- Data management for community relations plan;
- Data management for the feasibility study;
- Budget and schedule tracking; and
- Data management for quality assurance/quality control.

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

A Health and Safety Plan (HSP) will be prepared for all tasks performed at the Roosevelt Road Transmitter Site which may involve potential exposure to site contaminants in the field or laboratory. The HSP will be developed in accordance with all Federal, state, and local regulations, including 29 CFR 1910.120 regulations for hazardous waste field operations. The contractor's health and safety officer and project manager and the U.S. Army project manager for the Roosevelt Road Transmitter Site must approve the plan in writing before work commences. The HSP will address all tasks which are to be performed. If tasks are to be performed which are not addressed in the HSP, an addendum will be prepared and approved before these tasks commence.

Copies of the approved HSP must be distributed to each contractor employee prior to the commencement of field activities. Subcontractors may use the contractor's plan or may elect to prepare their own health and safety plan. If they prepare their own plan, it must be at least as stringent as the contractor's plan and be approved by the contractor and the U.S. Army Project Manager.

Each contractor/subcontractor employee must sign a safety compliance agreement form stating he/she has received and read a copy of the health and safety plan and agrees to comply with the plan.

The plan, at a minimum, shall include the following sections.

Project Safety Organization

Key project safety positions and the individuals filling the positions will be identified. Responsibilities accompanying each position and lines of authority will be described. At a minimum, the health and safety officer, project manager, and site safety officer position will be described.

Site Information

The site history will be described. Special emphasis will be placed on factors affecting health and safety of the workers. Items to be addressed include dates the site was active or inactive, how the site became contaminated, previous clean-up operations, and the location of current contamination. Any physical or biological features which may affect the workers or work to be performed will be addressed. A site map will be included in this section.

Work Activities

Work activities to be conducted by the contractor or subcontractor will be presented on a task-by-task basis. Each task to be conducted and the location where each task will occur will be described.

Hazard Assessment

Physical, biological, and chemical hazards at the site will be identified. The risk posed by chemical hazards will be identified for each task described in the work activities section. For each chemical identified at the site, the following information will be provided.

- Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit
- Immediately Dangerous to Life or Health (IDLH) Level
- American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV)
- ACGIH Short-Term Exposure Limit (STEL)

- o Ionization Potential
- o Instrumentation Relative Response
- o Concentrations in soil
- o Acute and chronic effects of exposure to each chemical

General Health and Safety Requirements

This section will address the general health and safety requirements described below.

Training

Types of training required for field workers will be described. Types of training may include basic 40-hour hazardous waste training, advanced training, site specific training, site supervisor training, and first aid/cardio-pulmonary resuscitation (CPR) training.

Medical Surveillance

Individuals required to participate in a medical surveillance program will be identified. Minimum medical surveillance requirements will be identified. If special medical tests are required, the frequency of testing and individuals who must be tested will be specified.

Accident/Incident Reporting

Methods used to report an accident or incident will be specified. An accident/incident report form will be included in the Appendices.

OSHA Poster

Specification of the OSHA Poster location will be identified and a copy of the poster will be included in the Appendices.

Site Specific Health and Safety Requirements

Site Control

Methods of controlling access of authorized persons to the site will be described. Methods may include but not be limited to physical barriers such as flagging, orange traffic cones, and warning signs.

Work Zones

Exclusion zones, contamination reduction zones, and support zones will be defined.

The exclusion zone is the area where contamination could or does occur. The contamination reduction zone (CRZ) is located between the exclusion zone and support zone and is the area used to reduce the potential for contamination migration to uncontaminated areas of the site. Personnel and equipment decontamination occurs within the CRZ. The support zone is the uncontaminated portion of the site where support personnel and clean equipment is located.

Demarcation methods and how access is obtained into each zone will be specified.

Prohibited Activities

Prohibited on-site activities such as eating, drinking, or smoking within an exclusion zone will be specified.

Site Audits

A site audit should be performed to monitor compliance with the health and safety plan, OSHA requirements, and generally accepted health and safety practices. Individuals qualified to perform site health and safety audits will be identified.

Personal Protective Equipment

Personal protective equipment to be used during the conduct of each task will be specified. Tasks may be grouped as appropriate.

Emergency Equipment

Emergency equipment such as fire extinguishers, first aid kits, emergency eye wash, etc., to be present on-site, will be specified. The location of this equipment during the conduct of field activities will also be identified.

Exposure Monitoring Requirements

Instrumentation used to monitor ambient air during conduct of each task will be specified. Frequency of instrument calibration and calibration procedures will also be specified. When an action level is reached, procedures to be used by workers to minimize potential exposure (i.e., upgrade to Level C or higher, back-off upwind, etc.) will be described.

Decontamination

Decontamination procedures to limit the migration of contaminants from contaminated areas to non-contaminated areas will be described. Each decontamination step and associated decontamination equipment (boot wash, scrub brush, etc.) will be identified.

Waste Disposal Procedures

Methods for containing and disposing of solid and liquid waste will be specified.

Buddy System

The buddy system will be used during all field activities. At no time will a field employee enter an exclusion zone or contamination reduction zone

alone or exit the zones leaving another employee alone within the zones. This will be stated in the HSP.

Heat Stress/Cold Stress Monitoring

Depending upon the time of year field work is conducted, heat stress or cold stress may be a concern. Procedures to be used to monitor personnel for heat or cold stress and the individual(s) responsible for monitoring will be identified.

Visitors

Visitors may frequent the site. Visitors must meet medical surveillance and training requirements and respirator fit rest requirements (as necessary) prior to entering an exclusion zone or CRZ. Methods for controlling visitor access will be specified.

Emergency Procedures

An emergency procedures section will be prepared which is consistent with the 29 CFR 1910.120 requirements. Specific items which may be addressed include:

- pre-emergency planning
- personnel roles, lines of authority, personnel authority, personnel training and communications
- emergency recognition and prevention
- safe distances and places of refuge
- site security and control
- evacuation routes and procedures
- decontamination
- emergency medical treatment and first aid
- emergency alerting and response procedures
- critique of emergency response and follow-up

Appendices to Accompany the Health and Safety Plan

Appendices should, at a minimum, contain an accident/incident report form, a copy of the OSHA poster, and applicable Standard Operating Procedures (SOPs).

COMMUNITY RELATIONS PLAN

OVERVIEW OF THE COMMUNITY RELATIONS PLAN

A Community Relations Plan (CRP) will describe the community relations program to be implemented by the U.S. Army and U.S. Air Force during conduct of the field investigation of the Roosevelt Road Transmitter Site. The CRP will be designed to keep citizens and local officials informed of site activities and scheduled events, to give citizens the opportunity to express their opinions, concerns, and objectives, and to resolve conflict.

SITE DESCRIPTION

A description of the site will be prepared which provides information on the following:

- site location, including a site map;
- date and type of contaminant release;
- potential threat to public health and the environment; and
- site investigations and monitoring results.

COMMUNITY BACKGROUND

Communities in the vicinity of the Roosevelt Road Transmitter site will be identified. For each community identified, the socioeconomic characteristics of the community will be described. Socioeconomic characteristics may include community population; projected growth; racial, sex, and age distribution; average household income; education; and median house value. Sociopolitical characteristics of the community will also be described.

HISTORY OF COMMUNITY INVOLVEMENT

The Army and local governmental agencies will be contacted to determine if any public inquiries have been made regarding the site. If inquiries have been made, they will be described. Actions taken as a result of inquiries will also be described.

KEY COMMUNITY CONCERNS

Personal interviews will be conducted with citizens and officials from the community to determine public concerns, information needs, and how citizens would like to be involved in the process. Results of interviews will be described.

Highlights of the Community Relations Plan

After the community's involvement history has been investigated and members of the community contacted to establish the level of community knowledge, concern, and interest, the CRP will be developed. The following topics will be addressed in the CRP: methods of communication; establish well-defined, two-way communication between the Army and the community; encourage citizen and business involvement; and provide opportunities for agency participation.

Methods of Communication

During the course of the investigation, information will be disseminated to the public. Activities conducted to disseminate information may include establishing information repositories, preparing mailing lists, writing and distributing fact sheets, and writing a responsiveness summary after the public meeting.

The CRP should establish well-defined, two-way communication in the early stages of the investigation. Methods for accomplishing this may include designation of a liaison person and preparing press releases.

Encourage Citizen and Business Involvement

Citizens and businesses should be encouraged to participate in the process. Methods for accomplishing this may include holding public meetings and allowing for a public comment period.

Resources to be Used in the CRP

Resources, including but not limited to local organization and meeting places, will be identified in the CRP.

Community Relations Activities and Timing

The type of community relations activities and when they are scheduled to be conducted will be presented in this section.

Appendices

The appendices will contain a mailing list of contacts and interested parties and a list of meeting locations and information repositories.

INSTALLATION RESTORATION PROGRAM (IRP)
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

STAGE 1

JOINT RESOURCES PROJECT
Fort Richardson, Fort Wainwright, and Fort Greely, Alaska

FINAL REPORT
VOLUME 5, APPENDICES A THROUGH F

Alaskan Air Command
HQ AAC/DEP
Elmendorf AFB, Alaska 99506

and

U. S. Army Directorate of
Engineering and Housing AFVR-DE
Fort Richardson, Alaska 99505

February 1990

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ADB/W-053

NOTICE

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Four sites at three U.S. Army bases in Alaska were investigated under the U.S. Air Force Phase I, Installation Restoration Program. The sites have serviced both the Army and Air Force during different periods of facility operation. The sites include the Anchorage Fuel Terminal and the Roosevelt Road transmitter site, Fort Richardson; Fort Wainwright Landfill, Fort Wainwright; and four Fire Training Pits (two at Fort Richardson, one at Fort Wainwright, and one at Fort Greely).

The Anchorage Fuel Terminal (AFT) is a tank farm on the southwest portion of Government Hill, just east of the Knick Arm of Cook Inlet. The area has a long history of fuel leaks and spills dating to the 1940s when the facility was first established. The investigation included an oil/water separation pilot test, a vapor extraction pilot test, a bioremediation bench scale test, drilling and well installation for groundwater sampling and monitoring, surface water sampling and assessment, and development of preliminary conceptual designs for two water treatment options including an air stripping system and a rotating biological

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contactor. The geology and hydrogeology at the facility are complex due to the presence of landslide deposits. Several potential remediation techniques were identified for use at the facility and further evaluation recommended. Additional characterization studies were not recommended.

The Roosevelt Road transmitter site is the location of a large PCB spill in the late 1970s. The spill occurred from large transformers that remained from an underground bunker utilized as a communication center. The soil around the transformer pad was contaminated with to 85,000 ppm PCB. Approximately 105 cubic yards of material were removed from the site and confirmation testing conducted to verify the removal effort. The transmitter pad and surface soils were cleaned up: however, the concentration of PCB-contaminated soil near the base of the excavation remained above the action level. As a result, the excavation was lined and backfilled for later remediation.

Fort Wainwright Landfill - An active landfill site, used by the military at Fort Wainwright, was investigated as a result of previous analyses which had identified the pesticides endrin and toxaphene at concentrations above the allowable for drinking water standards. The investigation included a geophyscial survey to evaluate the presence of a contaminant plume and the drilling and installation of three wells for a pump test. The purpose of the investigation was to evaluate potential contaminant migration from the landfill and model the large scale hydrologic properties of the unconfined aquifer the vicinity of the landfill. Additional data needs were identified and additional investigations recommended.

Fire Training Pits - Four fire training pits were investigated using soil gas techniques in an effort to define the limit of contaminant migration from combustion products and unburned fuel used in fire training exercises. The investigation identified methane gas at one location where the fire training pit was located partially on top of an old landfill and provided information on the contaminant migration at the other three sites. As a result of the investigation, preliminary remedial actions were recommended to prevent the spread of contaminants outside the burn pit are by wildlife, and further studies were recommended to quantify the type and extent of contamination present.

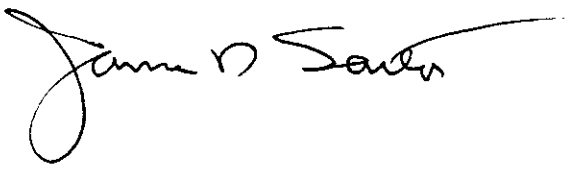
PREFACE

This 6-volume report describes the methods used and the results obtained from an Installation Restoration Program, Stage 1 investigation of four U.S. Army Bases in Alaska. The investigation and analyses were conducted by Woodward-Clyde Consultants under Contract F33615-85-D-4544, Work Order No. 9, Modification 1. The work was accomplished between August 1988 and May 1989. Capt. Franz Schmidt was the Technical Monitor for the Technical Services Division, USAF Occupational and Environmental Health Laboratory (USAFOEHL).

This document has been prepared in a modified version of the USAFOEHL format for Installation Restoration Program - Phase II reports. Modification of the prescribed format was necessary as a result of limitations in the scope of work and in order to provide clarity when discussing the sites investigated.

The present format allows each of the four sites defined in the statement of work to be discussed in a separate volume. Each volume is intended to stand alone as an independent report. Background material on the four sites is contained in the appendices and is presented in Volumes 5 and 6. To the extent possible, the volumes incorporate the format provided by USAFOEHL with slight modifications suggested by the U.S. Army, Directorate of Engineering and Housing.

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Joint Resources Project
Volume 5
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APPENDIX A

Glossary of Definitions, Nomenclature, and units of measure

Glossary of Definitions, Nomenclature, and Units of Measure

Absorption - The process of sucking up and taking in to make part of an existent whole.

Adsorption - The adhesion in an extremely thin layer of molecules to the surfaces of solid bodies or liquids with which they are in contact.

Alluvial - Pertaining to deposition resulting from the operations of modern rivers, and including the sediments laid down in river beds, flood plains, fans at the foot of mountain slopes, and estuaries.

Aquifer - A body of rock that contains sufficient saturated permeable material to yield significant quantities of ground water to wells or springs.

Aquitard - A restrictive layer or body of rock in the subsurface which impedes the flow or percolation of ground water.

Aroclor - A type of polychlorinated biphenyl. See PCBs.

Azide - A compound containing the group N3 combined with an element or radical.

BETX - The compounds Benzene, Ethylbenzene, Toluene, and Xylene, taken as a group. Commonly associated with fuels.

Biodegradation - The breakdown of substance or materials through biological processes.

Bioremediation - The process of remediation by a biological method such as introducing bacteria which metabolize a specific contaminant and remove it from the environment.

BOD - Biochemical Oxygen Demand - A measurement of the oxygen requirements for microbial metabolism of all particulate and dissolved organic compounds in water.

BTX - Benzene, toluene, and Xylenes. See BETX.

Cantonment - Troop quarters or main living area at a military facility.

Carcinogen - A substance or agent which produces or incites cancer.

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act - 1980, also known as the Superfund Act.

Chromatograms - A permanent visual record of the output from the detector used in a given system of chromatography. Common forms include color plates, graphs, and charts.

Chromatographic Signature - A specific trace produced on the chromatogram from the detector output of the gas chromatograph that identifies a specific combination of compounds such as gasoline or diesel. The trace is displayed as a series of peaks on a line that is characteristic for the mix, thus a "signature."

Contaminant Plume - The three dimensional distribution of a given contaminant in ground water, soil, or air.

Desorb - To remove by the reverse of either adsorption or absorption.

DRMO - Defense Reutilization and Marketing Office - The office which disposes of wastes and sells surplus.

Drumlin - A low smoothly rounded, elongated and oval hill, mound, or ridge of compact glacial till.

Duplicate Sample - A sample that is identical to another sample, such as a water sample that is taken from the same homogeneous mixture of water in the bailer but distributed into separate containers.

Endrin - A chlorinated hydrocarbon insecticide.

Esker - A long, low, narrow, sinuous, steep-sided ridge or mound composed of irregularly stratified sand and gravel deposited by a subglacial stream.

FID - Flame-ionization detector, used to detect compounds within a range of Ionization Potentials by using a hydrogen flame.

Fluvial - Of or pertaining to rivers; produced by river action.

Gas Chromatography (GC) - Separation of different compounds on the basis of their physical characteristics in a controlled gaseous environment. Typically a gas or liquid phase sample is injected into a known control gas and the compounds are separated by flowing through a packed or coated column and then passing through a detector.

Glacial - Pertaining to, produced by or deposited by, or derived from a glacier.

GPR - Ground Penetrating Radar, used in geophysical surveys to detect subsurface anomalies.

Grab Sample - A single sample taken at one specific time and location.

HNu - A trademark of a specific make of photo-ionization detector.

Hydrogeology - The study of waters of the earth in the subsurface.

Integrator - An electric device that both plots the chromatogram and evaluates the area under the curve of the chromatogram as a method of quantification in gas chromatography.

LC50 - An experimentally derived estimate of a lethal dose whereby one half of the population will expire. This refers to exposure by inhalation.

LCS - Laboratory control sample.

LD50 - LD50 is an experimentally-derived estimate of the chemical dose that will kill 50 percent of the exposed population of organisms. Dose is expressed in unit weight or chemical per unit weight of organism and is used when the chemical is administered orally, dermally, or parenterally (by injection). When the organisms are exposed to a chemical in air or water, the amount to which the organisms are exposed is called

concentration; thus, the expression becomes LC50, with "C" standing for concentration. LC50 estimates for mammalian inhalation toxicity are expressed in parts-per-million (ppm), volume-volume, or unit weight of chemical per cubic meter of air (usually mg/cu m). LC50 estimates for aquatic organisms are expressed unit weight of chemical per liter of water (usually mg/l).

Leachate - A solution or product obtained by the separation of soluble components by the action of percolation.

Log P - Octanol-water partition coefficient which provides a reasonable estimate of the propensity of a chemical to bind to soil containing organic material as well as to bioaccumulate. Chemicals with a high Log P tend to bind to organic materials to a greater degree that those with a low Log P.

LUFT - Leaking Underground Fuel Tanks - Standards and methods of remediation of underground fuel tanks consolidated into a manual and adopted by the State of California to classify leaking underground fuel storage tanks.

MCL - Maximum concentration level, generally a term used in regulations and standards to stipulate an allowable or non-allowable concentration.

Metamorphic rock - Rock that is changed by heat and/or pressure to produce a more compact, more crystalline rock.

Moraine - A mound, ridge or other accumulation of unstratified glacial drift, predominantly till.

NPDES - National Pollutant Discharge Elimination System.

Outwash - Stratified sand and gravel removed or "washed out" from a glacier by meltwater.

OVA - Organic Vapor Analyzer, a flame ionization detector used to measure organic vapors and gases.

PCBs - Polychlorinated Biphenyls. Once widely used industrial chemical whose high temperature stability contributed to both their commercial usefulness and their long term detrimental environmental and health effects.

Peristaltic pump - A pump in which fluid is forced along by waves of contraction produced mechanically on flexible tubing.

Permafrost - Permanently frozen ground (subsoil).

PID - Photo-ionization detector, used to detect compounds by using an ultra-violet lamp which ionizes compounds within a certain range.

Pleistocene - The earlier of two epochs comprising the Quaternary Period. The Pleistocene is known as the glacial age. This epoch corresponds to the span of time from about 2 million years to 10,000 years before the present.

ppb - Parts per billion.

ppm - Parts per million.

ppmv - Parts per million, volume to volume ratio.

QA/QC - Quality Assurance/Quality Control

Quaternary - The younger of two geologic periods in the Cenozoic Era. The Quaternary is subdivided into Pleistocene and Holocene epochs. The Quaternary period corresponds with the span of time from about 2 million years ago to the present.

RBC - Rotating biological contactor.

RCRA - Resource Conservation and Recovery Act of 1977.

Receptor - An organism which has the potential to receive or be exposed to contaminants. Sensitive receptors are humans, endangered or threatened species, and sometimes the general biota.

Replicate sample - A sample that differs slightly in space and time from another sample, such as a water sample taken from the same well but not from the same bailer or at the same time.

RI/FS - Remedial Investigation/Feasibility Study. A term used in CERCLA activities.

RPD - Relative percent difference. A term used in QC evaluation.

SARA - Superfund Amendments and Reauthorization Act - 1986. Related to CERCLA.

SBOD - Soluble biochemical oxygen demand. This is a measurement of the oxygen requirements for microbial metabolism of soluble or dissolved organic compounds in water.

SCS - Surrogate control sample. A term used in QA/QC activities.

Soil gas survey - A site characterization technique in which sampling probes are placed at particular locations at a site, and vapor from the vadose zone is sampled and analyzed in the gas chromatograph.

Sorb - To take up and hold by either adsorption or absorption.

TICs - Tentatively identified compound(s).

Toxaphene - A chlorinated hydrocarbon insecticide.

TPH - Total Petroleum Hydrocarbons.

U-Value - A condition used as a criterion to define steady-state flow for the Cooper and Jacob method of pumping test analysis.

where " $u = \frac{r^2 s}{4Tt}$ "

and r = distance from observation well to pumping well (ft)
s = storativity
T = transmissivity (gpd/ft)
t = time (days)

The method can be used when "u" is less than or equal to 0.05.

Vadose zone - A designation for the zone above the saturated zone in the soil (the zone of aeration).

Vapor pressure - The pressure exerted by a vapor that is in equilibrium with its solid or liquid form. The higher the vapor pressure the greater the tendency for a given substance to volatilize and convert to a gas.

VES - Volatile Extraction System, also Vapor Extraction System. See Volatile Extraction.

VOC(s) - Volatile Organic Compound(s).

Volatile Extraction - A remediation technique whereby a vacuum is applied to the subsurface to pull air through the vadose zone and volatilize contaminants.

Volatile Organics - Those organic substances which have a vapor pressure equal to or greater than 1 mm Hg.

Volatilization - The conversion of a substance from its liquid phase into its gaseous phase.

Wisconsin Period - The last of four classical glacial stages in the Pleistocene of North America, ending about 10,000 years ago.

WQC - Water Quality Criteria, from the Clean Water Act of 1977.

APPENDIX B

Copy of Task Descriptions/Statement of Work (SOW)

15 JUL 1988

STATEMENT OF WORK (SOW)

THE INSTALLATION RESTORATION PROGRAM
REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS)

STAGE 1 FOR

Joint Resources Project:
Ft. Richardson, Ft. Wainwright, and Ft. Greely AK

I. DESCRIPTION OF WORK

1.1 **Scope.** The objective of the Air Force Installation Restoration Program (IRP) is to assess past hazardous waste disposal and spill sites on Air Force installations and develop remedial actions consistent with the National Contingency Plan (NCP) for those sites which pose a threat to human health and welfare or the environment. The intent is to conduct the remedial investigation and feasibility study in parallel instead of in serial fashion. The USAFOEHL/TS Handbook, Version 2.0, dated April 1988 (mailed under separate cover), and the Joint Resources Project, Stage 1 Work Plan are an integral part of this task. All references in this Statement Of Work to the "Handbook" refer to the above version of the USAFOEHL/TS Handbook and imply by reference that it is provided under separate cover. The contractor shall comply with all Work Plan and Handbook requirements as specified in this Statement of Work (SOW). Section 1 of the Handbook lists all documents that apply to this SOW. The contractor shall accomplish the following actions for this stage of the IRP process at Fort Richardson, Fort Wainwright, and Fort Greely AK:

a. literature search,

b. determine public health and environmental requirements,

c. field investigation,

d. baseline risk assessment,

e. develop preliminary alternative remedial actions,

f. initial screening of alternatives,

g. detailed analysis of alternatives,

h. preparation of technical report.

1.2 **Literature Search.** Conduct a literature search to determine the geological, hydrogeological, and environmental settings for this investigation. Requirements are supplied under separate cover (see "Environmental Setting", Section II of the Report Format, contained in Section 3, USAFOEHL/TS Handbook). When gathering information for the demographic setting and conducting the well inventory, consider only those populations and wells within a three mile radius of the installation. Sources include: Federal and State geological agency reports, academic theses and related university research, municipality and

county reports, and historical and current aerial photographs. Cite all bibliographic references reviewed, including personal communications, in the appropriate part of the report. Identify gaps in data or analyses which may prevent an adequate determination of contaminant migration patterns or other factors critical to assessing the hazard potential associated with the individual sites.

1.3 **Public Health and Environmental Requirements.** Evaluate the threat of contaminants to public health and welfare or the environment through a literature search of documents. For the sites investigated, identify the regulatory requirements (ARARs) to which any remedial actions would need to be responsive. Sources for ARARs are listed in the Handbook, Section 2.

1.4. **Field Investigation.** As used in this SOW, 'field investigation' refers to the collection of all data, environmental and biological samples, and subsequent laboratory analysis of samples, as well as removal actions and site restoration activities. The purpose of data collection, sample collection and laboratory analysis is to determine whether any contaminants generated from installation activities are entering the environment. The field investigation is used to determine the source and extent of any identified contaminants, and the magnitude of contamination relative to ARARs and any naturally occurring or background concentrations for specific compounds.

1.4.1 **Quality Assurance/Quality Control (QA/QC).** A quality assurance/quality control (QA/QC) program shall be conducted and documented for ALL work specified in this Delivery Order.

1.4.1.1 Data generated under the QA/QC program shall be used to evaluate the analytical results assembled for each site and to formulate conclusions and recommendations pertaining to the need for additional site investigations or remediation.

1.4.1.2 QA/QC requirements for chemical analyses, laboratory operations, required detection limits, field operations, sampling, sample preservation, sample holding times, equipment decontamination, and chain-of-custody are delineated in the Handbook, Section 12.

1.4.1.3 Annex A, Tables A-4 and A-5 specify the maximum number of field QA/QC samples allowed for each analytical parameter for the entire investigative effort.

1.4.2 **Drilling Supervision.** The field investigation (including all drilling, sampling, and removal operations) shall be supervised by a registered geologist, engineering geologist, hydrogeologist or Professional Engineer certified by the state to install test wells. A detailed log of the conditions and materials penetrated during the course of the work shall be maintained by the geologist/hydrogeologist on site. Decisions on well locations, well depths, screened intervals, and other well construction details shall be made collectively by the USAFOEHL/TS Technical Program Manager (TPM) and the supervising geologist/hydrogeologist.

1.4.3 **Regulatory Requirements and Permits.** All well drilling, development, purging, sampling methods, and other activities pertaining to

this effort must conform to State and other applicable regulatory agency requirements. Cite references in an appendix to the Final Report (paragraph I.1.10.1). Complete permits, applications, and other documents which may be required by local and/or State regulatory agencies for the installation of test wells. File these documents with appropriate agencies and pay all applicable permitting and filing fees.

1.4.4 **Borehole Installation.**

1.4.4.1 **Reserved.**

1.4.4.2 **Lithologic Samples.** For purposes of lithologic descriptions, obtain split-spoon samples at five (5) foot intervals, unless directed otherwise by the USAFOEHL/TS TPM. Perform Standard Penetration Tests (SPT) and split-spoon sampling as detailed in ASTM D 1586. Monitor all split-spoon samples at the intervals specified with a photoionization meter or appropriate Organic Vapor Analyzer (OVA) and record the vapor levels detected. As often as necessary, describe drill cuttings to indicate significant changes in lithology or characteristic properties that relate to the strata penetrated. Follow the standard identification practices detailed in ASTM D 2488. Correlate the materials encountered with local geologic formations as determined from the literature search. Include observations made by the driller and hydrogeologist during drilling such as depth to water, penetration rate, drill rig behavior, and other observations that might be indicative of changes in formation characteristics. Compile all of this information into standard boring or well logs. Indicate on the logs the intervals where discrete split-spoon samples were taken and the corresponding OVA readings and SPT data.

1.4.4.3 **Air Monitoring During Drilling.** Monitor the ambient air during all well drilling and soil boring work with a photoionization meter or appropriate organic vapor analyzer to identify any generation of potentially hazardous and/or toxic vapors or gases. Include air monitoring results in the borehole logs. If soil encountered during borehole drilling or test pit work is suspected to be hazardous because of abnormal discoloration, odor or air monitoring levels, containerize the soil cuttings in new, unused drums. (Note: Contractor is responsible for providing all necessary containers, i.e., 55-gallon drums.) Enter into the boring logs the depth(s) from which suspected contaminated soil cuttings were collected.

1.4.4.4 **Soil Toxicity Sampling.** Collect a maximum of five (5) composite samples, one from the contents of each drum specified in paragraph I.1.4.4.3. Test each composite sample for metals (EP Toxicity, 40 CFR 261.24), for volatile organic compounds (Method SW8240), and for base/neutral and acid extractable organic compounds (Method SW3550/SW8270) to determine if the soil cuttings must be disposed of as hazardous waste.

1.4.4.5 **Water Level Measurements.** Whenever possible, measure water levels in all boreholes after the water level has stabilized. Examine the water surface for the presence of hydrocarbons. Include this information in the borehole logs. Record soil moisture conditions (moist, wet, saturated, etc.) in the boring log.

1.4.4.6 **Marking Borehole Locations.** Permanently mark each soil boring location. Record the location on a project map for each specific site or zone, whichever is applicable.

1.4.5 **Well Installation.** Drill a maximum of one (1) eight-inch pumping well and two (2) two-inch observation wells at the Fort Wainwright Landfill (Site 3) for the purpose of conducting a pump test. Total footage for the eight-inch well shall not exceed thirty-five (35) linear feet, and total footage for the two-inch observation wells shall not exceed sixty (60) linear feet. Drill a maximum of five (5) two-inch test wells at the Anchorage Fuel Terminal (Site 1). Total footage for the two-inch wells shall not exceed three hundred (300) linear feet. Total screening for the eight-inch well shall not exceed thirty (30) linear feet, and total screening for the two-inch wells shall not exceed two hundred forty (240) linear feet.

1.4.5.1 **Well Drilling.** Drill all wells, except the eight-inch pumpimg well, using hollow stem auger techniques. Drill the eight-inch well using a 14-inch, solid flight auger with driven casing. Augers, temporary casings and/or boreholes shall be sufficiently large to provide a minimum of 2 inch annular space on all sides of the well casing and screen during well completion. Ensure wells are installed straight, plumb and centered in the borehole. Describe the lithology of materials encountered as described for borings in paragraph I.1.4.4.2. Containerize drill cuttings and test for toxicity as described in paragraphs I.1.4.4.3 and I.1.4.4.4. Avoid installing wells in depressions or areas subject to frequent flooding and/or standing water. If wells must be installed in such areas, design the wells such that standing water does not leak into the top of the casing or cascade down the annular space from a 25 year flood.

1.4.5.2 **Well Casing Requirements.** Construct each two-inch well with two inch inside diameter (I.D.), Schedule 40, PVC casing. Construct the pumping well at Site 3 using eight-inch I.D., Schedule 40, PVC casing. Use threaded screw-type joints only. Glued fittings are not permitted. Flush-thread all connections.

1.4.5.3 **Well Depth.** Install test wells at a sufficient depth to collect representative samples of aquifer quality and to intercept contaminants that may be floating or stratified in the aquifer.

1.4.5.4 **Well Screening Requirements.**

a. Screen each two-inch well using two-inch I.D. PVC casing having up to 0.020-inch slots. Screen the eight-inch well at Site 3 using eight-inch I.D. PVC casing having up to 0.020-inch slots. Slot size may be smaller based upon borehole geology or sieve analysis of aquifer materials. Each well screen shall be a maximum of twenty-five (25) feet in length. Cap the bottom of the screen.

b. Once the casing is in place, install the sand/gravel pack. If the formation is compatible with the screen slot size, allow the formation to collapse around the well screen. Supplement with washed and bagged, rounded silica sand or gravel with a grain size distribution compatible with the screen and the formation. Place the pack from the

bottom of the borehole to two (2) feet above the top of the screen. The sand/gravel pack should not extend into an overlying formation. Tremie a two (2) foot bentonite seal (granulated or pellets) above the sand/gravel pack. Ensure that the bentonite forms a complete seal. Grout the remainder of the annulus to the land surface with a Type I Portland cement/bentonite slurry. The slurry shall be prepared by adding 3-5 pounds of bentonite clay and 6.5 gallons of clean water for each 94 pound sack of Type I Portland cement. The bentonite used shall be free of additives that may affect water quality.

1.4.5.5 **Well Completion.** Complete all test wells using the following specifications:

a. Coordinate with the Base Point Of Contact (POC) to determine well completion (flush or projected above the ground surface) requirements.

(1) If well stick-up is of concern in an area, complete the well flush with the land surface. Cut the casing two to three inches below land surface, and install a protective locking lid consisting of a cast-iron valve box assembly. Center the lid assembly in a three (3) foot diameter concrete pad sloped away from the valve box. Ensure that free drainage is maintained within the valve box. Also, provide a screw-type casing cap to prevent infiltration of surface water. Maintain a minimum of one (1) foot clearance between the casing top and the bottom of the valve box. Clearly mark the well number on the valve box lid and well casing using an impact labeling method.

(2) If an above-ground-surface completion is used, extend the well casing two or three feet above land surface. Provide an end plug or casing cap for each well. Shield the extended casing with a steel guard pipe (sleeve) which is placed over the casing and cap and seated in a two-foot by two-foot by four-inch (2' X 2' X 4") concrete surface pad. Slope the pad away from the well sleeve. Install a lockable cap or lid on the guard pipe. Install three (3), three-inch diameter concrete-filled steel guard posts if the base POC determines the well is in an area which needs such protection. The guard posts shall be five (5) feet in total length and installed radially from each wellhead. Recess the guard posts approximately two (2) feet into the ground and set in concrete. Do not install the guard posts in the concrete pad placed at the well base. Fill each guard post with concrete. Clearly mark the well number on the well protective sleeve exterior using paint and/or impact lettering. The base POC will specify color to blend with the paint scheme of the base.

b. All wells shall be secured as soon as possible after drilling. Provide corrosion resistant locks for both flush and above-ground well assemblies. The locks must either have identical keys or be keyed for opening with one master key. Turn the lock keys over to the Base POC following completion of the field effort.

c. Include well completion summaries in the Final Report (paragraph I.1.10.1).

1.4.5.6 **Well Logs.** For each well, prepare a well completion log and schematic diagram showing well construction details. Lithologic descriptions and other information included in the well logs shall conform

to the specifications of paragraph I.1.4.4.2.

1.4.5.7 **Well Development.** Develop each test well as soon as practical after well completion and grout curing with a submersible pump, bailer, and/or airlift method. Continue well development until the discharge water is clear and free of sediment to the fullest extent possible (i.e., turbidity less than 5 NTU). Measure the rate of water production, pH, specific conductance, and water temperature during well development and include this information in the Final Report (paragraph I.1.10.1).

1.4.5.8 **Water Level Measurements.** Measure water levels at all test wells as feet below the measuring point elevation (usually top of casing) to the nearest 0.01 foot. Report as mean sea level (MSL). Measure static water levels in wells prior to well development and before all well purging preceeding sampling events.

1.4.5.9 **Well Abandonment.** Recommend well abandonment method(s) or technique(s) which are applicable to the type of test wells installed and the geological conditions. Consider that these wells will be abandoned at some future date after the study objectives have been met. The actual process of well abandonment is not a part of this task order. Insure that the recommended method(s) is consistent with State and local well abandonment guidelines or regulations.

1.4.6 **Surveying.** Determine by certified land surveyor the elevations and locations of all newly installed test wells, soil borings, and sampling points. This shall be a third order survey. Notch the top of the riser casing where well elevations are established. Record the positions on both project and site-specific maps. Bench marks used must have previously been established from, and be traceable to, a US Coast and Geodetic Survey (USCGS) or US Geological Survey (USGS) survey marker. Clearly identify all bench mark locations on the base map.

1.4.7 **Well and Boring Precautions.** Mark the field locations of all wells and soil borings during the planning/mobilization phase of the field investigation. Consult with base personnel to minimize disruption of base activities, to properly position wells with respect to site locations, and to avoid underground utilities. Obtain written approval from the base civil engineer prior to commencement of digging or drilling operations.

1.4.8 **Well and Borehole Cleanup.** Dispose of all uncontaminated well/borehole cuttings per direction of the base civil engineer and clean the general area following the completion of each well/borehole. If approved by the base civil engineer, uncontaminated cuttings may be spread over the general area in the vicinity of the well or borehole or trucked to more suitable areas for disposal. Containerize and store cuttings suspected to be contaminated in accordance with paragraph I.1.4.4.3. Transport these drums to an accumulation point within the installation boundary designated by the Base POC. The base is responsible for ultimate disposal of contaminated soils using base resources.

1.4.9 **Geophysical Surveys**

1.4.9.1 **Soil Gas Surveys.** Establish appropriate grid systems and

conduct a maximum of eight (8) days of soil gas survey. Collect and analyze a maximum of three (3) confirmatory water samples from the probe holes at the Fort Wainwright burn pit. Select the samples on the basis of head space screening analysis, and collect one (1) "clean" sample (negative result from head space analysis), one (1) "dirty" sample (highest reading from head space analysis), and one (1) additional sample with a reading between these two. Refer to Annex A, Table A-2 for specific numbers of analyses for these samples. Prepare posting maps of soil gas values relative to their location on the grids used. Provide these maps in the Informal Technical Information Report submitted after completion of the surveys and all analyses (paragraph I.1.10.2) and in the Final Report (paragraph I.1.10.1).

1.4.9.2 **Ground Penetrating Radar Survey.** Perform a maximum of three (3) days of ground penetrating radar survey to identify the location, material, and condition of the subsurface drainage system at the Anchorage Fuel Terminal (Site 1). Provide the results of this survey in the Informal Technical Information Report submitted after completion of the survey and all analyses (paragraph I.1.10.2) and in the Final Report (paragraph I.1.10.1).

1.4.9.3 **Electromagnetic Survey.** Establish appropriate grid systems and perform a maximum of three (3) days of electromagnetic survey. Use the results of this survey to site the locations of the wells to be used in the pump test. Prepare a contour map of the results of the electromagnetic survey. Provide this map in the Informal Technical Information Report submitted after completion of the survey and all analyses (paragraph I.1.10.2) and in the Final Report (paragraph I.1.10.1).

1.4.10 **Pump Test.** Conduct a nine-hour three-step drawdown test on the eight-inch well installed at the Fort Wainwright Landfill (Site 3). Monitor water levels in all Site 3 wells before, during, and after the pump test. Evaluate the results of the pump test and estimate aquifer characteristics. Include in this evaluation information obtained from geophysical surveys, well installation, and groundwater sampling (including historical results) at this site. Develop a semi-analytical model of the aquifer, and estimate contaminant transport in the aquifer based on this model. Incorporate the results of the pump test into the Final Report (paragraph I.1.10.1), and submit any software and documentation generated from this model to USAFOEHL (Item VI, Paragraph 6.2, Sequence No. 1).

1.4.11 **Groundwater Modelling.** In addition to the model specified in paragraph 1.4.10 above, and based on information obtained from various sources, including U.S. Geological Survey records, prior U.S. Army studies, and data obtained from the new test wells, construct a three-dimensional model depicting the geology, hydrology, and contamination plume dynamics at the Anchorage Fuel Terminal (Site 1). Use this model to estimate contaminant transport from this site, and include these results in the Final Report (paragraph I.1.10.1). Submit any software and documentation generated from this task to USAFOEHL (Item VI, Paragraph 6.2, Sequence No. 1).

1.4.12 **Bench Scale and Pilot Studies.** Following the initial field investigation, the contractor shall present the specific design for each bench scale and pilot study along with evaluation procedures and criteria to the USAFOEHL Technical Program Manager for review and approval prior to implementation of the tests. Include the findings of these studies in the Final

Report (paragraph I.1.10.1), and include cost estimates for implementation of the methods tested in the cost letter for the next effort (paragraph I.1.12.2). The maximum numbers of analyses for these tests are summarized in Annex A, Table A-6.

1.4.12.1 **In-Situ Volatiles Extraction.** Conduct a pilot study to evaluate the effectiveness of in-situ volatiles extraction for removal of petroleum hydrocarbons from vadose zone soils at Site 1, the Anchorage Fuel Terminal. The duration of the test shall not exceed two (2) weeks. Use test results to evaluate the affected chemicals, delineate the area of influence of the test system, and determine the expected time and cost required to achieve acceptable levels of cleanup in a full-scale remediation system.

1.4.12.2 **Enhanced Bioremediation.** Conduct a bench-scale test to determine the compatability of enhanced bioremediation techniques with conditions at Site 1, the Anchorage Fuel Terminal. The duration of this test shall not exceed four (4) weeks. Use test results to identify optimum system parameters and to estimate the time and cost required to achieve acceptable cleanup levels in a full-scale remediation system.

1.4.12.3 **Water Collection System.** Conduct a pilot study to determine the feasibility of surface and groundwater collection, oil/water separation, and water treatment for Site 1, the Anchorage Fuel Terminal. The duration of this test shall not exceed four (4) weeks. Conduct this pilot study by installing a line trench/sump collection system with an oil/water separator and vacuum treatment or water aeration treatment equipment. Based on the results of this test, prepare a cost estimate for full-scale operation of this alternative in achieving an acceptable level of cleanup at the site.

1.4.13 **Sample Collection.**

1.4.13.1 **Groundwater Samples.** Collect a maximum of nine (9) groundwater samples, one from each of the five wells at Site 1, one from the eight-inch well at Site 3, and three from the burn pits (Site 4) (paragraph I.1.4.9.1). The maximum number of analyses for each parameter and the required analytical method is given in Table A-2, Annex A.

1.4.13.2 **Soil Samples.** Collect a maximum of eighteen (18) soil samples. Refer to the site specific requirements section for the distribution of these samples and the analytical requirements.

1.4.14 **Site-specific Requirements.** Perform the site-specific requirements as listed in the following sub-paragraphs. The field tasks shall be performed as specified in the Joint Resources Project Work Plan. Refer to Annex A of this SOW, Table A-1 for the number of wells, borings, soil gas, geophysical surveys, aquifer tests and bench scale/pilot tests by site. Table A-2 lists water analyses by site, and Table A-3 lists soil analyses by site.

1.4.14.1 **Site 1. Anchorage Fuel Terminal.**

a. Field tasks include: Ground penetrating radar survey, installation and one (1) round of groundwater sampling and analysis of five (5) test wells, collection and analysis of eighteen (18) soil samples from the well borings, development of a semi-analytical groundwater model, two pilot

tests, and a bench-scale test. The maximum numbers of analyses for each parameter and the required analytical methods are given in Tables A-2 and A-3, Annex A.

1.4.14.2 **Site 2. Roosevelt Road Transmitter Site.**

a. Field tasks include: Expedited Response Action with confirmatory sampling, removing all debris, vegetation, and soil containing greater than ten (10) parts per million PCB, containerization and weighing of each container, transport of PCB-contaminated material to Defense Reutilization and Marketing Office at Elmendorf AFB AK, applying an encapsulant over the concrete pad, filled surfaces, trenches, and sidewalls, placing clean fill and topsoil in areas that were excavated, and seeding the area to promote revegetation.

1.4.14.3 **Site 3. Fort Wainwright Landfill.**

a. Field tasks include: Electromagnetic survey, installation of one eight-inch and two two-inch wells, one groundwater sample, pump test, and development of a semi-analytical model of the aquifer.

1.4.14.4 **Site 4. Fire Burn Pits.**

a. Field tasks include: Soil gas surveys (with groundwater sampling at the Fort Wainwright Burn Pit).

1.5 Baseline Risk Assessment. After a thorough review of all data gathered during the field investigation and the establishment of ARARs (paragraph I.1.3), determine the potential risk to human health and welfare or the environment from the contaminants identified at the various sites investigated. This task will utilize primarily a qualitative approach, with the establishment of a baseline risk level for judging the effectiveness of implementing the remedial technologies tested during this study as a goal. Include results of the baseline risk assessment in Section IV of the Final Report (paragraph I.1.10.1). Identify those sites posing no threat to human health, welfare or the environment and which no further action is appropriate.

1.6 Preliminary Alternative Remedial Actions (FS Phase I). Utilize a streamlined approach of screening and evaluation that will focus feasibility study efforts rapidly on practical and permanent solutions to contamination problems. Submit an outline of this approach to USAFOEHL/TS as an attachment to the Informal Technical Information Report (paragraph I.1.10.2). For all past hazardous waste disposal and spill sites investigated at Fort Wainwright, Fort Richardson, and Fort Greely AK, except those where no further action is applicable, utilize the data and conclusions obtained from the hydrogeological survey, site characterization, bench scale and pilot studies, and baseline risk assessment to develop preliminary alternative remedial actions. Alternatives developed shall include the following categories:

a. Alternatives for off-site treatment and/or disposal

b. Alternatives that attain ARARs

c. Alternatives that exceed ARARs

d. Alternatives that do not attain ARARs

e. No action

Further, alternatives outside of these categories may also be developed, such as non-cleanup alternatives (e.g., alternate water supply, relocation, etc.). Documentation of the remedial alternative development process, including the decision rationale, shall be included in Section V of the Final Report (paragraph I.1.10.1).

1.7 **Initial Screening of Alternatives (FS Phase II).** The alternatives developed in paragraph I.1.6 shall be screened to eliminate those that are clearly infeasible or inappropriate, prior to undertaking detailed evaluation of the remaining alternatives. The screening process and identification of the alternatives remaining shall be included in Section V of the Final Report (paragraph I.1.10.1).

1.8 **Detailed Analysis of Alternatives (FS Phase III).** Perform a detailed analysis of the alternatives remaining after the initial screening. The detailed analysis will include the following:

a. Technical Analysis

b. Environmental Analysis

c. Public Health Analysis

d. Institutional Analysis

e. Cost Analysis

f. Evaluation of Alternatives

The analysis procedures, decision process, results and conclusions of the detailed analysis shall be included in Section V of the Final Report (paragraph I.1.10.1). Score all sites where a remedial alternative is selected using the Defense Site Remediation Priority Model (DSRPM). Guidance is provided in the Handbook, Section 9, and in the DSRPM Users Manual (provided under separate cover).

1.10 **Reports**

1.10.1 **Final Report.** Prepare a report delineating all findings from this investigative stage of the remedial investigation/feasibility study. Review the Results, Conclusions and Recommendations concerning the sites listed in this task which were investigated during previous studies. Use this information and data from previous efforts to establish trends and develop conclusions and recommendations. Integrate all investigative work done at each site to date so that the report reflects the total cumulative information for each site studied in this effort. Environmental sample results shall be analyzed with respect to QA/QC data unique to this project. Summary statistics shall be used and reported when justified by the amount and quality of data. This report must also include a detailed discussion of the recommended alternative remedial actions and a description of any work proposed. Forward

the report to USAFOEHL/TS for Air Force and regulatory agency review (Item VI, Sequence No. 4, paragraph 6.1).

1.10.1.1 **Draft Reports.** Draft reports are considered "drafts" only in the sense that they have not been reviewed and approved by the Air Force. In all other respects, "drafts" must be complete, in the proper format, and free of grammatical and typographical errors. All draft reports shall be thoroughly screened through in-house peer technical review before being released to USAFOEHL/TS.

1.10.1.2 **Report Format.** Strictly adhere to the USAFOEHL/TS Report Format (USAFOEHL/TS Handbook, Section 3) for preparation of draft and Final Reports. This format is an integral part of this Delivery Order.

1.10.1.3 **Microfiche Copies of Final Report.** Provide three (3) microfiche copies of the approved Final Report (Item VI, Sequence No. 17, paragraph 6.1).

1.10.2 **Analytical Data.** Upon completion of all analyses, soil gas and geophysical surveys tabulate and incorporate all analytical data into an Informal Technical Information Report and forward the report to USAFOEHL/TS no later than three (3) weeks after all analyses have been completed (Item VI, Sequence No. 3, paragraph 6.1).

1.11 **Plans.**

1.11.1 **Health and Safety Plan.** Provide a written Health and Safety Plan within four (4) after the Notice To Proceed (NTP) (Item VI, Sequence No. 3, paragraph 6.1). Comply with USAF, OSHA, EPA, State and local health and safety regulations regarding the upcoming work effort. Use EPA guidelines for designating the appropriate levels of protection needed at the study sites. Coordinate the Health and Safety Plan directly with applicable regulatory agencies prior to submittal to USAFOEHL/TS. Provide the USAFOEHL/TS TPM with evidence of Health and Safety Plan approval prior to the start of field work.

1.11.2. **Cost Proposal.** In a separate letter, submit a lump sum cost estimate for the effort required to perform the work described in the recommendations for the next effort (Item VI, Sequence No. 2, paragraph 6.1). Include also in this letter the cost estimates generated for implementing the alternatives tested in the pilot/bench scale tests (paragraphs I.1.4.12.1-3).

1.12 **Special Notifications.** Immediately report to the USAFOEHL/TS TPM or his/her supervisor, via telephone, any data/results generated during this investigation which may indicate an imminent health risk. Follow the telephone notification with a written notice within three (3) days and attach a copy of the raw laboratory data (e.g., chromatograms, standards used for calibration, etc).

1.13 **R & D Status Reports.** Include all data as required by the USAFOEHL/TS Handbook, Section 6. Tabulated field and laboratory test results and QA/QC data shall be incorporated into the next monthly R & D Status Report as they become available and forwarded to the USAFOEHL/TS (Item VI, Sequence No. 1, paragraph 6.1).

1.14 The above technical efforts which include maximum requirements are estimates only. Should the contractor determine technical efforts, including field work, require variation from these estimates, the contractor shall obtain a written concurrence from the contracting officer's technical representative at USAFOEHL/TS. This concurrence is required prior to proceeding with the variation. Under such circumstances the ceiling price of this order shall remain unchanged. Should an increase in the ceiling amount be necessary contracting officer authorization will be required prior to proceeding with the variation.

II. SITE LOCATION AND DATES:

Fort Richardson, Fort Wainwright, and Fort Greely AK
Date to be established

III. BASE SUPPORT

The Base will:

3.1 Locate underground utilities and issue digging or other appropriate permits to the IRP contractor prior to the commencement of digging or drilling operations.

3.2 Assign accumulation points within the installation to which the contractor can deliver any drill cuttings or well installation/development fluids generated from the required work which are suspected to be hazardous. The contractor is responsible for providing all necessary containers (55-gallon drums) for drilling and well development fluids and for transporting this containerized material to the accumulation point. The contractor is responsible for analyzing all containerized wastes generated during this study.

3.3 Take custody of all PCB contaminated soils removed from the Roosevelt Road Transmitter Site and any drill cuttings or well installation/ development fluids suspected to be hazardous and properly dispose of the material according to applicable State and/or Federal regulations.

3.4 Provide the contractor with existing engineering plans, drawings, diagrams, aerial photographs, soil gas survey results, well logs, water and soil analytical results, digitized map files, etc., to facilitate evaluation of IRP sites under investigation.

3.5 Arrange for, and have available prior to the start-up of field work, the following services, materials, work space, and items of equipment to support the contractor during the investigation:

a. Personnel identification badges, vehicle passes and/or entry permits.

b. A secure staging area (approximately 1000 square feet) for storing equipment and supplies.

c. A supply (e.g., fire hydrant, stand pipe, etc.) of large quantities of potable water for borehole flushing, equipment cleaning, etc.

d. A paved area where drilling equipment can be cleaned and decontaminated. A source of potable water (i.e., ordinary outdoor water faucet) and a 110/115 VAC electrical outlet must be available within 25 feet of the paved area for steam cleaner hookup. Drainage from this paved area should be through an oil/water separator to a sanitary sewer.

e. A temporary office area, not to exceed 100 square feet and equipped with a Class A telephone for local and long distance telephone calls. The contractor shall pay for any long distance telephone calls made by contractor personnel from this phone.

f. A set of keys to the locks on any existing test/monitoring wells at Forts Richardson, Wainwright, and Greely AK. The keys shall be returned to the Base POC by the contractor when the survey has been completed.

g. Temporary construction barriers and parking/traffic control at the well sites in areas of vehicle traffic.

IV. GOVERNMENT FURNISHED PROPERTY: None.

V. GOVERNMENT POINTS OF CONTACT:

5.1 USAFOEHL/TS
Technical Program Manager (TPM)
1Lt Franz J. Schmidt
USAFOEHL/TSS
Brooks AFB TX 78235-5501
(512) 536-9001, ext. 227
AV 240-9001, ext. 227
1-800-821-4528, ext. 227

5.2 Base Point of Contact (POC)
Ms Catherine Benediktsson
6th Inf Div
Directorate of Engineering and Housing (DEH) AFVR-DE
(907) 862-0193
AV 317-0188

5.3 Alaskan Air Command POC
Ms C. Amy Wickstrom
HQ AAC/DEP
Elmendorf AFB AK
(907) 552-2117
AV 552-2117

VI. DELIVERABLES

6.1 Attachment 1 of the basic contract. In addition to Sequence Numbers 1 and 5 listed in Attachment 1 to the basic contract which apply to all orders, the Sequence Numbers and dates listed below are applicable to this order:

Sequence No.	Para No.	Block 10	Block 11	Block 12	Block 13	Block 14
3 (Health & Safety)	I.1.11.1	OTIME	88 JUL 29	88 AUG 08	-	10
3 (ITIR-Analytical Data)	I.1.10.2	OTIME	*	*	-	4
4 (Tech. Rpt)	I.1.10.1	ONE/R	88 SEP 19	88 NOV 14	89 APR 03	**
2 (Cost Ltr)	I.1.11.2	OTIME	89 JAN 09	89 APR 03	-	3
17 (Microfiche)	I.1.10.1.3	OTIME	89 FEB 06	89 APR 03	-	3

6.2 Attachment 2 of the basic contract.

Sequence No.	Para No.	Block 10	Block 11	Block 12	Block 13	Block 14
1 (Groundwater Modelling)	I.1.4.10-11	OTIME	88 SEP 19	89 JAN 09	-	1

6.3 Notes:.

* For the analytical data, geophysical survey and soil gas maps, provide the ITIR upon completion of the total analytical effort and not later than three weeks after all analyses have been completed.

** One first draft report (15 copies), one second draft report (25 copies), and one Final Report (50 copies plus the original camera-ready copy) are required. Incorporate Air Force comments into the second draft and Final Reports as specified by USAFOEHL/TS. Supply USAFOEHL/TS with an advance copy of the first draft, second draft, and Final Reports for acceptance prior to distribution. Distribute the remaining 14 copies of the first draft report, 24 copies of the second draft report, and 49 copies of the Final Report as specified by USAFOEHL/TS.

ANNEX A, Table A-1
Summary of Field Work by Site

	Site 1	Site 2	Site 3	Site 4	Total
No. of Wells	5	0	3	0	8
Soil Gas Survey	no	no	no	yes	--
Electromagnetic Survey	yes	no	yes	no	--
Ground Penetrating Radar	yes	no	no	no	--
Expedited Removal Action	no	yes	no	no	--
Bench Scale/Pilot Test	yes	no	no	no	--
Groundwater Modelling	yes	no	yes	no	--

ANNEX A, Table A-2
Approximate Number of Water Analyses by Site

PARAMETER	ANALYTICAL METHOD	Site 1	Site 2	Site 3	Site 4	Total
Specific Conductance (Field Test)	E120.1	5	0	1	0	6
[illegible] (Field Test)	E150.1	5	0	1	0	6
Temperature (Field Test)	E170.1	5	0	1	0	6
[illegible] by	E180.1	0	0	1	0	1
Petroleum Hydrocarbons	E418.1	5	0	1	0	6
[illegible]	SW1110	0	0	1	0	1
[illegible]	SW3005/ SW7460					
[illegible] Recoverable		0	0	1	0	1
Dissolved		0	0	1	0	1
Lead	SW3005/ SW7421					
Total Recoverable		5	0	1	0	6
Dissolved		5	0	1	0	6
Purgeable Aromatics	SW5030/ SW8020	5	0	0	0	5
Organochlorine Pesticides	SW3510/ SW8080	0	0	1	0	1
Volatile Organic Compounds	SW8240	0	0	0	3	3

ANNEX A, Table A-3
Approximate Number of Soil Analyses by Site

PARAMETER	ANALYTICAL METHOD	Site 1	Site 2	Site 3	Site 4	Drill Cuttings	Total
Petroleum Hydrocarbons	SW3550/ E418.1	18	0	0	0	0	18
Lead	SW3005/ SW7420	18	0	0	0	0	18
Volatile Organic Compounds	SW8240	18	0	0	0	5	23
Semivolatile Organic Compounds	SW3550/ SW8270	18	0	0	0	5	23
Extraction Procedure Toxicity, Metals Only	SW1310 (extraction only; use appropriate methods for analysis of eight EP Tox Metals)	0	0	0	0	5	5
Soil Moisture Content	ASTM D2216	18	0	0	0	0	18

ANNEX A, Table A-4
Analytical Methods and TOTAL Number of Water Analyses

PARAMETER	ANALYTICAL METHOD (a)	REPORTING UNITS	NUMBER OF ANALYSES	TRIP BLANKS	DUP/REP	SECOND COLUMN (d)	TOTAL ANALYSES
Specific Conductance (Field Test)	E120.1	umhos/cm	6	0	0	0	6
pH (Field Test)	E150.1	pH Units	6	0	0	0	6
Temperature (Field Test)	E170.1	deg C	6	0	0	0	6
Turbidity	E180.1	NTU	1	0	0	0	1
Petroleum Hydrocarbons	E418.1	mg/L	6	0	1	0	7
Corrosivity	SW1110	mmpy	1	0	0	0	1
Manganese	SW3005/ SW7460	mg/L					
Total Recoverable			1	0	0	0	1
Dissolved (c)			1	0	1	0	2
Lead	SW3005/ SW7421	mg/L					
Total Recoverable			6	0	1	0	7
Dissolved (c)			6	0	1	0	7
Purgeable Aromatics	SW5030/ SW8020	ug/L	5	1	1	4	11
Organochlorine Pesticides	SW3510/ SW8080	ug/L	1	0	1	1	3
Volatile Organic Compounds	SW8240	ug/L	3	0	0	0	3

ANNEY A, Table A-5
Analytical Methods and TOTAL Number of Soil Analyses (b)

PARAMETER	ANALYTICAL METHOD (a)	REPORTING UNITS	NUMBER OF ANALYSES	DUP/REP	TOTAL ANALYSES
Petroleum Hydrocarbons	SW3550/ E418.1	mg/kg	18	2	20
Lead	SW3005/ SW7420	mg/kg	18	2	20
Volatile Organic Compounds	SW8240	mg/kg	23	2	25
Semivolatile Organic Compounds	SW3550/ SW6270	mg/kg	23	2	25
Extraction Procedure Toxicity, Metals Only	SW1310 (extraction only; use appropriate methods for analysis of eight EP Tox Metals)	mg/L	5	0	5
Soil Moisture Content (b)	ASTM D2216	per cent (%)	18	0	18

ANNEX A, Table A-6
Analytical Methods and Maximum Number of Analyses
for Pilot Tests and Bench Scale Tests

PARAMETER	ANALYTICAL METHOD (soil)	ANALYTICAL METHOD (water)	REPORTING UNITS	NUMBER OF ANALYSES, SOIL	NUMBER OF ANALYSES, WATER	TOTAL ANALYSES
Petroleum Hydrocarbons	SW3550/ E418.1	E418.1	mg/kg (soil), mg/L (water)	40	4	44
Benzene-Toluene-Xylene	SW5030/ SW8020	SW5030/ SW8020	ug/kg (soil), ug/L (water)	4	4	8
Biological Oxygen Demand (5d)	-	E405.1	mg/L	0	4	4
Chemical Oxygen Demand	E410.1	E410.1	mg/kg (soil), mg/L (water)	4	4	8
Total Organic Carbon	E415.1	E415.1	mg/kg (soil), mg/L (water)	4	4	8
Dissolved Organic Carbon	-	E415.1	mg/L	0	4	4
Organic Nitrogen	E351.2	E351.2	mg-N/kg (soil), mg-N/L (water)	4	4	8
Total Bacteria	SA38-4	SA38-4	#/g	4	4	8
Phosphorus (ortho)	E365.1	E365.1	mg/kg (soil), mg/L (water)	4	4	8
Phosphorus (total)	E365.1	E365.1	mg/kg (soil), mg/L (water)	4	4	8
Sulfide	-	E376.2	mg/L	0	4	4
Nitrate, Nitrite, Sulfate	-	E300	mg/L	0	4	4

NOTES

a Unless an abbreviated list of analytes is specified under "Parameter" above, the analytical protocol shall include all analytes listed in the referenced analytical method. The methods cited are from the following sources:

"A" Methods	Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985)
"E" Methods	Methods for Chemical Analysis of Water and Wastes, EPA Manual, 600/4-79-020 (USEPA, 1983 - with additions)
"SW" Methods	Test Methods for Evaluating Solid Waste, Physical/ Chemical Methods, SW-846, 3rd Edition (USEPA, 1986)
"ASTM" Methods	American Society for Testing and Materials, 1919 Race Street, Philadelphia PA 19103
"SA" Methods	Methods of Soil Analysis, Part 2: Chemical and Microbiological Properties, Second Edition, American Society of Agronomy, Inc./Soil Science Society of America, Inc. Madison, WI

b For soil/sediment samples, report results as mg/kg of dry soil or sediment. Report moisture content for each sample. Contractor shall modify the equation for calculation of moisture content in ASTM D-2216 to read:

$$w = [(W1-W2)/(W1-WC)] \times 100$$

where w = moisture content, %

W1 = weight of container and moist soil, g

W2 = weight of container and oven-dried soil, g

WC = weight of container, g.

c The sample shall be filtered in the field through a 0.5 um filter at the time of sample collection and before sample preservation.

d The maximum number of second-column confirmational analyses shall not exceed fifty percent (50%) of the actual number of field samples (to include duplicates, replicates, ambient condition blanks, trip blanks and equipment blanks). If the number of samples requiring second-

column confirmation exceeds this allowance, contact the USAFOEHL/TS Technical Program Manager. The total number of samples listed in Tables A-4 and A-5 includes the allowance applicable to each GC method. If GC/MS, or a combination of second-column GC and GC/MS, is used, the total cost of all such analyses for a particular parameter shall not exceed the funding allowed for positive confirmation using only second-column GC.

Woodward-Clyde Consultants
CONTRACT No. F33615-85-D-4544
Proposed Order 0009

July 25, 1988

ASSUMPTIONS
Joint Resources Project

The following assumptions apply to the cost estimate for site investigations under the Joint Resources Project at three Army bases.

1. Fieldwork labor estimates are based on assumption of normal summer weather. Delays for inclement weather are assumed to consume no more than a total of 24 crew hours (maximum of 48 man-hours) over the life of the task order.

2. The literature search required will be based primarily on sources identified and used in previous reports on the sites, and will consist in the main of an update to incorporate new information.

3. ARARs. The requirement for satisfaction of the Superfund Amendments and Reauthorization Act (SARA) has been removed from the Statement of Work, since the requirements of SARA generally do not apply to non-NPL sites. Instead, in regard to ARARs the contractor will identify and describe the principal environmental and public health regulatory concerns that are relevant to each site, and document that satisfaction of these concerns has been addressed in the evaluation of alternative remedies for each site.

4. Baseline Risk Assessment and Preliminary Alternative Remedial Actions. The reference to CERCLA and SARA guidance and the requirement for adherence to the format of the OEHL handbook have been removed from the Statement of Work, since the requirements of SARA do not generally apply to non-NPL sites. It is assumed that the risk assessment will be similar to the qualitative assessments that have been done in the past by Woodward-Clyde Consultants for OEHL at DEW-line and LRRS sites, as documented in several Technical Documents in Support of No Further Action. It is assumed that the intent of the risk assessment is to determine the need for further action, and for sites requiring

further action, to determine the relative urgency of need, based on a qualitative assessment of the risk to human health and environmental receptors.

It is assumed that the intent of the Preliminary Alternative Remedial Actions task is to identify practical and permanent solutions to contamination problems at sites that may require further action. Since CERCLA and SARA do not apply strictly to remedy selection for the sites in question, it is assumed that the approach to this task should be streamlined and pragmatic, but defensible in terms of the degree of protectiveness, the implementability and the cost effectiveness of the alternatives selected. An outline of the approach to be used will be submitted for OEHL approval prior to its utilization to screen and select remedies.

5. ITIR. Reference to the OEHL handbook was removed from the Statement of Work. The Informal Technical Information Report will consist of copies of lab data as received from the subcontractor laboratory, and copies of field records and logs, organized by location and/or chronological sequence. No summary tables or other tables of interpreted data will be prepared for inclusion in this deliverable. The intent of the ITIR is to provide the OEHL TPM with timely data to assist in his understanding of the initial findings of the field investigations. The ITIR also will include a written description of the streamlined approach to remedy selection, as discussed in the above assumptions.

6. Report It is assumed that the overall level of detail of evaluations and reporting will be commensurate with (1) the kind of risk presented by these sites, and (2) the level of effort proposed in this cost proposal. That is, guidelines of the OEHL Handbook that are ostensibly addressed to larger, more complex contamination situations will be interpreted liberally for these sites.

7. Surveys Third-order surveys will be utilized for locating new groundwater monitoring wells only. For these surveys it is assumed that USGS or USCGS survey markers will be available and accessible. Otherwise the wells

will be tied into the local base coordinate system. Other sampling locations will be referenced to existing site features using hand-held instruments and will be entered on a site map of field locations.

8. Soil Gas Surveys It is expected that one day of electromagnetic survey will be required at each site at which a soil gas survey is planned, to do the utility clearance at the planned soil gas probe locations. Further, it is expected that each fire burn pit location (4 total) will require 20 probe holes of average 15-foot depth.

9. PCB Removal It is assumed that the volume of PCB-contaminated soil to be removed is 100 cubic yards. If acceptably clean soil is not encountered over the entire excavation area with this volume of removal, the excavation will be backfilled only to the extent that the additional soil yet to be removed remains accessible. The site will then be secured in an acceptable manner and left for future removal efforts.

10. Flow and Transport Modeling Flow and transport modeling will be performed at two sites to obtain the large-scale hydraulic properties of the aquifers underlying the sites and to estimate the design parameters (i.e., locations and extraction rates) of the extraction system that may be required to hydraulically contain and mitigate the plume in groundwater. As the first step of modeling, a two- (or three) dimensional advection-dispersion model of migration of chemicals from the site will be developed. This model will be calibrated with the aid of existing data on distribution of chemicals in the groundwater. The results of transport modeling will yield an estimate of the flow velocity of the groundwater. The estimated velocity along with the estimates of porosity and hydraulic gradients will be used to estimate the large-scale hydraulic conductivity of the aquifers underlying the sites. This model can also be used to estimate the rates at which the plume will expand if no remedial measures are taken.

Refined estimates of the hydraulic properties will be used in a semi-analytical flow model to estimate the locations and extraction rates of the extraction wells needed to hydraulically control and mitigate the groundwater plume.

These modeling analyses will use semi-analytical methods of flow and transport modeling with the following assumptions:

- o The aquifer is homogeneous and isotropic.
- o The seasonal changes in groundwater gradients are small.
- o The aquifers are laterally extensive and horizontal flow velocities are significantly larger than the vertical rate of recharge.

If the site conditions differ considerably from the above mentioned assumptions and the actual conditions are such that the use of semi-analytical methods may yield erroneous results, then detailed modeling, using a finite-element or finite-difference technique, would be required. This type of modeling is not included in the present scope.

11. Pumping Test The pumping test at Ft. Wainwright will be made only if the produced water can be either delivered to the base wastewater treatment plant or can be tested on site and discharged. It is assumed that the monitoring wells installed as part of the site investigation are suitably spaced to serve as water-table observation wells during the pumping test.

12. Collect and Separate Water-Oil The oil-water collection and separation pilot test will involve a 25-foot-long trench. The trench will be at a maximum 10 feet deep and 2 feet wide. It is assumed that the excavated soil can be left on site. A sump and well will be installed, then the trench backfilled with open-graded rock near the bottom and on-site soil above.

Treatment of produced oil and water will involve oil-water separation. It is assumed that treated water can be discharged locally. It is also assumed that the pilot test well and sump can remain in place after the test. Process testing will include total petroleum hydrocarbons.

13. Enhanced Bioremediation The oil spill at the Anchorage Terminal Site has produced contamination of the vadose zone, and possibly of the underlying groundwater. Two studies directed toward enhanced bioremediation will be made; the first is a bench-scale test of soil biodegradation potential (land treatment), the second is a field assessment of the feasibility of applying enhanced in-situ biodegradation for remediation of the groundwater. The results of the field assessment may be useful for designing a pilot-scale test of in-situ bioremediation.

Test 1: Soil Biodegradation Potential - The bench-scale test of soil biodegradation potential will be conducted using microcosms designed to simulate a contained land-treatment system. Large-mouth glass beakers (1000cc capacity) will be used as incubation vessels. Five hundred cc aliquots of representative contaminated soil will be added to each of eight beakers. The contaminated soil will be collected on site, frozen, and shipped to WCC's Pleasant Hill, California Laboratory. At Pleasant Hill, the sample will be thawed and homogenized, and two replicate subsamples will be extracted and analyzed for total petroleum hydrocarbons (TPH, method 418.1), benzene/toluene/xypene (BTX, method 602), and total bacteria (acridine orange technique).

Incubation vessels will be placed in an environmental chamber set at a temperatureof 25, C and with a 12 hr/12 hr light/dark lighting system. The incubation temperature was chosen to maximize microbial activity during the initial four-week incubation period.

On a weekly basis, the soil in each incubation vessel will be gently, but thoroughly mixed (to simulate roto-tilling), and a dilute solution of nutrients will be added to enhance microbial activity.

After four weeks of incubation, two of the incubation vessels will be randomly selected for analysis. The same series of analyses performed initially (TPH, BTX, bacteria) will be repeated. Contaminant concentrations and bacterial densities will be compared to initial values. A finding of contaminant reduction coupled with a concomitant increase in

bacterial density will be a strong indication that soil bioremediation is feasible.

The remaining incubation vessels will be maintained at least until receipt and analysis of the results of the 4-week-old samples. If appreciable contaminant reduction has not taken place in 4 weeks, the bench study will be continued up to a maximum of 12 weeks, at which time the last samples will be tested.

Test 2: In-Situ Remediation Assessment Two groundwater monitoring wells, one at the contaminated site and one from an upgradient background well (the latter newly installed for the purpose) will be sampled. Soil samples will also be collected from each well. Analysis will include:

	Water	Soil
Total petroleum hydrocarbons	X	X
Volatile organics	X	X
Chemical oxygen demand (COD)	X	X
Total bacteria (AODC)	X	X
Organic nitrogen	X	X
Phosphate (total and ortho)	X	X
Total organic content (TOC)	X	X
Anion scan for NO_3, NO_2, SO_4, PO_4	X	
Dissolved organic carbon (DOC)	X	
Sulfide	X	
Biological oxygen demand	X	

Evaluation of comparative results between the contaminated and background samples will indicate the feasibility of groundwater bioremediation.

14. Drill Rig Decontamination It is assumed that during drilling of several borings at one location only the in-hole equipment will be decontaminated between borings. Between sites the in-hole equipment and visibly contaminated parts of the drill rig will be decontaminated, and only at the end of drilling at a location will the entire drill rig be decontaminated.

SCHEDULE OF CHANGES

Contract Number: F33615-85-D-4544

Order Number: 09

Modification Number: 01

Contractor: Woodward-Clyde Consultants

Date Of Modification: 88 DEC 16

Pen and Ink Changes:

Paragraph	Change
1.4.12.2	Change: "four (4) weeks" TO "twelve (12) weeks".
1.4.12.4	Add Following Paragraph: **Conceptual Design.** Prepare a preliminary conceptual design of an air stripping system and rotating biological contactor to remove dissolved hydrocarbons (BTX) from the runoff at the Anchorage Fuel Terminal (AFT). To perform this task, evaluate the volume of water discharged to Cook Inlet from the AFT (considering seasonal variations). Collect and analyze a maximum of sixteen (16) water samples, eight in the fall and eight in the spring, for Benzene-Toluene-Xylene, Oil & Grease, and Biological Oxygen Demand. Refer to Annex A, Table A-6 for analytical methods. Details of the conceptual design and results from the fall water sampling shall be included in the final report, and the results of the spring samples shall be submitted as an informal technical report (Item VI, paragraph 6.1).
6.1	Change Sequence No.4, Block 12: From "88 NOV 14" to "88 DEC 14"
6.1	Change Sequence No.4, Block 13: From "89 APR 03" to "89 MAY 03"
6.1	INSERT

SEQ No.	Para No.	BLK10	BLK11	BLK12	BLK13	BLK14
3 (ITIR-Spring Results)	I.1.4.12.4	OTIME	*	*	-	4

Table A-3	Replace with attached Table A-3A.
Table A-5	Replace with attached Table A-5A.
Table A-6	Replace with attached Table A-6A.

ANNEX A, Table A-3A
Approximate Number of Soil Analyses by Site

PARAMETER	ANALYTICAL METHOD	Site 1	Site 2	Site 3	Site 4	Drill Cuttings	Total
Petroleum Hydrocarbons	SW3550/ E418.1	18	0	0	0	0	18
Lead	SW3005/ SW7420	18	0	0	0	0	18
Volatile Organic Compounds	SW8240	18	0	0	0	0	18
Semivolatile Organic Compounds	SW3550/ SW8270	18	0	0	0	0	18
Extraction Procedure Toxicity, Metals Only	SW1310 (extraction only; use appropriate methods for analysis of eight EP Tox Metals)	0	0	0	0	0	0
Soil Moisture Content	ASTM D2216	18	0	0	0	0	18

ANNEX A, Table A-5A
Analytical Methods and TOTAL Number of Soil Analyses (b)

PARAMETER	ANALYTICAL METHOD (a)	REPORTING UNITS	NUMBER OF ANALYSES	DUP/REP	TOTAL ANALYSES
Petroleum Hydrocarbons	SW3550/ E418.1	mg/kg	18	2	20
Lead	SW3005/ SW7420	mg/kg	18	2	20
Volatile Organic Compounds	SW8240	mg/kg	18	2	20
Semivolatile Organic Compounds	SW3550/ SW8270	mg/kg	18	2	20
Extraction Procedure Toxicity, Metals Only	SW1310 (extraction only; use appropriate methods for analysis of eight EP Tox Metals)	mg/L	0	0	0
Soil Moisture Content (b)	ASTM D2216	per cent (%)	18	0	18

ANNEX A, Table A-6A
Analytical Methods and Maximum Number of Analyses
for Pilot Tests and Bench Scale Tests *

PARAMETER	ANALYTICAL METHOD (soil)	ANALYTICAL METHOD (water)	REPORTING UNITS	NUMBER OF ANALYSES, SOIL	NUMBER OF ANALYSES, WATER
Petroleum Hydrocarbons	SW3550/ E418.1	E418.1	mg/kg (soil), mg/L (water)	4	4
Benzene-Toluene-Xylene	SW5030/ SW8020	SW5030/ SW8020	ug/kg (soil), ug/kg (water)	4	32
Benzene-Toluene-Xylene/ Petroleum Hydrocarbons	**	-	ug/kg (soil)	24	0
Biological Oxygen Demand (5d)	-	E405.1	mg/L	0	24
Chemical Oxygen Demand	E410.1	E410.1	mg/kg (soil), mg/L (water)	4	4
Total Organic Carbon	E415.1	E415.1	mg/kg (soil), mg/L (water)	4	4
Dissolved Organic Carbon	-	E415.1	mg/L	0	4
Organic Nitrogen	E351.2	E351.2	mg-N/kg (soil), mg-N/L (water)	4	4
Total Bacteria	SA38-4	SA38-4	#/g	28	4
Phosphorus (ortho)	E365.1	E365.1	mg/kg (soil), mg/L (water)	4	4
Phosphorus (total)	E365.1	E365.1	mg/kg (soil), mg/L (water)	4	4
Sulfide	-	E376.2	mg/L	0	4
Nitrate, Nitrite, Sulfate	-	E300	mg/L	0	4
Oil & Grease	-	E413.2	mg/L	0	18
pH	E150.1	E150.1	pH Units	24	16

* Analyses in this table are not included in the totals specified in Tables A-4 and A-5.

** Use a modified SW8015/8020 method to analyze for petroleum hydrocarbons and B-T-X.

APPENDIX C

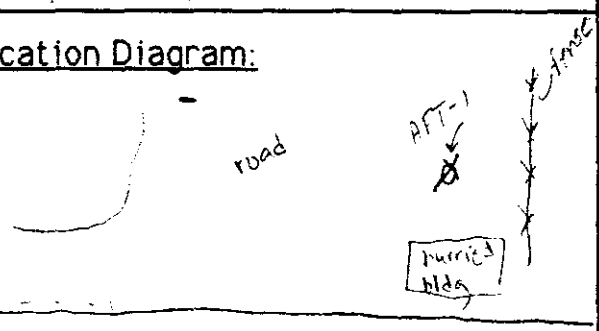
Well Data and Lithologic Logs

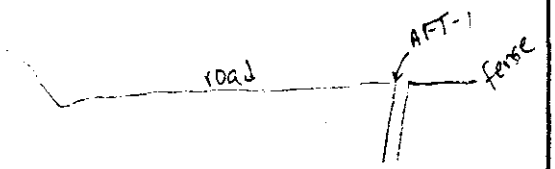
Well Data and Lithologic Logs for Anchorage Fuel Terminal

Project: Joint Resources
912715 K /3061

LOG OF BORING NO. AFT-1

Location Diagram:





☑ Monitoring Well ☐ Test Boring

Logged By: MA S.B.

Driller: Discovery Rig: CME 45

Drill Method: hollow stem auger

Sample Method: split spoon

Hammer Wt: 340 Drop: 30 in

Start Time: 1000 Date: 9-14-88

Complete Time: 1430 Date: 9-14-88

Weather: partly cloudy

Instrumentation: HNu

Comments:
TIP Background:
CGI Background:

Water depth:			
Time:			
Date:			

Depth (ft)	Blows/6 in.	Analytical Samples	Frozen	Material Description	USC	Temp. °F	VOC ppm	% LEL	Odor	Screen Setting
				0-7						
				brn sandy GRAVEL, moist loose	GW					
				(road bed) gravel subrounded						
				.5-2 in dia						
5	9	R-FT-0501		brn sandy GRAVEL damp/moist	GW		0		N	
	10			med dense - same as above						
	11									
	15									
				7-22						
10	11	no samples submitted		brn sandy GRAVEL, gravelly SAND,	GW/SW		0		N	
	20			damp, dense, trace ~~brn~~ silt						
	21			gravel angular to subrounded						
	16			.25 to 3.0 in dia						

Woodward-Clyde Consultants

Figure

Project: Joint Resources
90275K/3061

LOG OF BORING NO. AFT-1

Depth (ft)	Blows/6 in.	Analytical Samples	Frozen	Material Description	USC	Temp. °F	YOC ppm	% LEL	Odor	Screen Setting
15	8	R-FT-0502 dup			SW		0		N	
	17									
	18									
	16									
				gradation change						
20	9	no samples submitted		brn/gray gravelly SAND, damp	SW		1		N	
	13			med dense to dense, gravel						
	17			upto 0.25 in dia						
	14									
				22-30						
25	9	no samples submitted		brn clean sand, damp/moist	SP		0		N	
	12			med dense, trace silt, med						
	17			grained sand						
	15									
				30-						
30	8									
	16			blue/gray clayey SILT, damp	ML		0		N	
	9			firm to stiff, trace sand						
	10									
	10									
	11				ML		0		N	
35	14									
		EOH = 35'								
40										

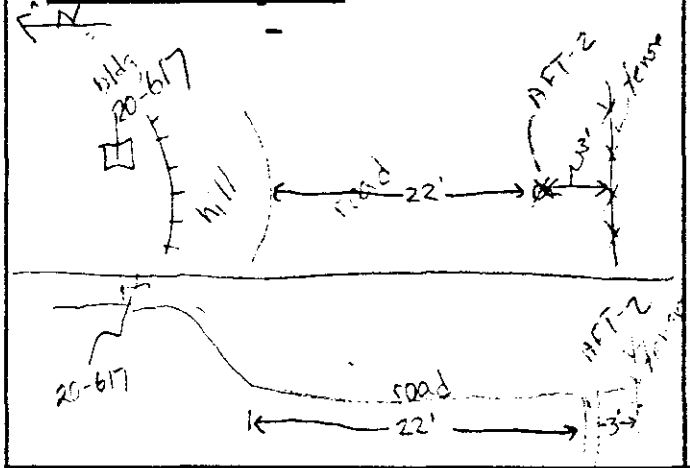
Project No. | **Woodward-Clyde Consultants** | Figure

Project: Joint Resources
90275K/3061

LOG OF BORING NO. AFT-2

Page 1 of 1

Location Diagram: 14 posts from fence



☑ Monitoring Well ☐ Test Boring

Logged By: SA S.B.
Driller: Discovery Rig: CME 45
Drill Method: hollow stem auger
Sample Method: split spoon
Hammer Wt: 340 Drop: 30 in
Start Time: 0830 Date: 9-16-88
Complete Time: 1145 Date: 9-16-88
Weather: cloudy, intermittent showers
Instrumentation: HNu

Comments:
TIP Background:
CGI Background:

Water depth:			
Time:			
Date:			

Depth (ft)	Blows/6 in.	Analytical Samples	Frozen	Material Description	USC	Temp. °F	VOC ppm	% LEL	Odor	Screen Setting
				0 - 8						
				brn sandy GRAVEL, moist, loose gravel angular to subrounded upto 3 in dia	GW		0		N	
5	5 7 9	R-FT-0601			GW		0.1		N	
				8 - 18						
10	9 14 13	no samples submitted		mottled brn/gray sandy Gravel, gravelly SAND, moist, med dense, subangular to subrounded gravel, mottling orange brn and blk on sample surface	GW		0.1		N	

Woodward-Clyde Consultants

Figure

Project: Joint Resources 90275K/3061

LOG OF BORING NO. AFT-2

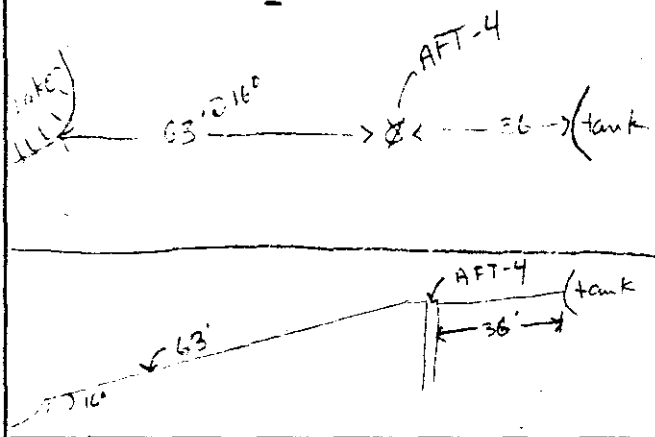
Depth (ft)	Blows/6 in.	Analytical Samples	Frozen	Material Description	USC	Temp. °F	VOC ppm	% LEL	Odor	Screen Setting
15	8 12 14	R-FT-0602			SW/GW		4 cut 0		SL Y	
				17'						
				18'-22.5'						
20	5 5 4	R-FT-0603 composite blk + sand		brn SAND, moist, loose, med to large grained - trace silt	SW		1.5		N	
				20.5' blk coal? shaley piece			30		Y	
				22.5-23.5 gravel layer - driller comment	GW					
				23.5 - 31			cut 0.1		N	
25	6 6 7	no samples submitted		brn med gr. SAND, moist, loose trace silty	SP		1.0		Y	
							cut 3			
30	6 10 8	no samples submitted		31' mottled gray/brn SILT damp/moist firm -	ML		3			
35		BOH = 35'								
40										

Project No. | Woodward-Clyde Consultants | Figure

Project:
Joint Resources
90275K/3061

LOG OF BORING NO. AFT-4

Location Diagram:



☑ Monitoring Well ☐ Test Boring

Logged By: JH S.B.
Driller: D.D Rig: CME 45
Drill Method: hollow stem auger
Sample Method: split spoon
Hammer Wt: 340 Drop: 30 in
Start Time: 0930 Date: 9-13-88
Complete Time: 1215 Date: 9-13-88
Weather: overcast
Instrumentation: HNu

Comments:
TIP Background:
CGI Background:

Water depth:	15'		
Time:	1200		
Date:	9-13-88		

Depth (ft)	Blows/6 in.	Analytical Samples	Frozen	Material Description	USC	Temp. °F	VOC ppm	% LEL	Odor	Screen Setting
				0 - 1						
				brn gravelly SAND, moist, soft	SP					
				1 - 8						
				blue gray sandy gravel, damp. Firm, gravel subangular to	GP					
5	4	K-FT-0301		subrounded 0.25 - 1.5 in dia (fill)			0		N	
	4			silty						
	5									
				8 - 14						
				mottled brn gray gravelly SAND			1.5		Y	
10	4			soft/firm, trace silt, gravel						
	4			0.25 - 2 in dia						
	4			@ 11.5 ft wood chip (fill)						

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Figure

Project: Joint Resources
95345K/3061

LOG OF BORING NO. FT-4

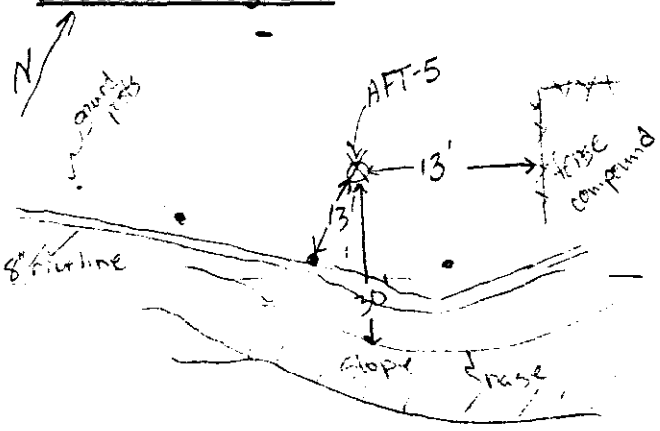
Depth (ft)	Blows/6 in.	Analytical Samples	Frozen	Material Description	USC	Temp. °F	VOC ppm	% LEL	Odor	Screen Setting
15	5 7 8 10	R-FT-0302 dup		14- gray sandy Gravel, sat. med. dense, contaminated, sheen on water in spoon	GP		410 TOA 125 N.S.		Y	
20	9 9 10 10	no samples submitted					3C TOA		Y	
		EOH = 23'								
25										
30										
35										
40										

Project No. | Woodward-Clyde Consultants | Figure

Project: Saint Resources 902-75K/2061

LOG OF BORING NO. AFT-5

Location Diagram:



☑ Monitoring Well ☐ Test Boring

Logged By: JA S.B.

Driller: Discovery Rig: CME 45

Drill Method: hollow stem auger

Sample Method: split spoon

Hammer Wt: 340 Drop: 30 in

Start Time: 1300 Date: 9-13-88

Complete Time: 1500 Date: 9-13-88

Weather: partly cloudy

Instrumentation: HNu

Comments:
TIP Background:
CGI Background:

Water depth:			
Time:			
Date:			

Depth (ft)	Blows/6 in.	Analytical Samples	Frozen	Material Description	USC	Temp. °F	VOC ppm	% LEL	Odor	Screen Setting
				0-						
				brn sandy GRAVEL, damp to wet, med. dense, trace silt	GP					
5	5/7/6 1-1/2	A-FT-0401		5.5-6' organic rich buried top soil - lots of small roots	SL		30		Y	
				6' brn sandy GRAVEL, damp to wet, loose to med dense, trace silt.	GP				Y	
				7' contaminant sat blue-gray, gravelly SAND						▽ 7'
10	4/5/5 1			9' gray sandy CLAY moist, firm/stiff, some sandy			30 cont. 20		Y Y	
				BOH = 12'						

Woodward-Clyde Consultants

Figure

Scott - water encountered at 7½ ft

Saint Resources 902-75K/2061 Boring Log AFT-5 Screen 10-5'

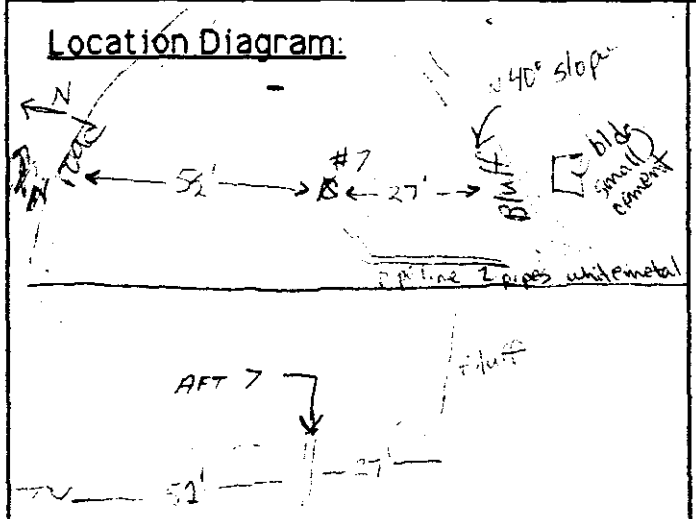
Fm ED Bedwell

Project: 90275K/3061

Ft Rich AFT Joint Resources

LOG OF BORING NO. 7

Location Diagram:



☐ Monitoring Well ☐ Test Boring

Logged By: JH

Driller: S.C Rig: CME-45

Drill Method: Hollow stem auger 4"

Sample Method: split spoon

Hammer Wt: 340 Drop: ✓

Start Time: 1200 Date: 9-8-88

Complete Time: 1500 Date: 9-9-88

Weather: clear slight breeze

Instrumentation:

Boring re-done 9-12-88

Comments: dry sand on surface
TIP Background: veg=scattered grass up to 1 foot
CGI Background:

Water depth:	55.9'		
Time:	1015		
Date:	9-12-88		

Depth (ft)	Blows/6 in.	Analytical Samples	Frozen	Material Description	USC	Temp. °F	VOC ppm	% LEL	Odor	Screen Setting
1.5				moist D. brn clean sand small gravel up to 1 inch Ø ~~sandy gravel~~						
5		3/9/17 5'					5			
7				increase gravel size after drilling ~ 40% gravel up to 4 in Ø rounded to subrounded						
10				wrangled piece of metal came out of hole 11-12 driller- stiffer (?silt?)						

Woodward-Clyde Consultants

Figure

5, 15, 51

Project: 90275K/3061
Joint Resources
Ft Rich AFT

LOG OF BORING NO. #7

Depth (ft)	Blows/6 in.	Analytical Samples	Frozen	Material Description	USC	Temp. °F	VOC ppm	% LEL	Odor	Screen Setting
5		3/3/5/6 8270 8240 418.1 7420 02216		15' stiff gray CLAY 0.4 ppm background - upto 6 ppm			6			
20				20' sandy CLAY stiff gray damp gradational change 22' increase in sand content 23' increasing moisture						
25										
		29' ± Bolt		drilling resumed 1550 9-8-88						
30										
		33'		33' driller's comment 6 inch sand layer						
3				36' softer drilling slight increase in moisture						
4				notes on following page are blow 40-45 ft resume drilling 0850 9-9-88						

Project No. | **Woodward-Clyde Consultants** | Figure

Project: 90275K/3061
Joint Resources
Ft Rich AFT

LOG OF BORING NO. #7

Depth (ft)	Blows/6 in.	Analytical Samples	Frozen	Material Description	USC	Temp. °F	VOC ppm	% LEL	Odor	Screen Setting
15										
20		3/1/19 4118.1 8270 8240 02216 7420		43' driller comment 6 inch sand layer 48-48½ drillers comment may have hit water table easier drilling 0900 48.1 ft water 48 ft one blow to set sample and it sank 1ft last 6" 9 blows 1000 - no water at 51.8 ft 51.5' drillers comment stiffer drilling			2			
25										
30				BOH = ~~51.5'~~ BOH = 57.6'						
35										
40										

Project No. | Woodward-Clyde Consultants | Figure

Project: 9075K.13061

LOG OF BORING NO. AFT-7b

Location Diagram:

-

location on AFT-7

☐ Monitoring Well ☑ Test Boring

Logged By: AH

Driller: S. Clinkenbeard Rig: CME 45

Drill Method: hollow stem auger

Sample Method: split spoon

Hammer Wt: 340 Drop: ✓

Start Time: 0915 Date: 9-12-98

Complete Time: _____ Date: _____

Weather: cloudy intermittent showers

Instrumentation: _____

Comments:
TIP Background:
CGI Background:

Water depth:	16.1		
Time:	1130		
Date:	9-12-98		

Measure to top of PVC

Depth (ft)	Blows/6 in.	Analytical Samples	Frozen	Material Description	USC	Temp. °F	VOC ppm	% LEL	Odor	Screen Setting
				0-12 ft brn gravelly SAND med grained moist, trace silt, loose to med dense gravel upto 2 in dia	SP					
5										
10	4 8 10				SP		ND		N	
				12 - 13.5 ft: Brown coarse gravel, moist, dense						

Woodward-Clyde Consultants

Figure

Project:
902-75K/3061
Joint Resources

LOG OF BORING NO. AFT-7b

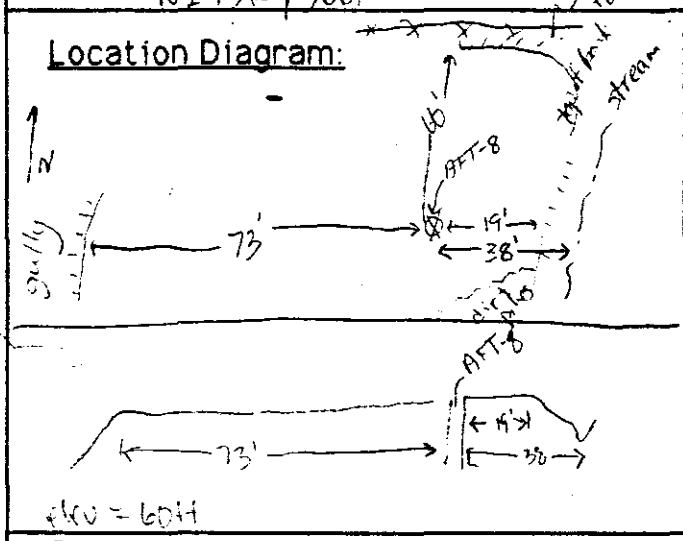
Depth (ft)	Blows/6 in.	Analytical Samples	Frozen	Material Description	USC	Temp. °F	VOC ppm	% LEL	Odor	Screen Setting
15				15.5' brn/gray, gravelly SAND moist to v. moist trace silt gravel ~ 1in dia						
20	3 6 8			19' gray blue gray, SILTY CLAY moist, hard						
25										
30										
35										
40										

Project No. | **Woodward-Clyde Consultants** | Figure

Project: Joint Resources
90278k/3061

LOG OF BORING NO. AFT-8

Location Diagram:



flow = 60ft

☑ Monitoring Well ☐ Test Boring

Logged By: RD

Driller: S. Clinkenbeard Rig: CME 45

Drill Method: hollow stem auger

Sample Method: split-spoon

Hammer Wt: 340 Drop: 30 in

Start Time: 1315 Date: 9-12-88

Complete Time: Date:

Weather: sprinkles

Instrumentation: HNu

Comments:
TIP Background:
CGI Background:

Water depth:			
Time:			
Date:			

Depth (ft)	Blows/6 in.	Analytical Samples	Frozen	Material Description	USC	Temp. °F	VOC ppm	% LEL	Odor	Screen Setting
				0-3 ft ± brown silt with some sand + trace gravel, firm, moist (FILL)	ML		—	—		
				3-7 ft						
5	2 3 4	R-FT-0201		mottled brn and bluegray sandy SILT with subangular small gravel upto 2 in dia (FILL)			1	—	N	
				8' Dbon silty organic SAND moist, soft			5		Y	
10	3 3 4	R-FT-0202		9.5' TOP of auger			6		Y	
				10' gray gravelly SAND with trace silt very moist to sat. small gravel <5 in dia subrounded to subangular			65		N	▽ 10'
		BOH = 15'								

Woodward-Clyde Consultants

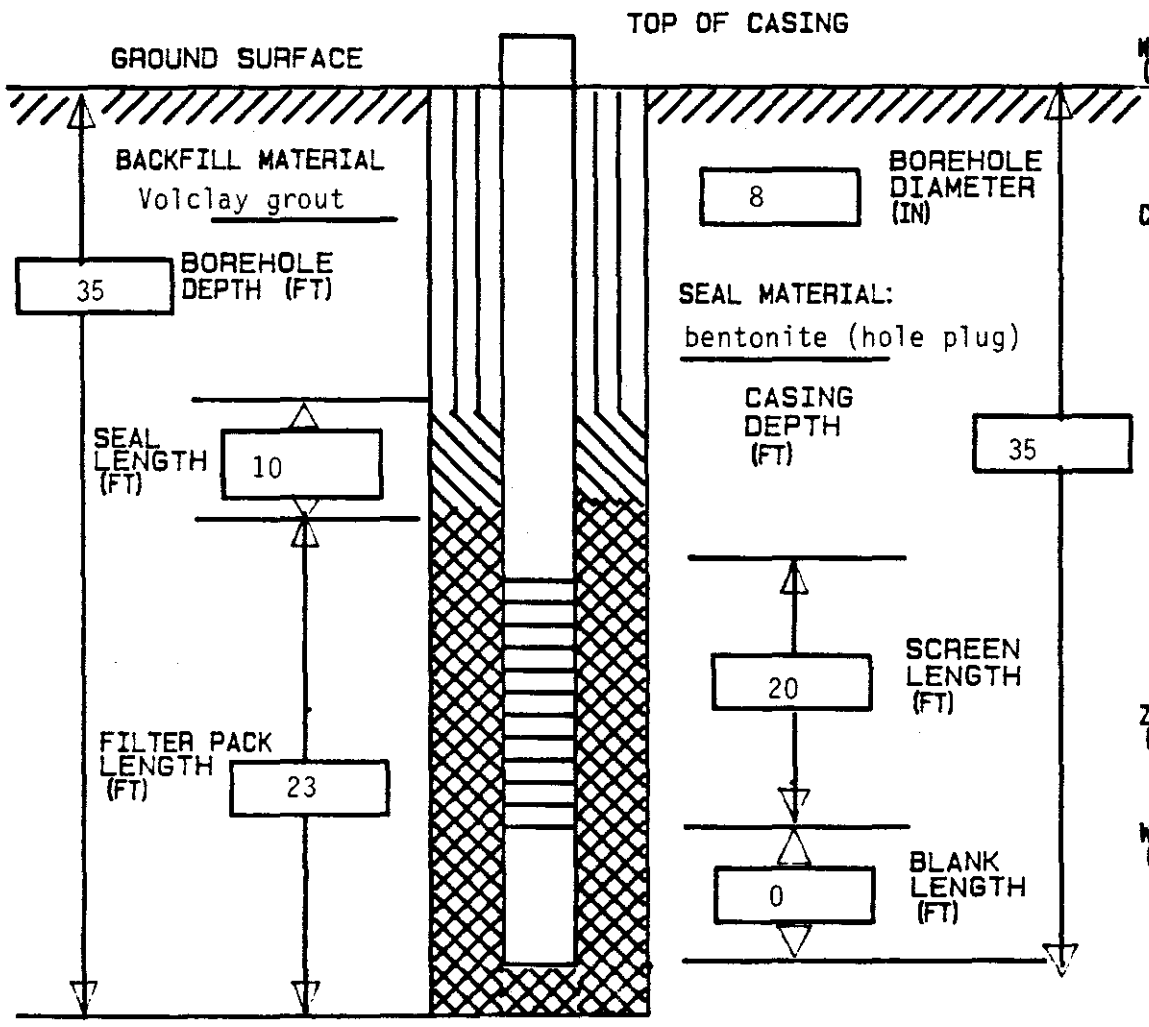
Figure

WELL COMPLETION INFORMATION

INSTALLATION ID AFT
LOCATION ID AFT-1
WELL OWNER U.S. Army
WELL TYPE CLASS MNW
FORMATION OF COMPLETION Silt/Sand & Gravel
SEAL END DEPTH (FT) 12
MEAS.POINT ELEV. (FT MS) 115
CASING DEPTH (FT) 35
CASING DIAMETER (IN) 2 I.D.
CASING MATERIAL PVC

LOCATION TYPE WL
INSTALLATION DATE 9-14-88
INSTALLER J. Holzman
WELL COMPLETION METHOD GS
ZONE OF COMPLETION A
FILTER PACK LENGTH (FT) 23
SCREEN BEGIN DEPTH (FT) 35
SCREEN LENGTH (FT) 20
SCREEN SLOT SIZE (IN) 0.02

REMARKS Pulling out of hole odor at 5 ft.



WELL TYPE CLASSIFICATION (WT CODE)
MNW-MONITORING WELL
PRW-PRODUCTION WELL
TST-TEST WELL
WSW-WATER SUPPLY WELL

CASING MATERIAL (CMACODE)
ABS-ABS
BRK-BRICK
CBS-CARBON STEEL
CNC-CONCRETE
COP-COPPER
FBG-FIBERGLASS
GLS-GALVANIZED STEEL
WRI-WROUGHT IRON
SLS-STAINLESS STEEL
LCS-LOW CARBON STEEL
M-OTHER METAL
TF-TEFLON
PLY-POLYPROPYLENE
PVC-PVC
RST-ROCK OR STONE
STL-STEEL
TIL-TILE
COS-COATED STEEL
WD-WOOD

ZONE OF COMPLETION (GZCCODE)
A-AQUIFER
C-CONFINING LAYER

WELL COMPLETION METHODS (WCMCODE)
C-POROUS CONCRETE
GP-GRAVEL PACK W/PERF.
GS-GRAVEL PACK W/SCR.
H-HORIZONTAL GALLERY
OE-OPEN END
P-PERFORATED OR SLOTTE
S-SCREEN
SP-SAND POINT
W-WALLED OR SHORED
OP-OPEN

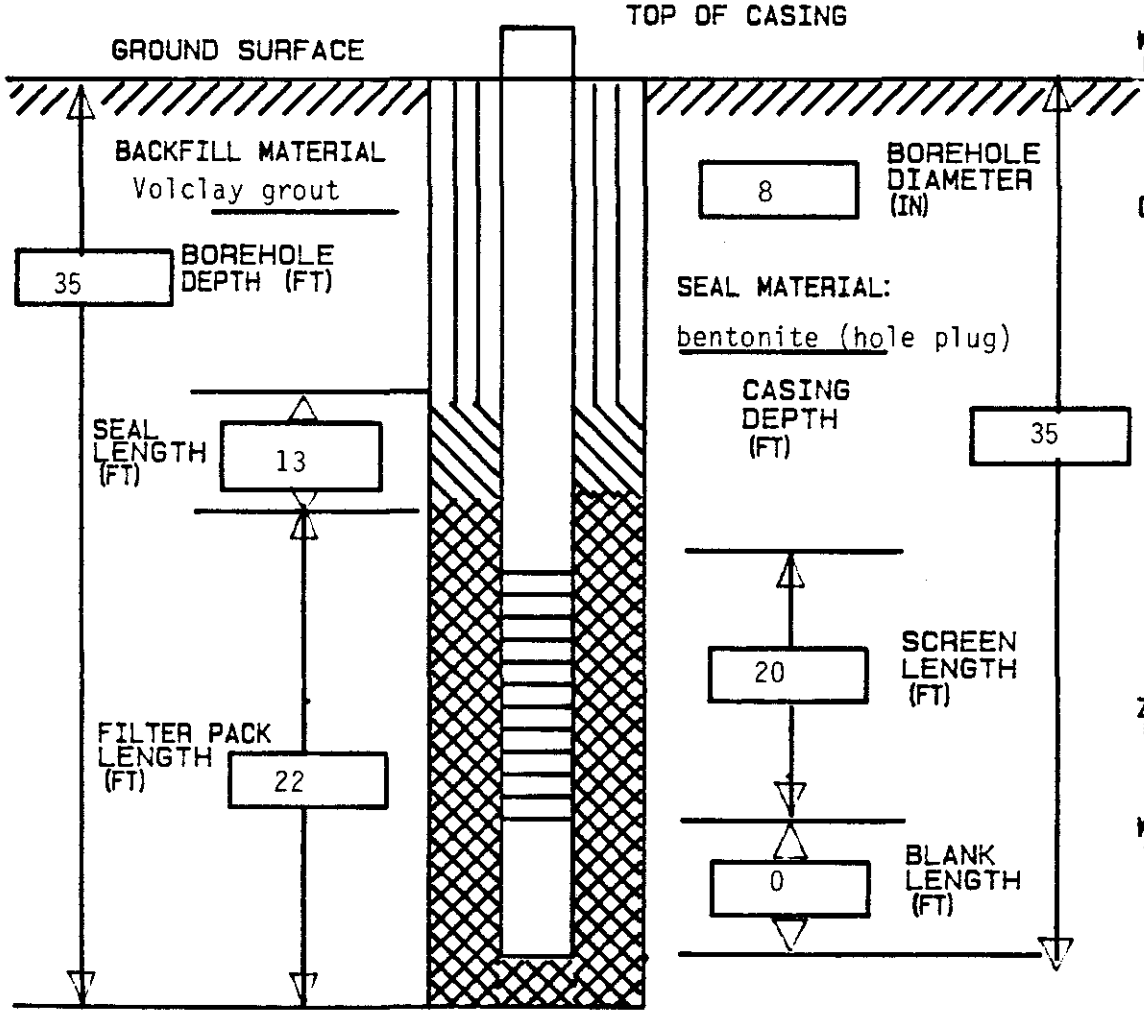
FILTER PACK MATERIAL Silica sand No. 8

WELL COMPLETION INFORMATION

INSTALLATION ID AFT
LOCATION ID AFT-2
WELL OWNER U.S. Army
WELL TYPE CLASS MNW
FORMATION OF COMPLETION Sand
SEAL END DEPTH (FT) 13
MEAS.POINT ELEV. (FT MS) 115
CASING DEPTH (FT) 35
CASING DIAMETER (IN) 2 in. I.D.
CASING MATERIAL PVC

LOCATION TYPE WL
INSTALLATION DATE 9-16-88
INSTALLER J. Holzman
WELL COMPLETION METHOD GS
ZONE OF COMPLETION A
FILTER PACK LENGTH (FT) 22
SCREEN BEGIN DEPTH (FT) 15
SCREEN LENGTH (FT) 20
SCREEN SLOT SIZE (IN) 0.02

REMARKS Flush mount.



FILTER PACK MATERIAL No. 8 Silica sand.

WELL TYPE CLASSIFICATION (WT CODE)
MNW-MONITORING WELL
PRW-PRODUCTION WELL
TST-TEST WELL
WSW-WATER SUPPLY WELL

CASING MATERIAL (CMACODE)
ABS-ABS
BRK-BRICK
CBS-CARBON STEEL
CNC-CONCRETE
COP-COPPER
FBG-FIBERGLASS
GLS-GALVANIZED STEEL
WRI-WROUGHT IRON
SLS-STAINLESS STEEL
LCS-LOW CARBON STEEL
M-OTHER METAL
TF-TEFLON
PLY-POLYPROPYLENE
PVC-PVC
RST-ROCK OR STONE
STL-STEEL
TIL-TILE
COS-COATED STEEL
WD-WOOD

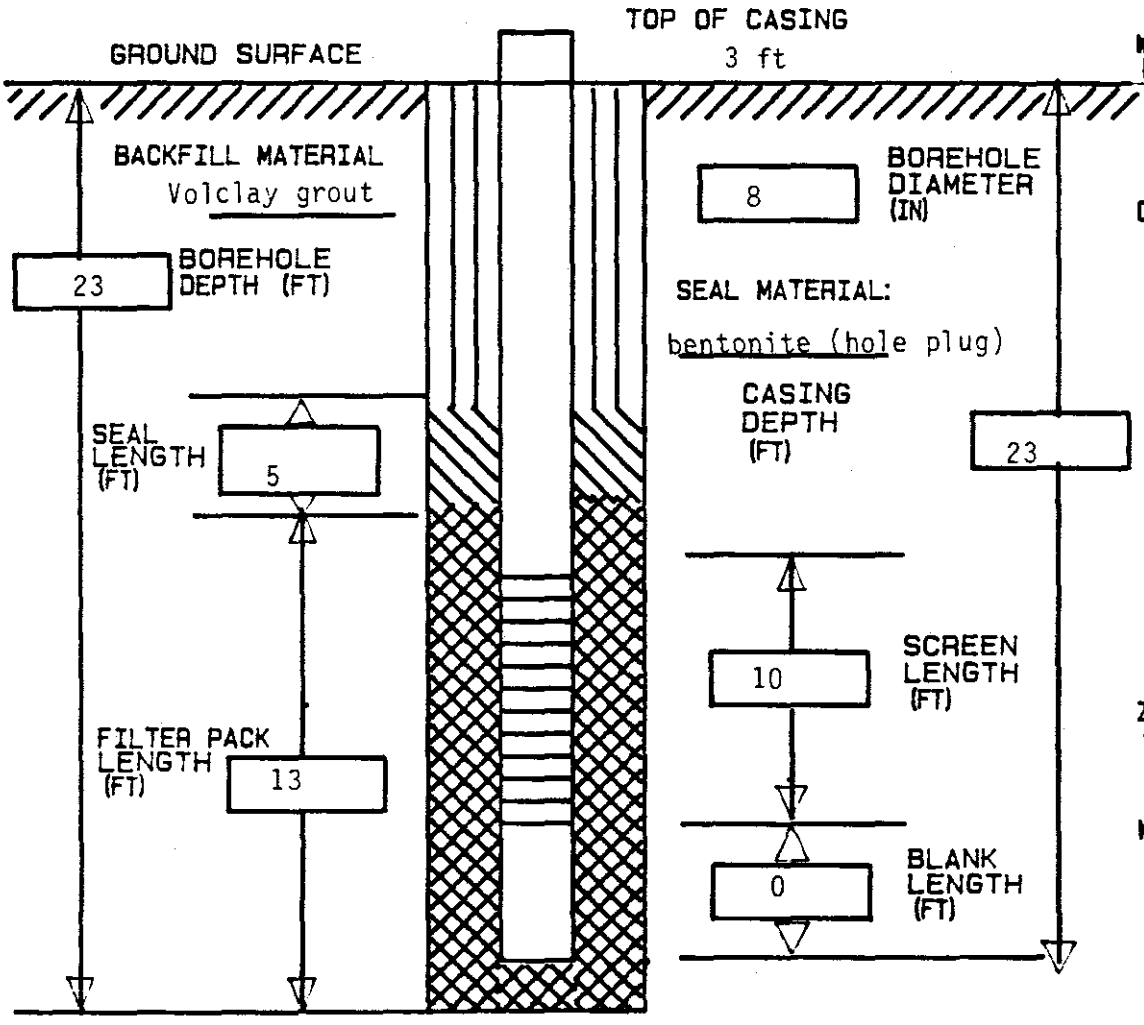
ZONE OF COMPLETION (GZCCODE)
A-AQUIFER
C-CONFINING LAYER

WELL COMPLETION METHODS (WCMCODE)
C-POROUS CONCRETE
GP-GRAVEL PACK W/PERF.
GS-GRAVEL PACK W/SCR.
H-HORIZONTAL GALLERY
OE-OPEN END
P-PERFORATED OR SLOTTE
S-SCREEN
SP-SAND POINT
W-WALLED OR SHORED
OP-OPEN

WELL COMPLETION INFORMATION

INSTALLATION ID Ft. Rich - AFT
LOCATION ID AFT-4
WELL OWNER U.S. Army
WELL TYPE CLASS MNW
FORMATION OF COMPLETION GP
SEAL END DEPTH (FT) 5
MEAS.POINT ELEV. (FT MS) 88
CASING DEPTH (FT) 23
CASING DIAMETER (IN) 2 in. I.D.
CASING MATERIAL PVC
REMARKS

LOCATION TYPE WL
INSTALLATION DATE 9-13-88
INSTALLER J. Holzman
WELL COMPLETION METHOD GS
ZONE OF COMPLETION A
FILTER PACK LENGTH (FT) 13
SCREEN BEGIN DEPTH (FT) 23
SCREEN LENGTH (FT) 10
SCREEN SLOT SIZE (IN) 0.01



WELL TYPE CLASSIFICATION (WT CODE)
MNW-MONITORING WELL
PRW-PRODUCTION WELL
TST-TEST WELL
WSW-WATER SUPPLY WELL

CASING MATERIAL (CMACODE)
ABS-ABS
BRK-BRICK
CBS-CARBON STEEL
CNC-CONCRETE
COP-COPPER
FBG-FIBERGLASS
GLS-GALVANIZED STEEL
WRI-WROUGHT IRON
SLS-STAINLESS STEEL
LCS-LOW CARBON STEEL
M-OTHER METAL
TF-TEFLON
PLY-POLYPROPYLENE
PVC-PVC
RST-ROCK OR STONE
STL-STEEL
TIL-TILE
COS-COATED STEEL
WD-WOOD

ZONE OF COMPLETION (GZCODE)
A-AQUIFER
C-CONFINING LAYER

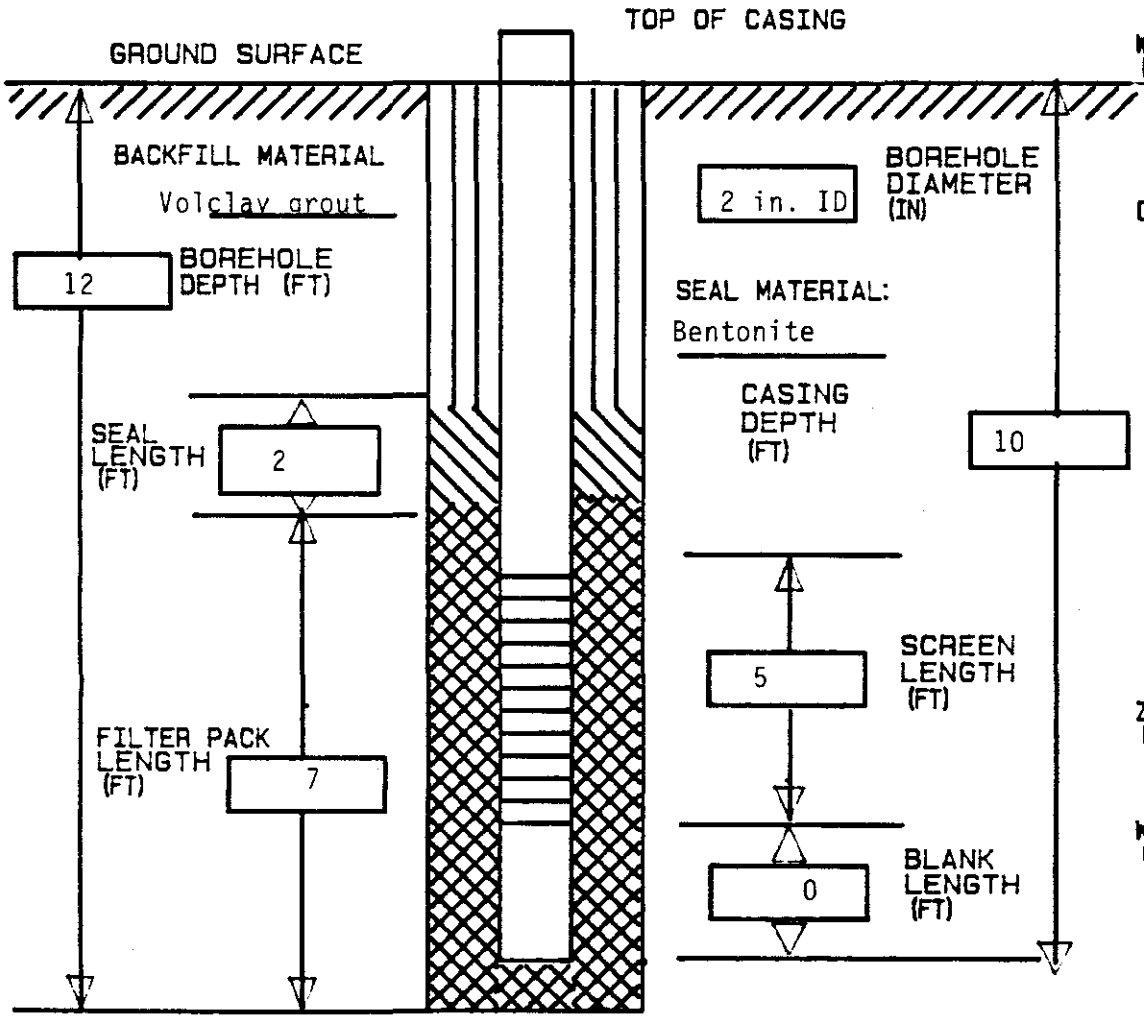
WELL COMPLETION METHODS (WCMCODE)
C-POROUS CONCRETE
GP-GRAVEL PACK W/PERF.
GS-GRAVEL PACK W/SCR.
H-HORIZONTAL GALLERY
OE-OPEN END
P-PERFORATED OR SLOTTE
S-SCREEN
SP-SAND POINT
W-WALLED OR SHORED
OP-OPEN

FILTER PACK MATERIAL No. 8 Silica sand.

WELL COMPLETION INFORMATION

INSTALLATION ID AFT
LOCATION ID AFT-5
WELL OWNER U.S. Army
WELL TYPE CLASS MNW
FORMATION OF COMPLETION Sandy gravel
SEAL END DEPTH (FT) 10
MEAS.POINT ELEV. (FT MS) 100
CASING DEPTH (FT) 10
CASING DIAMETER (IN) 2 in. I.D.
CASING MATERIAL PVC
REMARKS

LOCATION TYPE WL
INSTALLATION DATE 9-13-88
INSTALLER SMB
WELL COMPLETION METHOD GS
ZONE OF COMPLETION A
FILTER PACK LENGTH (FT) 7
SCREEN BEGIN DEPTH (FT) 5
SCREEN LENGTH (FT) 5
SCREEN SLOT SIZE (IN) 0.01



FILTER PACK MATERIAL Silica sand.

WELL TYPE CLASSIFICATION (WT CODE)
MNW-MONITORING WELL
PRW-PRODUCTION WELL
TST-TEST WELL
WSW-WATER SUPPLY WELL

CASING MATERIAL (CMACODE)
ABS-ABS
BRK-BRICK
CBS-CARBON STEEL
CNC-CONCRETE
COP-COPPER
FBG-FIBERGLASS
GLS-GALVANIZED STEEL
WRI-WROUGHT IRON
SLS-STAINLESS STEEL
LCS-LOW CARBON STEEL
M-OTHER METAL
TF-TEFLON
PLY-POLYPROPYLENE
PVC-PVC
RST-ROCK OR STONE
STL-STEEL
TIL-TILE
COS-COATED STEEL
WD-WOOD

ZONE OF COMPLETION (GZCCODE)
A-AQUIFER
C-CONFINING LAYER

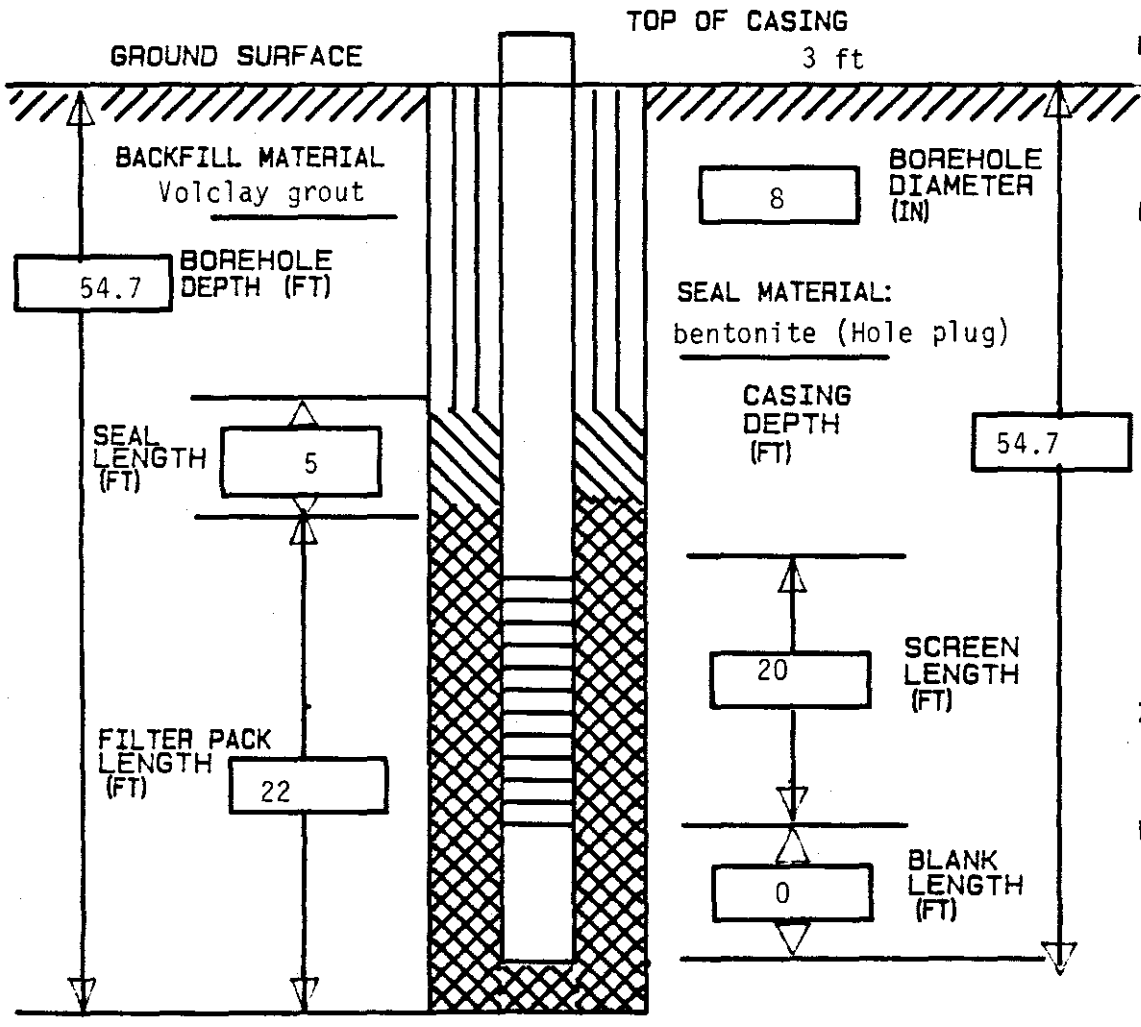
WELL COMPLETION METHODS (WCMCODE)
C-POROUS CONCRETE
GP-GRAVEL PACK W/PERF.
GS-GRAVEL PACK W/SCR.
H-HORIZONTAL GALLERY
OE-OPEN END
P-PERFORATED OR SLOTTE
S-SCREEN
SP-SAND POINT
W-WALLED OR SHORED
OP-OPEN

WELL COMPLETION INFORMATION

INSTALLATION ID AFT
LOCATION ID AFT-7
WELL OWNER U.S. Army
WELL TYPE CLASS MNW
FORMATION OF COMPLETION Silty clay
SEAL END DEPTH (FT) 32.7
MEAS.POINT ELEV. (FT MS) 58
CASING DEPTH (FT) 54.7
CASING DIAMETER (IN) 2 in. I.D.
CASING MATERIAL PVC

LOCATION TYPE WL
INSTALLATION DATE 9-9-88
INSTALLER Discovery Drilling
WELL COMPLETION METHOD GS
ZONE OF COMPLETION C
FILTER PACK LENGTH (FT) 22
SCREEN BEGIN DEPTH (FT) 54.7
SCREEN LENGTH (FT) 20
SCREEN SLOT SIZE (IN) 0.01

REMARKS 3 ft stickup bottom of casing = 54.7 ft.



WELL TYPE CLASSIFICATION (WT CODE)
MNW-MONITORING WELL
PRW-PRODUCTION WELL
TST-TEST WELL
WSW-WATER SUPPLY WELL

CASING MATERIAL (CMACODE)
ABS-ABS
BRK-BRICK
CBS-CARBON STEEL
CNC-CONCRETE
COP-COPPER
FBG-FIBERGLASS
GLS-GALVANIZED STEEL
WRI-WROUGHT IRON
SLS-STAINLESS STEEL
LCS-LOW CARBON STEEL
M-OTHER METAL
TF-TEFLON
PLY-POLYPROPYLENE
PVC-PVC
RST-ROCK OR STONE
STL-STEEL
TIL-TILE
COS-COATED STEEL
WD-WOOD

ZONE OF COMPLETION (GZCCODE)
A-AQUIFER
C-CONFINING LAYER

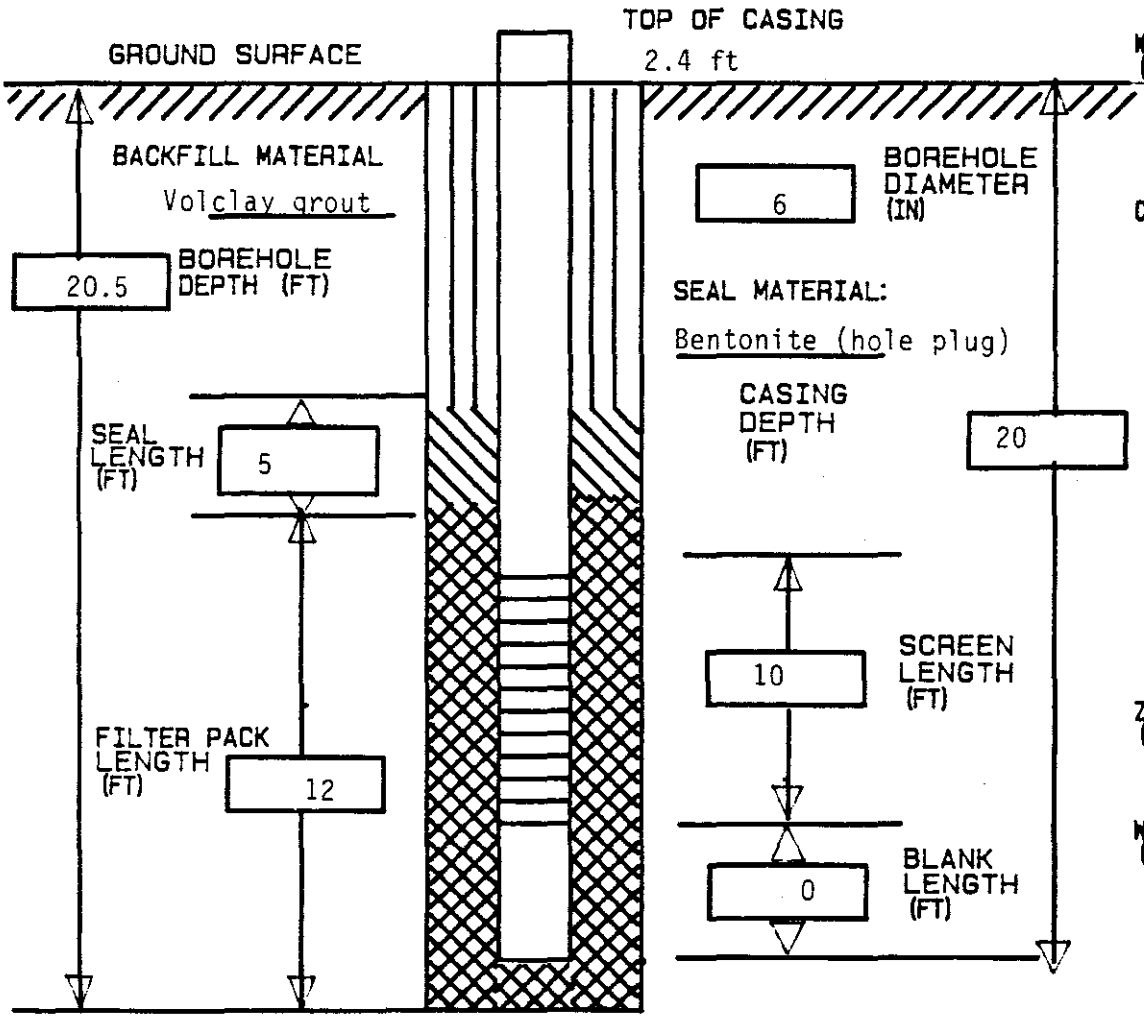
WELL COMPLETION METHODS (WCMCODE)
C-POROUS CONCRETE
GP-GRAVEL PACK W/PERF.
GS-GRAVEL PACK W/SCR.
H-HORIZONTAL GALLERY
OE-OPEN END
P-PERFORATED OR SLOTTE
S-SCREEN
SP-SAND POINT
W-WALLED OR SHORED
OP-OPEN

FILTER PACK MATERIAL No. 8 Silica sand.

WELL COMPLETION INFORMATION

INSTALLATION ID AFT
LOCATION ID AFT-7b
WELL OWNER U.S. Army
WELL TYPE CLASS MNW
FORMATION OF COMPLETION Sand
SEAL END DEPTH (FT) 3
MEAS.POINT ELEV. (FT MS) 58
CASING DEPTH (FT) 20
CASING DIAMETER (IN) 2 in. I.D.
CASING MATERIAL PVC
REMARKS Stick-up 2.4 ft.

LOCATION TYPE WL
INSTALLATION DATE 9-12-88
INSTALLER J. Holzman
WELL COMPLETION METHOD GS
ZONE OF COMPLETION A
FILTER PACK LENGTH (FT) 12
SCREEN BEGIN DEPTH (FT) 10
SCREEN LENGTH (FT) 10
SCREEN SLOT SIZE (IN) 0.01



FILTER PACK MATERIAL No. 8 Silica sand.

WELL TYPE CLASSIFICATION (WT CODE)
MNW-MONITORING WELL
PRW-PRODUCTION WELL
TST-TEST WELL
WSW-WATER SUPPLY WELL

CASING MATERIAL (CMACODE)
ABS-ABS
BRK-BRICK
CBS-CARBON STEEL
CNC-CONCRETE
COP-COPPER
FBG-FIBERGLASS
GLS-GALVANIZED STEEL
WRI-WROUGHT IRON
SLS-STAINLESS STEEL
LCS-LOW CARBON STEEL
M-OTHER METAL
TF-TEFLON
PLY-POLYPROPYLENE
PVC-PVC
RST-ROCK OR STONE
STL-STEEL
TIL-TILE
COS-COATED STEEL
WD-WOOD

ZONE OF COMPLETION (GZCODE)
A-AQUIFER
C-CONFINING LAYER

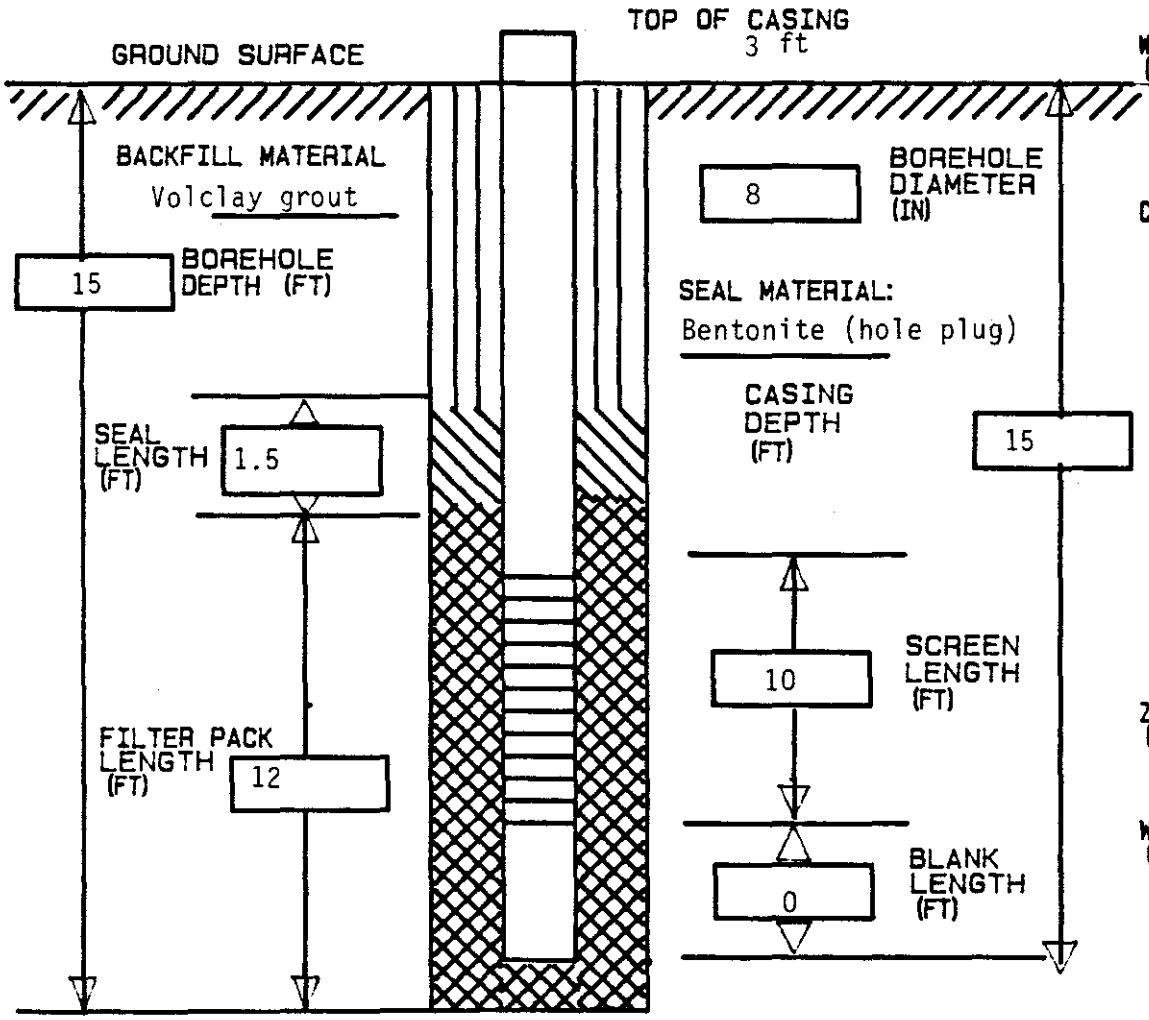
WELL COMPLETION METHODS (WCMCODE)
C-POROUS CONCRETE
GP-GRAVEL PACK W/PERF.
GS-GRAVEL PACK W/SCR.
H-HORIZONTAL GALLERY
OE-OPEN END
P-PERFORATED OR SLOTTE
S-SCREEN
SP-SAND POINT
W-WALLED OR SHORED
OP-OPEN

WELL COMPLETION INFORMATION

INSTALLATION ID R-FT AFT
LOCATION ID AFT-8
WELL OWNER U.S. Army
WELL TYPE CLASS MNW
FORMATION OF COMPLETION Gravelly sand
SEAL END DEPTH (FT) 1.5
MEAS.POINT ELEV. (FT MS) 80
CASING DEPTH (FT) 15
CASING DIAMETER (IN) 2 in. I.D.
CASING MATERIAL PVC

LOCATION TYPE WL
INSTALLATION DATE 9-12-88
INSTALLER J. Holzman
WELL COMPLETION METHOD GS
ZONE OF COMPLETION A
FILTER PACK LENGTH (FT) 12
SCREEN BEGIN DEPTH (FT) 15
SCREEN LENGTH (FT) 10
SCREEN SLOT SIZE (IN) 0.01

REMARKS 3 ft stick-up of PVC.



WELL TYPE CLASSIFICATION (WT CODE)
MNW-MONITORING WELL
PRW-PRODUCTION WELL
TST-TEST WELL
WSW-WATER SUPPLY WELL

CASING MATERIAL (CMACODE)
ABS-ABS
BRK-BRICK
CBS-CARBON STEEL
CNC-CONCRETE
COP-COPPER
FBG-FIBERGLASS
GLS-GALVANIZED STEEL
WAI-WROUGHT IRON
SLS-STAINLESS STEEL
LCS-LOW CARBON STEEL
M-OTHER METAL
TF-TEFLON
PLY-POLYPROPYLENE
PVC-PVC
RST-ROCK OR STONE
STL-STEEL
TIL-TILE
COS-COATED STEEL
WD-WOOD

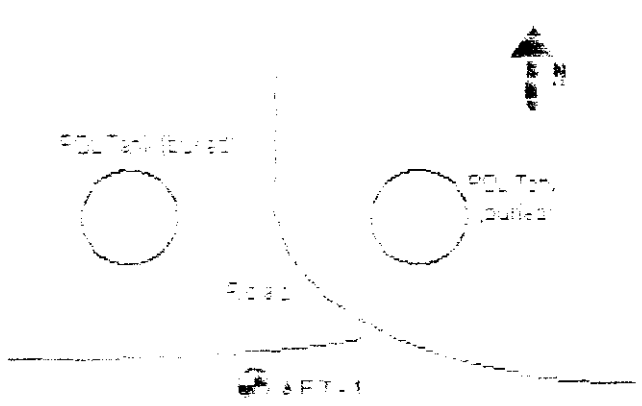
ZONE OF COMPLETION (GZCCODE)
A-AQUIFER
C-CONFINING LAYER

WELL COMPLETION METHODS (WCMCODE)
C-POROUS CONCRETE
GP-GRAVEL PACK W/PERF.
GS-GRAVEL PACK W/SCR.
H-HORIZONTAL GALLERY
OE-OPEN END
P-PERFORATED OR SLOTTE
S-SCREEN
SP-SAND POINT
W-WALLED OR SHORED
OP-OPEN

FILTER PACK MATERIAL No. 8 Silica Sand.

PROJECT:
JOINT RESOURCES

LOG OF BORING NO. APT-1



NOT TO SCALE

MONITORING WELL ☐ TEST BORING

LOGGED BY: J. HOLZINGER

DRILLER: DISCOVERY RIG: CME-45

DRILL METHOD: HOLLOW STEM AUGER

HAMMER WT: 340 LBS DROP: 30 IN

START TIME: 1500 DATE: 8/14/98

COMPLETE TIME: 1430 DATE: 8/14/98

WEATHER: PARTLY CLOUDY

INSTRUMENTATION: UNUSED

WATER DEPTH (FT TOP)	07.72	08.40
TIME	1115	441
DATE	9/9/98	9/10/98

DEPTH (FT)	SAMPLE NO.	ANALYTICAL SAMPLE	PID (PPM)	MATERIAL DESCRIPTION	USCS	MOIST.	PID (PPM)	COMMENTS	GRAPHIC LOG
5	A-APT-0501			(GW) FT. BROWN SANDY GRAVEL, (GW) SOME COBBLE, ROUNDED GRAVEL SUBROUNDED TRACE OIL	GW				
				BROWN, SANDY GRAVEL, DAMP/ MOIST, MED. DENSE, SAME AS ABOVE.	GW	D			
10		NONE		(GW) FT. BROWN, SANDY GRAVEL GRAVEL = SUBROUNDED, COBBLE = ROUNDED, TRACE OIL, GRAVEL ANGULAR TO SUBROUNDED, 1.25-1.0 IN. DIA.	GW SW	D			
15									

PROJECT NO. 30170

WOODWARD-CLYDE CONSULTANTS

FIGURE

PROJECT:
JOINT RESOURCES

LOG OF BORING NO.
APT-1

DEPTH FT	BLOWS/FT	ANALYTICAL SAMPLES	FROZEN	MATERIAL DESCRIPTION	USCS	VOC (PPM)	TEMP °C	ODOR	GRAPHIC LOG
		R-FT-0502			GW SW	0		N	
20		NONE		GRADATION CHANGE BROWN/GRAY GRAVELLY SAND DAMP, MED. DENSE TO DENSE, GRAVEL UP TO 0.25 IN. DIA.	SW	1			
		NONE		25-30 FT, BROWN, CLEAN SAND, DAMP (MOIST), MED. DENSE, TRACE SILT, MED. GRAINED SAND.	SP	0			
30		NONE		30-35 FT, BLUE/GRAY CLAYEY SILT, FIRM TO STIFF, TRACE SAND.	ML	0		N	
35				▼		0		N	
				TD = 35 FT					
40									
45									

PROJECT NO. 80275A

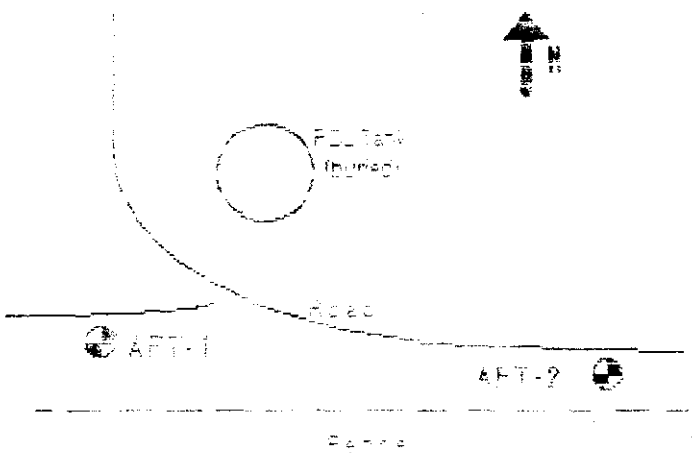
WOODWARD-CLYDE CONSULTANTS

FIGURE

PROJECT:
JOINT RESOURCES

LOG OF BORING NO.
APT-2

LOCATION DIAGRAM



NOT TO SCALE

■ MONITORING WELL ☐ TEST BORING

LOGGED BY: J. HOLEMAN

DRILLER: DISCOVERY RIG: CME-45

DRILL METHOD: HOLLOW STEM AUGER

HAMMER WT: 240 LBS DROP: 30 IN

START TIME: 0630 DATE: 8/16/88

COMPLETE TIME: 1145 DATE: 8/14/88

WEATHER: CLOUDY SHOWERS

INSTRUMENTATION: HALLIB

WATER DEPTH (FT BGS)	88.56	88.75	88.47
TIME	1130	1416	1447
DATE	8/19/88	8/19/88	8/21/88

COMMENTS:

DEPTH (FT)	BLOWS/FT	PANEL TEST OR FIELD	SAMPLE	MATERIAL DESCRIPTION	USCS	VOC (PPM)	TEMP °C	COLOR	GRAPHIC LOG
5	8 9 12	R FT 0801		0-9 FT, BROWN, SANDY GRAVEL, MOIST, LOOSE, GRAVEL ANGULAR TO SUBROUNDED UP TO 3.0 IN DIA	GW GW	0.1		N	
10	8 14 19	NONE		9-19 FT, MOTTLED BROWN/GRAY SANDY GRAVELLY SAND, MOIST, MED DENSE, SUBANGULAR TO SUBROUNDED GRAVEL, MOTTLING ORANGE/BROWN AND BLACK ON SAMPLE SURFACE.	GW SW	0.1		N	
15									

PROJECT NO. 66170

WOODWARD-CLYDE CONSULTANTS

FIGURE

PROJECT:
JOINT RESOURCES

LOG OF BORING NO.
ART-2

DEPTH FT	BLANK	ANALYTICAL SAMPLES	FROZEN	MATERIAL DESCRIPTION	USCS	VOC PPM	TEMP C	ODOR	GRAPHIC LOG
		R-FT-0802			SW SW	4		Y	
20		R-FT-0803		18-22.5 FT: BROWN SAND, LOOSE, MED. TO LARGE GRAINED, TRACE SILT. 20.5 FT: BLACK COAL? SHALEY PIECE	SW	1.5 30		Y Y	
				22.5-23.5 FT: GRAVEL LAYER	GW				
25		NONE		23.5-31 FT: BROWN MED. GRAINED SAND, MOIST, LOOSE, TRACE SILT	SP	1.0			
30		NONE							
35				31-35 FT: MOTTLED GRAY/BROWN SILT, DAMP/MOIST, FIRM	ML	3		Y	
				TD = 35 FT					
40									
45									

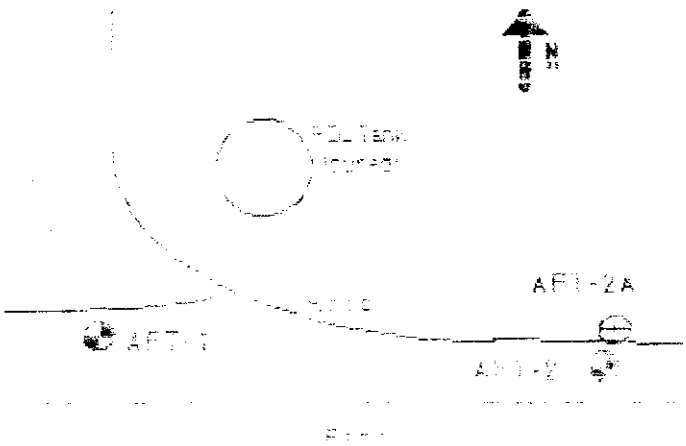
PROJECT NO. 802781

WOODWARD-CLYDE CONSULTANTS

FIGURE

PROJECT: JOINT RESOURCES

LOG OF BORING NO. APT-2A



NOT TO SCALE

☐ MONITORING WELL ■ TEST BORING

LOGGED BY: J. HOLZMAN

DRILLER: DISCOVERY RIG: CME-45

DRILL METHOD: HOLLOW STEM AUGER

HAMMER WT: 340 LBS DROP: 30 IN.

START TIME: 1220 DATE: 8/21/98

COMPLETE TIME: 1335 DATE: 8/21/98

WEATHER: CLOUDY

INSTRUMENTATION: PAVING

WATER DEPTH (FT BGS)	NONE
TIME	
DATE	

DEPTH (FT)	SAMPLE NO.	ENGINEERING PROPERTIES	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS	VOC (PPM)	H2S (PPM)	COMBUSTIBLES (%LEL)	CO (PPM)
5	NONE			SAND, BROWN, SANDY GRAVEL, LITTLE SILT, MOIST, LOOSE, GRAVEL UP TO 1/2 IN DIA	GW SW	0.1		N	
10	NONE				GW SW	0.2		N	
15									

PROJECT NO. 20077-0

WOODWARD-CLYDE CONSULTANTS

FIGURE

PROJECT:
JOINT RESOURCES

LOG OF BORING NO.
APT-2A

DEPTH FT	BLOWS	ANALYTICAL SAMPLES	FROZEN	MATERIAL DESCRIPTION	USC	WOD PPM	TEMP C	ODOR	GRAPHIC LOG
20				INCREASING SAND CONTENT, INCREASING MOISTURE	GW SW	1.9		N	
				18-22 FT, THIN LENSES OF GRAVEL, MOSTLY SAND	SW	1.6		N	
25				22 FT, BROWN MED. GRAINED SAND, MOIST	SP	1.0		N	
	16 12 13	A-FT-02A01			SP	1.4		N	
				TD = 26.5 FT					
30									
35									
40									
45									

PROJECT NO. 80276A

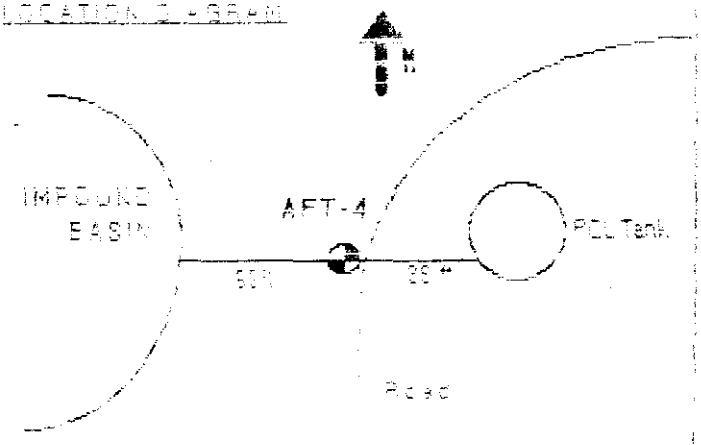
WOODWARD-CLYDE CONSULTANTS

FIGURE

PROJECT:
JOINT RESOURCES

LOG OF BORING NO.
AFT-4

LOCATION DIAGRAM



NOT TO SCALE

☒ MONITORING WELL ☐ TEST BORING

LOGGED BY: J. HOLZMAN

DRILLER: DISCOVERY RIG: CME-45

DRILL METHOD: HOLLOW STEM AUGER

HAMMER WT: 340 LBS DROP: 30 IN

START TIME: 0830 DATE: 9/13/89

COMPLETE TIME: 1215 DATE: 9/13/89

WEATHER: CLOUDY

INSTRUMENTATION: PID, OVA

WATER DEPTH (FT TOC)	15.00	17.61	15.91
TIME	1200	1536	1210
DATE	9/13/89	9/19/89	9/21/89

COMMENTS:

DEPTH IN FT	PID (PPM)	ANALYTICAL SAMPLES	LITHOLOGY	MATERIAL DESCRIPTION	USCS	WOC (PPM)	TEMP °C	CM/CO2	GRAPHIC LOG
5	4 4 3	B-AFT-0301		0-6 FT. BROWN, GRAVELLY SAND MOIST, SOFT 6-8 FT. BLUE/GRAY SANDY GRAVEL, DAMP FIRM, GRAVEL SUBANGULAR TO SUB-ROUNDED 1.25-2 IN DIA (FILL) SILTY.	SP	0		N	
10	4 4 4	NONE		8-14 FT. MOTTLED BROWN/GRAY GRAVELLY SAND, SOFT, FIRM, TRACE SILT, GRAVEL 0.25 TO 2 IN. 11.5 FT. WOOD CHIP (FILL)	GP	1.5		N	
15									

PROJECT NO. 90276

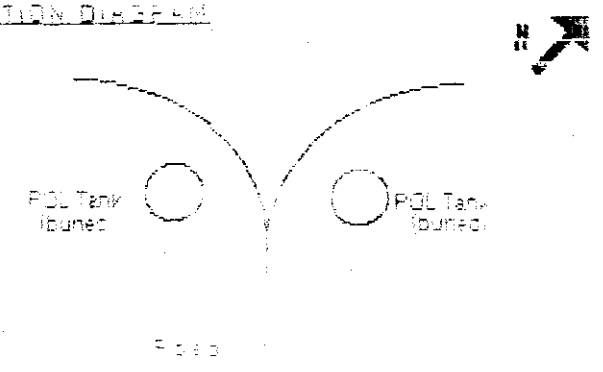
WOODWARD-CLYDE CONSULTANTS

FIGURE

PROJECT
JOINT RESOURCES

LOG OF BORING NO.
AFT-6

LOCATION DIAGRAM



■ MONITORING WELL ☐ TEST BORING

LOGGED BY: J. HOLZMAN
DRILLER: DISCOVERY RIG: CME-45
DRILL METHOD: HOLLOW STEM AUGER
HAMMER WT: 240 LBS DROP: 30 IN.
START TIME: 1001 DATE: 8/15/96
COMPLETE TIME: 1500 DATE: 8/15/96
WEATHER: PARTLY CLOUDY
INSTRUMENTATION: PID, OVA

WATER DEPTH (FT BGS)	9.43	9.41	9.33
TIME	1153	1415	1315
DATE	8/16/96	8/16/96	8/21/96

NOT TO SCALE

COMMENTS:

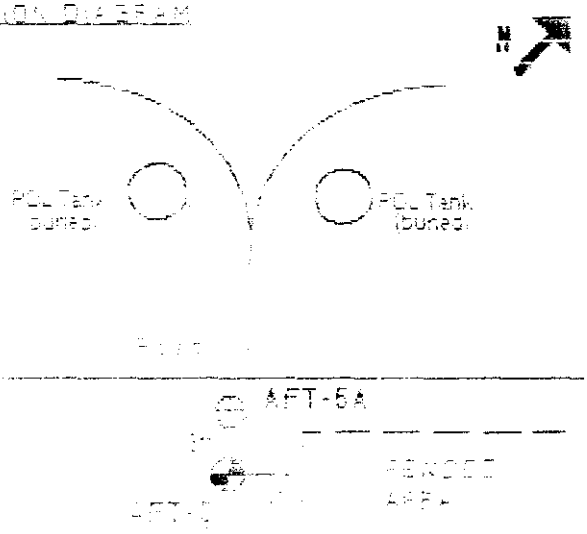
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	RECOVERY (INCHES)	MATERIAL DESCRIPTION	USCS	WELL DIAGRAM
5				0-5 FT, BROWN, SANDY GRAVEL, MED. DENSE, TRACE SILT	GP	
10	B-FT-0401	4	24	5-6 FT, ORGANIC RICH BURIED TOPSOIL, MANY SMALL ROOTS 6-7 FT, BROWN SANDY GRAVEL, LAMP, LOOSE TO MED. DENSE, TRACE SILT 7-9 FT, SATURATED WITH CONTAM-(WAFTS, BLUE/GRAY GRAVELLY SILT)	OL GP	
	NONE	4	24	9-10 FT, BROWN SANDY CLAY, MOIST, STARTING AT 9' BGS	SC	
15				TD = 12 FT		

PROJECT NO. 90275.1 WOODWARD-CLYDE CONSULTANTS FIGURE

PROJECT:
JOINT RESOURCES

LOG OF BORING NO.
AFT-5A

LOCATION DIAGRAM



NOT TO SCALE

COMMENTS

☐ MONITORING WELL ■ TEST BORING

LOGGED BY: J. HOLZMAN

DRILLER: DISCOVERY RIG: CME-4[illegible]

DRILL METHOD: HOLLOW STEM AUGER

HAMMER WT: 340 LBS DROP: [illegible]

START TIME: 1400 DATE: [illegible]

COMPLETE TIME: 1445 DATE: [illegible]

WEATHER: CLOUDY

INSTRUMENTATION: UNKNOWN

WATER DEPTH (FT TOP)	7.00
TIME	1423
DATE	9/19/[illegible]

DEPTH (FT)	SAMPLE NO.	BLOWS/FT	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	MOIST.	PEN. RES.	ORGANIC VAPOR (PPM)	CHLORIDE	CHEMICAL TOC
5			0-8 FT: BROWN, SANDY GRAVEL, LOOSE, ANGULAR TO SUB-ROUNDED UP TO 1 IN DIA.	GW				0	N	
				GW				0	N	
	R-FT-05A01	3 4 2	8-8.5 FT: GRAY/BROWN, GRAVELLY SAND, WET, LOOSE.	SW					Y	
10			8.5-10 FT: BLUE/GRAY CLAYEY SILT, MOIST TO VERY MOIST, SOFT/FIRM	ML						
			TD=11 FT							
15										

PROJECT NO. [illegible]

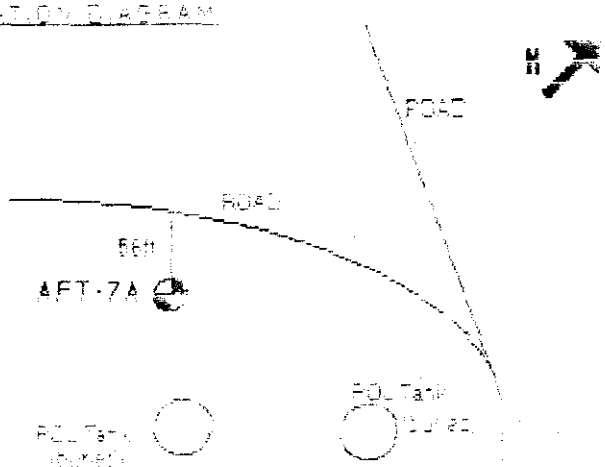
WOODWARD-CLYDE CONSULTANTS

FIGURE

PROJECT:
JOINT RESOURCES

LOG OF BORING NO.
AFT-7A

LOCATION DIAGRAM



NOT TO SCALE

MONITORING WELL ☐ TEST BORING

LOGGED BY: J. HOLZMAN

DRILLER: DISCOVERY RIG: CME-45

DRILL METHOD: HOLLOW STEM AUGER

HAMMER WT: 340 LBS DROP: 30 IN.

START TIME: 1300 DATE: 8/8/89

COMPLETE TIME: 1500 DATE: 8/8/89

WEATHER: CLEAR, SLIGHT BREEZE

INSTRUMENTATION: HNU, PID

WATER DEPTH (FT BGS)	36.5	54.81	60.82
TIME	0830	1210	0815
DATE	8/10/89	8/15/89	8/21/89

COMMENTS:

DEPTH IN FEET	SAMPLE FROM	ANALYTICAL SAMPLES	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS	WELL DIAGRAM
5	3.5 TO 5	B-FT-0101		0-5 FT: DARK BROWN, GRAVELLY SAND, MOIST, LOOSE, GRAVEL UP TO 1 IN. DIA.	SP	
					SP	
10				5-35 FT: INCREASE IN GRAVEL CONTENT UP TO 4 IN. DIA.	CL	
				10 FT: MANGLED PIECE OF METAL		
				12 FT: INCREASING FINES		
15						

PROJECT NO. 90175K

WOODWARD-CLYDE CONSULTANTS

FIGURE

PROJECT: JOINT RESOURCES

LOG OF BORING NO. ART-7A

DEPTH IN FEET	BLOWS/FT	ANALYTICAL SAMPLES	RECOVERY	MATERIAL DESCRIPTION	USCS	WATER CONTENT, %	DENSITY, PCF	MOISTURE	UNCONFINED COMPRESSIVE STRENGTH, TSF
		R-FT-0102		GRAY SILTY CLAY, SOFT, INTERMITTENT SANDY LAYERS	CL	0.2		N	
30									
35									
40									
45									

PROJECT NO. 81076V

WOODWARD-CLYDE CONSULTANTS

FIGURE

PROJECT:
JOINT RESOURCES

LOG OF BORING NO.
AFT-7A

DEPTH FT	BTMX	ANALYTICAL SAMPLES	FROZEN	MATERIAL DESCRIPTION	USC	VOC PPM	TEMP C	ODOR	GRAPHIC LOG
50		B-FT-0103			CL	0.2		N	
55				TD=54.1 FT					
60									
65									
70									
75									

PROJECT NO. 80278K

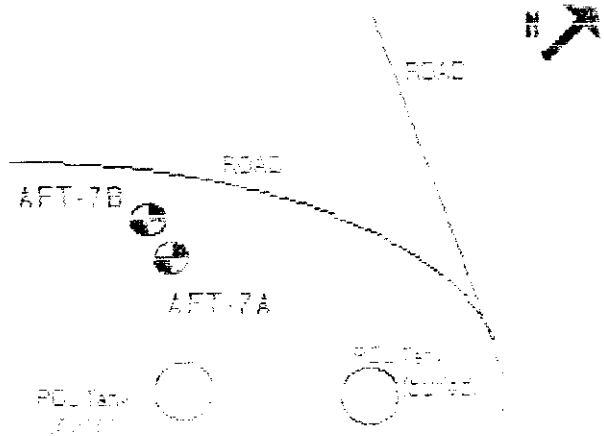
WOODWARD-CLYDE CONSULTANTS

FIGURE

PROJECT:
JOINT RESOURCES

LOG OF BORING NO.
AFT-7B

LOCATION DIAGRAM



NOT TO SCALE

■ MONITORING WELL ☐ TEST BORING

LOGGED BY: J. HOLZMAN

DRILLER: DISCOVERY RIG: DME-45

DRILL METHOD: HOLLOW STEM AUGER

HAMMER WT: 340 LBS. DROP: 30 IN.

START TIME: 0815 DATE: 9/12/98

COMPLETE TIME: 1600 DATE: 9/12/98

WEATHER: CLOUDY, SHOWERS

INSTRUMENTATION: BAILER

WATER DEPTH (FT TOC)	16.1	16.3	16.1
TIME	1100	0830	1615
DATE	9/12/98	9/13/98	9/14/98

DEPTH (FT)	SAMPLE NO.	ANALYTICAL SAMPLES	PID (PPM)	MATERIAL DESCRIPTION	USCS	WELL DIAGRAM	PID (PPM)	GRAPHIC LOG
				0-10 FT: BROWN GRAVELLY SAND (SP), MOIST, LOOSE TO MED. DENSE, MOIST, TRACE SILT, LOOSE TO MED. DENSE, GRAVEL UP TO 1 IN. DIA.				
5								
10	A 45 11	NONE			SP	0.8		N
				10-13.5 FT: BROWN COARSE GRAVEL, MOIST, DENSE.				
15								

PROJECT NO. 90176 WOODWARD-CLYDE CONSULTANTS FIGURE

PROJECT:
JOINT RESOURCES

LOG OF BORING NO.
AFT-7R

DEPTH FT	BLOWS	ANALYTICAL SAMPLES	RECVD	MATERIAL DESCRIPTION	USC	VOC PPM	TEMP C	ODOR	GRAPHIC LOG
				18.5-19 FT: BROWN/GRAY GRAVELLY SAND, MOIST TO VERY MOIST, TRACE SILT, GRAVEL <1 IN DIA					
20	9 8 10	NONE		19-21 FT: GRAY, BLUE/GRAY SILTY CLAY, MOIST, SOFT	CL	0		N	
				TD=21 FT					
25									
30									
35									
40									
45									

PROJECT NO 002750

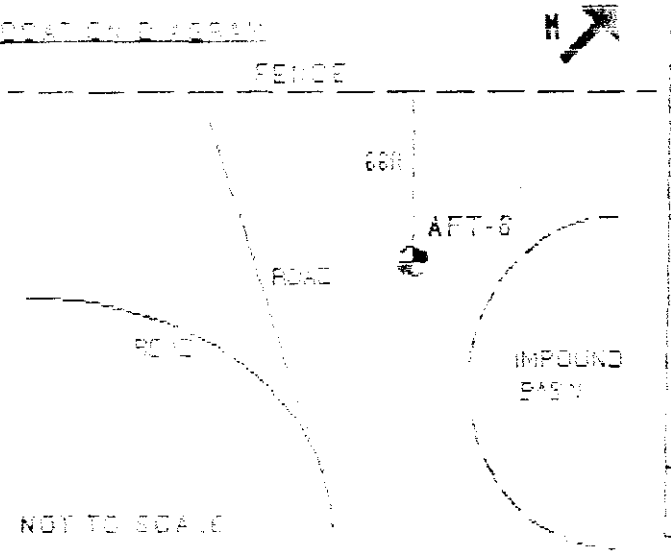
WOODWARD-CLYDE CONSULTANTS

PLATE

PROJECT:
JOINT RESOURCES

LOG OF BORING NO.
AFT-8

LOCATION DIAGRAM



■ MONITORING WELL ☐ TEST BORING

LOGGED BY: J. HOLZMAN
DRILLER: DISCOVERY RIG: CME-45
DRILL METHOD: HOLLOW STEM AUGER
HAMMER WT: AUTO 340 LBS DROP: 30 IN.
START TIME: 1315 DATE: 9/12/88
COMPLETE TIME: 1400 DATE: 9/12/88
WEATHER: CLOUDY SHOWERS
INSTRUMENTATION: WELL CG

WATER DEPTH (FT TOC)	10.46	10.22
TIME	1532	1031
DATE	9/19/88	9/21/88

CEMENTED

DEPTH (FEET)	BLOWS/6"	SAMPLE NO.	RECOVERY (INCHES)	MATERIAL DESCRIPTION	USCS	WOC / BPM	TEMP (°F)	ORGANIC VAPOR (PPM)	OTHER TESTS
				0-5 FT: BROWN SILT WITH SOME SAND, TRACE GRAVEL FIRM MOIST, (FILL).	ML				
5		R-FT-8701	24	5-7 FT: MOTTLED BROWN AND BLUE/GRAY SAND/SILT WITH SUB-ANGULAR SMALL GRAVEL UP TO 2 IN. DIA. (FILL).		1		N	
				7-10 FT: DARK BROWN SILTY ORGANIC SAND, MOIST, SOFT.		5			
10		NONE	24	10-15 FT: GRAY GRAVELLY SAND WITH TRACE SILT, VERY MOIST TO SATURATED, SMALL GRAVEL TO 0.5 IN. DIA. SUBROUNDED TO SUBANGULAR.		6		Y	
						0.6		N	
15									

TD=15 FT

PROJECT NO. 8021.04 WOODWARD-CLYDE CONSULTANTS PAGE

Well Data and Lithologic Logs for Fort Wainwright Landfill

Joint Resources Project

Subject Ft. Wainwright Landfill

By Jane Showalter Checked By

Date September 30, 1988 Date

Project No. 90275K

Task No. 3071

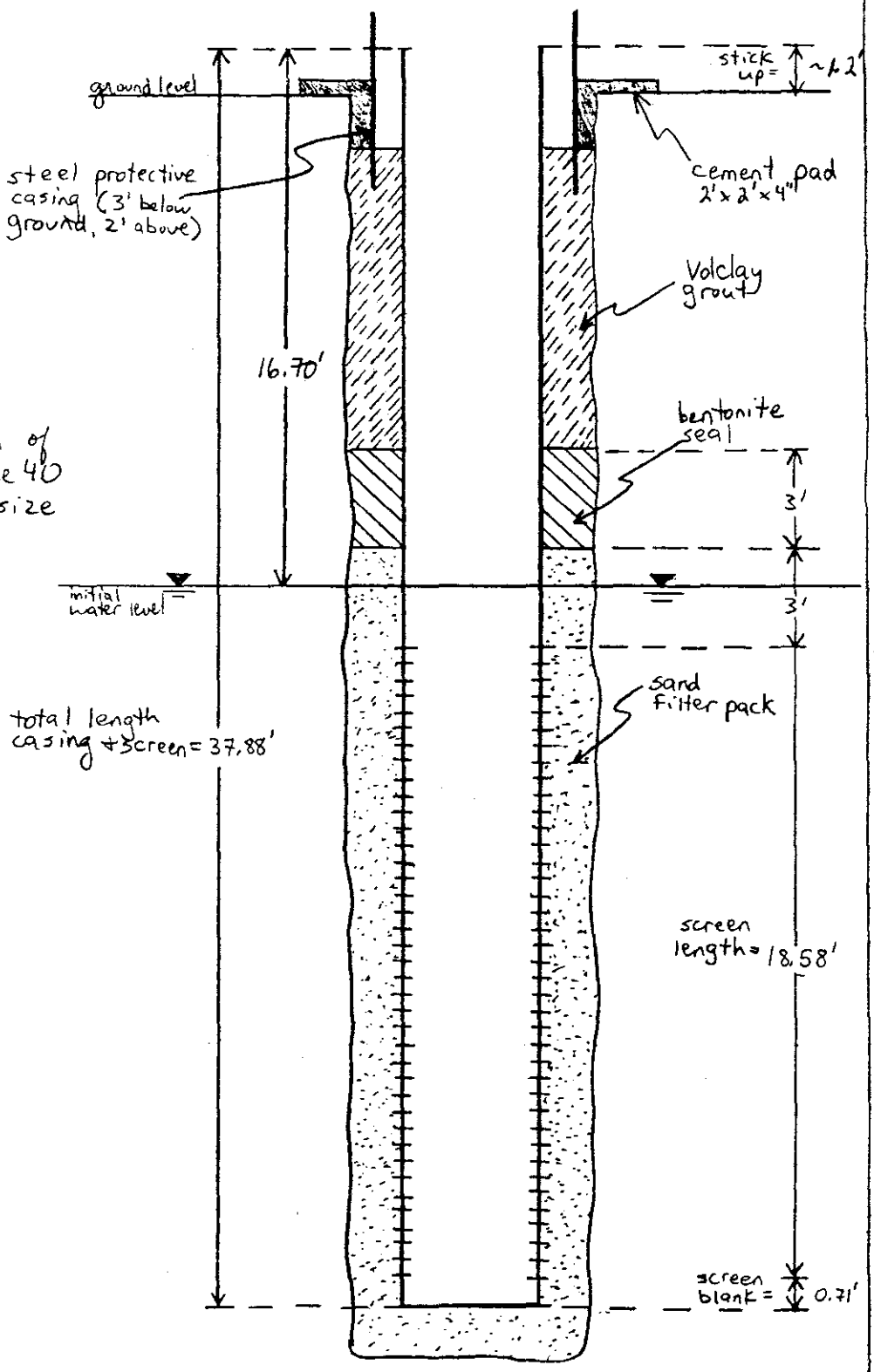
File No. _____

Sheet _____ of _____

well W-LF-01

pumping well

drilled 9/7/88
installed 9/8/88



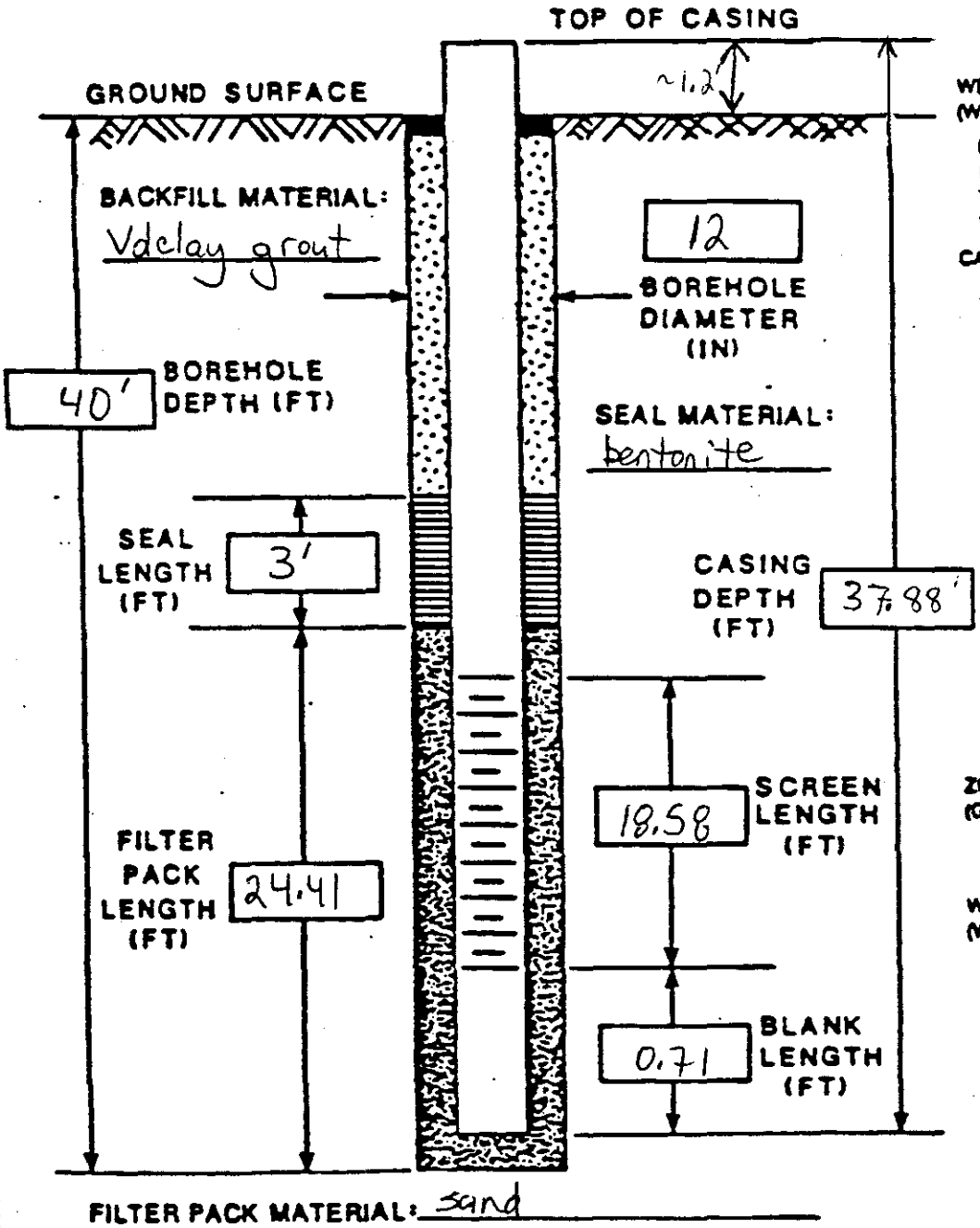
casing and screen of 8" PVC Schedule 40 with 0.010" slot size

Woodward-Clyde Consultants

WELL COMPLETION INFORMATION

INSTALLATION ID Ft. Wainwright, Landfill
LOCATION ID W-LF-01
WELL OWNER U.S. Army
WELL TYPE CLASS. _____
FORMATION OF COMPLETION _____
sandy gravel aquifer
SEAL END DEPTH (FT) 36.64
MEAS. POINT ELEV. (FTMSL) _____
CASING DEPTH (FT) 36.64
CASING DIAMETER (IN) 8"
CASING MATERIAL PVC
REMARKS _____

LOCATION TYPE WL
INSTALLATION DATE 9/8/88
INSTALLER Discovery Drlg / Aurora Drlg
WELL COMPLETION METHOD _____
ZONE OF COMPLETION _____
FILTER PACK LENGTH (FT) 24.41
SCREEN BEGIN. DEPTH (FT) 17.35
SCREEN LENGTH (FT) 18.58
SCREEN SLOT SIZE (IN) 0.010



WELL TYPE CLASSIFICATIONS (WTCCODE)
- MNW - MONITORING WELL
- PRW - PRODUCTION WELL
- TST - TEST WELL
- WSW - WATER SUPPLY WELL

CASING MATERIAL (CMACODE)
- ABS - ABS
- BRK - BRICK
- CBS - CARBON STEEL
- CNC - CONCRETE
- COP - COPPER
- FBG - FIBERGLASS
- GLS - GALVANIZED STEEL
- WRI - WROUGHT IRON
- SLS - STAINLESS STEEL
- LCS - LOW CARBON STEEL
- M - OTHER METAL
- TFL - TEFLON
- PLY - POLYPROPYLENE
- PVC - PVC
- RST - ROCK OR STONE
- STL - STEEL
- TIL - TILE
- COS - COATED STEEL
- WD - WOOD

ZONE OF COMPLETION (GZCCODE)
- A - AQUIFER
- C - CONFINING LAYER

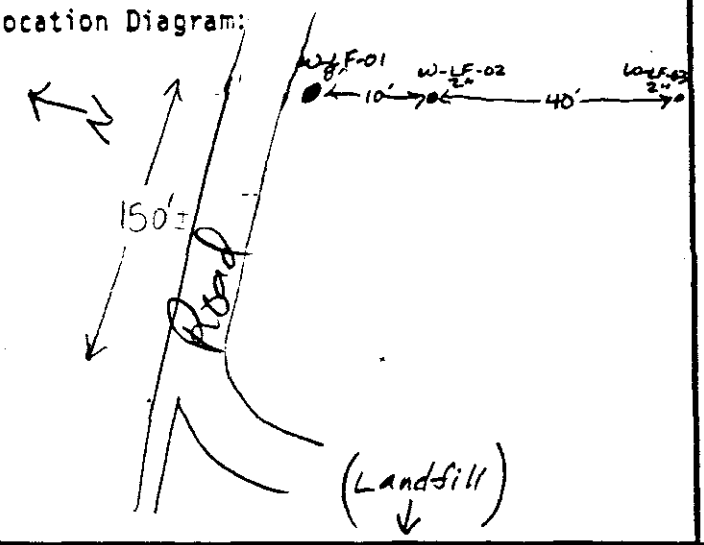
WELL COMPLETION METHODS: (WCMCODE)
- C - POROUS CONCRETE
- GP - GRAVEL PACK W/PERF.
- GS - GRAVEL PACK W/SCREE
- H - HORIZONTAL GALLERY
- OE - OPEN END
- P - PERFORATED OR SLOTTE
- S - SCREEN
- SP - SAND POINT
- W - WALLED OR SHORED
- OP - OPEN

Woodward-Clyde Consultants

Boring No. W-LF-02 Sheet 1 of 3

Job No. 9025-K Depth: _____

Location Diagram:



Project: Joint Reserves

Logged By: (see comments)

Contractor: Aurora Drilling

Drill Rig: Cyclone 1000

Driller's Name: Edward Paddy

Drilling Method: Poundt 12" casing

Sampling Method: none

Hammer Wt: _____ Drop: _____

Start Time: 1245 Date: 9/7/88

Complete Time: 1600 Date: 9/8/88

Weather: partly cloudy

Instrumentation: _____

Comments: split spoon samples could not be taken so the well was just drilled.

Water Depth:		16.7'	
Time:		0900	
Date:		9/9/89	

Surface Cond: silty, sandy, organic

Vegetation: scrub forest.

Elev: _____ Datum: _____

Depth, Ft.	Sample No.	Sampler Type	Blow Count	% Recov'd	Jar ID	Vane Tests: Peak	Vane Tests: Remold	Depth, Ft.
1								1
2								2
3								3
4								4
5								5
6								6
7								7
8								8
9								9
10								10

(Sandy Gravel overall GW)

Sample No.	Sampler Type	Blow Ct	Driven	Recov'd					Depth	Graphic Log	Boring No. W-LF-02 Sheet 2 of 3 Job No. 90275.K
									11		
		—							12		
		—							13		
		—							14		
		—							15		
		—							16		
		—							17		
		—							18		
		—							19		
		—							20		
		—							21		
		—							22		
		—							23		
		—							24		
		—							25		
		—							26		
		—							27		
		—							28		
		—							29		
		—							30		

Sample No.	Sampler Type	Blow Ct	Driven / Recov'd						Depth		Graphic Log	Boring No. W-LF-02 Sheet 3 of 3 Job No. 90279-K
									31			
		—							32			
		—							33			
		—							34			
		—							35			
		—							36			TD = 35
		—							37			
		—							38			
		—							39			
		—							40			
		—							1			
		—							2			
		—							3			
		—							4			
		—							5			
		—							6			
		—							7			
		—							8			
		—							9			
		—							0			

Subject Ft. Wainwright Landfill

Project No. 90275K

By Jane Shoualter Checked By

Task No. 3071

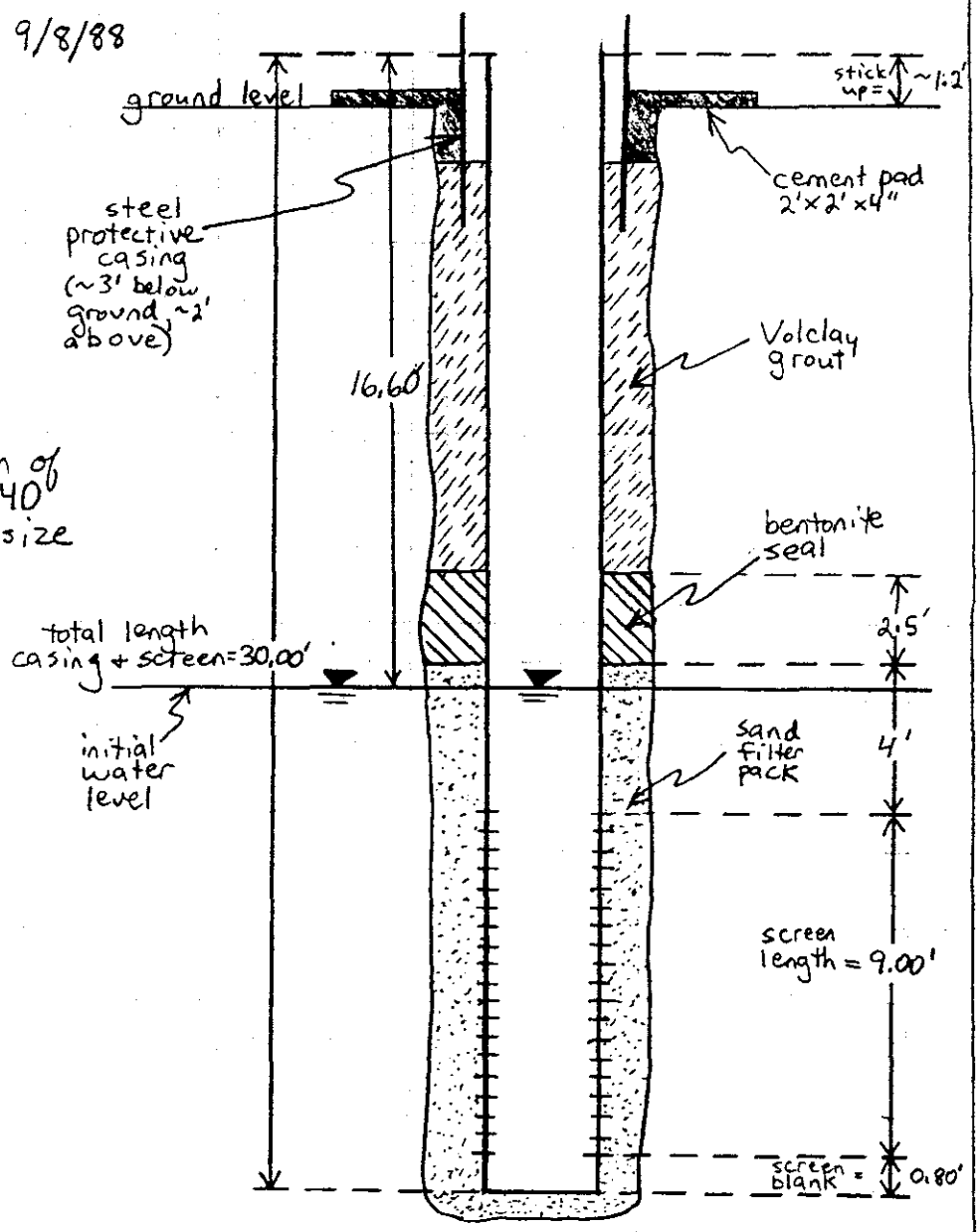
Date September 30, 1988 Date

File No.

Sheet ____ of ____

well W-LF-02
9.9' from pumping well

drilled + installed 9/8/88



casing and screen of
2" PVC Schedule 40
with 0.010" slot size

WELL COMPLETION INFORMATION

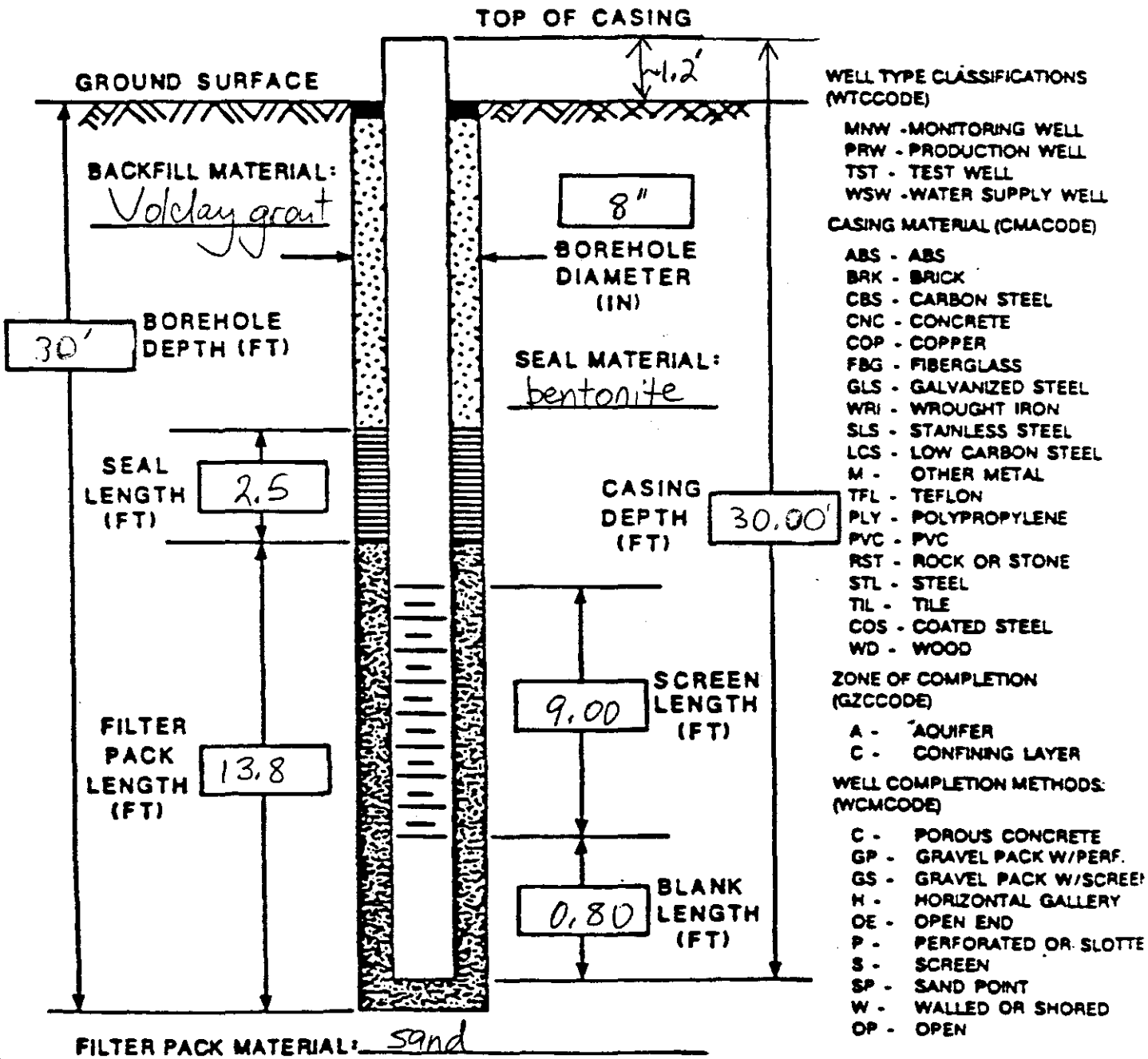
INSTALLATION ID Ft. Wainwright Landfill
LOCATION ID W-LF-02
WELL OWNER U.S. Army
WELL TYPE CLASS. _____
FORMATION OF COMPLETION sandy gravel aquifer

LOCATION TYPE WL
INSTALLATION DATE 9/8/88
INSTALLER Discovery Drlg
WELL COMPLETION METHOD _____
ZONE OF COMPLETION _____

SEAL END DEPTH (FT) 28.77
MEAS. POINT ELEV. (FTMSL) _____
CASING DEPTH (FT) 28.77
CASING DIAMETER (IN) 2"
CASING MATERIAL PVC

FILTER PACK LENGTH (FT) 13.8
SCREEN BEGIN. DEPTH (FT) 18.96
SCREEN LENGTH (FT) 9.00
SCREEN SLOT SIZE (IN) 0.010

REMARKS _____



WELL TYPE CLASSIFICATIONS (WTCODE)
- MNW - MONITORING WELL
- PRW - PRODUCTION WELL
- TST - TEST WELL
- WSW - WATER SUPPLY WELL

CASING MATERIAL (CMACODE)
- ABS - ABS
- BRK - BRICK
- CBS - CARBON STEEL
- CNC - CONCRETE
- COP - COPPER
- FBG - FIBERGLASS
- GLS - GALVANIZED STEEL
- WRI - WROUGHT IRON
- SLS - STAINLESS STEEL
- LCS - LOW CARBON STEEL
- M - OTHER METAL
- TFL - TEFLON
- PLY - POLYPROPYLENE
- PVC - PVC
- RST - ROCK OR STONE
- STL - STEEL
- TIL - TILE
- COS - COATED STEEL
- WD - WOOD

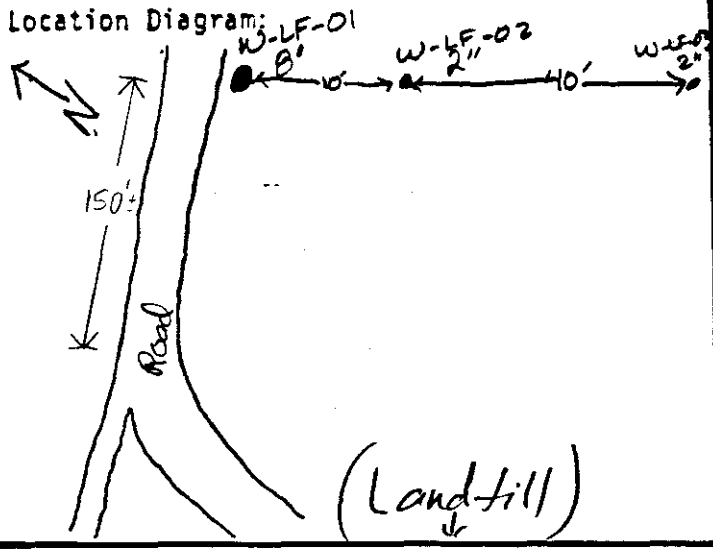
ZONE OF COMPLETION (GZCODE)
- A - AQUIFER
- C - CONFINING LAYER

WELL COMPLETION METHODS (WCMCODE)
- C - POROUS CONCRETE
- GP - GRAVEL PACK W/PERF.
- GS - GRAVEL PACK W/SCREE
- H - HORIZONTAL GALLERY
- OE - OPEN END
- P - PERFORATED OR SLOTTE
- S - SCREEN
- SP - SAND POINT
- W - WALLED OR SHORED
- OP - OPEN

Woodward-Clyde Consultants

Boring No. W-LF-02 Sheet 1 of 3
Job No. 90275-K Depth: 31.5'

Location Diagram:



Project: Joint Resources Project
Logged By: Holly Graham
Contractor: Discovery Drilling
Drill Rig: CME 75
Driller's Name: Gary Wilson
Drilling Method: Hollow stem Auger
Sampling Method: split spoon
Hammer Wt: 300 lb Drop: 30"
Start Time: 1700 Date: 9/8/88
Complete Time: 1820 Date: 9/9/88
Weather: partly sunny - partly cloudy
Instrumentation:

Comments:

Water Depth:	16.7'	16.6'	
Time:	1923	1520	
Date:	9/8/88	9/9/88	

Surface Cond: sandy silt w/organics
Vegetation: scrub forest,
Elev: Datum:

Depth, Ft.	Sample No.	Sampler Type	Blow Count	% Recov'd	Jar ID	Vane Tests Peak	Vane Tests Remoldy	Depth, Ft.	
1								1	organics brown silt.
2								2	
3								3	
4								4	
5		split spoon	3					5	fine silt grading to fine sand (SP)
6			6					6	fine sand grade to med. sand, dry.
			13						Dry sample
7								7	
8								8	
9								9	
10		split spoon	10					10	grey brown sand (SP/SW), dry

Boring No. W-LF-02 Sheet 2 of 3
Job No. 90275-K

Depth	Sample No.	Sampler Type	Blow Ct.	Driven	Recov'd	Graphic Log	
11			13				gravelly sand w/ some small gravel (SW)
			16				
12			—				
13			—				
14			—				
15		Split Spoon	—				well graded grey sands (SP) w/ increasing amts. of gravel near 16.5'.
16			—				sample is wet, approx. H_2O table.
17			—				
18			—				
19			—				
20		Split Spoon	7				sandy gravel (GW).
21			7				sand size ranges from fine to coarse
			5				gravel size ranges from fine to coarse
22			—				
23			—				
24			—				
25		Split Spoon	16				clean, washed sandy gravel (GW). Up to 2" gravel. Sands are fine to coarse.
26			12				
			13				Sample is saturated with water.
27			—				
28			—				
29			—				
30		Split Spoon	17				Gravelly sand (SW)

Boring No. W-LF-02 Sheet 3 of 3

Job No. 90275-K

Sample No.	Sampler Type	Blow Ct	Driven	Recov'd	Depth	Graphic Log	
	Split Spoon	10			31		decreasing amts of gravel interspersed with fine to coarse sands. Wet (end)
		15					
		—			32		
		—			33		TD = 315'
		—			34		well completion: see diagram
		—			35		
		—			36		
		—			37		
		—			38		
		—			39		
		—			40		
		—			1		
		—			2		
		—			3		
		—			4		
		—			5		
		—			6		
		—			7		
		—			8		
		—			9		
		—			0		

Resources Project

Subject Ft. Wainwright Landfill

Project No. 90275K

By Jane Showalter Checked By

Task No. 3071

File No.

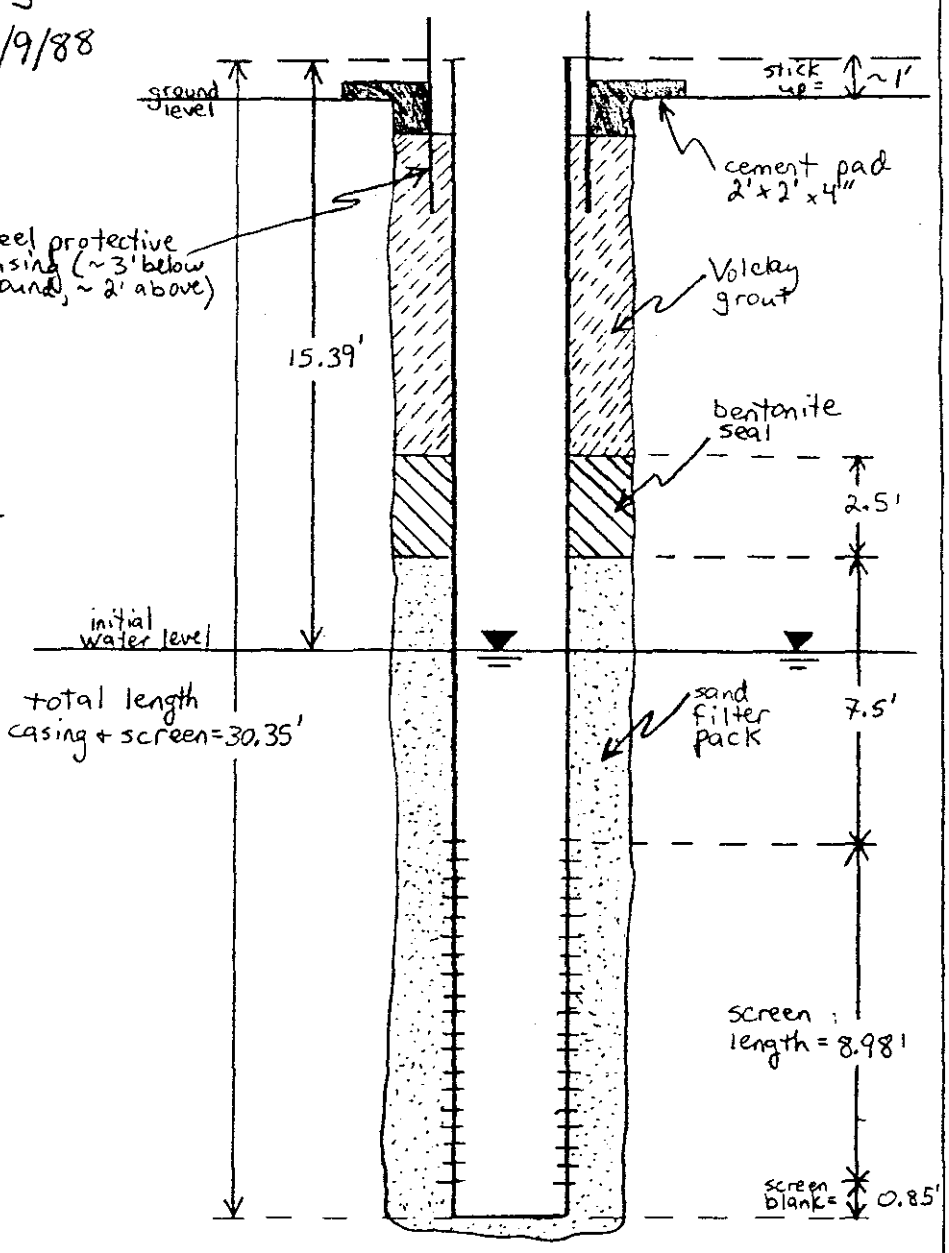
Date September 30, 1988 Date

Sheet of

Well W-LF-03

48.7' from pumping well

drilled + installed 9/9/88



casing and screen of 2" PVC schedule 40 with 0.010" slot size

WELL COMPLETION INFORMATION

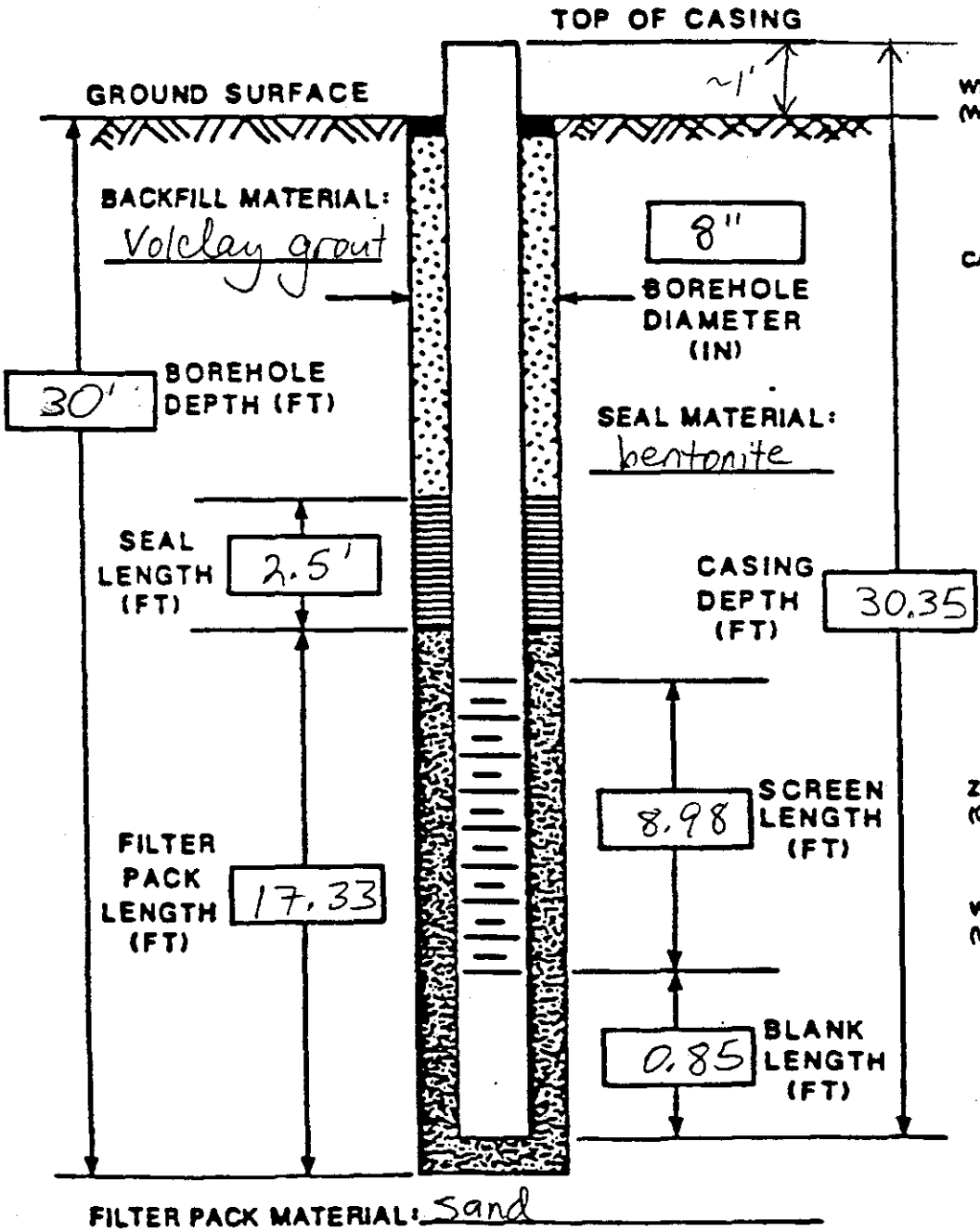
INSTALLATION ID Ft. Wainwright, Landfill
LOCATION ID W-LF-03
WELL OWNER U.S. Army
WELL TYPE CLASS. _____
FORMATION OF COMPLETION sandy gravel aquifer

LOCATION TYPE WL
INSTALLATION DATE 9/9/88
INSTALLER Discovery Drlg
WELL COMPLETION METHOD _____
ZONE OF COMPLETION _____

SEAL END DEPTH (FT) 29.38
MEAS. POINT ELEV. (FTMSL) _____
CASING DEPTH (FT) 29.38
CASING DIAMETER (IN) 2"
CASING MATERIAL PVC

FILTER PACK LENGTH (FT) 17.33
SCREEN BEGIN. DEPTH (FT) 19.55
SCREEN LENGTH (FT) 8.98
SCREEN SLOT SIZE (IN) 0.010

REMARKS _____



WELL TYPE CLASSIFICATIONS (WTCODE)
- MNW - MONITORING WELL
- PRW - PRODUCTION WELL
- TST - TEST WELL
- WSW - WATER SUPPLY WELL

CASING MATERIAL (CMACODE)
- ABS - ABS
- BRK - BRICK
- CBS - CARBON STEEL
- CNC - CONCRETE
- COP - COPPER
- FBG - FIBERGLASS
- GLS - GALVANIZED STEEL
- WRI - WROUGHT IRON
- SLS - STAINLESS STEEL
- LCS - LOW CARBON STEEL
- M - OTHER METAL
- TFL - TEFLON
- PLY - POLYPROPYLENE
- PVC - PVC
- RST - ROCK OR STONE
- STL - STEEL
- TIL - TILE
- COS - COATED STEEL
- WD - WOOD

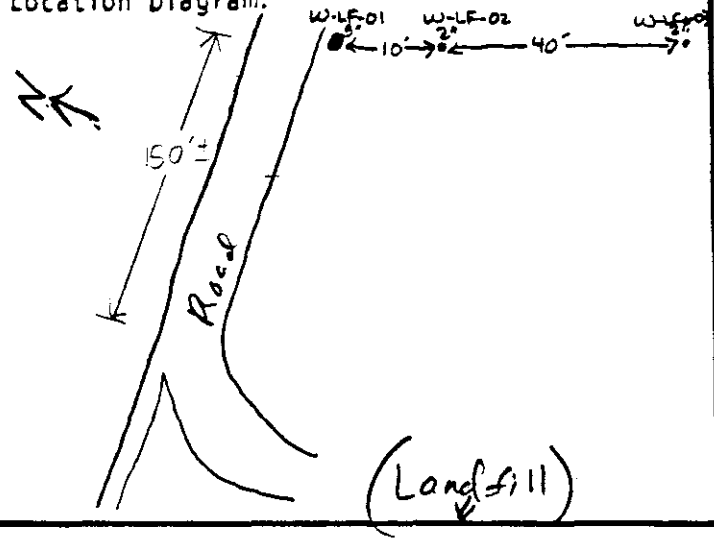
ZONE OF COMPLETION (GZCODE)
- A - AQUIFER
- C - CONFINING LAYER

WELL COMPLETION METHODS: (WCMCODE)
- C - POROUS CONCRETE
- GP - GRAVEL PACK W/PERF.
- GS - GRAVEL PACK W/SCREE
- H - HORIZONTAL GALLERY
- OE - OPEN END
- P - PERFORATED OR SLOTTE
- S - SCREEN
- SP - SAND POINT
- W - WALLED OR SHORED
- OP - OPEN

Woodward-Clyde Consultants

Boring No. W-LF-03 Sheet 1 of 3
Job No. 9027S-1K Depth: 31.5'

Location Diagram:



Project: Joint Resources
Logged By: Holly Graham
Contractor: Discovery Drilling
Drill Rig: CME 75
Driller's Name: Gary Wilson
Drilling Method: Hollow stem Auger
Sampling Method: split spoon
Hammer Wt: 300lb Drop: 30"
Start Time: 1000 Date: 9/9/98
Complete Time: 1130 Date: 9/9/98
Weather: partly cloudy - partly sunny
Instrumentation:

Comments:

Water Depth:	15.5'		
Time:	1520		
Date:	9/9/98		

Surface Cond: Sandy, silty, organics
Vegetation: scrub forest
Elev: Datum:

Depth, Ft.	Sample No.	Sampler Type	Blow Count	% Recov'd	Jar ID	Vane Tests Peak	Vane Tests Remold	Depth, Ft.	
1								1	organics, silts some fine sands
2								2	
3								3	
4								4	
5		Split spoon	10					5	Brown sandy silt (ML)
6			12					6	grades to sandy gravel (GW). Rounded
			17						gravel ≈ .25-1". Sands are med to fine.
7								7	
8								8	
9								9	
10		Split spoon	11					10	Light grey, sandy gravel (GW).

Boring No. W-LF-03 Sheet 2 of 3
Job No. 90275-K

Sample No.	Sampler Type	Blow Ct	Driven	Recov'd	Depth	Graphic Log	
		15			11		max gravel size is 1", rounded & subrounded.
		19					Sands are fine & med. grained.
		—			12		
		—			13		
		—			14		
	split spoon	6			15		Gravelly sand (SW).
		7					Sand size are fine to med. Gravels are
		11			16		rounded up to 1" - various sizes. Wet
		—			17		
		—			18		
		—			19		
	split spoon	13			20		Heave sands. Equigranular, clean sand (SP),
		11			21		grey, very saturated.
		15					
		—			22		
		—			23		
		—			24		
	split spoon	4			25		Gravelly sand (SW). Fine & med
		3					sands w/ some coarse. Gravels are
		7			26		small - typically, ≤ 0.75", rounded, wet
		—			27		
		—			28		
		—			29		
	split spoon	9			30		Sandy gravel (GW)

Boring No. W-LF-03 Sheet 3 of 3

Job No. 9025-K

Sample No.	Sampler Type	Blow Ct	Driven	Recov'd	Depth	Graphic Log	
	3" OD	10			31		Wide range of gravel sizes .25" – 1" well rounded. Sands med to fine grained (end)
		10					
		—			32		
		—			33		TD 31.5' Well Completion
		—			34		
		—			35		
		—			36		
		—			37		
		—			38		
		—			39		
		—			40		
		—			1		
		—			2		
		—			3		
		—			4		
		—			5		
		—			6		
		—			7		
		—			8		
		—			9		
		—			0		

APPENDIX D

Raw Field Data

Raw Field Data for Anchorage Fuel Terminal

Trench site

3:50pm ~~Drill site 8~~ – Utilities line marked w/ post by road was detected + marked (w/ blue flagging) towards site. (Note turn it makes, paralleling edge of pond.

3/4" pipe daylights (marked w/ blue pin flag), continues across site buried (marked w/ whee). Beyond 2nd flag, no indication w/ M480. Note that location of pipe is much less certain than location of utilities. Suggest putting trench between sets of flags.

4:15 Drill site 8

Any pipes would be 6-8' deep ⇒ TOO deep f/ detection w/ M480 or radar.

4:30pm Drill site 7

Partially exposed fuel lines on N + W sides of drill site area. Two blue flags (w/ ? marks) mark most likely edge of drain system (questionable), which appears to be between flags + fuel tank.

W/ M480, detected both lines + marked w/ blue flags.

3pm Drillsite 3 - Between road & above ground fuel line.
Utilities cable (marked w/ yellow posts) is not detectable w/ Metrotech 480, too much surface metal. Site marked ~~midway between~~ away from above ground & fuel lines & buried cable marker.
(Run radar over area)

3:15pm Drill site 4 - No markings of utility lines, no apparent fuel lines (other than across road fr/site). Checked f/ pipes/cables on edge of road - None apparent (by Metrotech) but not too definative. No pipes daylighting to pond in drill site. Topography too uneven f/ radar.

3:25pm Drillsite 2
Checked f/ pipe along fence (w/M480), (Manhole by gate ~60' to east). Fence too close to get any indication. From on top of tank, no apparent pipes in direction of drill site.

3:35pm Drill site 1. 1 pipe (~3') in dug out hole, goes across road, marked w/ blue flagging, detected w/ M480. Electrical outlet (other side of fence), could not get indication of where cable goes w/ M480 (perhaps due to underground piping. Perhaps it goes to electrical boxes across road. (Maybe do radar.)

Subject _____ Project No. _____

By Checked Task No. _____

All ppm

Location	B	T	X	TPH	Comments
nFTS	No BTX;			870	0.6 in Hg; TS-3
				710	-4
				640	-5
				750	-6
				380	-7
F:03				750	-8
	1600	1800	780	46000	TS-1
	3800	2400	5000	36000	-2
	6400	4100	1800	58000	-3
	6100	2300	360	58000	-4
	5300	3100	770	64000	-5
	4500	2500	610	64000	-6
	4600	3100	620	64000	-7

Water Flow rates and locations for Anchorage Fuel Terminal
– 25/26 OCT 1988 –

Location (SEE MAP)	Comments	Rate ml/sec
Site 1	metal box w/ grating Fuel Trap	Avg. 455 ml in 15 sec. 30 ml/sec
Site 2	metal box w/ grating Fuel Trap	Avg. 1525 ml in 15 sec. 102 ml/sec
Site 3	metal box w/ grating Fuel Trap	Avg. 610 ml in 10 sec. 61 ml/sec
Site 4	Culvert	Avg. 1432 ml in 5 sec. 286 ml/sec
Site 5	Culvert w/ flow directed around fuel trap.	Avg. 610 ml in 15 sec 41 ml/sec
Site 6	Fuel Trap Frozen w/ some underice flow	No Data
Site 7	Wooden Weir (sum of two separate flows)	Approx. 100 ml in 15 sec. 7 ml/sec
Site 8	Stream Channel outside of fence North of A.F.T.	4400 ml in 15 sec. 293 ml/sec
Site 9	metal box with grating Fuel Trap	4920 ml in 10 sec. 492 ml/sec
Site 10	culvert above shut-off valve to containment pond.	5106 ml in 15 sec 340 ml/sec
Site 11	metal box w/ grating Fuel Trap	avg. 1940 ml in 15 sec 189 ml/sec
Site 12	Fuel Trap completely Frozen	No Data

Anchorage fuel terminal
Ron Peterson & Jane Shoualter

Sat 8/28

09:30 Enter AFT, look over site. Scout areas to be surveyed

10:00 Use EM transmitter/receiver to locate a known culvert (8" diameter, ~1' deep), positive response. Set up GPR. Made test passes over same known culvert & over 3/4" pipe at surface, Calibrated instrument.

2:30 pm (Metrotech, model 480, Pipe & Cable Locator) Serial #

© As a check, used Metrotech480 (M480) to site marked utility cables. Positive response as expected. Marked w/blue flagging where cable crosses road by site ⑥

Drill site 6

Note: overhead powerlines near site ⑥ (~6' from east side road, an apparent pipe or cable)
Stay w/in 3' of flag.

2:50 pm Drill site 5

Between fence & above ground fuel line (protected by yellow posts).
Metrotech indeterminant, too much surface metal invicinity (fence, etc)
May try radar over this site.

Subject Headspace Analysis AFT Project No. 90275K

By Checked By Task No.

All ppm

Location	B	T	X	TPH	Comments
AFT-1	—	.027	—	3.3	Background sample
AFT-2	—	.672	TR	3.0	Background sample
AFT-5	—	TR	TR	720	Background, Diesel
AFT-1	14	23	2.9	91	0.2 in. Hg
	26	44	6.6	160	0.6 in.
	35	68	11	230	1.0 in
	39	89	17	350	0.6 in; 30 min.
	37	91	18	325	0.6 in; 60 min.
AFT-2	TR	TR	—	5	0.6 in
	TR	TR	—	19	0.6 in; 15 min
AFT-4	1800	2700	350	23000	3 in; Drew H_2O into unit Methane - 1,200
AFT-5	—	—	14	890	
	—	—	TR	760	
AFT-8	27	—	19	15,000	Mostly Methane
	TR	0.71	—	1.3	1st sample
	—	0.73	—	4.2	
AFT7B	0.18	—	—	5.2	Background
AFT7A	61	TR	TR	64	Background
AFT7B	—	0.70	0.48	2.2	Test Sample 1 (TS-1)
	TR	.019	TR	3.2	TS-2
AFT7A	—	0.67	0.80	2.9	TS-1
	—	0.089	TR	1.9	TS-2
	TR	0.55	0.69	2.5	TS-3
AFT4	1700	1900	120	23000	3 in Hg, TS-2
	680	780	68	7000	1 in Hg -3
	420	600	76	7300	-4
	630	890	120	6400	-5
	670	990	130	6300	-6
	380	490	36	7000	-7
	640	930	90	6100	-8

(Continued)

Page 11 of 2

Location (EEE MAP)	Comments	Rate ml/sec
* Artesian Well	outside of Fence North of A.F.T.	5 gal in 5 min 57 sec 18,925 ml in 357 sec 53 ml/sec

NOTES

Sampling method consisted of catching flow in a bucket for a set amount of time, then measuring the water in the bucket with a 1000 ml graduated cylinder.

* Sampling method was total time to fill a 5 gal. bucket.

Temperatures during sampling days were below freezing

Subject Field Data

Project No.

By

Checked By

Task No.

File No.

Date

Date

Sheet of

Stream Location - 1301

	* Horiz. meas dist (ft)	* Depth of water (ft)	Meas. depth .6 of depth	* Velocity ft/sec.	Area x-sect (ft²)	Area x Velocity	* Sect width
north ↓ south 0"	26"	3½"		0			6"
6"		3½"		0.15			
12"		2½"		0			
6"	12"	2"		0.5			
Stream Location - 1401							
east ↓ west 0"	22"	1"		0.35			6"
6"		2"		1.25			
12"		1"		1.10			
Stream Location - Big Stream							
west 0	64"	1"		0.3			6"
6		3"		1.7			
12		4½		1.8			
18		6		2.0			
24		5½		1.45			
30		5		0.9			
36		4		0.5			
42		2¾		0.4			
48		3		0.5			
54		2½		0.3			
east 60		1		0.2			
Stream Location - D1							
north 0	18"	—		—			6"
6		0.4'		0			
12		0.4		0.18			
18		0.4		0			
Stream Location - V6							
north ↓ south 6"	27"	0.2'		0			6"
12"		0.15'		0			
18		0.2		0			

Subject _____ Project No. _____

By _____ Checked By _____ Task No. _____

File No. _____

Date _____ Date _____ Sheet _____ of _____

Site 0901 - yucky!

1. 0.81 L | 10.3 sec. 10.3 sec
2. 1.62 L | 20 sec.

Site W1

1. 0.25 L | 10 sec.
2. 0.25 L | 10 sec.

Site W7

No flow

Site W6

No catchable flow

Site 0801

1. 1.52 L / 10 sec.
2. 1.58 L / 10.2 sec.

Site W12

1. 7.0 L / 10 sec
2. 8.4 L / 10 sec.

Subject _____ Project No. _____

By _____ Checked By _____ Task No. _____

File No. _____

Date _____ Date _____ Sheet _____ of _____

	Horiz. measurement Distance	Depth of Water	meas. depth 0.6 of depth	Velocity ft/sec	Area x-sect. (ft²)	Area x velocity (ft³/sec)	sect. width
MH 37							
	12"	1"		0.7 (estimate)			
1.	→ 550 ml / 20 sec. 10% of flow						
2.	1.8 liter / 20 sec. 20% of flow						
Stream Location - WD							
east 5"	18"	1½"	(0.125')	0.35	0.052	0.0182	0.417'
10		2	(0.167')	0.2	0.0696	0.0139	0.417'
↓ 15		1	(0.085')	0.1	0.035	0.0035	0.417'
WF - Site 1101							
1.	3.2 L / 10 sec.						
2.	3.2 L / 10 sec.						
Stream Location - D10							
south fork 5½	9"	1"		0.9			halfway
North fork 4'	8"	1"		0.5			

two parallel flowing forks of stream

Site W-2 - catchment from pipe / no flow from fuel trap

1. 2.54 L / 10 sec
2. 2.77 L / 10.4 sec.

Site 1001

1. 1.52 / 5 sec.
2. 1.70 / 5.4 sec.

Marsh - McBirney

Subject Data sheets for Water Rate (Streams) at AFT

By Checked By

Project No.

Task No.

File No.

Date Date Sheet of

Rate

Location		Total Horiz Dist Meas (ft)	Depth of Water (ft)	Velocity Reading (ft/sec)	Area x Velocity (ft³/sec)	Section width (ft)	Total Q Rate (ft³/sec)	Area (ft²)
1301	#1	2.2	.30	0	0	.5		0.15
	#2		.30	0.15	0.023	.5	0.023	0.15
	#3		.20	0	0	.5		0.1
1401	#1	1.8	.08	0.35	0.014	.5		0.04
	#2		.16	1.25	0.100	.5	0.158	0.08
	#3		.08	1.10	0.044	.5		0.04
Big Stream near D-17	#1	5.2	.08	0.30	0.012	.5		0.04
	#2		.25	1.70	0.213	↓		.125
	#3		.38	1.80	0.342			0.19
	#4		.50	2.00	0.500			0.25
	#5		.46	1.45	0.334		1.822	0.23
	#6		.42	0.90	0.189			0.21
	#7		.33	0.50	0.083			0.165
	#8		.23	0.40	0.046			0.115
	#9		.25	0.50	0.063			0.125
	#10		.21	0.30	0.032			0.105
	#11		.08	0.20	0.008			0.04
D-7	#1	1.5	0.4	0	0	0.5		0.2
	#2		0.4	.18	0.036	↓	0.036	0.2
	#3		0.4	0	0			0.2
108	#1	2.25	0.2	0 (ND)	ND	0.5		0.10
	#2		0.15	0 (ND)	ND	↓	ND	.075
	#3		0.20	0 (ND)	ND			0.10
	#4		0.25	0 (ND)	ND			0.125
WR	#1	1.5	0.13	0.35	0.019	.42		0.054
	#2		0.17	0.20	0.017	↓	0.039	0.082
	#3		0.08	0.10	0.003			0.033
D-10 North and D-10 South	#1	0.75	0.08	0.9	0.054	0.75	0.009	0.06
	#1	0.67	0.08	0.5	0.67	0.67		0.05

RECD APR 1 9 1989

Memorandum **Woodward-Clyde Consultants**

To Dennis McCrumb
Seattle

From Jane Showalter JMS

Office Anchorage

Date March 31, 1989

Subject Anchorage Fuel Terminal Surface Runoff
90275K

Following is a statement of the work to be performed at the Anchorage Fuel Terminal (AFT) this spring. This work is planned to fulfill requirements of contract number F33615-85-D-4544, order number 09, modification number 01, dated October 18, 1988. The objectives of the surface water monitoring program are to estimate the volume and quality (as related to petroleum hydrocarbons) of the total annual surface flow across the site and to estimate the site's contribution of petroleum hydrocarbons to the surface water. For this monitoring effort, the water in the abandoned sewer line will be considered part of the surface water system.

Monitoring Network

The sampling locations (listed on Table 1 and marked on the map of Figure 1) are the same as some of the locations sampled in the fall of 1988. They represent the surface water in the major streams at the farthest upstream and downstream points on the AFT site. One grab sample for water quality analysis will be taken from each of those locations. Measurements of the temperature, pH and specific conductance of each sample will be taken on-site. The flow rate of the stream at each sampling location will be measured at the time of sampling. Laboratory analyses will be performed to determine the concentration of each of the following water quality parameters: benzene, toluene, xylenes, oil, grease, and biochemical oxygen demand (BOD).

Operating Plans and Procedures

Care must be taken to collect samples that are representative of the entire cross-section of the streams at the sampling locations and that the bottom sediments disturbance is minimized. Collect samples directly into the sample bottles without rinsing the bottles with stream water. If the stream is small enough, or if a suitable stream constriction exists at the sampling point, collect the entire stream flow in the sample bottles. Since the volume of spring run-off is expected to be too great to allow this without flushing the preservatives from the sample container, a visually estimated depth-integrated sampling procedure is recommended. With this method, the sample containers are filled in the middle of the stream while being

raised from the bottom of the stream to the surface. Collecting the water sample from the abandoned sewer line will not be as straight forward as collecting samples from the streams. A sample bottle holder with a reach of approximately ten feet will be required.

A total of 3 sample bottles will be filled at each sampling location. the type of container to be used and the type and amount of preservative required for each parameter analyzed are listed on Table 2. The preservatives are to be placed in the sample bottles before or during mobilization. It is very important not to rinse any of the sample bottles with stream water before sample collection since the preservatives would then be lost.

Take one field duplicate sample for every ten samples collected, with a minimum of one duplicate during each day of sampling. From each sample bottle for BOD analysis (which contains no preservatives) take field measurements of temperature, pH, and specific conductance. Decontaminate the probes before measuring each sample. After being filled, each bottle is to be capped tightly, sealed in a Ziplock bag, labeled, and placed in a cooler with ice substitute.

Measure the flow rate of the stream at each sampling location at the time of sampling using one of the two recommended methods discussed below. The catchment method involves collecting all of the stream flow for a specific period of time and then measuring the volume collected. This method may be possible at locations where the stream flows from a pipe or over an obstruction. The second recommended method is to define the cross-section of the stream at the sampling locations and then use the Marsh-McBirney meter to measure the average velocity of the water at equal width increments across the stream.

With completed chain-of-custody papers, ship the cooler of samples to Enseco-Rocky Mountain Analytical Laboratory via Federal Express. Deliver the samples to the airport Federal Express office by 1 p.m. for next day delivery. Call the laboratory when the samples were sent, tell them when to expect the samples, and what the maximum holding times are. Ask that lab personnel call the Anchorage Woodward-Clyde office to confirm receipt of the samples. The address and phone number of the laboratory are listed below:

Enseco-Rocky Mountain Analytical Laboratory
4955 Yarrow Street
Arvada, CO 80002
(303) 421-6611

Table 1. Sample Locations

Sample Number	Surface Water System	Sample Location Description
R-FT-0901	Culvert/ditch drainage flowing to the west	Fuel trap by buried tanks 20-623 at headwaters of culvert/ditch drainage system
R-FT-1501	Culvert/ditch drainage flowing to the west	Fuel trap near pump house (where sample W12 was taken)
R-FT-1101	Stream 1	Headwaters of a tributary of Stream 1
R-FT-1301	Stream 1	Stream 1, near the eastern AFT boundary
R-FT-1401	Stream 1	Stream 1, near the northern AFT boundary (not the northern fence line)
R-FT-1001	Stream 2	Fuel trap at headwaters of Stream 2
R-FT-1601	Stream 2	Stream 2, near the northwestern boundary of AFT (where sample D1 was taken)
R-FT-1801	Abandoned sewer line	Manhole #37, near northwestern boundary of AFT

Table 2. Analytical Specifications

Parameter	Container	Preservatives	Maximum Holding Time	Analytic Method*
Purgeable aromatics: benzene, toluene, and xylenes	Three 40 ml glass vials with teflon-lined caps	4°C, 0.008% $Na_2S_2O_3$, HCl to pH=2	14 days	EPA 602
Oil and grease	1 l glass	4°C, 4 ml 50% Sulfuric Acid	28 days	EPA 9070
BOD (5 day)	500 ml polyethylene or glass	4°C	48 hours	SM 507
Total petroleum hydrocarbons	1 l wide-mouth glass	4°C, 5 ml Hydrochloric Acid	10 days	EPA 418.1

*Sources: EPA = USEPA, March 1983. Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.
SM = American Public Health Association, 1985. Standard Methods for the Examination of Water and Wastewater.

RECD APR 19 1989

Memorandum **Woodward-Clyde Consultants**

To Dennis McCrumb

From: Jane Showalter JMS

Office: Anchorage

Date: April 11, 1989

Subject: Anchorage Fuel Terminal Surface Runoff
90275K

There is still some snow at AFT. Within the next two weeks it should be melted. The runoff is noticeably higher than in the fall. According to AFT personnel, this higher springtime runoff rate usually continues from early April to mid-June. We plan to collect the surface water samples as described in my memo to you (March 31, 1989) on May 1-2. It should require 1 day for 2 people or 1½ days for 1 person.

Due to the 48-hour maximum holding time for BOD analysis, we plan to have them performed in Anchorage. Chemical and Geological Laboratories of Alaska will perform BOD (5 day) analyses of water samples for $35 each.

Memorandum **Woodward-Clyde Consultants**

To: Dennis McCrumb
Seattle

From Holly Graham

Office Anchorage

Date May 22, 1989

Subject: Anchorage Fuel Terminal Spring Runoff

These are observations I noted while resampling in the spring at the Anchorage Fuel Terminal. These notes are to be accompanied by a site map which is marked to correspond to the numerical notations below.

Map Notation Number	Notes:
1.	The oil-water separator below buried tank 622. Water flows into the fuel trap at about 1 gal a minute or less. A strong fuel odor was evident. Within the fuel trap, fuel was floating on the water. Water exiting the fuel trap had a sheen as it flowed into the ditch. The water then flowed into the ground and accumulated in a swampy pond at site 2.
2.	The pond (15 x 25 ft) does not display a sheen or odor. The vegetation in the pond does not appear to be stressed.
3.	The fuel trap below buried tank 623 is sample location R-FT-0902. We sampled water flowing into the fuel trap because water exiting fuel trap was too difficult to obtain in sample bottles. Water was flowing into the fuel trap at about 1 to 2 gal per minute. The water in the fuel trap had product in it and emanated a strong fuel odor. The exiting water had a definite sheen.
4.	The exiting water flows downhill into a culvert, under the road and circumvents another fuel trap at location 4.
5.	Drain pipe and fuel trap near building 817. No sheen or odor was noticed at either the fuel trap or the adjacent water pipe flowing into the same drainage. The water appeared to be flowing at less than 1 gallon per minute into the fuel trap.
6.	A pipe exiting the berm and the location of sample R-FT-1102. The flow out of the pipe was about 1 gal per

minute or less. There was no odor or sheen. There was the typical oxidized build up of gunk around the outflow.

7. This site is atrocious. See attached diagram. A pipe exits from the hill just below tank 618. The water is really contaminated by fuel. You can see free product in the effluent. West of the outflow is some kind of oil seep in the ground. The soil smells strongly of petroleum and there is a large (5 x 6 ft) dark stain. The vegetation in the area is stressed or dead. Below this outfall the water has ponded in a small area (6 x 10 ft) up to 2 ft deep. There is free product visible on the surface of this small ponded accumulation of water. There is oxidized gunk in the pond. The fuel trap below this area also exhibits strong fuel odors and sheen. Sample R-FT-0801 was probably taken from this fuel trap.

8. Fuel trap near pump house. The fuel trap here is backed up and flooded by the large pond on Chevron property to the south. Sample R-FT-1502 was taken in the stagnant ponded water at the exit point of the fuel trap. A slight sheen on the water was visible. No odor was noticed.

9. This stream/ditch is a split off from the one located on the map. A road traverses the area between the two ditches at 9 and 10. The two ditches at sites 9 and 10 contain slow moving water on either side. The ditches are 3 to 6 ft wide each. No sheen or odor was detected.*

10. This stream/ditch is located on the map. 3 to 6 ft wide, slow flowing stream. No sheen or odor detected.*

11. The location of a fuel trap. No sheen or odor was detected. Perhaps a sample at this location would be informative.

12. A manhole cover. Inside the water was flowing at a good clip to the west. Perhaps a sample at this location would be informative.

13. Manhole #37 on map. Retrieved sample R-FT-1801. The water inside was flowing at about 5 gal per minute and exhibited a fuel odor. We lowered a 5 gal bucket on a rope to obtain a sample.

14. This site is a small creek flowing into the pond by the road. We retrieved sample R-FT-1601 at this location. The creek appeared very clean, and the water was clear. There was no sheen or odor at this location.

15. The stream at this location appeared swollen and turbid. There were some high water marks along the banks indicating recent flooding or heavy runoff. We took sample R-FT-1402 from this location. No oily sheen or odor was detected, but the water was flowing rapidly.

16. The stream appeared slightly swollen and turbid. The water was foamy and polluted looking. There was lots of trash and debris scattered about. We took sample R-FT-1302 from here. No oily sheen or odor was detected.

* The observance of these areas had to be quick because of dive bombing seagulls attempting to protect their nests, which are concentrated in this area. They lay their eggs along the ditches and roads and practically attack anyone who comes near. They are quite aggressive and I felt compelled to make very abbreviated visits at these locations, or drive by and look from the vehicle. No fooling. Alfred Hitchcock all over again.

Table 1. Sampling Field Test Results and Notes for 5/15/89

Sample Number	Field Test Results	Remarks
R-FT-0902	Temp. = 7°C; pH = 7.01; Cond. = 40 mmohs	Strong odor and sheen emanating from the fuel trap. Sampled water flow into the fuel trap because exiting water was difficult to catch.
R-FT-1002	Temp. = 8°C; pH - 7.00; Cond. = 30 mmohs	No odor or sheen was detected at time of sampling. The water was slightly gunky with oxidation.
R-FT-1102	Temp. = 7°C; pH - 6.66; Cond. = 30 mmohs	No odor or sheen was detected at time of sampling. The water was slightly gunky with oxidation.
R-FT-1502	Temp. = 10°C; pH - 7.35; Cond. = 70 mmohs	This water was stagnant. The fuel trap was backed up by the pond on Chevron property to the south. The stagnant water may explain why the temperature, pH, and conductivities are anomalous to other samples. A slight sheen was detected.
R-FT-1801	Temp. = 6°C; pH = 7.15; Cond. = 30 mmohs	This sample was taken at manhole #37 on the map. We lowered a bucket on a rope to retrieve the sample. A fuel odor was very noticeable over the opening.
R-FT-1601	Temp. = 8°C; pH - 7.39; Cond. = 30 mmohs	This pH reading is suspect. I believe pH is slightly lower. I recalibrated the pH meter after this sample. Very clean looking surface water. No sheen, odor, or oxidation. The water was flowing clear.
R-FT-1302	Temp. = 9°C; pH - 6.39; Cond. = 9 mmohs	The water was flowing at a good clip. The surface stream looked polluted. The water was cloudy and foamy with garbage and debris throughout.
R-FT-1402	Temp. = 9°C; pH = 7.03; Cond. = 10 mmohs	Surface water was flowing heavy. High flood marks on the banks indicated a recently swollen stream. Good flow. Water cloudy, no foam or sheen.

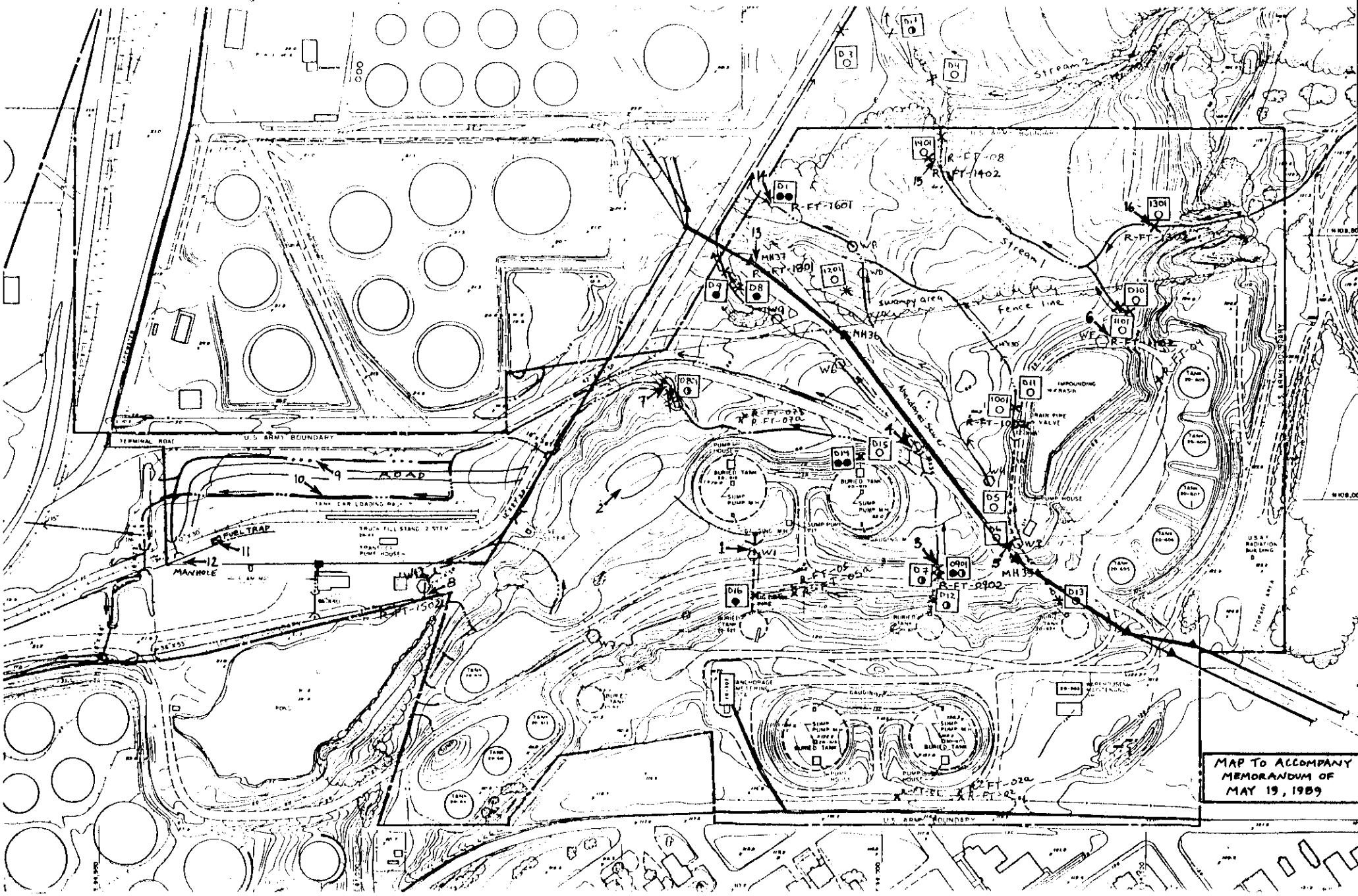
Table 2. Sample and Resample Locations

Sample Number	Surface Water System	Sample Location Description
R-FT-0901 and -0902	Culvert/ditch drainage flowing to the west	Fuel trap by buried tanks 20-623 at headwaters of culvert/ditch drainage system
R-FT-1501 and -1502	Culvert/ditch drainage flowing to the west	Fuel trap near pump house (where sample W12 was taken)
R-FT-1101 and -1102	Stream 1	Headwaters of a tributary of Stream 1
R-FT-1301 and -1302	Stream 1	Stream 1, near the eastern AFT boundary
R-FT-1401 and -1402	Stream 1	Stream 1, near the northern AFT boundary (not the northern fence line)
R-FT-1001 and -1002	Stream 2	Fuel trap at headwaters of Stream 2
R-FT-1601	Stream 2	Stream 2, near the northwestern boundary of AFT (where sample D1 was taken)
R-FT-1801	Abandoned sewer line	Manhole #37, near northwestern boundary of AFT

Table 3. Analytical Specifications

Parameter	Container	Preservatives	Maximum Holding Time	Analytic Method*
Purgeable aromatics: benzene, toluene, and xylenes	Three 40 ml glass vials with teflon-lined caps	4°C, 0.008% $Na_2S_2O_3$, HCl to pH=2	14 days	EPA 602
Oil and grease	1 l glass	4°C, 4 ml 50% Sulfuric Acid	28 days	SM 413.2
BOD (5 day)	500 ml polyethylene or glass	4°C	24 hours (in Alaska)	EPA 405.1
Total petroleum hydrocarbons	1 l glass	4°C, 5 ml Hydrochloric Acid	10 days	EPA 418.1

*Sources: EPA = USEPA, March 1983. Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.
SM = American Public Health Association, 1985. Standard Methods for the Examination of Water and Wastewater.


MAP TO ACCOMPANY
MEMORANDUM OF
MAY 19, 1989
U.S. ARMY BOUNDARY
TERMINAL ROAD
ROAD
FUEL TRAP
MANHOLE
TANK CAR LOADING RACK
TRUCK FILL STAND 2 STEP
PUMP HOUSE
SUMP PUMP MH
BURIED TANK
GAUGING MH
ANCHORAGE METERING
U.S.A.F. RADIATION BUILDING
IMPOUNDING BASIN
DRAIN PIPE VALVE
Stream 1
Stream 2
Fence line
swampy area
Academy Street
R-FT-1501
R-FT-1601
R-FT-1401
R-FT-1402
R-FT-1301
R-FT-1302
R-FT-1101
R-FT-1102
R-FT-1001
R-FT-1002
R-FT-0901
R-FT-0902
R-FT-0801
R-FT-0802
R-FT-0701
R-FT-0702
R-FT-0601
R-FT-0602
R-FT-0501
R-FT-0502
MH37
MH36
MH35
MH34
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Memorandum **Woodward-Clyde Consultants**

To Dennis McCrumb
Seattle

From Holly Graham

Office Anchorage

Date May 30, 1989

Subject Anchorage Fuel Terminal
Spring Water Rate Measurement

On May 26, Paige Spatz and myself measured water flow rates at the Anchorage Fuel Terminal. The previous week I had been collecting water samples in the same areas and noticed that by 5/26/89 the water rates appeared to have decreased slightly. This was probably due to little or no precipitation in the week between water sampling and water rate measurements.

We measured water rates by two methods. We used a catchment method if water was flowing out of a pipe or some catchable channel. We used a Marsh-McBirney meter to estimate the flow volume if the water was flowing as a stream.

Catchment Method: This entailed catching the total volume of water outpouring from a source in a bucket, and timing it for a specific number of seconds. We would then measure the amount using a 1000 ml - 1 L cylinder. In each case we took two measurements to average the water flow rate between the two readings. The flow was measured in liters per seconds and also converted to cubic feet per second by a calculation.

Marsh-McBirney Meter Method: Where water was flowing as a stream, we measued the flow using a Marsh-McBirney meter. We first measured the width of the stream then divided the stream into approximately equal sections (usually 0.5 ft). We then measured the depth and width of each section to calculate the area of each section of the stream. Using the meter, we measured the velocity of the flow in ft/sec for each individual section of the stream. We then calculated the velocity for each unit area to get a water flow rate for each incremental section. The sum of the flow rates for each section is the estimated total flow rate in ft^3/sec for that stream. In most cases the streams were so small we took only three separate readings in cross section and in one case took a single flow reading. We attempted 0.6 of the depth of the water to take the meter reading (in most cases the streams were so shallow we merely immersed the meter sensor in the stream).

Included with this memo are Tables 1 and 2 which provide the results of both measuring methods. Also included is a site map showing field

locations of water rate measurements, and my rough field notes and calculations.

Please call me with any questions.

Table 1. Water Rates at Anchorage Fuel Terminal (Catchment Method). May 23, 1989.

Site Location	Method	Observations	Rate (L/sec)	Rate (ft^3/sec)	Comments
Sample Site 0901	Catchment	Gunky with oxidation; fuel odor; product inside fuel trap.	0.080	0.0028	Water rate taken at inflow to fuel trap.
Site W1	Catchment	Gunky with oxidation; fuel odor; fuel product inside fuel trap.	0.025	0.0009	Water rate taken at inflow to fuel trap.
W7	NA	None	NM	NM	No flow at this site 5/23/89. Previously recorded flow here.
W6	NA	This flow is a continuation of the flow measured upgradient at site 0901. Gunky ditch.	NM	NM	Small amount of flow in ditch which was circumventing the fuel trap. The flow was uncatchable without pipe.
Sample Site 0801	Catchment	Gunky with oxidation; fuel odor; fuel product inside fuel trap.	0.153	0.0054	Water rate taken at inflow to fuel trap.
W12	Catchment	Slight sheen on the water surface, slow flowing.	0.77	0.0272	Water rate measured at inflow to fuel trap.
Manhole 37 Sample Site 1801	Catchment	Some gunky residue in stream, odor over opening of manhole.	0.36*	0.0127*	Estimated that we were catching 25% of flow in a 5 gal bucket and thus projected total flow rate.
WF- Sample Site 1101	Catchment	No odor, no sheen, slight oxidation.	0.32	0.0113	Rate measured at exit pipe on north berm of impoundment basin.

Table 1. (Continued) Water Rates at Anchorage Fuel Terminal (Catchment Method). May 23, 1989.

Site Location	Method	Observations	Rate (L/sec)	Rate (ft^3/sec)	Comments
W-3	Catchment	No odor, no sheen, no oxidation.	0.26	0.0092	Rate measured at exit pipe from ground. No flow in nearby fuel trap.
Sample Site 1001	Catchment	No odor, no sheen, slight oxidation.	0.31	0.0109	Rate measured at exit pipe from ground west of impound basin berm.

NM = No measurement taken - see comments
NA = Not applicable - see comments

* See comment
Source: Field data collected by Holly Graham

Table 2. Stream Flow Rates at Anchorage Fuel Terminal May 23, 1989 (as measured in cross-section with a Marsh-McBirney Meter).

Stream Location	Approx. Cross-Sect. Area (ft^2)	Stream Depth at Deepest (ft)	Stream Width (ft)	No. of Measurements per X-Section	Meas. Intervals (ft)	Flow Rate Calcylated (ft^3/sec)	Comments
1301	0.40	0.30	2.2	3	0.5	0.023	The stream was cloudy. Trash and debris littered the area.
1401	0.16	0.16	1.8	3	0.5	0.158	The stream was cloudy and slightly swollen.
Big Stream near D-17	1.60	0.50	5.3	11	0.5	1.822	Large stream collecting both flow on and off site. Took measurement there previous fall.
D-1	0.60	0.18	1.5	3	0.5	0.036	Measurement taken from the stream below the fuel trap about 15 meters.
W8	1.08	0.25	2.25	4	0.5	ND	While there was definitely flow here, it was too slow to be measured by the meter.
WD	1.50	0.17	1.5	3	0.4	0.039	Water was flowing from north end of swampy AFT site.
D-10 (north and south fork combined)	0.11	0.08	1.42	2	0.75 and 0.67	0.79	The stream forked immediately after exiting the ground. We measured both north and south forks and combined the results.

ND = No detection
Source: Field data collected by Holly Graham

Raw Field Data for Roosevelt Roads PCB Site

15 SEP 1988
US ARMY - ROOSEVELT ROAD
PCB CLEAN UP :
.90275 K 3131 /3132

0730 - ARRIVE FORT RICH MAIN GATE AND OBTAIN TEMPORARY PASS

0745 - ARRIVE MP HEADQUARTERS AND OBTAIN 95 DAY VEHICLE PASS

0800 - ARRIVE ROOSEVELT ROAD TRANSMITTER SITE. NO MARTECH PERSONNEL ARE ON-SITE

- SURVEY STAKES AND RIBBON HAVE BEEN USED TO DEFINE AN EXCLUSION ZONE, CONTAMINATION REDUCTION ZONE, AND A CLEAN ZONE.

- A DECON STALL HAS BEEN ERECTED BETWEEN CONTAMINATED AREAS AND CLEAN AREAS

15 SEP 1988 CONT'D

- A JCB 530B HL LOADALL IS ON SITE.

Morning Weather: CLEAR AND SUNNY + COOL : 38°F

0900 - CALL MARTECH AND SPOKE W/ DON LITCHFIELD (spell ?). HE SAID THE BAGS THEY INTEND TO USE FOR THE PCB REMOVAL DON'T INCLUDE PCB'S ON THEIR LIST OF APPROVED CHEMICALS TO BE PLACED IN THEM. HE FELT THE BAGS WERE ADEQUATE BUT THE SGT @ DRMO WONT ACCEPT THEM UNLESS HE CAN GET A DOT REP TO AGREE THAT THE BAGS ARE SUITABLE. HE DOESN'T WANT TO USE DRUMS OTHER THAN AS A LAST RESORT. HE IS TRYING TO GET SOMETHING GOING FOR TODAY OR TOMORROW.. WORST CASE WOULD BE EARLY NEXT WEEK.
I ASKED HIM IF HE WAS THE

15 SEP 88: CONT'D

PM, he SAID he WAS. I also ASKED THAT HE CALL ME AND Keep me informed on the project STATUS.

- RETURN TO OFFICE

19 SEP 88

CALLED DON Litchfield AND ASKED him the STATUS OF THE PROJECT. HE SAID They had resolved the container problem to everyone's SATISFACTION.
They will excavate the contaminate soil AND place it in bags. The bags are still a concern for USAF-DRMO, so the bags will be placed in a conex box. The "C" box is DOT Approved AND DRMO will accept it.
DON expects the bags to Arrive sometime thursday and plans to begin work as soon as they ARRIVE. They (MARTECH) will WORK 12 hr days through the weekend.
DON hopes to have all the material excavated AND bagged by Sunday. They will then load the bags into the boxes on monday and tuesday. The

19 Sep 88 (CONT'D).

epoxy Resin will be placed on Monday AND Tuesday concurrently with the boxing.
I will TRY TO SAMPLE while the epoxy is being placed.

22 SEP 88

called Don Litchfield - he said it would BE AT LEAST ONE more day before the START.

23 SEP 88

Met w/ MARTECH @ 0830 HRS.
Ed CRONICK, Don Litchfield, John Simpson, present for Martech.
They said they are still waiting for an answer on the acceptability of the Conex BOXES. They will know by 10:00.
If the boxes are not acceptable MARTECH will build plywood

23 SEP 88 CONT'D.

boxes and place one bag in each box. This will be acceptable to ORNG DOT, and others.

- TALKED TO DON LITCHFIELD
They will BEGIN WORK TOMORROW @ 0800, This means they will begin moving soil @ about 10:00

- 1600 HRS Spoke w P. STUCKE US ARMY. He said he will fill out the turn in documents and asked that I meet w/ him on monday morning in BLDG 730 and he would go over everything we need to do to turn-in the waste.

- spoke w/ D. Litchfield he said they still plan to begin digging tomorrow @ about 10:00 they don't know what containers to use yet. but will dig and bag any way.

24 SEP 1988

0830 READY GEAR AND leave for site
0900 ARRIVE on site
MARTECH IS ON site.
They have in place:
2 Decon stalls
1 MAN/GEAR shed (conex)
Jones Construction steam cleaning vehicle.
IH 630 TRACK HOE.
several barrels
BAGS AND A Hopper
JCB 530 B H L.

Weather: CLEAR AND Sunny.
Still 30° F.

1030 Begin EXCAVATION on West side

I have MARKED the boundaries for all excavations west & North

All work level D C
Double gloves, rubber boots
tyvek, Resp. Tape @ wrist + ankles

24 SEP 88 CONT'D

BAGS removed from West

(60) ||||| ||||| ||||| ||||| ||||| |||||

|||||

24 Sep 88 cont'd

Bags are being filled directly from the bucket this is a very slow and difficult operation since the bags are smaller dimension than the bucket. Ed Cronk said they will have a smaller machine on-site by lunch

MATERIAL APPEARS TO BE A GRAVELLY SAND w/ some silt.

1330 – Lunch – 21 bags so far.

Switch to TAKeuchi TB68 Trackhoe following lunch.

Bottom of concrete slab 4.5 ft

1700 – BEGAN smelling A very STRONG moth-ball like odor. ACC MARTECH personnel went to Organic vapor cartridges. I already had them depth ± 7 ft.

24 SEP 88 (CONT'D)

MARTECH put one man on cleaning the top of the cement pad following Lunch. Approximately 7 bags have been filled by 1300 hrs

FOUND A small burned area on the concrete pad. 2 1/4 ft South of the north end ± center of main portion.

The burn has caused a small depression ± 2ft x 3ft x 1/2 to 1 inch deep. There were many nails in the depression as if someone had been burning wood

TOTAL Bags today 56

EACH bag 1/2 – 2/3 yd^3

28 SEP 88

0745 ARRIVE ON SITE.
WEATHER - CLEAR / SUNNY ± 30°F

- SPOKE W/ NEW HEO OPERATOR AND TOLD HIM WHAT WE NEED.

THERE IS STILL A SHARP ODOR @ THE EXCAVATION. THE SMELL IS SIMILAR TO MOTH-BALLS. I WENT TO THE STORAGE AREA AND COULD SMELL A FAINT ODOR THERE IS ALSO. THE BAGS ARE NOT COMPLETELY TIGHT W/ RESPECT TO VAPORS (MY OPINION).

I SPOKE W/ DON LITCHFIELD AND JOHN SIMPSON OF MARTECH AND NOTIFIED THEM OF MY CONCERNS.

I ASKED IF THEY HAD ANY MONITORING EQUIP. AVAILABLE. THEY SAID NO.

MY CONCERNS ARE AS FOLLOWS:

25 SEP 88 CONT'D

1) WE DON'T HAVE ANY IDEA WHAT THE SMELL MAY BE ASSOCIATED W/. WE DON'T KNOW THE CHEMICAL MAKEUP OR CONCENTRATION.

I AM ALLOWING WORK TO CONTINUE SINCE ALL WORK IS BEING DONE LEVEL (KS) C. NO ODOR IS DETECTED WHEN WEARING THE RESPIRATORS. I HAVE ASKED THAT ALL PERSONNEL WEAR ORGANIC VAPOR CARTRIDGES FOR THE REMAINDER OF THE PROJECT.

2) IS THE CHEMICAL GENERATING THE ODOR HAZARDOUS OR TOXIC. IF SO, ARE THE BAGS APPROVED FOR THAT CHEMICAL?

I WILL CALL DAN GRAHAM (PM) @ 0:00 TO ASK IF
1) HE HAS ANY KNOWLEDGE OF

25 Sep 88 cont'd

any Further chemical testing beyond PCB:

2) if he can put it in the budget to run some volatiles/semi volatiles (8010, 8020) on some material taken from the excavation.

1000 HES CALL DAN GRAHAM

NO TESTS were done other than PCB. USACE did not smell anything when they did the Augerings.

Agreed to take 8010 analysis

ASKED John Simpson if 160-170 Bags would be OK he said yes

Previous calcs were for 105 bags on west 45 bags North.

AREA below 10 FT

$\frac{1}{2}(11)(4)(14)$ 308 FT^3 = 11 3/4 YDS = 18 bags

25 Sep 88 cont'd

Bags taken from west today

105 - 18 = 87 bags should complete bottom to 10 FT

currently 56+18 = 74

Can use up to 115-170 bags on west side with 25 bags for el below -10 try to get to hide square up of 90 bags - 95

1245 DAN GRAHAM was on site. he said we can not exceed 100 yd^3. We have been getting 1/2-3/4 yd^3 per bag. I will put a limit of 160 bags.

15 are for the slab. leaves 145

105 for west
40 for north

25 Sep 88 cont'd

105 BAGS from West side. Have 40 BAGS from N. end are based on 160 TOTAL BAGS, 45 for S/66 clean up.

Will take a sample of the odorous material and have a flame ionization done on a headspace method.

1300 - Following lunch I had the HOE operator str up the EXCAVATION I got A MAX H-NU = 4 ppm 3 FT below the surface.

- Currently have removed 87 bags from the west side I TOLD the operator to take A MAX of 5 more bags w/ the small hoe; then START the deeper cut w/ the LARGER hoe.

25 Sep 88 cont'd

1330 TOOK sample RR-1 H-NU = 24 ppm in bucket of EXCAVATER

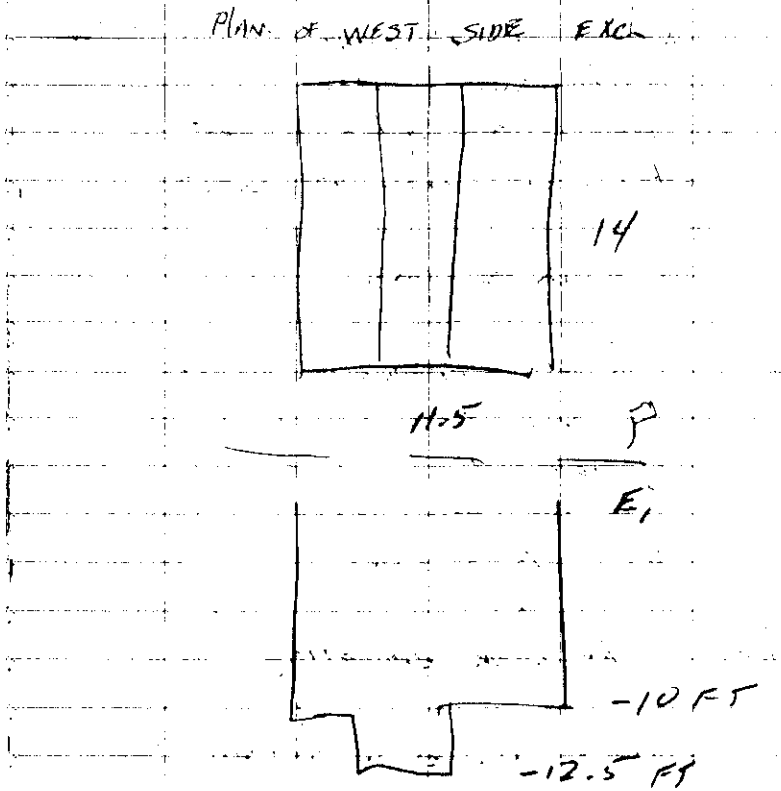
H-NU IN Sample BAG = 40 ppm 2.5 ppm 1 FT ABOVE BAG (I.E. BREATHING Zone)

1400 TOOK Sample RR-2 from BUCKET w/ H-NU = 30 ppm

Highest H-NU on 5 bags = 40 ppm NU. These bags are from ± 10 FT

1530 Complete EXCAVATION on west side of the PAD Bottom depth was only 12½ FT, but the 100 ppm Limit requires that we move to the north side now. DAN said he would prefer to dig both bottoms rather than to dig this one to design.

25 Sep 88 CONT'D



25 Sep 88 CONT'D

1630 - BEGIN EXCAVATION ON North END ON NORTHEAST CORNER 105 west 120 bags to this point 15 and BAGS EXCAVATED FROM North

1815 TOOK H-NU READING in trench 1-3 ppm once Low level was established I broke the Seal on my respirator. Very slight odor.

1900 Slight odor emmating from the ditch. H-NU - 10ppm in ditch 2 ppm in Breathing Zone

26 SEP 88

0800 PAUL SIVEKE of USA DEH was on site w/ somebody from DEMO They said the bags are all right as is. No Bobs are needed.

PAUL provided us w/ a scale w/ a max capacity of 2000 lbs. he said if we exceed the capacity of the scale use 2200 # since this is the bag capacity

We are trying for 300000 lbs = 150 TONS ± 1875 #/bag with 160 bags

Slight odor @ EXCAVATIONS

The HNU is missing the collar @ the probe connection and is in operation. I will fix this when there is a stop or slowdown of operations

26 SEP 88 cont'd

BAGS Removed from North Facility ~~XII IIIX~~ = 37 TONS TODAY 27 yesterday FOR 147 TOTAL We plan to stop @ 160 BAGS So I've told MARETECH To excavate 10 additional BAGS from the North end this will leave 3 bags for clean up.

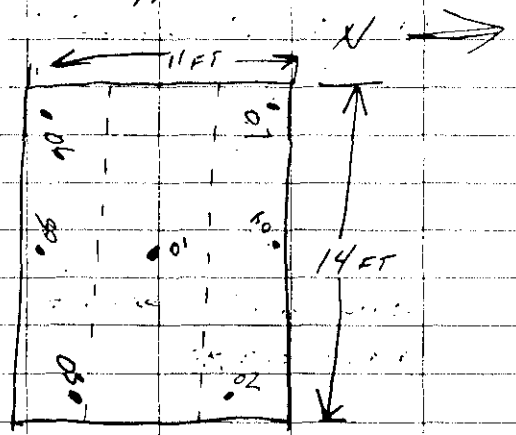
TRIM Weighing of a few misc bags to get an idea of avg wt 2200 1790 1600

1345 - SPOKE w/ John Wilson of DEH He ASKED THAT if we have any SPARE Tonnage we remove Some Surface Contamination from the north end. I Said this would not be a problem. He ALSO SAID there would

26 SEP 88 cont'd

There was no problem w/ sealing the concrete trenches and placing the gravel fill back over the seal and.

1430 TOOK Sample R-RR-0101 from bottom center of west EXCAVATION. DEPTH = 12.5 FT H·Nu = 24 ppm



Plan of west excavation

1448 TOOK Sample R-RR-0102 3.2 FT South of North wall 1.8 FT West of EAST wall DEPTH = 11 FT H Nu = 4 PPM

26 SEP 88 CONT'D

1500 TOOK Sample R-RR-0103 3.2 FT NORTH of South wall 1.8 FT West of east wall Depth = 11 FT H·Nu = 2 ppm

all material is a Brown, GRAVELLY SAND to Sandy gravel

1505 TOOK Sample R-RR-0104 CENTER E-W, 1/2 FT South of NORTH wall Depth = 10 FT H-Nu = 9 ppm

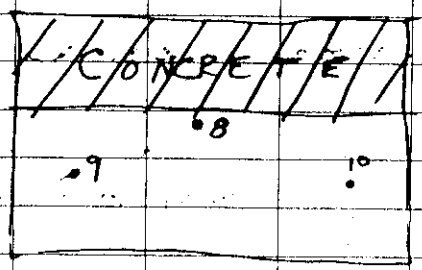
1515 TOOK Sample R-RR-0105 Center E-W 1/2 FT North of South wall depth = 10 FT H-Nu = 2 ppm

1525 TOOK Sample R-RR-0106 1.8 FT EAST of west wall 3.6 FT NORTH of South wall Depth = 10 1/2 FT H·Nu = < 1 ppm

26 Sep 88 Cont'd

1535 TOOK Sample R-RR-0107
1.8 FT EAST of west wall
3:6 FT South of North wall
DEPTH 11 FT H-NU = 19 ppm

ELEVATION of North wall



1535 TOOK Sample R-RR-0108
Center of NORTH WALL
4.2 FT below surface.
H-NU = 6 ppm

1610 TOOK Sample R-RR-0109
ON NORTH WALL 1.8 FT EAST
OF west wall 8 FT Below Surface
H-NU = 2 ppm.

26 Sep 88 Cont'd

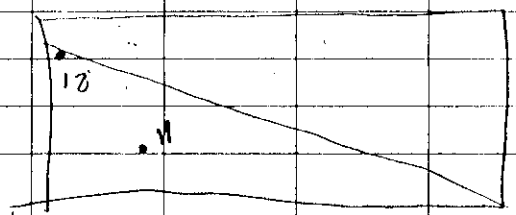
1625 TOOK Sample R-RR-0110
ON North wall 1.8 FT west
of east wall. Depth = 7.5 FT
H-NU = 75 ppm.

1641 TOOK Sample R-RR-0111
ON South wall 1.8 FT WEST
of east wall 7.2 FT below
surface. H-NU = 3 ppm

1645 TOOK SAMPLE R-RR-0112
ON South wall 1/2 FT west of
east wall, 2.2 FT Below Grade
H-NU not taken.

1655 TOOK Sample R-RR-0113
from EAST WALL composited
@ 4.5 FT deep. H-NU = 5 ppm

ELEVATION of South WALL



26 Sep 88 CONT'D

1705 TOOK Sample R-RR-014
Composite from EAST WALL
AT 19½ FT Depth
H NU = ? (Failed to record)

1715 TOOK Sample R-RR-015
from West wall Composite
@ 10½ FT H-NU = 4 ppm

1725 TOOK Sample R-RR-016
from west WALL composite
@ 4.5 FT.
H NU = 140 ppm

1900 - Spoke w/ DAN GRAHAM he
would like 4 wipe samples
AND 1 sample from the small
bunker entrance.
16 + 5 = 21 = 16 Samples of
Soil on the north side.

27 SEP 88

0800 - ARRIVE ON SITE NO MARTECH personnel on site

We have been avg 0.56 - 0.59 yd^3 per bag

100 ÷ 0.56 = 178 bags

We have currently filled 160 bags

Volumetrically we CAN Justify up to 20 more bags

With 3×10^5 lb max

$3 \times 10^5 \div 180 = 1667$ lb Avg for bags.

When John Simpson ARRIVES I will calculate an avg weight of bags taken out thus far (± 44)

I will advise on further excavation @ that time

1) IF Avg weight < 1700 lb

then excavate 20 additional bags

(using 1700 lb because we have 14 bags from the slab which will be light)

27 SEP 88

2) if avg weight > 1700 lb

then excavate

$(3 \times 10^5 \div$ Avg Weight$) - 160$ additional bags

0830 - John Simpson arrived on site they are having forklift problems @ the off loading site.

~~Avg of 41~~ (45)

Avg of 43 bags = 1595 = 1600 lbs

I TOLD John to excavate 20 additional bags

my est of total weight

165 (1600) + 15 (800) = 277,500 lb

LOCATED Surface Sample #4 will ASK if USA would like us to clean it up

Avg AFTER 72 bags = 1650 lbs

27 SEP 88 CONT'D

CONTACTED PAUL STUEKE W/ DEH. he SAID WE NEED TO CHANGE THE LAST number on the Document & we place on the bags. -0003 should be 0009 for any FUERTHER EXCAVATION. I TOLD him We would probably EXCAVATE AN Additional 20 bags

- CALLED STEVE Ede of Chemical AND GEOLOGICAL LAB. He SAID to WIPE a KNOWN area with GAUZE OR FILTER PAPER after SATURATING it with SOLVENT He SUGGESTED I ET SAMPLES the last AREA and SAID that HEXANE WAS the SOLVENT OF CHOICE

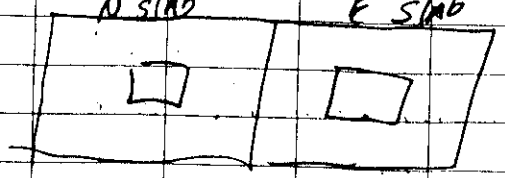
28 Sep 88

0800 - ARRIVE ON SITE. BAGging operation & Loading on trailers in process.

0900 - leave site to get wipe sampling gear

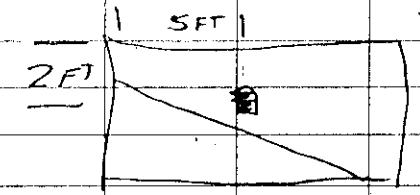
1000 - Return to Site. Excavation on the north side has begun

1045 TOOK Sample R-RR-0117 A composite wipe sample from the west excavation using a 1FT x 1FT template and hexane as a solvent I did a wipe on the centers of each concrete slab face i.e. North & EAST slabs.

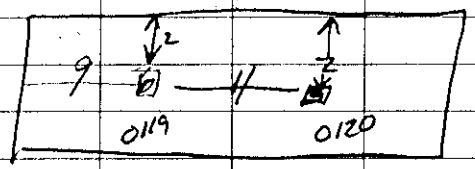


28 Sep 88 cont'd

1100 TOOK SAMPLE R-RR-0118 A Wipe SAMPLE FROM the South wall of the west EXCAVATION



1130 TOOK SAMPLE R-RR-0119 from NORTH EXCAVATION. A Wipe sample centered ± 2FT below top of PAD 9 FT west of EAST END



North end of concrete slab

1145 TOOK sample R-RR-0120 from North end of SAB A Wipe Sample 2FT below Surface 28 FT from end of PAD

28 Sep 88 : CONT'D

1443 - TOOK SAMPLE R-RR-0124 9" North of pad 19 FT West of EAST END. Depth = 6 FT H-Nu = 26 ppm

1449 TOOK R-RR-0125 bottom of exc. 9" North of pad 3½ FT EAST of west end of exc. Depth = 6 FT H-Nu = 9 ppm

1453 TOOK SAMPLE R-RR-0126 under North edge of Concrete pad 7½ FT West of EAST END Depth = 4.5 FT H-Nu = 2 ppm

1500 TOOK R-RR-0127 under North edge of pad 15 FT West of EAST end Depth = 4.5 H-Nu = 130 ppm

1505 R-RR-0128 from under North edge of pad 7.5 FT EAST of west end of excn - from Depth = 4.5 FT H-Nu = 100 ppm

28 Sep 88 CONT'D

1510 - R-RR-0129 from under North end of pad West end of exc. Depth = 4.5 H-Nu = 2 ppm

1516 R-RR-0130 9" NORTH of PAD ON EAST END of EXC. Depth = 1.3 FT H-Nu = BG

1521 R-RR-0131 3 FT North of pad ON west end of exc. Depth = 2 FT H-Nu = 0.1 ppm

1526 R-RR-0132 on west end of exc. 1.7 FT DOWN CUT SLOPE Depth ≈ 1.5 FT. H-Nu = BG

1533 R-RR-0133 FROM North s-de of North exc. 7.4 FT EAST of west end 1.7 FT down cut slope Depth ≈ 1.5 FT H-Nu = BG

1538 R-RR-0134 North side of exc. 13 FT west of east end of pad 1.7 FT down cut slope Depth ≈ 1.5 FT H-Nu = BG.

28 Sep 88 CONT'D

1542 R-RR-0135 FROM North wall of EXC. 9½ FT West of EAST end of PAD. Depth = 1 FT H-Wy - BG

1546 R-RR-0136 FROM North wall of EXC. 2 FT West of EAST end of PAD Depth = 1 FT H-Wy = BG

EPOXY COATING USED FOR SLAB
SCOTCHKOTE BY 3M
LIQUID EPOXY COATING
TWO PART COATING

181 BAGS 283,983 # TOTAL
1569 # / BAG (1.8% over my est)

2 OCT 88

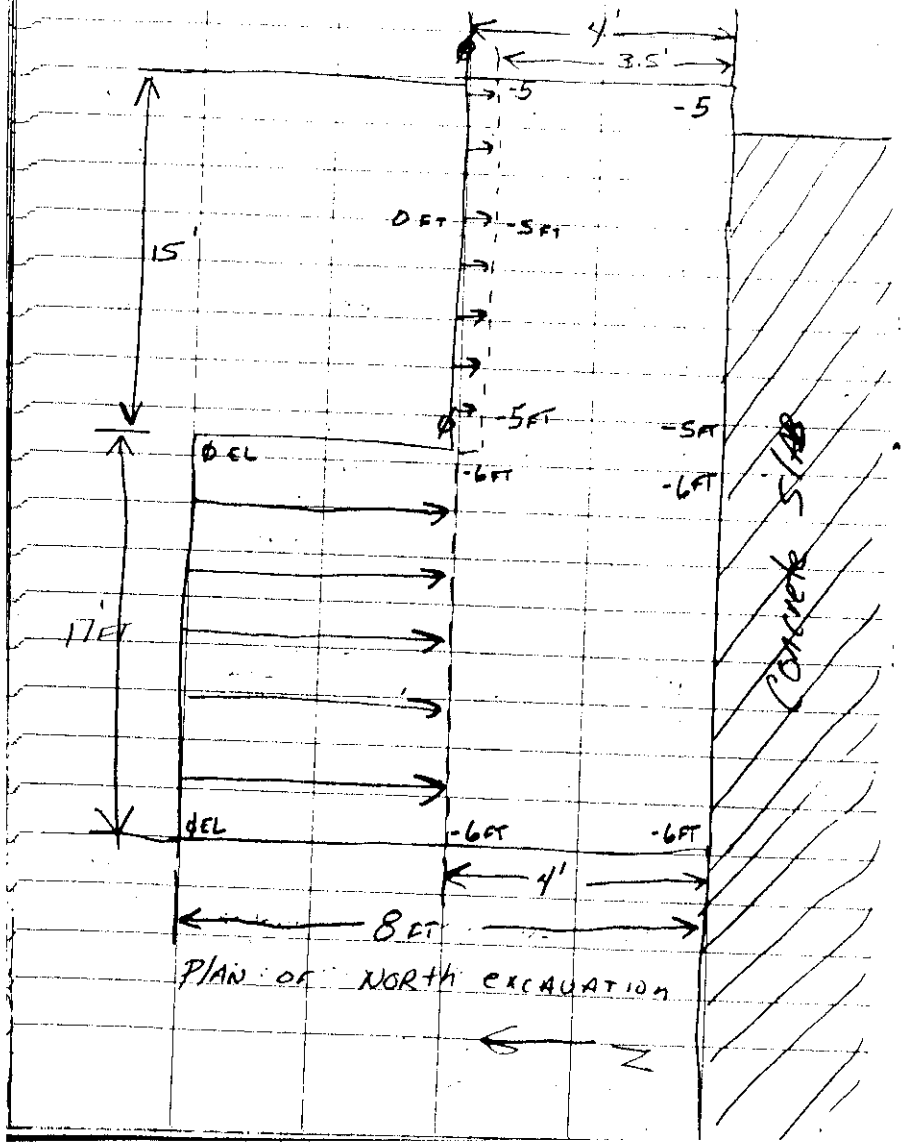
- Received Logs for EXCAVATED SOIL, Debris and Liquids from MARTECH.
I found Some Addition errors
My TOTALS
SOIL 283,743 lbs
Debris 1257 lbs
Liquid 3291 lbs
TOTA 288,291 lbs
this falls within the 150 ton MAX the AIR FORCE had requested (144.1 TONS).

105 YD³ for 144.1 TONS

I HAVE ASSUMED short TONS

28 Sep 88 Cont'd.

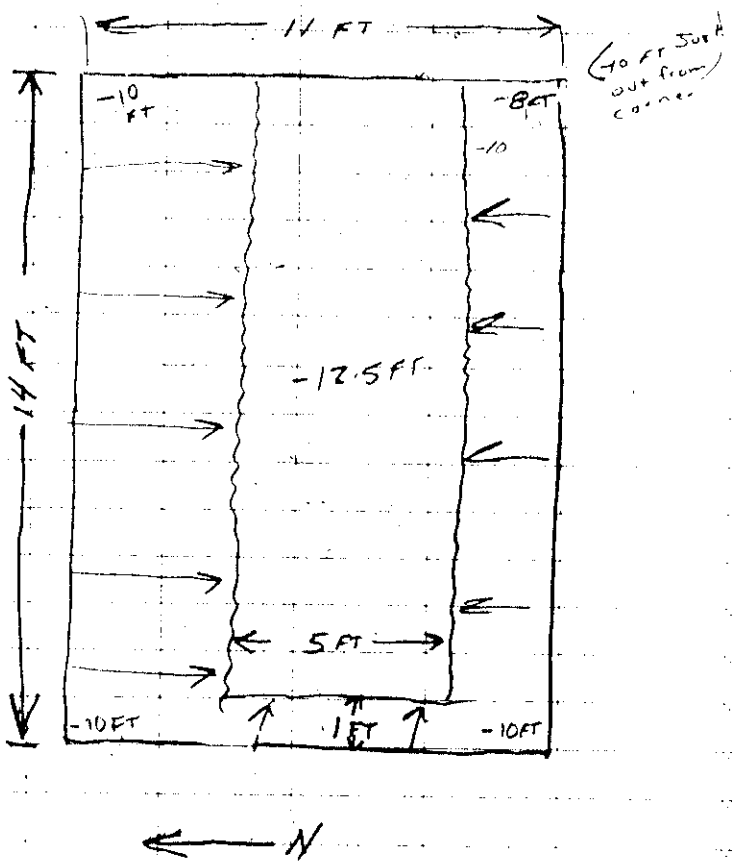
1200 hrs Complete excavation on North end



PLAN OF NORTH EXCAVATION

28 Sep 88 CONT'D

PLAN of West EXCAVATION



FINAL # of BAGS excavated = 163, 181 TOTAL BAGS

105 from west
58 from North
18 slab + clean up (1/4 slab)

28 SEP 88 cont'd

Volume calcs

1) NORTH END

$V = 15(5)(3.5) + 17(6)(4) + \frac{1}{2}(4)(6)(17) = 874\ FT^3$

this neglects small volume on EAST END of shape $\frac{1}{2}(\frac{1}{2})(5)(5)$

2) West Side

$14(11)(10) + 5(25)(13)$

$= 1702\ FT^3$

this neglects stuff undermining the pad and the small corner of material in the Southwest corner of the pit.

TOTAL EXCAVATED = 1702 + 874 = 2576

$2578\ FT^3 \cdot \frac{1\ YD^3}{27\ FT^3} = 95.4\ YD^3$

$95.4\ YD^3 \div 163 = 0.58\ YD^3/BAG$

18 bags of cleanup of slab

$18(0.58) = 10.4\ YD^3$

TOTAL Removal

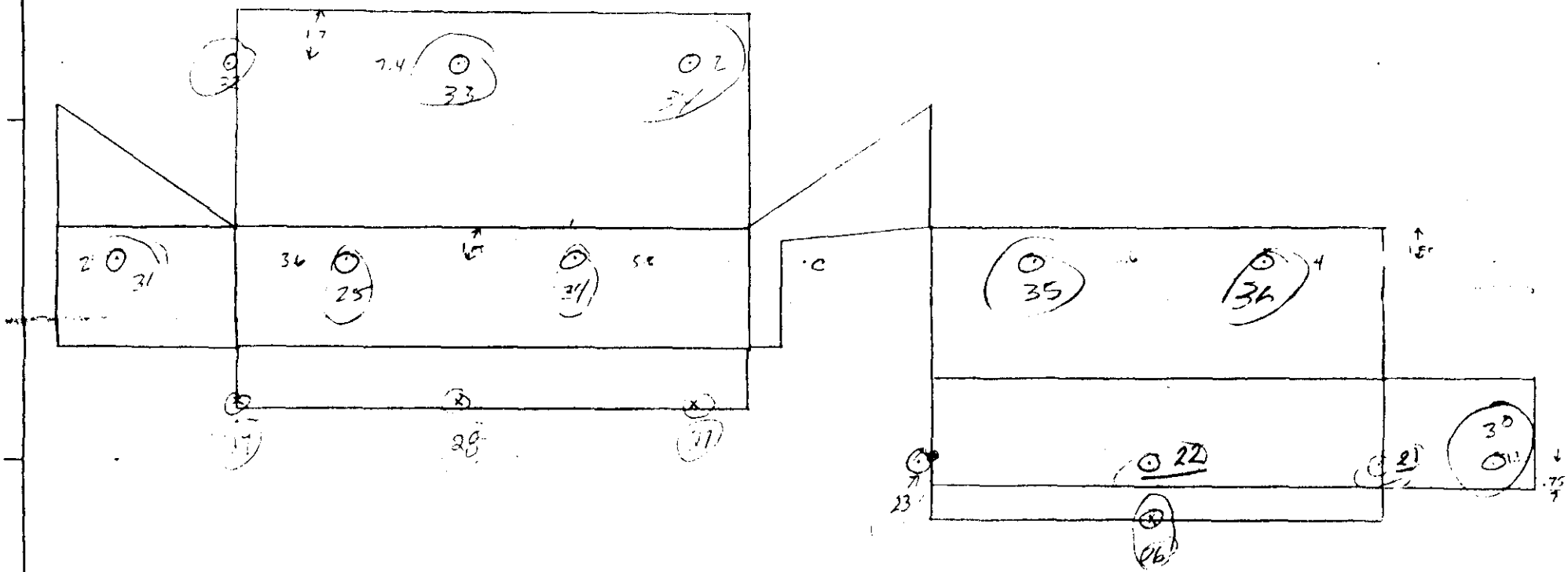
$95.4 + 10.4 = 105.8 \approx \boxed{105\ YD^3}$

28 SEP 88 cont'd

1420 – TOOK SAMPLE R-RR-0121 Soil from northern excavation taken @ East end of excavation 9" North of PAD @ 5 FT depth H-NU = 5ppm

1430 TOOK SAMPLE R-RR-0122 ALL Remaining samples from North excavation. Sample 122 from bottom of exc 9" north of pad 5½ FT west of EAST END of PAD. DEPTH = 5 FT H-NU = 5 ppm

1435 TOOK SAMPLE R-RR-0123 from bottom of exc. 9" North of pad 13½ FT WEST of EAST END. Depth = 5½ FT (taken in transition area between 5 and 6 FT depths) H-NU = 150 ppm



$L_D = 50.6$

$R = 25.3$

$S = .03(25.3) = 7.6$

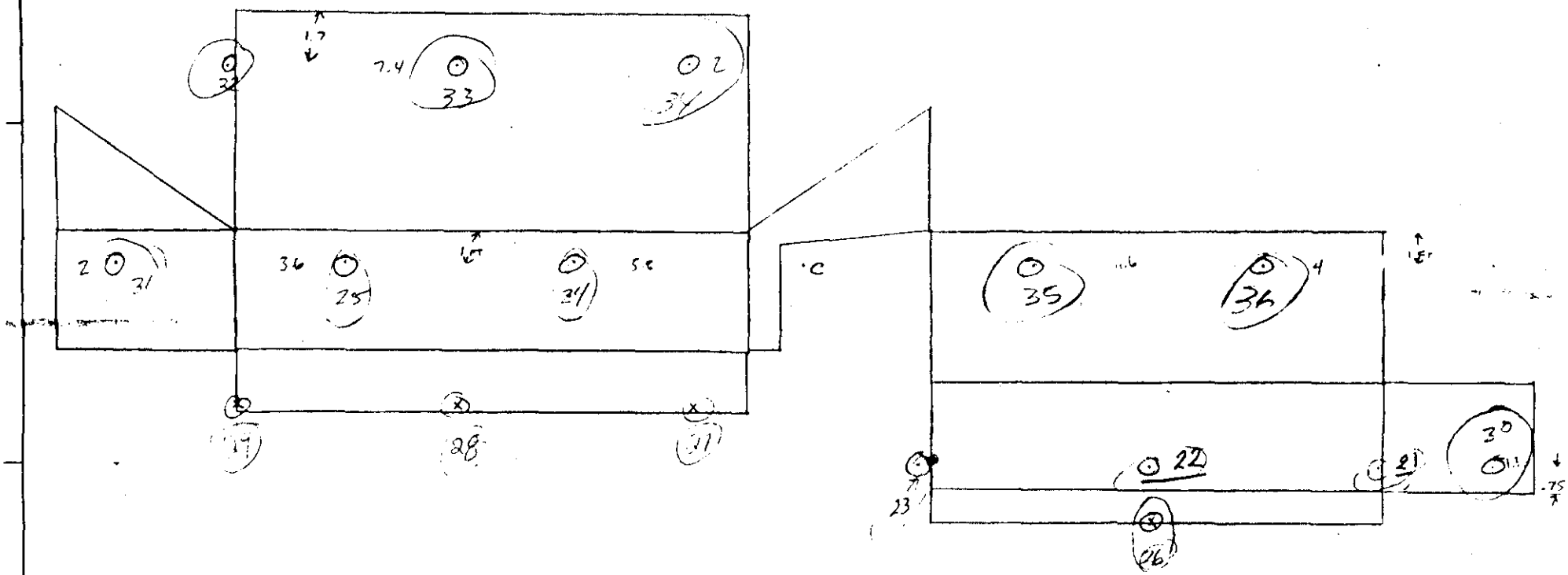
$U = .26(25.3) = 6.6$

12 POINTS ON SURFACE

+ 4 OPTIONAL = 16 POINTS

+ 2 WIPE SAMPLES

AMPAD
22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS



$L_D = 50.6$

$R = 25.3$

$S = 0.3(25.3) = 7.6$

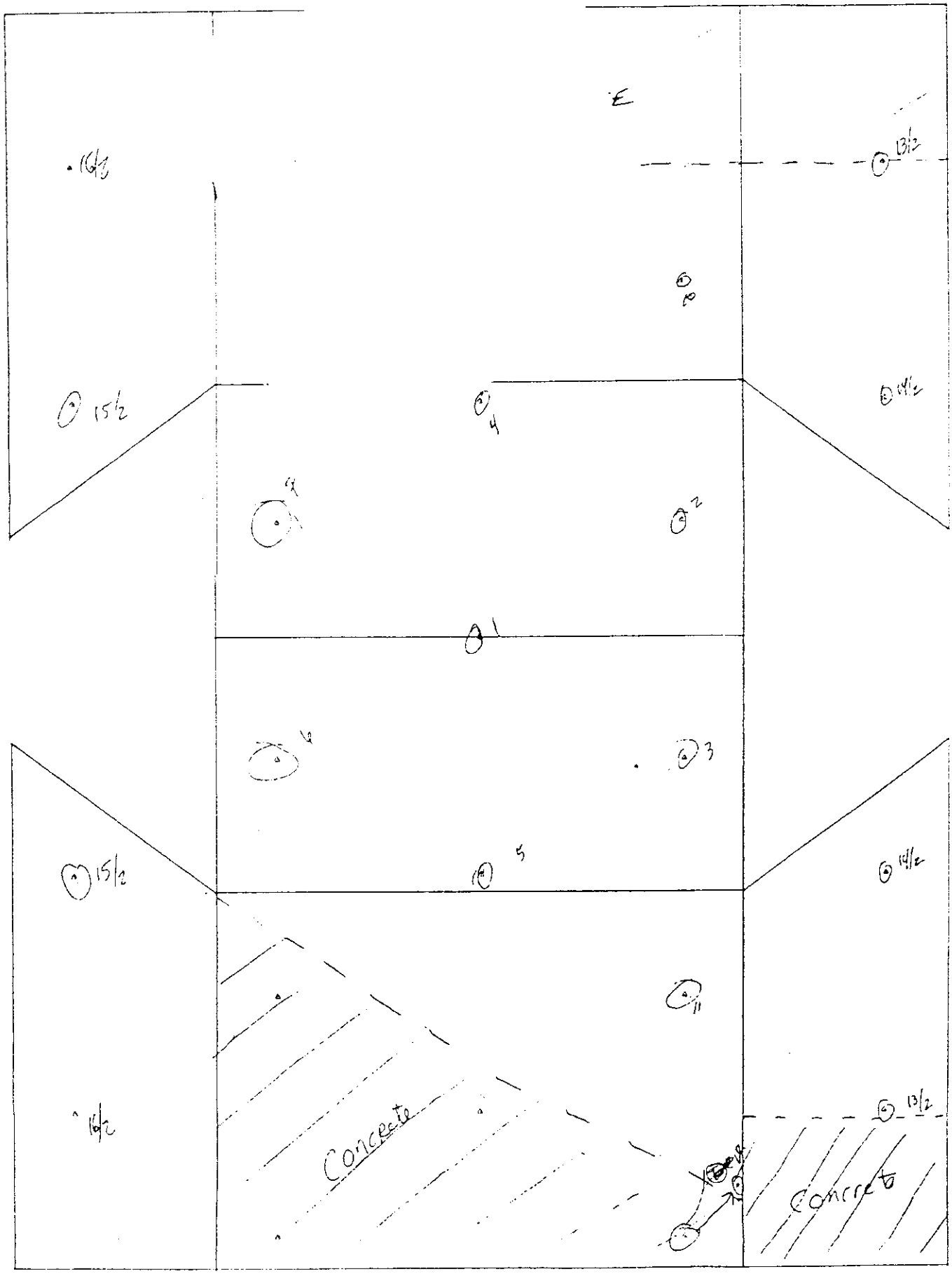
$u = .26(25.3) = 6.6$

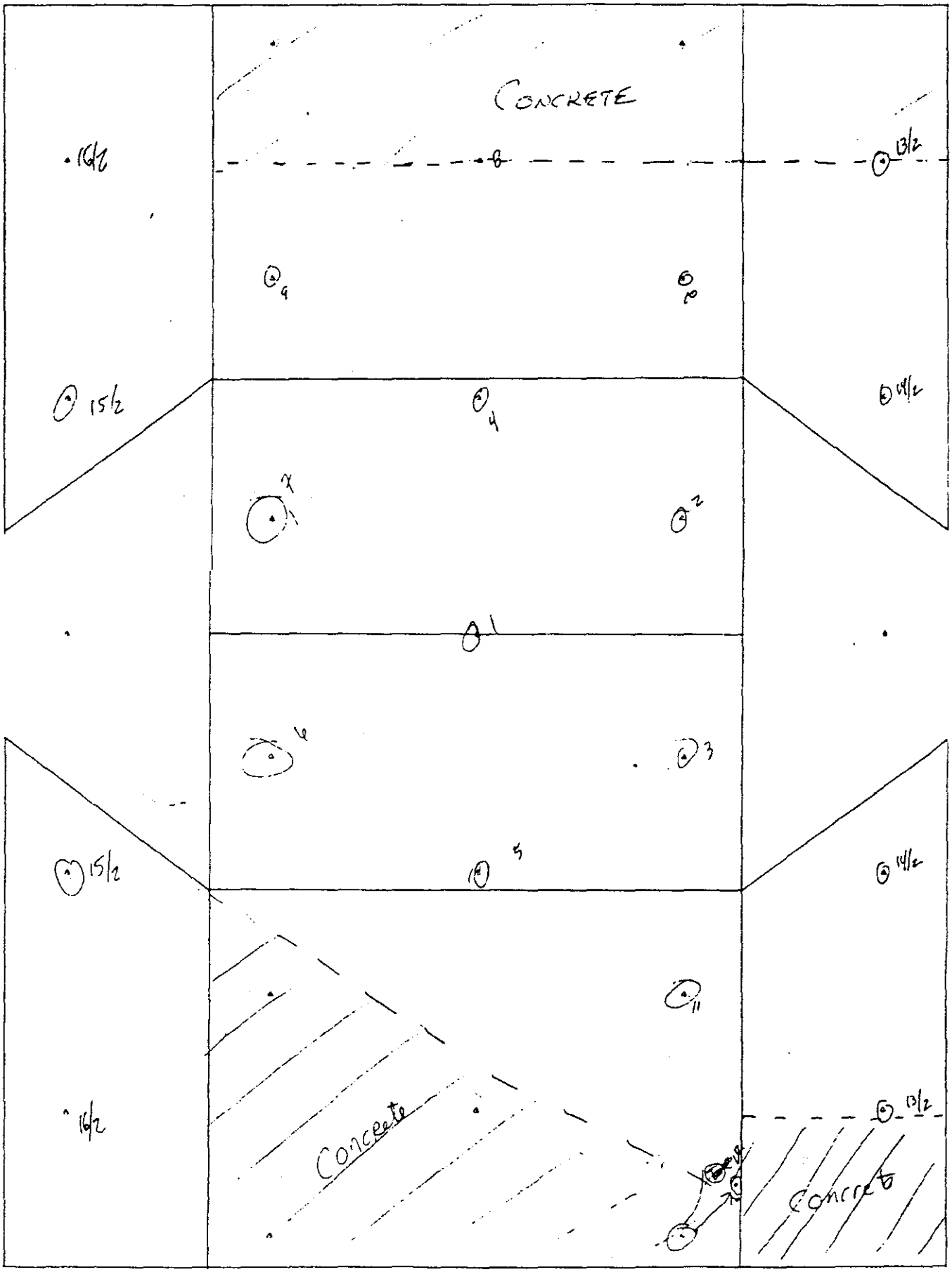
12 POINTS ON SURFACE

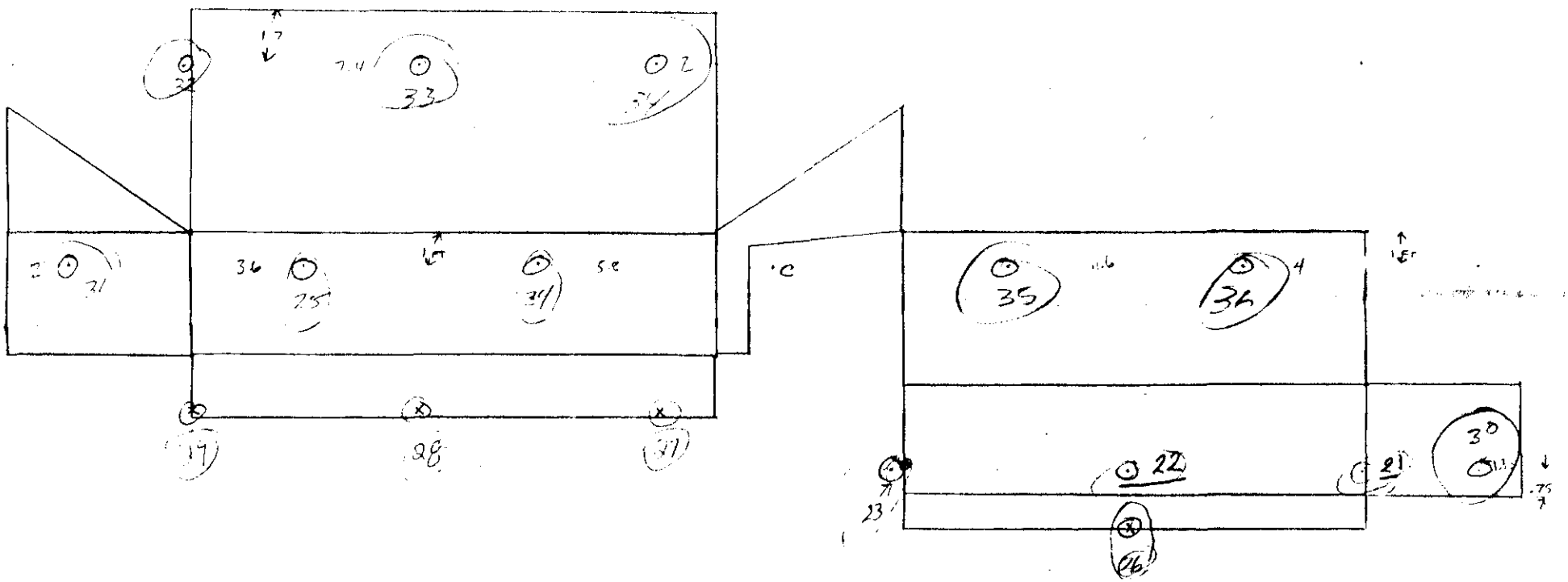
+ 4 OPTIONAL = 16 POINTS

+ 2 WIPE SAMPLES

AMPAD
22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS


E
13½
15½
14½
15½
14½
16½
13½
Concrete
Concrete


CONCRETE
16½
13½
15½
14½
15½
14½
16½
13½
Concrete
Concrete



$L_D = 50.6$

$R = 25.3$

$S = 0.3(25.3) = 7.6$

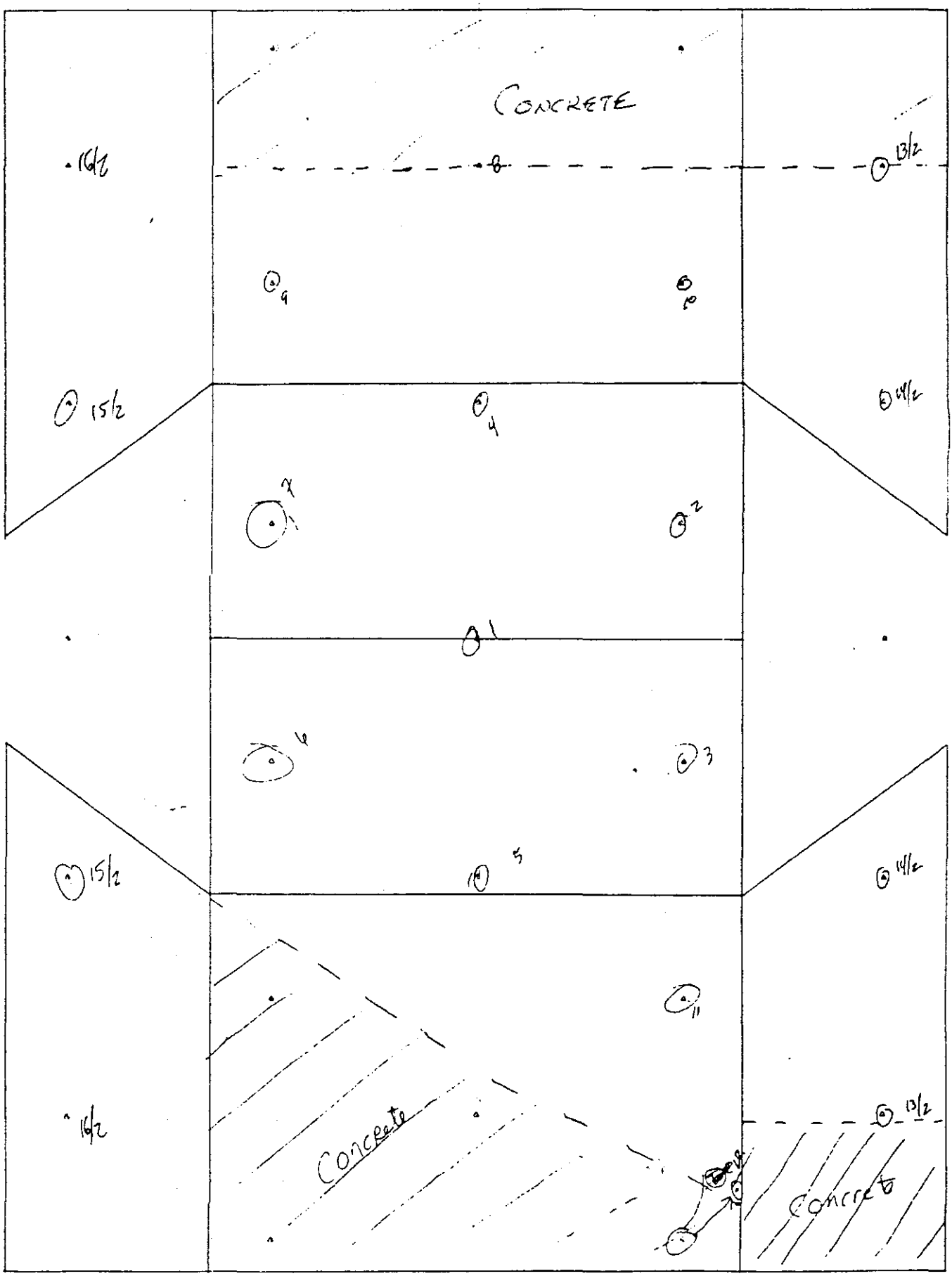
$U = .26(25.3) = 6.6$

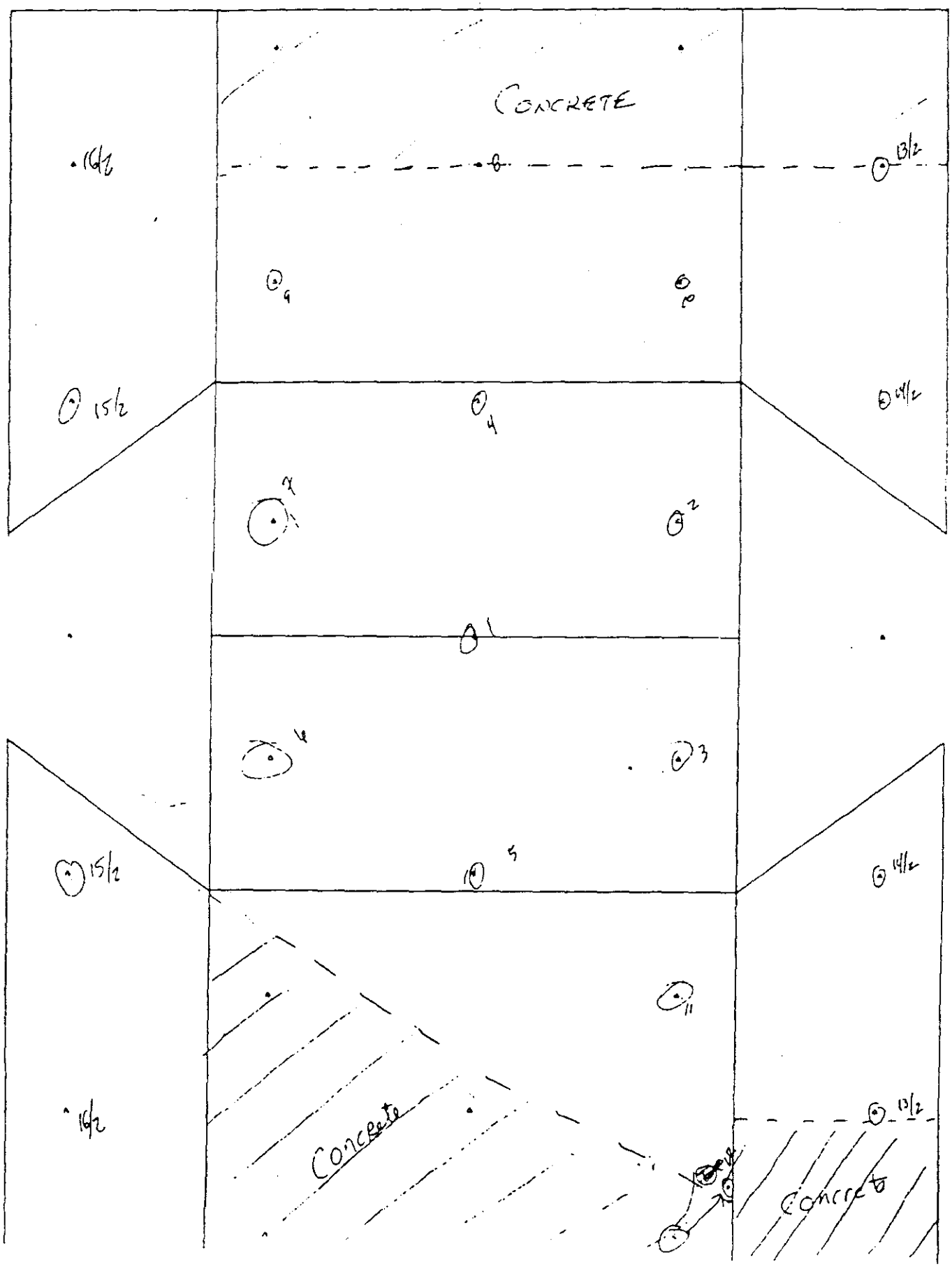
12 POINTS ON SURFACE

+4 OPTIONAL = 16 POINTS

+ 2 WIPE SAMPLES

AMPAD
22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS


CONCRETE
16 1/2
13 1/2
15 1/2
14 1/2
9
10
4
7
2
1
6
3
5
15 1/2
14 1/2
11
16 1/2
Concrete
13 1/2
Concrete


CONCRETE
16 1/2
13 1/2
9
10
15 1/2
4
14 1/2
7
8
1
6
3
15 1/2
5
14 1/2
11
16 1/2
Concrete
13 1/2
Concrete

Raw Field Data for Fort Wainwright Landfill

Subject Fort Wainwright Landfill

Project No. 90275K

By Jane Showalter Checked By

Task No. 3071

File No.

Date 9/20/88 Date

Sheet of

General Information

Well Numbers: W-LF-01, W-LF-02, W-LF-03
WWC personnel on-site: Jane Showalter + Holly Graham
Dates of field work: 9/7/88 through 9/13/88

Drilling contractors: Discovery Drilling, Anchorage
driller - Gary Wilson
rig - CME Model 75
onsite for aquifer test - Kyle Brown

Aurora Drilling, Fairbanks
driller - Edward Paddy
rig - Cyclone 1000

Well locations: In a small clearing in the forest, just off of an unmaintained road, about 800 ft east of the sanitary landfill on Ft. Wainwright, Fairbanks, AK. (See attached maps).

General Schedule:
9/7/88 Drill 8" well, W-LF-01.
9/8/88 Install and develop W-LF-01.
Drill + install 2" well, W-LF-02.
9/9/88 Drill + install 2" well, W-LF-03.
9/12-13/88 Perform aquifer test, take water sample.
(see drilling summary, well completion schematics, and well logs for each well.)

Well site condition: Each well has a steel casing protective sleeve with about 2' stick-up, a locked steel lid (with well number stamped on lid), and 2'x2' cement pad. Drill cuttings were spread over the ground at the site. The same key opens all three well locks. A copy of this key was left with Cristal Fosbrook, Dept. of Engineering and Housing, Ft. Wainwright. A key is being sent with this report to Dennis McCrumb, Woodward-Clyde, Oakland. A key is in the project file at the Woodward Clyde Anchorage office.

Subject Ft. Wainwright Landfill

Project No. 90275K

By Jane Showalter Checked By JMS

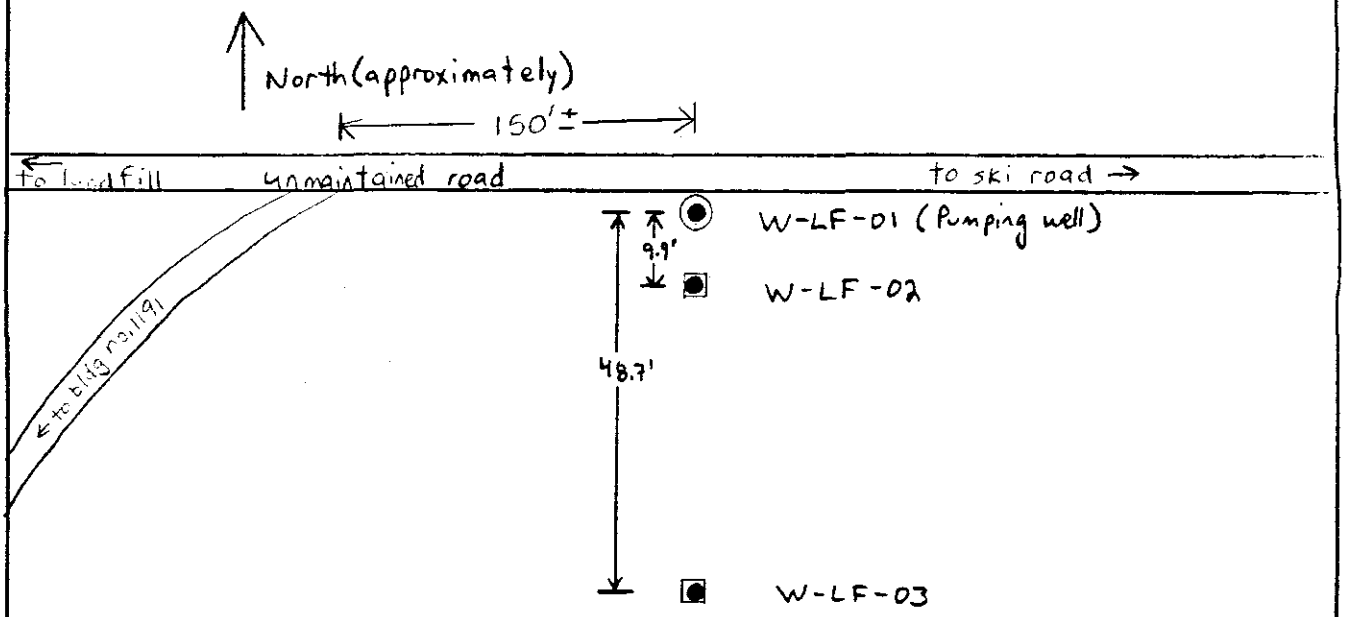
Task No. 3071

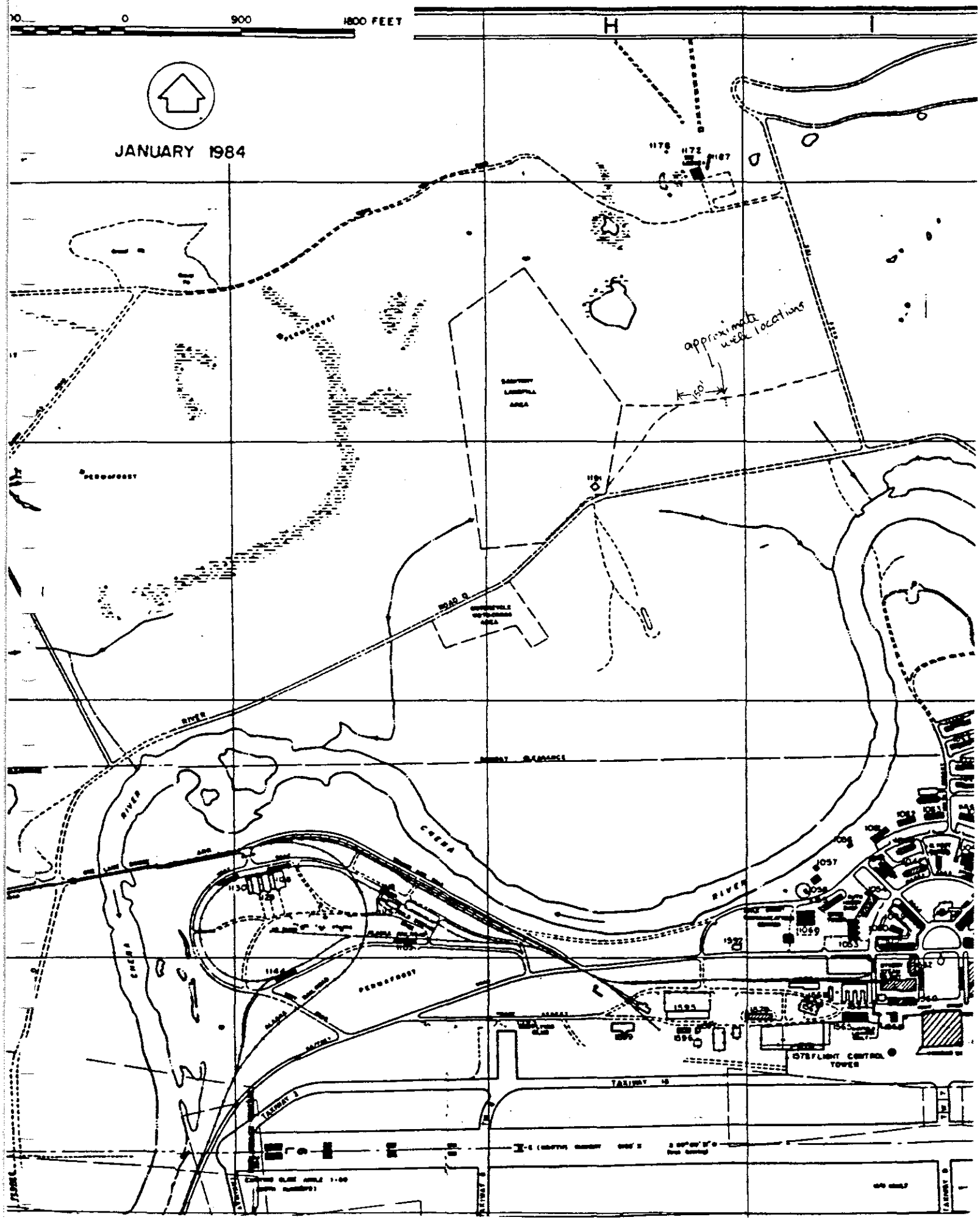
Date 9/15/88 Date

File No. _____

Sheet _____ of _____

Well locations relative to an approximately east/west road between the landfill area and Ski Road. This unmaintained road runs roughly parallel to River Road. See attached map of general area.




0
900
1800 FEET
JANUARY 1984
H
I
approximate well locations
150'
RIVER
CREEK
FLIGHT CONTROL TOWER

Subject Fort Wainwright Landfill

By Jane Showalter Checked By

Date 9/16/88 Date

Project No.

Task No. 902751K/3071

File No.

Sheet ____ of ____

Drilling Summary

Well W-LF-01

9/7/88

10:00 Rig up Aurora Drilling Unload 8" casing and equipment.

12:30 Spud well. Drill with 8" bit and air to 40'. (This step was done to be sure we hit water and no permafrost or other drilling hazards before driving casing.) Pull out of hole w/bit.

13:15 Rig up to drive casing.

14:00 Drive 12" steel casing to 37', periodically assuring that it is straight.

15:35 Go in hole with 10" bit, blowing air and drilling to 37'. With air, clean out gravel and sand from inside casing. Pull out of hole with bit.

16:45 Bail well to clear out additional sand and gravel.

17:30 Water level at about 16' from ground level.

9/8/88

08:40 Make up casing and screen, 8" PVC Schedule 40 with 0.010" slot size. Lower casing and screen in hole. Place cap on casing. Fill area below casing with sand.

09:30 Pull 12" steel casing from hole, adding sand every few feet (keeping about 1' sand in 8" x 12" annulus). Cut off top joint of 12" casing.

10:00 Top of sand at about 16' from top of 8" casing. Pour bentonite pellets into 8" x 12" annulus as 12" steel casing is pulled from hole. Lay down 12" casing. Top of bentonite plug at 13' from top of 8" casing (⇒ 3' of bentonite plug).

10:15 Mix grout. Pour into 8" x hole annulus to 2' below ground level.

11:00 Run in hole with 10" bit. Develop well by reciprocating bit while blowing air through bit, forcing sand and formation water up annulus.

12:10 Pick up 5' length of 12" steel casing with hinged lid welded on it. Set protective casing in hole with about 3' stick-up.

12:20 Rig down Aurora Drilling rig.

16:00 Continue developing well at 160 gpm with surface
16:30 pump. Observed 7½' drawdown in 30 minutes. Water level recovered in about 5 minutes.

Subject Fort Wainwright Landfill

By Jane Showalter Checked By

Date 9/16/88 Date

Project No. 90275K

Task No. 3071

File No.

Sheet ____ of ____

Drilling Summary

Well ..W-LF-02

9/8/88

16:40 Rig up Discovery Drilling rig. 4½" ID

17:00 Spud well. Drill with hollow stem auger to 30', performing standard penetration tests and split spoon sampling (for lithologic descriptions) at 5' intervals. Hit water at about 16'.

time	sample depth	hammer blows required to advance each 6" interval	
		seating drive	standard pen. resistance
	5'-6.5'	3	6, 13
	10-11.5'	10	13, 16
17:30	15-16.5'	8	8, 6
17:44	20-21.5'	7	7, 5
17:55	25-26.5'	6	12, 13
18:16	30-31.5'	17	10, 15

18:20 Make up 2" PVC schedule 40 casing and screen with 0.010" slot size. Lower casing and screen into hole. Cap casing.

18:30 Rig up to pull auger out. Pull auger while periodically adding sand to auger x 2" annulus. Top of sand is 15' from ground level. Add bentonite to 12½' from ground level (⇒ 2.5' bentonite plug). Continue to pull auger from hole. Casing began coming out of hole with auger. Push casing back in place. Continue out of hole with auger, casing stayed in place. Tagged bentonite plug at 12.5' from ground level.

19:20 Pour 5 gallon water in hole to hydrolyze bentonite. Mix grout. Pour grout in hole x 2" annulus to 2' from ground level.

9/9/88

09:10 Put steel protective casing with lid on well. Cement in place. Make cement pad.

Joint Resource Project

Subject Fort Wainwright Landfill

By Jane Showalter Checked By

Date 9/16/88 Date

Project No. 90275K

Task No. 3071

File No.

Sheet ____ of ____

Drilling Summary

Well W-LF-03

9/9/88

09:30 Rig up Discovery Drilling rig.

10:00 Spud well. Drill with 4¼" ID hollow stem auger to 30', performing standard penetration tests and split spoon sampling (for lithologic descriptions) at 5' intervals. Hit water at about 15'.

time	sample depth (ft)	hammer blows required to advance each 6" interval: seating drive	standard penetration resistance
10:15	5'-6.5'	10	12, 17
10:25	10-11.5'	11	15, 19
10:37	15-16.5'	6	7, 11
	20-21.5'	13	11, 15
11:04	25-26.5'	4	3, 7
11:20	30-31.5'	9	10, 10

11:25 Make up 2" PVC schedule 40 casing and screen with 0.010" slot size. Lower into hole. Tag bottom at 28'.

11:35 Pull auger out of hole while periodically adding sand to auger x 2" annulus. Top of sand is at 12' below ground level. Finish pulling auger.

12:15 Add bentonite to fill annulus to 9.5' from ground level (⇒ 2.5' of bentonite plug). Pour in 5 gallons water to hydrolyze bentonite.

12:20 Pour grout in hole x 2" annulus to 1' below ground level.

Rig down Discovery rig.

Put steel protective casing with lid on well. Cement in place. Make cement pad.

Subject Ft. Wainwright Landfill

By Jane M. Showalter Checked By

Date Oct. 3, 1988 Date

Project No. 90275K

Task No. 3071

File No.

Sheet of

Aquifer Test Summary

9/7/88

15:30 Rig up surface pump on well W-LF-01.

16:00 Pump at 160 gpm for 30 minutes. Observed 7 ft drawdown in 30 minutes. Water level recovered in approximately 5 min. This pre-test was performed to determine distance from the pumping well to drill the observation well. Discussion with Jim Munter led to the decision to drill one 10' and one 50' from the pumping well, and to pump at a rate of 100 - 120 gpm during the aquifer test.

9/10/88

16:00 Gather equipment and personnel to perform aquifer test.

19:30 Rig up to run down hole pump in hole. Run pump in on 3" PVC pipe. Tag bottom, pull up 2'. Rig up flow meter, discharge line, gate valve, and generator.

20:10 start down hole pump. Run with gate valve fully open. Meter indicates 160 gpm. Flow remained constant for 20 minutes.

20:30 Shut off pump. Secure wells.

9/11/88

07:30 Start pump test with meter indicating 120 gpm. Flow did not appear stable. Shut pump down & aborted test after pumping 10 minutes. Wait for recharge.
Attempted to restart test, but pump would not start any of 5 subsequent times.

10:00 Disconnect surface equipment. Pipe (3") full of water. Attempted to start pump. Water did not move. Pull pump.
With pump on surface and no water above it, pump would not start. Each time, the generator put out 60 amps for ~10 seconds before kicking a breaker.

Test pump at shop of Aurora Drlg. Got it going. It had sieged up.

Subject Ft. Wainwright Landfill

Project No. 90275K

By Jane M. Showalter Checked By

Task No. 3071

File No.

Date Oct 3, 1988 Date

Sheet ____ of ____

three times in shop, each time on an instantaneous peak of 60 amps.

9/12/88
09:20 Attempt to start test again. Pump would not start.
09:30 Control box taken to town to test capacitors and have it generally checked out.
12:30 Control panel had been incorrectly wired. Once rewired, test was ready to start.
13:00 Start pump. Run at metered flow of 120 gpm.
13:45 Abort test again. Flow meter reading is significantly low according to catchment method verification.
Wait for aquifer recharge. Water levels steady for 25 minutes.
15:00 Start aquifer test. Pump at 80 gpm (based on catchment method).
Flow appears constant (155 gpm meter reading).
19:05 Took water quality sample from produced water. Temperature = 1.5°C, specific conductance = 210 $\mu mhos_{water}$.

9/13/88
00:04 Shut pump off. Take recovery data. Pull pump. Rig down pump equip
02:30 Secure wells.
08:50 Take last water level measurement.
Secure wells. Deliver a key to well locks to Dept. of Engineering and Housing, Ft. Wainwright.

Subject Fort Wainwright Landfill

Project No. 90275K

Task No. 3071

By Jane Showalter Checked By

File No.

Date 9/16/88 Date

Sheet ____ of ____

Pre-Aquifer Test Water Level Trends

well no.	date	time	water level (ft. From T.O.C.)
W-LF-01	9/9/88	09:00	16.73'
	9/10/88	12:57	16.66
	9/10/88	19:56	16.65
	9/11/88	~~01:20~~ 07:00	16.69
	9/11/88	20:00	16.69
	9/12/88	08:55	16.72
	9/12/88	13:15	16.70
W-LF-02	9/9/88	09:05	16.60'
	9/9/88	15:20	16.70'
	9/10/88	13:00	16.53'
	9/10/88	20:08	16.52
	9/11/88	07:01	16.59
	9/11/88	20:01	16.53
	9/12/88	08:55	16.57
	9/12/88	13:15	16.60
W-LF-03	9/9/88	15:20	15.50'
	9/10/88	13:08	15.62'
	9/10/88	20:05	15.35
	9/11/88	07:02	15.40
	9/11/88	20:02	15.40
	9/12/88	08:55	15.40
	9/12/88	13:15	15.43

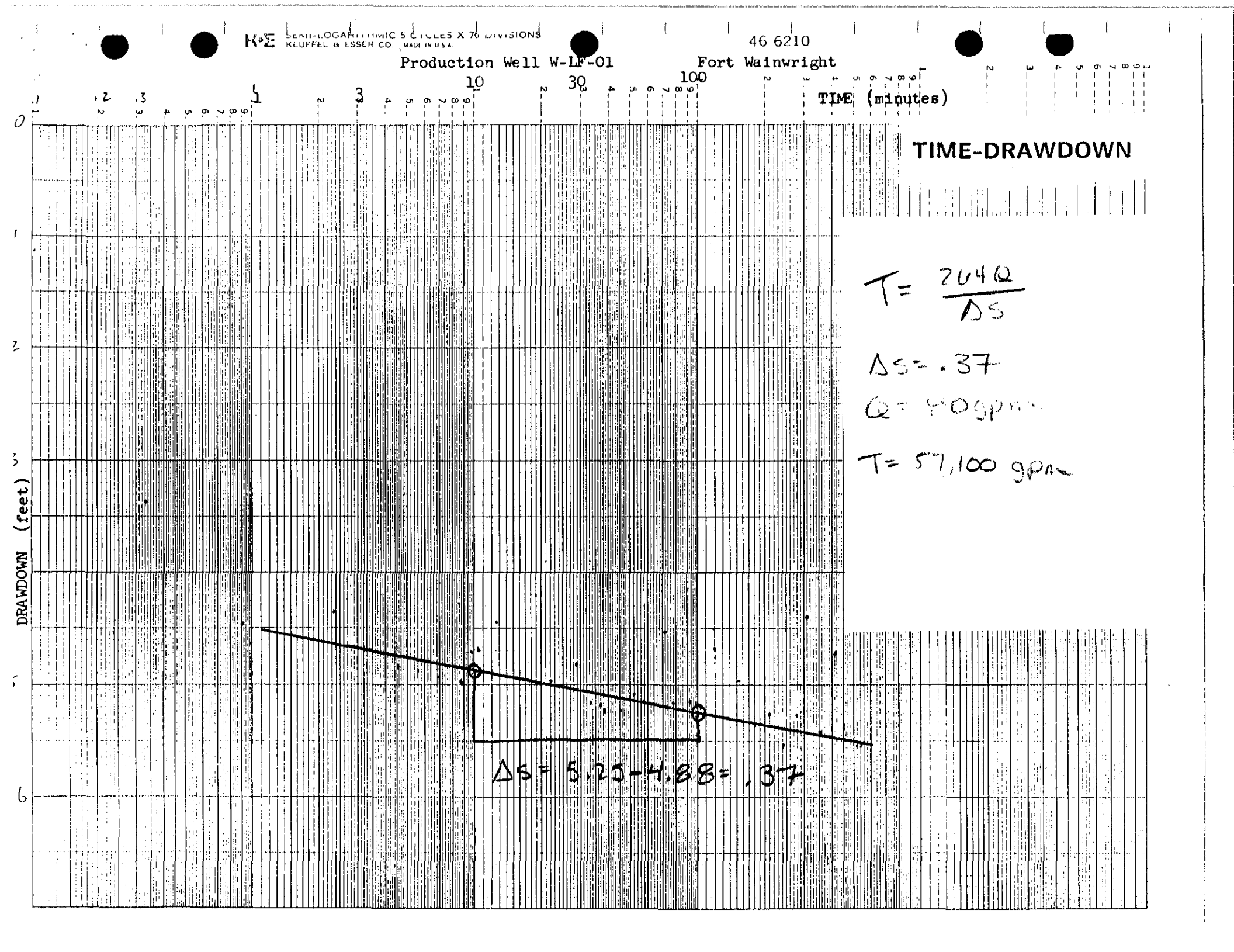
Joint Resources
Fort Wainwright LF

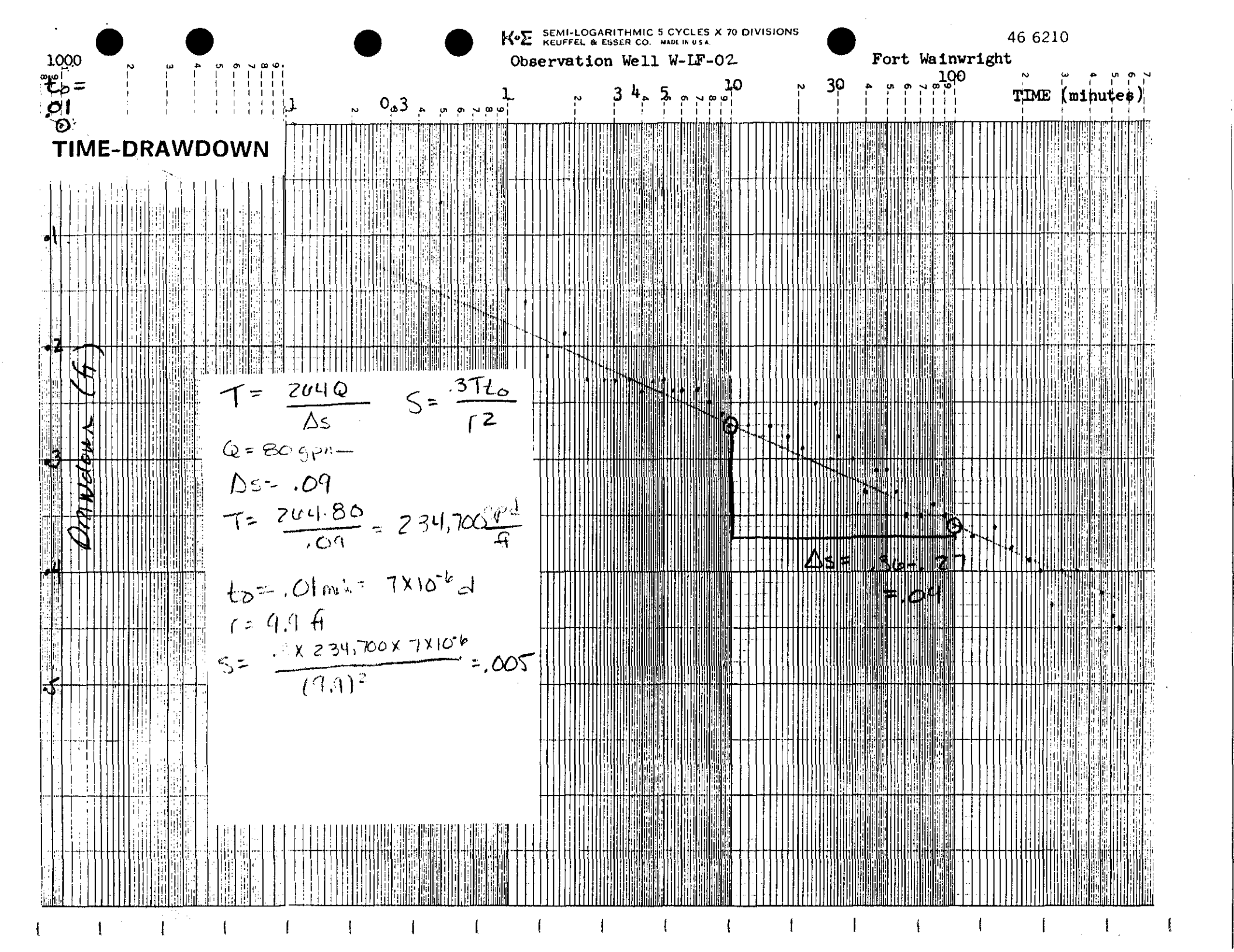
Pump test analyses
presented in Table 4-1

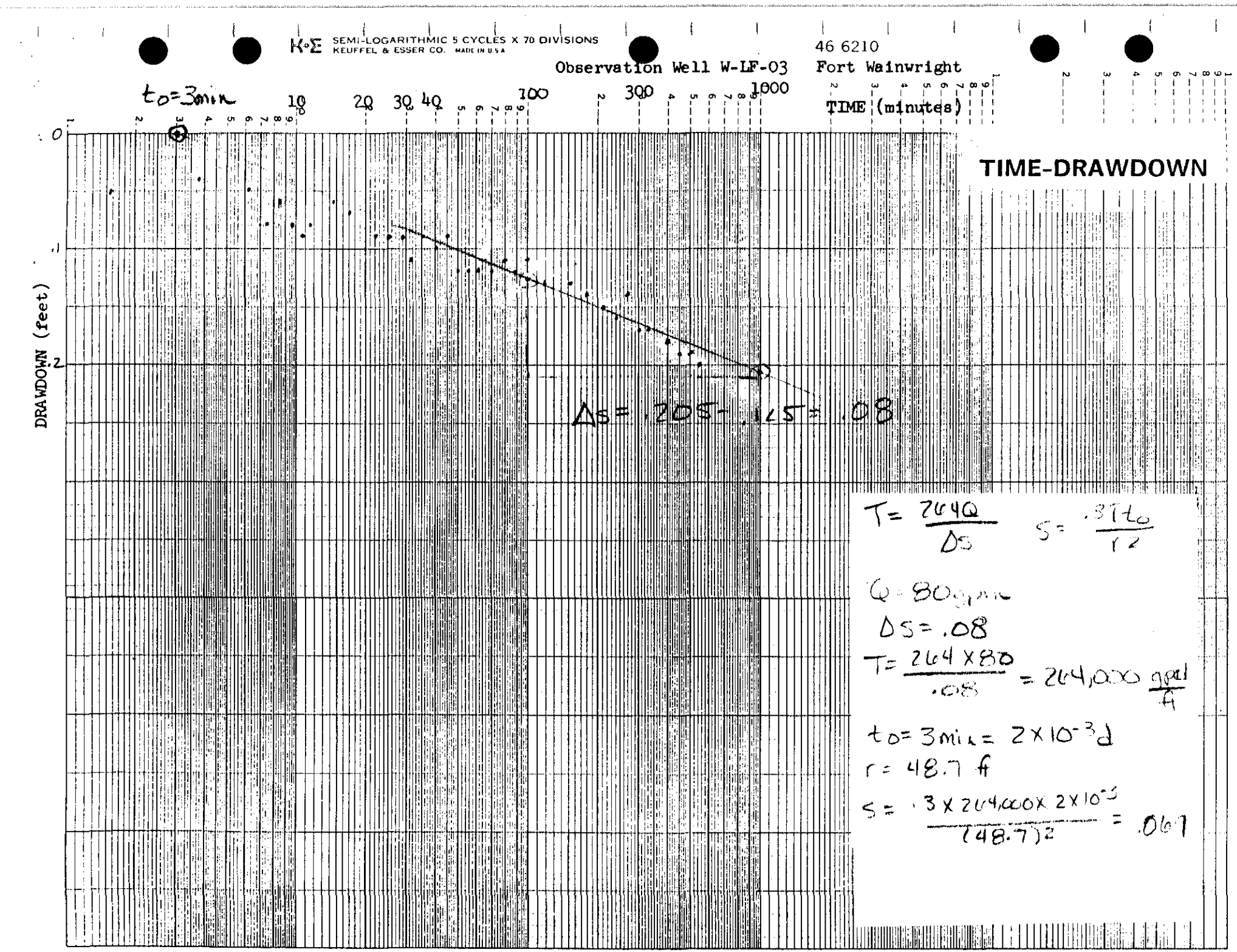
Check of: • graphs
• calculations

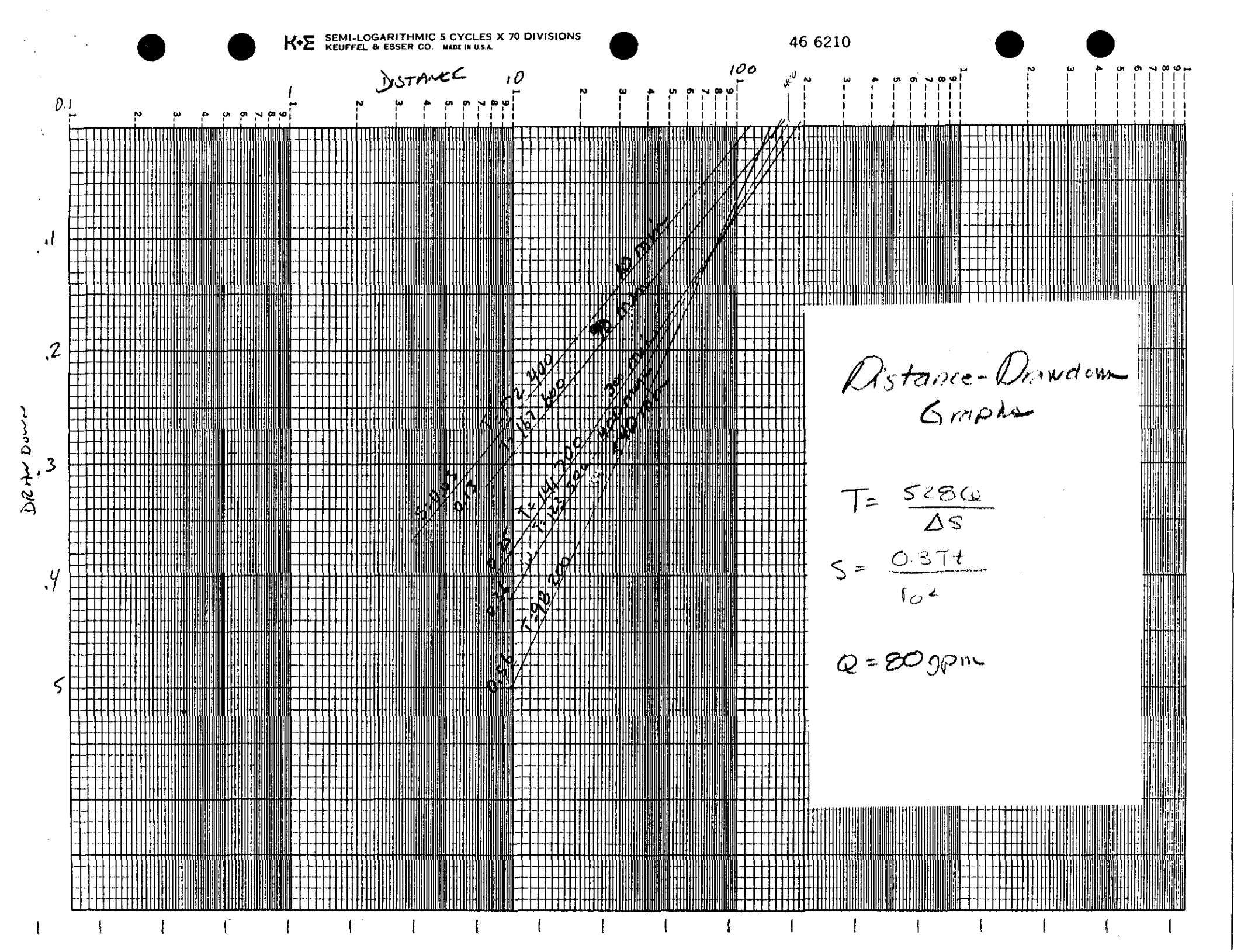
Added back up information
(graphic fit of Δs, calculations)

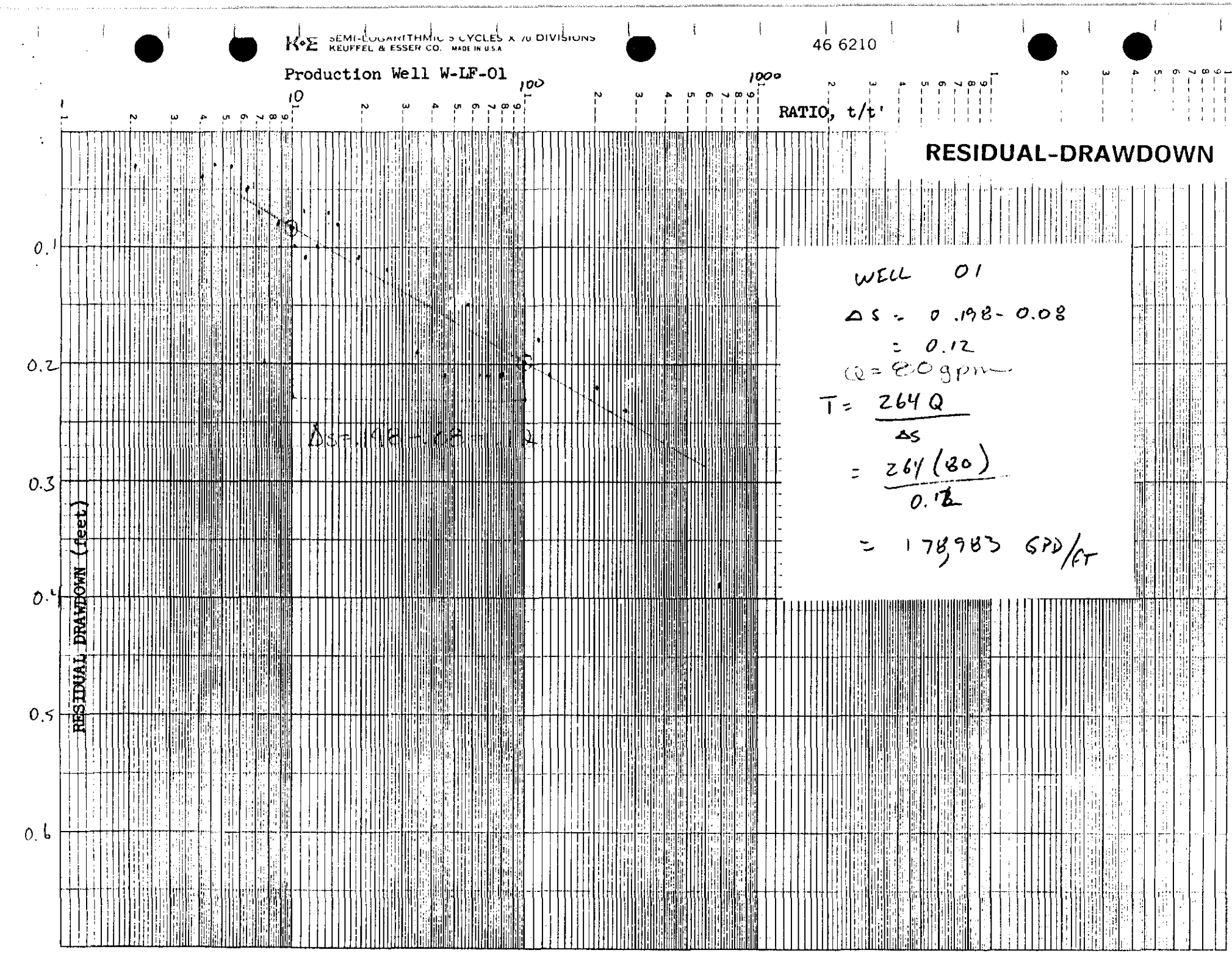
T Meeks
5/22/89

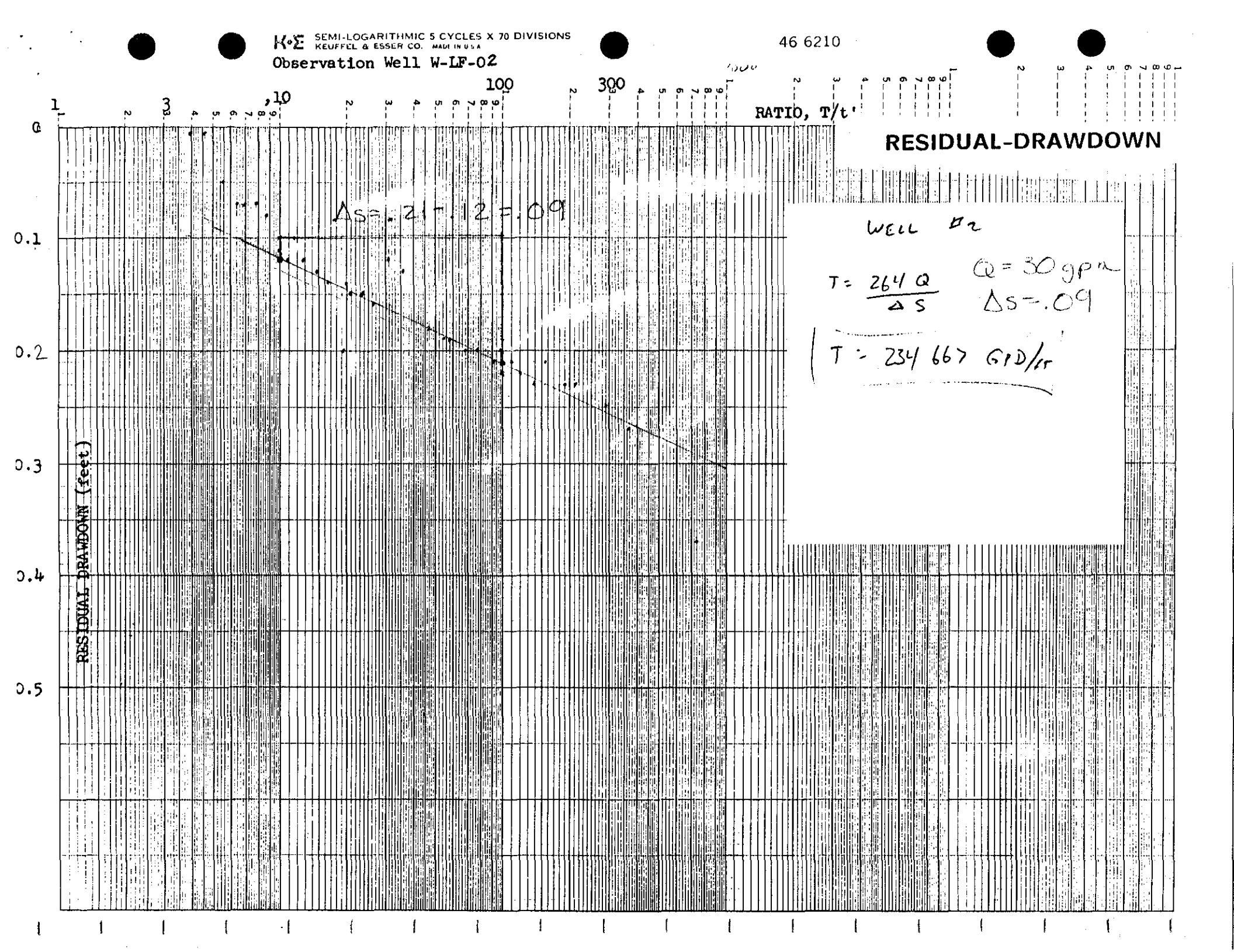

K&E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 6210
Production Well W-LF-01
Fort Wainwright
TIME (minutes)
1
10
30
100
DRAWDOWN (feet)
0
1
2
3
6
TIME-DRAWDOWN
T= 264Q/Δs
Δs=.37
Q= 400gpm
T= 57,100 gpd
Δs = 5.25-4.88= .37

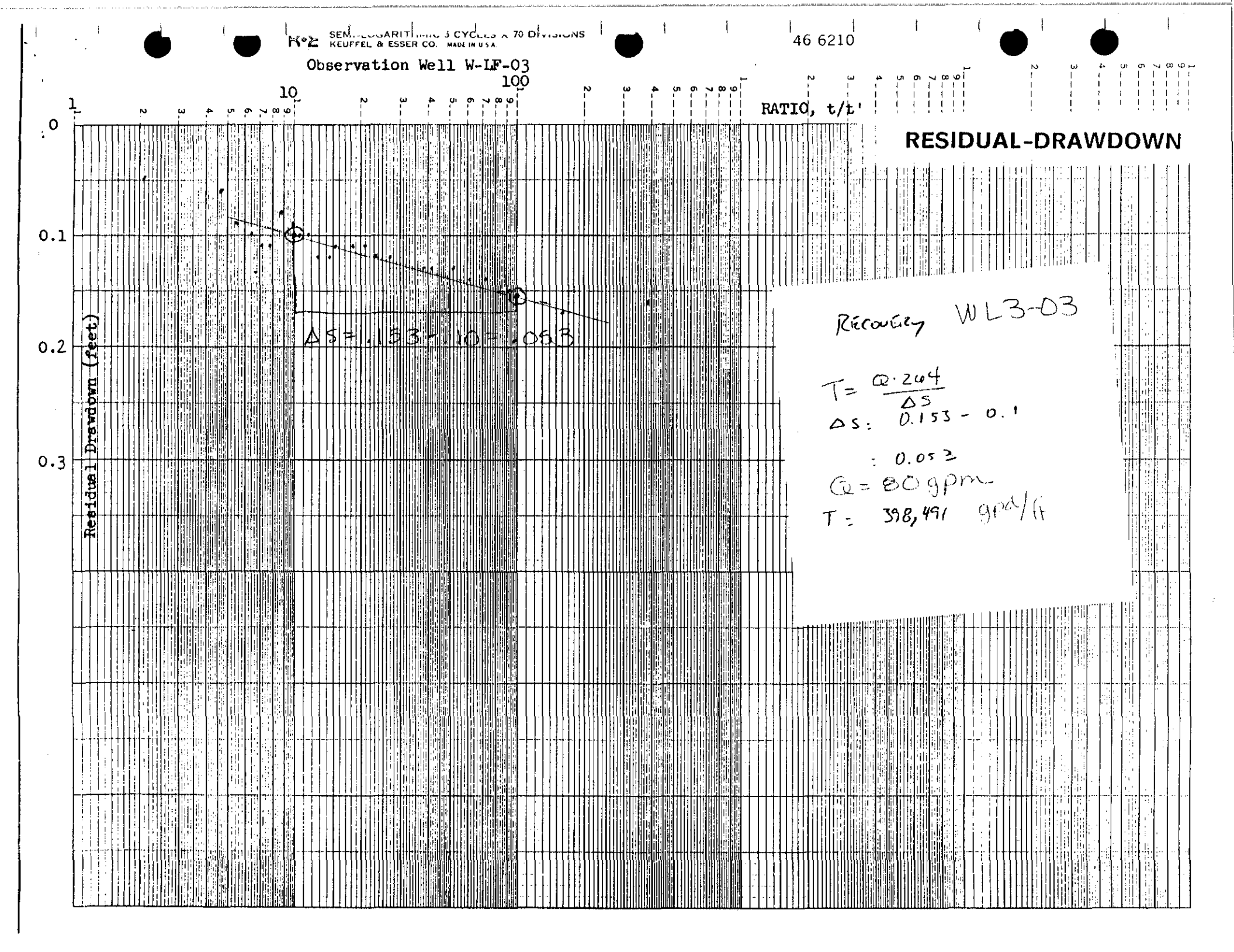

K•Σ SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 6210
Observation Well W-LF-02
Fort Wainwright
TIME-DRAWDOWN
TIME (minutes)
Drawdown (ft)
T = 264Q / Δs
S = .3Tt0 / r2
Q = 80 gpm
Δs = .09
T = 264.80 / .09 = 234,700 gpd/ft
t0 = .01 min = 7X10^-6 d
r = 9.9 ft
S = .3 X 234,700 X 7X10^-6 / (9.9)^2 = .005
Δs = .36 - .27
= .09


K+E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 6210
Observation Well W-LF-03
Fort Wainwright
t_o=3min
10
20
30
40
100
300
1000
TIME (minutes)
DRAWDOWN (feet)
0
1
2
TIME-DRAWDOWN
$\Delta s = .205 - .125 = .08$
$T = \frac{264Q}{\Delta s}$
$S = \frac{.3 t_o}{r^2}$
$Q = 80$ gpm
$\Delta s = .08$
$T = \frac{264 \times 80}{.08} = 264{,}000 \frac{gal}{ft}$
$t_o = 3 min = 2 \times 10^{-3} d$
$r = 48.7$ ft
$S = \frac{.3 \times 264{,}000 \times 2 \times 10^{-3}}{(48.7)^2} = .067$


K·Σ SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 6210
DISTANCE
Distance-Drawdown Graph
T = 528Q / ΔS
S = 0.3Tt / r²
Q = 80 gpm


K•E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 6210
Production Well W-LF-01
RATIO, t/t'
RESIDUAL-DRAWDOWN
RESIDUAL DRAWDOWN (feet)
0.1
0.2
0.3
0.4
0.5
0.6
WELL 01
Δs = 0.198 - 0.08
= 0.12
Q = 80 gpm
T = 264 Q / Δs
= 264 (80) / 0.12
= 178,983 GPD/FT

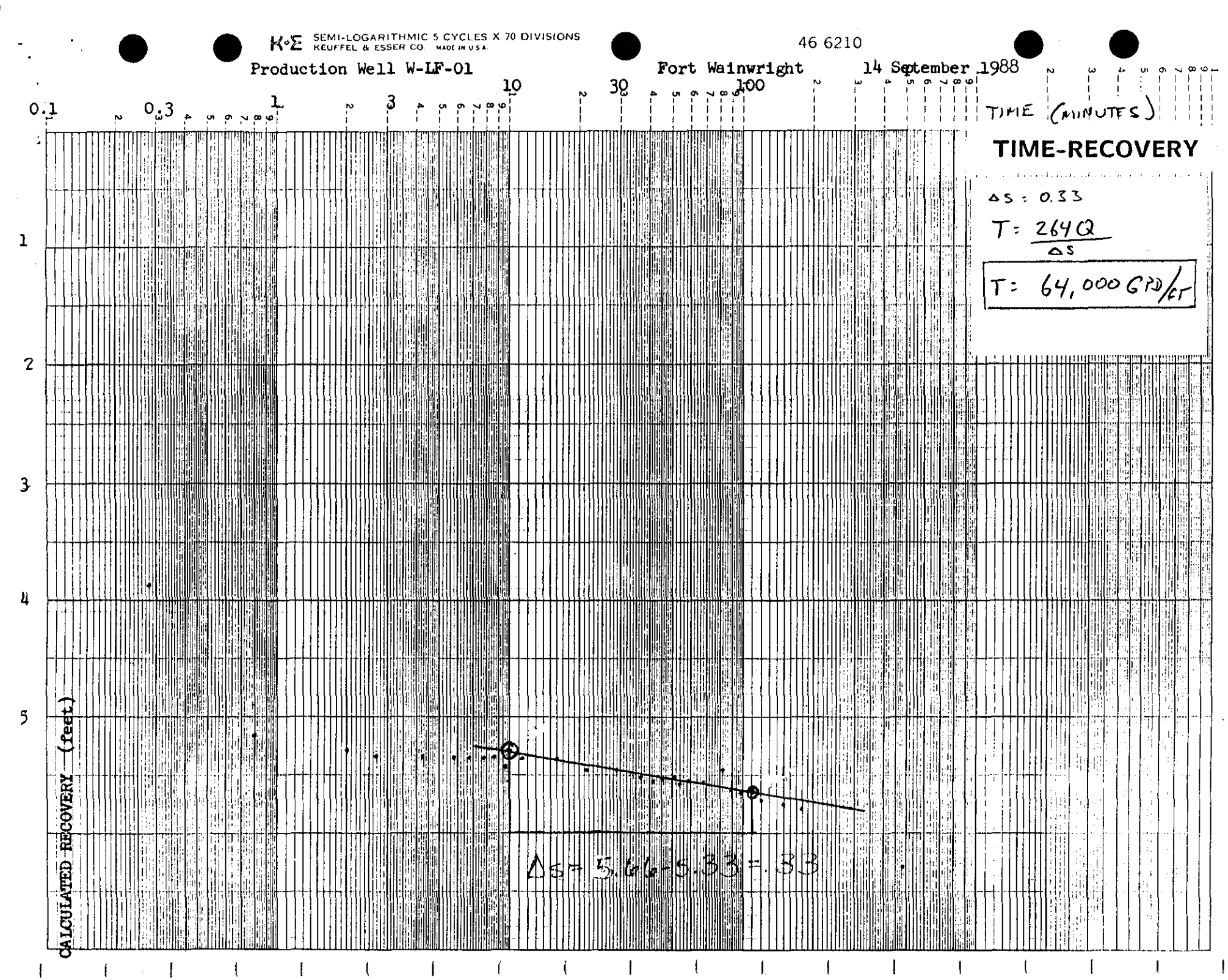

K•E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 6210
Observation Well W-LF-02
RATIO, T/t'
RESIDUAL-DRAWDOWN
RESIDUAL DRAWDOWN (feet)
0
0.1
0.2
0.3
0.4
0.5
1
3
10
100
300
Δs = .21 r = 12 r = 09
WELL #2
T = 264 Q / Δs
Q = 30 gpm
Δs = .09
T = 234 667 GPD/ft


K&E SEMI-LOGARITHMIC 3 CYCLES x 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 6210
Observation Well W-LF-03
RATIO, t/t'
RESIDUAL-DRAWDOWN
Residual Drawdown (feet)
0
0.1
0.2
0.3
ΔS = .153 - .10 = .053
Recovery WL3-03
T = Q·264 / ΔS
ΔS: 0.153 - 0.1
: 0.053
Q = 80 gpm
T: 398,491 gpd/ft

K·E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 6210

Production Well W-LF-01 Fort Wainwright 14 September 1988

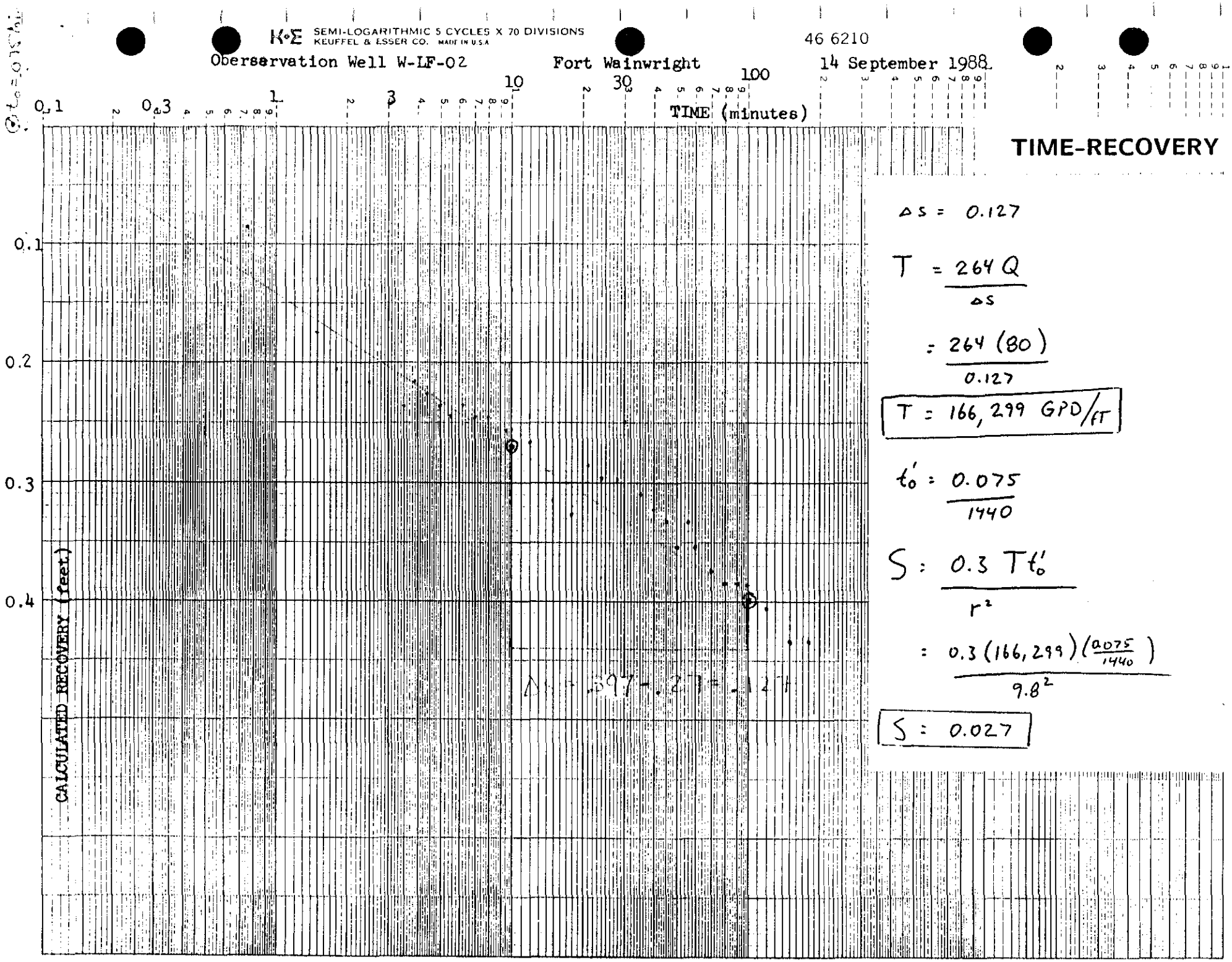


TIME-RECOVERY

$\Delta s = 0.33$

$T = \frac{264Q}{\Delta s}$

$T = 64{,}000$ GPD/FT



TIME-RECOVERY

$\Delta s = 0.127$

$$T = \frac{264\,Q}{\Delta s}$$

$$= \frac{264\,(80)}{0.127}$$

$$\boxed{T = 166,299\ GPD/ft}$$

$$t_o' = \frac{0.075}{1440}$$

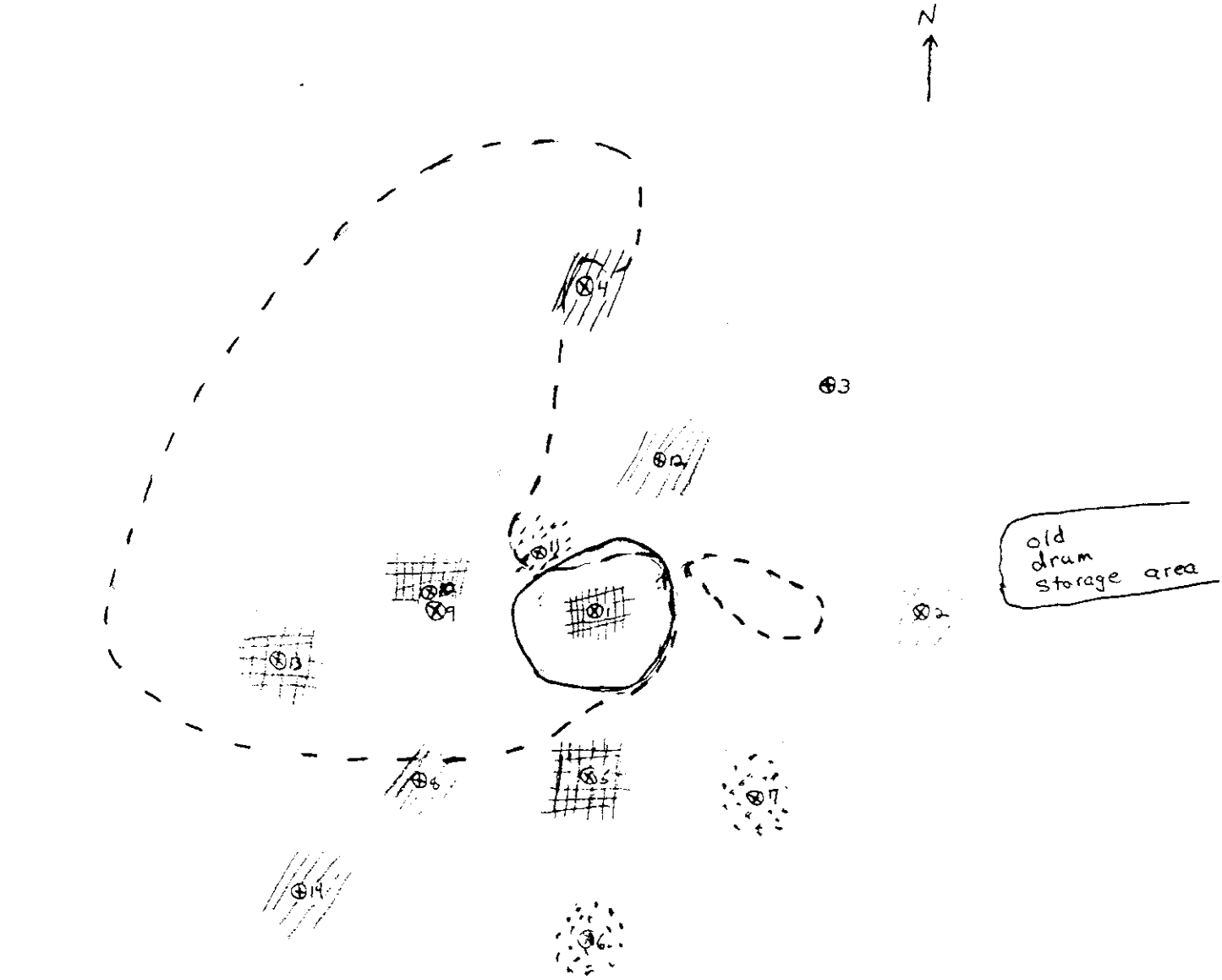
$$S = \frac{0.3\,T t_o'}{r^2}$$

$$= \frac{0.3\,(166,299)\left(\frac{0.075}{1440}\right)}{9.8^2}$$

$$\boxed{S = 0.027}$$

Raw Field Data for Fire Training Pits

Fort Richardson FTP-1



Legend

- ⊗1 Probe locations
- ○ Approximate pit boundary
- ◌ Approximate limits of contaminated dirt piles
- Trace to Low level contamination
- Low to medium level contamination
- Medium to High levels contamination

Fort Richardson FTP-1

Probe #	Depth	B ppm	T ppm	X ppm	
1	2	53.4	278.4	236.3	other Hydro Carbons 556 ppm
	5	701	908.8	447.5	other HC 70.9 ppm
	10	19.1	154.3	59.4	
	12.5	25.5	442.5	332.1	
2	2	5.3	3.0	.1	
	5	Tr	16.1	7.2	
	9.5	—	4.8	4.2	
3	5	—	—	—	methane only .56 ppm
	6.5	—	—	—	methane 6.84 ppm
4	2	—	—	—	
	5	Tr	3.4	3.7	
	9.5	Tr	10.7	4.2	
5	5	825	585.5	443	
	10	19.9	44.9	51.1	
6	5	—	—	Tr	Tr damp silt
	10	1.8	—	.4	wet silt to surface
7	2	—	3.3	—	
8	5	—	—	32.5	methane 86.8 ppm
9	2	—	Tr	—	
10	5	—	Tr	24.3	methane 88.8 ppm other HC 114.6 ppm
11	2	—	—	—	
	5	—	—	3.9	methane 90.3 ppm
12	4.5	—	Tr.	4.4	methane 83.1 ppm other HC 18.7 ppm

over→

Fort Richardson FTP-1

Probe #	Depth	Benzene ppm	Toluene ppm	Xylene ppm	Comments
13	2		Tr	Tr	methane 107.5 ppm other HC 63.4
	5		Tr	5.5	methane 88.2 ppm
14	4.5		Tr	28.6	methane 87 ppm other HC 34.1 ppm

Tr Values Below Quantifiable Limits

— Below Detectable Limits

Background readings Benzene — Toluene .47 Xylene 1.97

Fort Richardson FTP-2



Legend:

⊗1 Probe locations

O Approximate pit boundary

Approximate limit of burned junk

Trace to Low level contamination

Low to Medium level contamination

Medium to High levels of contamination

0 50 100 Ft

Approx Scale

Fort Richardson FTP-2

Probe #	Depth	Benzene ppm	Toluene ppm	Total Xylenes ppm	Comments
1	2	6.2	38.0	6.8	methane 664ppm
2	2	~~72~~ ~~24~~	~~35~~ ~~3.1~~	~~19~~ ~~2.6~~	~~10.1~~ methane 181ppm water to surface
3	2	—	6.8	12.1	
	3.5	1.3	3.5	3.7	
4	2	.7	.4	.2	
	5	.4	.7	.5	
5	2	84.1	124.4	59.5	methane 272ppm
	4.5	1.1	5.4	4.3	
6	2	—	2.04	—	
	5	245.0	1394.5	631.0	methane 239ppm other HC 626ppm
7	2	Tr	Tr	Tr	
	4.5	—	1.3	.6	
8	2	—	1.1	Tr	
9	2	—	.4	—	
	5	—	2.6	Tr	
10	2	—	—	1.4	
	4	—	—	Tr	
11	2	~~245~~	902.5	Tr	xylene masked by Toluene
	5	245.0	2496.5	1233	
12	2	Tr	11.7	Tr	
	5	Tr	4.7	Tr	
	9	—	54.6	Tr	
~~3~~	~~2~~				

over

Fort Richardson FTP-2

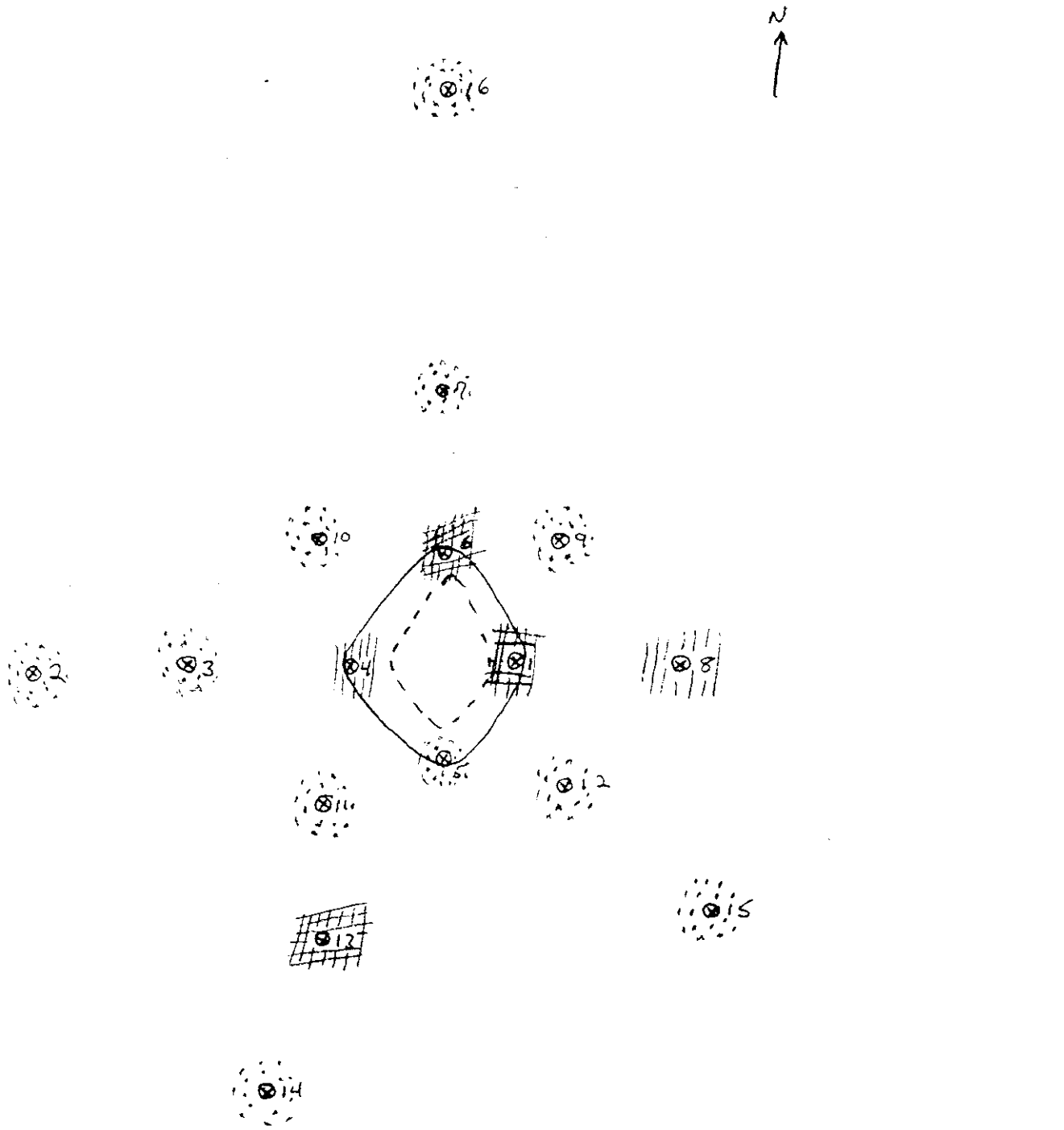
Probe #	Depth	Benzene ppm	Toluene ppm	Total Xylenes ppm	
13	2	.5	sli Tr	sli Tr	
14	2	—	5.0	4.8	
	5	10.1	21.9	Tr	
15	1.5	2.0	3.6	3.45	methane 31 ppm
	3	.24	Tr	—	methane 41 ppm

— Values Below Detectable Limits

Tr Values Below Quantifiable Limits

Background values Benzene .02ppm; Toluene .58ppm; Xylene 1.80ppm

Fort Wainwright FTP-3



Legend:

- ⊗1 Probe locations
- ◯ Approximate pit boundary
- ◌ Approximate surface water boundary
- Trace to Low Level Contamination
- //// Low to Medium Level Contamination
- #### Medium to High Level contamination

Ft Wainwright ~~B[illegible]~~ FTP-3

Probe #	Depth	Bppm	Tppm	Xppm	Comments
1	2	1590	5350	Tr	
	5	930	5016	44	
	10	20	16	19	
	15	238.3	265.1	81.8	~~joint @ 10'~~ last joint is leaking
2	2	6.1	Tr	9.6	
	5	1.13	2.5	1.9	
	10	—	11.9	—	
3	2.5	.18	.38	Tr	sucked up some silt
	5	.95	—	.85	
	10	1.57	3.5	Tr	
	15	Tr	6.25	4.01	
4	2	Tr	.27	.46	
	5	—	35.0	Tr	
	10	1.7	1.5	.1	
5	2	.02	.89	Tr	
	5	—	1.6	2.74	
	10	—	Tr	1.31	
	15	—	.54	3.35	
6	2	—	122	314	
	5	26	157	188	other HC 22.4 ppm, water to surface
7	2	.3	.79	Tr	
	5	Tr	2.08	.76	
	10	—	Tr	3.62	
	15	—	1.96	4.52	
8	2	—	1.80	Tr	
	5	—	1.60	3.84	
	10	—	16.96	9.90	
	15	—	1.96	Tr	
	20	—	2.99	Tr	
9	2	—	1.34	.46	
	5	Tr	2.32	Tr	
	10	—	.71	7.15	
	15	—	1.92	9.13	Last joint leaking
10	2	Tr	Tr	9.5	

over

Fort Wainwright FTP-3

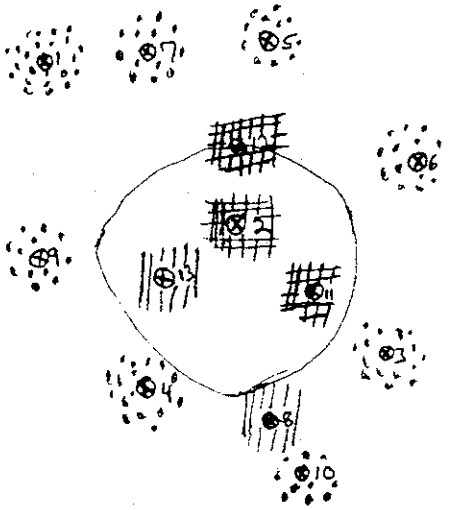
Probe #	Depth	Benzene ppm	Toluene ppm	Total Xylenes ppm	Comments
10	5	–	.44	8.54	
	10	.68	–	6.22	
	15	Tr	5.9	5.9	
11	2	–	Tr	2.4	
	10	–	93	2.02	
	13.5	–	1.8	6.7	
12	2	–	Tr	6.2	
	5	–	1.3	1.90	
	10	–	.4	5.2	
	15	Tr	4.22	4.69	
13	2	–	265	200	[redacted] spill just south of pit, [redacted] JP-4
	5	27	~~246~~ 65	~~71~~ 24	
	10	–	246	123	
14	2	–	.63	.70	South of possible spill
	5	.33	.80	–	
	10	–	.43	–	
15	5	–	~~1~~ .61	–	
16	15	Tr	4.32	Tr	

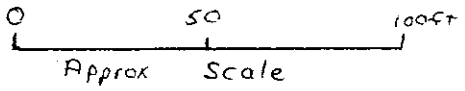
– values Below Detectable Limits

Tr Values Below Quantifiable Limits

~~Background values~~ [redacted]

Fort Greely FTP-4





Legend

⊗1 Probe locations

◯ Approximate pit boundary

Trace to Low level Contamination

//// Low to Medium level Contamination

Medium to High level contamination

Fort Greely FTP 4

Probe #	Depth	Benzene ppm	Toluene ppm	Total xylenes ppm	
1	3	—	.13		
	6	.50	.37	.58	
	10	—	Tr	.27	
2	3	536.7	581.7	399.8	other HC 90ppm, Approx. Center of pit
	5	459.4	665.3	997.1	other HC 193 ppm
	8	1174.0	1090.2	416.1	other HC 53ppm
3	3	—	1.7	—	
	5	—	4.2	—	
4	2	—	1.3	Tr	off gravel fill
	5	—	1.9	3.3	
5	3	—	Tr	2.1	
	5		1.0		
	10	~~—~~ Tr	3.0	3.3	
6	3	Tr	1.1	Tr	
	5	Tr	.9	2.2	
7	2	Tr	1.1	Tr	
	5	Tr	.6	1.8	
	2.5	Tr	.5	.7	
8	3	—	Tr	Tr	other HC 22.4ppm
	5	3.0	~~2.4~~ 5.8	Tr	other HC 520 ppm
	10	Tr	8.4	Tr	other HC 7.5ppm
9	3	~~2.65~~ —	1.0	~~1.6~~	
	5	2.65	Tr	Tr	
	10	Tr	1.2	Tr	
10	5	2.27	Tr	Tr	

over

Fort Greely FTP-4

Probe #	Depth	Benzene ppm	Toluene ppm	Total Xylenes ppm	Comments
11	5	250.8	361.1	191.1	other HC 311.7ppm
	10	5.67	12.5	6.7	other HC 42.8 ppm
12	5	376.8	439.4	528.1	other HC 106ppm
13	5	—	11.4	12.9	
	10	—	16.9	Tr	

— values Below Detectable Limits

Tr values Below Quantifiable Limits

Background readings Benzene —; Toluene .32 ppm; Xylene 1.2ppm

APPENDIX E

Surveying Data

Surveying Data for
Anchorage Fuel Terminal

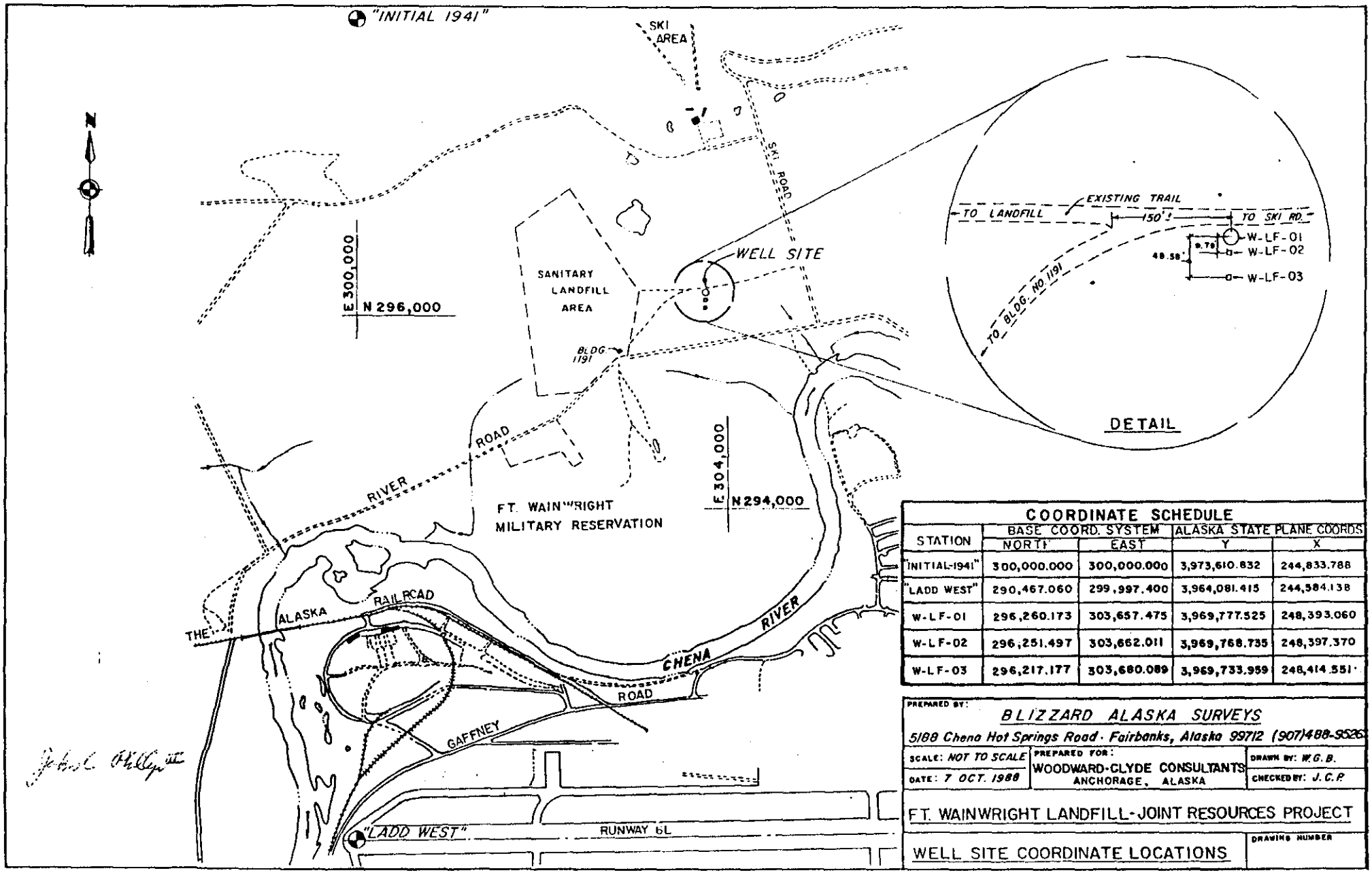
The AFT info. came in as a fax, with additional survey info. Here's what I gleened from it:

Well #	elevation above msl
AFT-1	122.140
AFT-2	118.660
Trench	88.470
AFT-4	90.810
AFT-5	88.330
AFT-7B	59.760
AFT-7A	60.240
AFT-8	67.120

The fax I recieved from LCMF is included.

```
TIME FOR THIS RUN:      0 04 48.7
TOTAL TIME ON FILE:     0 49 08.2
COORDINATES STORED
-------------------------------------------------------------------------------
COORDINATE FILE:88051S LENGTH =  200 POINTS; TIME ON FILE:    0 49 08.2
FORT RICH TEST WELLS              ***** JOB #88051
-------------------------------------------------------------------------------
************ COGO ************
-------------------------------------------------------------------------------
FROM TYPE          BEARING      DISTANCE   TO          NORTHING          EASTING
-------------------------------------------------------------------------------
LIST
                                           1     2,642,304.400     521,666.093
                                           2     2,642,300.040     521,788.761
                                           3     2,642,709.749     521,496.515
                                           4     2,643,094.405     522,187.562
                                           5     2,642,707.968     521,513.044
                                           6     2,643,012.732     521,406.688
                                           7     2,643,014.891     521,404.599
                                           8     2,643,118.336     521,808.671
LIST
                1   2,642,304.400   521,666.093   122.140 MFT-1
                2   2,642,300.040   521,788.761   119.660 MFT-2
                3   2,642,709.749   521,496.515    88.470 TRENCH
                4   2,643,094.405   522,187.562   90.810 MFT-4
                5   2,642,707.968   521,513.044   86.338 MFT-5
                6   2,643,012.732   521,406.688   59.760 MFT-78
                7   2,643,014.891   521,404.599   60.240 MFT-78
                8   2,643,118.336   521,808.671   67.120 MFT-8
```

Surveying Data for
Fort Wainwright Landfill



COORDINATE SCHEDULE

STATION	BASE COORD. SYSTEM NORTH	BASE COORD. SYSTEM EAST	ALASKA STATE PLANE COORDS Y	ALASKA STATE PLANE COORDS X
"INITIAL-1941"	300,000.000	300,000.000	3,973,610.832	244,833.788
"LADD WEST"	290,467.060	299,997.400	3,964,081.415	244,584.138
W-LF-01	296,260.173	303,657.475	3,969,777.525	248,393.060
W-LF-02	296,251.497	303,662.011	3,969,768.735	248,397.370
W-LF-03	296,217.177	303,680.089	3,969,733.959	248,414.551

PREPARED BY:
BLIZZARD ALASKA SURVEYS
5188 Cheno Hot Springs Road · Fairbanks, Alaska 99712 (907)488-9526

SCALE: NOT TO SCALE
DATE: 7 OCT. 1988
PREPARED FOR: WOODWARD-CLYDE CONSULTANTS ANCHORAGE, ALASKA
DRAWN BY: W.G.B.
CHECKED BY: J.C.P.

FT. WAINWRIGHT LANDFILL-JOINT RESOURCES PROJECT

WELL SITE COORDINATE LOCATIONS

DRAWING NUMBER

APPENDIX F

Chain-of-Custody Forms

Chain-of-Custody Forms for Anchorage Fuel Terminal

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

Attn: Jean Zimmerman

CHAIN OF CUSTODY

No. 2094

Enseco Client Woodward-Clyde
Project Joint Resources
Sampling Co. WCC
Sampling Site Anchorage Fuel Terminal
Team Leader Robert Bugan

SAMPLE SAFE™ CONDITIONS

1. Packed by: Y. Holtzman Seal # _____
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: Y Holtzman
5. Initial Contents Temp.: _____ °C Seal # _____
6. Sampling Status: Done Continuing Until 10/88
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: _____ °C
9. Condition of Contents: _____

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/21/88	0947	R-FT-0701	Aqueous	1	418.1	—
				1	~~72~~ 7421	TOTAL
				1	7421	Dissolved - filtered
	1110	R-FT-0203		1	418.1	—
				1	7421	TOTAL
				1	7421	Dissolved - filtered
	1345	R-FT-0404		3	8020	
	1345	R-FT-0403		3	8020	
	0947	R-FT-0701		3	8020	
		R-FT-0203		3	8020	

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	[signature]			
2				
3				

SHIPPING DETAILS

Delivered to Shipper by: Y. Holtzman
Method of Shipment: Fedex Airbill # 9165542945
Received for Lab: _____ Signed: _____ Date/Time _____
Enseco Project No. _____

White and Pink Copies to Lab Yellow to Sampler

SS-001

#2

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

Attn: Jean Zimmerman

CHAIN OF CUSTODY

No. 2895

Enseco Client: Woodward - Clyde
Project: Joint Resources
Sampling Co.: WCC
Sampling Site: Anchorage Fuel Terminal
Team Leader: Robert Dyan

SAMPLE SAFE™ CONDITIONS

1. Packed by: P. Spatz Seal #
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: P. Spatz
5. Initial Contents Temp.: °C Seal #
6. Sampling Status: Done Continuing Until 10/88
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: °C
9. Condition of Contents:

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/9/88		B-FT-0103	Soil	1	418.1/7420/D2216	
9/9/88		↓	Soil	1	8270	
9/9/88		↓	Soil	1	8240	

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	[signature]	[signature]	9/12/88	10:15
2	[signature]			
3				

SHIPPING DETAILS

Delivered to Shipper by: P. Spatz PHS
Method of Shipment: Fed Ex Airbill # 916554285 3
Received for Lab: Signed: Date/Time
Enseco Project No.

White Pink Yellow to Sender

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

Attn: Jean Zimmerman

CHAIN OF CUSTODY

No. 2896

Enseco Client Woodward - Clyde
Project Joint Resources
Sampling Co. WCC
Sampling Site Anchorage Fuel Terminal
Team Leader Robert Dyson

SAMPLE SAFE™ CONDITIONS

1. Packed by: P Spatz Seal # _____
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: P. Spatz
5. Initial Contents Temp.: _____ °C Seal # _____
6. Sampling Status: Done Continuing Until 10/88
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: _____ °C
9. Condition of Contents: _____

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/14/88		R - F+ - 501	glass jar w/ soil	1	418.1/7420/D2216	
		R - F+ - 501		1	8240	
		R - F+ - 501		1	8270	
		R - F+ - 502		1	418.1/7420/D2216	
		R - F+ - 502		1	8240	
		R - F+ - 502		1	8270	
		R - F+ - 502 D		1	418.1/7420/D2216	
		R - F+ - 502 D		1	8240	
		R - F+ - 502 D		1	8270	

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	[signature]	[signature]	15/Sept/88	1130
2	[signature]			
3				

SHIPPING DETAILS

Delivered to Shipper by: P. Spatz
Method of Shipment: Fed. Ex Airbill # 916554291 2
Received for Lab: _____ Signed: _____ Date/Time _____
Enseco Project No. _____

White and Pink Copies to Lab Yellow to Sampler

SS-001

Enseco - Rocky Mountain Analytical
4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

CHAIN OF CUSTODY

No. 2897

Attn: Jean Zimmerman

Enseco Client Woodward - Clyde

Project [illegible]

Sampling Co. [illegible]

Sampling Site [illegible]

Team Leader [illegible]

SAMPLE SAFE™ CONDITIONS

1. Packed by: [illegible] Seal # [illegible]
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: [illegible]
4. Sealed for Shipping by: [illegible]
5. Initial Contents Temp.: [illegible] °C Seal # [illegible]
6. Sampling Status: Done Continuing Until [illegible]
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: [illegible] °C
9. Condition of Contents: [illegible]

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
1/13/88		R-FT-0401	Soil	1	418.1/7420/3220	
1/13/88		↓	↓	1	3270	
1/13/88		↓	↓	1	8240	
1/13/88		R-FT-0402	Soil	1	418.1/7420/3220	
1/13/88		↓	↓	1	3270	
1/13/88		↓	↓	1	8240	

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	[signature]	[signature]	1/14/88	[illegible]
2	[signature]			
3				

SHIPPING DETAILS

Delivered to Shipper by: [illegible]

Method of Shipment: Fed Ex Airbill # 916554201

Received for Lab: Signed: Date/Time

Enseco Project No.

White Pink [illegible] to [illegible] Yl to Sa [illegible] SS-[illegible]

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

Attn: Jean Zimmerman

CHAIN OF CUSTODY

No. 2902

Enseco Client: Woodward-Clyde
Project: Joint Resources
Sampling Co.: WCC
Sampling Site: Arch. Fuel Terminal
Team Leader: Robert Dugan

SAMPLE SAFE™ CONDITIONS

1. Packed by: Price Spatz Seal #
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: P. Spatz
5. Initial Contents Temp.: °C Seal #
6. Sampling Status: Done Continuing Until 10/88
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: °C
9. Condition of Contents:

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/12/88		R-FT-0201	Soil	1	418.1/9420/D2216	
9/12/88		↓	↓	1	8270	
9/12/88		↓	↓	1	8240	
9/12/88		R-FT-0202	Soil	1	418.1/7420/D2216	
9/12/88		↓	↓	1	8270	
9/12/88		↓	↓	1	8240	

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1		Price Spatz	9/13/88	1045
2	P H Spatz			
3				

SHIPPING DETAILS

Delivered to Shipper by: P Spatz
Method of Shipment: Fed. Ex Airbill # 916554284?
Received for Lab: Signed: Date/Time
Enseco Project No.

White and Pink Copies to Lab Yellow to Sampler SS-001

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

Attn: Joan Zimmerman

CHAIN OF CUSTODY

No. 2898

Enseco Client Woodward Clyde

Project Joint Resources

Sampling Co. WCC

Sampling Site Anchorage Fuel Terminal

Team Leader Robert Dugan

SAMPLE SAFE™ CONDITIONS

1. Packed by: P Spatz Seal # _____
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: P Spatz
5. Initial Contents Temp.: _____ °C Seal # _____
6. Sampling Status: Done Continuing Until 10/88
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: _____ °C
9. Condition of Contents: _____

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/11/88		R-FT-503	Gloss soil jar	1	418.1/7420/D2216	
		R-FT-503	↓	1	8240	
		R-FT-503	↓	1	8270	

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	JA Holzman	R. Dugan	[illegible]	1100
2	R Dugan	J		
3				

SHIPPING DETAILS

Delivered to Shipper by: P Spatz

Method of Shipment: Fed Ex Airbill # 916554291?

Received for Lab: _____ Signed: _____ Date/Time _____

Enseco Project No. _____

Wh[illegible]d Pin[illegible]ies to [illegible]v to [illegible]er sl

#17

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

Attn: Jean Zimmerman

CHAIN OF CUSTODY

No. 2899

SAMPLE SAFE™ CONDITIONS

Enseco Client: Woodward-Clyde
Project: Joint Reserves
Sampling Co.: WCC
Sampling Site: Andrews Fuel Terminal
Team Leader: Robert Dixon

1. Packed by: P. Spatz — Seal #
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: P. Spatz
5. Initial Contents Temp.: ____ °C Seal #
6. Sampling Status: Done Continuing Until 10/88
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: ____ °C
9. Condition of Contents: ____

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/19/88		R-FT-06A01	Soil	2	8020	
9/19/88		↓	↓	1	410.1/415.1/418.1/351.2/365.1	ortho & total
9/19/88		R-FT-06A02	Soil	2	8020	
9/19/88		↓	↓	1	410.1/415.1/418.1/351.2/365.1	ortho & total
9/19/88		R-FT-04A01	Soil	2	8020	
9/19/88		↓	↓	1	410.1/415.1/418.1/351.2/365.1	ortho & total
9/19/88		R-FT-04A02	Soil	1	8020	
9/19/88		↓	↓	1	410.1/415.1/418.1/351.2/365.1	ortho & total

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	J. H. Holzman	Larry L. Spatz	9/20/88	0915
2	Larry L. Spatz			
3				

SHIPPING DETAILS

Delivered to Shipper by: P. Spatz — P/S
Method of Shipment: Fed Ex — Airbill # 916554292 3
Received for Lab: ____ Signed: ____ Date/Time ____
Enseco Project No. ____

White and Pink Copies to Lab Yellow to Sampler

SS-001

#6

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

CHAIN OF CUSTODY

No. 3164

Attn: Jean Zimmerman

Enseco Client: Woodward - Clyde
Project: Joint Resources
Sampling Co.: WCC
Sampling Site: Anchorage Fuel Terminal
Team Leader: Robert Durgin

SAMPLE SAFE™ CONDITIONS

1. Packed by: J. Holzman Seal #
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed in Blue Ice
4. Sealed for Shipping by: J. Holzman
5. Initial Contents Temp.: °C Seal #
6. Sampling Status: Done Continuing Until 10/88
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: °C
9. Condition of Contents:

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/16/88		R - FT - 0601	Soil	1	418.1/7420/D2216	
9/16/88		↓	↓	1	8270	
9/16/88		↓	↓	1	8240	
9/16/88		R - FT - 0602	Soil	1	418.1/7420/D2216	
9/16/88		↓	↓	1	8270	
9/16/88		↓	↓	1	8240	
9/16/88		R - FT - 0603	Soil	1	418.1/7420/D2216	
9/16/88		↓	↓	1	8270	
9/16/88		↓	↓	1	8240	

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	J. Holzman			
2				
3				

SHIPPING DETAILS

Delivered to Shipper by: J. Holeman PHS
Method of Shipment: ~~Fed Ex~~ United PHS Airbill # ~~[illegible]~~ 8680 - 9704 PHS
Received for Lab: Signed: Date/Time
Enseco Project No.

~~Enseco - Rocky Mountain Analytical~~ WCC LAB

CHAIN OF CUSTODY

No. 3166

~~4955 Yarrow Street~~
~~Arvada, Colorado 80002~~
~~303/421-6611 Facsimile: 303/431-7171~~ Pleasant Hill CA

Attn: Mike Haas

~~Enseco~~ Client WCC Anchorage
Project Joint Resources
Sampling Co. WCC
Sampling Site Anchorage Fuel Terminal
Team Leader Robert Dugan

SAMPLE SAFE™ CONDITIONS

1. Packed by: S. Ban Seal #
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: PACKED w/ Blue Ice
4. Sealed for Shipping by: S. Ban
5. Initial Contents Temp.: °C Seal #
6. Sampling Status: Done Continuing Until
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: °C
9. Condition of Contents:

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/21/00	1345	~~BF~~ R-FT-0403	Aqueous	1	SA 38-4	—
↓	↓	R-FT-0404	↓	1	SA 38-4	—
		-NO bacteria samples taken at the upgradient				
		Well today.				

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	SM B			
2				
3				

SHIPPING DETAILS

Delivered to Shipper by: PLS
Method of Shipment: Fed ex Airbill # 916554 3203
Received for Lab: Signed: Date/Time
Enseco Project No.

White and Pink Copies to Lab Yellow to Sampler SS-001

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

Attn: Jean Zimmerman

CHAIN OF CUSTODY

No. 3167

Enseco Client: Woodward-Clyde
Project: Joint Resourses
Sampling Co.: WCC
Sampling Site: Anchorage Fuel Terminal
Team Leader: Robert Bugan

SAMPLE SAFE™ CONDITIONS

1. Packed by: J. Holtzman Seal # _____
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: J. Holtzman
5. Initial Contents Temp.: _____ °C Seal # _____
6. Sampling Status: Done Continuing Until 10/88
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: _____ °C
9. Condition of Contents: _____

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/21/88	1345	R-FT-0404	Aqueous	2	418.1 / 351.2	-
				2	410.1 / 415.1	TOTAL
				1	405.1	-
				1	415.1	DISSOLVED (FILTERED)
				1	376.2 sulfide	
				1	365.1 sulfate/nitrite	ORTHO + TOTAL PO_4
	↓	↓		1	Nitrate	-
	1245	R-FT-0303		1	418.1	-
				1	7421	TOTAL
↓	↓	↓	↓	1	7421	Dissolved

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	SM Bu			
2				
3				

SHIPPING DETAILS

Delivered to Shipper by: J Holtzman
Method of Shipment: Fed Ex Airbill # 9165542945 ~~805~~
Received for Lab: _____ Signed: _____ Date/Time _____
Enseco Project No. _____

White and Pink Copies to Lab Yellow to Sampler

SS-001

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

Attn: Jean Zimmerman

CHAIN OF CUSTODY

No. 3168

Enseco Client Woodward-Clyde
Project Joint Resources
Sampling Co. WCC
Sampling Site Anchorage Fuel Terminal
Team Leader Robert Dugan

SAMPLE SAFE™ CONDITIONS

1. Packed by: J. Holeman Seal # _____
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: J. Holeman
5. Initial Contents Temp.: _____ °C Seal # _____
6. Sampling Status: Done Continuing Until 10/88
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: _____ °C
9. Condition of Contents: _____

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/21/88	1345	R-FT-0403	Aqueous	2	418.1 / 351.2	—
↓	↓	↓	↓	1	365.1 sulfate/nitrate	ortho + total PO4
				1	nitrate	—
				1	7421	TOTAL
				1	7421	Dissolved (filtered)
				2	410.1 / 415.1	total
				1	405.1	—
				1	415.1	Dissolved (filtered)
↓	↓	↓	↓	1	376.2 sulfide	—
9/21/88		Trip Blank W-	Aqueous	1	8020	—

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	SM Bo	X	X	X
2	X			
3				

SHIPPING DETAILS

Delivered to Shipper by: J. Holeman
Method of Shipment: Fed. Ex Airbill # 916554280 945
Received for Lab: _____ Signed: _____ Date/Time _____
Enseco Project No. _____

White and Pink Copies to Lab Yellow to Sampler

SS-001

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

WCC - Pleasant Hill

Attn: Michael Haus

CHAIN OF CUSTODY

No. 3169

Enseco Client

Project Joint Resources

Sampling Co. WCC

Sampling Site Anchorage Fuel Terminal

Team Leader Robert J Dygan

SAMPLE SAFE™ CONDITIONS

1. Packed by: P. Spatz Seal # ____
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: P. Spatz
5. Initial Contents Temp.: ____ °C Seal # ____
6. Sampling Status: Done Continuing Until 10/88
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: ____ °C
9. Condition of Contents: ____

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/19/88		R-FT-06A01	Soil	1	SA38-4	
9/19/88		R-FT-06A01D	Soil	1	SA38-4	D = Duplicate
9/19/88		R-FT-04A01	Soil	1	SA38-4	
9/19/88		R-FT-04A01D	Soil	1	SA38-4	D = Duplicate

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	SMB	[illegible]	9/20/88	0945
2	DH Spatz			
3				

SHIPPING DETAILS

Delivered to Shipper by: P. Spatz Pkgs

Method of Shipment: Fed Ex Airbill # 916554763

Received for Lab: ____ Signed: ____ Date/Time ____

Enseco Project No.: ____

W nd Pl pies ow to ler

~~Enseco - Rocky Mountain Analytical~~ WCC

CHAIN OF CUSTODY

No. 3170

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 ~~Facsimile: 303/431-7171~~
Pleasant Hill Lab

Attn: Michael Haas

Enseco Client _____

Project Joint Resources

Sampling Co. Woodward - Clyde

Sampling Site Anchorage Fuel Terminal - Trench Site

Team Leader Dan Graham

SAMPLE SAFE™ CONDITIONS

1. Packed by: Paige Spatz Seal # _____
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed with Dry Ice
4. Sealed for Shipping by: P. Spatz
5. Initial Contents Temp.: _____ °C Seal # _____
6. Sampling Status: (Done) Continuing Until _____
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: _____ °C
9. Condition of Contents: _____

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/28/88		Bench Test - Soil from Trench	Soil	-	Bioremediation Test	
		Sample Jars for 418.1 (TPH) test	-	10 8	-	-

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	[signature]	Paige M Spatz	9/29/88	8:30
2	P M Spatz			
3				

SHIPPING DETAILS

Delivered to Shipper by: P. Spatz PM

Method of Shipment: Fed Ex Airbill # 916554375 2

Received for Lab: _____ Signed: _____ Date/Time _____

Enseco Project No. _____

White and Pink Copies to Lab Yellow to Sampler

SS-001

#12

Enseco - Rocky Mountain Analytical
4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

Attn: Jean Zimmerman

CHAIN OF CUSTODY

No. 3215

Enseco Client: Woodward - Clyde Cons.
Project: 90275K - Joint Resources
Sampling Co.: WCC
Sampling Site: Anchorage Fuel Terminal
Team Leader: Bob Dugan

SAMPLE SAFE™ CONDITIONS

1. Packed by: S. Ban Seal #
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: S. Ban
5. Initial Contents Temp.: °C Seal #
6. Sampling Status: (Done) Continuing Until
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: °C
9. Condition of Contents:

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/30	1400	R-FT-0105 (7B)	Aqueous	2	418.1 / 351.2	
				2	410.4 / 415.1 TOTAL	
				1	~~351.2~~ 405.1	
				1	376.2	
				1	365.1 / Nitrite / ~~sulfide~~	Orthophosphate
				1	~~Nitrate~~	
				3	8020	
				1	415.1	Dissolved Filtered

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	SnBa			
2				
3				

SHIPPING DETAILS

Delivered to Shipper by:
Method of Shipment: United Airbill # 016 ANC 6008 7112
Received for Lab: Signed: Date/Time
Enseco Project No.

W[illegible]d Pi[illegible]pies [illegible]ow to[illegible]ler

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

Attn: Joan Zimmerman

CHAIN OF CUSTODY

No. 3854

Enseco Client: Woodward-Clyde Consultants
Project: Joint Resources
Sampling Co.: WCC
Sampling Site: Anchorage Fuel Terminal
Team Leader: Bob Dugan

SAMPLE SAFE™ CONDITIONS

1. Packed by: S. Ban Seal #
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: S. Ban
5. Initial Contents Temp.: °C Seal #
6. Sampling Status: Done Continuing Until
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: °C
9. Condition of Contents:

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/30	1400	R-FT-0106	Aqueous	2	418.1 / 351.2	
				2	410.1 / 415.1 TOTAL	
				1	~~351.2~~ 405.1	
				1	376.2	
				1	365.1 / Nitrate / Sulfate	ORTHO & TOTAL
				1	NITRATE	
				3	8020	
				1	415.1	Dissolved Filtered

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	S. M Ban			
2				
3				

SHIPPING DETAILS

Delivered to Shipper by:
Method of Shipment: United Airbill # 016 ANC 60008712
Received for Lab: Signed: Date/Time
Enseco Project No.

White and Pink Copies to Lab Yellow to Sampler

SS-001

#4

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

CHAIN OF CUSTODY

No. 4403

Attn: Jean Zimmerman

Enseco Client Woodward-Clyde Consultants

Project Joint Resources 902751K

Sampling Co. WCC

Sampling Site AFT-4

Team Leader Robert Dugan

SAMPLE SAFE™ CONDITIONS

1. Packed by: P Spate Seal # _____
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: P Spate
5. Initial Contents Temp.: _____ °C Seal # _____
6. Sampling Status: Done Continuing Until 10/88
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: _____ °C
9. Condition of Contents: _____

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/13/88	0940	R-FT-0301	Soil	1	418.1 / 7420 / D2216	
	↓	↓	↓	↓	8270	
	↓	↓	↓	↓	8240	
	1025	R-FT-0302	—		418.1 / 7420 / D2216	
		↓			8270	
		↓			8240	
		R-FT-0302D			418.1 / 7420 / D2216	Field Duplicate
					8270	↓
					8240	
↓	↓	↓	↓	↓		

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	[signature]	[signature]	9/14/88	0930
2	[signature]			
3				

SHIPPING DETAILS

Delivered to Shipper by: P Spate

Method of Shipment: Fed Ex Airbill # 916554290 1

Received for Lab: _____ Signed: _____ Date/Time _____

Enseco Project No. _____

White and Pink copies to ... ow to ... ler

#13

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

Attn: Jean Zimmerman / Debbie Fizio

CHAIN OF CUSTODY

No. 5991

Enseco Client: Woodward-Clyde
Project: Joint Resources
Sampling Co.: WCC
Sampling Site: Arch. Fuel Terminal
Team Leader: Mike Pietrowski

SAMPLE SAFE™ CONDITIONS

1. Packed by: P. Spatz Seal #
2. Seal Intact Upon Receipt by Sampling Co.: WCC Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: P. Spatz
5. Initial Contents Temp.: °C Seal #
6. Sampling Status: (Done) Continuing Until
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: °C
9. Condition of Contents:

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
10/31	1425	R-FT-1101P	Aqueous	3	602	
10/31	↓	↓	↓	1	413.2	
10/31	↓	↓	↓	1	405.1	Filtered
10/31	1505	R-FT-1201P	Aqueous	3	602	
10/31	↓	↓	↓	2	413.2	
10/31	↓	↓	↓	1	405.1	Filtered
10/31	1530	R-FT-1301P	Aqueous	3	602	
10/31	↓	↓	↓	2	413.2	
10/31	↓	↓	↓	1	405.1	Filtered

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	SmBe	P.H Spatz	11/1/88	10:15
2	PH Spatz			
3				

SHIPPING DETAILS

Delivered to Shipper by: P. Spatz
Method of Shipment: Fed Ex Airbill # 916554297 1
Received for Lab: Signed: Date/Time
Enseco Project No.

White and Pink Copies to Lab Yellow to Sampler

SS-001

#13

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

CHAIN OF CUSTODY

No. 5992

Attn: Jean Zimmerman / Debbie Frizio

Enseco Client: Woodward-Clyde

Project: Joint Resources

Sampling Co.: WCC

Sampling Site: Arch. Fuel Terminal

Team Leader: Mike Pietrowski

SAMPLE SAFE™ CONDITIONS

1. Packed by: P. Spatz Seal #
2. Seal Intact Upon Receipt by Sampling Co.: WCC Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: P. Spatz
5. Initial Contents Temp.: °C Seal #
6. Sampling Status: (Done) Continuing Until
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: °C
9. Condition of Contents:

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
10/31	1600	R-FT-1401P	Aqueous	3	602	
10/31	↓	↓	↓	2	413.2	
10/31	↓	↓	↓	1	405.1	Filtered
10/31	1445	R-FT-0901D	Aqueous	3	602	Duplicate
10/31	1250	R-FT-0403R	Aqueous	1	365.1/405.1	Resample
10/31	1250	R-FT-0404R	Aqueous	1	365.1/405.1	Resample
10/31	1308	R-FT-0702R	Aqueous	1	365.1/405.1	Resample
10/31	1308	R-FT-0703R	Aqueous	1	365.1/405.1	Resample

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	[signature]	P.H. Spatz	11/1/88	1020
2	P.H. Spatz			
3	[signature]			

SHIPPING DETAILS

Delivered to Shipper by: P Spatz

Method of Shipment: Fed Ex Airbill # 916554297 1

Received for Lab: Signed: Date/Time

Enseco Project No.

White and Pink Copies to Lab Yellow to Sampler

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#13

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

CHAIN OF CUSTODY

No. 5994

Attn: Jean Zimmerman / Debbie Fazio

Enseco Client: Woodward Clyde

Project: Joint Resources

Sampling Co.: WCC

Sampling Site: Anch. Fuel Term.

Team Leader: Mike Pietrowski

90275K / 3051

SAMPLE SAFE™ CONDITIONS

1. Packed by: P. Spatz Seal #
2. Seal Intact Upon Receipt by Sampling Co.: WCC Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: P. Spatz
5. Initial Contents Temp.: °C Seal #
6. Sampling Status: (Done) Continuing Until
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: °C
9. Condition of Contents:

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
10/31	1320	R-FT-0801P	Aqueous	3	602	
10/31	↓	↓	↓	1	413.2	
10/31	↓	↓	↓	1	405.1	Filtered
10/31	1350	R-FT-0901P	Aqueous	3	602	
10/31	↓	↓	↓	1	413.2	
10/31	↓	↓	↓	1	405.1	Filtered
10/31	1410	R-FT-1001P	Aqueous	3	602	
10/31	↓	↓	↓	1	413.2	
10/31	↓	↓	↓	1	405.1	Filtered

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	~~[illegible]~~ SMB	PH Spatz	11/1/93	10:00
2	PH Spatz			
3				

SHIPPING DETAILS

Delivered to Shipper by: P. Spatz

Method of Shipment: Fed. Ex Airbill # 916554297 1

Received for Lab: Signed: Date/Time

Enseco Project No.

White and Pink Copies to Lab Yellow to Sampler

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Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

Attn: Jean Zimmerman

CHAIN OF CUSTODY

No. 12066

Enseco Client: Woodward-Clyde
Project: Joint Resources-AFT. 90225 K
Sampling Co.: Woodward-Clyde
Sampling Site: Anchorage Fuel Terminal
Team Leader: Dennis McCrumb

SAMPLE SAFE CONDITIONS

1. Packed by: Holly Graham Seal # _____
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: P. Spatz
5. Initial Contents Temp.: _____ °C Seal # _____
6. Sampling Status: (Done) Continuing Until _____
7. Seal Intact Upon Receipt by Laboratory: (Yes) No
8. Contents Temperature Upon Receipt by Lab: 7.9 °C
9. Condition of Contents: OK

Date	Time	Sample ID/Description	RMA #	Sample Type	No. Containers	Analysis Parameters	Remarks
5/15/89	1500	R-FT-0901	05	Water	3 (VOAs)	EPA 602	
	1500	R-FT-0901	05		1 liter	413.2	
	1500	R-FT-0901	05		1 liter	418.1	
	1545	R-FT-1001	06		3 (VOAs)	EPA 602	
	1545	R-FT-1001	06		1 liter	413.2	
	1545	R-FT-1001	06		1 liter	418.1	
	1600	R-FT-1101	07		3 (VOAs)	EPA 602	
	1600	R-FT-1101	07		1 liter	413.2	
	1600	R-FT-1101	07		1 liter	418.1	
	1630	R-FT-1501	01		3 (VOAs)	EPA 602	

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	Holly Graham	P H Spatz	5/16/89	9:30
2	P H Spatz			
3				

SHIPPING DETAILS

Delivered to Shipper by: P. Spatz
Method of Shipment: Fed. Ex. Airbill # 944365297610
Received for Lab: RMA Signed: [illegible] Date/Time 5/17/89 0845
Enseco Project No. 4952

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

CHAIN OF CUSTODY

No. 12068

Attn: Jean Zimmerman

Enseco Client: Woodward-Clyde

Project: Joint Resources

Sampling Co.: Woodward-Clyde

Sampling Site: Anchorage Fuel Terminal

Team Leader: Dennis McCrumb

SAMPLE SAFETY CONDITIONS

1. Packed by: Holly Graham Seal # _____
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: P. Spatz
5. Initial Contents Temp.: _____ °C Seal # _____
6. Sampling Status: (Done) Continuing Until _____
7. Seal Intact Upon Receipt by Laboratory: (Yes) No
8. Contents Temperature Upon Receipt by Lab: 7.9 °C
9. Condition of Contents: ok

Date 5/15/89	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
5/15	1830	R-FT-1601-D 04	water	2 liter	418.1	
	1825	R-FT-1301 08		3 (VOAs)	EPA 602	resampled when VOAs broke
	1800	R-FT-1301 08		1 litre	413.2	
	1800	R-FT-1301 08		1 litre	418.1	
	1815	R-FT-1401 09		3 (VOAs)	EPA 602	
	1815	R-FT-1401 09		2 liter	413.2	
	1815	R-FT-1401 09		1 liter	418.1	
		~~R-FT-1401~~ (FB)				

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	Holly Graham	Paige A. Spatz	5/16/89	9:35
2	P. A. Spatz			
3				

SHIPPING DETAILS

Delivered to Shipper by: P. Spatz

Method of Shipment: Fed Ex Airbill # 944365296O

Received for Lab: RMA Signed: [signature] Date/Time 5/17/89

Enseco Project No. 4952 0815

White and Pink Copies to Lab Yellow to Sampler

SS-001

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

Attn: Jean Zimmerman

CHAIN OF CUSTODY

No. 12067

Enseco Client: Woodward-Clyde
Project: Joint Resources
Sampling Co.: Woodward-Clyde
Sampling Site: Anchorage Fuel Terminal
Team Leader: Dennis McCrumb

SAMPLE SAFE™ CONDITIONS

1. Packed by: Holly Graham Seal # _____
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: P. Spatz
5. Initial Contents Temp.: _____ °C Seal # _____
6. Sampling Status: (Done) Continuing Until _____
7. Seal Intact Upon Receipt by Laboratory: (Yes) No
8. Contents Temperature Upon Receipt by Lab: 7.9 °C
9. Condition of Contents: one broken cap 1L 1801

Date 5/15/89	Time	Sample ID/Description	RMA #	Sample Type	No. Containers	Analysis Parameters	Remarks
5/15	1630	R-FT-1501	01	water	1 litre	413.2	
	1630	R-FT-1501	01		1 liter	418.1	
	1650	R-FT-1801	02		3 (VOAs)	EPA 602	
	1650	R-FT-1801	02		1 liter	413.2	
	1650	R-FT-1801	02		1 litre	418.1	
	1715	R-FT-1601	03		3 (VOAs)	EPA 602	
	1715	R-FT-1601	03		1 liter	413.2	
	1715	R-FT-1601	03		1 liter	418.1	
	1830	R-FT-1601-D	04		3(VOAs)	EPA 602	
	1830	R-FT-1601-D	04		1 liter	413.2	

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	Holly Graham	P.H. Spatz	5/15/89	9:30
2	P.H. Spatz			
3				

SHIPPING DETAILS

Delivered to Shipper by: P. Spatz
Method of Shipment: Fed. Ex Airbill # 944365296 0
Received for Lab: RMA Signed: [signature] Date/Time 5/17/89 0815
Enseco Project No. 4952

Wh d Pin les t w to er ss

Woodward-Clyde Consultants

500 12th Street, Suite 100, Oakland, CA 94607-4041
(415) 893-3600

Chain of Custody Record

PROJECT NO. 90275k / 3032

SAMPLERS: (Signature) Piotrowski / Lumsden

DATE	TIME	SAMPLE NUMBER	General Mineral	Priority Pollutant Metals	EPA Method 624	EPA Method 625	EPA Method 608	AODC					Number of Containers	REMARKS (Sample preservation, handling procedures, etc.)
10/26/88	1130	Rep 1 - Initial						✓				X	1	2 reps Please perform 2 counts per rep Samples shipped overnight on ice
"	1130	Rep 2 - Initial						✓				X	1	

TOTAL NUMBER OF CONTAINERS: 2

RELINQUISHED BY : (Signature)	DATE/TIME	RECEIVED BY : (Signature)	RELINQUISHED BY : (Signature)	DATE/TIME	RECEIVED BY : (Signature)
Michael P. Piotrowski	10/26/88 1155				

METHOD OF SHIPMENT :	SHIPPED BY : (Signature)	COURIER : (Signature)	RECEIVED FOR LAB BY : (Signature)	DATE/TIME
FED-EX			Barbara B. Hemmingsen	10/27/88 11:30am

Arrived cold!

Woodward-Clyde Consultants

500 12th Street, Suite 100, Oakland, CA 94607-4041
(415) 893-3600

Chain of Custody Record

PROJECT NO. 90275K (Anchorage Terminal)

SAMPLERS: (Signature) Guy Tunnicliffe

DATE	TIME	SAMPLE NUMBER	General Mineral	Priority Pollutant Metals	EPA Method 624	EPA Method 625	EPA Method 608							Number of Containers	REMARKS (Sample preservation, handling procedures, etc.)
11/28	8:30	Azide Rep 1												1	
11/28	8:30	Azide Rep 2												1	
11/28	9:00	Emulsified Rep 1												1	
11/28	9:00	Emulsified Rep 2												1	
11/28	9:15	Emulsified/nutrient Rep 1												1	
11/28	9:15	Emulsified/nutrient Rep 2												1	

ANALYSES

TOTAL NUMBER OF CONTAINERS: 6

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
Guy Tunnicliffe	11/28 10:30	Mike Hawes	Mike Hawes 11/28 14:00	Nov. 29, 1988 11 30am	BB Hemminger

METHOD OF SHIPMENT:	SHIPPED BY: (Signature)	COURIER: (Signature)	RECEIVED FOR LAB BY: (Signature)	DATE/TIME

Woodward-Clyde Consultants
500 12th Street, Suite 100, Oakland, CA 94607-4041
(415) 893-3600

Chain of Custody Record

PROJECT NO. 90275K (Anchorage Terminal)

SAMPLERS: (Signature) [signature]

DATE	TIME	SAMPLE NUMBER	General Mineral	Priority Pollutant Metals	EPA Method 624	EPA Method 625	EPA Method 608	Bacteria	Number of Containers	REMARKS (Sample preservation, handling procedures, etc.)
12/30	12:00	Azide Rep 1						X	1	Samples frozen after collection and while sending to S.D. State.
12/30	12:00	Azide Rep 2						X	1	
12/30	12:15	Emulsified Rep 1						X	1	
12/30	12:15	Emulsified Rep 2						X	1	
12/30	12:20	Emulsifier/Nutrient Rep 1						X	1	
12/30	12:20	Emulsifier/Nutrient Rep 2						X	1	

TOTAL NUMBER OF CONTAINERS: 6

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
[signature]	1/3/89 13:40				

METHOD OF SHIPMENT:	SHIPPED BY: (Signature)	COURIER: (Signature)	RECEIVED FOR LAB BY: (Signature)	DATE/TIME
			B. Hemmingsen	1/4/89 3:15pm

Woodward-Clyde Consultants

500 12th Street, Suite 100, Oakland, CA 94607-4041
(415) 893-3600

Chain of Custody Record

PROJECT NO. 90275K / 3032

SAMPLERS: (Signature) [signatures]

DATE	TIME	SAMPLE NUMBER	General Mineral	Priority Pollutant Metals	EPA Method 624	EPA Method 625	EPA Method 608	Total/Bact					Number of Containers	REMARKS (Sample preservation, handling procedures, etc.)
26Jan89	1500	Distilled H2O Rep 1						✓					1	Samples unpreserved shipped on ice
"	"	Distilled H2O Rep 2						✓					1	
"	"	Azide Rep 1						✓					1	
"	"	Azide Rep 2						✓					1	
"	"	Emulsifier Rep 1						✓					1	
"	"	Emulsifier Rep 2						✓					1	
"	"	Emul/Nut Rep 1						✓					1	
"	"	Emul/Nut Rep 2						✓					1	
"	"	Nutrient Rep 1						✓					1	
"	"	Nutrient Rep 2						✓					1	

TOTAL NUMBER OF CONTAINERS: 10

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
[signature]	1/26 1545	BB Hemminger 1/27/89 3pm			

METHOD OF SHIPMENT:	SHIPPED BY: (Signature)	COURIER: (Signature)	RECEIVED FOR LAB BY: (Signature)	DATE/TIME

Chain-of-Custody Forms for Fort Wainwright Landfill

#1

Enseco - Rocky Mountain Analytical
4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

CHAIN OF CUSTODY

No. 4402

Attn: ~~x Jane Shoemaker~~ Maureen McDivitt

Enseco Client x Woodward-Clyde Consultants
Project Joint Reserves
Sampling Co. WCC
Sampling Site Ft. Wainwright Landfill
Team Leader Dee Graham/Dennis McCurdy

SAMPLE SAFE™ CONDITIONS

1. Packed by: x [illegible] Seal # _____
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: x Jane M. Shoemaker
5. Initial Contents Temp.: _____ °C Seal # _____
X 6. Sampling Status: Done Continuing Until 10/25
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: _____ °C
9. Condition of Contents: _____

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/12	19:05	W-LF-0101	water	2	418.1	1 bottle to analyze
9/12	19:08	W-LF-0102	water	2	418.1	" " " "
9/12	19:05	W-LF-0101	water	2	8080	" " " "
9/12	17:05	W-LF-0102	water	2	8080	" " " "
9/12	19:07	W-LF-0101	water	1	7460/7421 total	
9/12	19:07	W-LF-0102	water	1	7460/7421 total	
9/12	19:08	W-LF-0101	water	1	7460/7421 dissolved	
9/12	19:08	W-LF-0102	water	1	7460/7421 dissolved	
9/12	19:07	W-LF-0101	water	1	E180.1/SW1110	
9/12	19:07	W-LF-0102	water	1	E180.1/SW1110	

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
x 1	Jane M. Shoemaker	[illegible]	9/13	0830
2	[illegible]			
3				

SHIPPING DETAILS

Delivered to Shipper by: x Jane M. Shoemaker PHS
Method of Shipment: Federal Express Airbill # x 234995670
Received for Lab: _____ Signed: _____ Date/Time _____
Enseco Project No. _____

White and Pink Copies to Lab Yellow to Sampler

SS-001

Chain-of-Custody Forms for Fire Training Pits

Enseco - Rocky Mountain Analytical

4955 Yarrow Street
Arvada, Colorado 80002
303/421-6611 Facsimile: 303/431-7171

Attn: Jean Zimmerman

CHAIN OF CUSTODY

No. 2172

Enseco Client: Woodward Clyde
Project: Joint Resources
Sampling Co.: WCC
Sampling Site: Ft. Wainwright Burn Pits
Team Leader: Bob Dyan

SAMPLE SAFE™ CONDITIONS

1. Packed by: P Spatz Seal #
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: Packed w/ Blue Ice
4. Sealed for Shipping by: P Spatz
5. Initial Contents Temp.: °C Seal #
6. Sampling Status: Done Continuing Until 10/88
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: °C
9. Condition of Contents:

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
9/11/88		W-BP-0201	Aqueous	2	8240	911881450
9/11/88		W-BP-0301	Aqueous	2	8240	911881545
		Trip Blank added by CK		1		

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	Bob Wilson/EHS	P H Spatz	9/13/88	1050
2	P H Spatz			
3				

SHIPPING DETAILS

Delivered to Shipper by: P. Spatz
Method of Shipment: Fed. Ex Airbill # 916554284 2
Received for Lab: Emay Signed: L Mayo Date/Time 0800 9-14-88
Enseco Project No. 1657a

White and Pink Copies to Lab Yellow to Sampler

SS-001

INSTALLATION RESTORATION PROGRAM (IRP)
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

STAGE 1

JOINT RESOURCES PROJECT
Fort Richardson, Fort Wainwright, and Fort Greely, Alaska

FINAL REPORT
VOLUME 6, APPENDICES G THROUGH J

Alaskan Air Command
HQ AAC/DEP
Elmendorf AFB, Alaska 99506

and

U. S. Army Directorate of
Engineering and Housing AFVR-DE
Fort Richardson, Alaska 99505

February 1990

PREPARED BY

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Oakland, California 94607

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ADB/W-053

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Four sites at three U.S. Army bases in Alaska were investigated under the U.S. Air Force Phase I, Installation Restoration Program. The sites have serviced both the Army and Air Force during different periods of facility operation. The sites include the Anchorage Fuel Terminal and the Roosevelt Road transmitter site, Fort Richardson; Fort Wainwright Landfill, Fort Wainwright; and four Fire Training Pits (two at Fort Richardson, one at Fort Wainwright, and one at Fort Greely).

The Anchorage Fuel Terminal (AFT) is a tank farm on the southwest portion of Government Hill, just east of the Knick Arm of Cook Inlet. The area has a long history of fuel leaks and spills dating to the 1940s when the facility was first established. The investigation included an oil/water separation pilot test, a vapor extraction pilot test, a bioremediation bench scale test, drilling and well installation for groundwater sampling and monitoring, surface water sampling and assessment, and development of preliminary conceptual designs for two water treatment options including an air stripping system and a rotating biological

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DD Form 1473, Continued / Block 19, Abstract

contactor. The geology and hydrogeology at the facility are complex due to the presence of landslide deposits. Several potential remediation techniques were identified for use at the facility and further evaluation recommended. Additional characterization studies were not recommended.

The Roosevelt Road transmitter site is the location of a large PCB spill in the late 1970s. The spill occurred from large transformers that remained from an underground bunker utilized as a communication center. The soil around the transformer pad was contaminated with to 85,000 ppm PCB. Approximately 105 cubic yards of material were removed from the site and confirmation testing conducted to verify the removal effort. The transmitter pad and surface soils were cleaned up: however, the concentration of PCB-contaminated soil near the base of the excavation remained above the action level. As a result, the excavation was lined and backfilled for later remediation.

Fort Wainwright Landfill - An active landfill site, used by the military at Fort Wainwright, was investigated as a result of previous analyses which had identified the pesticides endrin and toxaphene at concentrations above the allowable for drinking water standards. The investigation included a geophyscial survey to evaluate the presence of a contaminant plume and the drilling and installation of three wells for a pump test. The purpose of the investigation was to evaluate potential contaminant migration from the landfill and model the large scale hydrologic properties of the unconfined aquifer the vicinity of the landfill. Additional data needs were identified and additional investigations recommended.

Fire Training Pits - Four fire training pits were investigated using soil gas techniques in an effort to define the limit of contaminant migration from combustion products and unburned fuel used in fire training exercises. The investigation identified methane gas at one location where the fire training pit was located partially on top of an old landfill and provided information on the contaminant migration at the other three sites. As a result of the investigation, preliminary remedial actions were recommended to prevent the spread of contaminants outside the burn pit are by wildlife, and further studies were recommended to quantify the type and extent of contamination present.

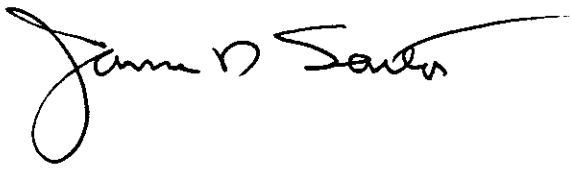
PREFACE

This 6-volume report describes the methods used and the results obtained from an Installation Restoration Program, Stage 1 investigation of four U.S. Army Bases in Alaska. The investigation and analyses were conducted by Woodward-Clyde Consultants under Contract F33615-85-D-4544, Work Order No. 9, Modification 1. The work was accomplished between August 1988 and May 1989. Capt. Franz Schmidt was the Technical Monitor for the Technical Services Division, USAF Occupational and Environmental Health Laboratory (USAFOEHL).

This document has been prepared in a modified version of the USAFOEHL format for Installation Restoration Program - Phase II reports. Modification of the prescribed format was necessary as a result of limitations in the scope of work and in order to provide clarity when discussing the sites investigated.

The present format allows each of the four sites defined in the statement of work to be discussed in a separate volume. Each volume is intended to stand alone as an independent report. Background material on the four sites is contained in the appendices and is presented in Volumes 5 and 6. To the extent possible, the volumes incorporate the format provided by USAFOEHL with slight modifications suggested by the U.S. Army, Directorate of Engineering and Housing.

Approved:



ADB/D-96

Joint Resources Project
Volume 6
Appendices G thru J

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Appendix J **Biographies of Key Personnel**

APPENDIX G

Analytical Data

Analytical Data
Anchorage Fuel Terminal

SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
001615-0001-SA	R-FT-0101	SOIL	08 SEP 88		10 SEP 88
001615-0002-SA	R-FT-0102	SOIL	08 SEP 88		10 SEP 88
001615-0003-SA	TRIP BLANK FT1	AQUEOUS	08 SEP 88		10 SEP 88

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0101
Lab ID: 001615-0001-SA Enseco ID: 1013180
Matrix: SOIL Sampled: 08 SEP 88 Received: 10 SEP 88
Authorized: 10 SEP 88 Prepared: 12 SEP 88 Analyzed: 13 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	0.10
1,1,1-Trichloroethane	ND	mg/kg	0.10
Bromodichloromethane	ND	mg/kg	0.10
Carbon tetrachloride	ND	mg/kg	0.10
1,1,2-Trichloroethane	ND	mg/kg	0.10
2-Butanone	ND	mg/kg	0.20
Benzene	ND	mg/kg	0.10
trans-1,3-Dichloropropene	ND	mg/kg	0.10
1,2-Dichloropropane	ND	mg/kg	0.10
1,2-Dichloroethane	ND	mg/kg	0.10
1,1,2,2-Tetrachloroethane	ND	mg/kg	0.10
2-Chloroethyl vinyl ether	ND	mg/kg	0.50
Bromoform	ND	mg/kg	0.10
Ethyl benzene	ND	mg/kg	0.10
Tetrachloroethene	ND	mg/kg	0.10
Chlorobenzene	ND	mg/kg	0.10
4-Methyl-2-pentanone	ND	mg/kg	0.10
Toluene	ND	mg/kg	0.10
cis-1,3-Dichloropropene	ND	mg/kg	0.10
Vinyl chloride	ND	mg/kg	0.10
Trichlorofluoromethane	ND	mg/kg	0.10
Chloroethane	ND	mg/kg	0.10
Acetone	ND	mg/kg	0.10
Methylene chloride	ND	mg/kg	0.10
Carbon disulfide	ND	mg/kg	0.10
1,1-Dichloroethene	ND	mg/kg	0.10
1,1-Dichloroethane	ND	mg/kg	0.10
trans-1,2-Dichloroethene	ND	mg/kg	0.10
Chloroform	ND	mg/kg	0.10
Bromomethane (Methylbromide)	ND	mg/kg	0.10
Trichloroethene	ND	mg/kg	0.10
Chlorodibromomethane	ND	mg/kg	0.10
Total xylenes	ND	mg/kg	0.10
Acrolein	ND	mg/kg	0.10
Acrylonitrile	ND	mg/kg	0.10
Dibromomethane	ND	mg/kg	0.10
Dichlorodifluoromethane	ND	mg/kg	0.10
Ethanol	ND	mg/kg	0.20
Ethyl methacrylate	ND	mg/kg	0.10
2-Hexanone	ND	mg/kg	0.10
Iodomethane	ND	mg/kg	0.10

ND=Not Detected
NA=Not Applicable

Reported By: Monica Brinkman Approved By: Jeff Lowry

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Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0101
Lab ID: 001615-0001-SA Enseco ID: 1013180
Matrix: SOIL Sampled: 08 SEP 88 Received: 10 SEP 88
Authorized: 10 SEP 88 Prepared: 12 SEP 88 Analyzed: 13 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	0.10
1,2,3-Trichloropropane	ND	mg/kg	0.10
Vinyl acetate	ND	mg/kg	0.30
trans-1,4-Dichloro-2-butene	ND	mg/kg	0.10
Toluene-d8	103	%	--
4-Bromofluorobenzene (BFB)	96.4	%	--
1,2-Dichloroethane-d4	93.8	%	--

ND=Not Detected
NA=Not Applicable

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Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0101
Lab ID: 001615-0001-SA Enseco ID: 1013180
Matrix: SOIL Sampled: 08 SEP 88 Received: 10 SEP 88
Authorized: 10 SEP 88 Prepared: 13 SEP 88 Analyzed: 19 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
1-Chloronaphthalene	ND	mg/kg	2.5
3-Methylcholanthrene	ND	mg/kg	2.5
N-Nitrosodiphenylamine	ND	mg/kg	0.50
Hexachlorocyclopentadiene	ND	mg/kg	2.5
2-Methylphenol	ND	mg/kg	0.50
2,3,4,6-Tetrachlorophenol	ND	mg/kg	2.5
Acetophenone	ND	mg/kg	0.50
4-Nitroaniline	ND	mg/kg	2.5
1-Naphthylamine	ND	mg/kg	2.5
a,a-Dimethylphen-ethylamine	ND	mg/kg	--
Benzidine	ND	mg/kg	5.6
2-Naphthylamine	ND	mg/kg	2.5
Benzoic acid	ND	mg/kg	2.5
4-Chloroaniline	ND	mg/kg	1.0
Benzyl alcohol	ND	mg/kg	1.0
N-Nitrosopiperidine	ND	mg/kg	2.5
Pentachlorobenzene	ND	mg/kg	2.5
Pronamide	ND	mg/kg	2.5
Methyl methanesulfonate	ND	mg/kg	2.5
N-Nitrosodimethylamine	ND	mg/kg	2.5
1,2,4,5-Tetrachloro-benzene	ND	mg/kg	2.5
N-Nitrosodi-n-butylamine	ND	mg/kg	2.5
2-Nitroaniline	ND	mg/kg	2.5
4-Methylphenol	ND	mg/kg	0.50
Aniline	ND	mg/kg	2.5
Diphenylamine	ND	mg/kg	2.5
Dibenz(a,j)acridine	ND	mg/kg	--
2-Picoline	ND	mg/kg	2.5
1,2-Diphenylhydrazine	ND	mg/kg	2.5
Phenacetin	ND	mg/kg	2.5
p-Dimethylaminoazobenzene	ND	mg/kg	2.5
2,6-Dichlorophenol	ND	mg/kg	2.5
3-Nitroaniline	ND	mg/kg	2.5
Pentachloronitrobenzene	ND	mg/kg	2.5
2-Methylnaphthalene	ND	mg/kg	0.50
Ethyl methanesulfonate	ND	mg/kg	2.5
7,12-Dimethylbenz-anthracene	ND	mg/kg	2.5
Dibenzofuran	ND	mg/kg	0.50
4-Aminobiphenyl	ND	mg/kg	2.5

ND=Not Detected
NA=Not Applicable

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Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0101
Lab ID: 001615-0001-SA Enseco ID: 1013180
Matrix: SOIL Sampled: 08 SEP 88 Received: 10 SEP 88
Authorized: 10 SEP 88 Prepared: 13 SEP 88 Analyzed: 19 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenol	ND	mg/kg	0.50
bis(2-Chloroethyl)ether	ND	mg/kg	0.50
2-Chlorophenol	ND	mg/kg	0.50
1,3-Dichlorobenzene	ND	mg/kg	0.50
1,4-Dichlorobenzene	ND	mg/kg	0.50
1,2-Dichlorobenzene	ND	mg/kg	0.50
bis(2-Chloroisopropyl) ether	ND	mg/kg	0.50
N-Nitroso-di-n-propylamine	ND	mg/kg	0.50
Hexachloroethane	ND	mg/kg	0.50
Nitrobenzene	ND	mg/kg	0.50
Isophorone	ND	mg/kg	0.50
2-Nitrophenol	ND	mg/kg	0.50
2,4-Dimethylphenol	ND	mg/kg	0.50
bis(2-Chloroethoxy) methane	ND	mg/kg	0.50
2,4-Dichlorophenol	ND	mg/kg	0.50
1,2,4-Trichlorobenzene	ND	mg/kg	0.50
Naphthalene	ND	mg/kg	0.50
Hexachlorobutadiene	ND	mg/kg	0.50
4-Chloro-3-methylphenol	ND	mg/kg	0.50
2,4,6-Trichlorophenol	ND	mg/kg	0.50
2,4,5-Trichlorophenol	ND	mg/kg	1.5
2-Chloronaphthalene	ND	mg/kg	0.50
Dimethyl phthalate	ND	mg/kg	0.50
Acenaphthylene	ND	mg/kg	0.50
Acenaphthene	ND	mg/kg	0.50
2,4-Dinitrophenol	ND	mg/kg	1.5
4-Nitrophenol	ND	mg/kg	2.5
2,4-Dinitrotoluene	ND	mg/kg	0.50
2,6-Dinitrotoluene	ND	mg/kg	0.50
Diethyl phthalate	ND	mg/kg	0.50
4-Chlorophenyl phenyl ether	ND	mg/kg	0.50
Fluorene	ND	mg/kg	0.50
4,6-Dinitro-2-methylphenol	ND	mg/kg	1.5
4-Bromophenyl phenyl ether	ND	mg/kg	0.50
Hexachlorobenzene	ND	mg/kg	0.50
Pentachlorophenol	ND	mg/kg	1.5

ND=Not Detected
NA=Not Applicable

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Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0101
Lab ID: 001615-0001-SA Enseco ID: 1013180
Matrix: SOIL Sampled: 08 SEP 88 Received: 10 SEP 88
Authorized: 10 SEP 88 Prepared: 13 SEP 88 Analyzed: 19 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenanthrene	ND	mg/kg	0.50
Anthracene	ND	mg/kg	0.50
Di-n-butyl phthalate	ND	mg/kg	0.50
Fluoranthene	ND	mg/kg	0.50
Pyrene	ND	mg/kg	0.50
Butyl benzyl phthalate	ND	mg/kg	0.50
3,3'-Dichlorobenzidine	ND	mg/kg	1.0
Benzo(a)anthracene	ND	mg/kg	0.50
bis(2-Ethylhexyl) phthalate	ND	mg/kg	0.50
Chrysene	ND	mg/kg	0.50
Di-n-octyl phthalate	ND	mg/kg	0.50
Benzo(b)fluoranthene	ND	mg/kg	0.50
Benzo(k)fluoranthene	ND	mg/kg	0.50
Benzo(a)pyrene	ND	mg/kg	0.50
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	0.50
Dibenzo(a,h)anthracene	ND	mg/kg	0.50
Benzo(g,h,i)perylene	ND	mg/kg	0.50
Nitrobenzene-d5	70.4	%	--
2-Fluorobiphenyl	68.4	%	--
Terphenyl-d14	89.0	%	--
Phenol-d5	68.5	%	--
2-Fluorophenol	74.7	%	--
2,4,6-Tribromophenol	66.0	%	--

ND=Not Detected
NA=Not Applicable

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TENTATIVELY IDENTIFIED COMPOUNDS

FOR

WOODWARD-CLYDE CONSULTANTS

SAMPLE NUMBER - 001615-0001

Compound Name	Fraction	Confidence Level	Estimated Concentration mg/kg
No compounds detected.	BNA	-	-

NOTES:

Confidence Levels

Level 3 - Confirmed Identification
Level 2 - Confident Identification
Level 1 - Tentative Identification

Qualifiers

I - Isomer
C - Class

Please refer to the discussion for further details.

Enseco

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0101
Lab ID: 001615-0001-SA Enseco ID: 1013180
Matrix: SOIL Sampled: 08 SEP 88 Received: 10 SEP 88
Authorized: 10 SEP 88 Prepared: 02 OCT 88 Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	20	mg/kg	10	239.1	10 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Hand Approved By: Kimberly Conroy

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General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0101
Lab ID: 001615-0001-SA
Enseco ID: 1013180
Matrix: SOIL
Sampled: 08 SEP 88
Received: 10 SEP 88
Authorized: 10 SEP 88
Prepared: NA
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	94.3	%	0.1	160.3	30 SEP 88
Total Petroleum Hydrocarbons	ND	mg/kg	50	3550/418.1 Mod.	16 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Leslie Dalla
Approved By: Leslie Dalla

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Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0102
Lab ID: 001615-0002-SA Enseco ID: 1013181
Matrix: SOIL Sampled: 08 SEP 88 Received: 10 SEP 88
Authorized: 10 SEP 88 Prepared: 12 SEP 88 Analyzed: 13 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	0.10
1,1,1-Trichloroethane	ND	mg/kg	0.10
Bromodichloromethane	ND	mg/kg	0.10
Carbon tetrachloride	ND	mg/kg	0.10
1,1,2-Trichloroethane	ND	mg/kg	0.10
2-Butanone	ND	mg/kg	0.20
Benzene	ND	mg/kg	0.10
trans-1,3-Dichloropropene	ND	mg/kg	0.10
1,2-Dichloropropane	ND	mg/kg	0.10
1,2-Dichloroethane	ND	mg/kg	0.10
1,1,2,2-Tetrachloroethane	ND	mg/kg	0.10
2-Chloroethyl vinyl ether	ND	mg/kg	0.50
Bromoform	ND	mg/kg	0.10
Ethyl benzene	ND	mg/kg	0.10
Tetrachloroethene	ND	mg/kg	0.10
Chlorobenzene	ND	mg/kg	0.10
4-Methyl-2-pentanone	ND	mg/kg	0.10
Toluene	ND	mg/kg	0.10
cis-1,3-Dichloropropene	ND	mg/kg	0.10
Vinyl chloride	ND	mg/kg	0.10
Trichlorofluoromethane	ND	mg/kg	0.10
Chloroethane	ND	mg/kg	0.10
Acetone	ND	mg/kg	0.10
Methylene chloride	ND	mg/kg	0.10
Carbon disulfide	ND	mg/kg	0.10
1,1-Dichloroethene	ND	mg/kg	0.10
1,1-Dichloroethane	ND	mg/kg	0.10
trans-1,2-Dichloroethene	ND	mg/kg	0.10
Chloroform	ND	mg/kg	0.10
Bromomethane (Methylbromide)	ND	mg/kg	0.10
Trichloroethene	ND	mg/kg	0.10
Chlorodibromomethane	ND	mg/kg	0.10
Total xylenes	ND	mg/kg	0.10
Acrolein	ND	mg/kg	0.10
Acrylonitrile	ND	mg/kg	0.10
Dibromomethane	ND	mg/kg	0.10
Dichlorodifluoromethane	ND	mg/kg	0.10
Ethanol	ND	mg/kg	0.20
Ethyl methacrylate	ND	mg/kg	0.10
2-Hexanone	ND	mg/kg	0.10
Iodomethane	ND	mg/kg	0.10

ND=Not Detected
NA=Not Applicable

Reported By: Monica Brinkman Approved By: Jeff Lowry

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Rev 230787

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0102
Lab ID: 001615-0002-SA Enseco ID: 1013181
Matrix: SOIL Sampled: 08 SEP 88 Received: 10 SEP 88
Authorized: 10 SEP 88 Prepared: 12 SEP 88 Analyzed: 13 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	0.10
1,2,3-Trichloropropane	ND	mg/kg	0.10
Vinyl acetate	ND	mg/kg	0.30
trans-1,4-Dichloro-2-butene	ND	mg/kg	0.10
Toluene-d8	111	%	--
4-Bromofluorobenzene (BFB)	84.4	%	--
1,2-Dichloroethane-d4	92.2	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Monica Brinkman Approved By: Jeff Lowry

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Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0102
Lab ID: 001615-0002-SA Enseco ID: 1013181
Matrix: SOIL Sampled: 08 SEP 88 Received: 10 SEP 88
Authorized: 10 SEP 88 Prepared: 13 SEP 88 Analyzed: 19 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
1-Chloronaphthalene	ND	mg/kg	2.5
3-Methylcholanthrene	ND	mg/kg	2.5
N-Nitrosodiphenylamine	ND	mg/kg	0.50
Hexachlorocyclopentadiene	ND	mg/kg	2.5
2-Methylphenol	ND	mg/kg	0.50
2,3,4,6-Tetrachlorophenol	ND	mg/kg	2.5
Acetophenone	ND	mg/kg	0.50
4-Nitroaniline	ND	mg/kg	2.5
1-Naphthylamine	ND	mg/kg	2.5
a,a-Dimethylphen-ethylamine	ND	mg/kg	--
Benzidine	ND	mg/kg	5.6
2-Naphthylamine	ND	mg/kg	2.5
Benzoic acid	ND	mg/kg	2.5
4-Chloroaniline	ND	mg/kg	1.0
Benzyl alcohol	ND	mg/kg	1.0
N-Nitrosopiperidine	ND	mg/kg	2.5
Pentachlorobenzene	ND	mg/kg	2.5
Pronamide	ND	mg/kg	2.5
Methyl methanesulfonate	ND	mg/kg	2.5
N-Nitrosodimethylamine	ND	mg/kg	2.5
1,2,4,5-Tetrachloro-benzene	ND	mg/kg	2.5
N-Nitrosodi-n-butylamine	ND	mg/kg	2.5
2-Nitroaniline	ND	mg/kg	2.5
4-Methylphenol	ND	mg/kg	0.50
Aniline	ND	mg/kg	2.5
Diphenylamine	ND	mg/kg	2.5
Dibenz(a,j)acridine	ND	mg/kg	--
2-Picoline	ND	mg/kg	2.5
1,2-Diphenylhydrazine	ND	mg/kg	2.5
Phenacetin	ND	mg/kg	2.5
p-Dimethylaminoazobenzene	ND	mg/kg	2.5
2,6-Dichlorophenol	ND	mg/kg	2.5
3-Nitroaniline	ND	mg/kg	2.5
Pentachloronitrobenzene	ND	mg/kg	2.5
2-Methylnaphthalene	ND	mg/kg	0.50
Ethyl methanesulfonate	ND	mg/kg	2.5
7,12-Dimethylbenz-anthracene	ND	mg/kg	2.5
Dibenzofuran	ND	mg/kg	0.50
4-Aminobiphenyl	ND	mg/kg	2.5

ND=Not Detected
NA=Not Applicable

Reported By: Tim Miller Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0102
Lab ID: 001615-0002-SA Enseco ID: 1013181
Matrix: SOIL Sampled: 08 SEP 88 Received: 10 SEP 88
Authorized: 10 SEP 88 Prepared: 13 SEP 88 Analyzed: 19 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenol	ND	mg/kg	0.50
bis(2-Chloroethyl)ether	ND	mg/kg	0.50
2-Chlorophenol	ND	mg/kg	0.50
1,3-Dichlorobenzene	ND	mg/kg	0.50
1,4-Dichlorobenzene	ND	mg/kg	0.50
1,2-Dichlorobenzene	ND	mg/kg	0.50
bis(2-Chloroisopropyl) ether	ND	mg/kg	0.50
N-Nitroso-di-n-propylamine	ND	mg/kg	0.50
Hexachloroethane	ND	mg/kg	0.50
Nitrobenzene	ND	mg/kg	0.50
Isophorone	ND	mg/kg	0.50
2-Nitrophenol	ND	mg/kg	0.50
2,4-Dimethylphenol	ND	mg/kg	0.50
bis(2-Chloroethoxy) methane	ND	mg/kg	0.50
2,4-Dichlorophenol	ND	mg/kg	0.50
1,2,4-Trichlorobenzene	ND	mg/kg	0.50
Naphthalene	ND	mg/kg	0.50
Hexachlorobutadiene	ND	mg/kg	0.50
4-Chloro-3-methylphenol	ND	mg/kg	0.50
2,4,6-Trichlorophenol	ND	mg/kg	0.50
2,4,5-Trichlorophenol	ND	mg/kg	1.5
2-Chloronaphthalene	ND	mg/kg	0.50
Dimethyl phthalate	ND	mg/kg	0.50
Acenaphthylene	ND	mg/kg	0.50
Acenaphthene	ND	mg/kg	0.50
2,4-Dinitrophenol	ND	mg/kg	1.5
4-Nitrophenol	ND	mg/kg	2.5
2,4-Dinitrotoluene	ND	mg/kg	0.50
2,6-Dinitrotoluene	ND	mg/kg	0.50
Diethyl phthalate	ND	mg/kg	0.50
4-Chlorophenyl phenyl ether	ND	mg/kg	0.50
Fluorene	ND	mg/kg	0.50
4,6-Dinitro-2-methylphenol	ND	mg/kg	1.5
4-Bromophenyl phenyl ether	ND	mg/kg	0.50
Hexachlorobenzene	ND	mg/kg	0.50
Pentachlorophenol	ND	mg/kg	1.5

ND=Not Detected
NA=Not Applicable

Reported By: Tim Miller Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0102
Lab ID: 001615-0002-SA Enseco ID: 1013181
Matrix: SOIL Sampled: 08 SEP 88 Received: 10 SEP 88
Authorized: 10 SEP 88 Prepared: 13 SEP 88 Analyzed: 19 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenanthrene	ND	mg/kg	0.50
Anthracene	ND	mg/kg	0.50
Di-n-butyl phthalate	ND	mg/kg	0.50
Fluoranthene	ND	mg/kg	0.50
Pyrene	ND	mg/kg	0.50
Butyl benzyl phthalate	ND	mg/kg	0.50
3,3'-Dichlorobenzidine	ND	mg/kg	1.0
Benzo(a)anthracene	ND	mg/kg	0.50
bis(2-Ethylhexyl) phthalate	ND	mg/kg	0.50
Chrysene	ND	mg/kg	0.50
Di-n-octyl phthalate	ND	mg/kg	0.50
Benzo(b)fluoranthene	ND	mg/kg	0.50
Benzo(k)fluoranthene	ND	mg/kg	0.50
Benzo(a)pyrene	ND	mg/kg	0.50
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	0.50
Dibenzo(a,h)anthracene	ND	mg/kg	0.50
Benzo(g,h,i)perylene	ND	mg/kg	0.50
Nitrobenzene-d5	54.2	%	--
2-Fluorobiphenyl	48.2	%	--
Terphenyl-d14	59.8	%	--
Phenol-d5	52.9	%	--
2-Fluorophenol	57.0	%	--
2,4,6-Tribromophenol	51.2	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Tim Miller Approved By: Jeff Lowry

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TENTATIVELY IDENTIFIED COMPOUNDS

FOR

WOODWARD-CLYDE CONSULTANTS

SAMPLE NUMBER - 001615-0002

Compound Name	Fraction	Confidence Level	Estimated Concentration mg/kg
No compounds detected.	BNA	-	-

NOTES:

Confidence Levels

Level 3 - Confirmed Identification
Level 2 - Confident Identification
Level 1 - Tentative Identification

Qualifiers

I - Isomer
C - Class

Please refer to the discussion for further details.

Enseco

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0102
Lab ID: 001615-0002-SA
Matrix: SOIL
Authorized: 10 SEP 88

Enseco ID: 1013181
Sampled: 08 SEP 88
Prepared: 02 OCT 88

Received: 10 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/kg	10	239.1	10 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Hand

Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0102
Lab ID: 001615-0002-SA Enseco ID: 1013181
Matrix: SOIL Sampled: 08 SEP 88 Received: 10 SEP 88
Authorized: 10 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	81.9	%	0.1	160.3	30 SEP 88
Total Petroleum Hydrocarbons	ND	mg/kg	50	3550/418.1 Mod.	16 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Leslie Dalla Approved By: Leslie Dalla

The cover letter is an integral part of this report.
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Enseco

Purgeable Volatile Organics

Method 624

Client Name: Woodward-Clyde Consultants
Client ID: TRIP BLANK FT1
Lab ID: 001615-0003-SA Enseco ID: 1013182
Matrix: AQUEOUS Sampled: 08 SEP 88 Received: 10 SEP 88
Authorized: 10 SEP 88 Prepared: 12 SEP 88 Analyzed: 13 SEP 88

Parameter	Result	Units	Reporting Limit
Chloromethane	ND	ug/L	14
Bromomethane (Methylbromide)	ND	ug/L	10
Vinyl chloride	ND	ug/L	11
Chloroethane	ND	ug/L	10
Methylene chloride	ND	ug/L	17
Acetone	ND	ug/L	50
Carbon disulfide	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	4.0
1,1-Dichloroethane	ND	ug/L	5.0
trans-1,2-Dichloroethene	ND	ug/L	5.0
Chloroform	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	3.0
2-Butanone	ND	ug/L	50
1,1,1-Trichloroethane	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	3.0
Bromodichloromethane	ND	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Trichloroethene	ND	ug/L	3.0
Chlorodibromomethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Benzene	ND	ug/L	3.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
2-Chloroethyl vinyl ether	ND	ug/L	100
Bromoform	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	50
1,1,2,2-Tetrachloroethane	ND	ug/L	7.0
Tetrachloroethene	ND	ug/L	3.0
Toluene	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Ethyl benzene	ND	ug/L	5.0
Total xylenes	ND	ug/L	5.0
Trichlorofluoromethane	ND	ug/L	10
Acrolein	ND	ug/L	16
Acrylonitrile	ND	ug/L	10
Dibromomethane	ND	ug/L	10
Dichlorodifluoromethane	ND	ug/L	10
Ethanol	ND	ug/L	50
Ethyl methacrylate	ND	ug/L	10
2-Hexanone	ND	ug/L	50
Iodomethane	ND	ug/L	10

ND=Not Detected
NA=Not Applicable

Reported By: Monica Brinkman Approved By: Jeff Lowry

The cover letter is an integral part of this report.
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Enseco

Purgeable Volatile Organics

Method 624

Client Name: Woodward-Clyde Consultants
Client ID: TRIP BLANK FT1
Lab ID: 001615-0003-SA Enseco ID: 1013182
Matrix: AQUEOUS Sampled: 08 SEP 88 Received: 10 SEP 88
Authorized: 10 SEP 88 Prepared: 12 SEP 88 Analyzed: 13 SEP 88

Parameter	Result	Units	Reporting Limit
Styrene	ND	ug/L	5.0
1,2,3-Trichloropropane	ND	ug/L	10
Vinyl acetate	ND	ug/L	50
trans-1,4-Dichloro-2-butene	ND	ug/L	50
Toluene-d8	101	%	--
4-Bromofluorobenzene (BFB)	98.0	%	--
1,2-Dichloroethane-d4	95.8	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Monica Brinkman Approved By: Jeff Lowry

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SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
001639-0001-SA	R-FT-0103	SOIL	09 SEP 88		13 SEP 88

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0103
Lab ID: 001639-0001-SA Enseco ID: 1013386
Matrix: SOIL Sampled: 09 SEP 88 Received: 13 SEP 88
Authorized: 13 SEP 88 Prepared: 14 SEP 88 Analyzed: 21 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	0.10
1,1,1-Trichloroethane	ND	mg/kg	0.10
Bromodichloromethane	ND	mg/kg	0.10
Carbon tetrachloride	ND	mg/kg	0.10
1,1,2-Trichloroethane	ND	mg/kg	0.10
2-Butanone	ND	mg/kg	0.20
Benzene	ND	mg/kg	0.10
trans-1,3-Dichloropropene	ND	mg/kg	0.10
1,2-Dichloropropane	ND	mg/kg	0.10
1,2-Dichloroethane	ND	mg/kg	0.10
1,1,2,2-Tetrachloroethane	ND	mg/kg	0.10
2-Chloroethyl vinyl ether	ND	mg/kg	0.50
Bromoform	ND	mg/kg	0.10
Ethyl benzene	ND	mg/kg	0.10
Tetrachloroethene	ND	mg/kg	0.10
Chlorobenzene	ND	mg/kg	0.10
4-Methyl-2-pentanone	ND	mg/kg	0.10
Toluene	ND	mg/kg	0.10
cis-1,3-Dichloropropene	ND	mg/kg	0.10
Vinyl chloride	ND	mg/kg	0.10
Trichlorofluoromethane	ND	mg/kg	0.10
Chloroethane	ND	mg/kg	0.10
Acetone	ND	mg/kg	0.10
Methylene chloride	ND	mg/kg	0.10
Carbon disulfide	ND	mg/kg	0.10
1,1-Dichloroethene	ND	mg/kg	0.10
1,1-Dichloroethane	ND	mg/kg	0.10
trans-1,2-Dichloroethene	ND	mg/kg	0.10
Chloroform	ND	mg/kg	0.10
Bromomethane (Methylbromide)	ND	mg/kg	0.10
Trichloroethene	ND	mg/kg	0.10
Chlorodibromomethane	ND	mg/kg	0.10
Total xylenes	ND	mg/kg	0.10
Acrolein	ND	mg/kg	0.10
Acrylonitrile	ND	mg/kg	0.10
Dibromomethane	ND	mg/kg	0.10
Dichlorodifluoromethane	ND	mg/kg	0.10
Ethanol	ND	mg/kg	0.20
Ethyl methacrylate	ND	mg/kg	0.10
2-Hexanone	ND	mg/kg	0.10
Iodomethane	ND	mg/kg	0.10

ND=Not Detected
NA=Not Applicable

Reported By: Lisa Traut Approved By: Jeff Lowry

The cover letter is an integral part of this report.
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Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0103
Lab ID: 001639-0001-SA Enseco ID: 1013386
Matrix: SOIL Sampled: 09 SEP 88 Received: 13 SEP 88
Authorized: 13 SEP 88 Prepared: 14 SEP 88 Analyzed: 21 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	0.10
1,2,3-Trichloropropane	ND	mg/kg	0.10
Vinyl acetate	ND	mg/kg	0.30
trans-1,4-Dichloro-2-butene	ND	mg/kg	0.10
Toluene-d8	133	%	--
4-Bromofluorobenzene (BFB)	54.8	%	--
1,2-Dichloroethane-d4	90.8	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Lisa Traut Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0103
Lab ID: 001639-0001-SA Enseco ID: 1013386
Matrix: SOIL Sampled: 09 SEP 88 Received: 13 SEP 88
Authorized: 13 SEP 88 Prepared: 14 SEP 88 Analyzed: 22 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
1-Chloronaphthalene	ND	mg/kg	2.5
3-Methylcholanthrene	ND	mg/kg	2.5
N-Nitrosodiphenylamine	ND	mg/kg	0.50
2-Methylphenol	ND	mg/kg	0.50
2,3,4,6-Tetrachlorophenol	ND	mg/kg	2.5
Acetophenone	ND	mg/kg	0.50
4-Nitroaniline	ND	mg/kg	2.5
1-Naphthylamine	ND	mg/kg	2.5
a,a-Dimethylphenethylamine	ND	mg/kg	--
Benzidine	ND	mg/kg	5.6
2-Naphthylamine	ND	mg/kg	2.5
Benzoic acid	ND	mg/kg	2.5
4-Chloroaniline	ND	mg/kg	1.0
Benzyl alcohol	ND	mg/kg	1.0
N-Nitrosopiperidine	ND	mg/kg	2.5
Pentachlorobenzene	ND	mg/kg	2.5
Pronamide	ND	mg/kg	2.5
Methyl methanesulfonate	ND	mg/kg	2.5
N-Nitrosodimethylamine	ND	mg/kg	2.5
1,2,4,5-Tetrachlorobenzene	ND	mg/kg	2.5
N-Nitrosodi-n-butylamine	ND	mg/kg	2.5
2-Nitroaniline	ND	mg/kg	2.5
4-Methylphenol	ND	mg/kg	0.50
Aniline	ND	mg/kg	2.5
Diphenylamine	ND	mg/kg	2.5
Dibenz(a,j)acridine	ND	mg/kg	--
2-Picoline	ND	mg/kg	2.5
1,2-Diphenylhydrazine	ND	mg/kg	2.5
Phenacetin	ND	mg/kg	2.5
p-Dimethylaminoazobenzene	ND	mg/kg	2.5
2,6-Dichlorophenol	ND	mg/kg	2.5
3-Nitroaniline	ND	mg/kg	2.5
Pentachloronitrobenzene	ND	mg/kg	2.5
2-Methylnaphthalene	ND	mg/kg	0.50
Ethyl methanesulfonate	ND	mg/kg	2.5
7,12-Dimethylbenzanthracene	ND	mg/kg	2.5
Dibenzofuran	ND	mg/kg	0.50
4-Aminobiphenyl	ND	mg/kg	2.5
Phenol	ND	mg/kg	0.50

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0103
Lab ID: 001639-0001-SA Enseco ID: 1013386
Matrix: SOIL Sampled: 09 SEP 88 Received: 13 SEP 88
Authorized: 13 SEP 88 Prepared: 14 SEP 88 Analyzed: 22 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
bis(2-Chloroethyl)ether	ND	mg/kg	0.50
2-Chlorophenol	ND	mg/kg	0.50
1,3-Dichlorobenzene	ND	mg/kg	0.50
1,4-Dichlorobenzene	ND	mg/kg	0.50
1,2-Dichlorobenzene	ND	mg/kg	0.50
bis(2-Chloroisopropyl) ether	ND	mg/kg	0.50
N-Nitroso-di-n-propylamine	ND	mg/kg	0.50
Hexachloroethane	ND	mg/kg	0.50
Nitrobenzene	ND	mg/kg	0.50
Isophorone	ND	mg/kg	0.50
2-Nitrophenol	ND	mg/kg	0.50
2,4-Dimethylphenol	ND	mg/kg	0.50
bis(2-Chloroethoxy) methane	ND	mg/kg	0.50
2,4-Dichlorophenol	ND	mg/kg	0.50
1,2,4-Trichlorobenzene	ND	mg/kg	0.50
Naphthalene	ND	mg/kg	0.50
Hexachlorobutadiene	ND	mg/kg	0.50
4-Chloro-3-methylphenol	ND	mg/kg	0.50
2,4,6-Trichlorophenol	ND	mg/kg	0.50
2,4,5-Trichlorophenol	ND	mg/kg	1.5
2-Chloronaphthalene	ND	mg/kg	0.50
Dimethyl phthalate	ND	mg/kg	0.50
Acenaphthylene	ND	mg/kg	0.50
Acenaphthene	ND	mg/kg	0.50
2,4-Dinitrophenol	ND	mg/kg	1.5
4-Nitrophenol	ND	mg/kg	2.5
2,4-Dinitrotoluene	ND	mg/kg	0.50
2,6-Dinitrotoluene	ND	mg/kg	0.50
Diethyl phthalate	ND	mg/kg	0.50
4-Chlorophenyl phenyl ether	ND	mg/kg	0.50
Fluorene	ND	mg/kg	0.50
4,6-Dinitro-2-methylphenol	ND	mg/kg	1.5
4-Bromophenyl phenyl ether	ND	mg/kg	0.50
Hexachlorobenzene	ND	mg/kg	0.50
Pentachlorophenol	ND	mg/kg	1.5
Phenanthrene	ND	mg/kg	0.50

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0103
Lab ID: 001639-0001-SA Enseco ID: 1013386
Matrix: SOIL Sampled: 09 SEP 88 Received: 13 SEP 88
Authorized: 13 SEP 88 Prepared: 14 SEP 88 Analyzed: 22 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Anthracene	ND	mg/kg	0.50
Di-n-butyl phthalate	ND	mg/kg	0.50
Fluoranthene	ND	mg/kg	0.50
Pyrene	ND	mg/kg	0.50
Butyl benzyl phthalate	ND	mg/kg	0.50
3,3'-Dichlorobenzidine	ND	mg/kg	1.0
Benzo(a)anthracene	ND	mg/kg	0.50
bis(2-Ethylhexyl) phthalate	ND	mg/kg	0.50
Chrysene	ND	mg/kg	0.50
Di-n-octyl phthalate	ND	mg/kg	0.50
Benzo(b)fluoranthene	ND	mg/kg	0.50
Benzo(k)fluoranthene	ND	mg/kg	0.50
Benzo(a)pyrene	ND	mg/kg	0.50
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	0.50
Dibenzo(a,h)anthracene	ND	mg/kg	0.50
Benzo(g,h,i)perylene	ND	mg/kg	0.50
Nitrobenzene-d5	64.6	%	--
2-Fluorobiphenyl	59.8	%	--
Terphenyl-d14	64.4	%	--
Phenol-d5	62.8	%	--
2-Fluorophenol	63.9	%	--
2,4,6-Tribromophenol	75.5	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

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TENTATIVELY IDENTIFIED COMPOUNDS

FOR

WOODWARD-CLYDE CONSULTANTS

SAMPLE NUMBER 001639-0001

Compound Name	Fraction	Confidence Level	Estimated Concentration mg/kg
Oxygenated Hydrocarbon	BNA	1C	49.
2-Hexanone, 5-Methyl-	BNA	2I	2.3

NOTES:

Confidence Levels

Level 3 - Confirmed Identification
Level 2 - Confident Identification
Level 1 - Tentative Identification

Qualifiers

I - Isomer
C - Class

Please refer to the discussion for further details.

Enseco

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0103
Lab ID: 001639-0001-SA Enseco ID: 1013386
Matrix: SOIL Sampled: 09 SEP 88 Received: 13 SEP 88
Authorized: 13 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/kg	10	239.1	10 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Hand Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
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Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0103
Lab ID: 001639-0001-SA
Matrix: SOIL
Authorized: 13 SEP 88
Enseco ID: 1013386
Sampled: 09 SEP 88
Prepared: NA
Received: 13 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	75.0	%	0.1	160.3	30 SEP 88
Total Petroleum Hydrocarbons	ND	mg/kg	50	3550/418.1 Mod.	27 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Kurt Ill
Approved By: Kimberly Conroy

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SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
001915-0001-SA	R-FT-0105	AQUEOUS	30 SEP 88	14:00	02 OCT 88
001915-0002-SA	R-FT-0106	AQUEOUS	30 SEP 88	14:00	02 OCT 88

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0105
Lab ID: 001915-0001-SA
Matrix: AQUEOUS
Authorized: 02 OCT 88

Enseco ID: 1015346
Sampled: 30 SEP 88
Prepared: NA

Received: 02 OCT 88
Analyzed: 04 OCT 88

Parameter	Result	Units	Reporting Limit
Benzene	4.4	ug/L	0.70
Toluene	ND	ug/L	1.0
Chlorobenzene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0
1,3-Dichlorobenzene	ND	ug/L	2.0
1,2-Dichlorobenzene	ND	ug/L	2.0
1,4-Dichlorobenzene	ND	ug/L	0.50

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy

Approved By: Kathy Humphreys

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Rev 230787

Enseco

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0105
Lab ID: 001915-0001-SA Enseco ID: 1015346
Matrix: AQUEOUS Sampled: 30 SEP 88 Received: 02 OCT 88
Authorized: 02 OCT 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Chemical Oxygen Demand (Regular)	40	mg/L	20	410.4	12 OCT 88
Dissolved Organic Carbon	16	mg/L	0.1	415.1	07 OCT 88
Ammonia as N	ND	mg/L	0.1	350.1	15 OCT 88
Nitrite as N	ND	mg/L	0.01	353.2	03 OCT 88
Nitrate as N	ND	mg/L	0.1	353.2	06 OCT 88
Orthophosphate as P	0.05	mg/L	0.01	365.3	03 OCT 88
Organic Nitrogen as N	1.2	mg/L	0.1	351.2/350.1	21 OCT 88
Sulfide, Total	ND	mg/L	0.05	376.2	04 OCT 88
Total Kjeldahl Nitrogen as N	1.2	mg/L	0.1	351.2	19 OCT 88
Total Organic Carbon	16	mg/L	0.1	415.1	13 OCT 88
Phosphorous, Total as P	0.69	mg/L	0.01	365.3	03 OCT 88
Total Petroleum Hydrocarbons	ND	mg/L	0.5	EPA 418.1	19 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Pam Rosas Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0106
Lab ID: 001915-0002-SA
Matrix: AQUEOUS
Authorized: 02 OCT 88

Enseco ID: 1015347
Sampled: 30 SEP 88
Prepared: NA

Received: 02 OCT 88
Analyzed: 04 OCT 88

Parameter	Result	Units	Reporting Limit
Benzene	6.7	ug/L	0.70
Toluene	ND	ug/L	1.0
Chlorobenzene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0
1,3-Dichlorobenzene	ND	ug/L	2.0
1,2-Dichlorobenzene	ND	ug/L	2.0
1,4-Dichlorobenzene	ND	ug/L	0.50

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy

Approved By: Kathy Humphreys

The cover letter is an integral part of this report.
Rev 230787

Enseco

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0106
Lab ID: 001915-0002-SA Enseco ID: 1015347
Matrix: AQUEOUS Sampled: 30 SEP 88 Received: 02 OCT 88
Authorized: 02 OCT 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Chemical Oxygen Demand (Regular)	60	mg/L	20	410.4	12 OCT 88
Dissolved Organic Carbon	18	mg/L	0.1	415.1	07 OCT 88
Ammonia as N	ND	mg/L	0.1	350.1	15 OCT 88
Nitrite as N	ND	mg/L	0.01	353.2	03 OCT 88
Nitrate as N	ND	mg/L	0.1	353.2	06 OCT 88
Orthophosphate as P	ND	mg/L	0.01	365.3	03 OCT 88
Organic Nitrogen as N	0.9	mg/L	0.1	351.2/350.1	21 OCT 88
Sulfide, Total	ND	mg/L	0.05	376.2	04 OCT 88
Total Kjeldahl Nitrogen as N	0.9	mg/L	0.1	351.2	19 OCT 88
Total Organic Carbon	16	mg/L	0.1	415.1	13 OCT 88
Phosphorous, Total as P	0.32	mg/L	0.01	365.3	03 OCT 88
Total Petroleum Hydrocarbons	ND	mg/L	0.5	EPA 418.1	19 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Pam Rosas Approved By: Kimberly Conroy

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SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
001656-0001-SA	R-FT-0201	SOIL	12 SEP 88		14 SEP 88
001656-0002-SA	R-FT-0202	SOIL	12 SEP 88		14 SEP 88
001656-0003-SA	~~W-LF-0101~~	AQUEOUS	12 SEP 88	19:05	14 SEP 88
001656-0004-SA	~~W-LF-0102~~	AQUEOUS	12 SEP 88	19:05	14 SEP 88
001656-0005-SA	~~W-BP-0201~~	AQUEOUS	11 SEP 88		14 SEP 88
001656-0006-SA	~~W-BP-0301~~	AQUEOUS	11 SEP 88		14 SEP 88
001656-0007-SA	~~TRIP BLANK~~	AQUEOUS	11 SEP 88		14 SEP 88

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0201
Lab ID: 001656-0001-SA Enseco ID: 1013428
Matrix: SOIL Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 15 SEP 88 Analyzed: 20 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	0.10
1,1,1-Trichloroethane	ND	mg/kg	0.10
Bromodichloromethane	ND	mg/kg	0.10
Carbon tetrachloride	ND	mg/kg	0.10
1,1,2-Trichloroethane	ND	mg/kg	0.10
2-Butanone	ND	mg/kg	0.20
Benzene	ND	mg/kg	0.10
trans-1,3-Dichloropropene	ND	mg/kg	0.10
1,2-Dichloropropane	ND	mg/kg	0.10
1,2-Dichloroethane	ND	mg/kg	0.10
1,1,2,2-Tetrachloroethane	ND	mg/kg	0.10
2-Chloroethyl vinyl ether	ND	mg/kg	0.50
Bromoform	ND	mg/kg	0.10
Ethyl benzene	ND	mg/kg	0.10
Tetrachloroethene	ND	mg/kg	0.10
Chlorobenzene	ND	mg/kg	0.10
4-Methyl-2-pentanone	ND	mg/kg	0.10
Toluene	ND	mg/kg	0.10
cis-1,3-Dichloropropene	ND	mg/kg	0.10
Vinyl chloride	ND	mg/kg	0.10
Trichlorofluoromethane	ND	mg/kg	0.10
Chloroethane	ND	mg/kg	0.10
Acetone	ND	mg/kg	0.10
Methylene chloride	ND	mg/kg	0.10
Carbon disulfide	ND	mg/kg	0.10
1,1-Dichloroethene	ND	mg/kg	0.10
1,1-Dichloroethane	ND	mg/kg	0.10
trans-1,2-Dichloroethene	ND	mg/kg	0.10
Chloroform	ND	mg/kg	0.10
Bromomethane (Methylbromide)	ND	mg/kg	0.10
Trichloroethene	ND	mg/kg	0.10
Chlorodibromomethane	ND	mg/kg	0.10
Total xylenes	ND	mg/kg	0.10
Acrolein	ND	mg/kg	0.10
Acrylonitrile	ND	mg/kg	0.10
Dibromomethane	ND	mg/kg	0.10
Dichlorodifluoromethane	ND	mg/kg	0.10
Ethanol	ND	mg/kg	0.20
Ethyl methacrylate	ND	mg/kg	0.10
2-Hexanone	ND	mg/kg	0.10
Iodomethane	ND	mg/kg	0.10

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley Approved By: Jeff Lowry

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Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0201
Lab ID: 001656-0001-SA
Matrix: SOIL
Authorized: 14 SEP 88

Enseco ID: 1013428
Sampled: 12 SEP 88
Prepared: 15 SEP 88

Received: 14 SEP 88
Analyzed: 20 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	0.10
1,2,3-Trichloropropane	ND	mg/kg	0.10
Vinyl acetate	ND	mg/kg	0.30
trans-1,4-Dichloro-2-butene	ND	mg/kg	0.10
Toluene-d8	107	%	--
4-Bromofluorobenzene (BFB)	76.0	%	--
1,2-Dichloroethane-d4	94.2	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley

Approved By: Jeff Lowry

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Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0201
Lab ID: 001656-0001-SA Enseco ID: 1013428
Matrix: SOIL Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 17 SEP 88 Analyzed: 23 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
1-Chloronaphthalene	ND	mg/kg	2.5
3-Methylcholanthrene	ND	mg/kg	2.5
N-Nitrosodiphenylamine	ND	mg/kg	0.50
Hexachlorocyclopentadiene	ND	mg/kg	0.50
2-Methylphenol	ND	mg/kg	0.50
2,3,4,6-Tetrachlorophenol	ND	mg/kg	2.5
Acetophenone	ND	mg/kg	0.50
4-Nitroaniline	ND	mg/kg	2.5
1-Naphthylamine	ND	mg/kg	2.5
a,a-Dimethylphen-ethylamine	ND	mg/kg	--
Benzidine	ND	mg/kg	5.6
2-Naphthylamine	ND	mg/kg	2.5
Benzoic acid	ND	mg/kg	2.5
4-Chloroaniline	ND	mg/kg	1.0
Benzyl alcohol	ND	mg/kg	1.0
N-Nitrosopiperidine	ND	mg/kg	2.5
Pentachlorobenzene	ND	mg/kg	2.5
Pronamide	ND	mg/kg	2.5
Methyl methanesulfonate	ND	mg/kg	2.5
N-Nitrosodimethylamine	ND	mg/kg	2.5
1,2,4,5-Tetrachloro-benzene	ND	mg/kg	2.5
N-Nitrosodi-n-butylamine	ND	mg/kg	2.5
2-Nitroaniline	ND	mg/kg	2.5
4-Methylphenol	ND	mg/kg	0.50
Aniline	ND	mg/kg	2.5
Diphenylamine	ND	mg/kg	2.5
Dibenz(a,j)acridine	ND	mg/kg	--
2-Picoline	ND	mg/kg	2.5
1,2-Diphenylhydrazine	ND	mg/kg	2.5
Phenacetin	ND	mg/kg	2.5
p-Dimethylaminoazobenzene	ND	mg/kg	2.5
2,6-Dichlorophenol	ND	mg/kg	2.5
3-Nitroaniline	ND	mg/kg	2.5
Pentachloronitrobenzene	ND	mg/kg	2.5
2-Methylnaphthalene	ND	mg/kg	0.50
Ethyl methanesulfonate	ND	mg/kg	2.5
7,12-Dimethylbenz-anthracene	ND	mg/kg	2.5
Dibenzofuran	ND	mg/kg	0.50
4-Aminobiphenyl	ND	mg/kg	2.5

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

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Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0201
Lab ID: 001656-0001-SA Enseco ID: 1013428
Matrix: SOIL Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 17 SEP 88 Analyzed: 23 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenol	ND	mg/kg	0.50
bis(2-Chloroethyl)ether	ND	mg/kg	0.50
2-Chlorophenol	ND	mg/kg	0.50
1,3-Dichlorobenzene	ND	mg/kg	0.50
1,4-Dichlorobenzene	ND	mg/kg	0.50
1,2-Dichlorobenzene	ND	mg/kg	0.50
bis(2-Chloroisopropyl) ether	ND	mg/kg	0.50
N-Nitroso-di-n-propylamine	ND	mg/kg	0.50
Hexachloroethane	ND	mg/kg	0.50
Nitrobenzene	ND	mg/kg	0.50
Isophorone	ND	mg/kg	0.50
2-Nitrophenol	ND	mg/kg	0.50
2,4-Dimethylphenol	ND	mg/kg	0.50
bis(2-Chloroethoxy) methane	ND	mg/kg	0.50
2,4-Dichlorophenol	ND	mg/kg	0.50
1,2,4-Trichlorobenzene	ND	mg/kg	0.50
Naphthalene	ND	mg/kg	0.50
Hexachlorobutadiene	ND	mg/kg	0.50
4-Chloro-3-methylphenol	ND	mg/kg	0.50
2,4,6-Trichlorophenol	ND	mg/kg	0.50
2,4,5-Trichlorophenol	ND	mg/kg	1.5
2-Chloronaphthalene	ND	mg/kg	0.50
Dimethyl phthalate	ND	mg/kg	0.50
Acenaphthylene	ND	mg/kg	0.50
Acenaphthene	ND	mg/kg	0.50
2,4-Dinitrophenol	ND	mg/kg	1.5
4-Nitrophenol	ND	mg/kg	2.5
2,4-Dinitrotoluene	ND	mg/kg	0.50
2,6-Dinitrotoluene	ND	mg/kg	0.50
Diethyl phthalate	ND	mg/kg	0.50
4-Chlorophenyl phenyl ether	ND	mg/kg	0.50
Fluorene	ND	mg/kg	0.50
4,6-Dinitro-2-methylphenol	ND	mg/kg	1.5
4-Bromophenyl phenyl ether	ND	mg/kg	0.50
Hexachlorobenzene	ND	mg/kg	0.50
Pentachlorophenol	ND	mg/kg	1.5

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

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Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0201
Lab ID: 001656-0001-SA Enseco ID: 1013428
Matrix: SOIL Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 17 SEP 88 Analyzed: 23 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenanthrene	ND	mg/kg	0.50
Anthracene	ND	mg/kg	0.50
Di-n-butyl phthalate	ND	mg/kg	0.50
Fluoranthene	ND	mg/kg	0.50
Pyrene	ND	mg/kg	0.50
Butyl benzyl phthalate	ND	mg/kg	0.50
3,3'-Dichlorobenzidine	ND	mg/kg	1.0
Benzo(a)anthracene	ND	mg/kg	0.50
bis(2-Ethylhexyl) phthalate	ND	mg/kg	0.50
Chrysene	ND	mg/kg	0.50
Di-n-octyl phthalate	ND	mg/kg	0.50
Benzo(b)fluoranthene	ND	mg/kg	0.50
Benzo(k)fluoranthene	ND	mg/kg	0.50
Benzo(a)pyrene	ND	mg/kg	0.50
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	0.50
Dibenzo(a,h)anthracene	ND	mg/kg	0.50
Benzo(g,h,i)perylene	ND	mg/kg	0.50
Nitrobenzene-d5	65.0	%	--
2-Fluorobiphenyl	70.0	%	--
Terphenyl-d14	74.6	%	--
Phenol-d5	67.9	%	--
2-Fluorophenol	68.3	%	--
2,4,6-Tribromophenol	82.2	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

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TENTATIVELY IDENTIFIED COMPOUNDS

FOR

WOODWARD-CLYDE

SAMPLE NUMBER 001656-0001

Compound Name	Fraction	Confidence Level	Estimated Concentration mg/kg
Saturated Hydrocarbon	BNA	1C	4.9
Saturated Hydrocarbon	BNA	1C	2.7
Saturated Hydrocarbon	BNA	1C	7.9
Saturated Hydrocarbon	BNA	2C	5.4
Hexadecane	BNA	2	2.7
Saturated Hydrocarbon	BNA	1C	3.8
Saturated Hydrocarbon	BNA	2C	5.7

NOTES:

Confidence Levels

Level 3 - Confirmed Identification
Level 2 - Confident Identification
Level 1 - Tentative Identification

Qualifiers

I - Isomer
C - Class

Please refer to the discussion for further details.

Enseco

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0201
Lab ID: 001656-0001-SA
Matrix: SOIL
Authorized: 14 SEP 88
Enseco ID: 1013428
Sampled: 12 SEP 88
Prepared: 05 OCT 88
Received: 14 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/kg	10	239.1	10 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Hand

Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
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Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0201
Lab ID: 001656-0001-SA
Matrix: SOIL
Authorized: 14 SEP 88

Enseco ID: 1013428
Sampled: 12 SEP 88
Prepared: NA

Received: 14 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	84.0	%	0.1	160.3	30 SEP 88
Total Petroleum Hydrocarbons	ND	mg/kg	50	3550/418.1 Mod.	22 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Roger Freize

Approved By: Roger Freize

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Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0202
Lab ID: 001656-0002-SA Enseco ID: 1013429
Matrix: SOIL Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 15 SEP 88 Analyzed: 20 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	0.10
1,1,1-Trichloroethane	ND	mg/kg	0.10
Bromodichloromethane	ND	mg/kg	0.10
Carbon tetrachloride	ND	mg/kg	0.10
1,1,2-Trichloroethane	ND	mg/kg	0.10
2-Butanone	ND	mg/kg	0.20
Benzene	ND	mg/kg	0.10
trans-1,3-Dichloropropene	ND	mg/kg	0.10
1,2-Dichloropropane	ND	mg/kg	0.10
1,2-Dichloroethane	ND	mg/kg	0.10
1,1,2,2-Tetrachloroethane	ND	mg/kg	0.10
2-Chloroethyl vinyl ether	ND	mg/kg	0.50
Bromoform	ND	mg/kg	0.10
Ethyl benzene	ND	mg/kg	0.10
Tetrachloroethene	ND	mg/kg	0.10
Chlorobenzene	ND	mg/kg	0.10
4-Methyl-2-pentanone	ND	mg/kg	0.10
Toluene	ND	mg/kg	0.10
cis-1,3-Dichloropropene	ND	mg/kg	0.10
Vinyl chloride	ND	mg/kg	0.10
Trichlorofluoromethane	ND	mg/kg	0.10
Chloroethane	ND	mg/kg	0.10
Acetone	ND	mg/kg	0.10
Methylene chloride	ND	mg/kg	0.10
Carbon disulfide	ND	mg/kg	0.10
1,1-Dichloroethene	ND	mg/kg	0.10
1,1-Dichloroethane	ND	mg/kg	0.10
trans-1,2-Dichloroethene	ND	mg/kg	0.10
Chloroform	ND	mg/kg	0.10
Bromomethane (Methylbromide)	ND	mg/kg	0.10
Trichloroethene	ND	mg/kg	0.10
Chlorodibromomethane	ND	mg/kg	0.10
Total xylenes	ND	mg/kg	0.10
Acrolein	ND	mg/kg	0.10
Acrylonitrile	ND	mg/kg	0.10
Dibromomethane	ND	mg/kg	0.10
Dichlorodifluoromethane	ND	mg/kg	0.10
Ethanol	ND	mg/kg	0.20
Ethyl methacrylate	ND	mg/kg	0.10
2-Hexanone	ND	mg/kg	0.10
Iodomethane	ND	mg/kg	0.10

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0202
Lab ID: 001656-0002-SA
Matrix: SOIL
Authorized: 14 SEP 88

Enseco ID: 1013429
Sampled: 12 SEP 88
Prepared: 15 SEP 88

Received: 14 SEP 88
Analyzed: 20 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	0.10
1,2,3-Trichloropropane	ND	mg/kg	0.10
Vinyl acetate	ND	mg/kg	0.30
trans-1,4-Dichloro-2-butene	ND	mg/kg	0.10
Toluene-d8	104	%	--
4-Bromofluorobenzene (BFB)	78.4	%	--
1,2-Dichloroethane-d4	96.6	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley

Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0202
Lab ID: 001656-0002-SA Enseco ID: 1013429
Matrix: SOIL Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 17 SEP 88 Analyzed: 23 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
1-Chloronaphthalene	ND	mg/kg	2.5
3-Methylcholanthrene	ND	mg/kg	2.5
N-Nitrosodiphenylamine	ND	mg/kg	0.50
Hexachlorocyclopentadiene	ND	mg/kg	0.50
2-Methylphenol	ND	mg/kg	0.50
2,3,4,6-Tetrachlorophenol	ND	mg/kg	2.5
Acetophenone	ND	mg/kg	0.50
4-Nitroaniline	ND	mg/kg	2.5
1-Naphthylamine	ND	mg/kg	2.5
a,a-Dimethylphen-ethylamine	ND	mg/kg	--
Benzidine	ND	mg/kg	5.6
2-Naphthylamine	ND	mg/kg	2.5
Benzoic acid	ND	mg/kg	2.5
4-Chloroaniline	ND	mg/kg	1.0
Benzyl alcohol	ND	mg/kg	1.0
N-Nitrosopiperidine	ND	mg/kg	2.5
Pentachlorobenzene	ND	mg/kg	2.5
Pronamide	ND	mg/kg	2.5
Methyl methanesulfonate	ND	mg/kg	2.5
N-Nitrosodimethylamine	ND	mg/kg	2.5
1,2,4,5-Tetrachloro-benzene	ND	mg/kg	2.5
N-Nitrosodi-n-butylamine	ND	mg/kg	2.5
2-Nitroaniline	ND	mg/kg	2.5
4-Methylphenol	ND	mg/kg	0.50
Aniline	ND	mg/kg	2.5
Diphenylamine	ND	mg/kg	2.5
Dibenz(a,j)acridine	ND	mg/kg	--
2-Picoline	ND	mg/kg	2.5
1,2-Diphenylhydrazine	ND	mg/kg	2.5
Phenacetin	ND	mg/kg	2.5
p-Dimethylaminoazobenzene	ND	mg/kg	2.5
2,6-Dichlorophenol	ND	mg/kg	2.5
3-Nitroaniline	ND	mg/kg	2.5
Pentachloronitrobenzene	ND	mg/kg	2.5
2-Methylnaphthalene	ND	mg/kg	0.50
Ethyl methanesulfonate	ND	mg/kg	2.5
7,12-Dimethylbenz-anthracene	ND	mg/kg	2.5
Dibenzofuran	ND	mg/kg	0.50
4-Aminobiphenyl	ND	mg/kg	2.5

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0202
Lab ID: 001656-0002-SA Enseco ID: 1013429
Matrix: SOIL Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 17 SEP 88 Analyzed: 23 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenol	ND	mg/kg	0.50
bis(2-Chloroethyl)ether	ND	mg/kg	0.50
2-Chlorophenol	ND	mg/kg	0.50
1,3-Dichlorobenzene	ND	mg/kg	0.50
1,4-Dichlorobenzene	ND	mg/kg	0.50
1,2-Dichlorobenzene	ND	mg/kg	0.50
bis(2-Chloroisopropyl) ether	ND	mg/kg	0.50
N-Nitroso-di-n-propylamine	ND	mg/kg	0.50
Hexachloroethane	ND	mg/kg	0.50
Nitrobenzene	ND	mg/kg	0.50
Isophorone	ND	mg/kg	0.50
2-Nitrophenol	ND	mg/kg	0.50
2,4-Dimethylphenol	ND	mg/kg	0.50
bis(2-Chloroethoxy) methane	ND	mg/kg	0.50
2,4-Dichlorophenol	ND	mg/kg	0.50
1,2,4-Trichlorobenzene	ND	mg/kg	0.50
Naphthalene	ND	mg/kg	0.50
Hexachlorobutadiene	ND	mg/kg	0.50
4-Chloro-3-methylphenol	ND	mg/kg	0.50
2,4,6-Trichlorophenol	ND	mg/kg	0.50
2,4,5-Trichlorophenol	ND	mg/kg	1.5
2-Chloronaphthalene	ND	mg/kg	0.50
Dimethyl phthalate	ND	mg/kg	0.50
Acenaphthylene	ND	mg/kg	0.50
Acenaphthene	ND	mg/kg	0.50
2,4-Dinitrophenol	ND	mg/kg	1.5
4-Nitrophenol	ND	mg/kg	2.5
2,4-Dinitrotoluene	ND	mg/kg	0.50
2,6-Dinitrotoluene	ND	mg/kg	0.50
Diethyl phthalate	ND	mg/kg	0.50
4-Chlorophenyl phenyl ether	ND	mg/kg	0.50
Fluorene	ND	mg/kg	0.50
4,6-Dinitro-2-methylphenol	ND	mg/kg	1.5
4-Bromophenyl phenyl ether	ND	mg/kg	0.50
Hexachlorobenzene	ND	mg/kg	0.50
Pentachlorophenol	ND	mg/kg	1.5

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0202
Lab ID: 001656-0002-SA Enseco ID: 1013429
Matrix: SOIL Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 17 SEP 88 Analyzed: 23 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenanthrene	ND	mg/kg	0.50
Anthracene	ND	mg/kg	0.50
Di-n-butyl phthalate	ND	mg/kg	0.50
Fluoranthene	ND	mg/kg	0.50
Pyrene	ND	mg/kg	0.50
Butyl benzyl phthalate	ND	mg/kg	0.50
3,3'-Dichlorobenzidine	ND	mg/kg	1.0
Benzo(a)anthracene	ND	mg/kg	0.50
bis(2-Ethylhexyl) phthalate	ND	mg/kg	0.50
Chrysene	ND	mg/kg	0.50
Di-n-octyl phthalate	ND	mg/kg	0.50
Benzo(b)fluoranthene	ND	mg/kg	0.50
Benzo(k)fluoranthene	ND	mg/kg	0.50
Benzo(a)pyrene	ND	mg/kg	0.50
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	0.50
Dibenzo(a,h)anthracene	ND	mg/kg	0.50
Benzo(g,h,i)perylene	ND	mg/kg	0.50
Nitrobenzene-d5	77.0	%	--
2-Fluorobiphenyl	77.2	%	--
Terphenyl-d14	76.4	%	--
Phenol-d5	74.3	%	--
2-Fluorophenol	78.9	%	--
2,4,6-Tribromophenol	98.1	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

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TENTATIVELY IDENTIFIED COMPOUNDS

FOR

WOODWARD-CLYDE

SAMPLE NUMBER 001656-0002

Compound Name	Fraction	Confidence Level	Estimated Concentration mg/kg
Ketone	BNA	1C	0.51
Unknown	BNA	--	0.54
Unknown	BNA	--	0.50

NOTES:

Confidence Levels

Level 3 - Confirmed Identification
Level 2 - Confident Identification
Level 1 - Tentative Identification

Qualifiers

I - Isomer
C - Class

Please refer to the discussion for further details.

Enseco

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0202
Lab ID: 001656-0002-SA
Matrix: SOIL
Authorized: 14 SEP 88
Enseco ID: 1013429
Sampled: 12 SEP 88
Prepared: 05 OCT 88
Received: 14 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/kg	10	239.1	10 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Hand

Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0202
Lab ID: 001656-0002-SA
Matrix: SOIL
Authorized: 14 SEP 88

Enseco ID: 1013429
Sampled: 12 SEP 88
Prepared: NA

Received: 14 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	90.0	%	0.1	160.3	30 SEP 88
Total Petroleum Hydrocarbons	ND	mg/kg	50	3550/418.1 Mod.	22 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Roger Freize

Approved By: Roger Freize

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SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
001669-0001-SA	R-FT-0301	SOIL	13 SEP 88	09:40	15 SEP 88
001669-0002-SA	R-FT-0302	SOIL	13 SEP 88	10:25	15 SEP 88
001669-0002-DU	R-FT-0302D	SOIL	13 SEP 88	10:25	15 SEP 88
001669-0003-SA	R-FT-0401	SOIL	13 SEP 88	10:25	15 SEP 88
001669-0004-SA	R-FT-0402	SOIL	13 SEP 88	10:25	15 SEP 88

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0301
Lab ID: 001669-0001-SA Enseco ID: 1013632
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 21 SEP 88 Analyzed: 27 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	0.10
1,1,1-Trichloroethane	ND	mg/kg	0.10
Bromodichloromethane	ND	mg/kg	0.10
Carbon tetrachloride	ND	mg/kg	0.10
1,1,2-Trichloroethane	ND	mg/kg	0.10
2-Butanone	ND	mg/kg	0.20
Benzene	ND	mg/kg	0.10
trans-1,3-Dichloropropene	ND	mg/kg	0.10
1,2-Dichloropropane	ND	mg/kg	0.10
1,2-Dichloroethane	ND	mg/kg	0.10
1,1,2,2-Tetrachloroethane	ND	mg/kg	0.10
2-Chloroethyl vinyl ether	ND	mg/kg	0.50
Bromoform	ND	mg/kg	0.10
Ethyl benzene	ND	mg/kg	0.10
Tetrachloroethene	ND	mg/kg	0.10
Chlorobenzene	ND	mg/kg	0.10
4-Methyl-2-pentanone	ND	mg/kg	0.10
Toluene	ND	mg/kg	0.10
cis-1,3-Dichloropropene	ND	mg/kg	0.10
Vinyl chloride	ND	mg/kg	0.10
Trichlorofluoromethane	ND	mg/kg	0.10
Chloroethane	ND	mg/kg	0.10
Acetone	ND	mg/kg	0.10
Methylene chloride	ND	mg/kg	0.10
Carbon disulfide	ND	mg/kg	0.10
1,1-Dichloroethene	ND	mg/kg	0.10
1,1-Dichloroethane	ND	mg/kg	0.10
trans-1,2-Dichloroethene	ND	mg/kg	0.10
Chloroform	ND	mg/kg	0.10
Bromomethane (Methylbromide)	ND	mg/kg	0.10
Trichloroethene	ND	mg/kg	0.10
Chlorodibromomethane	ND	mg/kg	0.10
Total xylenes	ND	mg/kg	0.10
Acrolein	ND	mg/kg	0.10
Acrylonitrile	ND	mg/kg	0.10
Dibromomethane	ND	mg/kg	0.10
Dichlorodifluoromethane	ND	mg/kg	0.10
Ethanol	ND	mg/kg	0.20
Ethyl methacrylate	ND	mg/kg	0.10
2-Hexanone	ND	mg/kg	0.10
Iodomethane	ND	mg/kg	0.10

ND=Not Detected
NA=Not Applicable

Reported By: Bob Martin Approved By: Jeff Lowry

The cover letter is an integral part of this report.
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Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0301
Lab ID: 001669-0001-SA Enseco ID: 1013632
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 21 SEP 88 Analyzed: 27 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	0.10
1,2,3-Trichloropropane	ND	mg/kg	0.10
Vinyl acetate	ND	mg/kg	0.30
trans-1,4-Dichloro-2-butene	ND	mg/kg	0.10
Toluene-d8	104	%	--
4-Bromofluorobenzene (BFB)	92.8	%	--
1,2-Dichloroethane-d4	93.0	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Bob Martin Approved By: Jeff Lowry

The cover letter is an integral part of this report.
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Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0301
Lab ID: 001669-0001-SA Enseco ID: 1013632
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
1-Chloronaphthalene	ND	mg/kg	2.5
3-Methylcholanthrene	ND	mg/kg	2.5
N-Nitrosodiphenylamine	ND	mg/kg	0.50
Hexachlorocyclopentadiene	ND	mg/kg	0.50
2-Methylphenol	ND	mg/kg	0.50
2,3,4,6-Tetrachlorophenol	ND	mg/kg	2.5
Acetophenone	ND	mg/kg	0.50
4-Nitroaniline	ND	mg/kg	2.5
1-Naphthylamine	ND	mg/kg	2.5
a,a-Dimethylphen-ethylamine	ND	mg/kg	--
Benzidine	ND	mg/kg	5.6
2-Naphthylamine	ND	mg/kg	2.5
Benzoic acid	ND	mg/kg	2.5
4-Chloroaniline	ND	mg/kg	1.0
Benzyl alcohol	ND	mg/kg	1.0
N-Nitrosopiperidine	ND	mg/kg	2.5
Pentachlorobenzene	ND	mg/kg	2.5
Pronamide	ND	mg/kg	2.5
Methyl methanesulfonate	ND	mg/kg	2.5
N-Nitrosodimethylamine	ND	mg/kg	2.5
1,2,4,5-Tetrachloro-benzene	ND	mg/kg	2.5
N-Nitrosodi-n-butylamine	ND	mg/kg	2.5
2-Nitroaniline	ND	mg/kg	2.5
4-Methylphenol	ND	mg/kg	0.50
Aniline	ND	mg/kg	2.5
Diphenylamine	ND	mg/kg	2.5
Dibenz(a,j)acridine	ND	mg/kg	--
2-Picoline	ND	mg/kg	2.5
1,2-Diphenylhydrazine	ND	mg/kg	2.5
Phenacetin	ND	mg/kg	2.5
p-Dimethylaminoazobenzene	ND	mg/kg	2.5
2,6-Dichlorophenol	ND	mg/kg	2.5
3-Nitroaniline	ND	mg/kg	2.5
Pentachloronitrobenzene	ND	mg/kg	2.5
2-Methylnaphthalene	ND	mg/kg	0.50
Ethyl methanesulfonate	ND	mg/kg	2.5
7,12-Dimethylbenz-anthracene	ND	mg/kg	2.5
Dibenzofuran	ND	mg/kg	0.50
4-Aminobiphenyl	ND	mg/kg	2.5

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0301
Lab ID: 001669-0001-SA Enseco ID: 1013632
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenol	ND	mg/kg	0.50
bis(2-Chloroethyl)ether	ND	mg/kg	0.50
2-Chlorophenol	ND	mg/kg	0.50
1,3-Dichlorobenzene	ND	mg/kg	0.50
1,4-Dichlorobenzene	ND	mg/kg	0.50
1,2-Dichlorobenzene	ND	mg/kg	0.50
bis(2-Chloroisopropyl) ether	ND	mg/kg	0.50
N-Nitroso-di-n-propylamine	ND	mg/kg	0.50
Hexachloroethane	ND	mg/kg	0.50
Nitrobenzene	ND	mg/kg	0.50
Isophorone	ND	mg/kg	0.50
2-Nitrophenol	ND	mg/kg	0.50
2,4-Dimethylphenol	ND	mg/kg	0.50
bis(2-Chloroethoxy) methane	ND	mg/kg	0.50
2,4-Dichlorophenol	ND	mg/kg	0.50
1,2,4-Trichlorobenzene	ND	mg/kg	0.50
Naphthalene	ND	mg/kg	0.50
Hexachlorobutadiene	ND	mg/kg	0.50
4-Chloro-3-methylphenol	ND	mg/kg	0.50
2,4,6-Trichlorophenol	ND	mg/kg	0.50
2,4,5-Trichlorophenol	ND	mg/kg	1.5
2-Chloronaphthalene	ND	mg/kg	0.50
Dimethyl phthalate	ND	mg/kg	0.50
Acenaphthylene	ND	mg/kg	0.50
Acenaphthene	ND	mg/kg	0.50
2,4-Dinitrophenol	ND	mg/kg	1.5
4-Nitrophenol	ND	mg/kg	2.5
2,4-Dinitrotoluene	ND	mg/kg	0.50
2,6-Dinitrotoluene	ND	mg/kg	0.50
Diethyl phthalate	ND	mg/kg	0.50
4-Chlorophenyl phenyl ether	ND	mg/kg	0.50
Fluorene	ND	mg/kg	0.50
4,6-Dinitro-2-methylphenol	ND	mg/kg	1.5
4-Bromophenyl phenyl ether	ND	mg/kg	0.50
Hexachlorobenzene	ND	mg/kg	0.50
Pentachlorophenol	ND	mg/kg	1.5

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0301
Lab ID: 001669-0001-SA
Matrix: SOIL
Authorized: 16 SEP 88

Enseco ID: 1013632
Sampled: 13 SEP 88
Prepared: 19 SEP 88

Received: 15 SEP 88
Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenanthrene	ND	mg/kg	0.50
Anthracene	ND	mg/kg	0.50
Di-n-butyl phthalate	ND	mg/kg	0.50
Fluoranthene	ND	mg/kg	0.50
Pyrene	ND	mg/kg	0.50
Butyl benzyl phthalate	ND	mg/kg	0.50
3,3'-Dichlorobenzidine	ND	mg/kg	1.0
Benzo(a)anthracene	ND	mg/kg	0.50
bis(2-Ethylhexyl) phthalate	ND	mg/kg	0.50
Chrysene	ND	mg/kg	0.50
Di-n-octyl phthalate	ND	mg/kg	0.50
Benzo(b)fluoranthene	ND	mg/kg	0.50
Benzo(k)fluoranthene	ND	mg/kg	0.50
Benzo(a)pyrene	ND	mg/kg	0.50
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	0.50
Dibenzo(a,h)anthracene	ND	mg/kg	0.50
Benzo(g,h,i)perylene	ND	mg/kg	0.50
Nitrobenzene-d5	80.0	%	--
2-Fluorobiphenyl	71.0	%	--
Terphenyl-d14	83.6	%	--
Phenol-d5	70.6	%	--
2-Fluorophenol	85.8	%	--
2,4,6-Tribromophenol	86.2	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling

Approved By: Jeff Lowry

The cover letter is an integral part of this report.

Enseco

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0301
Lab ID: 001669-0001-SA Enseco ID: 1013632
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 11 OCT 88 Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/kg	10	239.1	15 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
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Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0301
Lab ID: 001669-0001-SA
Matrix: SOIL
Authorized: 16 SEP 88

Enseco ID: 1013632
Sampled: 13 SEP 88
Prepared: NA

Received: 15 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	92.7	%	0.1	160.3	04 OCT 88
Total Petroleum Hydrocarbons	ND	mg/kg	50	3550/418.1 Mod.	20 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Roger Freize

Approved By: Roger Freize

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0302
Lab ID: 001669-0002-SA Enseco ID: 1013633
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 21 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	2.5
1,1,1-Trichloroethane	ND	mg/kg	2.5
Bromodichloromethane	ND	mg/kg	2.5
Carbon tetrachloride	ND	mg/kg	2.5
1,1,2-Trichloroethane	ND	mg/kg	2.5
2-Butanone	ND	mg/kg	5.0
Benzene	ND	mg/kg	2.5
trans-1,3-Dichloropropene	ND	mg/kg	2.5
1,2-Dichloropropane	ND	mg/kg	2.5
1,2-Dichloroethane	ND	mg/kg	2.5
1,1,2,2-Tetrachloroethane	ND	mg/kg	2.5
2-Chloroethyl vinyl ether	ND	mg/kg	12
Bromoform	ND	mg/kg	2.5
Ethyl benzene	ND	mg/kg	2.5
Tetrachloroethene	ND	mg/kg	2.5
Chlorobenzene	ND	mg/kg	2.5
4-Methyl-2-pentanone	ND	mg/kg	2.5
Toluene	ND	mg/kg	2.5
cis-1,3-Dichloropropene	ND	mg/kg	2.5
Vinyl chloride	ND	mg/kg	2.5
Trichlorofluoromethane	ND	mg/kg	2.5
Chloroethane	ND	mg/kg	2.5
Acetone	ND	mg/kg	2.5
Methylene chloride	ND	mg/kg	2.5
Carbon disulfide	ND	mg/kg	2.5
1,1-Dichloroethene	ND	mg/kg	2.5
1,1-Dichloroethane	ND	mg/kg	2.5
trans-1,2-Dichloroethene	ND	mg/kg	2.5
Chloroform	ND	mg/kg	2.5
Bromomethane (Methylbromide)	ND	mg/kg	2.5
Trichloroethene	ND	mg/kg	2.5
Chlorodibromomethane	ND	mg/kg	2.5
Total xylenes	ND	mg/kg	2.5
Acrolein	ND	mg/kg	2.5
Acrylonitrile	ND	mg/kg	2.5
Dibromomethane	ND	mg/kg	2.5
Dichlorodifluoromethane	ND	mg/kg	2.5
Ethanol	ND	mg/kg	5.0
Ethyl methacrylate	ND	mg/kg	2.5
2-Hexanone	ND	mg/kg	2.5
Iodomethane	ND	mg/kg	2.5

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Cornell Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0302
Lab ID: 001669-0002-SA
Matrix: SOIL
Authorized: 16 SEP 88

Enseco ID: 1013633
Sampled: 13 SEP 88
Prepared: 21 SEP 88

Received: 15 SEP 88
Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	2.5
1,2,3-Trichloropropane	ND	mg/kg	2.5
Vinyl acetate	ND	mg/kg	7.5
trans-1,4-Dichloro-2-butene	ND	mg/kg	2.5
Toluene-d8	75.4	%	
4-Bromofluorobenzene (BFB)	97.1	%	
1,2-Dichloroethane-d4	102	%	

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Cornell

Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0302
Lab ID: 001669-0002-SA Enseco ID: 1013633
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
1-Chloronaphthalene	ND	mg/kg	2.5
3-Methylcholanthrene	ND	mg/kg	2.5
N-Nitrosodiphenylamine	ND	mg/kg	0.50
Hexachlorocyclopentadiene	ND	mg/kg	0.50
2-Methylphenol	ND	mg/kg	0.50
2,3,4,6-Tetrachlorophenol	ND	mg/kg	2.5
Acetophenone	ND	mg/kg	0.50
4-Nitroaniline	ND	mg/kg	2.5
1-Naphthylamine	ND	mg/kg	2.5
a,a-Dimethylphenethylamine	ND	mg/kg	--
Benzidine	ND	mg/kg	5.6
2-Naphthylamine	ND	mg/kg	2.5
Benzoic acid	ND	mg/kg	2.5
4-Chloroaniline	ND	mg/kg	1.0
Benzyl alcohol	ND	mg/kg	1.0
N-Nitrosopiperidine	ND	mg/kg	2.5
Pentachlorobenzene	ND	mg/kg	2.5
Pronamide	ND	mg/kg	2.5
Methyl methanesulfonate	ND	mg/kg	2.5
N-Nitrosodimethylamine	ND	mg/kg	2.5
1,2,4,5-Tetrachlorobenzene	ND	mg/kg	2.5
N-Nitrosodi-n-butylamine	ND	mg/kg	2.5
2-Nitroaniline	ND	mg/kg	2.5
4-Methylphenol	ND	mg/kg	0.50
Aniline	ND	mg/kg	2.5
Diphenylamine	ND	mg/kg	2.5
Dibenz(a,j)acridine	ND	mg/kg	--
2-Picoline	ND	mg/kg	2.5
1,2-Diphenylhydrazine	ND	mg/kg	2.5
Phenacetin	ND	mg/kg	2.5
p-Dimethylaminoazobenzene	ND	mg/kg	2.5
2,6-Dichlorophenol	ND	mg/kg	2.5
3-Nitroaniline	ND	mg/kg	2.5
Pentachloronitrobenzene	ND	mg/kg	2.5
2-Methylnaphthalene	ND	mg/kg	0.50
Ethyl methanesulfonate	ND	mg/kg	2.5
7,12-Dimethylbenzanthracene	ND	mg/kg	2.5
Dibenzofuran	ND	mg/kg	0.50
4-Aminobiphenyl	ND	mg/kg	2.5

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0302
Lab ID: 001669-0002-SA Enseco ID: 1013633
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenol	ND	mg/kg	0.50
bis(2-Chloroethyl)ether	ND	mg/kg	0.50
2-Chlorophenol	ND	mg/kg	0.50
1,3-Dichlorobenzene	ND	mg/kg	0.50
1,4-Dichlorobenzene	ND	mg/kg	0.50
1,2-Dichlorobenzene	ND	mg/kg	0.50
bis(2-Chloroisopropyl) ether	ND	mg/kg	0.50
N-Nitroso-di-n-propylamine	ND	mg/kg	0.50
Hexachloroethane	ND	mg/kg	0.50
Nitrobenzene	ND	mg/kg	0.50
Isophorone	ND	mg/kg	0.50
2-Nitrophenol	ND	mg/kg	0.50
2,4-Dimethylphenol	ND	mg/kg	0.50
bis(2-Chloroethoxy) methane	ND	mg/kg	0.50
2,4-Dichlorophenol	ND	mg/kg	0.50
1,2,4-Trichlorobenzene	ND	mg/kg	0.50
Naphthalene	ND	mg/kg	0.50
Hexachlorobutadiene	ND	mg/kg	0.50
4-Chloro-3-methylphenol	ND	mg/kg	0.50
2,4,6-Trichlorophenol	ND	mg/kg	0.50
2,4,5-Trichlorophenol	ND	mg/kg	1.5
2-Chloronaphthalene	ND	mg/kg	0.50
Dimethyl phthalate	ND	mg/kg	0.50
Acenaphthylene	ND	mg/kg	0.50
Acenaphthene	ND	mg/kg	0.50
2,4-Dinitrophenol	ND	mg/kg	1.5
4-Nitrophenol	ND	mg/kg	2.5
2,4-Dinitrotoluene	ND	mg/kg	0.50
2,6-Dinitrotoluene	ND	mg/kg	0.50
Diethyl phthalate	ND	mg/kg	0.50
4-Chlorophenyl phenyl ether	ND	mg/kg	0.50
Fluorene	ND	mg/kg	0.50
4,6-Dinitro-2-methylphenol	ND	mg/kg	1.5
4-Bromophenyl phenyl ether	ND	mg/kg	0.50
Hexachlorobenzene	ND	mg/kg	0.50
Pentachlorophenol	ND	mg/kg	1.5

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0302
Lab ID: 001669-0002-SA Enseco ID: 1013633
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenanthrene	ND	mg/kg	0.50
Anthracene	ND	mg/kg	0.50
Di-n-butyl phthalate	ND	mg/kg	0.50
Fluoranthene	ND	mg/kg	0.50
Pyrene	ND	mg/kg	0.50
Butyl benzyl phthalate	ND	mg/kg	0.50
3,3'-Dichlorobenzidine	ND	mg/kg	1.0
Benzo(a)anthracene	ND	mg/kg	0.50
bis(2-Ethylhexyl) phthalate	ND	mg/kg	0.50
Chrysene	ND	mg/kg	0.50
Di-n-octyl phthalate	ND	mg/kg	0.50
Benzo(b)fluoranthene	ND	mg/kg	0.50
Benzo(k)fluoranthene	ND	mg/kg	0.50
Benzo(a)pyrene	ND	mg/kg	0.50
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	0.50
Dibenzo(a,h)anthracene	ND	mg/kg	0.50
Benzo(g,h,i)perylene	ND	mg/kg	0.50
Nitrobenzene-d5	86.2	%	--
2-Fluorobiphenyl	79.4	%	--
Terphenyl-d14	89.6	%	--
Phenol-d5	79.9	%	--
2-Fluorophenol	91.7	%	--
2,4,6-Tribromophenol	90.6	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

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Enseco

TENTATIVELY IDENTIFIED COMPOUNDS

FOR

WOODWARD-CLYDE CONSULTANTS

SAMPLE NUMBER 001669-0002

Compound Name	Fraction	Confidence Level	Estimated Concentration mg\kg
Oxygenated Hydrocarbon	BNA	1C	2.1
Decane,4-Methyl-	BNA	2I	1.1
Hydroxylamine,O-Decyl	BNA	1	1.3
Oxygenated Hydrocarbon	BNA	1C	2.9
Saturated Hydrocarbon	BNA	1C	2.0
Saturated Hydrocarbon	BNA	1C	3.4
Unknown	BNA	--	1.3
Cyclic Hydrocarbon	BNA	1C	1.2
Unsaturated Hydrocarbon	BNA	1C	1.5
Unknown	BNA	--	0.98
Saturated Hydrocarbon	BNA	1C	4.9
Saturated Hydrocarbon	BNA	1C	3.5
Unknown	BNA	--	1.4
Alcohol	BNA	1C	2.5
Saturated Hydrocarbon	BNA	1C	1.3
Saturated Hydrocarbon	BNA	1C	3.9
Saturated Hydrocarbon	BNA	1C	2.9
Cyclic Hydrocarbon	BNA	1C	1.4
Saturated Hydrocarbon	BNA	1C	3.3
Saturated Hydrocarbon	BNA	1C	2.8

NOTES:

Confidence Levels

Level 3 - Confirmed Identification
Level 2 - Confident Identification
Level 1 - Tentative Identification

Qualifiers

I - Isomer
C - Class

Please refer to the discussion for further details.

Enseco

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0302
Lab ID: 001669-0002-SA Enseco ID: 1013633
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 11 OCT 88 Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/kg	10	239.1	15 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts Approved By: Kimberly Conroy

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Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0302
Lab ID: 001669-0002-SA
Matrix: SOIL
Authorized: 16 SEP 88

Enseco ID: 1013633
Sampled: 13 SEP 88
Prepared: NA

Received: 15 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	91.9	%	0.1	160.3	04 OCT 88
Total Petroleum Hydrocarbons	1600	mg/kg	50	3550/418.1 Mod.	20 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Roger Freize

Approved By: Roger Freize

The cover letter is an integral part of this report.
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Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0401
Lab ID: 001669-0003-SA Enseco ID: 1013634
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 21 SEP 88 Analyzed: 27 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	10
1,1,1-Trichloroethane	ND	mg/kg	10
Bromodichloromethane	ND	mg/kg	10
Carbon tetrachloride	ND	mg/kg	10
1,1,2-Trichloroethane	ND	mg/kg	10
2-Butanone	ND	mg/kg	20
Benzene	ND	mg/kg	10
trans-1,3-Dichloropropene	ND	mg/kg	10
1,2-Dichloropropane	ND	mg/kg	10
1,2-Dichloroethane	ND	mg/kg	10
1,1,2,2-Tetrachloroethane	ND	mg/kg	10
2-Chloroethyl vinyl ether	ND	mg/kg	50
Bromoform	ND	mg/kg	10
Ethyl benzene	ND	mg/kg	10
Tetrachloroethene	ND	mg/kg	10
Chlorobenzene	ND	mg/kg	10
4-Methyl-2-pentanone	ND	mg/kg	10
Toluene	ND	mg/kg	10
cis-1,3-Dichloropropene	ND	mg/kg	10
Vinyl chloride	ND	mg/kg	10
Trichlorofluoromethane	ND	mg/kg	10
Chloroethane	ND	mg/kg	10
Acetone	ND	mg/kg	10
Methylene chloride	ND	mg/kg	10
Carbon disulfide	ND	mg/kg	10
1,1-Dichloroethene	ND	mg/kg	10
1,1-Dichloroethane	ND	mg/kg	10
trans-1,2-Dichloroethene	ND	mg/kg	10
Chloroform	ND	mg/kg	10
Bromomethane (Methylbromide)	ND	mg/kg	10
Trichloroethene	ND	mg/kg	10
Chlorodibromomethane	ND	mg/kg	10
Total xylenes	ND	mg/kg	10
Acrolein	ND	mg/kg	10
Acrylonitrile	ND	mg/kg	10
Dibromomethane	ND	mg/kg	10
Dichlorodifluoromethane	ND	mg/kg	10
Ethanol	ND	mg/kg	20
Ethyl methacrylate	ND	mg/kg	10
2-Hexanone	ND	mg/kg	10
Iodomethane	ND	mg/kg	10

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0401
Lab ID: 001669-0003-SA
Enseco ID: 1013634
Matrix: SOIL
Sampled: 13 SEP 88
Received: 15 SEP 88
Authorized: 16 SEP 88
Prepared: 21 SEP 88
Analyzed: 27 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	10
1,2,3-Trichloropropane	ND	mg/kg	10
Vinyl acetate	ND	mg/kg	30
trans-1,4-Dichloro-2-butene	ND	mg/kg	10
Toluene-d8	99.6	%	--
4-Bromofluorobenzene (BFB)	99.2	%	--
1,2-Dichloroethane-d4	96.0	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley
Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0401
Lab ID: 001669-0003-SA Enseco ID: 1013634
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
1-Chloronaphthalene	ND	mg/kg	500
3-Methylcholanthrene	ND	mg/kg	500
N-Nitrosodiphenylamine	ND	mg/kg	100
Hexachlorocyclopentadiene	ND	mg/kg	100
2-Methylphenol	ND	mg/kg	100
2,3,4,6-Tetrachlorophenol	ND	mg/kg	500
Acetophenone	ND	mg/kg	500
4-Nitroaniline	ND	mg/kg	500
1-Naphthylamine	ND	mg/kg	500
a,a-Dimethylphenethylamine	ND	mg/kg	--
Benzidine	ND	mg/kg	1100
2-Naphthylamine	ND	mg/kg	500
Benzoic acid	ND	mg/kg	500
4-Chloroaniline	ND	mg/kg	200
Benzyl alcohol	ND	mg/kg	200
N-Nitrosopiperidine	ND	mg/kg	500
Pentachlorobenzene	ND	mg/kg	500
Pronamide	ND	mg/kg	500
Methyl methanesulfonate	ND	mg/kg	500
N-Nitrosodimethylamine	ND	mg/kg	500
1,2,4,5-Tetrachlorobenzene	ND	mg/kg	500
N-Nitrosodi-n-butylamine	ND	mg/kg	500
2-Nitroaniline	ND	mg/kg	500
4-Methylphenol	ND	mg/kg	100
Aniline	ND	mg/kg	500
Diphenylamine	ND	mg/kg	500
Dibenz(a,j)acridine	ND	mg/kg	--
2-Picoline	ND	mg/kg	500
1,2-Diphenylhydrazine	ND	mg/kg	500
Phenacetin	ND	mg/kg	500
p-Dimethylaminoazobenzene	ND	mg/kg	500
2,6-Dichlorophenol	ND	mg/kg	500
3-Nitroaniline	ND	mg/kg	500
Pentachloronitrobenzene	ND	mg/kg	500
2-Methylnaphthalene	ND	mg/kg	100
Ethyl methanesulfonate	ND	mg/kg	500
7,12-Dimethylbenzanthracene	ND	mg/kg	500
Dibenzofuran	ND	mg/kg	100
4-Aminobiphenyl	ND	mg/kg	500

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

The cover letter is an integral part of this report.

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0401
Lab ID: 001669-0003-SA Enseco ID: 1013634
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenol	ND	mg/kg	100
bis(2-Chloroethyl)ether	ND	mg/kg	100
2-Chlorophenol	ND	mg/kg	100
1,3-Dichlorobenzene	ND	mg/kg	100
1,4-Dichlorobenzene	ND	mg/kg	100
1,2-Dichlorobenzene	ND	mg/kg	100
bis(2-Chloroisopropyl) ether	ND	mg/kg	100
N-Nitroso-di-n-propylamine	ND	mg/kg	100
Hexachloroethane	ND	mg/kg	100
Nitrobenzene	ND	mg/kg	100
Isophorone	ND	mg/kg	100
2-Nitrophenol	ND	mg/kg	100
2,4-Dimethylphenol	ND	mg/kg	100
bis(2-Chloroethoxy) methane	ND	mg/kg	100
2,4-Dichlorophenol	ND	mg/kg	100
1,2,4-Trichlorobenzene	ND	mg/kg	100
Naphthalene	ND	mg/kg	100
Hexachlorobutadiene	ND	mg/kg	100
4-Chloro-3-methylphenol	ND	mg/kg	100
2,4,6-Trichlorophenol	ND	mg/kg	100
2,4,5-Trichlorophenol	ND	mg/kg	300
2-Chloronaphthalene	ND	mg/kg	100
Dimethyl phthalate	ND	mg/kg	100
Acenaphthylene	ND	mg/kg	100
Acenaphthene	ND	mg/kg	100
2,4-Dinitrophenol	ND	mg/kg	300
4-Nitrophenol	ND	mg/kg	500
2,4-Dinitrotoluene	ND	mg/kg	100
2,6-Dinitrotoluene	ND	mg/kg	100
Diethyl phthalate	ND	mg/kg	100
4-Chlorophenyl phenyl ether	ND	mg/kg	100
Fluorene	ND	mg/kg	100
4,6-Dinitro-2-methylphenol	ND	mg/kg	300
4-Bromophenyl phenyl ether	ND	mg/kg	100
Hexachlorobenzene	ND	mg/kg	100
Pentachlorophenol	ND	mg/kg	300

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

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Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0401
Lab ID: 001669-0003-SA
Matrix: SOIL
Authorized: 16 SEP 88
Enseco ID: 1013634
Sampled: 13 SEP 88
Prepared: 19 SEP 88
Received: 15 SEP 88
Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenanthrene	ND	mg/kg	100
Anthracene	ND	mg/kg	100
Di-n-butyl phthalate	ND	mg/kg	100
Fluoranthene	ND	mg/kg	100
Pyrene	ND	mg/kg	100
Butyl benzyl phthalate	ND	mg/kg	100
3,3'-Dichlorobenzidine	ND	mg/kg	200
Benzo(a)anthracene	ND	mg/kg	100
bis(2-Ethylhexyl) phthalate	ND	mg/kg	100
Chrysene	ND	mg/kg	100
Di-n-octyl phthalate	ND	mg/kg	100
Benzo(b)fluoranthene	ND	mg/kg	100
Benzo(k)fluoranthene	ND	mg/kg	100
Benzo(a)pyrene	ND	mg/kg	100
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	100
Dibenzo(a,h)anthracene	ND	mg/kg	100
Benzo(g,h,i)perylene	ND	mg/kg	100
Nitrobenzene-d5	ND	%	--
2-Fluorobiphenyl	ND	%	--
Terphenyl-d14	ND	%	--
Phenol-d5	ND	%	--
2-Fluorophenol	ND	%	--
2,4,6-Tribromophenol	ND	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling
Approved By: Jeff Lowry

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TENTATIVELY IDENTIFIED COMPOUNDS

FOR

WOODWARD-CLYDE CONSULTANTS

SAMPLE NUMBER 001669-0003

Compound Name	Fraction	Confidence Level	Estimated Concentration mg/kg
Unknown	BNA	--	120
1-Decanol,2-Ethyl-	BNA	1I	200
Napthalene,Decahydro-2-Methyl-	BNA	1I	170
Unknown	BNA	--	180
Decane,2,5-Dimethyl-	BNA	2I	160
Decane,2,9-Dimethyl-	BNA	1I	140
Dodecane	BNA	2	450
Undecane,2,6-Dimethyl-	BNA	1I	620
Cyclohexane,2-Butyl-1,1,3-Trimethyl-	BNA	1I	270
Cyclic Hydrocarbon	BNA	1C	260
Unknown	BNA	--	220
Unknown	BNA	--	120
Tridecane,7-Methyl-	BNA	1I	890
Undecane,4,7-Dimethyl-	BNA	1I	550
Saturated Hydrocarbon	BNA	1C	160
Unknown	BNA	--	140
Unknown	BNA	--	170
Heptadecane,2,6-Dimethyl-	BNA	1I	400
Saturated Hydrocarbon	BNA	1C	350
Saturated Hydrocarbon	BNA	1C	230

NOTES:

Confidence Levels

Level 3 - Confirmed Identification
Level 2 - Confident Identification
Level 1 - Tentative Identification

Qualifiers

I - Isomer
C - Class

Please refer to the discussion for further details.

Enseco

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0401
Lab ID: 001669-0003-SA
Matrix: SOIL
Authorized: 16 SEP 88

Enseco ID: 1013634
Sampled: 13 SEP 88
Prepared: 07 OCT 88

Received: 15 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/kg	10	239.1	15 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts

Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
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Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0401
Lab ID: 001669-0003-SA
Matrix: SOIL
Authorized: 16 SEP 88
Enseco ID: 1013634
Sampled: 13 SEP 88
Prepared: NA
Received: 15 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	89.0	%	0.1	160.3	04 OCT 88
Total Petroleum Hydrocarbons	29000	mg/kg	50	3550/418.1 Mod.	20 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Roger Freize
Approved By: Roger Freize

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0402
Lab ID: 001669-0004-SA Enseco ID: 1013635
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 21 SEP 88 Analyzed: 27 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	0.10
1,1,1-Trichloroethane	ND	mg/kg	0.10
Bromodichloromethane	ND	mg/kg	0.10
Carbon tetrachloride	ND	mg/kg	0.10
1,1,2-Trichloroethane	ND	mg/kg	0.10
2-Butanone	ND	mg/kg	0.20
Benzene	ND	mg/kg	0.10
trans-1,3-Dichloropropene	ND	mg/kg	0.10
1,2-Dichloropropane	ND	mg/kg	0.10
1,2-Dichloroethane	ND	mg/kg	0.10
1,1,2,2-Tetrachloroethane	ND	mg/kg	0.10
2-Chloroethyl vinyl ether	ND	mg/kg	0.50
Bromoform	ND	mg/kg	0.10
Ethyl benzene	ND	mg/kg	0.10
Tetrachloroethene	ND	mg/kg	0.10
Chlorobenzene	ND	mg/kg	0.10
4-Methyl-2-pentanone	ND	mg/kg	0.10
Toluene	ND	mg/kg	0.10
cis-1,3-Dichloropropene	ND	mg/kg	0.10
Vinyl chloride	ND	mg/kg	0.10
Trichlorofluoromethane	ND	mg/kg	0.10
Chloroethane	ND	mg/kg	0.10
Acetone	ND	mg/kg	0.10
Methylene chloride	ND	mg/kg	0.10
Carbon disulfide	ND	mg/kg	0.10
1,1-Dichloroethene	ND	mg/kg	0.10
1,1-Dichloroethane	ND	mg/kg	0.10
trans-1,2-Dichloroethene	ND	mg/kg	0.10
Chloroform	ND	mg/kg	0.10
Bromomethane (Methylbromide)	ND	mg/kg	0.10
Trichloroethene	ND	mg/kg	0.10
Chlorodibromomethane	ND	mg/kg	0.10
Total xylenes	ND	mg/kg	0.10
Acrolein	ND	mg/kg	0.10
Acrylonitrile	ND	mg/kg	0.10
Dibromomethane	ND	mg/kg	0.10
Dichlorodifluoromethane	ND	mg/kg	0.10
Ethanol	ND	mg/kg	0.20
Ethyl methacrylate	ND	mg/kg	0.10
2-Hexanone	ND	mg/kg	0.10
Iodomethane	ND	mg/kg	0.10

ND=Not Detected
NA=Not Applicable

Reported By: Bob Martin Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0402
Lab ID: 001669-0004-SA Enseco ID: 1013635
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 21 SEP 88 Analyzed: 27 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	0.10
1,2,3-Trichloropropane	ND	mg/kg	0.10
Vinyl acetate	ND	mg/kg	0.30
trans-1,4-Dichloro-2-butene	ND	mg/kg	0.10
Toluene-d8	110	%	--
4-Bromofluorobenzene (BFB)	90.6	%	---
1,2-Dichloroethane-d4	95.8	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Bob Martin Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0402
Lab ID: 001669-0004-SA Enseco ID: 1013635
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
1-Chloronaphthalene	ND	mg/kg	10
3-Methylcholanthrene	ND	mg/kg	10
N-Nitrosodiphenylamine	ND	mg/kg	2.0
Hexachlorocyclopentadiene	ND	mg/kg	2.0
2-Methylphenol	ND	mg/kg	2.0
2,3,4,6-Tetrachlorophenol	ND	mg/kg	10
Acetophenone	ND	mg/kg	10
4-Nitroaniline	ND	mg/kg	10
1-Naphthylamine	ND	mg/kg	10
a,a-Dimethylphen-ethylamine	ND	mg/kg	--
Benzidine	ND	mg/kg	22
2-Naphthylamine	ND	mg/kg	10
Benzoic acid	ND	mg/kg	10
4-Chloroaniline	ND	mg/kg	4.0
Benzyl alcohol	ND	mg/kg	4.0
N-Nitrosopiperidine	ND	mg/kg	10
Pentachlorobenzene	ND	mg/kg	10
Pronamide	ND	mg/kg	10
Methyl methanesulfonate	ND	mg/kg	10
N-Nitrosodimethylamine	ND	mg/kg	10
1,2,4,5-Tetrachloro-benzene	ND	mg/kg	10
N-Nitrosodi-n-butylamine	ND	mg/kg	10
2-Nitroaniline	ND	mg/kg	10
4-Methylphenol	ND	mg/kg	2.0
Aniline	ND	mg/kg	10
Diphenylamine	ND	mg/kg	10
Dibenz(a,j)acridine	ND	mg/kg	--
2-Picoline	ND	mg/kg	10
1,2-Diphenylhydrazine	ND	mg/kg	10
Phenacetin	ND	mg/kg	10
p-Dimethylaminoazobenzene	ND	mg/kg	10
2,6-Dichlorophenol	ND	mg/kg	10
3-Nitroaniline	ND	mg/kg	10
Pentachloronitrobenzene	ND	mg/kg	10
2-Methylnaphthalene	ND	mg/kg	2.0
Ethyl methanesulfonate	ND	mg/kg	10
7,12-Dimethylbenz-anthracene	ND	mg/kg	10
Dibenzofuran	ND	mg/kg	2.0
4-Aminobiphenyl	ND	mg/kg	10

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0402
Lab ID: 001669-0004-SA Enseco ID: 1013635
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenol	ND	mg/kg	2.0
bis(2-Chloroethyl)ether	ND	mg/kg	2.0
2-Chlorophenol	ND	mg/kg	2.0
1,3-Dichlorobenzene	ND	mg/kg	2.0
1,4-Dichlorobenzene	ND	mg/kg	2.0
1,2-Dichlorobenzene	ND	mg/kg	2.0
bis(2-Chloroisopropyl) ether	ND	mg/kg	2.0
N-Nitroso-di-n-propylamine	ND	mg/kg	2.0
Hexachloroethane	ND	mg/kg	2.0
Nitrobenzene	ND	mg/kg	2.0
Isophorone	ND	mg/kg	2.0
2-Nitrophenol	ND	mg/kg	2.0
2,4-Dimethylphenol	ND	mg/kg	2.0
bis(2-Chloroethoxy) methane	ND	mg/kg	2.0
2,4-Dichlorophenol	ND	mg/kg	2.0
1,2,4-Trichlorobenzene	ND	mg/kg	2.0
Naphthalene	ND	mg/kg	2.0
Hexachlorobutadiene	ND	mg/kg	2.0
4-Chloro-3-methylphenol	ND	mg/kg	2.0
2,4,6-Trichlorophenol	ND	mg/kg	2.0
2,4,5-Trichlorophenol	ND	mg/kg	6.0
2-Chloronaphthalene	ND	mg/kg	2.0
Dimethyl phthalate	ND	mg/kg	2.0
Acenaphthylene	ND	mg/kg	2.0
Acenaphthene	ND	mg/kg	2.0
2,4-Dinitrophenol	ND	mg/kg	6.0
4-Nitrophenol	ND	mg/kg	10
2,4-Dinitrotoluene	ND	mg/kg	2.0
2,6-Dinitrotoluene	ND	mg/kg	2.0
Diethyl phthalate	ND	mg/kg	2.0
4-Chlorophenyl phenyl ether	ND	mg/kg	2.0
Fluorene	ND	mg/kg	2.0
4,6-Dinitro-2-methylphenol	ND	mg/kg	6.0
4-Bromophenyl phenyl ether	ND	mg/kg	2.0
Hexachlorobenzene	ND	mg/kg	2.0
Pentachlorophenol	ND	mg/kg	6.0

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0402
Lab ID: 001669-0004-SA Enseco ID: 1013635
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenanthrene	ND	mg/kg	2.0
Anthracene	ND	mg/kg	2.0
Di-n-butyl phthalate	ND	mg/kg	2.0
Fluoranthene	ND	mg/kg	2.0
Pyrene	ND	mg/kg	2.0
Butyl benzyl phthalate	ND	mg/kg	2.0
3,3'-Dichlorobenzidine	ND	mg/kg	4.0
Benzo(a)anthracene	ND	mg/kg	2.0
bis(2-Ethylhexyl) phthalate	ND	mg/kg	2.0
Chrysene	ND	mg/kg	2.0
Di-n-octyl phthalate	ND	mg/kg	2.0
Benzo(b)fluoranthene	ND	mg/kg	2.0
Benzo(k)fluoranthene	ND	mg/kg	2.0
Benzo(a)pyrene	ND	mg/kg	2.0
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	2.0
Dibenzo(a,h)anthracene	ND	mg/kg	2.0
Benzo(g,h,i)perylene	ND	mg/kg	2.0
Nitrobenzene-d5	77.2	%	--
2-Fluorobiphenyl	73.7	%	--
Terphenyl-d14	93.2	%	--
Phenol-d5	70.2	%	--
2-Fluorophenol	77.6	%	--
2,4,6-Tribromophenol	76.5	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Kevin Schilling Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

TENTATIVELY IDENTIFIED COMPOUNDS

FOR

WOODWARD-CLYDE CONSULTANTS

SAMPLE NUMBER 001669-0004

Compound Name	Fraction	Confidence Level	Estimated Concentration mg/kg
Isooctane,(Ethenyloxy)-	BNA	1	1.1
Napthalene,Decahydro-2-Methyl-	BNA	1I	1.9
Undecane,4,7-Dimethyl-	BNA	1I	1.3
Napthalene,Decahydro-2-Methyl-	BNA	1I	2.1
Aromatic Hydrocarbon	BNA	1C	1.1
Decane,2,9-Dimethyl-	BNA	1I	1.4
Unknown	BNA	--	1.5
Napthalene,Decahydro-2,6-Dimethyl-	BNA	1I	1.1
Decane,2,4,6-Trimethyl-	BNA	1I	2.0
Undecane,2,6-Dimethyl-	BNA	2I	7.7
Cyclohexane,2-Butyl-1,1,3-Trimethyl-	BNA	1I	4.0
Cyclic Hydrocarbon	BNA	1C	1.9
Unknown	BNA	--	1.6
Tridecane,7-Methyl-	BNA	1I	7.1
Undecane,4,7-Dimethyl-	BNA	1I	2.0
Tridecane,6-Methyl-	BNA	1I	1.3
Napthalene,1-Methyl-	BNA	1I	1.2
Unknown	BNA	--	1.5
Undecane	BNA	1	1.7
Heptadecane,2,6-Dimethyl-	BNA	1I	2.9

NOTES:

Confidence Levels

Level 3 - Confirmed Identification
Level 2 - Confident Identification
Level 1 - Tentative Identification

Qualifiers

I - Isomer
C - Class

Please refer to the discussion for further details.

Enseco

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0402
Lab ID: 001669-0004-SA Enseco ID: 1013635
Matrix: SOIL Sampled: 13 SEP 88 Received: 15 SEP 88
Authorized: 16 SEP 88 Prepared: 07 OCT 88 Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/kg	10	239.1	15 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
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Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0402
Lab ID: 001669-0004-SA
Matrix: SOIL
Authorized: 16 SEP 88

Enseco ID: 1013635
Sampled: 13 SEP 88
Prepared: NA

Received: 15 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	78.8	%	0.1	160.3	04 OCT 88
Total Petroleum Hydrocarbons	120	mg/kg	50	3550/418.1 Mod.	20 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Roger Freize

Approved By: Roger Freize

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Enseco

SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
001688-0001-SA	R-FT-503	SOIL	14 SEP 88	11:20	16 SEP 88
001688-0002-SA	R-FT-501	SOIL	14 SEP 88	10:05	16 SEP 88
001688-0003-SA	R-FT-502	SOIL	14 SEP 88		16 SEP 88
001688-0003-DU	R-FT-502D DUPLICATE	SOIL	14 SEP 88		16 SEP 88

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-503
Lab ID: 001688-0001-SA Enseco ID: 1013667
Matrix: SOIL Sampled: 14 SEP 88 Received: 16 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	0.10
Bromomethane (Methylbromide)	ND	mg/kg	0.10
Vinyl chloride	ND	mg/kg	0.10
Chloroethane	ND	mg/kg	0.10
Methylene chloride	ND	mg/kg	0.10
Acetone	ND	mg/kg	0.10
Carbon disulfide	ND	mg/kg	0.10
1,1-Dichloroethene	ND	mg/kg	0.10
1,1-Dichloroethane	ND	mg/kg	0.10
trans-1,2-Dichloroethene	ND	mg/kg	0.10
Chloroform	ND	mg/kg	0.10
1,2-Dichloroethane	ND	mg/kg	0.10
2-Butanone	ND	mg/kg	0.20
1,1,1-Trichloroethane	ND	mg/kg	0.10
Carbon tetrachloride	ND	mg/kg	0.10
Bromodichloromethane	ND	mg/kg	0.10
1,2-Dichloropropane	ND	mg/kg	0.10
trans-1,3-Dichloropropene	ND	mg/kg	0.10
Trichloroethene	ND	mg/kg	0.10
Chlorodibromomethane	ND	mg/kg	0.10
1,1,2-Trichloroethane	ND	mg/kg	0.10
Benzene	ND	mg/kg	0.10
cis-1,3-Dichloropropene	ND	mg/kg	0.10
2-Chloroethyl vinyl ether	ND	mg/kg	0.50
Bromoform	ND	mg/kg	0.10
4-Methyl-2-pentanone	ND	mg/kg	0.10
1,1,2,2-Tetrachloroethane	ND	mg/kg	0.10
Tetrachloroethene	ND	mg/kg	0.10
Toluene	ND	mg/kg	0.10
Chlorobenzene	ND	mg/kg	0.10
Ethyl benzene	ND	mg/kg	0.10
Total xylenes	ND	mg/kg	0.10
Trichlorofluoromethane	ND	mg/kg	0.10
Acrolein	ND	mg/kg	0.10
Acrylonitrile	ND	mg/kg	0.10
Dibromomethane	ND	mg/kg	0.10
Dichlorodifluoromethane	ND	mg/kg	0.10
Ethanol	ND	mg/kg	0.20
Ethyl methacrylate	ND	mg/kg	0.10
2-Hexanone	ND	mg/kg	0.10
Iodomethane	ND	mg/kg	0.10

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Cornell Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-503
Lab ID: 001688-0001-SA Enseco ID: 1013667
Matrix: SOIL Sampled: 14 SEP 88 Received: 16 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	0.10
1,2,3-Trichloropropane	ND	mg/kg	0.10
Vinyl acetate	ND	mg/kg	0.30
trans-1,4-Dichloro-2-butene	ND	mg/kg	0.10
Toluene-d8	97.6	%	---
4-Bromofluorobenzene (BFB)	87.2	%	---
1,2-Dichloroethane-d4	100	%	---

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Cornell Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-503
Lab ID: 001688-0001-SA Enseco ID: 1013667
Matrix: SOIL Sampled: 14 SEP 88 Received: 16 SEP 88
Authorized: 16 SEP 88 Prepared: 21 SEP 88 Analyzed: 28 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenol	ND	mg/kg	0.50
bis(2-Chloroethyl)ether	ND	mg/kg	0.50
2-Chlorophenol	ND	mg/kg	0.50
1,3-Dichlorobenzene	ND	mg/kg	0.50
1,4-Dichlorobenzene	ND	mg/kg	0.50
1,2-Dichlorobenzene	ND	mg/kg	0.50
bis(2-Chloroisopropyl) ether	ND	mg/kg	0.50
N-Nitroso-di-n-propylamine	ND	mg/kg	0.50
Hexachloroethane	ND	mg/kg	0.50
Nitrobenzene	ND	mg/kg	0.50
Isophorone	ND	mg/kg	0.50
2-Nitrophenol	ND	mg/kg	0.50
2,4-Dimethylphenol	ND	mg/kg	0.50
bis(2-Chloroethoxy) methane	ND	mg/kg	0.50
2,4-Dichlorophenol	ND	mg/kg	0.50
1,2,4-Trichlorobenzene	ND	mg/kg	0.50
Naphthalene	ND	mg/kg	0.50
Hexachlorobutadiene	ND	mg/kg	0.50
4-Chloro-3-methylphenol	ND	mg/kg	0.50
2,4,6-Trichlorophenol	ND	mg/kg	0.50
2,4,5-Trichlorophenol	ND	mg/kg	1.5
2-Chloronaphthalene	ND	mg/kg	0.50
Dimethyl phthalate	ND	mg/kg	0.50
Acenaphthylene	ND	mg/kg	0.50
Acenaphthene	ND	mg/kg	0.50
2,4-Dinitrophenol	ND	mg/kg	1.5
4-Nitrophenol	ND	mg/kg	2.5
2,4-Dinitrotoluene	ND	mg/kg	0.50
2,6-Dinitrotoluene	ND	mg/kg	0.50
Diethyl phthalate	ND	mg/kg	0.50
4-Chlorophenyl phenyl ether	ND	mg/kg	0.50
Fluorene	ND	mg/kg	0.50
4,6-Dinitro-2-methylphenol	ND	mg/kg	1.5
4-Bromophenyl phenyl ether	ND	mg/kg	0.50
Hexachlorobenzene	ND	mg/kg	0.50
Pentachlorophenol	ND	mg/kg	1.5

ND=Not Detected
NA=Not Applicable

Reported By: Michael Blades Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-503
Lab ID: 001688-0001-SA Enseco ID: 1013667
Matrix: SOIL Sampled: 14 SEP 88 Received: 16 SEP 88
Authorized: 16 SEP 88 Prepared: 21 SEP 88 Analyzed: 28 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenanthrene	ND	mg/kg	0.50
Anthracene	ND	mg/kg	0.50
Di-n-butyl phthalate	ND	mg/kg	0.50
Fluoranthene	ND	mg/kg	0.50
Pyrene	ND	mg/kg	0.50
Butyl benzyl phthalate	ND	mg/kg	0.50
3,3'-Dichlorobenzidine	ND	mg/kg	1.0
Benzo(a)anthracene	ND	mg/kg	0.50
bis(2-Ethylhexyl) phthalate	ND	mg/kg	0.50
Chrysene	ND	mg/kg	0.50
Di-n-octyl phthalate	ND	mg/kg	0.50
Benzo(b)fluoranthene	ND	mg/kg	0.50
Benzo(k)fluoranthene	ND	mg/kg	0.50
Benzo(a)pyrene	ND	mg/kg	0.50
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	0.50
Dibenzo(a,h)anthracene	ND	mg/kg	0.50
Benzo(g,h,i)perylene	ND	mg/kg	0.50
Acetophenone	ND	mg/kg	0.50
Aniline	ND	mg/kg	2.5
4-Aminobiphenyl	ND	mg/kg	2.5
Benzidine	ND	mg/kg	5.6
Benzoic acid	ND	mg/kg	2.5
Benzyl alcohol	ND	mg/kg	1.0
4-Chloroaniline	ND	mg/kg	1.0
Dibenz(a,j)acridine	ND	mg/kg	--
Dibenzofuran	ND	mg/kg	0.50
p-Dimethylaminoazobenzene	ND	mg/kg	2.5
7,12-Dimethylbenz-anthracene	ND	mg/kg	2.5
a,a-Dimethylphen-ethylamine	ND	mg/kg	--
Diphenylamine	ND	mg/kg	2.5
1,2-Diphenylhydrazine	ND	mg/kg	2.5
Ethyl methanesulfonate	ND	mg/kg	2.5
Methyl methanesulfonate	ND	mg/kg	2.5
2-Methylnaphthalene	ND	mg/kg	0.50
1-Naphthylamine	ND	mg/kg	2.5
2-Naphthylamine	ND	mg/kg	2.5
2-Nitroaniline	ND	mg/kg	2.5
3-Nitroaniline	ND	mg/kg	2.5
4-Nitroaniline	ND	mg/kg	2.5

ND=Not Detected
NA=Not Applicable

Reported By: Michael Blades Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-503
Lab ID: 001688-0001-SA
Matrix: SOIL
Authorized: 16 SEP 88

Enseco ID: 1013667
Sampled: 14 SEP 88
Prepared: 21 SEP 88

Received: 16 SEP 88
Analyzed: 28 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Pentachlorobenzene	ND	mg/kg	2.5
Pentachloronitrobenzene	ND	mg/kg	2.5
Phenacetin	ND	mg/kg	2.5
2-Picoline	ND	mg/kg	2.5
Pronamide	ND	mg/kg	2.5
1,2,4,5-Tetrachloro-benzene	ND	mg/kg	2.5
2,6-Dichlorophenol	ND	mg/kg	2.5
2-Methylphenol	ND	mg/kg	0.50
4-Methylphenol	ND	mg/kg	0.50
2,3,4,6-Tetrachlorophenol	ND	mg/kg	2.5
N-Nitrosodi-n-butylamine	ND	mg/kg	2.5
N-Nitrosodimethylamine	ND	mg/kg	2.5
N-Nitrosopiperidine	ND	mg/kg	2.5
1-Chloronaphthalene	ND	mg/kg	2.5
3-Methylcholanthrene	ND	mg/kg	2.5
N-Nitrosodiphenylamine	ND	mg/kg	0.50
Nitrobenzene-d5	64.6	%	--
2-Fluorobiphenyl	63.8	%	--
Terphenyl-d14	82.2	%	--
Phenol-d5	72.6	%	--
2-Fluorophenol	65.1	%	--
2,4,6-Tribromophenol	68.6	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Michael Blades

Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

TENTATIVELY IDENTIFIED COMPOUNDS

FOR

WOODWARD-CLYDE CONSULTANTS

SAMPLE NUMBER 001688-0001

Compound Name	Fraction	Confidence Level	Estimated Concentration mg/kg
None Detected	BNA	--	--

NOTES:

Confidence Levels

Level 3 - Confirmed Identification
Level 2 - Confident Identification
Level 1 - Tentative Identification

Qualifiers

I - Isomer
C - Class

Please refer to the discussion for further details.

Enseco

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-503
Lab ID: 001688-0001-SA
Matrix: SOIL
Authorized: 16 SEP 88
Enseco ID: 1013667
Sampled: 14 SEP 88
Prepared: 07 OCT 88
Received: 16 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/kg	10	239.1	15 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts

Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-503
Lab ID: 001688-0001-SA
Matrix: SOIL
Authorized: 16 SEP 88

Enseco ID: 1013667
Sampled: 14 SEP 88
Prepared: NA

Received: 16 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	93.3	%	0.1	160.3	30 SEP 88
Total Petroleum Hydrocarbons	ND	mg/kg	50	3550/418.1 Mod.	10 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell

Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-501
Lab ID: 001688-0002-SA Enseco ID: 1013668
Matrix: SOIL Sampled: 14 SEP 88 Received: 16 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	0.10
Bromomethane (Methylbromide)	ND	mg/kg	0.10
Vinyl chloride	ND	mg/kg	0.10
Chloroethane	ND	mg/kg	0.10
Methylene chloride	ND	mg/kg	0.10
Acetone	ND	mg/kg	0.10
Carbon disulfide	ND	mg/kg	0.10
1,1-Dichloroethene	ND	mg/kg	0.10
1,1-Dichloroethane	ND	mg/kg	0.10
trans-1,2-Dichloroethene	ND	mg/kg	0.10
Chloroform	ND	mg/kg	0.10
1,2-Dichloroethane	ND	mg/kg	0.10
2-Butanone	ND	mg/kg	0.20
1,1,1-Trichloroethane	ND	mg/kg	0.10
Carbon tetrachloride	ND	mg/kg	0.10
Bromodichloromethane	ND	mg/kg	0.10
1,2-Dichloropropane	ND	mg/kg	0.10
trans-1,3-Dichloropropene	ND	mg/kg	0.10
Trichloroethene	ND	mg/kg	0.10
Chlorodibromomethane	ND	mg/kg	0.10
1,1,2-Trichloroethane	ND	mg/kg	0.10
Benzene	ND	mg/kg	0.10
cis-1,3-Dichloropropene	ND	mg/kg	0.10
2-Chloroethyl vinyl ether	ND	mg/kg	0.50
Bromoform	ND	mg/kg	0.10
4-Methyl-2-pentanone	ND	mg/kg	0.10
1,1,2,2-Tetrachloroethane	ND	mg/kg	0.10
Tetrachloroethene	ND	mg/kg	0.10
Toluene	ND	mg/kg	0.10
Chlorobenzene	ND	mg/kg	0.10
Ethyl benzene	ND	mg/kg	0.10
Total xylenes	ND	mg/kg	0.10
Trichlorofluoromethane	ND	mg/kg	0.10
Acrolein	ND	mg/kg	0.10
Acrylonitrile	ND	mg/kg	0.10
Dibromomethane	ND	mg/kg	0.10
Dichlorodifluoromethane	ND	mg/kg	0.10
Ethanol	ND	mg/kg	0.20
Ethyl methacrylate	ND	mg/kg	0.10
2-Hexanone	ND	mg/kg	0.10
Iodomethane	ND	mg/kg	0.10

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Cornell Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-501
Lab ID: 001688-0002-SA Enseco ID: 1013668
Matrix: SOIL Sampled: 14 SEP 88 Received: 16 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	0.10
1,2,3-Trichloropropane	ND	mg/kg	0.10
Vinyl acetate	ND	mg/kg	0.30
trans-1,4-Dichloro-2-butene	ND	mg/kg	0.10
Toluene-d8	93.6	%	---
4-Bromofluorobenzene (BFB)	96.4	%	---
1,2-Dichloroethane-d4	100	%	---

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Cornell Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-501
Lab ID: 001688-0002-SA Enseco ID: 1013668
Matrix: SOIL Sampled: 14 SEP 88 Received: 16 SEP 88
Authorized: 16 SEP 88 Prepared: 21 SEP 88 Analyzed: 28 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenol	ND	mg/kg	0.50
bis(2-Chloroethyl)ether	ND	mg/kg	0.50
2-Chlorophenol	ND	mg/kg	0.50
1,3-Dichlorobenzene	ND	mg/kg	0.50
1,4-Dichlorobenzene	ND	mg/kg	0.50
1,2-Dichlorobenzene	ND	mg/kg	0.50
bis(2-Chloroisopropyl) ether	ND	mg/kg	0.50
N-Nitroso-di-n-propylamine	ND	mg/kg	0.50
Hexachloroethane	ND	mg/kg	0.50
Nitrobenzene	ND	mg/kg	0.50
Isophorone	ND	mg/kg	0.50
2-Nitrophenol	ND	mg/kg	0.50
2,4-Dimethylphenol	ND	mg/kg	0.50
bis(2-Chloroethoxy) methane	ND	mg/kg	0.50
2,4-Dichlorophenol	ND	mg/kg	0.50
1,2,4-Trichlorobenzene	ND	mg/kg	0.50
Naphthalene	ND	mg/kg	0.50
Hexachlorobutadiene	ND	mg/kg	0.50
4-Chloro-3-methylphenol	ND	mg/kg	0.50
2,4,6-Trichlorophenol	ND	mg/kg	0.50
2,4,5-Trichlorophenol	ND	mg/kg	1.5
2-Chloronaphthalene	ND	mg/kg	0.50
Dimethyl phthalate	ND	mg/kg	0.50
Acenaphthylene	ND	mg/kg	0.50
Acenaphthene	ND	mg/kg	0.50
2,4-Dinitrophenol	ND	mg/kg	1.5
4-Nitrophenol	ND	mg/kg	2.5
2,4-Dinitrotoluene	ND	mg/kg	0.50
2,6-Dinitrotoluene	ND	mg/kg	0.50
Diethyl phthalate	ND	mg/kg	0.50
4-Chlorophenyl phenyl ether	ND	mg/kg	0.50
Fluorene	ND	mg/kg	0.50
4,6-Dinitro-2-methylphenol	ND	mg/kg	1.5
4-Bromophenyl phenyl ether	ND	mg/kg	0.50
Hexachlorobenzene	ND	mg/kg	0.50
Pentachlorophenol	ND	mg/kg	1.5

ND=Not Detected
NA=Not Applicable

Reported By: Michael Blades Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-501
Lab ID: 001688-0002-SA Enseco ID: 1013668
Matrix: SOIL Sampled: 14 SEP 88 Received: 16 SEP 88
Authorized: 16 SEP 88 Prepared: 21 SEP 88 Analyzed: 28 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenanthrene	ND	mg/kg	0.50
Anthracene	ND	mg/kg	0.50
Di-n-butyl phthalate	ND	mg/kg	0.50
Fluoranthene	ND	mg/kg	0.50
Pyrene	ND	mg/kg	0.50
Butyl benzyl phthalate	ND	mg/kg	0.50
3,3'-Dichlorobenzidine	ND	mg/kg	1.0
Benzo(a)anthracene	ND	mg/kg	0.50
bis(2-Ethylhexyl) phthalate	ND	mg/kg	0.50
Chrysene	ND	mg/kg	0.50
Di-n-octyl phthalate	ND	mg/kg	0.50
Benzo(b)fluoranthene	ND	mg/kg	0.50
Benzo(k)fluoranthene	ND	mg/kg	0.50
Benzo(a)pyrene	ND	mg/kg	0.50
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	0.50
Dibenzo(a,h)anthracene	ND	mg/kg	0.50
Benzo(g,h,i)perylene	ND	mg/kg	0.50
Acetophenone	ND	mg/kg	0.50
Aniline	ND	mg/kg	2.5
4-Aminobiphenyl	ND	mg/kg	2.5
Benzidine	ND	mg/kg	5.6
Benzoic acid	ND	mg/kg	2.5
Benzyl alcohol	ND	mg/kg	1.0
4-Chloroaniline	ND	mg/kg	1.0
Dibenz(a,j)acridine	ND	mg/kg	--
Dibenzofuran	ND	mg/kg	0.50
p-Dimethylaminoazobenzene	ND	mg/kg	2.5
7,12-Dimethylbenz-anthracene	ND	mg/kg	2.5
a,a-Dimethylphen-ethylamine	ND	mg/kg	--
Diphenylamine	ND	mg/kg	2.5
1,2-Diphenylhydrazine	ND	mg/kg	2.5
Ethyl methanesulfonate	ND	mg/kg	2.5
Methyl methanesulfonate	ND	mg/kg	2.5
2-Methylnaphthalene	ND	mg/kg	0.50
1-Naphthylamine	ND	mg/kg	2.5
2-Naphthylamine	ND	mg/kg	2.5
2-Nitroaniline	ND	mg/kg	2.5
3-Nitroaniline	ND	mg/kg	2.5
4-Nitroaniline	ND	mg/kg	2.5

ND=Not Detected
NA=Not Applicable

Reported By: Michael Blades Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-501
Lab ID: 001688-0002-SA
Matrix: SOIL
Authorized: 16 SEP 88

Enseco ID: 1013668
Sampled: 14 SEP 88
Prepared: 21 SEP 88

Received: 16 SEP 88
Analyzed: 28 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Pentachlorobenzene	ND	mg/kg	2.5
Pentachloronitrobenzene	ND	mg/kg	2.5
Phenacetin	ND	mg/kg	2.5
2-Picoline	ND	mg/kg	2.5
Pronamide	ND	mg/kg	2.5
1,2,4,5-Tetrachloro-benzene	ND	mg/kg	2.5
2,6-Dichlorophenol	ND	mg/kg	2.5
2-Methylphenol	ND	mg/kg	0.50
4-Methylphenol	ND	mg/kg	0.50
2,3,4,6-Tetrachlorophenol	ND	mg/kg	2.5
N-Nitrosodi-n-butylamine	ND	mg/kg	2.5
N-Nitrosodimethylamine	ND	mg/kg	2.5
N-Nitrosopiperidine	ND	mg/kg	2.5
1-Chloronaphthalene	ND	mg/kg	2.5
3-Methylcholanthrene	ND	mg/kg	2.5
N-Nitrosodiphenylamine	ND	mg/kg	0.50
Nitrobenzene-d5	93.6	%	--
2-Fluorobiphenyl	92.4	%	--
Terphenyl-d14	117	%	--
Phenol-d5	101	%	--
2-Fluorophenol	91.3	%	--
2,4,6-Tribromophenol	96.0	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Michael Blades

Approved By: Jeff Lowry

The cover letter is an integral part of this report.
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TENTATIVELY IDENTIFIED COMPOUNDS

FOR

WOODWARD-CLYDE CONSULTANTS

SAMPLE NUMBER 001688-0002

Compound Name	Fraction	Confidence Level	Estimated Concentration mg/kg
None Detected	BNA	--	--

NOTES:

Confidence Levels

Level 3 - Confirmed Identification
Level 2 - Confident Identification
Level 1 - Tentative Identification

Qualifiers

I - Isomer
C - Class

Please refer to the discussion for further details.

Enseco

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-501
Lab ID: 001688-0002-SA
Matrix: SOIL
Authorized: 16 SEP 88
Enseco ID: 1013668
Sampled: 14 SEP 88
Prepared: 07 OCT 88
Received: 16 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/kg	10	239.1	15 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts
Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
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Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-501
Lab ID: 001688-0002-SA
Enseco ID: 1013668
Matrix: SOIL
Sampled: 14 SEP 88
Received: 16 SEP 88
Authorized: 16 SEP 88
Prepared: NA
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	97.2	%	0.1	160.3	30 SEP 88
Total Petroleum Hydrocarbons	ND	mg/kg	50	3550/418.1 Mod.	10 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell
Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-502
Lab ID: 001688-0003-SA Enseco ID: 1013669
Matrix: SOIL Sampled: 14 SEP 88 Received: 16 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	0.10
Bromomethane (Methylbromide)	ND	mg/kg	0.10
Vinyl chloride	ND	mg/kg	0.10
Chloroethane	ND	mg/kg	0.10
Methylene chloride	ND	mg/kg	0.10
Acetone	ND	mg/kg	0.10
Carbon disulfide	ND	mg/kg	0.10
1,1-Dichloroethene	ND	mg/kg	0.10
1,1-Dichloroethane	ND	mg/kg	0.10
trans-1,2-Dichloroethene	ND	mg/kg	0.10
Chloroform	ND	mg/kg	0.10
1,2-Dichloroethane	ND	mg/kg	0.10
2-Butanone	ND	mg/kg	0.20
1,1,1-Trichloroethane	ND	mg/kg	0.10
Carbon tetrachloride	ND	mg/kg	0.10
Bromodichloromethane	ND	mg/kg	0.10
1,2-Dichloropropane	ND	mg/kg	0.10
trans-1,3-Dichloropropene	ND	mg/kg	0.10
Trichloroethene	ND	mg/kg	0.10
Chlorodibromomethane	ND	mg/kg	0.10
1,1,2-Trichloroethane	ND	mg/kg	0.10
Benzene	ND	mg/kg	0.10
cis-1,3-Dichloropropene	ND	mg/kg	0.10
2-Chloroethyl vinyl ether	ND	mg/kg	0.50
Bromoform	ND	mg/kg	0.10
4-Methyl-2-pentanone	ND	mg/kg	0.10
1,1,2,2-Tetrachloroethane	ND	mg/kg	0.10
Tetrachloroethene	ND	mg/kg	0.10
Toluene	ND	mg/kg	0.10
Chlorobenzene	ND	mg/kg	0.10
Ethyl benzene	ND	mg/kg	0.10
Total xylenes	ND	mg/kg	0.10
Trichlorofluoromethane	ND	mg/kg	0.10
Acrolein	ND	mg/kg	0.10
Acrylonitrile	ND	mg/kg	0.10
Dibromomethane	ND	mg/kg	0.10
Dichlorodifluoromethane	ND	mg/kg	0.10
Ethanol	ND	mg/kg	0.20
Ethyl methacrylate	ND	mg/kg	0.10
2-Hexanone	ND	mg/kg	0.10
Iodomethane	ND	mg/kg	0.10

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Cornell Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-502
Lab ID: 001688-0003-SA Enseco ID: 1013669
Matrix: SOIL Sampled: 14 SEP 88 Received: 16 SEP 88
Authorized: 16 SEP 88 Prepared: 19 SEP 88 Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	0.10
1,2,3-Trichloropropane	ND	mg/kg	0.10
Vinyl acetate	ND	mg/kg	0.30
trans-1,4-Dichloro-2-butene	ND	mg/kg	0.10
Toluene-d8	105	%	---
4-Bromofluorobenzene (BFB)	94.0	%	---
1,2-Dichloroethane-d4	99.1	%	---

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Cornell Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-502
Lab ID: 001688-0003-SA Enseco ID: 1013669
Matrix: SOIL Sampled: 14 SEP 88 Received: 16 SEP 88
Authorized: 16 SEP 88 Prepared: 21 SEP 88 Analyzed: 03 OCT 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenol	ND	mg/kg	0.50
bis(2-Chloroethyl)ether	ND	mg/kg	0.50
2-Chlorophenol	ND	mg/kg	0.50
1,3-Dichlorobenzene	ND	mg/kg	0.50
1,4-Dichlorobenzene	ND	mg/kg	0.50
1,2-Dichlorobenzene	ND	mg/kg	0.50
bis(2-Chloroisopropyl) ether	ND	mg/kg	0.50
N-Nitroso-di-n-propylamine	ND	mg/kg	0.50
Hexachloroethane	ND	mg/kg	0.50
Nitrobenzene	ND	mg/kg	0.50
Isophorone	ND	mg/kg	0.50
2-Nitrophenol	ND	mg/kg	0.50
2,4-Dimethylphenol	ND	mg/kg	0.50
bis(2-Chloroethoxy) methane	ND	mg/kg	0.50
2,4-Dichlorophenol	ND	mg/kg	0.50
1,2,4-Trichlorobenzene	ND	mg/kg	0.50
Naphthalene	ND	mg/kg	0.50
Hexachlorobutadiene	ND	mg/kg	0.50
4-Chloro-3-methylphenol	ND	mg/kg	0.50
2,4,6-Trichlorophenol	ND	mg/kg	0.50
2,4,5-Trichlorophenol	ND	mg/kg	1.5
2-Chloronaphthalene	ND	mg/kg	0.50
Dimethyl phthalate	ND	mg/kg	0.50
Acenaphthylene	ND	mg/kg	0.50
Acenaphthene	ND	mg/kg	0.50
2,4-Dinitrophenol	ND	mg/kg	1.5
4-Nitrophenol	ND	mg/kg	2.5
2,4-Dinitrotoluene	ND	mg/kg	0.50
2,6-Dinitrotoluene	ND	mg/kg	0.50
Diethyl phthalate	ND	mg/kg	0.50
4-Chlorophenyl phenyl ether	ND	mg/kg	0.50
Fluorene	ND	mg/kg	0.50
4,6-Dinitro-2-methylphenol	ND	mg/kg	1.5
4-Bromophenyl phenyl ether	ND	mg/kg	0.50
Hexachlorobenzene	ND	mg/kg	0.50
Pentachlorophenol	ND	mg/kg	1.5

ND=Not Detected
NA=Not Applicable

Reported By: Michael Blades Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-502
Lab ID: 001688-0003-SA Enseco ID: 1013669
Matrix: SOIL Sampled: 14 SEP 88 Received: 16 SEP 88
Authorized: 16 SEP 88 Prepared: 21 SEP 88 Analyzed: 03 OCT 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenanthrene	ND	mg/kg	0.50
Anthracene	ND	mg/kg	0.50
Di-n-butyl phthalate	ND	mg/kg	0.50
Fluoranthene	ND	mg/kg	0.50
Pyrene	ND	mg/kg	0.50
Butyl benzyl phthalate	ND	mg/kg	0.50
3,3'-Dichlorobenzidine	ND	mg/kg	1.0
Benzo(a)anthracene	ND	mg/kg	0.50
bis(2-Ethylhexyl) phthalate	ND	mg/kg	0.50
Chrysene	ND	mg/kg	0.50
Di-n-octyl phthalate	ND	mg/kg	0.50
Benzo(b)fluoranthene	ND	mg/kg	0.50
Benzo(k)fluoranthene	ND	mg/kg	0.50
Benzo(a)pyrene	ND	mg/kg	0.50
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	0.50
Dibenzo(a,h)anthracene	ND	mg/kg	0.50
Benzo(g,h,i)perylene	ND	mg/kg	0.50
Acetophenone	ND	mg/kg	0.50
Aniline	ND	mg/kg	2.5
4-Aminobiphenyl	ND	mg/kg	2.5
Benzidine	ND	mg/kg	5.6
Benzoic acid	ND	mg/kg	2.5
Benzyl alcohol	ND	mg/kg	1.0
4-Chloroaniline	ND	mg/kg	1.0
Dibenz(a,j)acridine	ND	mg/kg	--
Dibenzofuran	ND	mg/kg	0.50
p-Dimethylaminoazobenzene	ND	mg/kg	2.5
7,12-Dimethylbenz-anthracene	ND	mg/kg	2.5
a,a-Dimethylphen-ethylamine	ND	mg/kg	--
Diphenylamine	ND	mg/kg	2.5
1,2-Diphenylhydrazine	ND	mg/kg	2.5
Ethyl methanesulfonate	ND	mg/kg	2.5
Methyl methanesulfonate	ND	mg/kg	2.5
2-Methylnaphthalene	ND	mg/kg	0.50
1-Naphthylamine	ND	mg/kg	2.5
2-Naphthylamine	ND	mg/kg	2.5
2-Nitroaniline	ND	mg/kg	2.5
3-Nitroaniline	ND	mg/kg	2.5
4-Nitroaniline	ND	mg/kg	2.5

ND=Not Detected
NA=Not Applicable

Reported By: Michael Blades Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-502
Lab ID: 001688-0003-SA Enseco ID: 1013669
Matrix: SOIL Sampled: 14 SEP 88 Received: 16 SEP 88
Authorized: 16 SEP 88 Prepared: 21 SEP 88 Analyzed: 03 OCT 88

Parameter	Result	Wet wt. Units	Reporting Limit
Pentachlorobenzene	ND	mg/kg	2.5
Pentachloronitrobenzene	ND	mg/kg	2.5
Phenacetin	ND	mg/kg	2.5
2-Picoline	ND	mg/kg	2.5
Pronamide	ND	mg/kg	2.5
1,2,4,5-Tetrachloro-benzene	ND	mg/kg	2.5
2,6-Dichlorophenol	ND	mg/kg	2.5
2-Methylphenol	ND	mg/kg	0.50
4-Methylphenol	ND	mg/kg	0.50
2,3,4,6-Tetrachlorophenol	ND	mg/kg	2.5
N-Nitrosodi-n-butylamine	ND	mg/kg	2.5
N-Nitrosodimethylamine	ND	mg/kg	2.5
N-Nitrosopiperidine	ND	mg/kg	2.5
1-Chloronaphthalene	ND	mg/kg	2.5
3-Methylcholanthrene	ND	mg/kg	2.5
N-Nitrosodiphenylamine	ND	mg/kg	0.50
Nitrobenzene-d5	54.6	%	--
2-Fluorobiphenyl	57.2	%	--
Terphenyl-d14	64.8	%	--
Phenol-d5	55.9	%	--
2-Fluorophenol	53.1	%	--
2,4,6-Tribromophenol	50.2	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Michael Blades Approved By: Jeff Lowry

The cover letter is an integral part of this report.
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Enseco

TENTATIVELY IDENTIFIED COMPOUNDS

FOR

WOODWARD-CLYDE CONSULTANTS

SAMPLE NUMBER 001688-0003

Compound Name	Fraction	Confidence Level	Estimated Concentration mg/kg
Unknown	BNA	--	1.3
Oxygenated Hydrocarbon	BNA	1C	0.71
Oxygenated Hydrocarbon	BNA	1C	44
2-Hexanone,5-Methyl-	BNA	2I	2.2
Oxygenated Hydrocarbon	BNA	1C	0.56

NOTES:

Confidence Levels

Level 3 - Confirmed Identification
Level 2 - Confident Identification
Level 1 - Tentative Identification

Qualifiers

I - Isomer
C - Class

Please refer to the discussion for further details.

Enseco

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-502
Lab ID: 001688-0003-SA
Matrix: SOIL
Authorized: 16 SEP 88

Enseco ID: 1013669
Sampled: 14 SEP 88
Prepared: 07 OCT 88

Received: 16 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/kg	10	239.1	15 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts

Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-502
Lab ID: 001688-0003-SA Enseco ID: 1013669
Matrix: SOIL Sampled: 14 SEP 88 Received: 16 SEP 88
Authorized: 16 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	95.7	%	0.1	160.3	30 SEP 88
Total Petroleum Hydrocarbons	ND	mg/kg	50	3550/418.1 Mod.	12 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Pam Rosas Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
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SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
001734-0001-SA	R-FT-0601	SOIL	16 SEP 88	08:50	17 SEP 88
001734-0002-SA	R-FT-0602	SOIL	16 SEP 88	09:20	17 SEP 88
001734-0003-SA	R-FT-0603	SOIL	16 SEP 88	09:30	17 SEP 88

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0601
Lab ID: 001734-0001-SA Enseco ID: 1013862
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 19 SEP 88 Analyzed: 30 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	0.10
Bromomethane (Methylbromide)	ND	mg/kg	0.10
Vinyl chloride	ND	mg/kg	0.10
Chloroethane	ND	mg/kg	0.10
Methylene chloride	ND	mg/kg	0.10
Acetone	ND	mg/kg	0.10
Carbon disulfide	ND	mg/kg	0.10
1,1-Dichloroethene	ND	mg/kg	0.10
1,1-Dichloroethane	ND	mg/kg	0.10
trans-1,2-Dichloroethene	ND	mg/kg	0.10
Chloroform	ND	mg/kg	0.10
1,2-Dichloroethane	ND	mg/kg	0.10
2-Butanone	ND	mg/kg	0.20
1,1,1-Trichloroethane	ND	mg/kg	0.10
Carbon tetrachloride	ND	mg/kg	0.10
Bromodichloromethane	ND	mg/kg	0.10
1,2-Dichloropropane	ND	mg/kg	0.10
trans-1,3-Dichloropropene	ND	mg/kg	0.10
Trichloroethene	ND	mg/kg	0.10
Chlorodibromomethane	ND	mg/kg	0.10
1,1,2-Trichloroethane	ND	mg/kg	0.10
Benzene	ND	mg/kg	0.10
cis-1,3-Dichloropropene	ND	mg/kg	0.10
2-Chloroethyl vinyl ether	ND	mg/kg	0.50
Bromoform	ND	mg/kg	0.10
4-Methyl-2-pentanone	ND	mg/kg	0.10
1,1,2,2-Tetrachloroethane	ND	mg/kg	0.10
Tetrachloroethene	ND	mg/kg	0.10
Toluene	ND	mg/kg	0.10
Chlorobenzene	ND	mg/kg	0.10
Ethyl benzene	ND	mg/kg	0.10
Total xylenes	ND	mg/kg	0.10
Trichlorofluoromethane	ND	mg/kg	0.10
Acrolein	ND	mg/kg	0.10
Acrylonitrile	ND	mg/kg	0.10
Dibromomethane	ND	mg/kg	0.10
Dichlorodifluoromethane	ND	mg/kg	0.10
Ethanol	ND	mg/kg	0.20
Ethyl methacrylate	ND	mg/kg	0.10
2-Hexanone	ND	mg/kg	0.10
Iodomethane	ND	mg/kg	0.10

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0601
Lab ID: 001734-0001-SA Enseco ID: 1013862
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 19 SEP 88 Analyzed: 30 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	0.10
1,2,3-Trichloropropane	ND	mg/kg	0.10
Vinyl acetate	ND	mg/kg	0.30
trans-1,4-Dichloro-2-butene	ND	mg/kg	0.10
Toluene-d8	100	%	---
4-Bromofluorobenzene (BFB)	97.0	%	---
1,2-Dichloroethane-d4	94.6	%	---

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0601
Lab ID: 001734-0001-SA Enseco ID: 1013862
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 21 SEP 88 Analyzed: 29 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
1-Chloronaphthalene	ND	mg/kg	2.5
3-Methylcholanthrene	ND	mg/kg	2.5
N-Nitrosodiphenylamine	ND	mg/kg	0.50
Hexachlorocyclopentadiene	ND	mg/kg	0.50
2-Methylphenol	ND	mg/kg	0.50
2,3,4,6-Tetrachlorophenol	ND	mg/kg	2.5
Acetophenone	ND	mg/kg	0.50
4-Nitroaniline	ND	mg/kg	2.5
1-Naphthylamine	ND	mg/kg	2.5
a,a-Dimethylphen-ethylamine	ND	mg/kg	--
Benzidine	ND	mg/kg	5.6
2-Naphthylamine	ND	mg/kg	2.5
Benzoic acid	ND	mg/kg	2.5
4-Chloroaniline	ND	mg/kg	1.0
Benzyl alcohol	ND	mg/kg	1.0
N-Nitrosopiperidine	ND	mg/kg	2.5
Pentachlorobenzene	ND	mg/kg	2.5
Pronamide	ND	mg/kg	2.5
Methyl methanesulfonate	ND	mg/kg	2.5
N-Nitrosodimethylamine	ND	mg/kg	2.5
1,2,4,5-Tetrachloro-benzene	ND	mg/kg	2.5
N-Nitrosodi-n-butylamine	ND	mg/kg	2.5
2-Nitroaniline	ND	mg/kg	2.5
4-Methylphenol	ND	mg/kg	0.50
Aniline	ND	mg/kg	2.5
Diphenylamine	ND	mg/kg	2.5
Dibenz(a,j)acridine	ND	mg/kg	--
2-Picoline	ND	mg/kg	2.5
1,2-Diphenylhydrazine	ND	mg/kg	2.5
Phenacetin	ND	mg/kg	2.5
p-Dimethylaminoazobenzene	ND	mg/kg	2.5
2,6-Dichlorophenol	ND	mg/kg	2.5
3-Nitroaniline	ND	mg/kg	2.5
Pentachloronitrobenzene	ND	mg/kg	2.5
2-Methylnaphthalene	ND	mg/kg	0.50
Ethyl methanesulfonate	ND	mg/kg	2.5
7,12-Dimethylbenz-anthracene	ND	mg/kg	2.5
Dibenzofuran	ND	mg/kg	0.50
4-Aminobiphenyl	ND	mg/kg	2.5

ND=Not Detected
NA=Not Applicable

Reported By: Jay Garamone Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0601
Lab ID: 001734-0001-SA Enseco ID: 1013862
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 21 SEP 88 Analyzed: 29 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenol	ND	mg/kg	0.50
bis(2-Chloroethyl)ether	ND	mg/kg	0.50
2-Chlorophenol	ND	mg/kg	0.50
1,3-Dichlorobenzene	ND	mg/kg	0.50
1,4-Dichlorobenzene	ND	mg/kg	0.50
1,2-Dichlorobenzene	ND	mg/kg	0.50
bis(2-Chloroisopropyl) ether	ND	mg/kg	0.50
N-Nitroso-di-n-propylamine	ND	mg/kg	0.50
Hexachloroethane	ND	mg/kg	0.50
Nitrobenzene	ND	mg/kg	0.50
Isophorone	ND	mg/kg	0.50
2-Nitrophenol	ND	mg/kg	0.50
2,4-Dimethylphenol	ND	mg/kg	0.50
bis(2-Chloroethoxy) methane	ND	mg/kg	0.50
2,4-Dichlorophenol	ND	mg/kg	0.50
1,2,4-Trichlorobenzene	ND	mg/kg	0.50
Naphthalene	ND	mg/kg	0.50
Hexachlorobutadiene	ND	mg/kg	0.50
4-Chloro-3-methylphenol	ND	mg/kg	0.50
2,4,6-Trichlorophenol	ND	mg/kg	0.50
2,4,5-Trichlorophenol	ND	mg/kg	1.5
2-Chloronaphthalene	ND	mg/kg	0.50
Dimethyl phthalate	ND	mg/kg	0.50
Acenaphthylene	ND	mg/kg	0.50
Acenaphthene	ND	mg/kg	0.50
2,4-Dinitrophenol	ND	mg/kg	1.5
4-Nitrophenol	ND	mg/kg	2.5
2,4-Dinitrotoluene	ND	mg/kg	0.50
2,6-Dinitrotoluene	ND	mg/kg	0.50
Diethyl phthalate	ND	mg/kg	0.50
4-Chlorophenyl phenyl ether	ND	mg/kg	0.50
Fluorene	ND	mg/kg	0.50
4,6-Dinitro-2-methylphenol	ND	mg/kg	1.5
4-Bromophenyl phenyl ether	ND	mg/kg	0.50
Hexachlorobenzene	ND	mg/kg	0.50
Pentachlorophenol	ND	mg/kg	1.5

ND=Not Detected
NA=Not Applicable

Reported By: Jay Garamone Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0601
Lab ID: 001734-0001-SA Enseco ID: 1013862
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 21 SEP 88 Analyzed: 29 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenanthrene	ND	mg/kg	0.50
Anthracene	ND	mg/kg	0.50
Di-n-butyl phthalate	ND	mg/kg	0.50
Fluoranthene	ND	mg/kg	0.50
Pyrene	ND	mg/kg	0.50
Butyl benzyl phthalate	ND	mg/kg	0.50
3,3'-Dichlorobenzidine	ND	mg/kg	1.0
Benzo(a)anthracene	ND	mg/kg	0.50
bis(2-Ethylhexyl) phthalate	ND	mg/kg	0.50
Chrysene	ND	mg/kg	0.50
Di-n-octyl phthalate	ND	mg/kg	0.50
Benzo(b)fluoranthene	ND	mg/kg	0.50
Benzo(k)fluoranthene	ND	mg/kg	0.50
Benzo(a)pyrene	ND	mg/kg	0.50
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	0.50
Dibenzo(a,h)anthracene	ND	mg/kg	0.50
Benzo(g,h,i)perylene	ND	mg/kg	0.50
Nitrobenzene-d5	64.6	%	--
2-Fluorobiphenyl	68.0	%	--
Terphenyl-d14	71.0	%	--
Phenol-d5	62.3	%	--
2-Fluorophenol	64.9	%	--
2,4,6-Tribromophenol	61.9	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Jay Garamone Approved By: Jeff Lowry

The cover letter is an integral part of this report.
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Enseco

TENTATIVELY IDENTIFIED COMPOUNDS

FOR

WOODWARD-CLYDE CONSULTANTS

SAMPLE NUMBER 001734-0001

Compound Name	Fraction	Confidence Level	Estimated Concentration mg/kg
Cyclotrisiloxane,Hexamethyl-	BNA	1	0.49
Unknown	BNA	--	0.46
2-Hexanone,6-(Acetyloxy)-	BNA	1I	0.83
2-Butanol,3-Methyl-,Acetate	BNA	1I	0.50

NOTES:

Confidence Levels

Level 3 - Confirmed Identification
Level 2 - Confident Identification
Level 1 - Tentative Identification

Qualifiers

I - Isomer
C - Class

Please refer to the discussion for further details.

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0601
Lab ID: 001734-0001-SA Enseco ID: 1013862
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 07 OCT 88 Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/kg	10	239.1	15 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
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General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0601
Lab ID: 001734-0001-SA
Matrix: SOIL
Authorized: 18 SEP 88

Enseco ID: 1013862
Sampled: 16 SEP 88
Prepared: NA

Received: 17 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	97.4	%	0.1	160.3	30 SEP 88
Total Petroleum Hydrocarbons	ND	mg/kg	50	3550/418.1 Mod.	10 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell

Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0602
Lab ID: 001734-0002-SA Enseco ID: 1013863
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 19 SEP 88 Analyzed: 30 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	0.10
Bromomethane (Methylbromide)	ND	mg/kg	0.10
Vinyl chloride	ND	mg/kg	0.10
Chloroethane	ND	mg/kg	0.10
Methylene chloride	ND	mg/kg	0.10
Acetone	ND	mg/kg	0.10
Carbon disulfide	ND	mg/kg	0.10
1,1-Dichloroethene	ND	mg/kg	0.10
1,1-Dichloroethane	ND	mg/kg	0.10
trans-1,2-Dichloroethene	ND	mg/kg	0.10
Chloroform	ND	mg/kg	0.10
1,2-Dichloroethane	ND	mg/kg	0.10
2-Butanone	ND	mg/kg	0.20
1,1,1-Trichloroethane	ND	mg/kg	0.10
Carbon tetrachloride	ND	mg/kg	0.10
Bromodichloromethane	ND	mg/kg	0.10
1,2-Dichloropropane	ND	mg/kg	0.10
trans-1,3-Dichloropropene	ND	mg/kg	0.10
Trichloroethene	ND	mg/kg	0.10
Chlorodibromomethane	ND	mg/kg	0.10
1,1,2-Trichloroethane	ND	mg/kg	0.10
Benzene	ND	mg/kg	0.10
cis-1,3-Dichloropropene	ND	mg/kg	0.10
2-Chloroethyl vinyl ether	ND	mg/kg	0.50
Bromoform	ND	mg/kg	0.10
4-Methyl-2-pentanone	ND	mg/kg	0.10
1,1,2,2-Tetrachloroethane	ND	mg/kg	0.10
Tetrachloroethene	ND	mg/kg	0.10
Toluene	ND	mg/kg	0.10
Chlorobenzene	ND	mg/kg	0.10
Ethyl benzene	ND	mg/kg	0.10
Total xylenes	ND	mg/kg	0.10
Trichlorofluoromethane	ND	mg/kg	0.10
Acrolein	ND	mg/kg	0.10
Acrylonitrile	ND	mg/kg	0.10
Dibromomethane	ND	mg/kg	0.10
Dichlorodifluoromethane	ND	mg/kg	0.10
Ethanol	ND	mg/kg	0.20
Ethyl methacrylate	ND	mg/kg	0.10
2-Hexanone	ND	mg/kg	0.10
Iodomethane	ND	mg/kg	0.10

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0602
Lab ID: 001734-0002-SA
Matrix: SOIL
Authorized: 18 SEP 88

Enseco ID: 1013863
Sampled: 16 SEP 88
Prepared: 19 SEP 88

Received: 17 SEP 88
Analyzed: 30 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	0.10
1,2,3-Trichloropropane	ND	mg/kg	0.10
Vinyl acetate	ND	mg/kg	0.30
trans-1,4-Dichloro-2-butene	ND	mg/kg	0.10
Toluene-d8	102	%	---
4-Bromofluorobenzene (BFB)	94.8	%	---
1,2-Dichloroethane-d4	93.4	%	---

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley

Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0602
Lab ID: 001734-0002-SA Enseco ID: 1013863
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 21 SEP 88 Analyzed: 30 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
1-Chloronaphthalene	ND	mg/kg	2.5
3-Methylcholanthrene	ND	mg/kg	2.5
N-Nitrosodiphenylamine	ND	mg/kg	0.50
Hexachlorocyclopentadiene	ND	mg/kg	0.50
2-Methylphenol	ND	mg/kg	0.50
2,3,4,6-Tetrachlorophenol	ND	mg/kg	2.5
Acetophenone	ND	mg/kg	0.50
4-Nitroaniline	ND	mg/kg	2.5
1-Naphthylamine	ND	mg/kg	2.5
a,a-Dimethylphenethylamine	ND	mg/kg	--
Benzidine	ND	mg/kg	5.6
2-Naphthylamine	ND	mg/kg	2.5
Benzoic acid	ND	mg/kg	2.5
4-Chloroaniline	ND	mg/kg	1.0
Benzyl alcohol	ND	mg/kg	1.0
N-Nitrosopiperidine	ND	mg/kg	2.5
Pentachlorobenzene	ND	mg/kg	2.5
Pronamide	ND	mg/kg	2.5
Methyl methanesulfonate	ND	mg/kg	2.5
N-Nitrosodimethylamine	ND	mg/kg	2.5
1,2,4,5-Tetrachlorobenzene	ND	mg/kg	2.5
N-Nitrosodi-n-butylamine	ND	mg/kg	2.5
2-Nitroaniline	ND	mg/kg	2.5
4-Methylphenol	ND	mg/kg	0.50
Aniline	ND	mg/kg	2.5
Diphenylamine	ND	mg/kg	2.5
Dibenz(a,j)acridine	ND	mg/kg	--
2-Picoline	ND	mg/kg	2.5
1,2-Diphenylhydrazine	ND	mg/kg	2.5
Phenacetin	ND	mg/kg	2.5
p-Dimethylaminoazobenzene	ND	mg/kg	2.5
2,6-Dichlorophenol	ND	mg/kg	2.5
3-Nitroaniline	ND	mg/kg	2.5
Pentachloronitrobenzene	ND	mg/kg	2.5
2-Methylnaphthalene	ND	mg/kg	0.50
Ethyl methanesulfonate	ND	mg/kg	2.5
7,12-Dimethylbenzanthracene	ND	mg/kg	2.5
Dibenzofuran	ND	mg/kg	0.50
4-Aminobiphenyl	ND	mg/kg	2.5

ND=Not Detected
NA=Not Applicable

Reported By: Jay Garamone Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0602
Lab ID: 001734-0002-SA Enseco ID: 1013863
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 21 SEP 88 Analyzed: 30 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenol	ND	mg/kg	0.50
bis(2-Chloroethyl)ether	ND	mg/kg	0.50
2-Chlorophenol	ND	mg/kg	0.50
1,3-Dichlorobenzene	ND	mg/kg	0.50
1,4-Dichlorobenzene	ND	mg/kg	0.50
1,2-Dichlorobenzene	ND	mg/kg	0.50
bis(2-Chloroisopropyl) ether	ND	mg/kg	0.50
N-Nitroso-di-n-propylamine	ND	mg/kg	0.50
Hexachloroethane	ND	mg/kg	0.50
Nitrobenzene	ND	mg/kg	0.50
Isophorone	ND	mg/kg	0.50
2-Nitrophenol	ND	mg/kg	0.50
2,4-Dimethylphenol	ND	mg/kg	0.50
bis(2-Chloroethoxy) methane	ND	mg/kg	0.50
2,4-Dichlorophenol	ND	mg/kg	0.50
1,2,4-Trichlorobenzene	ND	mg/kg	0.50
Naphthalene	ND	mg/kg	0.50
Hexachlorobutadiene	ND	mg/kg	0.50
4-Chloro-3-methylphenol	ND	mg/kg	0.50
2,4,6-Trichlorophenol	ND	mg/kg	0.50
2,4,5-Trichlorophenol	ND	mg/kg	1.5
2-Chloronaphthalene	ND	mg/kg	0.50
Dimethyl phthalate	ND	mg/kg	0.50
Acenaphthylene	ND	mg/kg	0.50
Acenaphthene	ND	mg/kg	0.50
2,4-Dinitrophenol	ND	mg/kg	1.5
4-Nitrophenol	ND	mg/kg	2.5
2,4-Dinitrotoluene	ND	mg/kg	0.50
2,6-Dinitrotoluene	ND	mg/kg	0.50
Diethyl phthalate	ND	mg/kg	0.50
4-Chlorophenyl phenyl ether	ND	mg/kg	0.50
Fluorene	ND	mg/kg	0.50
4,6-Dinitro-2-methylphenol	ND	mg/kg	1.5
4-Bromophenyl phenyl ether	ND	mg/kg	0.50
Hexachlorobenzene	ND	mg/kg	0.50
Pentachlorophenol	ND	mg/kg	1.5

ND=Not Detected
NA=Not Applicable

Reported By: Jay Garamone Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0602
Lab ID: 001734-0002-SA Enseco ID: 1013863
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 21 SEP 88 Analyzed: 30 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenanthrene	ND	mg/kg	0.50
Anthracene	ND	mg/kg	0.50
Di-n-butyl phthalate	ND	mg/kg	0.50
Fluoranthene	ND	mg/kg	0.50
Pyrene	ND	mg/kg	0.50
Butyl benzyl phthalate	ND	mg/kg	0.50
3,3'-Dichlorobenzidine	ND	mg/kg	1.0
Benzo(a)anthracene	ND	mg/kg	0.50
bis(2-Ethylhexyl) phthalate	ND	mg/kg	0.50
Chrysene	ND	mg/kg	0.50
Di-n-octyl phthalate	ND	mg/kg	0.50
Benzo(b)fluoranthene	ND	mg/kg	0.50
Benzo(k)fluoranthene	ND	mg/kg	0.50
Benzo(a)pyrene	ND	mg/kg	0.50
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	0.50
Dibenzo(a,h)anthracene	ND	mg/kg	0.50
Benzo(g,h,i)perylene	ND	mg/kg	0.50
Nitrobenzene-d5	75.4	%	--
2-Fluorobiphenyl	69.6	%	--
Terphenyl-d14	79.2	%	--
Phenol-d5	68.9	%	--
2-Fluorophenol	73.5	%	--
2,4,6-Tribromophenol	65.6	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Jay Garamone Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

TENTATIVELY IDENTIFIED COMPOUNDS

FOR

WOOWARD-CLYDE CONSULTANTS

SAMPLE NUMBER 001734-0002

Compound Name	Fraction	Confidence Level	Estimated Concentration mg\kg
Cyclotrisiloxane,Hexamethyl-	BNA	1	0.35
Unknown	BNA	--	0.50
2-Hexanone,6-(Acetyloxy)-	BNA	1	0.72
2-Butanol,3-Methyl-,Acetate	BNA	1	0.54

NOTES:

Confidence Levels

Level 3 - Confirmed Identification
Level 2 - Confident Identification
Level 1 - Tentative Identification

Qualifiers

I - Isomer
C - Class

Please refer to the discussion for further details.

Enseco

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0602
Lab ID: 001734-0002-SA Enseco ID: 1013863
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 07 OCT 88 Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/kg	10	239.1	15 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0602
Lab ID: 001734-0002-SA
Matrix: SOIL
Authorized: 18 SEP 88

Enseco ID: 1013863
Sampled: 16 SEP 88
Prepared: NA

Received: 17 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	95.8	%	0.1	160.3	30 SEP 88
Total Petroleum Hydrocarbons	ND	mg/kg	50	3550/418.1 Mod.	10 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell

Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0603
Lab ID: 001734-0003-SA Enseco ID: 1013864
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 19 SEP 88 Analyzed: 30 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Chloromethane	ND	mg/kg	0.10
Bromomethane (Methylbromide)	ND	mg/kg	0.10
Vinyl chloride	ND	mg/kg	0.10
Chloroethane	ND	mg/kg	0.10
Methylene chloride	ND	mg/kg	0.10
Acetone	ND	mg/kg	0.10
Carbon disulfide	ND	mg/kg	0.10
1,1-Dichloroethene	ND	mg/kg	0.10
1,1-Dichloroethane	ND	mg/kg	0.10
trans-1,2-Dichloroethene	ND	mg/kg	0.10
Chloroform	ND	mg/kg	0.10
1,2-Dichloroethane	ND	mg/kg	0.10
2-Butanone	ND	mg/kg	0.20
1,1,1-Trichloroethane	ND	mg/kg	0.10
Carbon tetrachloride	ND	mg/kg	0.10
Bromodichloromethane	ND	mg/kg	0.10
1,2-Dichloropropane	ND	mg/kg	0.10
trans-1,3-Dichloropropene	ND	mg/kg	0.10
Trichloroethene	ND	mg/kg	0.10
Chlorodibromomethane	ND	mg/kg	0.10
1,1,2-Trichloroethane	ND	mg/kg	0.10
Benzene	ND	mg/kg	0.10
cis-1,3-Dichloropropene	ND	mg/kg	0.10
2-Chloroethyl vinyl ether	ND	mg/kg	0.50
Bromoform	ND	mg/kg	0.10
4-Methyl-2-pentanone	ND	mg/kg	0.10
1,1,2,2-Tetrachloroethane	ND	mg/kg	0.10
Tetrachloroethene	ND	mg/kg	0.10
Toluene	ND	mg/kg	0.10
Chlorobenzene	ND	mg/kg	0.10
Ethyl benzene	ND	mg/kg	0.10
Total xylenes	ND	mg/kg	0.10
Trichlorofluoromethane	ND	mg/kg	0.10
Acrolein	ND	mg/kg	0.10
Acrylonitrile	ND	mg/kg	0.10
Dibromomethane	ND	mg/kg	0.10
Dichlorodifluoromethane	ND	mg/kg	0.10
Ethanol	ND	mg/kg	0.20
Ethyl methacrylate	ND	mg/kg	0.10
2-Hexanone	ND	mg/kg	0.10
Iodomethane	ND	mg/kg	0.10

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Purgeable Volatile Organics

Method 8240

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0603
Lab ID: 001734-0003-SA
Enseco ID: 1013864
Matrix: SOIL
Sampled: 16 SEP 88
Received: 17 SEP 88
Authorized: 18 SEP 88
Prepared: 19 SEP 88
Analyzed: 30 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Styrene	ND	mg/kg	0.10
1,2,3-Trichloropropane	ND	mg/kg	0.10
Vinyl acetate	ND	mg/kg	0.30
trans-1,4-Dichloro-2-butene	ND	mg/kg	0.10
Toluene-d8	101	%	--
4-Bromofluorobenzene (BFB)	93.8	%	--
1,2-Dichloroethane-d4	91.2	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley
Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0603
Lab ID: 001734-0003-SA Enseco ID: 1013864
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 21 SEP 88 Analyzed: 29 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
1-Chloronaphthalene	ND	mg/kg	2.5
3-Methylcholanthrene	ND	mg/kg	2.5
N-Nitrosodiphenylamine	ND	mg/kg	0.50
Hexachlorocyclopentadiene	ND	mg/kg	0.50
2-Methylphenol	ND	mg/kg	0.50
2,3,4,6-Tetrachlorophenol	ND	mg/kg	2.5
Acetophenone	ND	mg/kg	0.50
4-Nitroaniline	ND	mg/kg	2.5
1-Naphthylamine	ND	mg/kg	2.5
a,a-Dimethylphen-ethylamine	ND	mg/kg	--
Benzidine	ND	mg/kg	5.6
2-Naphthylamine	ND	mg/kg	2.5
Benzoic acid	ND	mg/kg	2.5
4-Chloroaniline	ND	mg/kg	1.0
Benzyl alcohol	ND	mg/kg	1.0
N-Nitrosopiperidine	ND	mg/kg	2.5
Pentachlorobenzene	ND	mg/kg	2.5
Pronamide	ND	mg/kg	2.5
Methyl methanesulfonate	ND	mg/kg	2.5
N-Nitrosodimethylamine	ND	mg/kg	2.5
1,2,4,5-Tetrachloro-benzene	ND	mg/kg	2.5
N-Nitrosodi-n-butylamine	ND	mg/kg	2.5
2-Nitroaniline	ND	mg/kg	2.5
4-Methylphenol	ND	mg/kg	0.50
Aniline	ND	mg/kg	2.5
Diphenylamine	ND	mg/kg	2.5
Dibenz(a,j)acridine	ND	mg/kg	--
2-Picoline	ND	mg/kg	2.5
1,2-Diphenylhydrazine	ND	mg/kg	2.5
Phenacetin	ND	mg/kg	2.5
p-Dimethylaminoazobenzene	ND	mg/kg	2.5
2,6-Dichlorophenol	ND	mg/kg	2.5
3-Nitroaniline	ND	mg/kg	2.5
Pentachloronitrobenzene	ND	mg/kg	2.5
2-Methylnaphthalene	ND	mg/kg	0.50
Ethyl methanesulfonate	ND	mg/kg	2.5
7,12-Dimethylbenz-anthracene	ND	mg/kg	2.5
Dibenzofuran	ND	mg/kg	0.50
4-Aminobiphenyl	ND	mg/kg	2.5

ND=Not Detected
NA=Not Applicable

Reported By: Jay Garamone Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0603
Lab ID: 001734-0003-SA Enseco ID: 1013864
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 21 SEP 88 Analyzed: 29 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenol	ND	mg/kg	0.50
bis(2-Chloroethyl)ether	ND	mg/kg	0.50
2-Chlorophenol	ND	mg/kg	0.50
1,3-Dichlorobenzene	ND	mg/kg	0.50
1,4-Dichlorobenzene	ND	mg/kg	0.50
1,2-Dichlorobenzene	ND	mg/kg	0.50
bis(2-Chloroisopropyl) ether	ND	mg/kg	0.50
N-Nitroso-di-n-propylamine	ND	mg/kg	0.50
Hexachloroethane	ND	mg/kg	0.50
Nitrobenzene	ND	mg/kg	0.50
Isophorone	ND	mg/kg	0.50
2-Nitrophenol	ND	mg/kg	0.50
2,4-Dimethylphenol	ND	mg/kg	0.50
bis(2-Chloroethoxy) methane	ND	mg/kg	0.50
2,4-Dichlorophenol	ND	mg/kg	0.50
1,2,4-Trichlorobenzene	ND	mg/kg	0.50
Naphthalene	ND	mg/kg	0.50
Hexachlorobutadiene	ND	mg/kg	0.50
4-Chloro-3-methylphenol	ND	mg/kg	0.50
2,4,6-Trichlorophenol	ND	mg/kg	0.50
2,4,5-Trichlorophenol	ND	mg/kg	1.5
2-Chloronaphthalene	ND	mg/kg	0.50
Dimethyl phthalate	ND	mg/kg	0.50
Acenaphthylene	ND	mg/kg	0.50
Acenaphthene	ND	mg/kg	0.50
2,4-Dinitrophenol	ND	mg/kg	1.5
4-Nitrophenol	ND	mg/kg	2.5
2,4-Dinitrotoluene	ND	mg/kg	0.50
2,6-Dinitrotoluene	ND	mg/kg	0.50
Diethyl phthalate	ND	mg/kg	0.50
4-Chlorophenyl phenyl ether	ND	mg/kg	0.50
Fluorene	ND	mg/kg	0.50
4,6-Dinitro-2-methylphenol	ND	mg/kg	1.5
4-Bromophenyl phenyl ether	ND	mg/kg	0.50
Hexachlorobenzene	ND	mg/kg	0.50
Pentachlorophenol	ND	mg/kg	1.5

ND=Not Detected
NA=Not Applicable

Reported By: Jay Garamone Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Semivolatile Organics

Method 8270

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0603
Lab ID: 001734-0003-SA
Matrix: SOIL
Authorized: 18 SEP 88

Enseco ID: 1013864
Sampled: 16 SEP 88
Prepared: 21 SEP 88

Received: 17 SEP 88
Analyzed: 29 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Phenanthrene	ND	mg/kg	0.50
Anthracene	ND	mg/kg	0.50
Di-n-butyl phthalate	ND	mg/kg	0.50
Fluoranthene	ND	mg/kg	0.50
Pyrene	ND	mg/kg	0.50
Butyl benzyl phthalate	ND	mg/kg	0.50
3,3'-Dichlorobenzidine	ND	mg/kg	1.0
Benzo(a)anthracene	ND	mg/kg	0.50
bis(2-Ethylhexyl) phthalate	ND	mg/kg	0.50
Chrysene	ND	mg/kg	0.50
Di-n-octyl phthalate	ND	mg/kg	0.50
Benzo(b)fluoranthene	ND	mg/kg	0.50
Benzo(k)fluoranthene	ND	mg/kg	0.50
Benzo(a)pyrene	ND	mg/kg	0.50
Indeno(1,2,3-c,d)pyrene	ND	mg/kg	0.50
Dibenzo(a,h)anthracene	ND	mg/kg	0.50
Benzo(g,h,i)perylene	ND	mg/kg	0.50
Nitrobenzene-d5	70.8	%	--
2-Fluorobiphenyl	68.4	%	--
Terphenyl-d14	82.0	%	--
Phenol-d5	72.0	%	--
2-Fluorophenol	76.5	%	--
2,4,6-Tribromophenol	78.6	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Jay Garamone

Approved By: Jeff Lowry

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TENTATIVELY IDENTIFIED COMPOUNDS

FOR

WOODWARD-CLYDE CONSULTANTS

SAMPLE NUMBER 001734-0003

Compound Name	Fraction	Confidence Level	Estimated Concentration mg/kg
Oxygenated Hydrocarbon	BNA	1C	0.39
Oxygenated Hydrocarbon	BNA	1C	0.75
Oxygenated Hydrocarbon	BNA	1C	0.50
Unknown	BNA	--	0.36
Unknown	BNA	--	0.67
Unknown	BNA	--	1.5
Saturated Hydrocarbon	BNA	1C	0.35
Unknown	BNA	--	0.33

NOTES:

Confidence Levels

Level 3 - Confirmed Identification
Level 2 - Confident Identification
Level 1 - Tentative Identification

Qualifiers

I - Isomer
C - Class

Please refer to the discussion for further details.

Enseco

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0603
Lab ID: 001734-0003-SA Enseco ID: 1013864
Matrix: SOIL Sampled: 16 SEP 88 Received: 17 SEP 88
Authorized: 18 SEP 88 Prepared: 07 OCT 88 Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/kg	10	239.1	15 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts Approved By: Kimberly Conroy

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Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0603
Lab ID: 001734-0003-SA
Matrix: SOIL
Authorized: 18 SEP 88
Enseco ID: 1013864
Sampled: 16 SEP 88
Prepared: NA
Received: 17 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Solids	93.1	%	0.1	160.3	30 SEP 88
Total Petroleum Hydrocarbons	ND	mg/kg	50	3550/418.1 Mod.	10 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell

Approved By: Kimberly Conroy

Enseco

SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
001816-0001-SA	R-FT-0403	AQUEOUS	21 SEP 88	13:45	23 SEP 88
001816-0002-SA	Trip blank W	AQUEOUS	21 SEP 88		23 SEP 88
001816-0003-SA	R-FT-0404	AQUEOUS	21 SEP 88	13:45	23 SEP 88
001816-0004-SA	R-FT-0303	AQUEOUS	21 SEP 88	12:45	23 SEP 88
001816-0005-SA	R-FT-0701	AQUEOUS	21 SEP 88	09:47	23 SEP 88
001816-0006-SA	R-FT-0203	AQUEOUS	21 SEP 88	11:10	23 SEP 88
001816-0007-SA	R-FT-0304	AQUEOUS	21 SEP 88	12:40	23 SEP 88
001816-0008-SA	R-FT-0104	AQUEOUS	22 SEP 88	08:45	23 SEP 88

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0403
Lab ID: 001816-0001-SA
Matrix: AQUEOUS
Authorized: 23 SEP 88

Enseco ID: 1014473
Sampled: 21 SEP 88
Prepared: NA

Received: 23 SEP 88
Analyzed: 28 SEP 88

Parameter	Result	Units	Reporting Limit
Benzene	18	ug/L	0.70
Toluene	ND	ug/L	1.0
Chlorobenzene	ND	ug/L	1.0
Ethyl benzene	45	ug/L	1.0
m-Xylene	44	ug/L	2.0
o & p-Xylene(s)	40	ug/L	2.0
1,3-Dichlorobenzene	ND	ug/L	2.0
1,2-Dichlorobenzene	ND	ug/L	2.0
1,4-Dichlorobenzene	ND	ug/L	0.50

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy

Approved By: Mike Hoffman

The cover letter is an integral part of this report.
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Enseco

Metals

Recoverable Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0403
Lab ID: 001816-0001-SA Enseco ID: 1014473
Matrix: AQUEOUS Sampled: 21 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: 24 OCT 88 Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	0.039	mg/L	0.002	239.2	25 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

Metals

Dissolved Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0403
Lab ID: 001816-0001-SA Enseco ID: 1014473
Matrix: AQUEOUS Sampled: 21 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/L	0.002	239.2	24 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Brian Anderson Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

General Inorganics

Enseco

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0403
Lab ID: 001816-0001-SA Enseco ID: 1014473
Matrix: AQUEOUS Sampled: 21 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	26	mg/L	2	405.1	29 SEP 88
Chemical Oxygen Demand (Regular)	208	mg/L	5	410.4	29 SEP 88
Dissolved Organic Carbon	21	mg/L	0.1	415.1	07 OCT 88
Ammonia as N	0.3	mg/L	0.1	350.1	11 OCT 88
Nitrite as N	ND	mg/L	0.01	353.2	23 SEP 88
Nitrate as N	ND	mg/L	0.1	353.2	06 OCT 88
Orthophosphate as P	0.33	mg/L	0.01	365.3	23 SEP 88
Organic Nitrogen as N	5.0	mg/L	0.1	351.2/350.1	28 OCT 88
Sulfide, Total	0.06	mg/L	0.05	376.2	27 SEP 88
Sulfate	6	mg/L	5	300.0	09 OCT 88
Total Kjeldahl Nitrogen as N	5.3	mg/L	0.1	351.2	19 OCT 88
Phosphorous, Total as P	1.5	mg/L	0.01	365.3	03 OCT 88
Total Petroleum Hydrocarbons	ND	mg/L	1	EPA 418.1	12 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Pam Rosas Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
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Enseco

GENERAL INORGANICS

(Water)

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0403
Lab ID: 043711-0001-SA
Matrix: AQUEOUS
Authorized: 03 OCT 88

Enseco ID: 70635
Sampled: 21 SEP 88
Prepared: NA

Received: 01 OCT 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Organic Carbon	22	mg/L	0.5	Method 415.1	18 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Don Fredrickson

Approved By: Hamid Foolad

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: Trip blank W
Lab ID: 001816-0002-SA Enseco ID: 1014474
Matrix: AQUEOUS Sampled: 21 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: 28 SEP 88

Parameter	Result	Units	Reporting Limit
Benzene	ND	ug/L	0.70
Toluene	1.6	ug/L	1.0
Chlorobenzene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0
1,3-Dichlorobenzene	ND	ug/L	2.0
1,2-Dichlorobenzene	ND	ug/L	2.0
1,4-Dichlorobenzene	ND	ug/L	0.50

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Mike Hoffman

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0404
Lab ID: 001816-0003-SA
Matrix: AQUEOUS
Authorized: 23 SEP 88

Enseco ID: 1014475
Sampled: 21 SEP 88
Prepared: NA

Received: 23 SEP 88
Analyzed: 28 SEP 88

Parameter	Result	Units	Reporting Limit
Benzene	16	ug/L	0.70
Toluene	ND	ug/L	1.0
Chlorobenzene	ND	ug/L	1.0
Ethyl benzene	45	ug/L	1.0
m-Xylene	44	ug/L	2.0
o & p-Xylene(s)	45	ug/L	2.0
1,3-Dichlorobenzene	ND	ug/L	2.0
1,2-Dichlorobenzene	ND	ug/L	2.0
1,4-Dichlorobenzene	ND	ug/L	0.50

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy

Approved By: Mike Hoffman

The cover letter is an integral part of this report.
Rev 230787

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0404
Lab ID: 001816-0003-SA Enseco ID: 1014475
Matrix: AQUEOUS Sampled: 21 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	16	mg/L	2	405.1	29 SEP 88
Chemical Oxygen Demand (Regular)	100	mg/L	20	410.4	12 OCT 88
Dissolved Organic Carbon	20	mg/L	0.1	415.1	07 OCT 88
Ammonia as N	0.3	mg/L	0.1	350.1	11 OCT 88
Nitrite as N	ND	mg/L	0.01	353.2	23 SEP 88
Nitrate as N	ND	mg/L	0.1	353.2	06 OCT 88
Orthophosphate as P	0.26	mg/L	0.01	365.3	23 SEP 88
Organic Nitrogen as N	5.6	mg/L	0.1	351.2/350.1	28 OCT 88
Sulfide, Total	ND	mg/L	0.05	376.2	27 SEP 88
Sulfate	6	mg/L	5	300.0	09 OCT 88
Total Kjeldahl Nitrogen as N	5.9	mg/L	0.1	351.2	19 OCT 88
Phosphorous, Total as P	3.9	mg/L	0.01	365.3	17 OCT 88
Total Petroleum Hydrocarbons	ND	mg/L	1	EPA 418.1	12 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Pam Rosas Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

GENERAL INORGANICS

(Water)

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0404
Lab ID: 043711-0003-SA
Matrix: AQUEOUS
Authorized: 03 OCT 88

Enseco ID: 70637
Sampled: 21 SEP 88
Prepared: NA

Received: 01 OCT 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Organic Carbon	19	mg/L	0.5	Method 415.1	18 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Don Fredrickson

Approved By: Hamid Foolad

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0303
Lab ID: 001816-0004-SA Enseco ID: 1014476
Matrix: AQUEOUS Sampled: 21 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: 28 SEP 88

Parameter	Result	Units	Reporting Limit
Benzene	200	ug/L	3.5
Toluene	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Ethyl benzene	70	ug/L	5.0
m-Xylene	140	ug/L	10
o & p-Xylene(s)	98	ug/L	10
1,3-Dichlorobenzene	ND	ug/L	10
1,2-Dichlorobenzene	ND	ug/L	10
1,4-Dichlorobenzene	ND	ug/L	2.5

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Mike Hoffman

The cover letter is an integral part of this report.
Rev 230787

Enseco

Metals

Recoverable Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0303
Lab ID: 001816-0004-SA Enseco ID: 1014476
Matrix: AQUEOUS Sampled: 21 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: 24 OCT 88 Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	0.017	mg/L	0.002	239.2	25 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

Metals

Dissolved Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0303
Lab ID: 001816-0004-SA Enseco ID: 1014476
Matrix: AQUEOUS Sampled: 21 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	0.002	mg/L	0.002	239.2	24 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Brian Anderson Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0303
Lab ID: 001816-0004-SA
Matrix: AQUEOUS
Authorized: 23 SEP 88

Enseco ID: 1014476
Sampled: 21 SEP 88
Prepared: NA

Received: 23 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Petroleum Hydrocarbons	1.5	mg/L	0.5	EPA 418.1	13 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Pam Rosas

Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0701
Lab ID: 001816-0005-SA Enseco ID: 1014477
Matrix: AQUEOUS Sampled: 21 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: 28 SEP 88

Parameter	Result	Units	Reporting Limit
Benzene	2.7	ug/L	0.70
Toluene	ND	ug/L	1.0
Chlorobenzene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0
1,3-Dichlorobenzene	ND	ug/L	2.0
1,2-Dichlorobenzene	ND	ug/L	2.0
1,4-Dichlorobenzene	ND	ug/L	0.50

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Mike Hoffman

The cover letter is an integral part of this report.
Rev 230787

Enseco

Metals

Recoverable Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0701
Lab ID: 001816-0005-SA
Matrix: AQUEOUS
Authorized: 23 SEP 88

Enseco ID: 1014477
Sampled: 21 SEP 88
Prepared: 24 OCT 88

Received: 23 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	0.036	mg/L	0.002	239.2	25 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts

Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

Metals

Dissolved Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0701
Lab ID: 001816-0005-SA Enseco ID: 1014477
Matrix: AQUEOUS Sampled: 21 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/L	0.002	239.2	24 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Brian Anderson Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0701
Lab ID: 001816-0005-SA
Matrix: AQUEOUS
Authorized: 23 SEP 88

Enseco ID: 1014477
Sampled: 21 SEP 88
Prepared: NA

Received: 23 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Petroleum Hydrocarbons	ND	mg/L	0.5	EPA 418.1	13 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Pam Rosas

Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0203
Lab ID: 001816-0006-SA Enseco ID: 1014478
Matrix: AQUEOUS Sampled: 21 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: 28 SEP 88

Parameter	Result	Units	Reporting Limit
Benzene	ND	ug/L	0.70
Toluene	ND	ug/L	1.0
Chlorobenzene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0
1,3-Dichlorobenzene	ND	ug/L	2.0
1,2-Dichlorobenzene	ND	ug/L	2.0
1,4-Dichlorobenzene	ND	ug/L	0.50

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Mike Hoffman

The cover letter is an integral part of this report.
Rev 230787

Enseco

Metals

Recoverable Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0203
Lab ID: 001816-0006-SA
Enseco ID: 1014478
Matrix: AQUEOUS
Sampled: 21 SEP 88
Received: 23 SEP 88
Authorized: 23 SEP 88
Prepared: 24 OCT 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	0.005	mg/L	0.002	239.2	25 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts
Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

Metals

Dissolved Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0203
Lab ID: 001816-0006-SA Enseco ID: 1014478
Matrix: AQUEOUS Sampled: 21 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/L	0.002	239.2	24 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Brian Anderson Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

General Inorganics

Enseco

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0203
Lab ID: 001816-0006-SA Enseco ID: 1014478
Matrix: AQUEOUS Sampled: 21 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Petroleum Hydrocarbons	ND	mg/L	0.5	EPA 418.1	13 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Pam Rosas Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0304
Lab ID: 001816-0007-SA Enseco ID: 1014479
Matrix: AQUEOUS Sampled: 21 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: 29 SEP 88

Parameter	Result	Units	Reporting Limit
Benzene	260	ug/L	7.0
Toluene	ND	ug/L	10
Chlorobenzene	ND	ug/L	10
Ethyl benzene	83	ug/L	10
m-Xylene	180	ug/L	20
o & p-Xylene(s)	160	ug/L	20
1,3-Dichlorobenzene	ND	ug/L	20
1,2-Dichlorobenzene	ND	ug/L	20
1,4-Dichlorobenzene	ND	ug/L	5.0

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Mike Hoffman

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0104
Lab ID: 001816-0008-SA Enseco ID: 1014480
Matrix: AQUEOUS Sampled: 22 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: 29 SEP 88

Parameter	Result	Units	Reporting Limit
Benzene	ND	ug/L	0.70
Toluene	ND	ug/L	1.0
Chlorobenzene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0
1,3-Dichlorobenzene	ND	ug/L	2.0
1,2-Dichlorobenzene	ND	ug/L	2.0
1,4-Dichlorobenzene	ND	ug/L	0.50

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Mike Hoffman

The cover letter is an integral part of this report.
Rev 230787

Enseco

Metals

Recoverable Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0104
Lab ID: 001816-0008-SA Enseco ID: 1014480
Matrix: AQUEOUS Sampled: 22 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: 24 OCT 88 Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	0.007	mg/L	0.002	239.2	25 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Dave Roberts Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

Metals

Dissolved Metals

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0104
Lab ID: 001816-0008-SA Enseco ID: 1014480
Matrix: AQUEOUS Sampled: 22 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/L	0.002	239.2	24 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Brian Anderson Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0104
Lab ID: 001816-0008-SA Enseco ID: 1014480
Matrix: AQUEOUS Sampled: 22 SEP 88 Received: 23 SEP 88
Authorized: 23 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Total Petroleum Hydrocarbons	ND	mg/L	1	EPA 418.1	13 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Pam Rosas Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
002350-0001-SA	R-FT-1101P	AQUEOUS	31 OCT 88	14:25	02 NOV 88
002350-0002-SA	R-FT-1201P	AQUEOUS	31 OCT 88	15:05	02 NOV 88
002350-0003-SA	R-FT-1301P	AQUEOUS	31 OCT 88	15:30	02 NOV 88
002350-0004-SA	R-FT-0801P	AQUEOUS	31 OCT 88	13:20	02 NOV 88
002350-0005-SA	R-FT-0901P	AQUEOUS	31 OCT 88	13:50	02 NOV 88
002350-0005-DU	R-FT-0901D	AQUEOUS	31 OCT 88	14:45	02 NOV 88
002350-0006-SA	R-FT-1001P	AQUEOUS	31 OCT 88	14:10	02 NOV 88
002350-0007-SA	R-FT-1401P	AQUEOUS	31 OCT 88	16:00	02 NOV 88
002350-0008-SA	R-FT-0403R	AQUEOUS	31 OCT 88	12:50	02 NOV 88
002350-0009-SA	R-FT-0404R	AQUEOUS	31 OCT 88	12:50	02 NOV 88
002350-0010-SA	R-FT-0702R	AQUEOUS	31 OCT 88	13:08	02 NOV 88
002350-0011-SA	R-FT-0703R	AQUEOUS	31 OCT 88	13:08	02 NOV 88

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1101P
Lab ID: 002350-0001-SA Enseco ID: 1018679
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: 04 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	ND	ug/L	0.70
Toluene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Kathy Humphreys

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1101P
Lab ID: 002350-0001-SA Enseco ID: 1018679
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	26	mg/L	2	405.1	02 NOV 88
Oil and Grease	ND	mg/L	0.5	413.2	15 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell Approved By: Dee Kettula

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1201P
Lab ID: 002350-0002-SA Enseco ID: 1018680
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: 07 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	ND	ug/L	0.70
Toluene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Kathy Humphreys

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1201P
Lab ID: 002350-0002-SA
Matrix: AQUEOUS
Authorized: 02 NOV 88

Enseco ID: 1018680
Sampled: 31 OCT 88
Prepared: NA

Received: 02 NOV 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	ND	mg/L	2	405.1	02 NOV 88
Oil and Grease	ND	mg/L	0.5	413.2	15 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell

Approved By: Dee Kettula

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1301P
Lab ID: 002350-0003-SA Enseco ID: 1018681
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: 07 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	ND	ug/L	0.70
Toluene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Kathy Humphreys

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1301P
Lab ID: 002350-0003-SA
Matrix: AQUEOUS
Authorized: 02 NOV 88

Enseco ID: 1018681
Sampled: 31 OCT 88
Prepared: NA

Received: 02 NOV 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	3	mg/L	2	405.1	02 NOV 88
Oil and Grease	ND	mg/L	0.5	413.2	15 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell

Approved By: Dee Kettula

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0801P
Lab ID: 002350-0004-SA
Matrix: AQUEOUS
Authorized: 02 NOV 88

Enseco ID: 1018682
Sampled: 31 OCT 88
Prepared: NA

Received: 02 NOV 88
Analyzed: 07 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	57	ug/L	1.8
Toluene	ND	ug/L	2.5
Ethyl benzene	33	ug/L	2.5
m-Xylene	66	ug/L	5.0
o & p-Xylene(s)	45	ug/L	5.0

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy

Approved By: Kathy Humphreys

The cover letter is an integral part of this report.
Rev 230787

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0801P
Lab ID: 002350-0004-SA Enseco ID: 1018682
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	176	mg/L	2	405.1	02 NOV 88
Oil and Grease	ND	mg/L	0.5	413.2	15 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell Approved By: Dee Kettula

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0901P
Lab ID: 002350-0005-SA Enseco ID: 1018683
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: 04 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	ND	ug/L	1.4
Toluene	ND	ug/L	2.0
Ethyl benzene	7.2	ug/L	2.0
m-Xylene	7.6	ug/L	4.0
o & p-Xylene(s)	11	ug/L	4.0

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Kathy Humphreys

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0901P
Lab ID: 002350-0005-SA Enseco ID: 1018683
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	22	mg/L	2	405.1	02 NOV 88
Oil and Grease	4.5	mg/L	0.5	413.2	15 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell Approved By: Dee Kettula

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0901D
Lab ID: 002350-0005-DU Enseco ID: 1018686
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: 04 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	59	ug/L	1.4
Toluene	3.0	ug/L	2.0
Ethyl benzene	34	ug/L	2.0
m-Xylene	70	ug/L	4.0
o & p-Xylene(s)	45	ug/L	4.0

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Kathy Humphreys

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1001P
Lab ID: 002350-0006-SA
Matrix: AQUEOUS
Authorized: 02 NOV 88

Enseco ID: 1018684
Sampled: 31 OCT 88
Prepared: NA

Received: 02 NOV 88
Analyzed: 04 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	1.4	ug/L	0.70
Toluene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy

Approved By: Kathy Humphreys

The cover letter is an integral part of this report.
Rev 230787

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1001P
Lab ID: 002350-0006-SA Enseco ID: 1018684
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	ND	mg/L	2	405.1	02 NOV 88
Oil and Grease	ND	mg/L	0.5	413.2	15 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell Approved By: Dee Kettula

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1401P
Lab ID: 002350-0007-SA
Matrix: AQUEOUS
Authorized: 02 NOV 88

Enseco ID: 1018685
Sampled: 31 OCT 88
Prepared: NA

Received: 02 NOV 88
Analyzed: 04 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	ND	ug/L	0.70
Toluene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy

Approved By: Kathy Humphreys

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1401P
Lab ID: 002350-0007-SA Enseco ID: 1018685
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	ND	mg/L	2	405.1	02 NOV 88
Oil and Grease	ND	mg/L	0.5	413.2	15 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell Approved By: Dee Kettula

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0403R
Lab ID: 002350-0008-SA Enseco ID: 1018687
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	8	mg/L	2	405.1	02 NOV 88
Orthophosphate as P	0.01	mg/L	0.01	365.3	02 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell Approved By: Dee Kettula

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0404R
Lab ID: 002350-0009-SA Enseco ID: 1018688
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	10	mg/L	2	405.1	02 NOV 88
Orthophosphate as P	ND	mg/L	0.01	365.3	02 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell Approved By: Dee Kettula

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0702R
Lab ID: 002350-0010-SA Enseco ID: 1018689
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	80	mg/L	2	405.1	14 NOV 88
Orthophosphate as P	0.05	mg/L	0.01	365.3	02 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell Approved By: Dee Kettula

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0703R
Lab ID: 002350-0011-SA Enseco ID: 1018690
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	45	mg/L	2	405.1	14 NOV 88
Orthophosphate as P	0.02	mg/L	0.01	365.3	02 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell Approved By: Dee Kettula

The cover letter is an integral part of this report.
Rev 230787

SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
001777-0001-SA	R-FT 06A01	SOIL	19 SEP 88		21 SEP 88
001777-0002-SA	R-FT 06A02	SOIL	19 SEP 88		21 SEP 88
001777-0003-SA	R-FT 04A01	SOIL	19 SEP 88		21 SEP 88
001777-0004-SA	R-FT 04A02	SOIL	19 SEP 88		21 SEP 88

Enseco

Aromatic Volatile Organics

SW8020

Client Name: Woodward-Clyde Consultants
Client ID: R-FT 06A01
Lab ID: 001777-0001-SA Enseco ID: 1014199
Matrix: SOIL Sampled: 19 SEP 88 Received: 21 SEP 88
Authorized: 21 SEP 88 Prepared: NA Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Benzene	ND	mg/kg	0.20
Toluene	ND	mg/kg	0.20
Chlorobenzene	ND	mg/kg	0.20
Ethyl benzene	ND	mg/kg	0.20
m-Xylene	ND	mg/kg	0.20
o & p-Xylene(s)	ND	mg/kg	0.20
1,3-Dichlorobenzene	ND	mg/kg	0.20
1,4-Dichlorobenzene	ND	mg/kg	0.20
1,2-Dichlorobenzene	ND	mg/kg	0.20

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Susan Brillante

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT 06A01
Lab ID: 001777-0001-SA
Matrix: SOIL
Authorized: 21 SEP 88

Enseco ID: 1014199
Sampled: 19 SEP 88
Prepared: 28 SEP 88

Received: 21 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Chemical Oxygen Demand (Regular)	4090	mg/kg	50	410.4 Mod.	10 OCT 88
Ammonia as N	ND	mg/kg	0.5	350.1	10 NOV 88
Orthophosphate as P	ND	mg/kg	0.05	365.3 mod.	28 SEP 88
Organic Nitrogen as N	68	mg/kg	1	351.2/350.1 Mod.	15 NOV 88
Total Kjeldahl Nitrogen as N	68	mg/kg	1	351.2 Mod.	10 NOV 88
Total Organic Carbon	0.06	%	0.05	9060	26 OCT 88
Phosphorous, Total as P	435	mg/kg	1	365.3	28 SEP 88
Total Petroleum Hydrocarbons	ND	mg/kg	50	3550/418.1 Mod.	13 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Pam Rosas

Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
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Enseco

Aromatic Volatile Organics

SW8020

Client Name: Woodward-Clyde Consultants
Client ID: R-FT 06A02
Lab ID: 001777-0002-SA Enseco ID: 1014200
Matrix: SOIL Sampled: 19 SEP 88 Received: 21 SEP 88
Authorized: 21 SEP 88 Prepared: NA Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Benzene	ND	mg/kg	0.20
Toluene	ND	mg/kg	0.20
Chlorobenzene	ND	mg/kg	0.20
Ethyl benzene	ND	mg/kg	0.20
m-Xylene	ND	mg/kg	0.20
o & p-Xylene(s)	ND	mg/kg	0.20
1,3-Dichlorobenzene	ND	mg/kg	0.20
1,4-Dichlorobenzene	ND	mg/kg	0.20
1,2-Dichlorobenzene	ND	mg/kg	0.20

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Susan Brillante

The cover letter is an integral part of this report.
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Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT 06A02
Lab ID: 001777-0002-SA
Matrix: SOIL
Authorized: 21 SEP 88

Enseco ID: 1014200
Sampled: 19 SEP 88
Prepared: 28 SEP 88

Received: 21 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Chemical Oxygen Demand (Regular)	4260	mg/kg	50	410.4 Mod.	10 OCT 88
Ammonia as N	ND	mg/kg	0.5	350.1	10 NOV 88
Organic Nitrogen as N	75	mg/kg	1	351.2/350.1 Mod.	15 NOV 88
Orthophosphate as P	ND	mg/kg	0.05	365.3 mod.	28 SEP 88
Total Kjeldahl Nitrogen as N	75	mg/kg	1	351.2 Mod.	10 NOV 88
Total Organic Carbon	0.05	%	0.05	9060	26 OCT 88
Phosphorous, Total as P	646	mg/kg	1	365.3	28 SEP 88
Total Petroleum Hydrocarbons	ND	mg/kg	50	3550/418.1 Mod.	13 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Pam Rosas

Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
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Enseco

Aromatic Volatile Organics

SW8020

Client Name: Woodward-Clyde Consultants
Client ID: R-FT 04A01
Lab ID: 001777-0003-SA
Matrix: SOIL
Authorized: 21 SEP 88
Enseco ID: 1014201
Sampled: 19 SEP 88
Prepared: NA
Received: 21 SEP 88
Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Benzene	ND	mg/kg	0.40
Toluene	ND	mg/kg	0.40
Chlorobenzene	ND	mg/kg	0.40
Ethyl benzene	ND	mg/kg	0.40
m-Xylene	2.1	mg/kg	0.40
o & p-Xylene(s)	ND	mg/kg	0.40
1,3-Dichlorobenzene	ND	mg/kg	0.40
1,4-Dichlorobenzene	ND	mg/kg	0.40
1,2-Dichlorobenzene	ND	mg/kg	0.40

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy
Approved By: Susan Brillante

The cover letter is an integral part of this report.
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Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT 04A01
Lab ID: 001777-0003-SA Enseco ID: 1014201
Matrix: SOIL Sampled: 19 SEP 88 Received: 21 SEP 88
Authorized: 21 SEP 88 Prepared: 28 SEP 88 Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Chemical Oxygen Demand (Regular)	22400	mg/kg	50	410.4 Mod.	10 OCT 88
Ammonia as N	ND	mg/kg	0.5	350.1	10 NOV 88
Organic Nitrogen as N	358	mg/kg	1	351.2/350.1 Mod.	15 NOV 88
Orthophosphate as P	0.06	mg/kg	0.05	365.3 mod.	28 SEP 88
Total Kjeldahl Nitrogen as N	358	mg/kg	1	351.2 Mod.	10 NOV 88
Total Organic Carbon	1.75	%	0.05	9060	26 OCT 88
Phosphorous, Total as P	683	mg/kg	1	365.3	28 SEP 88
Total Petroleum Hydrocarbons	6390	mg/kg	50	3550/418.1 Mod.	13 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Pam Rosas Approved By: Kimberly Conroy

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Enseco

Aromatic Volatile Organics

SW8020

Client Name: Woodward-Clyde Consultants
Client ID: R-FT 04A02
Lab ID: 001777-0004-SA Enseco ID: 1014202
Matrix: SOIL Sampled: 19 SEP 88 Received: 21 SEP 88
Authorized: 21 SEP 88 Prepared: NA Analyzed: 26 SEP 88

Parameter	Result	Wet wt. Units	Reporting Limit
Benzene	ND	mg/kg	2.0
Toluene	ND	mg/kg	2.0
Chlorobenzene	ND	mg/kg	2.0
Ethyl benzene	ND	mg/kg	2.0
m-Xylene	13	mg/kg	2.0
o & p-Xylene(s)	ND	mg/kg	2.0
1,3-Dichlorobenzene	ND	mg/kg	2.0
1,4-Dichlorobenzene	ND	mg/kg	2.0
1,2-Dichlorobenzene	ND	mg/kg	2.0

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Susan Brillante

The cover letter is an integral part of this report.
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Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT 04A02
Lab ID: 001777-0004-SA
Matrix: SOIL
Authorized: 21 SEP 88

Enseco ID: 1014202
Sampled: 19 SEP 88
Prepared: 28 SEP 88

Received: 21 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Chemical Oxygen Demand (Regular)	9740	mg/kg	50	410.4 Mod.	10 OCT 88
Ammonia as N	ND	mg/kg	0.5	350.1	10 NOV 88
Organic Nitrogen as N	214	mg/kg	1	351.2/350.1 Mod.	15 NOV 88
Orthophosphate as P	0.21	mg/kg	0.05	365.3 mod.	28 SEP 88
Total Kjeldahl Nitrogen as N	214	mg/kg	1	351.2 Mod.	10 NOV 88
Total Organic Carbon	0.73	%	0.05	9060	26 OCT 88
Phosphorous, Total as P	2510	mg/kg	1	365.3	28 SEP 88
Total Petroleum Hydrocarbons	5280	mg/kg	50	3550/418.1 Mod.	13 OCT 88

ND=Not Detected
NA=Not Applicable

Reported By: Pam Rosas

Approved By: Kimberly Conroy

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SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
002350-0001-SA	R-FT-1101P	AQUEOUS	31 OCT 88	14:25	02 NOV 88
002350-0002-SA	R-FT-1201P	AQUEOUS	31 OCT 88	15:05	02 NOV 88
002350-0003-SA	R-FT-1301P	AQUEOUS	31 OCT 88	15:30	02 NOV 88
002350-0004-SA	R-FT-0801P	AQUEOUS	31 OCT 88	13:20	02 NOV 88
002350-0005-SA	R-FT-0901P	AQUEOUS	31 OCT 88	13:50	02 NOV 88
002350-0005-DU	R-FT-0901D	AQUEOUS	31 OCT 88	14:45	02 NOV 88
002350-0006-SA	R-FT-1001P	AQUEOUS	31 OCT 88	14:10	02 NOV 88
002350-0007-SA	R-FT-1401P	AQUEOUS	31 OCT 88	16:00	02 NOV 88
002350-0008-SA	R-FT-0403R	AQUEOUS	31 OCT 88	12:50	02 NOV 88
002350-0009-SA	R-FT-0404R	AQUEOUS	31 OCT 88	12:50	02 NOV 88
002350-0010-SA	R-FT-0702R	AQUEOUS	31 OCT 88	13:08	02 NOV 88
002350-0011-SA	R-FT-0703R	AQUEOUS	31 OCT 88	13:08	02 NOV 88

Enseco-

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1101P
Lab ID: 002350-0001-SA Enseco ID: 1018679
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: 04 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	ND	ug/L	0.70
Toluene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0
pH	7.18		
Temperature	13.0	°C	
Conductivity	72	umhos/cm	

Appearance: clear, slight POL odor, no sheen, no metal floc.

flowrate = 0.016 cfs, 11/9/88 (Marsh Meb.), part of a braided stream

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Kathy Humphreys

The cover letter is an integral part of this report.
Rev 230787

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1101P
Lab ID: 002350-0001-SA Enseco ID: 1018679
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	26	mg/L	2	405.1	02 NOV 88
Oil and Grease	ND	mg/L	0.5	413.2	15 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell Approved By: Dee Kettula

The cover letter is an integral part of this report.
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Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1301P
Lab ID: 002350-0003-SA
Matrix: AQUEOUS
Authorized: 02 NOV 88

Enseco ID: 1018681
Sampled: 31 OCT 88
Prepared: NA

Received: 02 NOV 88
Analyzed: 07 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	ND	ug/L	0.70
Toluene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0

pH 7.57
Temperature 13.2 °C
Conductivity 200 umhos/cm

Appearance: foam fairly stable clean, foamy, slight moth ball odor, no sheen

Flow rate = 0.023 cfs, 10/31/89 (Catchment)

flow rate = 0.010 cfs, 11/9/88 (Marsh McBirney)

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy

Approved By: Kathy Humphreys

The cover letter is an integral part of this report.
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General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1301P
Lab ID: 002350-0003-SA Enseco ID: 1018681
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	3	mg/L	2	405.1	02 NOV 88
Oil and Grease	ND	mg/L	0.5	413.2	15 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell Approved By: Dee Kettula

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Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0801P
Lab ID: 002350-0004-SA
Matrix: AQUEOUS
Authorized: 02 NOV 88

Enseco ID: 1018682
Sampled: 31 OCT 88
Prepared: NA

Received: 02 NOV 88
Analyzed: 07 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	57	ug/L	1.8
Toluene	ND	ug/L	2.5
Ethyl benzene	33	ug/L	2.5
m-Xylene	66	ug/L	5.0
o & p-Xylene(s)	45	ug/L	5.0
Temperature	17	°C	
Conductivity	490	umhos/cm	
pH	6.79		

Appearance - Yellow, clear, strong POL odor, metal flocs sheen

Flowrate = 0.0046 cfs, 10/25/88 (Catchment)

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy

Approved By: Kathy Humphreys

The cover letter is an integral part of this report.
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General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0801P
Lab ID: 002350-0004-SA Enseco ID: 1018682
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	176	mg/L	2	405.1	02 NOV 88
Oil and Grease	ND	mg/L	0.5	413.2	15 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell Approved By: Dee Kettula

The cover letter is an integral part of this report.
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Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0901P
Lab ID: 002350-0005-SA Enseco ID: 1018683
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: 04 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	ND	ug/L	1.4
Toluene	ND	ug/L	2.0
Ethyl benzene	7.2	ug/L	2.0
m-Xylene	7.6	ug/L	4.0
o & p-Xylene(s)	11	ug/L	4.0
pH	7.05		
temperature	12.5	°C	
conductivity	340	umhos/cm	

appearance - clear, slt pol odor, sheen, metal floc

Flowrate = 0.0036 cfs, 10/25/88 (catchment)

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Kathy Humphreys

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General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0901P
Lab ID: 002350-0005-SA
Matrix: AQUEOUS
Authorized: 02 NOV 88
Enseco ID: 1018683
Sampled: 31 OCT 88
Prepared: NA
Received: 02 NOV 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	22	mg/L	2	405.1	02 NOV 88
Oil and Grease	4.5	mg/L	0.5	413.2	15 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell
Approved By: Dee Kettula

The cover letter is an integral part of this report.
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Enseco

Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0901D
Lab ID: 002350-0005-DU Enseco ID: 1018686
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: 04 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	59	ug/L	1.4
Toluene	3.0	ug/L	2.0
Ethyl benzene	34	ug/L	2.0
m-Xylene	70	ug/L	4.0
o & p-Xylene(s)	45	ug/L	4.0

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Kathy Humphreys

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Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1001P
Lab ID: 002350-0006-SA Enseco ID: 1018684
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: 04 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	1.4	ug/L	0.70
Toluene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0

pH	6.91	
temperature	12.1	°C
conductivity	195	umhos/cm

appearance: clear, strong POL odor, + sheen, metal floc.

Flow rate = 0.012 cfs, 10/25/88 (catchment)

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Kathy Humphreys

The cover letter is an integral part of this report.
Rev 230787

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1001P
Lab ID: 002350-0006-SA Enseco ID: 1018684
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	ND	mg/L	2	405.1	02 NOV 88
Oil and Grease	ND	mg/L	0.5	413.2	15 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell Approved By: Dee Kettula

The cover letter is an integral part of this report.
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Purgeable Aromatics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1401P
Lab ID: 002350-0007-SA Enseco ID: 1018685
Matrix: AQUEOUS Sampled: 31 OCT 88 Received: 02 NOV 88
Authorized: 02 NOV 88 Prepared: NA Analyzed: 04 NOV 88

Parameter	Result	Units	Reporting Limit
Benzene	ND	ug/L	0.70
Toluene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
m-Xylene	ND	ug/L	2.0
o & p-Xylene(s)	ND	ug/L	2.0

pH	7.54
Temperature	14.0°C
Conductivity	200 umhos/cm

Appearance: No foam, no odor

flowrate = 0.049 cfs, 11/9/88 (Marsh McB.)

ND=Not Detected
NA=Not Applicable

Reported By: Stan Dunlavy Approved By: Kathy Humphreys

The cover letter is an integral part of this report.
Rev 230787

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1401P
Lab ID: 002350-0007-SA
Enseco ID: 1018685
Matrix: AQUEOUS
Sampled: 31 OCT 88
Received: 02 NOV 88
Authorized: 02 NOV 88
Prepared: NA
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Biochemical Oxygen Demand	ND	mg/L	2	405.1	02 NOV 88
Oil and Grease	ND	mg/L	0.5	413.2	15 NOV 88

ND=Not Detected
NA=Not Applicable

Reported By: Mike Settell

Approved By: Dee Kettula

The cover letter is an integral part of this report.
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Woodward-Clyde Consultants

COC# 880272

I SAMPLE DESCRIPTION

WCC LAB ID	SAMPLE ID	MATRIX	DATE SAMPLED	CONTAINERS	ANALYSIS DESCRIPTION
880272-01-01	AZIDE REP 1	SOIL	11-28-88	1-8oz. GLASS JAR	TPH/BTEX/pH/MOISTURE
880272-02-01	AZIDE REP 2	SOIL	11-28-88	1-8oz. GLASS JAR	TPH/BTEX/pH/MOISTURE
880272-03-01	EMULSIFIED REP 1	SOIL	11-28-88	1-8oz. GLASS JAR	TPH/BTEX/pH/MOISTURE
880272-04-01	EMULSIFIED REP 2	SOIL	11-28-88	1-8oz. GLASS JAR	TPH/BTEX/pH/MOISTURE
880272-05-01	EMULSIFIED/NUTRIENT REP 1	SOIL	11-28-88	1-8oz. GLASS JAR	TPH/BTEX/pH/MOISTURE
880272-06-01	EMULSIFIED/NUTRIENT REP 2	SOIL	11-28-88	1-8oz. GLASS JAR	TPH/BTEX/pH/MOISTURE

The samples were received under chain of custody, warm.

Precision Summary

Analysis: TPH
Sample ID: 880272-01 COC#880272
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
TPH	300	250	18

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Precision Summary

Analysis: TPH
Sample ID: 880272-03 COC#880272
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
TPH	100	50	67

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Precision Summary

Analysis: TPH
Sample ID: 880272-05 COC#880272
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
TPH	130	140	7

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Precision Summary

Analysis: BTEX
Sample ID: 880272-01 COC#880272
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
BENZENE	ND	ND	0
TOLUENE	ND	ND	0
ETHYLBENZENE	ND	ND	0
XYLENES	ND	ND	0

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Precision Summary

Analysis: BTEX
Sample ID: 880272-03 COC#880272
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
BENZENE	ND	ND	0
TOLUENE	ND	ND	0
ETHYLBENZENE	ND	ND	0
XYLENES	ND	ND	0

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Precision Summary

Analysis: BTEX
Sample ID: 880272-05 COC#880272
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
BENZENE	ND	ND	0
TOLUENE	ND	ND	0
ETHYLBENZENE	ND	ND	0
XYLENES	ND	ND	0

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Precision Summary

Analysis: 9045
Sample ID: 880272-01 COC# 880272

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
pH	9.34	9.50	2

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

Precision Summary

Analysis: 9045
Sample ID: 880272-03 COC# 880272

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
pH	8.08	7.91	2

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

Precision Summary

Analysis: 9045
Sample ID: 880272-05 COC# 880272

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
pH	6.97	7.03	1

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

Precision Summary

Analysis: Moisture Content
Sample ID: 880272-01 COC# 880272

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
% Moisture	5.80	5.65	3

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

Precision Summary

Analysis: Moisture Content
Sample ID: 880272-03 COC# 880272

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
% Moisture	7.35	7.00	5

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

Precision Summary

Analysis: Moisture Content
Sample ID: 880272-05 COC# 880272

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
% Moisture	6.25	6.15	2

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

Accuracy Summary

Analysis: TPH
WCC Lab ID: 880272-05 COC# 880272-05
Concentration Units: mg/kg

	Diluted Concentration		True Concentration	Internal Accuracy
Parameter	Sample	Spiked Sample	Spike	% Recovery
TPH	130	290	200	80

ND - Not Detected: sample contained the parameter below the practical quantitation limit

NA - Not Analyzed

Accuracy Summary

Analysis: BTEX
WCC Lab ID: 880272-06 COC# 880272
Concentration Units: mg/kg

	Diluted Concentration		True Concentration	Internal Accuracy
Parameter	Sample	Spiked Sample	Spike	% Recovery
BENZENE	ND	114	100	114
TOLUENE	ND	112	100	112
ETHYLBENZENE	ND	115	100	115
XYLENES	ND	382	315	121

ND - Not Detected: sample contained the parameter below the practical quantitation limit

NA - Not Analyzed

Woodward-Clyde Consultants

TOTAL PETROLEUM HYDROCARBONS
MODIFIED EPA METHOD 8015

PROJECT NAME: ANCHORAGE FUEL LINE
PROJECT NUMBER: 90275K
PROJECT MANAGER: DENNIS McCRUMB

COC# 880272

WCC LAB ID	SAMPLE ID	MATRIX	COLLECTION DATE	EXTRACTION DATE	ANALYSIS DATE	DETECTION LIMIT (mg/kg)	TPH* (mg/kg)
880272-01-01	AZIDE REP 1	SOIL	11-28-88	12-01-88	12-01-88	10	300
880272-02-01	AZIDE REP 2	SOIL	11-28-88	12-01-88	12-01-88	10	250
880272-03-01	EMULSIFIED REP 1	SOIL	11-28-88	12-01-88	12-01-88	10	100
880272-04-01	EMULSIFIED REP 2	SOIL	11-28-88	12-01-88	12-01-88	10	50
880272-05-01	EMULSIFIED/NUTRIENT REP 1	SOIL	11-28-88	12-01-88	12-01-88	10	130
880272-05-01D	EMULSIFIED/NUTRIENT REP 1	SOIL	11-28-88	12-01-88	12-01-88	10	140
880272-06-01	EMULSIFIED/NUTRIENT REP 2	SOIL	11-28-88	12-01-88	12-01-88	10	120

* - QUANTITATED AS JET FUEL

REVIEWED BY:

Woodward-Clyde Consultants

BENZENE, TOLUENE, ETHYLBENZENE, XYLENES DATA
MODIFIED EPA METHOD 8020

PROJECT NAME: ANCHORAGE FUEL LINE
PROJECT NUMBER: 90275K
PROJECT MANAGER: DENNIS McCRUMB

COC# 880272

WCC LAB ID	SAMPLE ID	MATRIX	COLLECTION DATE	EXTRACTION DATE	ANALYSIS DATE	DETECTION LIMIT (mg/kg)	BENZENE (mg/kg)	TOLUENE (mg/kg)	ET-BENZ (mg/kg)	XYLENES (mg/kg)
880272-01-01	AZIDE REP 1	SOIL	11-28-88	11-29-88	12-01-88	1	ND	ND	ND	ND
880272-01-01D	AZIDE REP 1	SOIL	11-28-88	11-29-88	12-01-88	1	ND	ND	ND	ND
880272-01-01D	AZIDE REP 1	SOIL	11-28-88	11-29-88	12-01-88	1	ND	ND	ND	ND
880272-02-01	AZIDE REP 2	SOIL	11-28-88	11-29-88	12-01-88	1	ND	ND	ND	ND
880272-03-01	EMULSIFIED REP 1	SOIL	11-28-88	11-29-88	12-01-88	1	ND	ND	ND	ND
880272-04-01	EMULSIFIED REP 2	SOIL	11-28-88	11-29-88	12-01-88	1	ND	ND	ND	ND
880272-05-01	EMULSIFIED/NUTRIENT REP 1	SOIL	11-28-88	11-29-88	12-01-88	1	ND	ND	ND	ND
880272-06-01	EMULSIFIED/NUTRIENT REP 2	SOIL	11-28-88	11-29-88	12-01-88	1	ND	ND	ND	ND

REVIEWED BY: Ana Inés Provanche

Woodward-Clyde Consultants

pH ANALYSIS IN SOIL

CLIENT: ANCHORAGE FUEL LINE
PROJECT: 90275/3031
PROJ.MGR.: DENNIS McCRUMB

DATE SAMPLED: 11-28-88
DATE RECEIVED: 11-28-88
DATE ANALYZED: 12-03-88
METHOD ID: 9045

WCC LAB ID	SAMPLE ID	AVERAGE SOIL pH MEASURED IN WATER
880272-01-01	AZIDE REP 1	9.34
880272-02-01	AZIDE REP 2	9.50
880272-03-01	EMULSIFIED REP 1	8.08
880272-04-01	EMULSIFIED REP 2	7.91
880272-05-01	EMULSIFIED/NUTRIENT REP 1	6.97
880272-06-01	EMULSIFIED/NUTRIENT REP 2	7.03

REVIEWED BY: Ana Luis Provancher

MOISTURE CONTENT

CLIENT: ANCHORAGE FUEL LINE
PROJECT: 90275/3031
PROJ.MGR.: DENNIS McCRUMB

DATE SAMPLED: 11-28-88
DATE RECEIVED: 11-28-88
DATE ANALYZED: 12-02-88

WCC LAB ID	SAMPLE ID	%MOISTURE
880272-01-01	AZIDE REP 1	5.80
880272-02-01	AZIDE REP 2	5.65
880272-03-01	EMULSIFIED REP 1	7.35
880272-04-01	EMULSIFIED REP 2	7.00
880272-05-01	EMULSIFIED/NUTRIENT REP 1	6.25
880272-06-01	EMULSIFIED/NUTRIENT REP 2	6.15

REVIEWED BY: Ana Luis Rovanchek

Woodward-Clyde Consultants

COC# 880297

I SAMPLE DESCRIPTION

WCC LAB ID	SAMPLE ID	MATRIX	DATE SAMPLED	CONTAINERS	ANALYSIS DESCRIPTION
880297-01-01	AZIDE REP 1	SOIL	12-30-88	1-12oz. GLASS JAR	TPH/BTEX/pH/MOISTURE
880297-02-01	AZIDE REP 2	SOIL	12-30-88	1-12oz. GLASS JAR	TPH/BTEX/pH/MOISTURE
880297-03-01	EMULSIFIED REP 1	SOIL	12-30-88	1-12oz. GLASS JAR	TPH/BTEX/pH/MOISTURE
880297-04-01	EMULSIFIED REP 2	SOIL	12-30-88	1-12oz. GLASS JAR	TPH/BTEX/pH/MOISTURE
880297-05-01	EMULSIFIED/NUTRIENT REP 1	SOIL	12-30-88	1-12oz. GLASS JAR	TPH/BTEX/pH/MOISTURE
880297-06-01	EMULSIFIED/NUTRIENT REP 2	SOIL	12-30-88	1-12oz. GLASS JAR	TPH/BTEX/pH/MOISTURE

The samples were received under chain of custody, in good condition.

Field Precision Summary

Analysis: TPH
Sample ID: 880297-01/02 COC#880297
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
TPH	310	79	119

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: TPH
Sample ID: 880297-03/04 COC#880297
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
TPH	29	69	82

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: TPH
Sample ID: 880297-05/06 COC#880297
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
TPH	70	79	12

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: BTEX
Sample ID: 880297-01/02 COC#880297
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
BENZENE	ND	ND	0
TOLUENE	ND	ND	0
ETHYLBENZENE	ND	ND	0
XYLENES	ND	ND	0

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: BTEX
Sample ID: 880297-03/04 COC#880297
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
BENZENE	ND	ND	0
TOLUENE	ND	ND	0
ETHYLBENZENE	ND	ND	0
XYLENES	ND	ND	0

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: BTEX
Sample ID: 880297-05/06 COC#880297
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
BENZENE	ND	ND	0
TOLUENE	ND	ND	0
ETHYLBENZENE	ND	ND	0
XYLENES	ND	ND	0

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Accuracy Summary

Analysis: TPH
WCC Lab ID: 880297-03 COC# 880297
Concentration Units: mg/kg

	Diluted Concentration		True Concentration	Internal Accuracy
Parameter	Sample	Spiked Sample	Spike	% Recovery
TPH	29	85	99	57

ND - Not Detected: sample contained the parameter below the practical quantitation limit

NA - Not Analyzed

Accuracy Summary

Analysis: TPH
WCC Lab ID: 880297-03 DUPLICATE COC# 880297
Concentration Units: mg/kg

	Diluted Concentration		True Concentration	Internal Accuracy
Parameter	Sample	Spiked Sample	Spike	% Recovery
TPH	29	84	99	56

ND - Not Detected: sample contained the parameter below the practical quantitation limit

NA - Not Analyzed

Accuracy Summary

Analysis: 8020
WCC Lab ID: 880297-06 COC# 880297
Concentration Units: mg/kg

Parameter	Diluted Concentration: Sample	Diluted Concentration: Spiked Sample	True Concentration: Spike	Internal Accuracy: % Recovery
BENZENE	ND	3.6	4.8	75
TOLUENE	ND	3.4	4.8	71
ETHYLBENZENE	ND	3.2	4.8	67
XYLENES	ND	10.8	15.8	69

ND - Not Detected: sample contained the parameter below the practical quantitation limit

NA - Not Analyzed

Accuracy Summary

Analysis: 8020
WCC Lab ID: 880297-06 Duplicate COC# 880297
Concentration Units: mg/kg

Parameter	Diluted Concentration		True Concentration	Internal Accuracy
	Sample	Spiked Sample	Spike	% Recovery
BENZENE	ND	4.0	4.8	83
TOLUENE	ND	4.0	4.8	83
ETHYLBENZENE	ND	4.1	4.8	85
XYLENES	ND	13.9	15.8	88

ND - Not Detected: sample contained the parameter below the practical quantitation limit

NA - Not Analyzed

Matrix Spike Duplicate Summary

Analysis: TPH
Sample ID: 880297-03 COC#880297

Parameter	Spike Concentration Measured %REC 1	% REC 2	Avg. %REC	Precision RPD Sample
TPH	57	56	57	2

Matrix Spike Duplicate Summary

Analysis: 8020
Sample ID: 880297-06 COC#880297

Parameter	Spike Concentration Measured %REC 1	Spike Concentration Measured % REC 2	Spike Concentration Measured Avg. %REC	Precision RPD % REC
Benzene	75	83	79	10
Toluene	71	83	77	16
Ethylbenzene	67	85	76	24
Xylenes	69	88	79	24

Analytical Data
Roosevelt Road PCB Site

TABLE E-1 PCB FIELD SAMPLING RESULTS - WOODWARD-CLYDE CONSULTANTS
1988 FIELD INVESTIGATION

SAMPLE NO.	TYPE	PCB CONCENTRATION (ppm) Lab Results	HEADSPACE HNu (ppm) Field Results
1	Soil	375	24
2	Soil	52.5	4
3	Soil	ND	2
4	Soil	932	9
5	Soil	14.4	2
6	Soil	3.5	<1
7	Soil	109	19
8	Soil	301	6
9	Soil	232	2
10	Soil	24.9	75
11	Soil	1.13	3
12	Soil	286	NM
13	Soil	34.2	5
14	Soil	17.7	NM
15	Soil	33.4	4
16	Soil	106	140
17	Wipe	630*	NA
18	Wipe	7.85*	NA
19	Wipe	128*	NA
20	Wipe	119*	NA
21	Soil	1.99	5
22	Soil	9.43	5
23	Soil	411	150
24	Soil	23400	26
25	Soil	279	9
26	Soil	32.6	2
27	Soil	2800	130
28	Soil	3930	100
29	Soil	237	4
30	Soil	0.49	ND
31	Soil	0.083	0.1
32	Soil	0.55	ND
33	Soil	1.72	ND
34	Soil	0.18	ND
35	Soil	0.12	ND
36	Soil	0.74	ND

**Surface wipes in total micrograms per 100 sq. cm.
NM=Not Measured
NA=Not Applicable
ND=Not Detected

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:16

Client Sample ID:R-RR-0101
PWSID :UA
Collected SEP 26 88 @ 14:30 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 10 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275K: CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 1 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	375 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.
REPLICATE ANALYSIS YIELDED 482 ppm AROCLOR 1260.

2 Tests Performed * See Special Instructions Above UA-Unavailable
ND- None Detected ** See Sample Remarks Above
NA- Not Analyzed LT-Less Than, GT-Greater Than

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:16

Client Sample ID:R-RR-0102
PWSID :UA
Collected SEP 26 88 @ 14:48 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 10 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275K: CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 2 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	52.5 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.

---

2 Tests Performed * See Special Instructions Above UA-Unavailable
ND- None Detected ** See Sample Remarks Above
NA- Not Analyzed LT-Less Than, GT-Greater Than

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:16

Client Sample ID:R-RR-0103
PWSID :UA
Collected SEP 26 88 @ 15:00 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Analysis Completed :OCT 10 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275K: CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 3 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL ------AROCLOR	ND(1) ppm	EPA 8080	

Sample Remarks: SAMPLE COLLECTED BY KELLY.

2 Tests Performed
ND= None Detected
NA= Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

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FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:17

Client Sample ID:R-RR-0104
PWSID :UA
Collected SEP 26 88 @ 15:05 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 10 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stph C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275E: CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 4 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	932 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.

2 Tests Performed
ND- None Detected
NA- Not Analyzed
* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than
UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:18

Client Sample ID:R-RR-0105
PWSID :UA
Collected SEP 26 88 @ 15:15 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 10 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : S. C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275K; CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 5 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	14.4 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:18

Client Sample ID:R-RR-0106
PWSID :UA
Collected SEP 26 88 @ 15:25 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 11 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275R: CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 6 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	3.5 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:19

Client Sample ID:R-RR-0107
PWSID :UA
Collected SEP 26 88 @ 15:35 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Analysis Completed :OCT 11 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275K: CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 7 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	109 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:20

Client Sample ID:R-RR-0108
PWSID :UA
Collected SEP 26 88 @ 15:55 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 11 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275K: CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 8 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	301 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.

2 Tests Performed * See Special Instructions Above UA-Unavailable
ND- None Detected ** See Sample Remarks Above
NA- Not Analyzed LT-Less Than, GT-Greater Than

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:20

Client Sample ID:R-RR-0109
PWSID :UA
Collected SEP 26 88 @ 16:10 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Analysis Completed :OCT 11 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275K; CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 9 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	232 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:21

Client Sample ID:R-RR-0110
PWSID :UA
Collected SEP 26 88 @ 16:25 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 11 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275K; CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 10 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	24.9 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.

2 Tests Performed * See Special Instructions Above UA-Unavailable
ND- None Detected ** See Sample Remarks Above
NA- Not Analyzed LT-Less Than, GT-Greater Than

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:22

Client Sample ID:R-RR-0111
PWSID :UA
Collected SEP 26 88 @ 16:41 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 11 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275K; CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 11 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	1.13 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:22

Client Sample ID:R-RR-0112
PWSID :UA
Collected SEP 26 88 @ 16:45 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 11 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275K; CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 12 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	286 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:23

Client Sample ID:R-RR-013
PWSID :UA
Collected SEP 26 88 @ 16:55 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Analysis Completed :OCT 11 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275K; CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 13 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	34.2 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:24

Client Sample ID:R-RR-014
PWSID :UA
Collected SEP 26 88 @ 17:05 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Analysis Completed :OCT 11 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275K; CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 14 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	17.7 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:24

Client Sample ID:R-RR-015
PWSID :UA
Collected SEP 26 88 @ 17:15 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Analysis Completed :OCT 11 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275K; CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 15 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	33.4 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9480
Date Report Printed: OCT 17 88 @ 15:25

Client Sample ID:R-RR-016
PWSID :UA
Collected SEP 26 88 @ 17:25 hrs.
Received SEP 27 88 @ 10:35 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 11 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : DAN GRAHAM

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: PROJECT 90275K; CHAIN OF CUSTODY.

Chemlab Ref #: 2778 Lab Smpl ID: 16 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	106 ppm	EPA 8080	
------AROCLOR	1260		

Sample Remarks: SAMPLE COLLECTED BY KELLY.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:04

Client Sample ID:R-RR-0117 WIPE
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Analysis Completed :OCT 14 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 1 Matrix: OTHER

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	5,850 microg	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.
RESULTS ARE IN MICROGRAMS PER SQUARE FT.

2 Tests Performed * See Special Instructions Above UA-Unavailable
ND- None Detected ** See Sample Remarks Above
NA- Not Analyzed LT-Less Than, GT-Greater Than

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:05

Client Sample ID:R-RR-0118 WIPE
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 13 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 2 Matrix: OTHER

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	72.9 microg	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.
RESULTS ARE IN MICROGRAMS PER SQUARE FT.

2 Tests Performed * See Special Instructions Above UA-Unavailable
ND- None Detected ** See Sample Remarks Above
NA- Not Analyzed LT-Less Than, GT-Greater Than

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:06

Client Sample ID:R-RR-0120 WIPE
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 14 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 3 Matrix: OTHER

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	1,110 microg	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.
RESULTS ARE IN MICROGRAMS PER SQUARE FT.

2 Tests Performed * See Special Instructions Above UA-Unavailable
ND- None Detected ** See Sample Remarks Above
NA- Not Analyzed LT-Less Than, GT-Greater Than

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:06

Client Sample ID:R-RR-0121 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Analysis Completed :OCT 14 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 4 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	1.99 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX = WIPES
Remarks: SAMPLE COLLECTED BY K.S.

2 Tests Performed * See Special Instructions Above UA-Unavailable
ND- None Detected ** See Sample Remarks Above
NA- Not Analyzed LT-Less Than, GT-Greater Than

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:07

Client Sample ID:R-RR-0122 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 14 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 5 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	9.43 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:08

Client Sample ID:R-RR-0123 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 14 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 6 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	411 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.

---

2 Tests Performed * See Special Instructions Above UA-Unavailable
ND- None Detected ** See Sample Remarks Above
NA- Not Analyzed LT-Less Than, GT-Greater Than

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:08

Client Sample ID:R-RR-0124 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 14 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 7 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	23,400 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:09

Client Sample ID:R-RR-0125 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 16 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 8 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	279 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:10

Client Sample ID:R-RR-0126 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Analysis Completed :OCT 16 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 9 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	32.6 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.

2 Tests Performed * See Special Instructions Above UA-Unavailable
ND- None Detected ** See Sample Remarks Above
NA- Not Analyzed LT-Less Than, GT-Greater Than

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:10

Client Sample ID:R-RR-0127 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 17 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 10 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	2,800 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:11

Client Sample ID:R-RR-0128 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Analysis Completed :OCT 17 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 11 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	3,930 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:12

Client Sample ID:R-RR-0129 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 17 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 12 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	237 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:12

Client Sample ID:R-RR-0130 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Analysis Completed :OCT 17 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 13 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	0.49 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:13

Client Sample ID:R-RR-0131 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 17 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 14 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	0.083 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.

2 Tests Performed * See Special Instructions Above UA-Unavailable
ND- None Detected ** See Sample Remarks Above
NA- Not Analyzed LT-Less Than, GT-Greater Than

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:14

Client Sample ID:R-RR-0132 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Analysis Completed :OCT 17 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 15 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	0.55 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX = WIPES
Remarks: SAMPLE COLLECTED BY K.S.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:14

Client Sample ID:R-RR-0133 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 16 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 16 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	1.72 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:15

Client Sample ID:R-RR-0134 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Analysis Completed :OCT 17 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 17 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	0.18 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.

2 Tests Performed * See Special Instructions Above UA-Unavailable
ND- None Detected ** See Sample Remarks Above
NA- Not Analyzed LT-Less Than, GT-Greater Than

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:15

Client Sample ID:R-RR-0135 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 17 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 18 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	0.12 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.

---

2 Tests Performed * See Special Instructions Above UA-Unavailable
ND- None Detected ** See Sample Remarks Above
NA- Not Analyzed LT-Less Than, GT-Greater Than

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:16

Client Sample ID:R-RR-0136 SOIL
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Analysis Completed :OCT 17 88
Laboratory Supervisor :STEPHEN C. EDE
Released By :

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 19 Matrix: SOILS

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	0.74 ppm	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 9524
Date Report Printed: OCT 24 88 @ 15:17

Client Sample ID:R-RR-0119 WIPES
PWSID :UA
Collected SEP 28 88 @ hrs.
Received SEP 29 88 @ 10:40 hrs.
Preserved with :4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : KELLY S.

Analysis Completed :OCT 16 88
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special
Instruct:

Chemlab Ref #: 2818 Lab Smpl ID: 20 Matrix: OTHER

Parameter Tested	Result/Units	Method	Allowable Limits
POLYCHLORINATE BIPHENYLS-SOIL	1,190 microg	EPA 8080	
------AROCLOR	1260		

Sample MATRIX - WIPES
Remarks: SAMPLE COLLECTED BY K.S.
RESULTS ARE IN MICROGRAMS PER SQUARE FT.

2 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

Analytical Data
Ft. Wainwright Landfill

SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
001656-0001-SA	R-FT-0201	SOIL	12 SEP 88		14 SEP 88
001656-0002-SA	R-FT-0202	SOIL	12 SEP 88		14 SEP 88
001656-0003-SA	W-LF-0101	AQUEOUS	12 SEP 88	19:05	14 SEP 88
001656-0004-SA	W-LF-0102	AQUEOUS	12 SEP 88	19:05	14 SEP 88
001656-0005-SA	W-BP-0201	AQUEOUS	11 SEP 88		14 SEP 88
001656-0006-SA	W-BP-0301	AQUEOUS	11 SEP 88		14 SEP 88
001656-0007-SA	TRIP BLANK	AQUEOUS	11 SEP 88		14 SEP 88

Enseco

Organochlorine Pesticides/PCB's

EPA 608

Client Name: Woodward-Clyde Consultants
Client ID: W-LF-0101
Lab ID: 001656-0003-SA Enseco ID: 1013430
Matrix: AQUEOUS Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 16 SEP 88 Analyzed: 05 OCT 88

Parameter	Result	Units	Reporting Limit
alpha-BHC	ND	ug/L	0.050
beta-BHC	ND	ug/L	0.050
delta-BHC	ND	ug/L	0.050
gamma-BHC (Lindane)	ND	ug/L	0.050
Toxaphene	ND	ug/L	1.0
Heptachlor	ND	ug/L	0.020
Aldrin	ND	ug/L	0.050
Heptachlor epoxide	ND	ug/L	0.050
Endosulfan I	ND	ug/L	0.050
Dieldrin	ND	ug/L	0.020
4,4'-DDE	ND	ug/L	0.10
Endrin	ND	ug/L	0.060
Endosulfan II	ND	ug/L	0.10
4,4'-DDD	ND	ug/L	0.10
Endosulfan sulfate	ND	ug/L	0.10
4,4'-DDT	ND	ug/L	0.10
Endrin aldehyde	ND	ug/L	0.10
Chlordane	ND	ug/L	0.050
Aroclor-1016	ND	ug/L	0.50
Aroclor-1221	ND	ug/L	0.50
Aroclor-1232	ND	ug/L	0.50
Aroclor-1242	ND	ug/L	0.50
Aroclor-1248	ND	ug/L	0.50
Aroclor-1254	ND	ug/L	1.0
Aroclor-1260	ND	ug/L	1.0
Methoxychlor	ND	ug/L	0.50
Dibutylchlorendate	75.0	%	

ND=Not Detected
NA=Not Applicable

Reported By: Barbara Sullivan Approved By: Dianne Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Metals

Recoverable Metals

Client Name: Woodward-Clyde Consultants
Client ID: W-LF-0101
Lab ID: 001656-0003-SA
Enseco ID: 1013430
Matrix: AQUEOUS
Sampled: 12 SEP 88
Received: 14 SEP 88
Authorized: 14 SEP 88
Prepared: 28 SEP 88
Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/L	0.002	239.2	30 SEP 88
Manganese	0.71	mg/L	0.005	200.7	29 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Hand
Approved By:. Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

Metals

Dissolved Metals

Client Name: Woodward-Clyde Consultants
Client ID: W-LF-0101
Lab ID: 001656-0003-SA Enseco ID: 1013430
Matrix: AQUEOUS Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/L	0.002	239.2	16 SEP 88
Manganese	0.76	mg/L	0.005	200.7	28 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Hand Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: W-LF-0101
Lab ID: 001656-0003-SA Enseco ID: 1013430
Matrix: AQUEOUS Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Corrosivity	0.2	mmpy	0.1	NACE	21 OCT 88
Turbidity	13.0	NTU	0.1	180.1	16 SEP 88
Total Petroleum Hydrocarbons	ND	mg/L	0.5	EPA 418.1	22 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Roger Freize Approved By: Roger Freize

The cover letter is an integral part of this report.
Rev 230787

Enseco

Organochlorine Pesticides/PCB's

EPA 608

Client Name: Woodward-Clyde Consultants
Client ID: W-LF-0102
Lab ID: 001656-0004-SA Enseco ID: 1013431
Matrix: AQUEOUS Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 16 SEP 88 Analyzed: 05 OCT 88

Parameter	Result	Units	Reporting Limit
alpha-BHC	ND	ug/L	0.050
beta-BHC	ND	ug/L	0.050
delta-BHC	ND	ug/L	0.050
gamma-BHC (Lindane)	ND	ug/L	0.050
Toxaphene	ND	ug/L	1.0
Heptachlor	ND	ug/L	0.020
Aldrin	ND	ug/L	0.050
Heptachlor epoxide	ND	ug/L	0.050
Endosulfan I	ND	ug/L	0.050
Dieldrin	ND	ug/L	0.020
4,4'-DDE	ND	ug/L	0.10
Endrin	ND	ug/L	0.060
Endosulfan II	ND	ug/L	0.10
4,4'-DDD	ND	ug/L	0.10
Endosulfan sulfate	ND	ug/L	0.10
4,4'-DDT	ND	ug/L	0.10
Endrin aldehyde	ND	ug/L	0.10
Chlordane	ND	ug/L	0.050
Aroclor-1016	ND	ug/L	0.50
Aroclor-1221	ND	ug/L	0.50
Aroclor-1232	ND	ug/L	0.50
Aroclor-1242	ND	ug/L	0.50
Aroclor-1248	ND	ug/L	0.50
Aroclor-1254	ND	ug/L	1.0
Aroclor-1260	ND	ug/L	1.0
Methoxychlor	ND	ug/L	0.50
Dibutylchlorendate	60.0	%	

ND=Not Detected
NA=Not Applicable

Reported By: Barbara Sullivan Approved By: Dianne Lowry

The cover letter is an integral part of this report.
Rev 230787

Table 1. (Continued) Water Rates at Anchorage Fuel Terminal (Catchment Method). May 23, 1989.

Site Location	Method	Observations	Rate (L/sec)	Rate (ft^3/sec)	Rate gal/min	Comments
M-3	Catchment	No odor, no sheen, no oxidation.	0.26	0.0092	0.15	Rate measured at exit pipe from ground. No flow in nearby fuel trap.
Sample Site 1001	Catchment	No odor, no sheen, slight oxidation.	0.31	0.0109	0.17	Rate measured at exit pipe from ground west of impound basin berm.

NM = No measurement taken - see comments
NA = Not applicable - see comments

* See comment
Source: Field data collected by Holly Graham

Table 2. Stream Flow Rates at Anchorage Fuel Terminal May 23, 1989 (as measured in cross-section with a Marsh-McBirney Meter).

Stream Location	Approx. Cross-Sect. Area (ft^2)	Stream Depth at Deepest (ft)	Stream Width (ft)	No. of Measurements per X-Section	Meas. Intervals (ft)	Flow Rate Calculated (ft^3/sec)		Comments
1301	0.40	0.30	2.2	3	0.5	0.023	0.37	The stream was cloudy. Trash and debris littered the area.
1401	0.16	0.16	1.8	3	0.5	0.158	2.5	The stream was cloudy and slightly swollen.
Big Stream near D-17	1.60	0.50	5.3	11	0.5	1.822	28.88	Large stream collecting both flow on and off site. Took measurement there previous fall.
D-1	0.60	0.18	1.5	3	0.5	0.036	0.57	Measurement taken from the stream below the fuel trap about 15 meters.
W8	1.08	0.25	2.25	4	0.5	ND		While there was definitely flow here, it was too slow to be measured by the meter.
WD	1.50	0.17	1.5	3	0.4	0.039	0.62	Water was flowing from north end of swampy AFT site.
D-10 (north and south fork combined)	0.11	0.08	1.42	2	0.75 and 0.67	0.79	12.52	The stream forked immediately after exiting the ground. We measured both north and south forks and combined the results.

ND = No detection
Source: Field data collected by Holly Graham

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1402
Lab ID: 004952-0009-SA
Matrix: AQUEOUS
Authorized: 17 MAY 89
Enseco ID: 1038465
Sampled: 15 MAY 89
Prepared: See Below
Received: 17 MAY 89
Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	29	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize

Approved By: Kimberly Conroy

95/52/1

Table 1. Water Rates at Anchorage Fuel Terminal (Catchment Method). May 23, 1989.

Site Location	Method	Observations	Rate (L/sec)	Rate (gal/min)	Rate (ft^3/sec)	Comments
Sample Site 0901	Catchment	Gunky with oxidation; fuel odor; product inside fuel trap.	0.080	1.27	0.0028	Water rate taken at inflow to fuel trap.
Site W1	Catchment	Gunky with oxidation; fuel odor; fuel product inside fuel trap.	0.025	0.39	0.0009	Water rate taken at inflow to fuel trap.
W7	NA	None	NM		NM	No flow at this site 5/23/89. Previously recorded flow here.
W6	NA	This flow is a continuation of the flow measured upgradient at site 0901. Gunky ditch.	NM		NM	Small amount of flow in ditch which was circumventing the fuel trap. The flow was uncatchable without pipe.
Sample Site 0801	Catchment	Gunky with oxidation; fuel odor; fuel product inside fuel trap.	0.153	2.43	0.0054	Water rate taken at inflow to fuel trap.
W12	Catchment	Slight sheen on the water surface, slow flowing.	0.77	12.2	0.0272	Water rate measured at inflow to fuel trap.
Manhole 37 Sample Site 1801	Catchment	Some gunky residue in stream, odor over opening of manhole.	0.36*	5.7	0.0127*	Estimated that we were catching 25% of flow in a 5 gal bucket and thus projected total flow rate.
WF- Sample Site 1101	Catchment	No odor, no sheen, slight oxidation.	0.32	5.1	0.0113	Rate measured at exit pipe on north berm of impoundment basin.

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1102
Lab ID: 004952-0007-SA Enseco ID: 1038463
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	29	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize Approved By: Kimberly Conroy

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1302
Lab ID: 004952-0008-SA Enseco ID: 1038464
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	29	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	2.0	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize

Approved By: Kimberly Conroy

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0902
Lab ID: 004952 0005-SA Enseco ID: 1038461
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	ND	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize Approved By: Kimberly Conroy

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1002
Lab ID: 004952-0006-SA Enseco ID: 1038462
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	ND	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize

Approved By: Kimberly Conroy

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1601
Lab ID: 004952-0003-SA Enseco ID: 1038459
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	ND	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize

Approved By: Kimberly Conroy

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1601-D
Lab ID: 004952-0004-SA Enseco ID: 1038460
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	ND	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize

Approved By: Kimberly Conroy

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1502
Lab ID: 004952-0001-SA Enseco ID: 1038457
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	ND	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize Approved By: Kimberly Conroy

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1801
Lab ID: 004952-0002-SA Enseco ID: 1038458
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	1	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize Approved By: Kimberly Conroy

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1402
Lab ID: 004952-0009-SA Enseco ID: 1038465
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	ND	ug/L	0.70	T
Toluene	ND	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	
Total xylenes	ND	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: TRIP BLANK
Lab ID: 004952-0010-SA Enseco ID: 1038466
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	ND	ug/L	0.70	T
Toluene	ND	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	
Total xylenes	ND	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics-2nd Column Analysis

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1102
Lab ID: 004952-0007-SA Enseco ID: 1038463
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 25 MAY 89

Parameter	Result	Units	Reporting Limit
Benzene	ND	ug/L	0.70
Toluene	ND	ug/L	1.0
Chlorobenzene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
Total xylenes	6.0	ug/L	2.0
1,3-Dichlorobenzene	ND	ug/L	2.0
1,2-Dichlorobenzene	ND	ug/L	2.0
1,4-Dichlorobenzene	ND	ug/L	0.50

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-Fi-1302
Lab ID: 004952-0008-SA Enseco ID: 1038464
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	ND	ug/L	0.70	T
Toluene	ND	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	
Total xylenes	ND	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics-2nd Column Analysis

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1002
Lab ID: 004952-0006-SA Enseco ID: 1038462
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 25 MAY 89

Parameter	Result	Units	Reporting Limit
Benzene	8.8	ug/L	0.70
Toluene	ND	ug/L	1.0
Chlorobenzene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
Total xylenes	ND	ug/L	2.0
1,3-Dichlorobenzene	ND	ug/L	2.0
1,2-Dichlorobenzene	ND	ug/L	2.0
1,4-Dichlorobenzene	ND	ug/L	0.50

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1102
Lab ID: 004952-0007-SA Enseco ID: 1038463
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	5.2	ug/L	0.70	T
Toluene	ND	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	
Total xylenes	3.0	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics-2nd Column Analysis

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0902
Lab ID: 004952-0005-SA Enseco ID: 1038461
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 25 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	ND	ug/L	0.88	V
Toluene	6.3	ug/L	1.2	V
Chlorobenzene	ND	ug/L	1.2	
Ethyl benzene	8.4	ug/L	1.2	V
Total xylenes	40	ug/L	2.5	
1,3-Dichlorobenzene	ND	ug/L	2.5	
1,2-Dichlorobenzene	ND	ug/L	2.5	
1,4-Dichlorobenzene	ND	ug/L	0.62	

Note V : Secondary column result is the preferred value.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1002
Lab ID: 004952-0006-SA Enseco ID: 1038462
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	6.6	ug/L	0.70	T
Toluene	ND	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	
Total xylenes	ND	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-160[illegible]-D
Lab ID: 004952-0004 SA Enseco ID: 1038460
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	ND	ug/L	0.70	T
Toluene	ND	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	
Total xylenes	ND	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0902
Lab ID: 004952-0005-SA Enseco Id. 1038461
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	1.1	ug/L	0.88	T
Toluene	7.5	ug/L	1.2	
Chlorobenzene	ND	ug/L	1.2	
Ethyl benzene	10	ug/L	1.2	
Total xylenes	43	ug/L	2.5	
1,3-Dichlorobenzene	ND	ug/L	2.5	
1,2-Dichlorobenzene	ND	ug/L	2.5	
1,4-Dichlorobenzene	ND	ug/L	0.62	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics-2nd Column Analysis

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1801
Lab ID: 004952-0002-SA Enseco ID: 1038458
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 24 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	510	ug/L	18	
Toluene	240	ug/L	25	
Chlorobenzene	ND	ug/L	25	
Ethyl benzene	72	ug/L	25	V
Total xylenes	440	ug/L	50	V
1,3-Dichlorobenzene	ND	ug/L	50	
1,2-Dichlorobenzene	ND	ug/L	50	
1,4-Dichlorobenzene	ND	ug/L	12	

Note V : Secondary column result is the preferred value.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1601
Lab ID. 004952-0003-SA Enseco ID: 1038459
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	ND	ug/L	0.70	T
Toluene	ND	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	
Total xylenes	ND	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics-2nd Column Analysis

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1502
Lab ID: 004952-0001-SA Enseco ID: 1038457
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 24 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	1.0	ug/L	0.70	
Toluene	1.4	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	V
Total xylenes	4.8	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note V : Secondary column result is the preferred value.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1801
Lab ID: 004952-0002-SA Enseco ID: 1038458
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	490	ug/L	18	T
Toluene	240	ug/L	25	
Chlorobenzene	ND	ug/L	25	
Ethyl benzene	87	ug/L	25	
Total xylenes	510	ug/L	50	
1,3-Dichlorobenzene	ND	ug/L	50	
1,2-Dichlorobenzene	ND	ug/L	50	
1,4-Dichlorobenzene	ND	ug/L	12	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

MOISTURE CONTENT COC# 890026

CLIENT: ANCHORAGE FUEL LINE
PROJECT: 90275/3032
PROJ.MGR.: DENNIS McCRUMB

DATE SAMPLED: 01-26-89
DATE RECEIVED: 01-26-89
DATE ANALYZED: 01-27-89

WCC LAB ID	SAMPLE ID	%MOISTURE
890026-01-01	DISTILLED H2O REP 1	6.1
890026-02-01	DISTILLED H2O REP 2	5.8
890026-03-01	AZIDE REP 1	6.4
890026-04-01	AZIDE REP 2	5.5
890026-05-01	EMULSIFIER REP 1	6.4
890026-06-01	EMULSIFIER REP 2	7.0
890026-07-01	EMUL/NUT REP 1	5.9
890026-08-01	EMUL/NUT REP 2	7.2
890026-09-01	NUTRIENT REP 2	7.2
890026-10-01	NUTRIENT REP 1	6.8

REVIEWED BY: Anna Luis Provanche

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1502
Lab ID: 004952-0001-SA Enseco ID: 1038457
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	0.82	ug/L	0.70	T
Toluene	1.2	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	1.4	ug/L	1.0	
Total xylenes	3.8	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Woodward-Clyde Consultants

BENZENE, TOLUENE, ETHYLBENZENE, XYLENES DATA
MODIFIED EPA METHOD 8020

PROJECT NAME: ANCHORAGE FUEL LINE
PROJECT NUMBER: 90275K
PROJECT MANAGER: DENNIS McCRUMB

COC# 890026

WCC LAB ID	SAMPLE ID	MATRIX	COLLECTION DATE	EXTRACTION DATE	ANALYSIS DATE	DETECTION LIMIT (mg/kg)	BENZENE (mg/kg)	TOLUENE (mg/kg)	ET-BENZ (mg/kg)	XYLENES (mg/kg)
890026-01-01	DISTILLED H2O REP 1	SOIL	01-26-89	01-27-89	01-27-89	0.05	ND	ND	ND	ND
890026-02-01	DISTILLED H2O REP 2	SOIL	01-26-89	01-27-89	01-27-89	0.05	ND	ND	ND	ND
890026-03-01	AZIDE REP 1	SOIL	01-26-89	01-27-89	01-27-89	0.05	ND	ND	ND	ND
890026-04-01	AZIDE REP 2	SOIL	01-26-89	01-27-89	01-27-89	0.05	ND	ND	ND	ND
890026-05-01	EMULSIFIER REP 1	SOIL	01-26-89	01-27-89	01-27-89	0.05	ND	ND	ND	ND
890026-06-01	EMULSIFIER REP 2	SOIL	01-26-89	01-27-89	01-27-89	0.05	ND	ND	ND	ND
890026-07-01	EMUL/NUT REP 1	SOIL	01-26-89	01-27-89	01-27-89	0.05	ND	ND	ND	ND
890026-08-01	EMUL/NUT REP 2	SOIL	01-26-89	01-27-89	01-27-89	0.05	ND	ND	ND	ND
890026-09-01	NUTRIENT REP 1	SOIL	01-26-89	01-27-89	01-27-89	0.05	ND	ND	ND	ND
890026-10-01	NUTRIENT REP 2	SOIL	01-26-89	01-27-89	01-27-89	0.05	ND	ND	ND	ND

REVIEWED BY: Ana Luis Piovanchez

COC# 890026

pH ANALYSIS IN SOIL

CLIENT: ANCHORAGE FUEL LINE
PROJECT: 90275/3032
PROJ.MGR.: DENNIS McCRUMB

DATE SAMPLED: 01-26-89
DATE RECEIVED: 01-26-89
DATE ANALYZED: 01-27-89
METHOD ID: 9045

WCC LAB ID	SAMPLE ID	AVERAGE SOIL pH MEASURED IN WATER
890026-01-01	DISTILLED H2O REP 1	6.73
890026-02-01	DISTILLED H2O REP 2	6.84
890026-03-01	AZIDE REP 1	9.41
890026-04-01	AZIDE REP 2	9.62
890026-05-01	EMULSIFIER REP 1	7.59
890026-06-01	EMULSIFIER REP 2	7.47
890026-07-01	EMUL/NUT REP 1	7.21
890026-08-01	EMUL/NUT REP 2	6.89
890026-09-01	NUTRIENT REP 1	6.90
890026-10-01	NUTRIENT REP 2	6.71

REVIEWED BY: Ana Inés Provanchy

Laboratory Accuracy Summary

Analysis: BTEX
WCC Lab ID: 890026-02 COC# 890026
Concentration Units: mg/kg

SPIKE 1

Parameter	Diluted Concentration: Sample	Diluted Concentration: Spiked Sample	True Concentration: Spike	Internal Accuracy: % Recovery
BENZENE	ND	5.24	4.80	109
TOLUENE	ND	5.11	4.80	106
ETHYLBENZENE	ND	5.08	4.80	106
XYLENES	ND	16.7	15.8	106

SPIKE 2

Parameter	Diluted Concentration: Sample	Diluted Concentration: Spiked Sample	True Concentration: Spike	Internal Accuracy: % Recovery
BENZENE	ND	4.90	4.80	102
TOLUENE	ND	4.70	4.80	98
ETHYLBENZENE	ND	4.69	4.80	98
XYLENES	ND	15.40	15.8	97

ND - Not Detected: sample contained the parameter below the practical quantitation limit

NA - Not Analyzed

Woodward-Clyde Consultants

TOTAL PETROLEUM HYDROCARBONS
MODIFIED EPA METHOD 8015

PROJECT NAME: ANCHORAGE FUEL LINE
PROJECT NUMBER: 90275K
PROJECT MANAGER: DENNIS McCRUMB

COC# 890026

WCC LAB ID	SAMPLE ID	MATRIX	COLLECTION DATE	EXTRACTION DATE	ANALYSIS DATE	DETECTION LIMIT (mg/kg)	TPH (mg/kg)
890026-01-01	DISTILLED H2O REP 1	SOIL	01-26-89	01-27-89	01-28-89	5	51
890026-02-01	DISTILLED H2O REP 2	SOIL	01-26-89	01-27-89	01-28-89	5	45
890026-03-01	AZIDE REP 1	SOIL	01-26-89	01-27-89	01-28-89	5	96
890026-04-01	AZIDE REP 2	SOIL	01-26-89	01-27-89	01-28-89	5	32
890026-05-01	EMULSIFIER REP 1	SOIL	01-26-89	01-27-89	01-28-89	10	20
890026-06-01	EMULSIFIER REP 2	SOIL	01-26-89	01-27-89	01-28-89	10	30
890026-07-01	EMUL/NUT REP 1	SOIL	01-26-89	01-27-89	01-28-89	10	70
890026-08-01	EMUL/NUT REP 2	SOIL	01-26-89	01-27-89	01-28-89	10	80
890026-09-01	NUTRIENT REP 1	SOIL	01-26-89	01-27-89	01-28-89	5	57
890026-10-01	NUTRIENT REP 2	SOIL	01-26-89	01-27-89	01-28-89	5	55

Quantitated as Jet Fuel.

REVIEWED BY: Ana Luis Rovanches

Laboratory Precision Summary

Analysis: BTEX
WCC Lab ID: 890026-02 COC#890026

Parameter	Spike Concentration Measured %REC 1	% REC 2	Avg. %REC	Precision RPD
Benzene	109	102	106	7
Toluene	106	98	102	8
Ethylbenzene	106	98	102	8
Xylenes	106	97	102	9

Laboratory Accuracy Summary

Analysis: TPH
WCC Lab ID: 890026-06 COC# 890026
Concentration Units: mg/kg

SPIKE 1

Parameter	Diluted Concentration: Sample	Diluted Concentration: Spiked Sample	True Concentration: Spike	Internal Accuracy: % Recovery
TPH	30	130	100	100

SPIKE 2

Parameter	Diluted Concentration: Sample	Diluted Concentration: Spiked Sample	True Concentration: Spike	Internal Accuracy: % Recovery
TPH	30	140	100	110

ND - Not Detected: sample contained the parameter below the practical quantitation limit

NA - Not Analyzed

Field Precision Summary

Analysis: pH
WCC Lab ID: 890026-09/10 COC#890026

Parameter	Measured pH		Precision RPD
	Sample	Duplicate	Sample
pH	6.90	6.71	3

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Laboratory Precision Summary

Analysis: 8015
WCC Lab ID: 890026-06 COC#890026

Parameter	Spike Concentration Measured %REC 1	% REC 2	Avg. %REC	Precision RPD
TPH	100	110	105	10

Field Precision Summary

Analysis: pH
WCC Lab ID: 890026-05/06 COC#890026

Parameter	Measured pH		Precision RPD
	Sample	Duplicate	Sample
pH	7.59	7.47	2

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: pH
WCC Lab ID: 890026-07/08 COC#890026

Parameter	Measured pH		Precision RPD
	Sample	Duplicate	Sample
pH	7.21	6.89	5

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: pH
WCC Lab ID: 890026-01/02 COC#890026

Parameter	Measured pH		Precision RPD
	Sample	Duplicate	Sample
pH	6.73	6.84	2

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: pH
WCC Lab ID: 890026-03/04 COC#890026

Parameter	Measured pH		Precision RPD
	Sample	Duplicate	Sample
pH	9.41	9.62	2

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: BTEX
WCC Lab ID: 890026-07/08 COC#890026
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
BENZENE	ND	ND	0
TOLUENE	ND	ND	0
ETHYLBENZENE	ND	ND	0
XYLENES	ND	ND	0

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: BTEX
WCC Lab ID: 890026-09/10 COC#890026
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
BENZENE	ND	ND	0
TOLUENE	ND	ND	0
ETHYLBENZENE	ND	ND	0
XYLENES	ND	ND	0

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: BTEX
WCC Lab ID: 890026-03/04 COC#890026
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
BENZENE	ND	ND	0
TOLUENE	ND	ND	0
ETHYLBENZENE	ND	ND	0
XYLENES	ND	ND	0

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: BTEX
WCC Lab ID: 890026-05/06 COC#890026
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
BENZENE	ND	ND	0
TOLUENE	ND	ND	0
ETHYLBENZENE	ND	ND	0
XYLENES	ND	ND	0

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: TPH
WCC Lab ID: 890026-09/10 COC#890026
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
TPH	57	55	4

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: BTEX
WCC Lab ID: 890026-01/02 COC#890026
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
BENZENE	ND	ND	0
TOLUENE	ND	ND	0
ETHYLBENZENE	ND	ND	0
XYLENES	ND	ND	0

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: TPH
WCC Lab ID: 890026-05/06 COC#890026
Concentration Units: mg/kg

	Concentration Measured		Precision RPD
Parameter	Sample	Duplicate	Sample
TPH	20	30	40

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: TPH
WCC Lab ID: 890026-07/08 COC#890026
Concentration Units: mg/kg

Parameter	Concentration Measured		Precision RPD
	Sample	Duplicate	Sample
TPH	70	80	13

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: TPH
WCC Lab ID: 890026-01/02 COC#890026
Concentration Units: mg/kg

	Concentration Measured		Precision RPD
Parameter	Sample	Duplicate	Sample
TPH	51	45	12

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

Field Precision Summary

Analysis: TPH
WCC Lab ID: 890026-03/04 COC#890026
Concentration Units: mg/kg

	Concentration Measured		Precision RPD
Parameter	Sample	Duplicate	Sample
TPH	96	32	100

ND - Not Detected: sample contained the parameter below the practical quantitation limit.

NA - Not Analyzed

MOISTURE CONTENT

CLIENT: ANCHORAGE FUEL LINE
PROJECT: 90275/3031
PROJ.MGR.: DENNIS McCRUMB

DATE SAMPLED: 12-30-88
DATE RECEIVED: 12-30-88
DATE ANALYZED: 01-03-89

WCC LAB ID	SAMPLE ID	%MOISTURE
880297-01-01	AZIDE REP 1	6.98
880297-02-01	AZIDE REP 2	6.37
880297-03-01	EMULSIFIED REP 1	7.69
880297-04-01	EMULSIFIED REP 2	9.08
880297-05-01	EMULSIFIED/NUTRIENT REP 1	7.79
880297-06-01	EMULSIFIED/NUTRIENT REP 2	6.42

REVIEWED BY:

Woodward-Clyde Consultants

COC# 890026

I SAMPLE DESCRIPTION

WCC LAB ID	SAMPLE ID	MATRIX	DATE SAMPLED	CONTAINERS	ANALYSIS DESCRIPTION
890026-01-01	DISTILLED H2O REP 1	SOIL	01-26-89	1-12oz Glass Jar	TPH/BETX/pH/MOISTURE
890026-02-01	DISTILLED H2O REP 2	SOIL	01-26-89	1-12oz Glass Jar	TPH/BETX/pH/MOISTURE
890026-03-01	AZIDE REP 1	SOIL	01-26-89	1-12oz Glass Jar	TPH/BETX/pH/MOISTURE
890026-04-01	AZIDE REP 2	SOIL	01-26-89	1-12oz Glass Jar	TPH/BETX/pH/MOISTURE
890026-05-01	EMULSIFIER REP 1	SOIL	01-26-89	1-12oz Glass Jar	TPH/BETX/pH/MOISTURE
890026-06-01	EMULSIFIER REP 2	SOIL	01-26-89	1-12oz Glass Jar	TPH/BETX/pH/MOISTURE
890026-07-01	EMUL/NUT REP 1	SOIL	01-26-89	1-12oz Glass Jar	TPH/BETX/pH/MOISTURE
890026-08-01	EMUL/NUT REP 2	SOIL	01-26-89	1-12oz Glass Jar	TPH/BETX/pH/MOISTURE
890026-09-01	NUTRIENT REP 1	SOIL	01-26-89	1-12oz Glass Jar	TPH/BETX/pH/MOISTURE
890026-10-01	NUTRIENT REP 2	SOIL	01-26-89	1-12oz Glass Jar	TPH/BETX/pH/MOISTURE

The samples were received under chain of custody, in good condition.

Woodward-Clyde Consultants

TOTAL PETROLEUM HYDROCARBONS
MODIFIED EPA METHOD 8015

PROJECT NAME: ANCHORAGE FUEL LINE
PROJECT NUMBER: 90275K
PROJECT MANAGER: DENNIS McCRUMB

COC# 880297

WCC LAB ID	SAMPLE ID	MATRIX	COLLECTION DATE	EXTRACTION DATE	ANALYSIS DATE	DETECTION LIMIT (mg/kg)	TPH (mg/kg)
880297-01-01	AZIDE REP 1	SOIL	12-30-88	12-31-88	12-31-88	10	310
880297-02-01	AZIDE REP 2	SOIL	12-30-88	12-31-88	12-31-88	5	79
880297-03-01	EMULSIFIED REP 1	SOIL	12-30-88	12-31-88	12-31-88	5	29
880297-04-01	EMULSIFIED REP 2	SOIL	12-30-88	12-31-88	12-31-88	5	69
880297-05-01	EMULSIFIED/NUTRIENT REP 1	SOIL	12-30-88	12-31-88	12-31-88	5	70
880297-06-01	EMULSIFIED/NUTRIENT REP 2	SOIL	12-30-88	12-31-88	12-31-88	10	79

Quantitated as Jet Fuel.

REVIEWED BY: Anna Lois Provancher

pH ANALYSIS IN SOIL

CLIENT: ANCHORAGE FUEL LINE
PROJECT: 90275/3031
PROJ.MGR.: DENNIS McCRUMB

DATE SAMPLED: 12-30-88
DATE RECEIVED: 12-30-88
DATE ANALYZED: 12-31-88
METHOD ID: 9045

WCC LAB ID	SAMPLE ID	AVERAGE SOIL pH MEASURED IN WATER
880297-01-01	AZIDE REP 1	8.98
880297-02-01	AZIDE REP 2	9.61
880297-03-01	EMULSIFIED REP 1	8.02
880297-04-01	EMULSIFIED REP 2	7.66
880297-05-01	EMULSIFIED/NUTRIENT REP 1	6.96
880297-06-01	EMULSIFIED/NUTRIENT REP 2	6.96

REVIEWED BY: Ana Inés Provancher

Enseco

Purgeable Volatile Organics

Method 624

Client Name: Woodward-Clyde Consultants
Client ID: W-BP-0301
Lab ID: 001656-0006-SA Enseco ID: 1013433
Matrix: AQUEOUS Sampled: 11 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 15 SEP 88 Analyzed: 20 SEP 88

Parameter	Result	Units	Reporting Limit
Styrene	ND	ug/L	5.0
1,2,3-Trichloropropane	ND	ug/L	10
Vinyl acetate	ND	ug/L	50
trans-1,4-Dichloro-2-butene	ND	ug/L	50
Toluene-d8	98.2	%	--
4-Bromofluorobenzene (BFB)	84.2	%	--
1,2-Dichloroethane-d4	99.8	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Woodward-Clyde Consultants

BENZENE, TOLUENE, ETHYLBENZENE, XYLENES DATA
MODIFIED EPA METHOD 8020

PROJECT NAME: ANCHORAGE FUEL LINE
PROJECT NUMBER: 90275K
PROJECT MANAGER: DENNIS McCRUMB

COC# 880297

WCC LAB ID	SAMPLE ID	MATRIX	COLLECTION DATE	EXTRACTION DATE	ANALYSIS DATE	DETECTION LIMIT (mg/kg)	BENZENE (mg/kg)	TOLUENE (mg/kg)	ET-BENZ (mg/kg)	XYLENES (mg/kg)
880297-01-01	AZIDE REP 1	SOIL	12-30-88	12-31-88	12-31-88	0.05	ND	ND	ND	ND
880297-02-01	AZIDE REP 2	SOIL	12-30-88	12-31-88	12-31-88	0.1	ND	ND	ND	ND
880297-03-01	EMULSIFIED REP 1	SOIL	12-30-88	12-31-88	12-31-88	0.1	ND	ND	ND	ND
880297-04-01	EMULSIFIED REP 2	SOIL	12-30-88	12-31-88	12-31-88	0.1	ND	ND	ND	ND
880297-05-01	EMULSIFIED/NUTRIENT REP 1	SOIL	12-30-88	12-31-88	12-31-88	0.1	ND	ND	ND	ND
880297-06-01	EMULSIFIED/NUTRIENT REP 2	SOIL	12-30-88	12-31-88	12-31-88	0.1	ND	ND	ND	ND

REVIEWED BY: Dorena Rode

Enseco

Purgeable Volatile Organics

Method 624

Client Name: Woodward-Clyde Consultants
Client ID: W-BP-0201
Lab ID: 001656-0005-SA Enseco ID: 1013432
Matrix: AQUEOUS Sampled: 11 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 15 SEP 88 Analyzed: 21 SEP 88

Parameter	Result	Units	Reporting Limit
Styrene	ND	ug/L	120
1,2,3-Trichloropropane	ND	ug/L	250
Vinyl acetate	ND	ug/L	1200
trans-1,4-Dichloro-2-butene	ND	ug/L	1200
Toluene-d8	99.6	%	--
4-Bromofluorobenzene (BFB)	87.4	%	--
1,2-Dichloroethane-d4	98.2	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 624

Client Name: Woodward-Clyde Consultants
Client ID: W-BP-0301
Lab ID: 001656-0006-SA Enseco ID: 1013433
Matrix: AQUEOUS Sampled: 11 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 15 SEP 88 Analyzed: 20 SEP 88

Parameter	Result	Units	Reporting Limit
Chloromethane	ND	ug/L	14
Bromomethane (Methylbromide)	ND	ug/L	10
Vinyl chloride	ND	ug/L	11
Chloroethane	ND	ug/L	10
Methylene chloride	ND	ug/L	17
Acetone	ND	ug/L	50
Carbon disulfide	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	4.0
1,1-Dichloroethane	ND	ug/L	5.0
trans-1,2-Dichloroethene	ND	ug/L	5.0
Chloroform	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	3.0
2-Butanone	ND	ug/L	50
1,1,1-Trichloroethane	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	3.0
Bromodichloromethane	ND	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Trichloroethene	ND	ug/L	3.0
Chlorodibromomethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Benzene	ND	ug/L	3.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
2-Chloroethyl vinyl ether	ND	ug/L	100
Bromoform	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	50
1,1,2,2-Tetrachloroethane	ND	ug/L	7.0
Tetrachloroethene	ND	ug/L	3.0
Toluene	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Ethyl benzene	ND	ug/L	5.0
Total xylenes	ND	ug/L	5.0
Trichlorofluoromethane	ND	ug/L	10
Acrolein	ND	ug/L	16
Acrylonitrile	ND	ug/L	10
Dibromomethane	ND	ug/L	10
Dichlorodifluoromethane	26	ug/L	10
Ethanol	ND	ug/L	50
Ethyl methacrylate	ND	ug/L	10
2-Hexanone	ND	ug/L	50
Iodomethane	ND	ug/L	10

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
001656-0001-SA	R-FT-0201	SOIL	12 SEP 88		14 SEP 88
001656-0002-SA	R-FT-0202	SOIL	12 SEP 88		14 SEP 88
001656-0003-SA	W-LF-0101	AQUEOUS	12 SEP 88	19:05	14 SEP 88
001656-0004-SA	W-LF-0102	AQUEOUS	12 SEP 88	19:05	14 SEP 88
001656-0005-SA	W-BP-0201	AQUEOUS	11 SEP 88		14 SEP 88
001656-0006-SA	W-BP-0301	AQUEOUS	11 SEP 88		14 SEP 88
001656-0007-SA	TRIP BLANK	AQUEOUS	11 SEP 88		14 SEP 88

Enseco

Purgeable Volatile Organics

Method 624

Client Name: Woodward-Clyde Consultants
Client ID: W-BP-0201
Lab ID: 001656-0005-SA Enseco ID: 1013432
Matrix: AQUEOUS Sampled: 11 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 15 SEP 88 Analyzed: 21 SEP 88

Parameter	Result	Units	Reporting Limit
Chloromethane	ND	ug/L	350
Bromomethane (Methylbromide)	ND	ug/L	250
Vinyl chloride	ND	ug/L	280
Chloroethane	ND	ug/L	250
Methylene chloride	ND	ug/L	420
Acetone	3700	ug/L	1200
Carbon disulfide	ND	ug/L	120
1,1-Dichloroethene	ND	ug/L	100
1,1-Dichloroethane	ND	ug/L	120
trans-1,2-Dichloroethene	ND	ug/L	120
Chloroform	ND	ug/L	120
1,2-Dichloroethane	ND	ug/L	75
2-Butanone	ND	ug/L	1200
1,1,1-Trichloroethane	ND	ug/L	120
Carbon tetrachloride	ND	ug/L	75
Bromodichloromethane	ND	ug/L	120
1,2-Dichloropropane	ND	ug/L	120
trans-1,3-Dichloropropene	ND	ug/L	120
Trichloroethene	ND	ug/L	75
Chlorodibromomethane	ND	ug/L	120
1,1,2-Trichloroethane	ND	ug/L	120
Benzene	ND	ug/L	75
cis-1,3-Dichloropropene	ND	ug/L	120
2-Chloroethyl vinyl ether	ND	ug/L	2500
Bromoform	ND	ug/L	120
4-Methyl-2-pentanone	ND	ug/L	1200
1,1,2,2-Tetrachloroethane	ND	ug/L	180
Tetrachloroethene	ND	ug/L	75
Toluene	ND	ug/L	120
Chlorobenzene	ND	ug/L	120
Ethyl benzene	ND	ug/L	120
Total xylenes	ND	ug/L	120
Trichlorofluoromethane	ND	ug/L	250
Acrolein	ND	ug/L	400
Acrylonitrile	ND	ug/L	250
Dibromomethane	ND	ug/L	250
Dichlorodifluoromethane	ND	ug/L	250
Ethanol	ND	ug/L	1200
Ethyl methacrylate	ND	ug/L	250
2-Hexanone	ND	ug/L	1200
Iodomethane	ND	ug/L	250

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Analytical Data
Fire Training Pits

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 13341
Date Report Printed: MAY 24 89 @ 07:03

Client Sample ID:R-FT-1301
PWSID :UA
Collected MAY 15 89 @ 18:00 hrs
Received MAY 16 89 @ 08:44 hrs
Preserved with :COOL 4 DEG. C

Analysis Completed :MAY 21 89
Laboratory Supervisor :STEPHEN C. EDE
Released by :

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWF.P
P.O.# NONE REC D
Req #
Ordered By : HOLLY GRAHAM

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special AF1-90275R
Instruct: JOINT RESOURCES

ChemLab Ref #: 5300 Lab Smpl ID: 7 Matrix: WATER

Parameter Tested	Result/Units	Method	Allowable Limits
BOD	9.5 mg/l		

Sample Remarks: SAMPLE COLLECTED BY HOLLY GRAHAM

1 Tests Performed
ND- None Detected
NA- Not Analyzed
* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than
UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 13341
Date Report Printed: MAY 24 89 @ 07:02

Client Sample ID:R-FT-1601
PWSID :UA
Collected MAY 15 89 @ 17:15 hrs.
Received MAY 16 89 @ 08:44 hrs.
Preserved with :COOL 4 DEG. C

Analysis Completed :MAY 21 89
Laboratory Supervisor :STEPHEN C. EDE
Released By :

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : HOLLY GRAHAM

Send Reports to
1)WOODWARD-CLYDE CONSULTANTS
2)

Special AFI-90275K
Instruct: JOINT RESOURCES

Chemlab Rec #: 5300 Lab Smpl ID: 6 Matrix: WATER

Parameter Tested	Result/Units	Method	Allowable Limits
BOD5	5.2 mg/l		

Sample Remarks: SAMPLE COLLECTED BY HOLLY GRAHAM

1 Tests Performed
NL- None Detected
NA- Not Analyzed
* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than
UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 13341
Date Report Printed: MAY 24 89 @ 07:03

Client Sample ID:R-FT-1401
PWSID :UA
Collected MAY 15 89 @ 18 15 hrs.
Received MAY 16 89 @ 08:44 hrs
Preserved with :COOL 4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC D
Req #
Ordered By : HOLLY GRAHAM

Analysis Completed :MAY 21 89
Laboratory Supervisor :STEPHEN C. EDE
Released By :

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: API-90275R
JOINT RESOURCES

Chemlab Ref #: 5300 Lab Smpl ID: B Matrix: WATER

Parameter Tested	Result/Units	Method	Allowable Limits
BOD5	8.6 mg/l		

Sample Remarks: SAMPLE COLLECTED BY HOLLY GRAHAM

1 Tests Performed
ND= None Detected
NA= Not Analyzed
* See Special Instructions Above
** See Sample Remarks Above
LT=Less Than GT=Greater Than
UA=Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 13341

Date Report Printed: MAY 24 89 @ 07:01

Client Sample ID:R-FT-1501
PWSID :UA
Collected MAY 15 89 @ 16:30 hrs.
Received MAY 16 89 @ 08:44 hrs
Preserved with :COOL 4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O # NONE REC D
Req #
Ordered By : HOLLY GRAHAM

Analysis Completed :MAY 21 89
Laboratory Supervisor :STEPHEN C. EDE
Released By :

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special Instruct: AFI-90175F
JOINT RESOURCES

Chemlab Ref # 5300 Lab Smpl ID: 4 Matrix WATER

Parameter Tested	Result/Units	Method	Allowable Limits
BOD5	2.4 mg/l		

Sample Remarks: SAMPLE COLLECTED BY HOLLY GRAHAM

---

1 Tests Performed
ND- None Detected
NA- Not Analyzed
* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than. GT-Greater Than.
UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 13341
Date Report Printed: MAY 24 89 @ 07:01

Client Sample ID:R-FT-1601
PWSID :UA
Collected MAY 15 89 @ 16:50 hrs.
Received MAY 16 89 @ 08:44 hrs.
Preserved with :COOL 4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWEP
P.O.# NONE REC D
Req #
Ordered By : HOLLY GRAHAM

Analysis Completed :MAY 21 89
Laboratory Supervisor :STEPHEN C. EDE
Released By : Stephen C. Ede

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special AFI-90275E
Instruct JOINT RESOURCES

ChemLab Ref # 5300 Lab Smpl ID: 5 Matrix: WATER

Parameter Tested	Result/Units	Method	Allowable Limits
BOD5	5.0 mg/l		

Sample Remarks: SAMPLE COLLECTED BY HOLLY GRAHAM

1 Tests Performed
NL- None Detected
NA- Not Analyzed
* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than
UA-Unavailable

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 13341
Date Report Printed: MAY 24 89 @ 05:59

Client Sample ID:R-FT-1001
PWSID :UA
Collected MAY 15 89 @ 15:45 hrs.
Received MAY 16 89 @ 08:44 hrs.
Preserved with :COOL 4 DEG. C

Analysis Completed :MAY 21 89
Laboratory Supervisor :STEPHEN C EDE
Released By :

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC D
Req #
Ordered By : HOLLY GRAHAM

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special AFI-90275E
Instruct JOINT RESOURCES

Chemlab Ref #: 5300 Lab Smpl ID: 2 Matrix WATER

Parameter Tested	Result/Units	Method	Allowable Limits
BOD1	0.6 mg/l		

Sample Remarks: SAMPLE COLLECTED BY HOLLY GRAHAM

1 Tests Performed * See Special Instructions Above UA=Unavailable
ND= None Detected ** See Sample Remarks Above
NA= Not Analyzed LT=Less Than, GT=Greater Than

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 13341
Date Report Printed: MAY 24 89 @ 07:00

Client Sample ID:R-FT-1101
PWSID :UA
Collected MAY 15 89 @ 16:00 hrs.
Received MAY 16 89 @ 08:44 hrs.
Preserved with :COOL 4 DEG. C

Analysis Completed :MAY 21 89
Laboratory Supervisor :STEPHEN C. EDE
Released By

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC D
Req #
Ordered By : HOLLY GRAHAM

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special AFI-90275E
Instruct: JOINT RESOURCES

Chemlab Ref # 5390 Lab Smpl ID 3 Matrix WATER

Parameter Tested	Result/Units	Method	Allowable Limits
BOD	1.1 mg/l		

Sample Remarks: SAMPLE COLLECTED BY HOLLY GRAHAM

1 Tests Performed
ND- None Detected
NA- Not Analyzed

* See Special Instructions Above
** See Sample Remarks Above
LT-Less Than, GT-Greater Than

UA-Unavailable

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1402
Lab ID: 004952-0009-SA Enseco ID: 1038465
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	29	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize Approved By: Kimberly Conroy

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 B STREET ANCHORAGE, ALASKA 99518 TELEPHONE (907) 562-2343
FEDERAL TAX ID # 92-0040440

ANALYSIS REPORT BY SAMPLE for Work Order # 13341
Date Report Printed: MAY 24 89 @ 06:59

Client Sample ID:R-FT-0901
PWSID :UA
Collected MAY 15 89 @ 15:00 hrs.
Received MAY 16 89 @ 08:44 hrs.
Preserved with :COOL 4 DEG. C

Client Name : WOODWARD-CLYDE CONSULTANTS
Client Acct : WOODWRP
P.O.# NONE REC'D
Req #
Ordered By : HOLLY GRAHAM

Analysis Completed :MAY 21 89
Laboratory Supervisor :STEPHEN C. EDE
Released By :

Send Reports to:
1)WOODWARD-CLYDE CONSULTANTS
2)

Special AFI-90275R
Instruct JOINT RESOURCES

Chemlet Rec # 5305 Lab Smpl ID: 1 Matrix: WATER

Parameter Tested	Result/Units	Method	Allowable Limits
BOD5	2.1 mg/l		

Sample SAMPLE COLLECTED BY HOLLY GRAHAM
Remarks:

1 Tests Performed * See Special Instructions Above UA-Unavailable
ND- None Detected ** See Sample Remarks Above
NA- Not Analyzed LT-Less Than GT-Greater Than

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1102
Lab ID: 004952-0007-SA Enseco ID: 1038463
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	29	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize Approved By: Kimberly Conroy

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1302
Lab ID: 004952-0008-SA Enseco ID: 1038464
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	29	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	2.0	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize Approved By: Kimberly Conroy

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0902
Lab ID: 004952 0005-SA Enseco ID: 1038461
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	ND	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize Approved By: Kimberly Conroy

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1002
Lab ID: 004952-0006-SA Enseco ID: 1038462
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	ND	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize

Approved By: Kimberly Conroy

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1601
Lab ID: 004952-0003-SA Enseco ID: 1038459
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	ND	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize Approved By: Kimberly Conroy

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1601-D
Lab ID: 004952-0004-SA Enseco ID: 1038460
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	ND	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize

Approved By: Kimberly Conroy

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1502
Lab ID: 004952-0001-SA Enseco ID: 1038457
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	ND	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize Approved By: Kimberly Conroy

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1801
Lab ID: 004952-0002-SA Enseco ID: 1038458
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: See Below Analyzed: See Below

Parameter	Result	Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Oil and Grease	1	mg/L	1	413.2	NA	29 MAY 89
Total Petroleum Hydrocarbons	ND	mg/L	1.0	EPA 418.1	NA	27 MAY 89

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Roger Freize Approved By: Kimberly Conroy

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1402
Lab ID: 004952-0009-SA Enseco ID: 1038465
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	ND	ug/L	0.70	T
Toluene	ND	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	
Total xylenes	ND	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: TRIP BLANK
Lab ID: 004952-0010-SA Enseco ID: 1038466
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	ND	ug/L	0.70	T
Toluene	ND	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	
Total xylenes	ND	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics-2nd Column Analysis

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1102
Lab ID: 004952-0007-SA Enseco ID: 1038463
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 25 MAY 89

Parameter	Result	Units	Reporting Limit
Benzene	ND	ug/L	0.70
Toluene	ND	ug/L	1.0
Chlorobenzene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
Total xylenes	6.0	ug/L	2.0
1,3-Dichlorobenzene	ND	ug/L	2.0
1,2-Dichlorobenzene	ND	ug/L	2.0
1,4-Dichlorobenzene	ND	ug/L	0.50

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward Clyde Consultants
Client ID: R-F1-1302
Lab ID: 004952-0008-SA Enseco ID: 1038464
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	ND	ug/L	0.70	T
Toluene	ND	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	
Total xylenes	ND	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics-2nd Column Analysis

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1002
Lab ID: 004952-0006-SA Enseco ID: 1038462
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 25 MAY 89

Parameter	Result	Units	Reporting Limit
Benzene	8.8	ug/L	0.70
Toluene	ND	ug/L	1.0
Chlorobenzene	ND	ug/L	1.0
Ethyl benzene	ND	ug/L	1.0
Total xylenes	ND	ug/L	2.0
1,3-Dichlorobenzene	ND	ug/L	2.0
1,2-Dichlorobenzene	ND	ug/L	2.0
1,4-Dichlorobenzene	ND	ug/L	0.50

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1102
Lab ID: 004952-0007-SA Enseco ID: 1038463
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	5.2	ug/L	0.70	T
Toluene	ND	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	
Total xylenes	3.0	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics-2nd Column Analysis

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0902
Lab ID: 004952-0005-SA Enseco ID: 1038461
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 25 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	ND	ug/L	0.88	V
Toluene	6.3	ug/L	1.2	V
Chlorobenzene	ND	ug/L	1.2	
Ethyl benzene	8.4	ug/L	1.2	V
Total xylenes	40	ug/L	2.5	
1,3-Dichlorobenzene	ND	ug/L	2.5	
1,2-Dichlorobenzene	ND	ug/L	2.5	
1,4-Dichlorobenzene	ND	ug/L	0.62	

Note V : Secondary column result is the preferred value.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1002
Lab ID: 004952-0006-SA Enseco ID: 1038462
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	6.6	ug/L	0.70	T
Toluene	ND	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	
Total xylenes	ND	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Metals

Recoverable Metals

Client Name: Woodward-Clyde Consultants
Client ID: W-LF-0102
Lab ID: 001656-0004-SA Enseco ID: 1013431
Matrix: AQUEOUS Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 28 SEP 88 Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/L	0.002	239.2	30 SEP 88
Manganese	0.70	mg/L	0.005	200.7	29 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Hand Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

Metals

Dissolved Metals

Client Name: Woodward-Clyde Consultants
Client ID: W-LF-0102
Lab ID: 001656-0004-SA Enseco ID: 1013431
Matrix: AQUEOUS Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Lead	ND	mg/L	0.002	239.2	23 SEP 88
Manganese	0.74	mg/L	0.005	200.7	28 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Jeff Hand Approved By: Kimberly Conroy

The cover letter is an integral part of this report.
Rev 230787

Enseco

General Inorganics

Client Name: Woodward-Clyde Consultants
Client ID: W-LF-0102
Lab ID: 001656-0004-SA Enseco ID: 1013431
Matrix: AQUEOUS Sampled: 12 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: NA Analyzed: NA

Parameter	Result	Units	Reporting Limit	Analytical Method	Analyzed Date
Corrosivity	ND	mmpy	0.1	NACE	21 OCT 88
Turbidity	15.0	NTU	0.1	180.1	16 SEP 88
Total Petroleum Hydrocarbons	ND	mg/L	0.5	EPA 418.1	22 SEP 88

ND=Not Detected
NA=Not Applicable

Reported By: Roger Freize Approved By: Roger Freize

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 624

Client Name: Woodward-Clyde Consultants
Client ID: TRIP BLANK
Lab ID: 001656-0007-SA Enseco ID: 1013434
Matrix: AQUEOUS Sampled: 11 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 15 SEP 88 Analyzed: 20 SEP 88

Parameter	Result	Units	Reporting Limit
Chloromethane	ND	ug/L	14
Bromomethane (Methylbromide)	ND	ug/L	10
Vinyl chloride	ND	ug/L	11
Chloroethane	ND	ug/L	10
Methylene chloride	ND	ug/L	17
Acetone	ND	ug/L	50
Carbon disulfide	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	4.0
1,1-Dichloroethane	ND	ug/L	5.0
trans-1,2-Dichloroethene	ND	ug/L	5.0
Chloroform	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	3.0
2-Butanone	ND	ug/L	50
1,1,1-Trichloroethane	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	3.0
Bromodichloromethane	ND	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Trichloroethene	ND	ug/L	3.0
Chlorodibromomethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Benzene	ND	ug/L	3.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
2-Chloroethyl vinyl ether	ND	ug/L	100
Bromoform	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	50
1,1,2,2-Tetrachloroethane	ND	ug/L	7.0
Tetrachloroethene	ND	ug/L	3.0
Toluene	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Ethyl benzene	ND	ug/L	5.0
Total xylenes	ND	ug/L	5.0
Trichlorofluoromethane	ND	ug/L	10
Acrolein	ND	ug/L	16
Acrylonitrile	ND	ug/L	10
Dibromomethane	ND	ug/L	10
Dichlorodifluoromethane	ND	ug/L	10
Ethanol	ND	ug/L	50
Ethyl methacrylate	ND	ug/L	10
2-Hexanone	ND	ug/L	50
Iodomethane	ND	ug/L	10

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Purgeable Volatile Organics

Method 624

Client Name: Woodward-Clyde Consultants
Client ID: TRIP BLANK
Lab ID: 001656-0007-SA Enseco ID: 1013434
Matrix: AQUEOUS Sampled: 11 SEP 88 Received: 14 SEP 88
Authorized: 14 SEP 88 Prepared: 15 SEP 88 Analyzed: 20 SEP 88

Parameter	Result	Units	Reporting Limit
Styrene	ND	ug/L	5.0
1,2,3-Trichloropropane	ND	ug/L	10
Vinyl acetate	ND	ug/L	50
trans-1,4-Dichloro-2-butene	ND	ug/L	50
Toluene-d8	102	%	--
4-Bromofluorobenzene (BFB)	84.4	%	--
1,2-Dichloroethane-d4	98.2	%	--

ND=Not Detected
NA=Not Applicable

Reported By: Steve Remaley Approved By: Jeff Lowry

The cover letter is an integral part of this report.
Rev 230787

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1502
Lab ID: 004952-0001-SA
Matrix: AQUEOUS
Authorized: 17 MAY 89

Enseco ID: 1038457
Sampled: 15 MAY 89
Prepared: NA

Received: 17 MAY 89
Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	0.82	ug/L	0.70	T
Toluene	1.2	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	1.4	ug/L	1.0	
Total xylenes	3.8	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell

Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics-2nd Column Analysis

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1502
Lab ID: 004952-0001-SA Enseco ID: 1038457
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 24 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	1.0	ug/L	0.70	
Toluene	1.4	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	V
Total xylenes	4.8	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note V : Secondary column result is the preferred value.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1801
Lab ID: 004952-0002-SA Enseco ID: 1038458
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	490	ug/L	18	T
Toluene	240	ug/L	25	
Chlorobenzene	ND	ug/L	25	
Ethyl benzene	87	ug/L	25	
Total xylenes	510	ug/L	50	
1,3-Dichlorobenzene	ND	ug/L	50	
1,2-Dichlorobenzene	ND	ug/L	50	
1,4-Dichlorobenzene	ND	ug/L	12	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics-2nd Column Analysis

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1801
Lab ID: 004952-0002-SA Enseco ID: 1038458
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 24 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	510	ug/L	18	
Toluene	240	ug/L	25	
Chlorobenzene	ND	ug/L	25	
Ethyl benzene	72	ug/L	25	V
Total xylenes	440	ug/L	50	V
1,3-Dichlorobenzene	ND	ug/L	50	
1,2-Dichlorobenzene	ND	ug/L	50	
1,4-Dichlorobenzene	ND	ug/L	12	

Note V : Secondary column result is the preferred value.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-1601
Lab ID. 004952-0003-SA Enseco ID: 1038459
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	ND	ug/L	0.70	T
Toluene	ND	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	
Total xylenes	ND	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-16[illegible]-D
Lab ID: 004952-000[illegible] SA Enseco ID: 1038460
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	ND	ug/L	0.70	T
Toluene	ND	ug/L	1.0	
Chlorobenzene	ND	ug/L	1.0	
Ethyl benzene	ND	ug/L	1.0	
Total xylenes	ND	ug/L	2.0	
1,3-Dichlorobenzene	ND	ug/L	2.0	
1,2-Dichlorobenzene	ND	ug/L	2.0	
1,4-Dichlorobenzene	ND	ug/L	0.50	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

Enseco

Aromatic Volatile Organics

EPA 602

Client Name: Woodward-Clyde Consultants
Client ID: R-FT-0902
Lab ID: 004952-0005-SA Enseco Iu. 1038461
Matrix: AQUEOUS Sampled: 15 MAY 89 Received: 17 MAY 89
Authorized: 17 MAY 89 Prepared: NA Analyzed: 22 MAY 89

Parameter	Result	Units	Reporting Limit	
Benzene	1.1	ug/L	0.88	T
Toluene	7.5	ug/L	1.2	
Chlorobenzene	ND	ug/L	1.2	
Ethyl benzene	10	ug/L	1.2	
Total xylenes	43	ug/L	2.5	
1,3-Dichlorobenzene	ND	ug/L	2.5	
1,2-Dichlorobenzene	ND	ug/L	2.5	
1,4-Dichlorobenzene	ND	ug/L	0.62	

Note T : Preferred values unless footnoted on secondary column test.

N.D. = Not Detected
N.A. = Not Applicable

Reported By: Duane Newell Approved By: Kim Zilis

APPENDIX H

Correspondence with Government Agencies

APPENDIX H

No government agency

correspondence was received.

APPENDIX I

Data from previous investigations

Data From Previous Investigations
Anchorage Fuel Terminal

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499	**ORDERED BY:**	Brad Platt
	Fort Richardson, AK 99505	**SAMPLE RECVD:**	2/23/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	2/23/87
EPA METHOD:	602	**APPROVED BY:**	STEPHEN C. EDE SCE
MATRIX:	Water	**SAMPLES HELD UNTIL:**	3/24/87
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5506

CLIENT SAMPLE ID: Sample #87011, 2/23/87, by Paul Steucke

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	53
TOLUENE	2.2
ETHYLBENZENE	25
CHLOROBENZENE	ND (1)
p-XYLENE	95
m-XYLENE	
o-XYLENE	3.1
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5506

Sample Number D1

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499	**ORDERED BY:**	Brad Platt
	Fort Richardson, AK 99505	**SAMPLE RECVD:**	2/26/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	2/27/87
EPA METHOD:	602	**APPROVED BY:**	STEPHEN C. EDE
MATRIX:	Water	**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5536- 1

CLIENT SAMPLE ID: #1, by Beth Rodigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	148
TOLUENE	6.3
ETHYLBENZENE	49
CHLOROBENZENE	ND (1)
p-XYLENE	
m-XYLENE	164
o-XYLENE	4.0
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5536

Sample D1A

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

ANCHORAGE INDUSTRIAL CENTER 5633 B STREET ANCHORAGE, ALASKA 99518
TELEPHONE (907) 562-2343

ANALYTICAL REPORT

CLIENT: US Army/Fort Richardson
CLIENT P. O. #: Brad Platt DAKF70-87-M-0091
ADDRESS: Box 499
SAMPLES RECEIVED: 2/24/87
Fort Richardson, AK 99505
SAMPLES COLLECTED: [redacted]
REFER QUESTION TO: Stephen C. Ede
DATE ANALYZED: 3/3/87
APPROVED BY: Stephen C. Ede SCE
LAB SAMPLE NO. 5535

CLIENT SAMPLE I.D.: 87011 Water & [redacted] Material, Anchorage Terminal by Paul Steuke

MATRIX: [redacted]

METHOD: Standard Methods, 16th Edition,
503C, 503B, 503E
Capillary Gas Chromatography

Hydrocarbon Oil and Grease, ppm	[redacted]

The hydrocarbons recovered by extraction were concentrated and analyzed by capillary gas chromatography. This analysis indicates the hydrocarbons to be a middle distillate petroleum product such as diesel fuel, heating fuel, or Jet A-50.

This sample was taken at the same location as [redacted] Sample #87011 on 2/23/87 on the Map

Sample D1B

ND = NONE DETECTED
DETECTION LIMIT IN ( )

RESIDUAL SAMPLES WILL BE HELD UNTIL: 4/7/87

INVOICE # 5535

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499	**ORDERED BY:**	Brad Platt
	Fort Richardson, AK 99505	**SAMPLE RECVD:**	2/26/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	2/27/87
EPA METHOD:	602	**APPROVED BY:**	STEPHEN C. EDE SCE
MATRIX:	Water	**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5536-2

CLIENT SAMPLE ID: #2, by Beth Rodigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	ND (1)
TOLUENE	ND (1)
ETHYLBENZENE	ND (1)
CHLOROBENZENE	ND (1)
p-XYLENE	ND (1)
m-XYLENE	ND (1)
o-XYLENE	ND (1)
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5536

Sample D3

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499 Fort Richardson, AK 99505	**ORDERED BY:**	Brad Platt
		SAMPLE RECVD:	2/26/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	2/27/87
EPA METHOD:	602	**APPROVED BY:**	STEPHEN C. EDE
MATRIX:	Water	**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5536-3

CLIENT SAMPLE ID: #3, by Beth Rodigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	ND (1)
TOLUENE	ND (1)
ETHYLBENZENE	ND (1)
CHLOROBENZENE	ND (1)
p-XYLENE	ND (1)
m-XYLENE	ND (1)
o-XYLENE	ND (1)
1,4 DICHLOROBENZENE	ND (1)
1,3 DICHLOROBENZENE	ND (1)
1,2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5536

Sample D4

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499	**ORDERED BY:**	Brad Platt
	Fort Richardson, AK 99505	**SAMPLE RECVD:**	2/26/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	2/27/87
EPA METHOD:	602	**APPROVED BY:**	STEPHEN C. EDE
MATRIX:	Water	**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5536- 4

CLIENT SAMPLE ID: #4, by Beth Rodigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	ND (1)
TOLUENE	ND (1)
ETHYLBENZENE	ND (1)
CHLOROBENZENE	ND (1)
p-XYLENE	ND (1)
m-XYLENE	ND (1)
o-XYLENE	ND (1)
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5536

Sample D5

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499 Fort Richardson, AK 99505	**ORDERED BY:**	Brad Platt
		SAMPLE RECVD:	2/26/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	2/27/87
EPA METHOD:	602	**APPROVED BY:**	STEPHEN C. EDE
MATRIX:	Water	**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5536- 5

CLIENT SAMPLE ID: #5, by Beth Rodigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	ND (1)
TOLUENE	ND (1)
ETHYLBENZENE	ND (1)
CHLOROBENZENE	ND (1)
p-XYLENE	ND (1)
m-XYLENE	ND (1)
o-XYLENE	ND (1)
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5536

Sample D6

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499	**ORDERED BY:**	Brad Platt
	Fort Richardson, AK 99505	**SAMPLE RECVD:**	2/26/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	2/27/87
EPA METHOD:	602	**APPROVED BY:**	STEPHEN C. EDE SCE
MATRIX:	Water	**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5536- 6

CLIENT SAMPLE ID: 86, by Beth Rodigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	ND (1)
TOLUENE	ND (1)
ETHYLBENZENE	3.8
CHLOROBENZENE	ND (1)
p-XYLENE	12
m-XYLENE	
o-XYLENE	3.8
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5536

Sample D-7

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499 Fort Richardson, AK 99505	**ORDERED BY:**	Beth Rodigari
		SAMPLE RECVD:	3/5/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	3/6/87
EPA METHOD:		**APPROVED BY:**	STEPHEN C. EDE ACE
MATRIX:		**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5582- 2

CLIENT SAMPLE ID: TF, by Beth Rodigari, 3/5/87

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	205
TOLUENE	11
ETHYLBENZENE	81
CHLOROBENZENE	ND (1)
p-XYLENE	238
m-XYLENE	
o-XYLENE	5.5
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5582

Sample D-8

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499	**ORDERED BY:**	Beth Rodigari
	Fort Richardson, AK 99505	**SAMPLE RECVD:**	3/5/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	3/6/87
EPA METHOD:		**APPROVED BY:**	STEPHEN C. EDE SCE
MATRIX:		**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5582-3

CLIENT SAMPLE ID: "#2" by Beth Rodigari, 3/5/87

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	162
TOLUENE	6.8
ETHYLBENZENE	43
CHLOROBENZENE	ND (1)
p-XYLENE m-XYLENE	158
o-XYLENE	3.5
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5582

Sample D-9

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

ANCHORAGE INDUSTRIAL CENTER 5633 B STREET ANCHORAGE, ALASKA 99518
TELEPHONE (907) 562-2343

ANALYTICAL REPORT

CLIENT	US Army/Fort Richardson	CLIENT P. O. #	DAKF70-87-M-0081
ADDRESS	Box 499	SAMPLES RECEIVED:	3/5/87
	Fort Richardson, AK 99505	SAMPLES COLLECTED:	3/5/87
REFER QUESTION TO:	Stephen C. Ede	DATE ANALYZED:	3/6/87
APPROVED BY:	Stephen C. Ede	LAB SAMPLE NO.	5582-1

CLIENT SAMPLE I.D.: #1, by Beth Rodigari

MATRIX: Liquid/Soild

METHOD: EPA Method 418.1, Capillary Gas Chromatography

Hydrocarbon Oil and Grease, mg/l: 1,940

NOTE: The hydrocarbons extracted above were analyzed by capillary gas chromatography. The analysis indicates the hydrocarbons to consist of a weathered middle distillate petroleum product such as diesel juel, Jet A-50 or heating fuel.

This sample was taken at the same location as the water sample numbered #2; 3/5/87 on the map.

Sample D-9A

ND = NONE DETECTED
DETECTION LIMIT IN ( )

RESIDUAL SAMPLES WILL BE HELD UNTIL: 4/10/87

INVOICE # 5523

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499	**ORDERED BY:**	Beth Rodigari
	Fort Richardson, AK 99505	**SAMPLE RECVD:**	3/5/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	3/6/87
EPA METHOD:		**APPROVED BY:**	STEPHEN C. EDE SCE
MATRIX:		**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5582- 4

CLIENT SAMPLE ID: #3; by Beth Rodigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	ND (1)
TOLUENE	ND (1)
ETHYLBENZENE	ND (1)
CHLOROBENZENE	ND (1)
p-XYLENE	ND (1)
m-XYLENE	ND (1)
o-XYLENE	ND (1)
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5582

Sample DI0

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499 Fort Richardson, AK 99505	**ORDERED BY:**	Beth Rodigari
		SAMPLE RECVD:	3/5/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	3/6/87
EPA METHOD:		**APPROVED BY:**	STEPHEN C. EDE SCE
MATRIX:		**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5582- 5

CLIENT SAMPLE ID: #4, by Beth Rogigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	ND (1)
TOLUENE	ND (1)
ETHYLBENZENE	ND (1)
CHLOROBENZENE	ND (1)
p-XYLENE	ND (1)
m-XYLENE	ND (1)
o-XYLENE	ND (1)
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5582

Sample D11

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499	**ORDERED BY:**	Beth Rodigari
	Fort Richardson, AK 99505	**SAMPLE RECVD:**	3/9/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	3/11/87
EPA METHOD:	602	**APPROVED BY:**	STEPHEN C. EDE SCE
MATRIX:	Water	**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5607

CLIENT SAMPLE ID: Anchorage Terminal Tank Tunnel 623, 3/9/87, 1045 hrs. B. Rodigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	ND (1)
TOLUENE	ND (1)
ETHYLBENZENE	6.9
CHLOROBENZENE	ND (1)
p-XYLENE	16.9
m-XYLENE	
o-XYLENE	ND (1)
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5607

NOTE: Middle distillate fuel contamination indicated.

Sample D12

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499	**ORDERED BY:**	Beth Rodigari
	Fort Richardson, AK 99505	**SAMPLE RECVD:**	3/9/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	3/12/87
EPA METHOD:	602	**APPROVED BY:**	STEPHEN C. EDE SCE
MATRIX:	Water	**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5616- 4

CLIENT SAMPLE ID: #624, Water, Anchorage Terminal, 3/9/87, 1330 hrs., Rodigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	6.1
TOLUENE	3.5
ETHYLBENZENE	ND (1)
CHLOROBENZENE	ND (1)
p-XYLENE	6.3
m-XYLENE	
o-XYLENE	5.1
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5616

Sample D13

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499	**ORDERED BY:**	Beth Rodigari
	Fort Richardson, AK 99505	**SAMPLE RECVD:**	3/9/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	3/12/87
EPA METHOD:	602	**APPROVED BY:**	STEPHEN C. EDE ACE
MATRIX:	Water	**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5616-2

CLIENT SAMPLE ID: 1st of 2 vials, water sample #19, Anchorage Terminal, 3/9/87, Rodigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	154
TOLUENE	6.8
ETHYLBENZENE	ND (1)
CHLOROBENZENE	ND (1)
p-XYLENE	200
m-XYLENE	
o-XYLENE	5.8
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5616

Sample D14

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499	**ORDERED BY:**	Beth Rodigari
	Fort Richardson, AK 99505	**SAMPLE RECVD:**	3/9/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	3/12/87
EPA METHOD:	602	**APPROVED BY:**	STEPHEN C. EDE *SCE*
MATRIX:	Water	**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5616-2

CLIENT SAMPLE ID: 2nd of 2 vials, Water Sample #19, Anchorage Terminal, 3/9/87, Rodigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	179
TOLUENE	9.2
ETHYLBENZENE	55
CHLOROBENZENE	ND (1)
p-XYLENE	212
m-XYLENE	6.1
o-XYLENE	ND (1)
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5616

Sample D14A

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499	**ORDERED BY:**	Beth Rodigari
	Fort Richardson, AK 99505	**SAMPLE RECVD:**	3/9/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	3/12/87
EPA METHOD:	602	**APPROVED BY:**	STEPHEN C. EDE SCE
MATRIX:	Water	**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5616-3

CLIENT SAMPLE ID: #20, 3/9/87, Rodigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	ND (1)
TOLUENE	ND (1)
ETHYLBENZENE	ND (1)
CHLOROBENZENE	ND (1)
p-XYLENE	ND (1)
m-XYLENE	ND (1)
o-XYLENE	ND (1)
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5616

Sample D15

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499 Fort Richardson, AK 99505	**ORDERED BY:**	Beth Rodigari
		SAMPLE RECVD:	3/13/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	3/13/87
EPA METHOD:	602	**APPROVED BY:**	STEPHEN C. EDE
MATRIX:	Water	**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5665-1

CLIENT SAMPLE ID: #622, 3/13/87, Beth Rodigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	3.0
TOLUENE	32
ETHYLBENZENE	32
CHLOROBENZENE	ND (1)
p-XYLENE	256
m-XYLENE	208
o-XYLENE	ND (1)
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5665

Sample D-16

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.
5633 'B' STREET, ANCHORAGE, AK 99518
TELEPHONE (907) 562-2343

REPORT OF ANALYSIS

CLIENT:	US Army/Fort Richardson	**CLIENT PO NO:**	DAKF70-87-M-0081
SEND REPORT TO:	Box 499	**ORDERED BY:**	Beth Rodigari
	Fort Richardson, AK 99505	**SAMPLE RECVD:**	3/20/87
SEND REPORT TO:	Same	**DATE ANALYZED:**	3/24/87
EPA METHOD:	602	**APPROVED BY:**	STEPHEN C. EDE
MATRIX:	Water	**SAMPLES HELD UNTIL:**	NOT HELD
REFER QUESTIONS:	STEPHEN C EDE	**LAB SAMPLE NO:**	5723

CLIENT SAMPLE ID: #120, Elmendorf Stream, 3/20/87, 1500 hrs., B. Rodigari

VOLATILE AROMATIC HYDROCARBONS, ppb	RESULTS
BENZENE	ND (1)
TOLUENE	4.3
ETHYLBENZENE	1.3
CHLOROBENZENE	ND (1)
p-XYLENE	6.8
m-XYLENE	
o-XYLENE	ND (1)
1, 4 DICHLOROBENZENE	ND (1)
1, 3 DICHLOROBENZENE	ND (1)
1, 2 DICHLOROBENZENE	ND (1)

ND-NONE DETECTED
DETECTION LIMITS IN ( )

INVOICE # 5723

Sample D-17

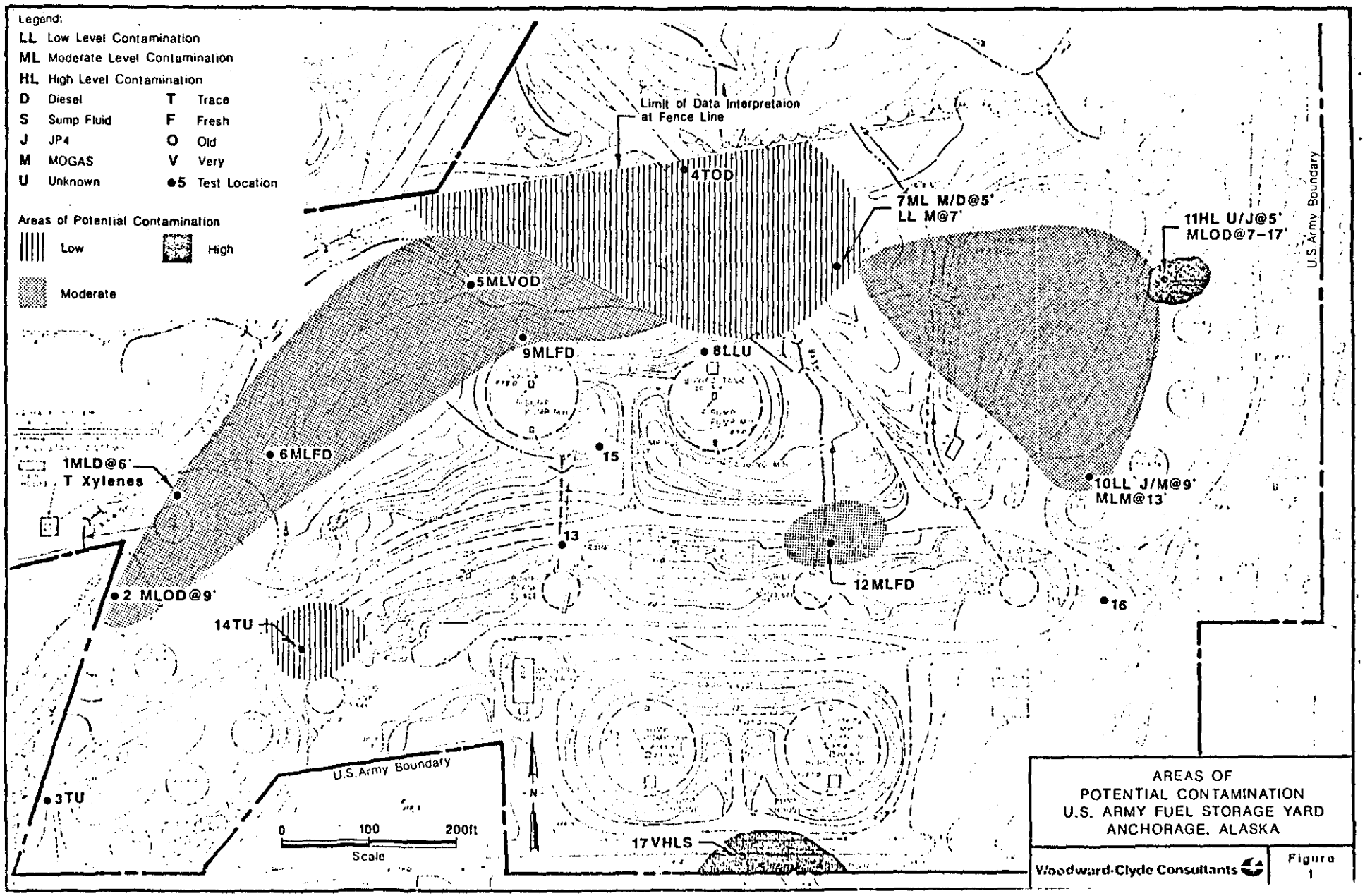
Probe Number	Depth (ft)	B	T	X	Comments
			(in ppm)		
1	4	-	-	TR	Trace xylenes
1	5	-	-	-	
1	6	2.3	19.4	13.1	Diesel, modified (mod Level)
2	5	-	-	-	
2	7	-	-	-	Verification analysis
2	9	TR	13.6	12.5	Soluble T&X only
3	5	-	-	-	
3	7	-	.27	-	
3	9	.06	.07	-	Unknown
4	5	-	-	-	
4	7	-	-	-	Verification analysis
4	9	-	TR	2.20	TR old diesel
5	2	-	-	-	
5	3	-	-	-	Verification analysis
5	4	-	TR	-	Mod very old diesel
6	5	.11	TR	.67	
6	7	1.33	2.35	3.51	Diesel, fresh
6	9	-	.04	1.18	
7	5	7.3	9.96	-	MOGAS/diesel
7	7	1.26	2.55	3.72	MOGAS
7	9	0.79	1.76	2.79	MOGAS
8	5	-	TR	-	Peak @ 1.41
8	7	TR	2.81	3.98	No heavies; TR benzene
9	3.5	1.30	5.37	TR	Fresh diesel
9	5	1.15	7.68	TR	Diesel
9	6	1.45	7.55	TR	
9	7.5	1.21	7.15	TR	
10	5	-	-	-	TR alcohol peak?
10	7	-	-	-	"
10	9	7.59	5.98	0.66	Poss JP4,/MOGAS
10	11	0.85	1.02	0.60	MOGAS
10	13	37.0	59.2	26.9	MOGAS, deep
11	5	604	1087	438	JP4/diesel
11	7	.64	.73	.35	
11	9	5.39	5.10	-	JP4
11	11	2.06	1.53	2.91	
11	13	11.8	5.93	1.93	
11	15	3.21	6.13	4.05	Diesel,
11	17	.87	3.53	2.89	Diesel,
12	5	-	28.3	24.9	Diesel
12	7	-	19.6	23.7	
12	9	-	7.21	4.97	
13	5	-	-	-	Clean
13	7	-	-	-	Verification analysis
13	9	-	-	-	
14	5	-	.27	.32	
14	7	-	-	-	Tr. alcohol
14	9	-	-	-	
15	5	-	-	-	Tr. alcohol/hex?
15	7	-	-	-	

Probe Number	Depth (ft)	B	T	X	Comments
			(in ppm)		
15	9	-	-	-	Verification analysis
16	5	-	-	TR	
16	8	-	-	-	Tr. diesel heavies
17	5	-	16778	21532	Sump fluid
17	7	14.5	1288	11572	"
17	9	54.2	2914	16111	"
17	10	-	5534	7564	"
17	11	31.4	1094	661	"
17	12	44.2	1102	682	"
17	13	31.4	1125	708	"

Reference Analyses

	µl
Diesel	100
	20
Sump Fluid	10
JP4	10
MOGAS	10

Total Analyses	137
QA/QC	47
Reference Standards	25
Verification Analyses	5
Net Analyses	60


Legend:
LL Low Level Contamination
ML Moderate Level Contamination
HL High Level Contamination
D Diesel
S Sump Fluid
J JP4
M MOGAS
U Unknown
T Trace
F Fresh
O Old
V Very
●5 Test Location
Areas of Potential Contamination
Low
High
Moderate
Limit of Data Interpretaion at Fence Line
4TOD
7ML M/D@5'
LL M@7'
11HL U/J@5'
MLOD@7-17'
U.S. Army Boundary
●5MLVOD
9MLFD
●8LLU
●6MLFD
15
1MLD@6'
T Xylenes
10LL J/M@9'
MLM@13'
13
12MLFD
●2 MLOD@9'
16
14TU
●3TU
U.S.Army Boundary
N
0 100 200ft
Scale
17VHLS
AREAS OF
POTENTIAL CONTAMINATION
U.S. ARMY FUEL STORAGE YARD
ANCHORAGE, ALASKA
Woodward-Clyde Consultants
Figure
1

Data From Previous Investigations
Roosevelt Road PCB Site

TABLE F-1 PCB RESULTS, ROOSEVELT ROAD TRANSMITTER SITE, U.S.C.O.E. 1988 FIELD INVESTIGATION

SAMPLE #	SAMPLE LOCATION	CONCENTRATION
1	SURFACE, SOIL	1.8
2	SURFACE, SOIL	2.9
3	SURFACE, SOIL	N/D
4	SURFACE, SOIL	38.3
5	SURFACE, SOIL	N/D
6	SURFACE, SOIL	N/D
7	SURFACE, SOIL	N/D
8	SURFACE, SOIL	N/D
9	SURFACE, SOIL	N/D
10	SURFACE, SOIL	12
11	SURFACE, SOIL	0.52
12	SURFACE, SOIL	N/D
13	SURFACE, SOIL	0.46
14	SURFACE, SOIL	2.3
15	SURFACE, SOIL	3.4
16	SURFACE, SOIL	5.8
17	SURFACE, PAD	N/D
18	SURFACE, PAD	N/D
19	SURFACE, SOIL	0.6
20	SURFACE, PAD	3.7
21	SURFACE, PAD	N/D
22	SURFACE, PAD	5.4
23	SURFACE, PAD	2.3
24	SURFACE, PAD	1.3
25	SURFACE, PAD	4.4
26	SURFACE, PAD	44400
27	SURFACE, PAD	73500
28	SURFACE, PAD	23700
29	SURFACE, PAD	101
30	SURFACE, SOIL	N/D
31	SURFACE, SOIL	11100
32	SURFACE, SOIL	0.57
33	SURFACE, SOIL	3.5
34	SURFACE, SOIL	7.7
35	SURFACE, SOIL	4810
36	SURFACE, SOIL	0.34
37	SURFACE, SOIL	N/D
38	SURFACE, SOIL	N/D
39	SURFACE, SOIL	1.8
40	SURFACE, SOIL	12.1
41	SURFACE, PAD	11
42	SURFACE, PAD	62100
43	SURFACE, PAD	25200
44	SURFACE, PAD	52900
45	SURFACE, PAD	51300
46	SURFACE, PAD	76900
47	SURFACE, PAD	19700
48	SURFACE, PAD	49600
49	SURFACE, PAD	2870

TABLE F-1 PCB RESULTS, ROOSEVELT ROAD TRANSMITTER SITE, U.S.C.O.E. 1988 FIELD INVESTIGATION

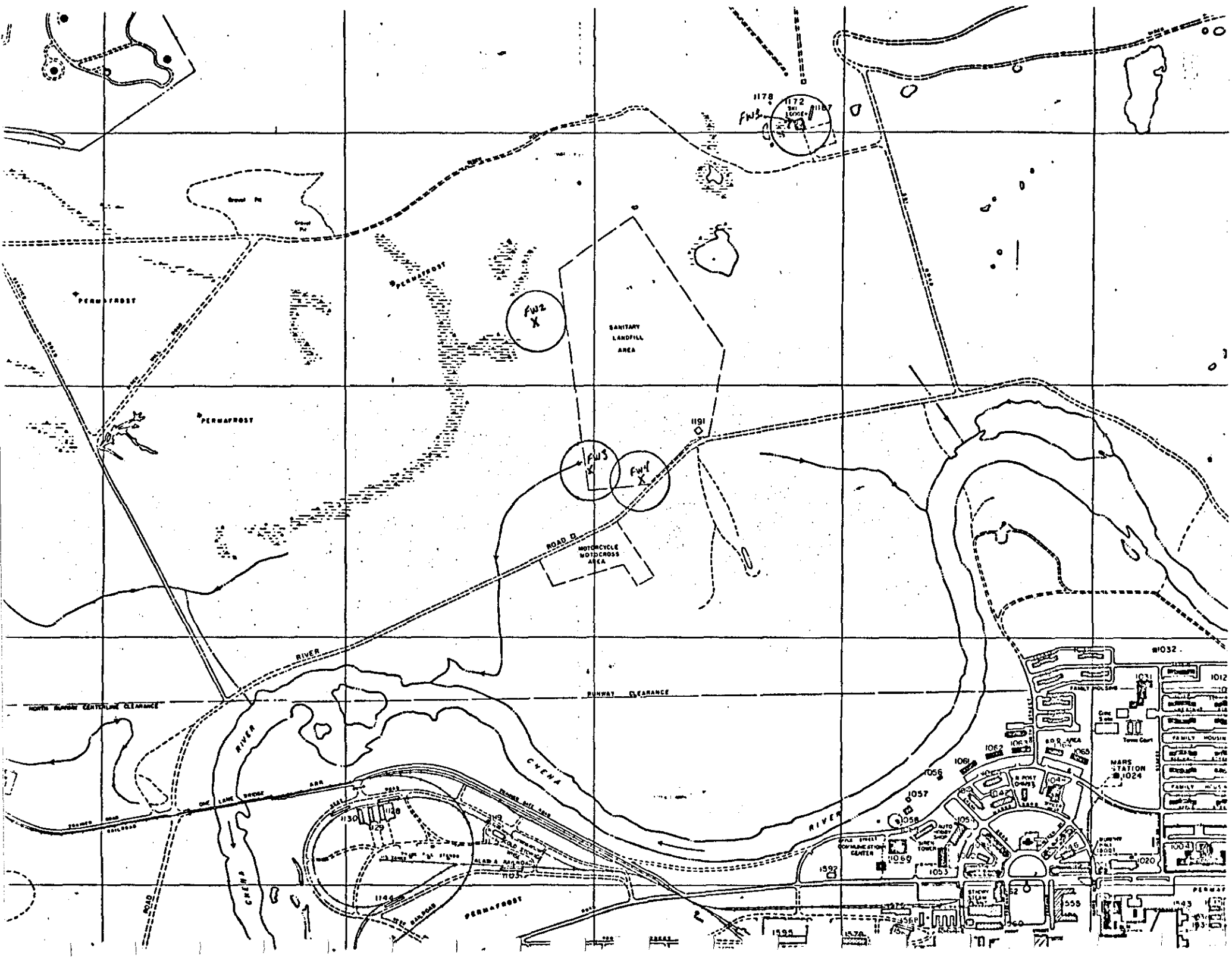
SAMPLE #	SAMPLE LOCATION	CONCENTRATION
50	SURFACE, SOIL	9.7
51	SURFACE, SOIL	52.4
52	SURFACE, SOIL	9850
53	SURFACE, SOIL	4590
54	SURFACE, SOIL	2150
55	SURFACE, SOIL	586
56	SURFACE, SOIL	238
57	SURFACE, SOIL	196
58	SURFACE, SOIL	36
59	SURFACE, SOIL	14
60	SURFACE, SOIL	7.5
61	SURFACE, SOIL	39
62	SURFACE, SOIL	131
63	SURFACE, SOIL	151
64	SURFACE, SOIL	15
65	SURFACE, SOIL	14
66	SURFACE, SOIL	140
67	SURFACE, SOIL	224
68	SURFACE, SOIL	8.1
69	SURFACE, SOIL	5640
70	SURFACE, SOIL	988
71	SURFACE, SOIL	12.6
72	SURFACE, SOIL	28.9
73	SURFACE, SOIL	1.49
74	SURFACE, SOIL	3.97
75	SURFACE, SOIL	29
76	SURFACE, SOIL	1.1
77	SURFACE, SOIL	16.1
	DRILL HOLE SAMPLES AT SURFACE	
DH0	SURFACE, SOIL	5.3
DH1	SURFACE, SOIL	2.54
DH2	SURFACE, SOIL	68
DH3	SURFACE, SOIL	142
DH4	SURFACE, SOIL	15
DH5	SURFACE, SOIL	7.1
DH6	SURFACE, SOIL	880
DH7	SURFACE, SOIL	35
DH8	SURFACE, SOIL	1200
DH9	SURFACE, SOIL	96
DH10	SURFACE, SOIL	1800
DH11	SURFACE, SOIL	ND
DH12	SURFACE, SOIL	0.41
DH13	SURFACE, SOIL	117
DH14	SURFACE, SOIL	122
DH15	SURFACE, SOIL	136

ND=Not Detected

TABLE F-2 PCB CONCENTRATION IN DRILL HOLES, FORT WAINWRIGHT ROOSEVELT ROAD PCB SITE

DEPTH (Ft.)	DH-2	DH-3	DH-4	DH-6	DH-8	DH-9	DH-10	DH-11	DH-12	DH-13	DH-14	DH-15
0.0	68.0	142.0	15.0	880.0	1200.0	96.0	1800.0		0.41	117.00		
1.5	1.96	55.0				0.25	1820.0					
2.5			1.10						3.89	5120.0	122.0	136.0
3.0						1.70						
4.5									0.69	206.0	ND	
5.0		6.80				0.00						
5.5												123.0
7.0				520.0	250.0						2.00	
7.5												18.0
8.5										2300.0		
9.0				0.78	1.30			5190.0				
10.0							7.50					
10.5								2360.0				
11.0												8.50
11.5							ND				ND	
13.0												
13.5								341.0				
14.5										1.50		0.23
All PCB concentrations in ppm												
ND=Not Detected												

Data From Previous Investigations
Ft. Wainwright Landfill


FW2
FW3
FW4
SANITARY LANDFILL AREA
MOTORCYCLE MOTOCROSS AREA
ROAD D
PERMAFROST
RIVER
CHENA
RUNWAY CLEARANCE
MARS STATION

FORT WAINWRIGHT SANITARY LANDFILL MONITORING

FWA Well Number One

Date Sampled	Parameter	Measured Value	Statute Limit
11/26/85	*Arsenic	120 ug/l	50 ug/l
	Chromium	65 ug/l	50 mg/l
	Lead	63 ug/l	50 ug/l
	*Selenium	30 ug/l	10 ug/l
	*Turbidity	280 NTU	1 NTU
	Color	26 units	15 units
	*Iron	49900 ug/l	300 ug/l
	*Manganese	1290 ug/l	50 ug/l
5/17/85	Arsenic	55 ug/l	50 ug/l
	*Turbidity	3.1 NTU	1 NTU
	Corrosivity	corrosive	noncorrosive
	Iron	552 ug/l	300 ug/l
	Manganese	61 ug/l	50 ug/l
	*Alpha, Gross	94.8 pCi/l	15 pCi/l

FWA Well Number Two

Date Sampled	Parameter	Measured Value	Statute Limit
5/17/85	*Turbidity	84 NTU	1 NTU
	*Color	125 units	15 units
	Corrosivity	corrosive	noncorrosive
	*Iron	21700 ug/l	300 ug/l
	*Manganese	388 ug/l	50 ug/l
	pH	5.94	6.5 - 8.5
	Endrin	0.4 ug/l	0.2 ug/l
	*Toxaphene	14 ug/l	5 ug/l
	Alpha, Gross	20.1 pC/l	15 pC/l
6/25/85 (incomplete analysis)	*Manganese	244 ug/l	50 ug/l
	pH	5.98	6.5 - 8.5
11/26/85	Lead	63 ug/l	50 ug/l
	*Selenium	30 ug/l	10 ug/l
	*Turbidity	4.5 NTU	1 NTU
	Corrosivity	corrosive	noncorrosive
	*Iron	3550 ug/l	300 ug/l
	Manganese	99 ug/l	50 ug/l

* indicates that the measured value exceedes the statute limit by more than two times

FWA Well Number Three

Date Sampled	Parameter	Measured Value	Statute Limit
11/27/85	Lead	63 ug/l	50 ug/l
	*Selenium	30 ug/l	10 ug/l
	*Turbidity	4.2 NTU	1 NTU
	*Color	59 units	15 units
	Corrosivity	corrosive	noncorrosive
	*Iron	1080 ug/l	300 ug/l
	*Manganese	283 ug/l	50 ug/l
	pH	6.23	6.5 - 8.5
5/17/85	Barium	1500 ug/l	1000 ug/l
	*Chromium	310 ug/l	50 ug/l
	*Lead	204.7 ug/l	50 ug/l
	*Turbidity	1200 NTU	1 NTU
	Color	18 units	15 units
	*Iron	183000 ug/l	300 ug/l
	*Manganese	2610 ug/l	50 ug/l
	*Odor	8	3
	Alpha, Gross	18.9 pC/l	15 pC/l
	Radium 226 and 228	9.3 pC/l	5 pC/l
6/25/85 (incomplete analysis)	*Manganese	1020 ug/l	50 ug/l
	Radium 226 and 228	9.3 pC/l	5 pC/l

FWA Well Number Four

Date Sampled	Parameter	Measured Value	Statute Limit
5/17/85	Chromium	78 ug/l	50 ug/l
	*Turbidity	220 NTU	1 NTU
	*Color	38 units	15 units
	Corrosivity	corrosive	noncorrosive
	*Iron	37000 ug/l	300 ug/l
	*Manganese	1320 ug/l	50 ug/l
	Odor	4	3
	Endrin	0.4 ug/l	0.2 ug/l
	*Toxaphene	14 ug/l	5 ug/l
6/25/85 (incomplete analysis)	*Manganese	1700 ug/l	50 ug/l
	Lead	51.4 ug/l	50 ug/l
11/27/85	Lead	63 ug/l	50 ug/l
	*Selenium	30 ug/l	10 ug/l
	*Turbidity	120 NTU	1 NTU
	*Color	38 units	15 units
	*Iron	14500 ug/l	300 ug/l
	*Manganese	1120 ug/l	50 ug/l

* indicates that the measured value exceedes the statute limit by more than [illegible]

CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

P.O. BOX 4-1276
Anchorage, Alaska 99509

TELEPHONE (907) 562-2343

ANCHORAGE INDUSTRIAL CENTER
5633 B Street

ANALYTICAL REPORT

From ESE Product Water

Address Anchorage, Alaska Date May 30, 1985

Other Pertinent Data

Analyzed by LJ Date May 31, 1985 Lab No. 8674

REPORT OF ANALYSIS
WATER SAMPLES
ANCHORAGE, ALASKA

Samples received May 30, 1985

SAMPLE I. D.	DATE/TIME	COLLECTED BY	Colonies/100ml FECAL COLIFORM
FW 1	5-29-85/12:00PM	G.P.	0
FW 2	5-29-85/10:00AM	G.P.	0
FW 3	5-29-85/10:50AM	G.P.	0

Data From Previous Investigations
Fire Training Pits

APPENDIX C

BORE LOGS

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT Ft Richardson DATE 10 Sep 86

LOCATION Active Fire Training Pit (P1) DRILLERS USAEDA

DRILL RIG Mobile B47 BORE HOLE BH1

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN.	DESCRIPTION	REMARKS
0	*	Brown silty clay	P1B101
		Brownish-gray rocky clayey sand	
5	*		P1B102
			BOH=6 Ft - Penetrated landfill Wood and metal chunks in soil
10			
			* split-spoon sample

HSE-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 Aug 74 which will be used.

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT Ft Richardson DATE 10 Sep 86

LOCATION Active Fire Training Pit (P1) DRILLERS USAEDA

DRILL RIG Mobile B47 BORE HOLE BH2

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN	DESCRIPTION	REMARKS
0	*	Brown silty clay	P1B201
5	*	Brown rocky clayey sand	P1B202
10			BOH=6 Ft - Penetrated landfill Wood and metal chunks in soil
			* split-spoon sample

HSE-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 Aug 74, which will be used.

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT Ft Richardson DATE 10 Sep 86

LOCATION Active Fire Training Pit (P1) DRILLERS USAEDA

DRILL RIG Mobile B47 BORE HOLE BH3

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN	DESCRIPTION	REMARKS
0	*	Blackish-brown silty clay	P1B301
		Gray rocky clayey sand	
5	*		P1B302 BOH=5 Ft - Penetrated landfill Wood and metal chunks in soil
10			
			* split-spoon sample

HSE-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 Aug 74, which will be used.

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT Ft Richardson DATE 10 Sep 86

LOCATION Old Fire Training Pit (P2) DRILLERS USAEDA

DRILL RIG Mobile B47 BORE HOLE BH1

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN	DESCRIPTION	REMARKS
0	*	Grayish-brown rocky silty sand	P2B101
	*	Gray rocky gravel	P2B102
		Grayish-brown silty sandy gravel	
10	*	Grayish-brown silty gravel	P2B103
		Grayish-brown gravelly clayey sand	13-15 Ft: Fuel odor
	*		P2B104
		Grayish-brown gravel	
20			BOH=20 Ft - Refusal
30			* split-spoon sample

HSE-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 [illegible] 71, which will be used.

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT Ft Richardson DATE 12 Sep 86

LOCATION Old Fire Training Pit (P2) DRILLERS USAEDA

DRILL RIG Mobile B47 BORE HOLE BH2

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN.	DESCRIPTION	REMARKS
0	*	Brown silty sand	P2B201
		Brown rocky silty sand	
	*		P2B202
		Brown silty sandy gravel	
10	*		P2B203
	*	Brown clayey sandy gravel	P2B204
		Gray-brown gravelly clayey sand	
20	*	Gray-brown rocky clayey sand	P2B205
		Grayish-brown rocky gravel	
		Grayish-brown silty gravel	
			BOH=26 Ft - Refusal
30			* split-spoon sample

HSE-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 [illegible] 74, which will be used.

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT Ft Richardson DATE 12 Sep 86

LOCATION Old Fire Training Pit (P2) DRILLERS USAEDA

DRILL RIG Mobile B47 BORE HOLE BH3

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN	DESCRIPTION	REMARKS
0	*	Grayish-brown rocky clayey sand	P2B301 Water in pit
		Gray-brown clayey sandy gravel	
		Gray-brown gravelly silty sand	
	*	Brown gravelly clayey sand	P2B302
		Grayish-brown rocky clayey sand	
10	*		P2B303
		Grayish-brown gravelly clayey sand	
	*		P2B304
		Gray rocky clayey sand	
20	*		P2B305 BOH=21 Ft - Refusal
30			* split-spoon sample

HSE-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 Aug 74, which will be used.

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT Ft Wainwright DATE 18 Sep 86

LOCATION Active Fire Training Pit (P3) DRILLERS USAEDA

DRILL RIG Mobile B50 BORE HOLE BH1

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN.	DESCRIPTION	REMARKS
0	*	Brown organic silty clay	P3B101
5	*	Tanish-brown silt	P3B102
10	*	Mixed brown and white fine sand	wet P3B103 BOH=10 Ft - water table
15			* split-spoon sample

HSE-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 [illegible] 74, which will be used.

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT Ft Wainwright DATE 18 Sep 86

LOCATION Active Fire Training Pit (P3) DRILLERS USAEDA

DRILL RIG Mobile B50 BORE HOLE BH2

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN	DESCRIPTION	REMARKS
0	*	Dark grayish-brown organic silt	P3B201
		Brown silt	
5	*	Mixed black and white fine sand	P3B202
		Brown silt	
		Mixed black and white fine sand	wet
10	*		P3B203 BOH=10 Ft - water table
15			* split-spoon sample

HSE-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 [illegible] 74, which will be used.

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT Ft Wainwright DATE 18 Sep 86

LOCATION Active Fire Training PIT (P3) DRILLERS USAEDA

DRILL RIG Mobile B50 BORE HOLE BH3

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN	DESCRIPTION	REMARKS
0	*	Blackish-brown silt	P3B301
5	*	Grayish-brown silt	P3B302
10	*	Brown gravelly sand	wet P3B303 BOH=10 Ft - water table
15			* split-spoon sample

HSE-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 * · 74, which will be used.

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT Fort Greely — DATE 20 Sep 86

LOCATION Closed Fire Training Pit (P4) — DRILLERS USAEDA

DRILL RIG Mobile B50 — BORE HOLE BH1

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN	DESCRIPTION	REMARKS
0	*	Brown gravelly silty sand	P4B101 Fill material
	*	Brown silty sand	P4B102
10	*	Brown gravelly silty sand	P4B103
	*	Brown rocky silty sand	P4B104
20	*		P4B105
		Brown gravelly silty sand	
		Grayish-brown rocky silty sand	* split-spoon sample BOH=30 Ft
30	*		P4B106

HSE-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 [illegible] 74, which will be used.

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT Ft Greely DATE 20 Sep 86

LOCATION Closed Fire Training Pit (P4) DRILLERS USAEDA

DRILL RIG Mobile B50 BORE HOLE BH2

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN	DESCRIPTION	REMARKS
0	*	Brown gravelly silty sand	P4B201 Fill Material
		Brown fine silty sand	
	*		P4B202
10	*	Brown rocky silty sand	P4B203
	*		P4B204 BOH=14 Ft - Refusal
20			
			* split-spoon sample

HSE-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 [illegible] 74, which will be used.

US ARMY ENVIRONMENTAL HYGIENE AGENCY

DRILLING LOG

PROJECT Ft Greely DATE 20 Sep 86

LOCATION Closed Fire Training DRILLERS USAEDA

DRILL RIG Mobile B50 BORE HOLE BH3

DEPTH	SAMPLE TYPE / BLOWS PER 6 IN	DESCRIPTION	REMARKS
0	*	Dark brown gravelly silty sand	Fill Material P4B301
	*	Dark brown silty sand	Fuel odor P4B302
10	*	Dark brown gravelly silty sand	Fuel odor P4B303
		Dark brown rocky silty sand	Fuel odor
	*	Dark grayish-brown gravelly silty sand	Fuel odor P4B304
20	*	Dark Grayish-brown rocky silty sand	Fuel odor P4B305
		Dark grayish-brown gravelly sand	Fuel odor
30	*		* split-spoon sample BOH=30 Ft P4B306

HSE-ES Form 78, 1 Jun 80

Replaces USAEHA Form 95, 12 [illegible] 74, which will be used.

APPENDIX D

CHEMICAL ANALYSIS

TABLE B-1. ANALYTICAL RESULTS FOR PURGABLE (VOLATILE) ORGANICS, METHOD NO. 624 - CONCENTRATIONS IN ug/gm

PARAMETER	DETECTION LIMITS	SITES P1S2
Toluene	35	207
Ethylbenzene	35	107

NOTE:
DUE TO EQUIPMENT MALFUNTIONS, THE DETECTION LIMITS FOR SAMPLES P1S2, P2S2, P3S2, AND P48304 WAS 35 UG/GM.
THE RESULTS REFLECT ONLY SAMPLES IN WHICH CONTAMINANTS WERE DETECTED. A COMPLETE LIST OF ANALYTICAL PARAMETERS AND THEIR DETECTION LIMITS IS PROVIDED IN APPENDIX E.

TABLE B-2. ANALYTICAL RESULTS FOR ACID EXTRACTABLE ORGANICS - CONCENTRATIONS IN ug/gm.

PARAMETER	DETECTION LIMITS	SITES P3S5
pentachlorophenol	2.5	TRC

NOTE:
THE RESULTS REFLECT ONLY SAMPLES IN WHICH CONTAMINANTS WERE DETECTED. A COMPLETE LIST OF ANALYTICAL PARAMETERS AND THEIR DETECTION LIMITS IS PROVIDED IN APPENDIX E.

TABLE B-3. ANALYTICAL RESULTS FOR PESTICIDES, HERBICIDES and PCB'S - CONCENTRATIONS IN ppm(ug/gm)

PARAMETER	DETECTION LIMITS	SAMPLES

ALL PARAMETERS WERE BELOW DETECTABLE LIMITS FOR ALL SAMPLES

NOTE:
A COMPLETE LIST OF ANALYTICAL PARAMETERS AND THEIR DETECTION LIMITS IS PROVIDED IN APPENDIX E.

TABLE D-4. ANALYTICAL RESULTS FOR BASE/NEUTRAL ORGANICS CONCENTRATIONS IN ug/ga.

PARAMETER	DETECTION LIMITS	SITES																							
		P1S1	P1S2	P1S3	P1S4	P1B301	P2S1	P2S2	P2S3	P2S4	P2B104	P2B301	P2B302	P3S1	P3S2	P3S3	P3S5	P3S7	P4B101	P4B301	P4B302	P4B303	P4B304	P4B305
naphthalene	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	TRC	BDL	TRC	TRC	50	40	TRC	TRC
acenaphthylene	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	TRC	BDL	BDL	BDL	BDL	BDL
diethyl phthalate	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	TRC	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
acenaphthene	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	TRC	TRC	BDL	BDL	BDL	BDL
2,4-dinitrotoluene	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	TRC	BDL	BDL	BDL	BDL
fluorene	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	TRC	BDL	BDL	BDL	BDL	TRC	TRC	TRC	BDL	BDL
diethyl phthalate	1	TRC	TRC	TRC	TRC	TRC	TRC	TRC	TRC	TRC	TRC	TRC	TRC	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
phenanthrene	1	BDL	TRC	BDL	TRC	TRC	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	TRC	TRC	TRC	BDL	BDL	BDL
anthracene	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	TRC	TRC	BDL	BDL	BDL	BDL
di-n-butyl phthalate	1	TRC	BDL	BDL	BDL	TRC	TRC	TRC	BDL	BDL	BDL	TRC	BDL	BDL	TRC	BDL	TRC	BDL	BDL	BDL	BDL	BDL	BDL	BDL
fluoranthene	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	40	30	TRC	BDL	BDL	BDL
pyrene	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	70	30	TRC	BDL	BDL	BDL
benzo (a) anthracene	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	60	30	TRC	BDL	BDL	BDL
chrysene	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	40	40	TRC	BDL	BDL	BDL
bis (2-ethylhexyl) phthalate	1	BDL	58	BDL	TRC	BDL	BDL	BDL	TRC	TRC	BDL	TRC	BDL	10	15	17	TRC	1	TRC	BDL	BDL	BDL	BDL	BDL
di-n-octyl phthalate	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	TRC	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
benzo (b) fluoranthene	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	20	100	BDL	BDL	BDL	BDL
benzo (K) fluoranthene	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	50	10	BDL	BDL	BDL	BDL
benzo (a) pyrene	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	50	40	BDL	BDL	BDL	BDL
indeno (1,2,3-cd) pyrene	2.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	40	20	BDL	BDL	BDL	BDL
dibenzo (a,h) anthracene	2.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	TRC	30	BDL	BDL	BDL	BDL
benzo (ghi) perylene	2.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	40	240	BDL	BDL	BDL	BDL
2-methylnaphthalene	1	BDL	270	47	54	54	BDL	BDL	BDL	BDL	BDL	BDL	TRC	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

NOTE:
THE RESULTS REFLECT ONLY SAMPLES IN WHICH CONTAMINANTSWERE DETECTED. A COMPLETE LIST OF ANALYTICAL PARAMETERS AND THEIR DETECTION LIMITS IS PROVIDED IN APPENDIX E.

TABLE D-5. ANALYTICAL RESULTS FOR METALS - CONCENTRATIONS IN ug/L

PARAMETER	DETECTION LIMITS	SITES
		P2S2
Pb	0.500	0.511

NOTE:
THE RESULTS REFLECT ONLY SAMPLES IN WHICH CONTAMINANTS WERE DETECTED. A COMPLETE LIST OF ANALYTICAL PARAMETERS AND THEIR DETECTION LIMITS IS PROVIDED IN APPENDIX E.

TABLE D-6. ANALYTICAL RESULTS FOR EXPLOSIVES - CONCENTRATIONS IN ug/g (ppm)

PARAMETER	DETECTION LIMITS	SITES

ALL PARAMETERS WERE BELOW DETECTABLE LIMITS FOR ALL SAMPLES

NOTE:
A COMPLETE LIST OF ANALYTICAL PARAMETERS AND THEIR DETECTION LIMITS IS PROVIDED IN APPENDIX E.

APPENDIX E

ANALYTICAL PARAMETERS, METHODS AND DETECTION LIMITS

TABLE E-1. PURGABLE (VOLATILE) ORGANICS, METHOD NO. 8240* - IN µg/gm

	Detection Limits
2-Chloroethylvinyl ether	0.5
Chloromethane	0.5
Bromomethane	0.5
Vinyl Chloride	0.5
Chloroethane	0.5
Methylene chloride	0.5
1,1-Dichloroethene	0.5
1,1-Dichloroethane	0.5
trans-1,2-Dichloroethene	0.5
Chloroform	0.5
1,2-Dichloroethane	0.5
1,1,1-Trichloroethane	0.5
Carbon tetrachloride	0.5
Bromodichloromethane	0.5
1,2-Dichloropropane	0.5
trans-1,3-Dichloropropene	0.5
Trichloroethylene	0.5
Benzene	0.5
cis-1,3-Dichloropropene	0.5
1,1,2-Trichloroethane	0.5
Dibromochloromethane	0.5
Bromoform	0.5
Tetrachloroethene	0.5
1,1,2,2-Tetrachloroethane	0.5
Toluene	0.5
Chlorobenzene	0.5
Ethylbenzene	0.5
Trichlorofluoromethane	0.5
1,2-Dichlorobenzene	0.5
1,3-Dichlorobenzene	0.5
1,4-Dichlorobenzene	0.5

NOTE: Because the holding times of the following samples were exceeded, they were not analyzed:

FTP1	FTP2	FTP3	FTP4
P1B101	P2B101	P3B101	P4B101
P1B102	P2B102	P3B301	P4B105
P1B201	P2B103	P3B302	P4B106
P1B202	P2B104	P3B303	P4B202
P1B301	P2B202	P3S1	P4B301
P1B302	P2B203	P3S3	P4B302
P1S1	P2B205	P3S7	P4B303
P1S3	P2B301	P3S8	P4B305
P1S4	P2B302		
P1S5	P2B304		
P1S6	P2S1		
	P2S4		

P1S2, P2S2, P3S2, and P4B304 had detection limits of 35 ppm.

* USEPA SW-846 (Appendix A, reference 9).

TABLE E-2. ACID EXTRACTABLE ORGANICS, METHOD NO. 8270 - IN µg/gm

	Detection Limits
2-chlorophenol	2.5
phenol	2.5
2-nitrophenol	2.5
2,4-dimethylphenol	2.5
2,4-dichlorophenol	2.5
4,6-dinitro-o-cresol	25
2,4,6-trichlorophenol	2.5
2,4-dinitrophenol	25
4-nitrophenol	2.5
P-chloro-M-cresol	2.5
pentachlorophenol	2.5

TABLE E-3. EP TOXIC METALS, METHOD NO. 1310 - IN mg/L

	Detection Limits
Ag	0.5
As	0.5
Ba	10
Cd	0.1
Cr	0.5
Pb	0.5
Se	0.1
Hg	0.02

TABLE E-4. EXPLOSIVES USAEHA PROCEDURE* - IN µg/gm

	Detection Limits
HMX	1
RDX	1
TETRYL	5
TNT	1
2,6-DNT	1
2,4-DNT	1

* Appendix A, reference 14.

TABLE E-5. BASE NEUTRAL ORGANICS, METHOD NO. 8270 - IN µg/gm

	Detection Limits
N-nitrosodimethylamine	1
bis (2-chloroethyl) ether	1
1,3-dichlorobenzene	1
1,4-dichlorobenzene	1
1,2-dichlorobenzene	1
bis (2-chloroisopropyl) ether	1
hexachloroethane	1
N-nitrosodi-n-propylamine	1
nitrobenzene	1
isophorone	1
bis (2-chloroethoxy) methane	1
1,2,4-trichlorobenzene	1
naphthalene	1
hexachlorobutadiene	1
hexachlorocyclopentadiene	1
2-chloronaphthalene	1
acenaphthylene	1
dimethyl phthalate	1
2,6-dinitrotoluene	1
acenaphthene	1
2,4-dinitrotoluene	1
fluorene	1
4-chlorophenyl phenyl ether	1
diethyl phthalate	1
1,2-diphenylhydrazine	1
N-nitrosodiphenylamine	1
4-bromophenyl phenyl ether	1
hexachlorobenzene	1
phenanthrene	1
anthracene	1
di-n-butyl phthalate	1
fluoranthene	1
pyrene	1
benzidine	1
butyl benzyl phthalate	1
benzo (a) anthracene	1
chrysene	1
3,3-dichlorobenzidine	1
bis (2-ethylhexyl) phthalate	1
di-n-octyl phthalate	1
benzo (b) fluoranthene	1
benzo (K) fluoranthene	1
benzo (a) pyrene	1
indeno (1,2,3-cd) pyrene	2.5
dibenzo (a,h) anthracene	2.5
benzo (ghi) perylene	2.5
2-methylnaphthalene	1

TABLE E-6. PESTICIDES, and PCB'S, METHOD NO. 8270 - IN µg/gm

	Detection Limits
ALPHA-BHC	1
BETA-BHC	1
GAMMA-BHC	1
DELTA-BHC	1
4,4-DDD	1
4,4-DDE	1
4,4-DDT	1
aldrin	1
alpha-endosulfan	1
beta-endosuflan	1
endosulfan sulphate	1
chlorodane	1
dieldrin	1
endrin	1
endrin aldehyde	1
heptachlor	1
heptachlor epoxide	1
toxaphene	50
PCB (Aroclor® 1242)	5
PCB (Aroclor 1248)	5
PCB (Aroclor 1254)	5
PCB (Aroclor 1260)	5
PCB (Aroclor 1221)	5
PCB (Aroclor 1232)	5
PCB (Aroclor 1016)	5

® Aroclor is a registered trademark of the Monsanto Company, St Louis, Missouri.

APPENDIX J

Biographies of Key Personnel

KEY PERSONNEL

(in alphabetical order)

Name	WCC Office Location
Suzanne M. Ban	Anchorage, AK
Martin Bozeman	Oakland, CA
Stacey Brown	Anchorage, AK
Martin Cramer	Oakland, CA
Lisa A. Gerhart	Seattle, WA
Danniel J. Graham	Anchorage, AK
Holly A. Graham	Anchorage, AK
David H. Liu	Oakland, CA
Dennis R. McCrumb	Seattle, WA
Michael R. Piotrowski	Oakland, CA
Jane M. Showalter	Anchorage, AK
Paige Herzon Spatz	Anchorage, AK
Kelly D. Susewind	Seattle, WA
Robert W. Wilson	Seattle, WA
Daniel R. Young	Anchorage, AK

SUZANNE M. BAN

marine ecology
biological oceanography
technical editing
hazardous waste investigations

EDUCATION

Florida Institute of Technology: M.S. Biological Oceanography, 1985
Pennsylvania State University: B.S. (with honor) Biology, 1982
Basic Health and Safety Training, Level C: Woodward-Clyde Consultants

PROFESSIONAL HISTORY

Woodward-Clyde Consultants, Senior Staff Scientist, 1985-date.
Center for Academic Publications, Melbourne, Florida, Technical Editor, 1984.
Florida Institute of Technology, Melbourne, Florida, Teaching and Research Assistant, 1982-1984.
Pennsylvania Cooperative Fisheries Research Unit, University Park, Pennsylvania, Research Assistant, 1982.
Pennsylvania Fish Commission, Bellefonte, Pennsylvania, Fisheries Intern, 1981.
Exxon Specialty Plant, Pittsburgh, Pennsylvania, Laboratory Technician, 1979, 1980.

REPRESENTATIVE EXPERIENCE

Ms. Ban is an environmental scientist and technical writer with specific experience in the following areas:

- Preparing environmental reports for exploration drilling operations in the Alaskan Outer Continental Shelf in compliance with MMS requirements. She has authored environmental reports for petroleum industry clients, including documents that were approved by MMS for exploratory drilling in the Navarin Basin and Camden Bay.

- Preparing extensive environmental scoping studies for possible oil exploration activities by industry clients in the Navarin Basin and St. George Basin.

- Conducting a thorough literature search and review of biological research conducted in Valdez Bay. Ms. Ban reviewed, critiqued and summarized large quantities of published and unpublished research.

- Conducting a similar literature review investigating the derivation of water quality criteria for the State of Alaska.

- Editing an oil spill response manual for the Cook Inlet region of Alaska.

- Authoring numerous NFAD (No Further Action Decision) documents for U.S. Air Force hazardous waste sites in Alaska. The documents included a background history, environmental setting description, and assessment of risk associated with remedial action. The documents will be used as a nation-wide example by the U.S. Air Force and represent the first EPA concurrence on a DOD site under environmental investigation.

Ms. Ban has also provided field and technical support for numerous projects including:

- Studies supporting NPDES permitting and compliance at the Ballast Water Treatment Facility, Valdez, Alaska. She conducted extensive field sampling, provided computer assisted data reduction and analysis, and assisted in writing and editing the draft and final reports submitted to the EPA. She was also named on-board data manager for a bathymetric survey and dye study in relation to the Ballast Water Treatment Plant outfall diffuser in the Port of Valdez. Ms. Ban directed in situ fluorometric and CTD sampling and was responsible for collecting, coding, and properly transferring all water samples.

- Debris inventories for numerous Defense Environmental Restoration Account (DERA) sites in Alaska. Ms. Ban enacted field inventories of abandoned military sites and provided editorial support for the draft and final reports.

- Investigation of U.S. Air Force hazardous waste sites in Alaska, 1986-1988. Ms. Ban completed boring logs, installed monitoring wells, collected soil and water samples and used and maintained photo-ionization and combustible gas instrumentation. In addition, she was responsible for data analysis and editorial comment for the operations plan, and draft and final reports.

- Investigation of a "Superfund" site near Port Arthur, Texas. Ms. Ban directed the collection of sediment, surface water, ground water and biological samples. She also took responsibility for analysis of sample results.

HONORS

Teagle Foundation (Exxon Corp.) Scholarship recipient, 1984-1985. Monetary award for academic excellence.

Hasselblad grant recipient, 1983. Support awarded to conduct research at three marine laboratories in Sweden.

AFFILIATIONS

American Society of Limnology and Oceanography
Phi Sigma - Biological Honor Society
Sigma Xi - Scientific Research Society
P.A.D.I. - Certified Open-Water Diver

PUBLICATIONS

Ban, S.M. and W.G. Nelson. 1987. The role of Diopatra cuprea tubes in structuring a subtropical infaunal community. Bull. of Mar. Sci. 40(1):11-21.

MARTIN BOZEMAN

freshwater fisheries
aquatic ecology
project management
environmental impact analysis

EDUCATION

Ohio State University: M.S., Zoology, 1975
University of Cincinnati: B.A., Biology, 1970

PROFESSIONAL HISTORY

Woodward-Clyde Consultants, Senior Staff Biologist to Project Scientist, 1973-date
Ohio State University, Ohio Co-operative Fishery Unit, Graduate Research Associate, 1971-1973
Ohio State University: Graduate Teaching Associate, 1971
Procter and Gamble Company, Cincinnati, Ohio, Research Technician, 1966-1970

REPRESENTATIVE EXPERIENCE

Mr. Bozeman is an aquatic biologist with an extensive background and international experience in the design, implementation, and analysis of aquatic ecological studies in a wide variety of environments. With considerable experience through much of the United States, Mr. Bozeman has been responsible for the design, conduct, and/or management of numerous aquatic environmental programs in areas ranging from Alaska to Colombia, South America. These programs involved studies of various freshwater environments varying from small streams to large rivers, ponds, lakes and reservoirs, and the Great Lakes, as well as studies of marine and estuarine ecosystems. His experience spans the following types of projects:

- o Siting and baseline studies for proposed:
  - fossil-fuel and nuclear power stations
  - coal and phosphate mining facilities
  - coal gasification plants
  - uranium mine and mill facilities
  - LNG terminals
  - oil and gas exploration activities
  - pipeline construction activities
  - dredging operations
  - chemical and sewage treatment facilities
  - residential centers
- o Monitoring programs to assess the effects of:
  - mining and industrial wastewater effluents
  - cooling water discharges for 316(a) studies
  - cooling water intake for 316(b) studies
  - urban runoff

- o Lake management programs
- o Third party EIS/EA preparation

Mr. Bozeman's primary technical interest and expertise lies in the area of freshwater ichthyology. His work has included studies of fish population dynamics as well as studies of the age, growth, and food habits of various freashwater fish species. His is thoroughly familiar with the use and deployment of all types of fish sampling gear and has conducted numerous studies for determining the abundance, distribution, and ecology of fishes for the purposes of impact assessment. Mr. Bozeman is also knowledgable in the collection and identification of benthic macroinvertebrates, plankton, periphyton, and aquatic macrophytes.

Mr. Bozeman has had extensive experience in the conduct of ichthyological studies to develop a quantitative and qualitative inventory of fishes in remote locations. The most recent project of this sort required Mr. Bozeman to assess the ichthyofauna of the Rio Rancheria drainage in northern Colombia, South America. He was responsible for the design and conduct of the one-year study, which involved 78 days of sampling during four seasons using a suite of sampling equipment types. During the field study he directed the efforts of two fishery technicians and several helpers recruited from the local population. Analysis of the sample required in-depth investigation of the systematic and taxomonic literature, as well as considerable work in the museums of Colombia and the United States.

More recently, Mr. Bozeman directed the field activities of three teams of fishery biologists investigating the effects of a coastal waterflood project on anadromous fishes along a 70-km stretch of the Beaufort Sea Coast of Alaska. This study was conducted for a 90-day period extending from ice breakup to freezeup. He was responsible for the conduct of concurrent fyke net sampling at 12 stations, wherein more than 18,000 anadromous fish were tagged or marked by freeze branding. In this program, Mr. Bozeman demonstrated a high level of ability to accomplish a complex field sampling program under rigorous environmental conditions.

Mr. Bozeman has served as project manager and principal biological investigator for an EPA funded study of the water quality and biological effects of urban runoff on a small stream draining into San Francisco Bay. He has also served as principal biological investigator for several lake management studies in the San Francisco Bay area and for baseline studies related to the construction of an urea and ammonia transfer facility on the Sacramento river. He designed and directed baseline and 316(b) studies for the proposed expansion of the Vermilion Power Station and the proposed Fairview Power Staion in Illinois. He authored the aquatic biology section of the third-party EIS for the Crow/Shell coal mine in Montana and Wyoming and served in a like capacity for the third-party EA for oil and gas exploration and development on the northern Cheyenne Reservation, Montana. He participated in the preparation of baseline water quality descriptions for proposed uranium mines in Colorado, Utah, Arizona, and Wyoming and has conducted field and laboratory work in conjuction with the development of a proposed phosphate mine in North Carolina.

Additionally, Mr. Bozeman has directed, conducted, or assisted with the aquatic environmental programs associated with a variety of other projects including:

- Site selection surveys of potential coal conversion plant sites in West Virginia, Pennsylvania, Ohio, Indiana, Kentucky, and Illinois
- Sediment monitoring at Campbell Power Station, Lake Michigan
- Baseline studies related to offshore sand removal for beach stabilization at Rockaway Beach, New York
- Environmental assessment of the development of a new town center, Maryland
- Baseline description and impact assessment for an LNG facility and 463-mile pipeline in Texas
- Field studies for 316(a) demonstration for Twin Branch Power Plant, St. Joseph River, Indiana
- Triaxial thermal plume monitoring and 316(a) studies for several power plants along the Arther Kill, Hackensack, and Passaic River, New Jersey.
- Baseline surveys for the proposed Berne Nuclear Station, Schuylkill River, Pennslyvania
- Field studies for Rush Island Electric Station, Mississippi River, Missouri.

While associated with the Department of Zoology, Ohio State Unversity, Mr. Bozeman gained experience in the collection and identification of plankton, benthos, fishes, and aquatic plants. He assisted with a broad range of fishery oriented research projects, some of which included sampling fish in the Ohio River for the National Pesticide Monitoring Program; invertebrate drift studies in a channelized stream in northwestern Ohio; biological sampling in Ohio borrow-pit ponds; and investigation of the effects of fish hatchery effluents on receiving streams in Minnesota and northern Michigan. His research experience includes various studies of the biology of the white crappie in a reservoir environment and basic research and microbiology.

AFFILIATIONS

American Fisheries Society - Life Member
International Association for Great Lakes Research

PUBLICATIONS

"Water Quality and Biological Effects of Urban Runoff on Coyote Creek. Phase I - Preliminary Survey," coauthored with R. Pitt. EPA-600/1-80-104, U.S. Environmental Protection Agency, Cincinnati, Ohio. August 1980.

MB 8-84/4

"Food Habits, Age and Growth of White Crappie in an Ohio Upground Reservoir," M.S. Thesis, Ohio State University, 1975.

"Individual and Site Variation in Composition of Facila Surface Lipids," coauthored with Anderson, Vos, and Whiteside, Journal of Investigative Dermatology, 58:369-372, 1972.

"Isolation and Characterization of a Staphylococcal Lipase," coauthored with J.A. Troller, Applied Microbiology, 20(3)480-484, 1970.

MB 8-84/4

STACEY BROWN

analytical chemistry
data base management

EDUCATION

National University: B.S., Computer Science, 1987
University of California, San Diego: B.A., Chemistry, 1983

PROFESSIONAL HISTORY

Woodward-Clyde Consultants, Senior Staff Scientist, 1988-date
Woodward-Clyde Consultants, Staff Scientist, 1987-1988
Aerojet Techsystems, Environmental Analysis Laboratory, Chemist, 1987
Aerojet Strategic Propulsion Company, Research & Development Laboratory, Associate Chemist, 1984-1987

REPRESENTATIVE EXPERIENCE

Mr. Brown is a chemist and data base specialist with expertise in quality control and quality assurance for sample analysis data. While at WCC, he has been responsible for quality control, accuracy of data gathering, and testing for a variety of projects, including groundwater and soil sampling.

Mr. Brown's project experience includes:

- Project chemist for all government projects. Responsible for quality assurance and quality control review of analytical data for each site, tabulating analytical data into a data base, formulating summary tables, and writing summary reports on the analytical data.
- Field chemist for government projects. Writes sampling and laboratory programs for various projects. The sampling program contains information regarding methodology, preservation methods, and field QA/QC programs. The laboratory program contains topics on identification of a laboratory, analytical methods, and laboratory QA/QC programs.
- Chemistry Task Leader/Data Base manager for a project in Alaska for the Air Force. Responsible for checking quality control and quality assurance on laboratory sample analysis data. Implemented a computer data base system for sample analysis data. Field sample coordinator.
- Casmalia data base person responsible for quality control and quality assurance for laboratory sample analysis data. Responsible for water quality data sections in quarterly reports. Task leader for investigation of groundwater site anomalies.
- Chemist responsible for quality control/quality assurance for soil and water data for Tracy project. Responsible for data analysis sections for soil and water samples.
- Chemical Analyst for quality assurance/quality control laboratory sample analysis data on Western Farms project.
- Chemist in Environmental Analysis Laboratory for Aerojet Techsystems. Analyzed water and waste samples by Ion chromatography using a Dionex instrument. Section leader for the wet chemistry laboratory. Quality control inspector for production manufacturing department involving particle analysis determination.
- Associate Chemist in Research & Development Laboratory for Aerojet Strategic Propulsion Company. Production quality control supervisor responsible for quality control and production line audits.

MARTIN A. CRAMER

oil and hazardous
material spill technology
environmental impact
assessment

EDUCATION

University of California, Davis: Certification for Hazardous Materials Management, 1987
University of San Francisco: M.S., Environmental Management/Hazardous Materials, 1984
University of California, Berkeley: B.S., Conservation of Natural Resources, 1976
Merritt College, California: A. A., Undergraduate Studies, 1974

PROFESSIONAL HISTORY

Woodward-Clyde Consultants, Senior Project Scientist, 1977-date
Federal Energy Administration, Researcher for Alaskan Oil Study, 1976

REPRESENTATIVE EXPERIENCE

Mr. Cramer has extensive experience in oil and hazardous materials spill contingency planning. He has completed the following manuals:

- A manual of practice for the EPA's Oil and Hazardous Materials Spills Branch concerning the protection and cleanup of shorelines endangered by oil spills
- A manual of practice concerning the use and application of oil spill chemicals, also for the EPA
- A state-of-the-art study of oil spill dispersant application systems for an oil spill chemical manual prepared for the Southern California Petroleum Contingency Organization

Recently, Mr. Cramer has become primarily involved with the assessment and mitigation of underground petroleum product and hazardous material spills. His participation in these projects includes overseeing drilling operations at the spill sites, analyzing soil samples and hydrological data to determine the extent of contamination and recommending and/or implementing measures to mitigate any impacts and recover the spilled material. Specific projects include:

- Supervision of surface sampling in investigation of large PCB contamination problem at several gas pipeline compressor stations in Arizona and New Mexico
- Design, installation, and initial operation of two pilot subsurface oil spill recovery systems for a major oil company in Augusta, Kansas
- Design, installation, and operation of subsurface spill recovery and groundwater treatment system for petroleum products pipeline terminal in Northern California

- Design, installation, and operation of several subsurface spill recovery systems at a major oil refinery in Northern California
- Managed and/or participated in numerous subsurface hydrocarbon spill investigations for a variety of major oil companies and private industries throughout California
- Prepared a Part B RCRA Permit Application (Operation Plan) for a TSD facility in Northern California
- Participated in the preparation of oil spill contingency plans for Clean Seas, Inc., Clean Harbors Cooperative, PG&E, and several major oil and pipeline companies
- Participated in the preparation of an oil and seawater spill contingency plan for Arco's Prudhoe Bay, Alaska operations
- Prepared a hazardous waste contingency plan for the U.S. Army's proposed Johnston Atoll Chemical Agent Disposal System
- Assisted in the preparation of a hazardous chemical spill plan for Allied Chemical Company's Bay Point works
- Participated in environmental assessments of the potential impacts of oil or petroleum product spills from various pipeline and storage facilities

PUBLICATIONS

Recovery of gasoline from a low permeability formation: A case study. Master's Thesis, University of San Francisco, 1984.

Underground gasoline spill recovery: A blend of science and engineering. Proceedings, 1983 Oil Spill Conference, American Petroleum Institute, San Antonio, Texas, 1983.

Dispersant application manual (with C. Foget and C. Castle). Southern California Petroleum Contingency Organization, 1978.

Manual of practice for use of oil spill dispersants (with C. Foget and R. Castle). U.S. Environmental Protection Agency, 1978.

Manuals of practice for cleanup and restoration of ocean, estuarine, and inland shorelines endangered by oil spills (with C. Foget and R. Castle). U.S. Environmental Protection Agency, 1978.

Suisun Marsh: Impacts of the Peripheral Canal and future water developments (coauthor). University of California, 1976.

LISA A. GERHART

health and safety
risk assessments
regulatory requirements
environmental health

EDUCATION

Colorado State University: B.S., Environmental Health, 1981

PROFESSIONAL HISTORY

Woodward-Clyde Consultants, Assistant Project Scientist, 1985-date
EKO Systems, Inc. Environmental Scientist, 1985-1985
Centric Corporation, Marketing Representative, 1984-1985
Brown & Root, Inc., Environmental Scientist/Staff Assistant, 1981-1984

REPRESENTATIVE EXPERIENCE

Ms. Gerhart has primarily been involved in the Woodward-Clyde health and safety program. Her experience as a health and safety officer has included implementation of the hazardous waste health and safety program for Denver, Seattle, and Anchorage Woodward-Clyde offices. Responsibilities associated with this position included developing or reviewing and approving site-specific health and safety plans, administration of the medical surveillance and training program, respirator fit testing, appointing or approving site safety officers, performing site audits, obtaining appropriate health and safety equipment for projects, and approving personnel to work on hazardous waste projects with regard to medical examinations and health and safety training. Ms. Gerhart has prepared health and safety plans for hazardous waste field activities at underground storage tank sites, natural gas processing facilities, a refinery, a chemical manufacturing facility, a marine tanker ballast water treatment system, and a wood treating facility. Preparation of plans have included a site history review, hazard assessment, personal protective and monitoring equipment specification, and decontamination and emergency response procedures.

Ms. Gerhart has also assisted with the Woodward-Clyde Consultants' 40-hour health and safety training course which meets the OSHA 29 CFR 1910.120 requirements and the 8-hour health and safety refresher course.

Other specific project experience has included the following:

- Prepared a risk assessment for a wood treating facility which evaluated the human carcinogenic and non-carcinogenic risk associated with contaminated ground water. The various routes of exposure evaluated included ingestion of contaminated ground water, ingestion by children of soil contaminated through ground water irrigation, ingestion of home produce contaminated through ground water irrigation, and showering or bathing with contaminated ground water. Risk associated with exposure to contaminated soils for projected future use scenarios was also estimated.

- Prepared a risk assessment for four drinking water systems in a major metropolitan area.
- Managed an indoor air quality project in a high-rise building in downtown Denver. The project included an evaluation of potential sources of indoor air quality problems and design and implementation of an air sampling program.
- Participated in the preparation of RCRA Part B permit applications for an oil refinery and an industrial plant.
- Researched and determined permit requirements for waste water sludge reuse projects in Florida and California.
- Evaluated alternative methods and equipment for oil spill clean up.
- Participated in site evaluations and preparation of environmental assessments for two postal facilities in Texas.

DANIEL J. GRAHAM

project management
project design
risk analysis
regulatory compliance
gas chromatography
spill response

EDUCATION

University of Wisconsin: B.S., Geology, 1982
University of Wisconsin: Graduate work in shale sedimentology, invertebrate paleontology and paleoecology, 1981-1982

PROFESSIONAL HISTORY

Woodward-Clyde Consultants, Anchorage, Alaska, Senior Project Scientist, 1986-present
Exploration Logging, USA, Anchorage, Alaska, Geologist, 1983-1986
Private Consultant, Anchorage, Alaska, oil exploration geology, 1982-1986
University of Wisconsin, Madison, Research Assistant, 1980-1982
University of Wisconsin, Madison, Departmental Tutor, 1979-1982
Wisconsin State Geological Survey, Madison, Geological Technician, 1980
Metal Coatings, Inc., Milwaukee, Wisconsin, Lab Supervisor, 1974-1976

REPRESENTATIVE EXPERIENCE

Mr. Graham has diverse experience in the earth sciences. His work includes hazardous waste applications, oil exploration, basic research in sandstone, carbonate and shale sedimentology and invertebrate paleontology. His experience includes work in recent, unconsolidated sediments, metamorphic environments, soil gas chromatography and quantitative heavy metal chemistry. He is EPA Level B certified.

Mr. Graham has performed risk analysis, designed sampling programs, performed and evaluated QA/QC programs, designed and supervised remediation efforts and provided regulatory agency liaison services at over fifty sites in Alaska, including sites in the U.S. Air Force Installation Restoration Program.

Specific projects include:

- Project design and management on an on-going multimillion dollar site investigation and feasibility study.
- Project design on a wide variety of hazardous waste site investigations for private industry.
- Using the Field Operable Gas-Chromatography Laboratory, Mr. Graham has vertically profiled volatile compound contamination in boreholes and probe locations. He has conducted subsurface soil gas studies with analysis to as deep as 160 feet.

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- Industrial-related chemical experience with nitrates, halogenated compounds, aliphatics, alcohols, clay mineralogy, a wide variety of naturally occurring liquid and gas phase hydrocarbons, and cadmium, zinc, lead, silver, gold, platinum, aluminum, tin, antimony, molybdenum, cyanides, arsenic and copper in a pH controlled environment.

HOLLY A. GRAHAM

environmental geology
environmental sampling
technical writing
contaminant history
background investigations
hazardous waste investigations
NEPA issues

EDUCATION

University of Oregon: B.S. Geology, 1987

PROFESSIONAL HISTORY

Woodward-Clyde Consultants, Anchorage, Alaska, Staff Scientist, 1987-date
Exploration Logging, USA. Anchorage, Alaska, 1985
NL Baroid, Anchorage, Alaska, 1984

REPRESENTATIVE EXPERIENCE

Ms. Graham is a geologist with environmental, hazardous waste, and technical writing experience, with specific experience in the following areas:

- Responsible for generating background and support information in the production of No Further Action Documents for the Air Force. These documents were accepted and signed by the EPA for official closure of sites under environmental investigation. These documents represent the first EPA concurrence with a Record of Decision document on DOD sites under environmental investigation.

- Authored a Technical Document in Support of No Further Action (TDSNFA), previously known as an NFADDs, for the Air Force. The document serves as a Record of Decision and presents data supporting a risk assessment for sites which qualify for no further action.

- Well site geologist for groundwater monitoring well installations to establish the extent of a contaminant plume from landfill leachate. Responsibilities included making judgements of installation depths, field water quality tests and health and safety compliance of subcontractors.

- Conducted site mapping to identify and document existing geologic and hydrologic conditions, locate areas where contaminated materials may be found, produce a field quality map which could be digitized and presented in the report.

- Assisted in several geophysical surveys conducted at hazardous waste sites in Alaska to document the location of potential contamination and select monitoring well locations.

- Assisted in the investigation of U.S. Air Force hazardous waste sites in Alaska, 1987-1988. Ms. Graham was responsible for completing boring logs, installing monitoring wells, collecting soil and water samples, and the operation of field monitoring equipment. In addition, Ms. Graham was responsible for data analysis and editorial comment for the operations plan, and draft and final reports.

- Conducted geotechnical investigations as a grout inspector at the Merril Creek Dam project in Harmony, New Jersey. The project involved design and construction of a earth rock fill dam to control water levels on the Delaware River for PSE&G.

- Conducted sampling procedures in large scale oil exploration in the Beaufort Sea and the Navarin Basin. Strict attention to sampling protocols was required. Ms. Graham was also responsible for shipping, QA/QC and record keeping.

- Experience includes geologic and structural mapping in metamorphic and volcanic terrains, including ophiolite sequences in central and northeastern Oregon.

AFFILIATIONS

Alaska Geological Society

DAVID H. W. LIU

toxicology
hazard assessment
health & safety

EDUCATION

Oregon State University: Ph.D., Pharmacology/Toxicology, 1969
University of Oregon: M.A., Biology/Physiology, 1960
University of Michigan: B.S., Zoology, 1958

PROFESSIONAL HISTORY

Woodward-Clyde Consultants, Senior Project Scientist, 1980-date
SRI International, Senior Toxicologist, 1973-1980
Envirogenics Company, Senior Toxicologist, 1971-1973
Washington State University: Postdoctoral Fellow, Drug Metabolism and Experimental Therapeutics, 1969-1971
Battelle-Northwest Laboratories, Biologist, 1964-1965
General Electric Company, Biologist, 1962-1964

REPRESENTATIVE EXPERIENCE

Dr. Liu has been performing investigations in human health and aquatic toxicology for government and industry since 1962. In recent years, he has focused on assessing the hazards and risks of hazardous chemical releases to public health and aquatic life. Examples of recent investigations performed by Dr. Liu are described below:

- Assessment of risk to agricultural workers and local population of trichloroethylene, perchloroethylene, methyl chloroform, and other chlorinated hydrocarbons in groundwater used to irrigate crops in the Salinas Valley.
- Assessment of risk to public health of trichloroethylene, styrene, toluene diisocyanate, and other compounds released during a train derailment in Livingston, LA.
- Assessment of risk to public health and aquatic life of arsenic, lead, trichloroethylene, and other substances found in a landfill at Hamilton Air Force Base in California.
- Assessment of risk to public and worker health of metals in steel mill slag used as fill on property in Torrance, CA.
- Assessment of risk of chlorinated solvents and polynuclear aromatic hydrocarbons in playground soil to children at a nursery school in Ventura, CA
- Assessment of risk of volatile aromatic hydrocarbons in soil to occupants of an office building in San Leandro, CA.

Before joining Woodward-Clyde Consultants, Dr. Liu worked at several other firms where he was engaged primarily in laboratory research. Some of the work he performed is described below:

- Managed four two-year EPA projects to evaluate new chronic toxicity testing methods for aquatic species and to determine the acute and chronic toxicity of selected pesticides and solvents to those species.

- Managed a five-year study, funded by the U.S. Army Medical Research and Development Command, to determine the acute and chronic toxicity of TNT wastewater and its components to aquatic organisms.
- Toxicology task manager in several EPA- and NIH-funded projects to review and summarize published information on production, use, environmental fate, and toxicity of chemicals.

HONORS

Member of Aldehyde Committee; National Academy of Sciences, 1979-1980
Post-Doctoral Fellow in Pharmacology; National Institutes of Health, 1969-1971
U.S. Public Health Service Trainee in Toxicology, 1965-1969

SELECTED PUBLICATIONS AND PRESENTATIONS

H.C. Baily, D.H.W. Liu, and H.A. Javitz, 1985. Time/Toxicity Relationships in Short-Term Static, Dynamic, and Plug-Flow Bioassays. In: Aquatic Toxicology and Hazard Assessment, Proc. Eighth Annual Symposium on Aquatic Toxicology. ASTM Special Tech. Publ. 891. p. 193.

D.H.W. Liu, H.C. Baily, and J.G. Pearson, 1983. Toxicity of a Complex Munitions Wastewater to Aquatic Organisms. In: Aquatic Toxicology and Hazard Assessment, Proc. Sixth Annual Symposium on Aquatic Toxicology. ASTM Special Tech. Publ. 802. p. 135.

G.E. Burrows, D.H.W. Liu, G.E. Isom, and J.L. Wang, 1982. Effect of Antagonists on the Physiologic Disposition of Sodium Cyanide, J. Toxicol. & Environmental Health. Vol. 10, pp. 181-189.

D.H.W. Liu, 1981. A Radiorespirometric Study of the Effects of a Chemical Substance on Carbohydrate Metabolism in the Intact Fish. In: Aquatic Toxicology and Hazard Assessment, Proc. Fourth Annual Symposium on Aquatic Toxicology, ASTM Special Tech. Publ. 737. p. 449.

Formaldehyde and Other Aldehydes, 1981. National Academy Press, Washington, D.C. Nine co-authors. 340 pp.

S.B. Radding, J.L. Jones, W.R. Mabey, D.H.W. Liu, and N. Bohonos, 1978. Assessment of Potential Toxic Releases from Leather Industry Dyeing Operations. 9EPA-600-2-78-215, 73 pp.

S.B. Radding, T. Mill, D.H.W. Liu, C. Gould, H. Johnson, D. Bomberger, and C. Fojo, 1975. The Environmental Fate of Selected Polynuclear Aromatic Hydrocarbons. EPA 560/2-75-009.

G.E. Isom, D.H.W. Liu, and J.L. Way, 1975. Effects of Sublethal Doses of Cyanide on Glucose Metabolism. Biochemical Pharmacology, Vol. 24, pp. 871-875.

D.H.W. Liu and J.L. Lee, 1975. Acute and Chronic Toxicity of Selected Pesticides to the Bay Mussel, Mytilus edulis. EPA 660/3-75-016.

G.E. Burrows, D.H.W. Liu, and J.L. Way, 1973. Effect of Oxygen on Cyanide Intoxication, V. Physiological Effects. J. Pharmacol. Exptl. Therap. Vol. 184, pp. 739-748.

D.H.W. Liu, H. Krueger, and C.H. Wang, 1970. Catabolic Pathways for Glucose in the Cichlid Fish. Comp. Biochem. Physiol. Vol. 36, pp. 173-181.

Acute Toxicity of Selected TNT Wastewater Components to the Fathead Minnow, Pimephales promelas. Presented at the First International Congress on Toxicology, Toronto, Canada, 1977.

Cyanide Intoxication: Protection with Hyperbaric Oxygen. Presented at the Fall Meeting of the American Society for Pharmacology and Experimental Therapeutics. Stanford, California, 1970.

Pentachlorophenol and Acetate Metabolism in Cichlosoma bimaculatum. Presented at the Fall Meeting of the American Society for Pharmacology and Experimental Therapeutics, Stanford, California, 1970.

DENNIS R. McCRUMB

project management
engineering geology
waste management

EDUCATION

Colorado State University: M.S., Geology, 1973
Fort Lewis College: B.S., Geology, 1971

REGISTRATION

Registered Geologist, California
Registered Geologist, Idaho
Certified Engineering Geologist, Oregon

PROFESSIONAL HISTORY

Woodward-Clyde Consultants, Senior Project Geologist, 1987-date
Golder Associates, Senior Geologist, 1985-1987
Western Air Drilling, Geologist/Technical Consultant, 1983-1985
Woodward-Clyde Consultants, Senior Project Geologist, 1973-1983
Colorado State University, Research Assistant, 1971-1973

REPRESENTATIVE EXPERIENCE

Mr. McCrumb has over 15 years of geotechnical experience. He has participated in both the management and technical aspects of projects that have involved site selection and/or characterization. These projects have ranged from small facilities of a few acres to regional areas involving many square miles. His experience and responsibilities include the application of engineering and ground water geology to multi-disciplinary projects for hazardous and mixed waste investigations, waste disposal siting studies, slope stability investigations, and geotechnical engineering projects. The following is a summary of selected assignments:

- Program manager for five RI/FS type hazardous waste projects for the U.S. Air Force under the Installation Restoration Program (IRP). Responsibilities included contractual compliance, technical monitoring, and administrative reporting.

- Project manager for a hazardous waste investigation at three U.S. Army installations in Alaska. Responsible for technical quality and contractual compliance. Activities included ground water remediation pilot studies and a bioremediation bench scale test. Regulations governing the investigations included both RCRA and SARA/CERCLA.

- Project manager and section leader for a support service contract to the Department of Energy, Richland, Washington (DOE-RL). Support provided by the project included an assessment of such issues as past releases of radioactive material at the facility and potentially hazardous products encountered during the field investigation.

- Senior geologist for a seismic hazard evaluation at numerous operating nuclear power plants in the central and eastern United States.

- Manager or task leader for several repository projects for high level radioactive waste. Activities included geophysical studies, geologic data management, preparation and review of technical procedures and implementation of a nuclear quality assurance program.

- Senior geologist for an investigation of marine terraces along the Washington and Oregon coast and the Wishkah River Fault Zone in western Washington in response to questions from the Nuclear Regulatory Commission and to evaluate implications to critical facilities from subduction zone earthquakes.

- Site geologist and manager for investigations during construction of the WNP 3 and 5 power plant in western Washington. The investigation included detailed mapping and age dating of material within and overlying mapped faults; investigation of several landslides in Quaternary deposits at the site; integration of field data for the Final Safety Analysis Report, and presentation of investigation results to the Nuclear Regulatory Commission staff.

- Geologist and task leader for a landslide investigation in the Astoria formation of the northern Willapa Hills in western Washington.

- Geologist for the regional geology and tectonics task for the Auburn Dam Investigation. The study included geologic mapping and aerial reconnaissance, analysis of SLAR imagery, air photo interpretation and correlation of geomorphic surfaces and stratigraphic units.

- Geologist and task leader for a regional siting study to locate and recommend potential areas for thermal power plants in the Pacific Northwest.

AFFILIATIONS

Association of Engineering Geologists
National Contract Management Association
Northwest Mining Association
Project Management Institute

PUBLICATIONS

A list of selected publications is available upon request.

MICHAEL R. PIOTROWSKI

biogeochemistry
hazardous waste bioremediation
in situ bioremediation

EDUCATION

Boston University Marine Program, Ph.D., Biogeochemistry, 1989
Cornell University: B.S., Ecology, 1974

PROFESSIONAL HISTORY

Woodward-Clyde Consultants, Project Scientist, 1988-date
Woodward-Clyde Consultants, Senior Staff Scientist, 1985-1988
Affinis, San Diego, California, Consultant, 1983-1985
Scripps Institution of Oceanography, LaJolla, California, Research Associate, 1983
Woodward-Clyde Consultants, Staff Scientist, 1979-1983
Marine Biological Laboratory, Woods Hole, Massachusetts, Educational Research Coordinator, 1977-1978
Boston University Marine Program, Woods Hole, Massachusetts, Research Associate, 1975-1976
Ichthyological Associates, Absecon, New Jersey, Marine Biological Aide, 1972-1974

REPRESENTATIVE EXPERIENCE

Dr. Piotrowski possesses an extensive background in multidisciplinary research. His broad knowledge and experience have allowed him to make major contributions to a variety of WCC projects, ranging from analyses of heavy metal bioaccumulation to toxic organic waste biodegradation.

Dr. Piotrowski is a bioremediation expert at WCC for the evaluation of the suitability and feasibility of biological methods for site remediation. He has consulted on a variety of hazardous waste projects dealing with such hazardous chemicals as pesticides, PCBs, PCP, creosote, coal tar, PAHs, chlorinated hydrocarbons, aromatic compounds, fuel/crude oils, and heavy metals.

Dr. Piotrowski has designed and performed bench, pilot, and full-scale studies to evaluate the efficacy of biological approaches for treatment of soils and waters contaminated with hazardous organic compounds.

Dr. Piotrowski's project experience includes:

- Principal investigator for a pilot study of in situ biological remediation of a Montana aquifer contaminated with wood preservatives. The study demonstrated that stimulation of in situ microbial activity produced significant reductions in organic contaminant concentrations in groundwater.
- Principal investigator for feasibility studies of biological remediation of soils and groundwater contaminated with wood preservatives at a Superfund site in Montana.
- Principal investigator for treatability study of biological decontamination of soils and groundwater contaminated with petroleum hydrocarbons in Alaska.

- Principal scientist for feasibility/economic evaluations for biological treatment alternatives to produce reductions in hazardous organic compounds in a major industrial waste stream in Alaska. Results of bench and prototype studies led to implementation of full-scale biological treatment of the waste stream, saving the client many millions of dollars in upgrade costs for that treatment system relative to other treatment options.
- Consultant for biotreatment feasibility assessment for the removal of PCBs from contaminated soils.
- Consultant for biotreatment alternatives for the closure plan for a site contaminated with multiple pesticides.
- Consultant for biodegradation remediation of a kerosene spill in San Diego County.
- Project scientist for a study to assess bioaccumulation of heavy metals, pesticides, and PAHs in aquatic biota of a hazardous waste pond.
- Project scientist for a study to assess heavy metal loading in an estuarine ecosystem.
- Consultant for site characterization studies for the Bunker Hill, Idaho, Superfund site for USEPA.

Dr. Piotrowski has also made major contributions to numerous projects that are not related to hazardous waste management. These include oil spill risk assessments, FERC relicensing studies for hydroelectric facilities, wetland delineation assessments, entrainment mortality studies for fossil fuel power plants, and many fisheries-related impact assessments.

AFFILIATIONS

American Geophysical Union
American Society for Microbiology

HONORS

New York State Regents Scholarship
Dyson Fund Scholarship
Heatley-Green Scholarship

PUBLICATIONS

A list of Dr. Piotrowski's publications is available on request.

PUBLICATIONS

Piotrowski, M.R. 1989. In situ biogeochemical reduction of hydrocarbon contamination of groundwater by injecting hydrogen peroxide: A case study in a Montana aquifer contaminated by wood preservatives. Ph.D dissertation, Boston University Graduate School, 218 pp.

Doyle, J.R., and Piotrowski, M.R. 1989. In situ bioremediation of wood treating compounds in groundwater. Paper accepted for presentation at Superfund '89, New Orleans, Louisiana, in April 1989.

Pilot-scale in situ biodegradation stimulation study for remediation of an aquifer contaminated with wood-preserving chemicals (with J.R. Doyle) 1988. Prepared for the U.S. Environmental Protection Agency. July 1988. 138 pp.

Effects of diversion entrainment on resident trout populations in three low order tributaries of the North Fork Mokelumne River, Amador County, California. Prepared for Pacific Gas and Electric Co., Research, Development, and Demonstration Project. In press.

Biodegradation of volatile aromatic hydrocarbons in aqueous environments. Report prepared for USEPA, 1987. 32 pp.

PGandE/Shell Hazardous Waste Pond Study. Prepared for Pacific Gas and Electric Company and Shell Oil Company, and California Regional Water Quality Control Board, December 1986. 163 pp.

Response of a salt marsh microbial community to inputs of heavy metals: Aerobic heterotrophic metabolism (with A.E. Giblin, B. Leighty, I. Valiela and J.M. Teal). Environmental Toxicology and Chemistry, v. 2, 1985.

PRESENTATIONS

In situ bioremediation of an aquifer contaminated with wood preservatives: A case study. Seminar presented at San Diego State University for the Applied Microbiology Work Group, January 23, 1989.

In situ biogeochemical reduction of hydrocarbon contamination of groundwater by injecting hydrogen peroxide: A case study in a Montana aquifer contaminated by wood preservatives. Seminar presented at the Marine Biological Laboratory, Woods Hole, Massachusetts, December 20, 1988.

Results of pilot-scale in situ biodegradation stimulation study for the Libby Superfund groundwater contamination site. Presented to U.S. Environmental Protection Agency, Denver, CO. April 1988.

An expert system for evaluating and designing biodegradation treatment strategies (with A. Lamont). Presented at the Workshop on Expert and Automated Systems in Hazardous Waste Management. U.S. Environmental Protection Agency, Cincinnati, OH. June 16-17, 1987.

Biodegradation concepts. Presentation to University of Arizona, Tucson, Seminar Series on Hazardous Waste Management. September 1987.

Biodegradation: current and future trends in applications. Presented to Woodward-Clyde Consultants Seminar on SARA. Long Beach, CA. August 1987.

Biodegradation of volatile aromatic hydrocarbons in aqueous environments. Presented to the U.S. Environmental Protection Agency, Seattle, WA. February 1987.

Biodegradation. Presentation to Woodward-Clyde Consultant's Seminar on Groundwater Assessment, Remediation, and Control. St. Louis, MO. September 1985.

JANE M. SHOWALTER

hazardous waste project management
environmental engineering
regulatory compliance
chemical engineering
technical writer

EDUCATION

Purdue University, West Lafayette, IN: B.S., Chemical Engineering, 1980
Colorado State University, Fort Collins, CO: M.S. Civil Engineering (Environmental Engineering Program), (anticipated graduation in May, 1989)

REGISTRATION

Engineer-In-Training: Indiana, 1980.

PROFESSIONAL HISTORY

Woodward-Clyde Consultants, Anchorage, Alaska, Assistant Project Engineer, 1988-present
Colorado State University, Ft. Collins, Colorado, Research Assistant, 1986-1988
ARCO Alaska, Inc., Kuparuk Field, Alaska, Drilling Rig Supervisor, 1985-1986
ARCO Exploration Company, Inc., Anchorage, Alaska, Drilling Engineer, 1982-1985
ARCO Oil and Gas Company, Houston, Texas, Drilling Engineer, 1981-1982
ARCO Oil and Gas Company, Houston, Texas, Operations Engineer, 1980-1981
ARCO Oil and Gas Company, Anchorage, Alaska, Junior Engineer, summers of 1977-1979

REPRESENTATIVE EXPERIENCE

Ms. Showalter is experienced in planning, organizing, scheduling and cost control. She has six years of experience in the oilfield as an engineer and a rig supervisor. As an environmental engineer, she has been responsible for all phases of hazardous waste investigations, from project planning through field work, data analysis, and report preparation. Specific projects and assignments have included:

- Developing sampling plans, performing sampling, and writing final reports for a variety of hazardous waste site assessments including: crude oil contaminated soil in Valdez, a processing plant on the Kenai Peninsula, and an excavation of underground storage tanks in Anchorage.

- Field supervisor of drilling and sampling operations conducted at several Alaskan sites. Responsibilities included: mobilization of equipment, completion of boring logs, installation and development of ground-water monitoring wells, soil and water sampling, decontamination of drilling and sampling equipment, use and maintenance of photo-ionization and combustible gas air monitoring equipment, and compliance with EPA and Alaska Department of Environmental Conservation regulations.

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- o Project manager of remediation of a PCB spill in Fairbanks. Planned and supervised remediation, planned and performed sampling procedures for verification of attainment of cleanup levels specified by the client and regulators, and wrote final report.

- o Completion of the EPA Basic Health and Safety training, certified to level "C."

As a Drilling Rig Supervisor, Ms. Showalter represented ARCO at drilling locations and coordinated the work of on-site contractor personnel. Specific responsibilites included: compliance with safety and environmental regulations, drilling equipment, personnel and material control, report preparation, and minimization of operating costs.

As a Drilling Engineer, Ms. Showalter was responsible for overall planning and on-going technical support of exploratory drilling operations in remote offshore Alaska locations: North Aleutian Shelf, St. George Basin, Navarin Basin, and Gulf of Alaska. Specific responsibilites included: preparation of permit applications, AFEs and RFPs, development of well and materials/logistic plans, project scheduling, project cost estimations and wellsite technical support. While in Texas, she was responsible for technical planning and support of drilling operations in onshore South Texas oilfields. Her duties included preparing well plans, workover plans, cost estimates and AFE's as well as providing on-site technical support of drilling operations.

Ms. Showalter's duties as an Operations Engineer included performing reservoir studies, analyzing field data, and recommending and justifying further remedial work. She was responsible for maximizing production from several onshore oilfields in South Texas.

AFFILIATIONS

American Society of Civil Engineers
Water Pollution Control Federation

PAIGE HERZON SPATZ

sedimentology
organic geochemistry
data management

EDUCATION

University of Wisconsin/Madison: M.S., Geology, 1983
University of California/Santa Cruz: B.S., Earth Science, 1978

PROFESSIONAL HISTORY

Woodward-Clyde Consultants, Project Geologist, 1988-date
Keystone Environmental Resources, Assistant Manager, Data Management, 1987
Brown & Ruth Laboratories, Geochemical Geologist, 1983-1987
University of Wisconsin/Madison, Teaching Assistant/Research Assistant, 1980-1982
United States Geological Survey/Alaska Branch, Junior Geologist, 1978-1980

REPRESENTATIVE EXPERIENCE

Ms. Spatz is a geologist with broad-based knowledge in sedimentology, geochemistry, structural and environmental geology. She has worked in a laboratory environment and has expertise in analytical data interpretation, especially of organic geochemical data, and writing interpretive reports of samples from diverse geologic settings. Her project reports have emphasized relating the geochemical data within a geologic framework. In addition to her geologic experience, Ms. Spatz has utilized computer-based data management systems for data assimilation and report generation. Ms. Spatz's specific project experience and data management responsibilities are summarized below.

Data Management Experience:

- Sample Manager for hazardous waste study using R:Base computer management system. Responsibilities included establishing a sample plan, providing computer-generated sample labels, monitoring the sample flow from the field to the laboratory, and ensuring holding times were met. In addition, the R:Base system was installed and formatted for the project, and laboratory results were entered into the system for assimilation and interpretation.

- Assistant Data Manager of an environmental analytical laboratory. Maintained a computerized data base using SAM and LIMS systems. Integrated data from five departments, compiled reports, and monitored work schedules. Reported data to clientele with information on methodology and detection limits.

- Quality Control Manager of organic geochemistry laboratory procedures. Reviewed all analytical data to ensure quality results, advised personnel on difficult samples and maintained the flow of samples, which averaged 3,000 to 5,000 per month, through the lab.

Project Experience:

- Data Interpreter of various organic geochemical analytical results, including TOC, pyrolysis, kerogen study, vitrinite reflectance, liquid

chromatography, gas chromatography, isotope analysis and minor amounts of gas chromatograph/mass spectrometry. Wrote interpretive reports of diverse sample groups including surface samples, entire well profiles, isolated well profiles and oils from all over the world for the petroleum industry.

- Project Manager of a regional study to evaluate the hydrocarbon formation potential of southern Appalachia. The study area encompassed seven states and included approximately 30 wells. Responsibility included data and sample acquisition, development of analytical protocol, data interpretation and generation of reports.

- Project Manager of a study to evaluate the hydrocarbon formation potential of the Sacramento Basin. Coordinated and collected cuttings material from 25 wells and over 300 surface samples. Analyzed sediments and oil samples by pyrolysis, gas chromatography and kerogen study. Wrote an interpretive overall assessment of the basin as well as individual well reports and a surface sample report.

- Project Manager of a regional study to assess the hydrocarbon formation and production potential of nine distinct basinal regions in Morocco. Described core samples and cuttings material, coordinated sample acquisition and laboratory analysis, and interpreted analytical results. Wrote individual basin reports incorporating analytical data, and recommended further planning measures for the region in general.

- Project Geologist for detailed sedimentological study on the Cretaceous sequence of Spitsburgen, Svalbard. Conducted an in-depth publication search in addition to field work and laboratory analysis. Described sedimentological units, modeled depositional environments and interpreted structural emplacement.

- Project Geologist and Group Leader for a mineral resource assessment conducted in the eastern Alaska Range, Alaska. Coordinated and led daily reconnaissance excursions to map both surficial (including glacial) and structural geology. Compiled field data, analyzed thin sections, and edited and drafted written reports for publication.

- Senior Laboratory Technician for K/Ar dating procedure. Conducted laboratory analysis and compiled and drafted the analytical results for publication. Skills used included mineral separation (heavy liquid and mechanical techniques), glass blowing, operation of the laboratory instruments and the computer program.

AFFILIATIONS

Geological Society of America
Alaska Geological Society
Houston Geological Society
American Association of Petroleum Geologists

KELLY D. SUSEWIND

hazardous waste investigation
geotechnical engineering
construction monitoring/inspection

EDUCATION

Washington State University: B.S., Geological Engineering, 1984
Grays Harbor College: A.S., Engineering, 1982

PROFESSIONAL HISTORY

Woodward-Clyde Consultants, Seattle, Washington, Senior Staff Engineer, 1988-date
Woodward-Clyde Consultants, Anchorage, AK, Senior Staff Engineer, 1985-1988
GeoEngineers, Bellevue, WA, Field Engineer, 1985

REPRESENTATIVE EXPERIENCE

Mr. Susewind has been involved with hazardous waste investigations in Alaska, Washington, and Texas. Specific responsibilities and projects have included:

- Field supervisor for drilling and sampling operations conducted at a variety of sites, including several remote Alaskan military installations. Responsibilities included supervision of crews of up to seven people, mobilization of equipment, supervision of drilling operations including well and boring locations, monitoring well installation and development, soils logging, soil and water sampling, field mapping, and assisting in the preparation of the final report.

- Member of a sampling and analytical team that characterized the constituents present throughout a ballast water treatment facility. Contributions to the project included: extensive sampling throughout the system, design and fabrication of a specialized sampling device, reduction and analysis of a major portion of the data collected, and assisting in writing the final report. Mr. Susewind also conducted an in-tank physical inspection in which he was responsible for devising a sampling scheme, designing and fabricating a sampling device and technique, sampling the tank, running appropriate laboratory tests, and reporting the results to the client.

- Field investigator and co-decon manager for an extensive drilling and sampling operation conducted at an abandoned hazardous waste dump site in Texas. His responsibilities included: mobilization of equipment, logging boreholes, devising proper sampling protocol, and soils sampling. As decon manager, he was responsible for proper decontamination of all drilling and sampling equipment.

- Soil-gas investigator for several fuel spill sites in Alaska. Responsibilities included design and fabrication of probes, operating a laboratory grade gas chromatograph, mobilization of equipment, installation and sampling of probes, and assisting in preparing the final reports.

- Completed hazardous waste training, level "B" and"C".

Mr. Susewind also has experience in more typical engineering applications including: soils logging of test pits and boreholes and geophysical logging of boreholes; performing calculations for bearing capacity, settlement, and time of settlement for building foundations; doing slope stability calculations using state-of-the-art computer programs; performing various hydrologic calculations; providing fill control and inspection; and monitoring the installation of auger-cast piles.

HONORS

Member of the Top Ten graduates, Weatherwax High School, 1979
Member of the Top Ten graduates, Grays Harbor College, 1982
Selected The Outstanding Senior in Geological Engineering, WSU, 1984
Recipient of The Bishop-Fleet Foundation Scholarship, 1982-1984.
Monetary award for academic excellence.

ROBERT W. WILSON

gas chromatography
well logging
subsurface geology

EDUCATION

State University of New York: B.S., Earth and Space Sciences (Geology), 1978

PROFESSIONAL HISTORY

Woodward-Clyde Consultants, Anchorage, Alaska, Staff Scientist, 1988-date
N.L. Baroid Logging Systems, Denver, Colorado, Geologist/Logging Engineer, 1983-1988
Core Laboratories, Inc., Dallas, Texas, Geologist/Logging Engineer, 1979-1983
Core Laboratories, Inc., Dallas, Texas, Consultant Geologist, 1981-1982

REPRESENTATIVE EXPERIENCE

A summary of specific project experience follows:

- Extensive experience throughout the Western United States and the North Slope of Alaska

- Experienced in operating and maintaining gas chromatography equipment, drafting equipment and computers

- Supervised two to four other people, since December 1979

- Successfully taught the intricacies of well logging to inexperienced people, those working directly for the firm and client's employees as well

DANIEL R. YOUNG

geology
hydrology
geophysical exploration
computer modeling

EDUCATION

University of Alberta, Edmonton: Ph.D. Program, Geology, 1982
University of North Dakota: M.A., Geology, 1980
Humboldt State University, B.A., Geology, 1976

PROFESSIONAL HISTORY

Terrasat, Anchorage, Alaska, Geologist, 1983-present
Harding-Lawson Associates, Anchorage, Alaska, Geologist, 1983
R.A. Kreig & Associates, Inc., Anchorage, Alaska, Geologist, 1982

REPRESENTATIVE EXPERIENCE

Mr. Young has led numerous hydrological, geological, and geophysical exploration projects in Alaska. Many of these projects have involved the hillside area of Anchorage. These projects include ground-water investigations for multiple use wells and individual use. Mr. Young has created a large graphical three-dimensional data base of subsurface conditions on the south Anchorage hillside and has a vast knowledge of subsurface conditions from the integration of photo interpretation, geological mapping and the data base. Mr. Young has effectively applied photo interpretation techniques to aid in a variety of solutions to geotechnical problems, ground-water exploration, and mineral exploration. He has developed and implemented numerous computer-aided programs for ground water modeling, resource analysis, well field dewatering, and solute transport prediction. His project experience includes:

- Hazardous waste investigation of a produced water pit, Kenai, Alaska
- Hazardous waste investigation of a refinery, Kenai, Alaska
- Ground-water exploration and resource evaluation of hillside area, Anchorage, Alaska
- Monitoring well - borehole geophysical investigation of landfill, Anchorage, Alaska
- Ground-water and geotechnical investigation of Potter Creek, Anchorage, Alaska
- Gravel resource evaluation of Potter Creek, Anchorage, Alaska
- Ground-water investigation and resource evaluation for a subdivision, Eagle River, Alaska
- Ground-water exploration for agricultural irrigation, Talkeetna, Alaska

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- Ground-water and geotechnical investigation for a subdivision, Wasilla, Alaska
- Geotechnical dewatering, Wasilla, Alaska
- Ground-water exploration, Wasilla, Alaska
- Drainage and ground-water flow investigation, Beluga area, Alaska
- Ground-water exploration, Palmer, Alaska
- Permafrost investigations, Anchorage, Alaska
- Pile foundation installation, Point Lay, Alaska
- Gravel study of Nechilik Channel of Colville River Delta, Alaska
- Gravel resource investigations of Cape Halkett, Harrison Bay, Alaska
- Slope stability investigation, Anchorage, Alaska
- Placer gold resource evaluation of Quartz Creek, Circle, Alaska
- Placer gold exploration of Harrison Creek, Circle, Alaska
- Placer gold exploration of Lucky Creek, Healy Mining District, Alaska
- Placer gold exploration of Gold Hill, Healy Mining District, Valdez Creek area, Alaska
- Placer resource evaluation, Sitkinak Island, Alaska

AFFILIATIONS

Alaska Geological Society
Alaska Groundwater Association
Alaska Water Well Association
American Geophysical Association
American Quaternary Association
Association of Engineering Geologists
Association of Ground Water Scientists and Engineers
International Association of Sedimentologists
Society of Economic Paleontologists and Mineralogists