FINAL

ORDOT DUMP
ORDOT-CHALAN PAGO, GUAM

Environmental Data Summary Report

Prepared for
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ACRONYMS

bgs	below ground surface
BOD	biological oxygen demand
CDM	Camp, Dresser, & McKee, Inc.
cm/sec	centimeters/second
COD	chemical oxygen demand
COPC	contaminant of potential concern
CSM	conceptual site model
CWA	Clean Water Act
D&A	Dueñas and Associates, Inc.
DDT	dichlorodiphenyltrichloroethane
DOJ	Department of Justice
DPW	Department of Public Works
DQO	data quality objective
EBS	Environmental Baseline Survey
FS	Feasibility Study
FSP	field sampling plan
ft/day	feet/day
GEPA	Guam Environmental Protection Agency
gpd	gallons per day
gpda	gallons per day per acre
GTA	Greenleaf/Telesca-Ahn
GWQS	Guam Water Quality Standards
JCTA	Juan C. Tenorio & Associates, Inc.
MCL	Maximum Contaminant Level
mgd	million gallons per day
MSL	mean sea level
NGL	Northern Guam Lens
NGLS	Northern Guam Lens Study
NOV	Notice of Violation
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRG	Preliminary Remediation Goal
QA	quality assurance
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RA	risk assessment
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SAP	sampling and analysis plan
SQL	sample quantitation limit
SVOC	semi-volatile organic compound
TDS	total dissolved solids
TOC	total organic carbon
TR	Technical Report

TRPH	total recoverable petroleum hydrocarbons
TRV	Toxicity Reference Value
TSS	total suspended solids
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UXO	unexploded ordnance
VOC	volatile organic compound
WERI	Water and Energy Research Institute

1.0 INTRODUCTION

1.1 BACKGROUND

The closure design of Ordot Dump, located on the island of Guam is currently being developed under a Consent Decree issued by the U.S. District Court of the Territory of Guam to the Guam Department of Public Works (DPW) (Civil Case No. 02-00022). In addition to the Consent Decree, Title 10, Chapter 51, Article 1 Solid Waste Management, §51101(4) of the Guam Code Annotated, mandates that the Ordot Dump be closed and converted to a public park.

This report presents a summary of existing environmental data for the Ordot Dump (Dump), identifies environmental data gaps, and presents general recommendations for further investigation. This report has been prepared as a component of the Environmental Baseline Survey (EBS) under Task 1 – Site Assessment for the Ordot Dump Closure. Other components of the EBS, including flora and fauna surveys, wetland determination and delineation, physical characterization, landfill fires, and landfill gas generation, are separately reported, and are not addressed specifically in this environmental data summary report.

As part of the closure process, an on-site and off-site Remedial Investigation (RI) (including chemical sampling and analysis) will be performed during Phase 2 of the Site Closure. The RI will be performed to support the completion of Human Health and Ecological Risk Assessments, the development of remedial action objectives, and a Feasibility Study (FS) for the site. The environmental data gaps identified in this report will be considered and provide a basis for the scoping of the RI for the Dump. The overall project goals of the RI/FS process are to provide the information necessary to characterize the site, define site dynamics, define risks, and develop a remedial program to mitigate current and potential threats to human health and the environment. Implementation of remediation efforts will be a part of the closure requirements. The detailed scope of work for remediation and post-closure care will be negotiated by DPW and the Guam Environmental Protection Agency (GEPA).

The evaluation of existing data presented in this report has been prepared in general accordance with the United States Environmental Protection Agency (U.S. EPA) guidance documents *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (U.S. EPA, 1988) and *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites* (U.S. EPA, 1991).

1.2 OBJECTIVES

The primary objective of this report is to summarize the existing environmental data for the site and to identify data gaps for additional physical and chemical environmental data needed to support closure design for the Dump, refine the conceptual site model (CSM) for contaminant fate and transport, and identify potential contaminants of concern for the development of the RI work plan for the site. Specific objectives include the following:

- Identify and compile existing environmental data, including chemical, geological, hydrological, and hydrogeological data;

- Assess the quality (accuracy, precision) of the existing chemical data and conformance with quality assurance/quality control (QA/QC) protocols under which they were collected, if possible;

- Evaluate data quality to determine the uncertainty associated with the current data and their usability;

- Develop a CSM to describe contaminant fate and transport, and exposure pathways;

- Perform a limited preliminary human health and ecological risk assessment based on existing data; and

- Identify physical and chemical environmental data gaps.

To accomplish these objectives, this report presents a summary of existing environmental data and their limitations, a CSM for contaminant transport and exposure pathways, and a data gap assessment. The environmental data gaps identified in this report will be considered during the development of the RI work plan, following review and acceptance of this report by GEPA.

2.0 SITE DESCRIPTION

2.1 LOCATION

Guam is located approximately 3,800 miles west of Hawaii and 1,500 miles south of Japan. Guam is the largest and southernmost island in the Marianas Archipelago. The island of Guam is approximately 212 square miles in area. Its main axis runs northeast-southwest, with a length of 30 miles and a width ranging between 4 and 11.5 miles.

The Ordot Dump is located approximately 2.5 miles south of Guam's capital, Hagatna, and about 1 mile southwest of the Dero Drive-Route 4 intersection (Figure 1). The Dump is an unlined disposal facility and has few to no control systems to manage landfill gas, leachate, surface water, erosion sedimentation, and vectors. The disposal area has been estimated to be approximately 46.8 acres, based on the limits of waste delineation performed in 2004.

The area surrounding the Dump is covered by dense brush and wooded areas and is developed with scattered residences. The nearest residences are approximately 200 feet from the Dump. The Dump is situated in a ravine that is a tributary to the Lonfit River, located to the south. The Dump occupies and borders property of the Government of Guam on the northeast, east, south, and southwest. The north and west limits of the Dump border public land in the form of a road and privately owned land, respectively.

2.2 HISTORY

The starting date for waste disposal at the Dump is not documented, but it is known that the Ordot Dump was in use before World War II (1939-1945). The Dump was used as a disposal area by the Japanese during the Japanese occupation of Guam from December 8, 1941 to July 21, 1944. Following the liberation of Guam, the U.S. Navy continued to use the site as a disposal area. Ownership of the Ordot Dump was transferred from the United States Naval Government of Guam to the Government of Guam in 1950 under the Organic Act. Since then, the Government of Guam, specifically DPW, has been operating Ordot Dump as a municipal solid waste disposal facility.

According to GEPA, the Ordot Dump has received not only municipal solid waste, but also hazardous waste. Anecdotal references to dumping of polychlorinated biphenyl (PCB)-containing wastes, pesticides, and military ordnance have been reported, however no documentation has been identified to confirm these practices.

Many fires have occurred at the Dump; however, a history of the fires has not been thoroughly documented. Since about 1990, it is generally accepted that there has been an average of at least one fire every one to two years. This includes a major tire fire that was essentially allowed to burn out in 1998. Subsurface (deep-seated) fires fueled by the generation of flammable (methane) and combustible gases during the decomposition of waste within the landfill have also been reported. With the exception of the tire fire of 1998, documentation of the type, size, location, and duration of the fires is mostly unavailable.

The following is a chronological summary of the operational and regulatory history for the Dump. This summary is adapted from the U.S. EPA (2002).

1940s	Dump used by Japanese and U.S. Naval military forces
November 1, 1950	Transfer of site from U.S. Navy to the Government of Guam
November 8-12, 1982	RI for Insular Territory Hazardous Waste Sites (draft report May 20, 1983)
September 8, 1983	Site placed on National Priorities List
March 26, 1986	U.S. EPA Clean Water Act (CWA) Notice of Violation (NOV) and Order to Guam DPW
November 18, 1987	Initial Site Characterization Report
September 1988	No Action Record of Decision (ROD)
July 24, 1990	U.S. EPA CWA Administrative Order to Guam DPW
September 30, 1993	First Five-year Review Report
December 1998	Superfund response to Ordot tire fire
August 7, 2002	Department of Justice (DOJ) files complaint against Guam for CWA violations
September 2002	Second Five-year Review Report
February 11, 2004	Consent Decree for closure of Ordot Dump
Present	Continued use as Guam's only municipal dump

3.0 SITE CHARACTERISTICS

3.1 GEOLOGY AND HYDROGEOLOGY

The Ordot Dump rests on the weathered surface of the Alutom formation, the oldest volcanically derived suite of rocks in Guam (Tracey et al., 1964). The Dump surface drains to the south to the Lonfit River. On the north side of the drainage divide, which crests at approximately 320 feet above mean sea level (MSL) and is located approximately 400 feet to the north, the ground slopes north toward the great limestone plateau of North Guam, in which the bulk of the groundwater resources of the island occur. However, the data thus far collected suggest that the site is not tributary to the limestone. If it was, several important municipal wells in Ordot would be threatened with pollution.

The Alutom formation consists dominantly of tuffaceous shale and sandstone, interbedded with basaltic and andesitic lava flows, as well as beds of volcanic conglomerate and breccia. All of these rocks were originally deposited beneath the sea, and consequently the tuff and its derivative sediments settled in compact layers, and the lavas were quenched. Both processes are unfavorable to the creation of a permeable rock mass. Subsequently, precipitation from hydrothermal fluids filled much of the pores, reducing permeability even further. The final result is a sequence of layered rocks with very low intrinsic permeability. The permeability that does exist is mostly due to secondary fractures.

The surficial deposits are composed of a few feet of soil and subsoil beneath which the parent volcanic rock is weathered to a depth of 10 to 30 feet. Below the saprolite of the weathered zone the rocks lie in their original, unweathered state. The strata are laterally discontinuous and a typical vertical sequence may contain pillow lavas, massive layered lava, fine tuff, coarse sand, conglomerate, and breccia. In most instances, none of the individual rock units exceed several feet in thickness; however, a few stratum may be tens of feet thick, particularly where the rock consists of tuff and tuffaceous shale. It is impossible to predict the sequence of strata in any region because of the great heterogeneity in rock types and their original environment of deposition.

The volcanic rocks are beneath a thin cover of alluvium below an elevation of 50 feet in the Lonfit River valley. Downstream of the confluence of the Lonfit and Sigua Rivers, the Pago River flows on alluvium, which is bounded on the north by limestone and on the south by volcanics.

The Alutom formation is a very poor medium for groundwater movement. The hydraulic conductivity is low, normally less than 0.1 feet/day (ft/day) (3.5E-5 centimeters/second [cm/sec]), and consequently the groundwater gradient is high, greater than 0.1. One of the earlier studies on the environment of the Dump (GTA, 1970) reported hydraulic conductivity values of 0.0386 ft/day (1.36E-5 cm/sec) and 0.4535 ft/day (1.60E-4 cm/sec) from samples taken at depth 10 to 15 feet in a borehole. These values are of the same magnitude as hydraulic conductivity values determined from pumping tests in deep wells completed in the Alutom formation in other areas of Guam (Barrett Consulting and CDM, 1982).

Due to the very low permeability of the volcanic rocks, groundwater accumulates and moves very slowly through them. In the typical volcanic terrain of Southern Guam, the groundwater flows toward stream valleys. Groundwater discharge takes place in the stream channels and a zone on the valley walls several tens of feet above a channel.

Subsurface regional geological conditions in the vicinity of the Ordot Dump are complicated by the presence of the Adelup-Pago fault, which divides Guam into two provinces, the northern one covered by limestone and the southern one consisting primarily of volcanics. The vertical displacement on the fault adjacent to the Dump is about 400 feet down to the north, which results in a downthrow of the original volcanic surface to approximately 200 feet below sea level on the north. Figure 2 is a cross-section that shows the relationships between the Dump, the Lonfit River, and North Guam separated by the fault. Figure 3 is a map showing the position of the volcanic basement beneath the northern limestone, which was determined from the seismic survey conducted during the Northern Guam Lens Study (Barrett Consulting and CDM, 1982). The contours express the elevation below sea level to the volcanic basement north of the fault. Just north of the Dump the limestone rests on the volcanics at 210 feet below sea level.

3.2 MONITORING WELLS AND BORINGS

A total of 19 borings were drilled in the volcanic substrate in the vicinity of the Ordot Dump between 1970 and 1993, and another two were drilled in the limestone to the east of the Dump in 1992. In addition, numerous excavations have been made, including the test pits recently completed by Dueñas & Associates, Inc. (D&A) to identify the limits of waste. Figure 4 shows the known locations of historical monitoring wells at and near the Dump. Available boring logs are included in Appendix A.

The first set of borings was drilled in 1970 as part of the Greenleaf/Telesca-Ahn (GTA) study. Of the eight borings, six were drilled in the ravine to the west of the then-existing Dump and two within the Dump footprint. The borings were shallow, ranging from 14 feet to 40 feet below the surface. The elevation of the bottom of the borings ranged from 122 to 210 feet MSL. Groundwater was not encountered in any of the borings. The lithologic logs and a boring location map are included in Appendix A.

The Water and Energy Research Institute (WERI) of the University of Guam had nine borings drilled and groundwater monitoring wells (well 1 through well 9) installed in 1989 (WERI, 1989). Eight were located between the toe of the Dump and the Lonfit River, and the other was located just beyond the northern edge of the Dump (Figure 4). Boring logs for these wells are not available, however based on the report, each of the WERI borings was deep enough to have encountered the water table in the volcanics. Several of the down-gradient wells may still exist but were not located during a well identification study by D&A in 2004. The up-gradient boring (Well 9, also identified as GW-4) is close to the Ordot Dump manager's office. Recently, Well 9 was located and found to be accessible for water table measurements.

In 1992, the USGS installed two deep monitoring wells east of the Dump, and perhaps a third, in the volcanics up-gradient of the Dump not far from Well 9. They are numbered OMW-1 and OMW-2 (Figure 4). The wells are at an approximate surface elevation of 270 feet MSL and encountered the water table 10 to 20 feet below ground surface (bgs). Recent attempts to locate these wells have been unsuccessful. Boring logs are provided in Appendix A.

Two wells (MW-01 and MW-02) were drilled in the limestone terrain to the east of the Dump in 1992 by URS, for GEPA. Neither well penetrated to the volcanic basement. Well logs are included in Appendix A.

Table 1 summarizes available drilling information for all of the well borings.

3.3 SURFACE WATER

The average flow in the Lonfit River is 6.5 million gallons per day (mgd) from a drainage basin of 1,984 acres, an average of 3,250 gallons per day per acre (gpda). The flow data are for the entire period of record, 1951-1960, when the river was gaged by the USGS. In the dry season, flow decays to less than 100,000 gallons per day (gpd), and in severe droughts has reached zero. More recent flow data is not available.

Leachate from several seeps at the toe of the Dump drain into rivulets on the narrow alluvial terrace between the Dump and the Lonfit River and then into the River. Field estimates indicate the total visible leachate flow to be on the order of 10,000 to 20,000 gpd. This relatively small volume appears to be less than expected based on rainfall onto and through the exposed Dump surface; however, an approximate water budget indicates that seepage through the Dump is relatively small. The surface area of the Dump is about 47.1 acres and the average annual rainfall is 92 inches. Assuming that the rate of direct runoff per acre from the Dump area is the same as for the Lonfit River drainage basin, direct overland runoff amounts to 44 inches per year, leaving 48 inches for evaporation and infiltration. Average yearly pan evaporation in Guam is greater than 60 inches, but assigning just 30 inches as evaporation yields an infiltration rate of 18 inches per year. On 47.1 acres, 18 inches per year amounts to an average potential infiltration of about 63,000 gpd, some of which may be discharged at the toe of the Dump as leachate.

3.4 GROUNDWATER

Measurements of depth to water in the volcanics at Well 9 indicate a water table elevation of approximately 250 feet MSL. The ground level at this location is about 270 feet MSL and during Fall 2004, depth to water measurements of 23, 20, and 19 feet bgs were recorded. Assuming a mean elevation of the Lonfit River of 30 feet MSL as the surface of the water table, the decrease in head from Well 9 to the Lonfit River is 220 feet over a distance of 1,600 feet, giving an overall groundwater gradient, i, of 0.14. Although this is a very high gradient for groundwater, the grain size of the volcanic rock, combined with the low hydraulic conductivity of the Alutom formation (k = 0.1 ft/day), suggests a low Reynolds number (less than 10) and therefore possibly laminar (Darcian) flow in the volcanics. The velocity of the groundwater can be calculated by the equation:

$$v = k * i / n$$

where:

k = hydraulic conductivity (0.1 ft/day)

i = groundwater gradient (0.14 ft/ft)

n = effective porosity, assumed value of 0.10

Based on the assumptions described above, the velocity of groundwater is 0.14 ft/day, which is very small compared, for example, to the velocity of groundwater in the limestone of North Guam, which exceeds 10 ft/day.

Groundwater discharge into the Lonfit River from the area downgradient of the Dump can be estimated by the Darcy formula:

$$Q = k * z * i * l$$

where:

Q = discharge (ft^3/day)

k = hydraulic conductivity, estimated as 0.10 ft/day

z = approximate thickness of aquifer discharging to the Lonfit River, estimated as 200 feet (difference between the water table at Well 9 and the elevation of the Lonfit River channel)

i = groundwater gradient (0.14 ft/ft)

l = width of the Dump (ft), along the river (1,200 ft)

The calculation suggests that total groundwater flow in the Alutom volcanics from the 1,200-foot-wide landfill to the north side of the Lonfit River is on the order of 25,000 gpd. Although this value is a poorly constrained estimate, it implies that the daily groundwater flow from the volcanics beneath the landfill to the river is small relative to the average flow in the river.

Because of the very low permeability of the volcanics, it is likely that leachate from the mass of refuse does not percolate very far below the volcanic rock surface. Conceptually, the principal leachate flow infiltrates vertically to the refuse or saprolite interface with the rock, then flows laterally along the interface between the saprolite and alluvium and the underlying volcanics (Figure 2). The topographic contour map of the region before emplacement of the landfill shows a shallow valley tributary to the Lonfit River where the refuse is now piled (Figure 3). It is likely that much of the leachate drains to this pre-existing valley floor and emerges as small streams at the landfill toe that flow on the narrow alluvial terrace to the Lonfit River. As the screened intervals for historical monitoring wells are unknown and there has been no attempt to assess whether there is preferential flow within discrete stratigraphic units within the volcanic rocks, the available groundwater data do not allow an evaluation of whether contaminants potentially generated at the Dump are migrating solely through the near surface saprolite/alluvium or if there is migration via a deeper volcanic unit.

4.0 WASTE CHARACTERISTICS

4.1 WASTE CHARACTERISTICS

All non-hazardous municipal solid wastes generated on the island of Guam, excluding the wastes generated at the Naval and Air Force Installations, are currently accepted at the Dump for disposal. A study on the composition of Guam's waste was conducted by Rossi-Nayve Consultancy Services, Inc (JCTA, 1993). The majority of the waste received at the Dump consists of non-hazardous residential and commercial solid waste. The Dump also receives construction/demolition waste, bulky metal, and other related wastes. DPW does not accept hazardous wastes. DPW is permitted to receive wastewater treatment sludge with prior approval from the Guam Environmental Protection Agency (GEPA). According to Operations personnel, sludge is rarely received at the Dump.

Specific records of the types and quantities of materials placed in the Dump do not exist; however, since the implementation of the Resource Conservation and Recovery Act (RCRA) in the 1980s, the Dump has received primarily municipal waste. The Dump is therefore considered to contain a lesser amount of hazardous waste from pre-RCRA historical dumping. Types of municipal solid waste disposed of at the Dump likely include a heterogeneous mixture of materials composed primarily of household refuse (yard, food wastes, and paper) and commercial waste (plastics, inert mineral waste, glass, and paper).

U.S. EPA identifies four ways in which hazardous wastes may have become disposed at landfills (U.S. EPA, 1991):

1. Landfills (dumps) operated prior to the implementation of RCRA in November 1980 typically accepted and co-disposed both solid and liquid hazardous wastes.

2. Small quantity generators may contribute varying quantities of hazardous waste within the non-hazardous waste debris.

3. Some hazardous household waste (e.g., batteries and paint) may be disposed.

4. Biodegradation or landfill fires may create new components that are hazardous.

Given the history and current operations of the Dump, it is likely that all four of these mechanisms have contributed to the presence of hazardous materials at the Dump. Sampling and analysis of leachate samples from the Dump have been aimed at identifying hazardous constituents that are being released in the landfill leachate. Results for sampling and analysis of landfill leachate are presented in Section 5.

Constituents and properties that are typically present at elevated concentrations in leachate from domestic refuse include heavy metals, sulfates, chlorides, phosphates, sodium, hardness, chemical oxygen demand (COD), biological oxygen demand (BOD), Kjeldahl nitrogen, total organic carbon (TOC), total dissolved solids (TDS), and total suspended solids (TSS) (EPA 1991). Hazardous waste compounds generated by commercial, industrial, and agricultural activities that are typically found in municipal solid waste include heavy metals, volatile organic compounds (VOCs), and pesticides (Sharma *et al.* 1994). Hazardous organic and inorganic constituents potentially associated with landfills are also identified in Appendix II to the solid waste regulations, 40 CFR 258, and include metals, VOCs, semi-volatile organic compounds (SVOCs), pesticides, PCBs, cyanide, and others. Based on the above information, the following hazardous constituents are reasonably expected to be contaminants of potential concern (COPCs) at the Dump:

- Heavy metals;
- Cyanide;
- VOCs;
- SVOCs;
- Pesticides; and
- PCBs.

In addition to the hazardous constituents listed above, it is widely known that significant quantities of unexploded ordnance (UXO) were placed in the Dump, especially during World War II, by both the Japanese and the U.S. forces on Guam. Many anecdotal accounts of this ordnance exploding, sometimes causing fires, have been related. However, there is no particular record of any serious damage or injuries as a result. Generally speaking, the location of any remaining UXO is unknown; however it is known that the operating area at that time was more or less confined to the northwest corner of the existing footprint, adjacent to Dero Drive. Chemicals potentially associated with World War II-era explosives include nitroaromatics and nitramines. These chemicals are also considered to be COPCs.

Pyrolytic oil and dioxins/furans are hazardous materials generated or mobilized during tire or landfill fires. Pyrolytic oil is a free-flowing, oily tar that is generated by the breakdown of tires during the high temperatures and oxygen-deprived atmospheres occurring during tire fires. Hazardous constituents potentially associated with pyrolytic oil include heavy metals, polynuclear aromatic hydrocarbons (PAHs) and other hydrocarbons, and dioxins/furans. Dioxins/furans are persistent, highly toxic chlorinated organic compounds that may be formed during combustion of material that includes organic carbon and chlorine. Dioxins/furans may be generated during both landfill fires and tire fires. Multiple fires, including at least one tire fire, have occurred at the Dump. Dioxins/furans and hazardous constituents associated with pyrolytic oil are also considered to be COPCs.

4.2 WASTE QUANTITIES

Records of waste quantities received at the Dump do not exist for the majority of the period of operation. Information on the exact filling rates are not available; however, it is estimated that approximately 200 tons per day (for approximately 300 days per year) of refuse entered the landfill from 1950 to 1990, followed by 350 tons per day (for approximately 300 days per year) from 1990 to present. The Dump is scheduled to continue receiving waste through closure in

2007. The annual incoming waste tonnage at Ordot Dump between 2005 and 2007 is estimated to be approximately 120,000 tons (D&A, 2004).

5.0 SUMMARY OF EXISTING ENVIRONMENTAL DATA

Studies aimed at evaluating the impacts of the Dump on the Lonfit and Pago Rivers have been conducted since the 1970s. This section presents a summary of the existing chemical characteristic data for the site. The objective of this review is to provide a synopsis of the available data and conclusions that can be drawn from the results. The synopsis of available data will be incorporated into the CSM and serve as the basis for the development of the environmental data gap assessment (Section 7.0).

The summary consists of a desktop review of available environmental data, including an assessment of the data representativeness and usability. Data usability will address the appropriateness of the data for regulatory comparison and the use of the data for developing a CSM and/or RI work plan. The set of available reports reviewed during the preparation of this report are described in Section 5.1. Section 5.2 describes those reports or datasets that are known or suspected to exist, but were not available for review during the preparation of this report. A summary of the existing analytical data is presented in Section 5.3, and data limitations are discussed in Section 5.4.

5.1 EXISTING REPORTS REVIEWED

During the development of this summary report, the project team identified, obtained, and reviewed copies of readily available reports that contain chemical characteristic information for the site. The following reports were available for review by the project team:

- RI, Insular Territory Hazardous Waste Sites, Draft Report. Prepared by Black and Veatch (B&V) for U.S. EPA. May 20, 1983.
- Draft Initial Site Characterization Report, Ordot Landfill, Island of Guam. Prepared for U.S. EPA by Camp, Dresser, & McKee, Inc. (CDM). October 7, 1987.
- Agency Review Draft, Risk Assessment, Ordot Landfill Site, Guam. July 8, 1988. Prepared by CH2M Hill/B&V.
- WERI of the Western Pacific, University of Guam. Technical Report (TR) 72: The Occurrence of Certain Pesticides in Ground and Surface Waters Associated with Ordot Landfill in the Pago River Basin, Guam, Mariana Islands. November 1989.
- FS for the Expansion of Ordot Sanitary Landfill, Municipality of Pago-Ordot, Territory of Guam, Volume II. Juan C. Tenorio & Associates, Inc. September 1993.
- Surface Water Sampling Report for March 1998, Ordot Landfill, Ordot, Guam. Prepared for DPW, Government of Guam by Unitek Environmental-Guam. April 10, 1998.
- Surface Water Sampling Report for July 1998, Ordot Landfill, Ordot, Guam. Prepared for DPW, Government of Guam by Unitek Environmental-Guam. August 20, 1998.

- Surface Water Sampling Report for August 1998, Ordot Landfill, Ordot, Guam. Prepared for DPW, Government of Guam by Unitek Environmental-Guam. September 8, 1998.

- Surface Water Sampling Report for November 1998, Ordot Landfill, Ordot, Guam. Prepared for DPW, Government of Guam by Unitek Environmental-Guam. December 21, 1998.

- Letter to Mr. Jesse Cruz, GEPA from Unitek Environmental-Guam re: Ordot Sampling. February 24, 1999.

- Five-year Review Report, Second Five-year Review, Ordot Landfill Site, Territory of Guam. U.S. EPA Region 9. September 2002.

- USGS Project Synopsis Report June 2003. Title: Impact of Ordot Dump on Water Quality of Lonfit River Basin in Central Guam. Principal Investigators: G.R.W. Denton, M. Golabi, and H.R. Wood.

- Data Tables provided to D&A by GEPA. 2004. Surface water data 1974-1977 and 1997-1998.

Table 2 presents a summary of the sampling and chemical analyses described in these reports, including sample matrices (surface water, leachate, groundwater, sediment), sampling dates, sampling locations, sampling methods, chemical analyses, and available QA information (field and laboratory).

5.2 OTHER REPORTS

The following reports were not available for review by the project team during the preparation of this summary report. These reports were either specifically referenced or referred to in the reports listed in Section 5.1 and may include sampling and/or analytical information relating to the chemical characterization of the Ordot Dump. Data from several of these reports are included in the analytical results tables included in Appendix B.

- Revised Work Plan for Ordot Landfill, Guam. Prepared by CDM. November 20, 1985.

- Surface water sampling reports for November 1997, December 1997, January 1998, February 1998, April 1998, May 1998, June 1998, September 1998, and October 1998, Ordot Landfill, Ordot, Guam. Unitek Environmental-Guam. Dates unknown.

- Water quality results for Pago River water year 1981. United States Geological Survey (USGS). Date Unknown.

- Monitoring well installation and sampling field forms. URS Consultants. October 29, 1992.

- Leachate and surface water sampling results for USGS funded study, 1986 to 1987. WERI of the Western Pacific, University of Guam. No date.

- Leachate and surface water sampling results from trace metals sampling program, 1990 to 1994. WERI of the Western Pacific, University of Guam. No date.

With the exception of the 1997-1998 Unitek monthly surface water sampling reports, the sampling and analyses described in these unavailable reports occurred over ten years ago. As such, these historical data would be of little to no use for describing current site conditions and these missing reports are considered to be of relatively low value and significance. The missing 1997-1998 Unitek monthly surface water monitoring reports are only a subset of the available reports for this monthly monitoring program, and in several cases the analytical results from the missing Unitek reports were included in the analytical summary table from the Second Five-year Review (U.S. EPA Region 9, 2002). These data are summarized in Appendix B. Analytical data from the missing reports could potentially help to improve the CSM or further refine the list of potential constituents of concern identified by this report; however, the absence of these data do not prevent the identification of data gaps that should be addressed during subsequent investigations at the Dump.

5.3 EXISTING ENVIRONMENTAL DATA

The available analytical data were compiled from investigations spanning more than two decades. The available data vary by medium, and the amount of information ranges from relatively extensive (for surface water and leachate) to non-existent (for soil and biota). Several of the reviewed reports do not describe the specific quality assurance/quality control (QA/QC) measures included with the sampling and analysis, and laboratory analytical reports were not included with several of the reports (Table 2). Nevertheless, the available analytical data for the Dump do provide some potentially useful information regarding the likely chemicals of concern associated with leachate from the Dump and the potential effects of the Dump on groundwater, surface water, and sediment at and adjacent to the site.

During the preparation of the Second Five-year Review Report (U.S. EPA Region 9, 2002), EPA's consultant compiled and tabulated analytical results for surface water/leachate, groundwater, and sediment. These summary tables (Tables 1, 2, and 3 from the Second Five-year Review Report) have been included as Appendix B of this summary report. Environmental data identified during this review, which were not included on the Second Five-year Review Report tables, have been included as supplemental Table 1a (surface water/leachate) and Table 3a (sediment) in Appendix B. Analytical results from the June 2003 USGS Project Synopsis Report *Impact of Ordot Dump on Water Quality of Lonfit River Basin in Central Guam* are not included in the Appendix B data tables. This report is included in its entirety as Appendix C.

The existing environmental data for leachate, groundwater, surface water, and sediment are described in the following subsections. The usability of analytical data for regulatory comparison is discussed by comparing the analytical results to screening levels, when available. Screening levels for leachate, groundwater, surface water, and sediment were derived from Guam Water Quality Standards (GWQS) (GEPA, 2002) and U.S. EPA Region 9 Preliminary Remediation Goals (PRGs)(U.S. EPA, 2004) as follow:

- Leachate, surface water – GWQS (category S-1);
- Sediment – PRGs (residential soil PRG or soil screening level for migration to groundwater); and
- Groundwater – GWQS (category G-2) or PRGs (where GWQS do not have a standard).

When multiple values were available in the referenced sources, the lowest value was conservatively used for comparison with analytical results.

5.3.1 Leachate

Leachate samples have been collected at different times from four leachate sampling locations (SW-5, SW-7, SW-9, and SW-10) identified on Figure 5. Existing leachate analytical results for seeps SW-5 (south leachate stream), SW-7 (leachate pond), SW-9 (southeast leachate stream), and SW-10 (west leachate stream) are tabulated in Appendix B, Tables 1 and 1a. A summary of leachate analytical data, including the number and range of available analytical results and associated screening levels, is provided in Table 3.

A description of the location and frequency of sampling for each location is summarized below:

- **SW-5** – Leachate sampling location SW-5 is located in a tributary stream to the Lonfit River that includes leachate discharging from the eastern portion of the southern face of the Dump. Based on the USGS topographic map of the site prior to use as a dump (GTA, 1970), the stream tributary SW-5 appears to be aligned with a natural drainage which has been covered by the dump. Intermittent analytical data for leachate sampling location SW-5 are available for the period 1981 to 1999.
- **SW-7** – Leachate sampling location SW-7 is described as a leachate pond located along the southern toe of the Dump. The pond was likely formed by the pooling of leachate in a depression on the downgradient slope of the Dump. Water samples were collected from leachate sampling location SW-7 in 1982 (B&V, 1983) and 1987 (CDM, 1987). The leachate pond described as SW-7 was not observed during site reconnaissance performed in October 2004 as part of the closure design and is believed to have been covered by filling activities that have occurred since 1987.
- **SW-9** – Leachate sampling location SW-9, also referred to as GEPA sampling station LFL-3, has been described as a stream originating from the northern edge of the Dump (B&V, 1983) and as a leachate stream to the southeast of the Dump (U.S. EPA Region 9, 2002). Leachate sampling location SW-9 has not been sampled since the early 1980s.
- **SW-10** – Leachate sampling location SW-10 is located in a tributary stream, which flows along the western edge of the Dump to the Lonfit River southwest of the Dump. This stream includes leachate that discharges from the western portion of the Dump, along with surface water runoff from areas north and northwest of the site. The confluence of this tributary stream with the Lonfit River is at location SW-0 (Figure 2). Intermittent

analytical data for leachate sampling location SW-10 are available for the period 1982 to 1999.

Leachate samples from the above locations were analyzed for metals (1981-1998), VOCs (1982 and 1987), semi-volatile organic compounds (SVOCs) (1982 and 1987), pesticides (1982, 1989 and 1998), PCBs (1982 and 1998), total recoverable petroleum hydrocarbons (TRPH) (1998), and/or conventionals (1980 – 1998).

The study conducted by USGS in 2002/2003 included the collection of leachate samples from two locations for a one-time analysis of all priority pollutants listed under GWQS (GEPA, 2002). A figure showing the leachate sampling locations was not included in the USGS report.

VOCs and SVOCs were either not detected or detected at only trace levels in leachate samples collected during the 1982 and 1987 studies at the Dump. In most cases, constituents with low-level detection in leachate samples were also detected in the associated laboratory (method) blanks. VOCs and SVOCs were not detected at concentrations exceeding applicable GWQS. With the exception of bis(2-ethylhexyl) phthalate, the reporting limits provided by the data reports were below available GWQS. However, the lists of analytes reported from the VOC and SVOC analyses for the 1982 and 1987 studies appear limited and do not contain many common VOCs and SVOCs for which GWQS are established.

The focused 1989 study to evaluate pesticide occurrence did not detect pesticides in leachate samples collected at SW-10 (WERI, 1989), however for the pesticides with corresponding GWQS the reporting limits were well above the GWQS criteria. Two pesticides (dieldrin and endosulfan sulfate) were detected in the field duplicate sample collected from leachate stream SW-9 during the 1982 RI, however these pesticides were not detected in the primary field sample. Pesticides were not detected in other leachate samples collected during the 1982 RI, however the reporting limits were well above established GWQS surface water criteria. Monthly monitoring performed by Unitek for DPW did not detect DDT or PCBs in leachate streams at SW-5 and SW-10, and the discontinuation of PCB/DDT analysis was approved by GEPA following seven months of consecutive non-detects for these analytes (Unitek, 1998b). The reporting limits for DDT and PCB results from the monthly monitoring program were well above GWQS surface water criteria.

For the 2003 USGS study, organic constituents were not detected above GWQS. Organic constituents detected at concentrations below GWQS or for which water quality standards have not been established include pesticides (p-dichlorobenzene), organic solvents (acetone, benzene, ethylbenzene, tetrahydrofuran, toluene, cis-1,2-dichloroethene, m,p-xylenes, and o-xylene), and phenolic compounds. PCBs, polynuclear aromatic hydrocarbons (PAHs), dioxins and furans were not detected during the 2003 USGS study.

Inorganic and conventional constituents detected at concentrations exceeding GWQS surface water criteria during studies performed 1980 - 1998 include aluminum (SW-5, -7, and –9), (SW-5, -7, -9, and –10), cadmium (SW-5), copper (SW-5, -7, -9, and –10), lead (SW-5, -7, and –9), mercury (SW-5, -7, -9, and –10), selenium (SW-5), silver (SW-5), zinc (SW-7), ammonia (SW-5 and –10), cyanide (SW-10), nitrate (SW-5 and –10), and phosphorus (SW-5 and –10). The measured pH in leachate samples from streams SW-5 and SW-10 were below the GWQS surface water criteria of 6.5 – 9 during the 1987 (SW-5 and –10) and 1997 (SW-5) sampling events. Results from the USGS 2003 study indicated total coliforms, indicator bacteria (*E. coli*, *Enterrococci*), nitrite/nitrate, ammonia, orthophosphate, cyanide, and metals (aluminum, antimony, arsenic, chromium, copper, iron, lead, manganese, nickel, and zinc) above GWQS for surface water and/or drinking water. The reporting limits for the historical inorganic and conventional data set were generally acceptable for comparison with GWQS. GWQS surface water criteria are not established for manganese; however, manganese has been detected in leachate samples at concentrations generally an order of magnitude greater than concentrations detected in the Lonfit River. A summary of leachate sample analytical results for inorganic constituents is presented in Table 3.

Available leachate analytical data indicate that the Dump may be contributing to elevated concentrations of total coliforms, indicator bacteria (*E. coli*, *Enterrococci*), nutrients, cyanide, metals, phenolic compounds, a pesticide (p-dichlorobenzene), and selected organic solvents in the leachate.

5.3.2 Groundwater

Seven groundwater monitoring wells have been sampled at different times to investigate conditions on or adjacent to the Dump (Figure 4). Two production wells (Municipal Wells A-11 and A-12), northeast of the site and the fault which acts as a hydrologic barrier (Figure 3) have also been sampled. Groundwater analytical data are available for these monitoring and production wells from sampling events performed in 1982 (B&V, 1983), 1987 (CDM, 1987), and 1989 (WERI, 1989). Groundwater samples were analyzed for metals (1982 and 1987), VOCs (1982 and 1987), SVOCs (1982 and 1987), pH (1982 and 1987), cyanide (1987), pesticides (1989), and PCBs (1982). Available groundwater analytical results are summarized in Table 4 and tabulated in Appendix B, Table 2. Several of the wells can not be located or have been damaged. Table 1 indicates which monitoring wells have been successfully located in the field during recent (2004) work at the Dump.

Organic constituents, including VOCs, SVOCs, pesticides and PCBs have either not been detected or detected at only trace levels below GWQS or PRGs in groundwater samples collected from near the Dump. The majority of the detections of organics in groundwater have also been considered suspicious due to concurrent detections in the associated field or laboratory blank(s). Bis(2-ethylhexyl)phthalate was detected at a concentration exceeding the PRG in a sample collected from Well 9 in 1987. Reporting limits provided for VOCs, SVOCs, pesticide, and PCB analyses were generally acceptable for comparison with GWQS or PRGs; however, the lists of analytes reported from the VOC or SVOC analyses appear limited and do not include many common VOCs and SVOCs for which GWQS are established.

Based on the available data, aluminum, iron, and manganese were the only metals detected at concentrations that exceed GWQS or PRGs in monitoring wells associated with the Dump. Mercury was detected one time only at a concentration exceeding the primary GWQS in municipal well A-11. This well is completed in the limestone of the Northern Guam Lens (NGL) aquifer. Mercury has not been detected in groundwater samples collected from monitoring wells associated with the Dump. With the exception of antimony and thallium, the reporting limits provided in the historical analytical data summaries were acceptable for comparison with groundwater screening levels.

The USGS collected subsurface water samples using suction cup lysimeters from five sites around the western edge and southern toe of the dump as part of their 2002/2003 investigation (USGS, 2003). Subsurface water samples were collected from the buried lysimeters at depths of 2 feet, 4 feet, and 6 feet below ground level and analyzed for total metals, bacteria, and nutrients. A figure showing the subsurface water sampling locations was not included in the synopsis report. The USGS 2003 report indicates "little or no subsurface movement of bacterial pathogens from the dump into the watershed." The study also observed nitrate/nitrite enrichment in the majority of samples from the shallower depths and occasionally at the deepest level. Ammonia and orthophosphate levels were generally low and indicative of a fairly well aerated soil environment at all depths. Samples were also analyzed for heavy metals; however, analytical results were not available at the time of the USGS report preparation and have not been provided in any subsequent report made available to the project team to date.

The available groundwater data for sampling locations located downgradient of the Dump indicate that it may be contributing to elevated metals and nutrient concentrations in groundwater.

5.3.3 Surface Water

Three surface water stations have been sampled on the Lonfit River in the vicinity of the Dump: SW-1 (upstream of the Dump), SW-0 (at the confluence of the leachate seep SW-10 with the River), and SW-2 (downstream of the Dump). The locations of the three sampling stations are shown on Figure 5. Surface water samples were analyzed for metals (1981-1998), VOCs (1982 and 1987), SVOCs (1982 and 1987), pesticides (1982, 1989 and 1998), PCBs (1982 and 1998), TRPH (1998), and/or conventionals (1980 – 1998). Analytical results for surface water sampling performed between 1980 and 1999 are presented in Appendix B Tables 1 and 1a. Table 3 presents a summary of the number of analytical results, minimum and maximum detected concentrations, and associated screening levels. Lonfit River water quality data provided by GEPA for 1974 to 1977 were not included in the summary tables because these water quality data did not include COPCs (Section 4.1) and more recent data were available.

The USGS collected surface water samples at monthly intervals from five locations in the Lonfit River and Pago River during their 2002/2003 investigation (USGS, 2003). A figure showing the surface water sampling locations was not included in the synopsis report, however the sampling locations were identified as 10 feet, 500 feet, 1,000 feet, 4,500 feet and 5,000 feet from the discharge point of an unidentified leachate seep's confluence with the Lonfit River. The synopsis report does not discuss a surface water sampling location in the Lonfit River upstream of the leachate discharge point. Surface water samples collected during the 2003 study were analyzed for bacteria, dissolved metals, and nutrients.

VOCs and SVOCs were either not detected or detected at only trace levels in surface water samples collected during the 1982 and 1987 studies at the Dump. In most cases, constituents with low-level detections in samples were also detected in the associated laboratory (method) blanks. VOCs and SVOCs were not detected at concentrations exceeding applicable GWQS.

With the exception of bis(2-ethylhexyl) phthalate, the reporting limits provided by the data reports were below GWQS. As described above for leachate, the lists of analytes reported for VOC and SVOC analyses do not contain multiple common VOCs and SVOCs. Pesticides and PCBs have not been detected in surface water samples, however the reporting limits for most of these constituents exceed GWQS criteria.

For the metals and conventionals that were detected, only cadmium, copper, lead, mercury, selenium, silver, ammonia, and nitrate were detected at concentrations exceeding QWQS. The USGS 2003 report indicated that fecal coliform and indicator bacteria, inorganic nitrogen, and heavy metal enrichment were observed at the station nearest to the landfill, and that concentrations of metals attenuated downstream either through dilution or partitioning to sediment. Inorganic nitrogen and fecal coliform/indicator bacteria concentrations at the sampling locations further downstream from the dump were noted as suspected to be influenced by discharges to the river of wastewater not associated with the Dump.

The available analytical data for samples collected from the Lonfit River upstream and downstream of the Dump indicate that it may be contributing to increased metals, nutrients, COD, fecal coliform, and indicator bacteria concentrations in the Lonfit River.

5.3.4 Sediment

Sediment sampling and analysis was performed one time in 1982 as part of the Insular Territories Hazardous Waste Sites RI (B&V, 1983). Sediment samples were collected at two locations in the Lonfit River (upstream at SS-1 and downstream at SS-11) and from four leachate streams (SS-3, SS-5, SS-7, and SS-9) (Figure 5). Sediment samples were analyzed for selected metals, VOCs, SVOCs, and pesticides. Analytical results for sediment samples are summarized in Table 5 and tabulated in Appendix B Tables 3 and 3a.

Organic compounds detected in sediment samples include phthalates (bis[2-ethylhexyl]phthalate and butyl benzyl phthalate), PAHs (fluoranthene, pyrene, and aniline) VOCs (methylene chloride and fluorotrichloromethane) and a pesticide (dieldrin). Methylene chloride was detected in all sediment samples at concentrations exceeding the PRG; however, the VOC detections in samples were similar to the detected concentrations in the associated trip blanks. Detections of PAHs were not confirmed by the associated field duplicate samples collected at each location. Similarly, phthalate detections were not confirmed by field duplicates except for the sediment sample collected at location SS-9, located near leachate seep SW-9 on the east side of the dump (Figure 5). The only pesticide detection was also associated with the sediment sample from location SS-9, where dieldrin was detected at a concentration exceeding the PRG. The reporting limits provided for organic analyses were generally acceptable for comparison with PRGs.

The metals antimony, arsenic, barium, chromium, iron, manganese, and nickel were detected in sediment samples at concentrations that exceed PRGs for residential soil or soil screening levels for protection of groundwater (U.S. EPA Region 9, 2004). Detections of antimony, iron, and manganese that exceeded PRGs were associated with sediment samples collected from leachate streams. For the metals detected in Lonfit River sediment samples at concentrations exceeding PRGs (arsenic, barium, chromium, nickel), samples collected from both upstream and downstream of the Dump exceeded PRGs. With the exception of antimony, selenium, silver, and thallium, the reporting limits provided in the historical reports were acceptable for comparison to PRGs.

The available analytical data for sediment samples collected upstream and downstream of the Dump indicate that the Dump may be contributing to increases in metals (aluminum and iron) concentrations in sediment in the Lonfit River.

5.4 LIMITATIONS OF AVAILABLE ANALYTICAL DATA

While the existing environmental data for the Dump do assist with identifying potential chemicals of concern associated with the various media, there are recognized limitations to the use of the existing data for site characterization. The following is a list of some substantial limitations of existing data with respect to characterizing contamination at the site:

- Many of the data are relatively old (greater than ten years) and consequently these data are not likely to be representative of current site conditions.

- The lists of analytes reported for VOC and SVOC analyses appear to be limited and do not contain some common constituents. For example, data sets for VOC analyses do not include results for vinyl chloride, a common VOC that is frequently of environmental concern.

- In many cases the reporting limits provided for the historical chemical analyses are greater than the screening levels and therefore not useful for comparison to screening criteria (e.g., GWQS, PRGs).

- Reports reviewed do not include complete laboratory analytical reports; therefore, sufficient information is not available to perform data quality reviews or data validation.

Statistical comparisons of analytical data to screening levels (i.e., evaluating the confidence interval for non-exceedance of GWQS) were not performed due to the limitations of the data described above.

6.0 CONCEPTUAL SITE MODEL AND EXPOSURE PATHWAYS

The development of a preliminary conceptual site model (CSM) for contaminant fate and transport is the first step in assessing exposure pathways. The preliminary CSM was developed, based on the current understanding of site dynamics and the available environmental data for the Dump. Section 6.1 presents the preliminary CSM for the Dump. Descriptions of potential exposure pathways and human and ecological populations are discussed in Section 6.2. As additional data is collected through the RI process, detailed CSMs for both human and ecological exposures will be generated.

6.1 CONCEPTUAL SITE MODEL

A CSM describes the sources of chemicals at a site, their release and transfer through environmental media (e.g., soil, water, and air), and the points and means by which human and ecological populations might contact the chemicals. The goal of the CSM is to provide an understanding of what physical, chemical, and biological processes are affecting the nature and distribution of chemicals of concern. It also addresses where these chemicals may be present in the future, so that the populations that could encounter the chemicals can be identified and protective remedial alternatives can be developed. The preliminary CSM for the Dump, showing the movement of contamination throughout the site (the "fate and transport" of the landfill-generated chemicals) is presented in Figure 6. The CSM was developed based on the current understanding of the physical characteristics of the site, as described in Section 3, and the chemical characteristics of environmental media at or near the site, as described in Section 5.

Hazardous chemicals, which were either disposed of or generated at the Dump through biodegradation of waste or landfill fires are released either to the air (as dust or gases) or to the ground surface or subsurface (as leachate or contaminated surface runoff). Leachate is generated by the percolation of precipitation or liquids disposed at the Dump, through the waste in the Dump. Because of the very low permeability of the underlying volcanic rocks, it is likely that leachate from the mass of waste does not percolate very far below the volcanic rock surface, if at all. The currently available data suggests that leachate infiltrates to the rock surface and primarily flows along the interface between the waste and/or saprolite and the volcanics. It appears that much of the leachate preferentially drains to valleys that existed prior to filling at the Dump (paleo-valleys) and emerges as small streams that flow onto the narrow alluvial terrace along the Lonfit River, from where it seeps into wetlands or the river. Leachate from the Dump is discharged either to subsurface soils and groundwater or to surface water and wetlands as leachate seeps. Surface water-groundwater interactions, occurring either as infiltration of surface water to groundwater or the discharge of groundwater to surface water or wetlands, may complicate the transport pathways of leachate and contaminated surface runoff from the Dump. In addition, there is insufficient subsurface stratigraphic and groundwater data to assess whether there has been significant leachate infiltration into the volcanic rock and lateral flow within discrete stratigraphic units within the volcanics.

Hazardous chemicals may also be generated or mobilized by landfill fires or tires fires occurring at the Dump (dump fires). Dump fires release chemicals to the air as vapors, smoke, and dust, and may also generate or mobilize chemicals to the surface and subsurface as pyroltic oil and ash. Pyrolytic oil released during dump fires may migrate within the Dump and become commingled with leachate.

6.2 EXPOSURE PATHWAYS

After the preliminary CSM is developed, potential exposure pathways may be identified. An exposure pathway is the mechanism by which a receptor (human or ecological) is exposed to hazardous chemicals from a source (i.e., the Dump). The following four elements constitute a complete exposure pathway:

- a source and mechanism of chemical release;
- a retention or transport medium (e.g., soil);
- a point of potential receptor contact with the affected medium; and
- a means of entry into the body (e.g., ingestion) at the contact point.

Only complete pathways containing all four elements result in exposures and require data collected from the site. Several possible pathways of exposure may exist at the Dump. For the purposes of this report, likely pathways of exposure have been identified to assist with identifying data gaps that will need to be filled in order to assess health risks from the particular pathways. The following subsections describe potential human health and ecological exposure pathways.

6.2.1 Human Health Exposure

Human exposures are dependent on the human land uses in the immediate vicinity of the Dump. The Dump is located in a rural agricultural area with scattered residences. The nearest residences are approximately 200 feet and in a presumed hydrologically upgradient location from the Dump. However, during the landfill fires in 2002, multiple families were considered close enough to the threat that they were required to evacuate their residences (U.S. EPA Region 9, 2002). In addition to nearby residences, Agueda Johnston Middle School is located less than one mile northeast of the Dump.

The closure design for the Dump includes the placement of a cap and the installation of leachate and landfill gas collection and treatment systems. The Guam Code Annotated regulations require that the Dump be converted to a public park after closure. As the Dump is in the process of closure, the exposure pathways and potential human receptors for hazardous constituents associated with the Dump will be different in the future from what they are now. As part of the RI/FS process US EPA requires that baseline risk assessments be conducted assuming no remedial actions occur and risks are evaluated for both current and future conditions. However, for municipal landfills where there is a "presumed remedy", US EPA guidance recommends a streamlined or limited baseline risk assessment (US EPA 1992b). Because containment of the landfill's contents is known to be the response action, the risk assessment is of most use in identifying areas outside the landfill that might need to be addressed in order to protect human and environmental health. In other words, there is no need to conduct a full baseline risk assessment assuming no remedial measures. For human health this means that the following exposure pathways that could be occurring in the present will not be considered in the risk assessment:

- Direct contact with soil and/or debris that will be covered by the landfill cap;

- Exposure to contaminated groundwater within the landfill prevented by groundwater controls;

- Exposure to contaminated leachate prevented by leachate collection and treatment; and

- Exposure to landfill gas addressed by a gas collection and/or treatment system.

We note that construction workers (adult only population) involved in capping and re-development of the site could be exposed to the Dump's soil and debris through incidental ingestion, inhalation, and dermal contact with chemicals in subsurface and surface soil and through inhalation of gases, vapors, or dusts. However, the exposure hazards of this short-term exposure would be addressed through worker protection regulations (e.g., OSHA), and would be prevented through the requirements and controls established in the job-specific health and safety plan. The risk assessment will address construction workers qualitatively and no data need be collected to quantify health risks to this population.

After closure activities effectively remove the exposure pathways identified above, the remaining media of concern for potential human health exposure will include impacted soil and groundwater outside the boundaries of the closure cap, surface water, and sediment. The Lonfit River is located downgradient and south of the Dump (Figure 1). The river and small streams of leachate between the Dump toe and the River are surface waters potentially affected by the Dump. The types of human populations that could be exposed to chemicals of concern in each of the above media are listed below along with potential exposure pathway(s):

- Current trespassers (population includes school-aged children) walking over impacted surface soil outside of the landfill cap could be exposed through incidental ingestion of and dermal contact with chemicals in surface soil.

- Current trespassers (population includes school-aged children) walking over impacted surface soil outside the footprint of the landfill cap could be exposed through inhalation of vapors and dusts generated from surface soil.

- Current residents (adults and children) inhaling vapors emitted from groundwater outside the landfill and intruding into buildings. If there is no impacted groundwater beneath existing buildings, then this pathway is incomplete and does not require evaluation unless there is a chance that a future building would be constructed above impacted groundwater.

- Future residents (adults and children) who use potentially impacted groundwater outside the landfill for domestic purposes, including drinking the water, inhaling vapors, and absorption through the skin could be exposed to chemicals in groundwater.

- Current/future recreational populations (adults and children) who are exposed to chemicals in surface water, soil, and sediment via incidental ingestion, inhalation, and dermal contact during recreational activities.

- Nearby residents (adults and children) consuming fish caught in the Lonfit River.

6.2.2 Ecological Exposure

For ecological risk assessments, the species that are to be evaluated must be selected in the initial stages of the risk assessment. Ecological risk assessments must address both terrestrial and aquatic receptors. Specific ecological receptors that have been observed or are expected to occur near the Ordot Dump were evaluated as part of the EBS for the Dump closure; however additional potential receptors may be identified during the work plan stage. Selection criteria for identifying representative species for evaluation in the risk assessment include the following:

- species has special status (threatened or endangered);

- species has a small home range;

- species is from a high trophic level (e.g., predators) that might be susceptible to bioaccumulation or biomagnification;

- species is ecologically important; and

- species is valuable locally as a food source or economic resource.

While the species that will be evaluated have yet to be selected, the media of concern are known to be soil, sediment, and surface water. Ecological receptors would not be exposed to groundwater. Selection of species for evaluation will be completed after the completion of the EBS during the development of the RI work plan

7.0 DATA GAP ASSESSMENT AND RECOMMENDATIONS

This section identifies environmental data gaps related to the completion of an RI and associated Human Health and Ecological Risk Assessments for the Dump. General recommendations to address the data gaps are described. Specific sampling locations or numbers of samples are not identified in the data gap and recommendations discussions. Sample locations, analytical methods, and appropriate field and laboratory QA/QC procedures will be identified during the development of the RI work plan(s).

General data needs for completing risk assessments and sample types and locations by exposure pathway are described in Section 7.1. Environmental data gaps for leachate, soil, groundwater, surface water, sediment, and biota are presented in Section 7.2 and sample quantitation requirements are discussed in Section 7.3.

7.1 DATA NEEDS FOR RISK ASSESSMENT

Risk assessments require adequate data as the basis for the assessments of health risks. While human health and ecological risk assessments have differing approaches and methodology, appropriate to the different populations evaluated, the initial step of both types of risk assessments is a data evaluation. Data must be of sufficient quantity and quality so health risks can be adequately estimated from the data and the best decisions regarding site cleanup/redevelopment can be made. EPA's data usability guidance (U.S. EPA, 1992a) identifies four data application questions requiring an answer for risk assessments. The 1992 guidance is focused on human health; however the data application questions are appropriate for both human and ecological risk assessments. The data application questions are as follow:

1. **What contamination is present, and at what levels?** This question applies to the selection of analytical procedures and detection limits. The analytical methods identified for the RI should be selected to capture all potential contaminants at the site. The sample quantitation limits (SQLs) requirements for risk assessments are discussed in Section 7.3.

2. **Are site concentrations different from background?** Concentrations of chemicals that occur on site in the absence of site activities are defined as background concentrations. Background information is particularly significant for ecological receptors where effects on a site-impacted ecological population are compared to a "reference" or background area. Both human health and ecological risk assessments require background data collected from unimpacted areas for comparison with the site data. The identification of appropriate background/unimpacted areas should be carefully evaluated and agreed upon prior to field sample collection in order to provide analytical data that is credible for definition of background concentrations of chemicals of interest.

3. **Are all exposure pathways and areas identified and examined?** Exposure pathways will be defined as the risk assessment (RA) work plans are developed. However, the preliminary exposure pathways described in Section 6 are sufficient to identify data requirements for future sampling activities.

4. **Are all exposure areas fully characterized?** This data application question deals with data quantity and the representativeness of those data. Sufficient samples of each medium of concern should be collected for meaningful statistical analysis to be generated for each exposure area. Data sets should generally include at least 10 samples for each medium, however more samples may be required if the spatial or temporal variability of concentration data is expected to be large. The sampling approach should aim at assessing the extent and magnitude of contaminants in each medium by the most appropriate sampling regime (random sampling locations versus systematic sampling) for individual exposure areas or media. An exposure area is a section of the site (sometimes the entire site) where people or ecological receptors would encounter the chemical.

The following subsections present the data collection requirements for the completion of human health and ecological risk assessments. Data requirements for assessing risk to humans are presented based on potential exposure pathways. Ecological risk assessment data requirements are presented by media.

7.1.1 Human Health

The following data requirements have been identified for assessing post-closure health risks for the potential human health exposure pathways:

- *Incidental ingestion, dermal exposure, and inhalation of vapors/dusts from impacted surface soil outside the boundaries of the proposed landfill cap.* Surface soil samples from the impacted soil (top 0-1 foot below ground surface [bgs]) should be collected using either a random or stratified sampling approach.

- *Inhalation of vapors emitted from groundwater and intruding into buildings* - Additional wells should be drilled to assess the lateral and vertical extent of potential groundwater impacts and the direction of groundwater movement. Sampling should occur over several seasons, if possible, to evaluate potential variability of concentrations over time due to seasonal fluxes. If groundwater impacted by volatile hazardous constituents from the landfill is suspected to occur near residences, groundwater samples from beneath or immediately adjacent to buildings should be collected. In addition, to evaluate vapor intrusion, specific soils properties data should be collected for use in vapor modeling.

- *Ingestion, vapor inhalation, and absorption through the skin of hazardous constituents in groundwater used for domestic purposes* – If a groundwater plume is identified, nearby domestic water supply wells should be assessed for the potential to be affected by the plume. Sample collection requirements are as those described above for groundwater vapor inhalation.

- *Incidental ingestion, inhalation, and dermal contact with surface water and sediment* - Sufficient samples should be collected to define the nature and extent of contamination. Surface water samples should be collected at varying points in time to assess potential seasonal variability as a function of water flow in the Lonfit River.

- *Consumption of fish caught in the Lonfit River* - Bioassay of tissue samples from the fish that people may eat is the preferable data collection method for evaluating this pathway. If fish cannot be collected, concentrations in fish may be modeled from surface water and sediment data.

7.1.2 Ecological

Sampling requirements for each medium of concern for assessing risk to ecological receptors and the associated species categories to be used for evaluating risks are as follow:

- *Surface soil* (0-1 foot bgs) – Data should be collected as for human health, using random or stratified sampling methods. [Note that soil sampling efforts are limited to the impacted soil outside the boundaries of the landfill cap.] Samples should be collected from potentially impacted areas that provide decent habitat (e.g., the surface of the Dump might be impacted but contain no plants or animals). Surface soil data will be used to evaluate soil microbial processes, terrestrial plants and invertebrates, and burrowing and non-burrowing birds and mammals.

- *Near surface soil* (>1-6 feet bgs) – Data shall be collected as described for surface soil. Data will be used to evaluate terrestrial plants and burrowing birds and mammals.

- *Sediment* (top 4 inches) – Sufficient samples shall be collected to define impacted area. Data will be used to evaluate freshwater aquatic plants, benthic macroinvertebrates, and semi-aquatic birds and mammals.

- *Surface water* – Sufficient samples shall be collected to define impacted areas and seasonal trends, if any, in water quality. These data will be used to evaluate freshwater aquatic plants and organisms, and semi-aquatic birds and mammals.

7.2 ENVIRONMENTAL DATA GAPS AND RECOMMENDATIONS BY MEDIUM

The following sections identify data gaps and provide sampling/analytical recommendations for leachate, soil, groundwater, surface water, sediment, and biota. These environmental data gaps have been identified as necessary to validate and/or refine the CSM presented in Section 6 and to fulfill the data needs for human health and ecological risk assessments as described in Section 7.2. The data gaps presented below include both physical and chemical sampling requirements. Physical data gaps relate to non-chemical aspects of the CSM, including hydrological and hydrogeological data gaps. Chemical data gaps are identified as relate to the COPCs for the Dump identified in Section 4.1 and summarized below:

- VOCs

- SVOCs (including PAHs)

- PCBs

- pesticides

- dioxins/furans
- explosives (nitroaromatics and nitramines)
- metals
- cyanide

These constituents include the Priority Toxic Pollutants listed in Appendix A GWQS (GEPA, 2002), as well as hazardous constituents associated with pyrolytic oil generated by landfill or tire fires.

Data gaps relating to landfill gas monitoring are not described in this report. A quantitative model and report on landfill gas generation for the dump is being prepared under separate cover for the EBS report submittal.

7.2.1 Leachate

Leaching of contaminants from refuse is usually the contaminant release mechanism of greatest concern at landfills (U.S. EPA, 1991), therefore a detailed analysis of leachate quantity and quality is critical for the evaluation of contaminant fate and transport and the identification of potential chemicals of concern in other environmental media. The available data for leachate identify total coliforms, indicator bacteria (*E. coli*, *Enterrococci*), nutrients, cyanide, metals, phenolic compounds, a pesticide (p-dichlorobenzene), and selected organic solvents as being potentially elevated in the leachate. Available leachate data are of questionable usability due to the age of the data, the elevated reporting limits (compared to screening levels) fore some constituents, uncertainties in sampling locations and methods, unidentified analytical methods or laboratories, and missing QA/QC information. In addition to the uncertainties relating to leachate chemistry, quantitative leachate flow data have not been collected.

In order to fill the identified data gaps, leachate discharge monitoring and sampling should be performed at all identified seeps at least twice (once during the wet season and once during the dry season). Leachate discharge from permanent leachate seeps should be measured by installing a weir or similar device in the leachate channel. Leachate samples should be collected concurrently with flow measurement to facilitate mass loading calculations for constituents being transported in the landfill leachate. Leachate samples should be analyzed at a minimum for the COPCs for the Dump identified in Section 4.1.

Leachate samples may also be analyzed for the one or more of the following parameters to provide data for leachate collection and treatment system design:

- BOD;
- COD;
- pH;
- TDS;

- TSS;
- oil and grease;
- TOC;
- chlorides;
- nitrate;
- nitrite;
- ammonia;
- phosphorus (total and ortho-phosphate);
- sulfides; and
- bacteria.

7.2.2 Soil and Geology

Existing environmental data for soil were not identified during the environmental data review. Elevated levels of chemical constituents in soil may result from direct contact with hazardous wastes disposed at the Dump, airborne transportation of hazardous constituents from the Dump, or direct contact between soil and leachate as leachate discharges around the perimeter of the dump and flows over the soil or from the infiltration of leachate into the soil. Soil data are required to refine the CSM and provide data for use in the Ecological and Human Health Risk Assessments.

To fill these data gaps, a one-time soil sampling event should be performed where soil samples are collected from shallow borings and/or test pits in or adjacent to each of the leachate seeps (outside of the limits of the refuse). Soil borings and/or test pits completed for the sampling should be monitored and logged in order to refine the CSM for subsurface conditions and to evaluate the thickness of saprolite and alluvium overlying the volcanic rock between the Dump toe and the Lonfit River. To assess the background levels, soil samples should also be collected from one or more areas outside the limits of the waste and the potential influence of leachate and airborne transport of hazardous constituents, if practical. Soil samples (including background samples) should be analyzed for the COPCs for the Dump identified in Section 4.1.

These analyses include Priority Toxic Pollutants listed in Appendix A GWQS (GEPA, 2002), as well as hazardous constituents associated with pyrolytic oil generated by landfill or tire fires.

7.2.3 Groundwater

Existing groundwater measurements and chemistry data are not sufficient to rigorously evaluate the potential impacts of leachate on groundwater near the Dump. The available groundwater data for sampling locations located downgradient of the Dump indicate that the Dump may be contributing to elevated heavy metals and nutrient concentrations in shallow groundwater. However, existing groundwater data are insufficient to evaluate the occurrence and quality of groundwater in the volcanic rocks underlying the Dump and groundwater flow direction(s) and gradient(s) or velocity in perched and deeper groundwater zones. The utility of the available groundwater data is also limited by the age of the data, the elevated reporting limits (compared to screening levels), uncertainties in sampling locations and methods, unidentified analytical methods or laboratories, and missing QA/QC information. As the screened intervals for historical monitoring wells are unknown, the available groundwater data do not identify whether contaminants potentially generated at the Dump are traveling through the near surface or deeper (volcanic) geologic units or at all. The available groundwater data do not sufficiently characterize the nature and extent of potential increases in landfill leachate-associated chemical constituents relative to background conditions in groundwater. The locations and numbers of current domestic groundwater users near the Dump and the hydrogeology between the Dump and areas of domestic wells have not been identified to evaluate the potential for human exposure to leachate-impacted groundwater.

Due to the limited number of existing monitoring wells that can be located, the lack of boring logs and construction details (i.e., well depth and screened interval) for the existing wells, it is recommended that a video camera and downhole geophysical survey is conducted on existing wells without construction details and/or geologic logs. In addition, a minimum of eight additional monitoring wells should be installed at the site and sampled in conjunction with selected existing monitoring wells. The recommended locations include three new shallow monitoring wells and two deeper wells between and parallel to the southern boundary of the dump and the Lonfit River, and three new monitoring wells north-northeast of the Dump and south-southwest of the Adelup-Pago fault. The downgradient wells will assist in the evaluation of shallow groundwater flow and characteristics between the Dump and the river. The two deeper wells should be adjacent to shallow wells with known or suspected contaminated groundwater to assess vertical contaminant migration and gradients. The three new monitoring wells north of the Dump will allow for calculation of groundwater flow direction and gradient to the north of the Dump and thereby address background concentrations and concerns for potential migration of leachate-impacted groundwater into the NGL aquifer north of the fault. Confirmation of groundwater flow direction to the north of the Dump is critical for evaluating potential human exposure via groundwater, as described above. The new monitoring wells may also be incorporated in the Groundwater Monitoring Program required as part of the application for consent of continued operations and post-closure requirements for the Dump (URS, 2004).

Each of the new shallow monitoring wells should be screened in the first water-bearing zone encountered in the borehole. In order to evaluate the vertical extent of contamination (if present) and the groundwater flow gradient it is recommended that the two deeper monitoring wells located between the Dump and the Lonfit River be geologically logged in detail and downhole geophysical surveys conducted to assess the presence and lateral continuity of deeper groundwater. Borings for the shallow monitoring wells to be installed between the Dump and the river should be extended to the top of the alluvium/volcanics interface to determine the thickness of alluvium/saprolite adjacent to the Dump.

The new monitoring wells should be sampled in conjunction with accessible, existing monitoring wells at least twice (once during the dry season and once during the wet season). Groundwater samples should be analyzed at a minimum for the COPCs for the Dump (Section 4.1) and TOC.

Water level measurements in the wells should be collected on a monthly or quarterly basis for a period of one year to assess seasonal water level fluctuations and potential changes in groundwater flow direction. Slug or pumping tests should be performed in the wells to evaluate hydraulic conductivity and help assess groundwater flows and velocity near the Dump. Representative, undisturbed samples of the soils and rock should be laboratory tested for physical parameters including grain size, moisture content, total and effective porosity, and horizontal and vertical hydraulic conductivity.

To evaluate the potential for groundwater to pose a health risk to human populations near the Dump, the extent of any groundwater plumes must be identified and the relation and movement of the plumes to any existing groundwater domestic wells must be identified. As part of this evaluation, a survey of any existing domestic uses of groundwater should be performed. Well construction details should be compiled and groundwater levels and total depths should be collected for accessible wells. The hydrogeology between the Dump and areas of domestic wells needs to be assessed to evaluate whether there is a potential for contaminant migration to the groundwater zones that supply the domestic wells.

7.2.4 Surface Water

The existing analytical data set for surface water in the Lonfit River suggests that the Ordot Dump may be contributing to increased metals, nutrient, and COD concentrations in the Lonfit River. As described above for leachate, the available surface water data are of questionable usability due to the age of the data, the elevated reporting limits (compared to screening levels), uncertainties in sampling locations and methods, unidentified analytical methods or laboratories, and missing QA/QC information. Because analytical results for surface water are presented without accompanying river discharge measurements, mass loading calculations can not be performed to assess the influence of dilution from surface water or discharges from groundwater on chemical concentrations in the Lonfit River. Adequate background water quality data is also necessary.

In order to further evaluate the current conditions in the river and impacts to water quality that may be occurring as a result of leachate discharge, discharge monitoring and additional water quality sampling are recommended at monitoring locations upstream, adjacent, and downstream of the Dump. Monitoring locations upstream of the dump will also be used in the human health and ecological risk assessments to evaluate background conditions.

Discharge monitoring should be completed to quantify input to the Lonfit River adjacent to and downgradient of the Dump and to evaluate gaining or losing reaches of the river during different seasons (wet and dry). Discharge monitoring should be performed either by direct measurement, the establishment of gaging stations, or the development of rating curves for fixed measuring locations. Discharge measurements should be collected both upstream and downstream of influence from the Dump, at a minimum, and should be coordinated with leachate seep flow and groundwater level measurements to provide a more comprehensive data set to evaluate the relative contribution of surface water versus groundwater discharges to the Lonfit River adjacent to the site.

Surface water sampling for chemical analysis should be performed at least twice (once during the wet season and once during the dry season) and should be coordinated with the discharge measurements described above. The coupling of discharge and water chemistry data will facilitate mass-loading calculations to help assess the relative contribution of the Dump to the loads (concentrations) of chemical constituents in the Lonfit River. Surface water samples should be analyzed at a minimum for the COPCs for the Dump identified in Section 4.1.

7.2.5 Sediment

The historical sediment data indicate potentially elevated concentrations of selected metals, SVOCs (phthalates and PAHs) and one pesticide (dieldrin). The existing data set for sediment analytical results is limited to only one sampling event in 1982. Results from the 1982 sampling were mostly inconclusive due to poor comparability between primary samples and field duplicates and other QC related issues, such as blank contamination. Relative abundance of sediment in the Lonfit River and associated floodplain and the depositional environments within the Lonfit River have not been described. As such, the available data for sediment do not sufficiently characterize current conditions and potential impacts from leachate.

In order to address environmental data gaps for sediment, sediment samples should be collected from the Lonfit River at locations upstream of, adjacent to, and downstream of the Dump. Monitoring locations upstream of the dump will also be used in the human health and ecological risk assessments to evaluate background conditions. During the sampling effort, total sediment thickness should be measured and channel profiles should be obtained to assess sediment distribution and scour/deposition areas. Samples should be collected from the top 4 inches of sediment, as described in Section 7.1. The Lonfit River sediment samples will help to evaluate changes in chemical characteristics of river sediment potentially resulting from leachate and help to assess the potential for ecological and human exposures. Sediment samples should be analyzed, at a minimum, for the COPCs for the Dump (Section 4.1) and TOC.

7.2.6 Biota

Existing environmental data for biota were not identified during the environmental data review. Data needs related to biota include the identification of resident species, especially those species which are ecologically important, endangered/threatened, have the potential for bioaccumulation or biomagnification of toxins, or used a food source for human consumption. Biological survey data are needed both for ecological and human health risk assessments. If species are identified that fit these categories, sampling and analysis of biota for hazardous constituents potentially associated with the Dump may be required to complete the risk assessments.

To fulfill these data gaps, existing surveys (such as the flora and fauna evaluation being prepared for the EBS) should be reviewed or field surveys should be conducted to determine the resident aquatic and terrestrial species near the Dump. After the resident species have been identified, the need for sampling and analysis of aquatic and terrestrial biota will be addressed during the development of the RI work plan.

7.3 SAMPLE QUANTITATION LIMIT REQUIREMENTS

The analytical methods used to assess chemical concentration must have adequate SQLs. SQLs are used in risk assessment data evaluations because they "take into account sample characteristics, sample preparation, and analytical adjustments" (U.S. EPA, 1989), and they are considered to be the most relevant quantitation limits for evaluating non-detected chemicals.

In order to meet risk assessment requirements, SQLs must be below the lowest screening value of the chemical based on applicable regulatory and guidance cleanup levels for the specific analyte and environmental media. Human and ecological risk assessments use different screening levels. If a chemical is not detected in a sample, it could be present at a concentration just below the reported SQL, or it may not be present in the sample at all. If the SQL is below the screening value, the resulting data set provides the risk assessor with a higher degree of certainty in identifying chemicals that might present a health risk. Generally, SQLs should be at least an order of magnitude below the relevant screening level, if at all possible. The following screening levels are most likely to be used for the Ordot Dump:

Human Health- Soil

- U.S. EPA Region 9 PRGs (U.S. EPA Region 9, 2004).

Human Health – Surface Water (non-drinking)

- Guam Numerical Criteria for Ingestion of Freshwater Organisms (GEPA, 2002); and
- U.S. EPA National Recommended Water Quality Criteria for Ingestion of Freshwater Organisms (U.S. EPA, 2002).

Human Health – Groundwater (used for drinking)

- GWQS (both primary and secondary) (GEPA, 2002);
- U.S. EPA Primary and Secondary Maximum Contaminant Levels (MCLs, U.S. EPA, 2003); and
- U.S. EPA Region 9 PRGs (U.S. EPA Region 9, 2004).

Ecological – Surface Water

- Guam Numerical Criteria for Freshwater Organisms (GEPA, 2002);
- U.S. EPA National Recommended Water Quality Criteria for freshwater organisms (U.S. EPA, 2002); and
- acute and chronic toxicity data obtained from the peer reviewed scientific literature.

Ecological – Sediment

- Toxicity Reference Values (TRVs) obtained from various peer reviewed sources in the United States and Canada (specifically the US National Oceanic and Atmospheric Administration and Environment Canada).

The specific analytical methods to be used for the RI will be identified through the development of data quality objectives (DQOs) as described in *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (U.S. EPA, 1998) and *Guidance for the Data Quality Objectives Process* (U.S. EPA, 2000). The DQO process will result in the preparation of a sampling and analysis plan (SAP) which consists of a field sampling plan (FSP) and a quality assurance project plan (QAPP). The QAPP will address the target SQLs by analysis for each medium to be sampled.

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Table 1
Borings and Wells in the Ordot Dump Area
Ordot Dump
Territory of Guam

Report	Boring/Well ID	Approximate Ground Elevation (feet above MSL)	Well/Boring Depth (feet)	Screened Interval (feet bgs)	Depth to Water (feet bgs)	Approximate Water Table Elevation (feet above MSL)	Field Located
GTA 1970							
	1	164	21	NA	NA	NA	No
	2	176	16	NA	NA	NA	No
	3	192	14	NA	NA	NA	No
	4	139	17	NA	NA	NA	No
	5	230	27	NA	NA	NA	No
	6	229	20	NA	NA	NA	No
	7	225	15	NA	NA	NA	No
	8	234	40	NA	NA	NA	No
WERI 1989							
	Well 1	50	NA	NA	NA	NA	No
	Well 2	50	NA	NA	NA	NA	No
	Well 3 (GW-6)	50	NA	NA	10	40	Yes
	Well 4	60	26	NA	15	45	No
	Well 5	60	NA	NA	NA	NA	No
	Well 6	60	NA	NA	NA	NA	No
	Well 7	70	NA	NA	NA	NA	No
	Well 8	70	NA	NA	10	40	No
	Well 9 (GW-4)	250	58	NA	20	45	Yes
GEPA (URS) 1992							
	MW-01	48	55	NA	28	21	Yes
	MW-02	159	211	NA	133	26	No
USGS 1992							
	OMW-1	271	200	15 - 185	18	253	No
	OMW-2	273	202	32 - 202	12	261	No

Notes:
bgs - below ground surface
MSL - mean sea level
NA - not available or not applicable

Table 2
Summary of Reports Reviewed
Ordot Dump
Territory of Guam

Report Date	Author	Reprt Title	Matrix	Sampling Dates	Number of Samples	Locations	Sampling Method	Analyses	Analytical Laboratory	QA/QC	Other
Undated	GEPA	Data tables provided to D&A (1974-1977 Data)	SW	1974-1977		1 location upstream, 2 locations below dump	NA	DO, DO sat, FC, NO2, NO3, pH, P, Temp, TSS	Unkown	NA	
			Leachate			1 location					
May 20, 1983	Black and Veatch	Remedial Investigation, Insular Territory Hazardous Waste Sites, Draft Report	SW	November 10-12, 1982	2	SW-1, SW-2	NA	Priority Pollutant Organics and Inorganics	Mead Compu Chem (RTP, NC) and U.S. Testing (Hoboken, NJ)	Field duplicates, field blanks	Sampling plan reviewed and approved by EPA / GEPA.
			Leachate		4	SW-5, SW-7, SW-9, SW-10					
			Sed		6	SS-1, SS-3, SS-5, SS-7, SS-9, SS-11					
			GW		1	A-11					
October 7, 1987	CDM	Draft Initial Site Characterization Report, Ordot Landfill, Island of Guam	SW	March 10-16, 1987	2	SW-1, SW-2	Grab samples	Volatiles, semi-volatiles, pesticides, PCBs, inorganics	Unknown	Field duplicates, field blanks. Report also identifies basic field QA procedures (equipment decontamination, sample collection, chain-of-custody, etc.)	Work Plan, Sampling and Analysis Plan, and Quality Assurance Project Plan were prepared, however not available for review. Leachate sample SW-7 (pond) was collected from a hand-excavated ditch in the pond after the ditch had filled with water.
			Leachate		3	SW-10, SW-7, SW-5	Grab samples	Inorganics, pesticides, PCBs			
			GW		5	GW-01 (A-11), GW-03 (A-12), GW-04 (upgradient well), GW-05 (downgradient well), GW-06 (well 4)	In-place pumps (A-11 and A-12); Teflon bailers (other wells)	Volatiles, semi-volatiles, pesticides, PCBs, inorganics			
September 1993	Juan C. Tenorio & Associates, Inc.	Feasibility Study for the Expansion of Ordot Sanitary Landfill, Municipality of Pago-Ordot, Territory of Guam, Volume II	NA	NA	NA	NA	NA	NA	NA	NA	Refers to WERI TR-72 for groundwater quality
Undated	GEPA	Data tables provided to D&A (1997-1998 data)	SW	1997 - 1998		1 location above, 1 location below dump	Unknown	Temp, DO, pH, sal, Ent., E. Coli, turb, TSS, TDS, TS, NO2, NO3, P-T, o-P, cond	Unknown	NA	
			Leachate			1 location					
July 8, 1988	CH2MHill / Black and Veatch	Agency Review Draft, Risk Assessment, Ordot Landfill Site, Guam	NA	NA	NA	NA	NA	NA	NA	NA	Refers to CDM 1987 and B&V 1983
April 10, 1998	Unitek Environmental-Guam	Surface Water Sampling Report for March 1998, Ordot Landfill, Ordot, Guam	SW	March 20, 1998	3	SW-1, SW-2, SW-0	Bailers	4,4'-DDT, PCBs, TRPH, Total Metals (Al, As, Ba, Cd, Ca, Cr, Fe, Pb, Mg, Mn, K, Na, Zn), BOD, COD, NO2+NO3, NO3, TKN, pH, P-T, TSS, TDS, TOC	Environmental Laboratory of the Pacific (ELP) (Honolulu, HI)	EPA Level III data package from laboratory	
			Leachate		2	SW-10, SW-5					
August 20, 1998	Unitek Environmental-Guam	Surface Water Sampling Report for July 1998, Ordot Landfill, Ordot, Guam	SW	July 10, 1998	3	SW-1, SW-2, SW-0	Pre-cleaned, disposable plastic jugs	Total Metals (Al, As, Ba, Cd, Ca, Cr, Fe, Pb, Mg, Mn, K, Na, Zn), BOD, COD, NO2+NO3, NO3, TKN, pH, P-T, TSS, TDS, TOC, NH3, temp	Environmental Laboratory of the Pacific (ELP) (Honolulu, HI)	EPA Level III data package from laboratory	4,4'-DDT, PCBs, and TRPH analyses discontinued per June 2, 1998 letter from USEPA Region 9
			Leachate		2	SW-10, SW-5					
September 8, 1998	Unitek Environmental-Guam	Surface Water Sampling Report for August 1998, Ordot Landfill, Ordot, Guam	SW	August 17, 1998	3	SW-1, SW-2, SW-0	Pre-cleaned, disposable plastic jugs	Total Metals (Al, As, Ba, Cd, Ca, Cr, Fe, Pb, Mg, Mn, K, Na, Zn), BOD, COD, NO2+NO3, NO3, TKN, pH, P-T, TSS, TDS, TOC, NH3, temp	Environmental Laboratory of the Pacific (ELP) (Honolulu, HI)	EPA Level III data package from laboratory	
			Leachate		2	SW-10, SW-5					
December 21, 1998	Unitek Environmental-Guam	Surface Water Sampling Report for November 1998, Ordot Landfill, Ordot, Guam	SW	November 23, 1998	3	SW-1, SW-2, SW-0	Pre-cleaned, disposable plastic jugs	Total Metals (Al, As, Ba, Cd, Ca, Cr, Fe, Pb, Mg, Mn, K, Na, Zn), BOD, COD, NO2+NO3, NO3, TKN, pH, P-T, TSS, TDS, TOC, NH3	APCL (Chino, CA)	Summary data package from laboratory (no laboratory QC info)	
			Leachate		2	SW-10, SW-5					
February 24, 1999	Unitek Environmental-Guam	Letter to Mr. Jesse Cruz (GEPA) re: Ordot Sampling	SW	December 1998, January 1999	6	SW-1, SW-2, SW-0	NA	Total Metals (Al, As, Ba, Cd, Ca, Cr, Fe, Pb, Mg, Mn, K, Na, Zn), BOD, COD, NO2+NO3, NO3, TKN, pH, P-T, TSS, TDS, TOC, NH3, temp	NA	NA	Tabulated analytical results only
			Leachate		4	SW-10, SW-5					
November 1989	WERI	TR-72 The Occurence of Certain Pesticides in Ground and Surface Waters Assocìacted with Ordot Landfill in the Pago River Basin, Guam, Mariana Islands	GW	Monthly, June 1989 - November 1989	5	well 3, 4, 8, 9, well A-11	Bladder pump	Chlorinated pesticides, nitrogen-containing and phosphorus-containing pesticides, conductivity	Unknown	Unknown	
			SW		1	SW-0	Unknown				
			Leachate		1	SW-10	Unknown				

Table 2
Summary of Reports Reviewed
Ordot Dump
Territory of Guam

Report Date	Author	Report Title	Matrix	Sampling Dates	Number of Samples	Locations	Sampling Method	Analyses	Analytical Laboratory	QA/QC	Other
September 2002	USEPA	Second Five-year Review Report, Ordot Landfill Site, Territory of Guam.	NA	NA	NA	NA	NA	NA	NA	NA	Tabulated existing analytical results from: Black & Veatch 1983 CDM 1985 WERI 1986-1987 CDM 1987 WERI 1989 WERI 1990-1994 URS Consultants 1992 USEPA Region IX and GEPA 1997 Unitek February 1998 Unitek April 1998 Unitek October 1998
June 2003	USGS	Impact of Ordot Dump on Water Quality of Lonfit River Basin in Central Guam	Leachate	December 2002	2	Unknown (locations on southern face)	Unknown	All priority pollutants listed under Guam Water Quality Standards (GEPA 2001)	Unknown (off-island lab)	NA	Analytical methods are specified in the report. Pore water metals results not available.
			SW	Monthly, October 2002 - May 2003	Unknown	5 locations (unidentified) sampled monthly for eight months		Tot Col, E. Coli, Ent., NOx, NH4, ortho-P, dissolved metals (Ag, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Zn)	Unknown		
			Soil Pore Water		Variable *	5 locations (unidentified) sampled at 3 depths monthly for eight months	Suction cup lysimeters	Tot Col, E. Coli, Ent., NOx, NH4, ortho-P, total metals (Ag, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Zn)			

Notes:
CDM - Camp Dresser & McKee, Inc.
D&A - Duenas & Associates
GEPA - Guam Environmental Protection Agency
GW - groundwater
NA - not available
SW - surface water
USEPA - U.S. Environmental Protection Agency
USGS - U.S. Geological Survey
Variable * - Number of analses varied by method. 98 samples analyzed bacterial counts, 21 samples analyzed for nutrients. Metals data not available.
WERI - Water and Energy Research Institute

Analyses

BOD - biological oxygen demand (5-day)	P - phosphorus
COD - chemical oxygen demand	PCBs - polychlorinated biphenyls
cond - conductivity	P-T - total phosphorus
DO - dissolved oxygen	sal - salinity
DO sat - dissolved oxygen saturation	TDS - total dissolved solids
Ent - Enterococci	temp - temperature
FC - fecal coliform	TKN - total kjeldahl nitrogen
NH3 - ammonia	TOC - total organic carbon
NO2 - nitrite	TRPH - total recoverable petroleum hydrocarbons
NO3 - nitrate	TS - total solids
NOx - nitrate / nitrite	TSS - total suspended solids
o-P - orthophosphate	turb - turbidity

Table 3
Surface Water and Leachate Analytical Results
Ordot Dump
Territory of Guam

	Analyte	Units		SW-0 Confluence of SW-10 and Lonfit River	SW-1 Lonfit River Upstream	SW-2 Lonfit River Downstream	SW-5 Leachate Stream South	SW-7 Leachate Pond South	SW-9 Leachate Stream Southeast	SW-10 Leachate Stream West	Guam Water Quality Standards (GWQS)
				Sample Identification and Location							
Metals	aluminum	mg/L	n	8	11	9	8	2	1	10	1
			min - max	0.0786 J - 0.38	0.0196 J - 2.3	0.0477 J - 0.56	0.0436 J - 4.58	0.358 - 3.583	2.56 - 2.56	0.0596 J - 1.24	
	antimony	mg/L	n	1	3	2	3	2	1	3	4.3
			min - max	0.0202 U	0.020 U	0.020 U	0.020 U	0.020 U	ND	0.020 U	
	arsenic	mg/L	n	6	18	8	18	2	2	10	0.150
			min - max	0.005 U - 0.0025 J	0.000106 - 0.0137	0.0000092 - 0.0025 J	0.0000154 - 0.0091	ND - 0.01	ND - 0.0000157	0.0015 J - 0.012	
	barium	mg/L	n	7	19	9	21	2	2	11	NE
			min - max	0.0624 - 0.16	0.000625 - 0.207	0.0000625 - 0.025	0.0004494 - 0.273	0.24 - 0.307	0.0000625 - 0.199	0.113 - 0.44	
	beryllium	mg/L	n	1	3	2	3	2	1	3	NE
			min - max	0.0002 U	0.0002 U - 0.005 U	0.0002 U - 0.0005 U	0.0002 U - 0.011 [a]	0.0002 U - 0.005 U	0.005 U	0.0002 U - 0.005 U	
	boron	mg/L	n	0	1	1	1	1	1	1	NE
			min - max		0.1 U	0.1 U	0.458	4.98	0.96	1.02	
	cadmium	mg/L	n	6	41	19	18	2	1	31	0.0011 (H)
			min - max	0.001 U - 0.0013 U	0.0000133 - 0.00889	ND - 0.0000128	ND - 0.00769	ND	ND	0.002 U	
	calcium	mg/L	n	9	10	9	10	1	0	10	NE
			min - max	32 - 120	32 - 44	31 - 55	7.1 - 83	85.87		77 - 130	
	chromium (total)	mg/L	n	7	41	20	19	2	2	34	0.21 (H)
			min - max	0.00082 J - 0.0026 J	0.00006427 -	0.0003 U - 0.0023 J	0.000092 - 0.0278	ND - 0.011	ND - 0.000013	0.0011 - 0.005	
	cobalt	mg/L	n	1	3	2	3	2	1	3	NE
			min - max	0.0048	0.0021 U - 0.0068 U	ND - 0.0068 U	0.0068 U - 0.005	ND - 0.013	ND	0.0068 U - 0.004	
	copper	mg/L	n	1	26	13	3	2	1	28	0.012 (H)
			min - max	0.0131	0.0003 U - 0.084	0.0003 U - 0.002	0.01 - 0.0105	0.031 - 0.159	0.086	0.0017 - 0.101	
	iron	mg/L	n	9	33	21	10	2	1	36	3
			min - max	0.14 - 2.5	0.001 - 1.858	0.0047 - 1.1	0.1 U - 4.68	9.66 - 39.26	6.36	0.012 - 14	
	lead	mg/L	n	7	42	20	19	2	2	34	0.0032 (H)
			min - max	0.001 - 0.013	0.0003 U - 0.0833	0.0000815 - 0.008 [a]	0.0000463 - 0.075	0.018 - 0.024	0.0000287 - 0.01	0.0003 U - 0.006	
	magnesium	mg/L	n	9	10	9	10	1	0	10	NE
			min - max	6.5 - 32	6.5 - 9.3	6.9 - 11	44.3 - 73	60.29		19.7 - 37	
	manganese	mg/L	n	9	33	21	11	2	1	36	NE
			min - max	0.03 - 1.1	0.0038 - 0.122	0.005 - 0.88	0.046 - 0.636	0.772 - 3.161	1.28	0.0833 - 1.113	
	mercury	mg/L	n	0	35	15	12	2	2	27	0.000012
			min - max		0.0000105 - 0.077	0.0000018 - 0.0062	0.000014 - 0.0034	0.0002 U - 0.0328	0.0000208 -	0.0002 U - 0.0029	
	nickel	mg/L	n	1	26	14	3	2	1	28	0.052 (H)
			min - max	0.023	0.0006 U - 0.023 U	0.0006 U - 0.051	0.004 U [a] - 0.0178	0.004 U - 0.023 U	0.004 U	0.0027 - 0.0285	
	potassium	mg/L	n	9	10	9	10	1	0	10	NE
			min - max	1.7 - 46.9	0.948 - 1.8	0.948 - 3.3	14.7 - 92	22.22		10.9 - 63	
	selenium	mg/L	n	1	13	3	13	2	2	3	0.005
			min - max	0.125 U	0.0000237 - 0.00677	0.0000178 - ND	0.000022 - 0.00606	ND - 0.025 U	0.0000146 - ND	ND - 0.005 U	
	silver	mg/L	n	1	36	15	13	2	3	28	0.0041 (H)
			min - max	0.0019 U	0.00000687 - 0.00952	0.0000023 - 0.013	0.00000392 - 0.00952	0.0051 U - 0.010 U	0.000016 - 0.01 U	0.0001 U - 0.01 U	
	sodium	mg/L	n	9	10	9	10	1	0	10	NE
			min - max	19 - 250	14.2 - 24	19.18 - 33	126.6 - 340	119.8		92.87 - 280	
	thallium	mg/L	n	1	3	2	3	2	2	3	0.0063
			min - max	0.16 U	0.01 U - 0.16 U	0.01 U	0.01 U - 0.16 U	0.01 U	0.01 U	0.01 U - 0.16 U	
	tin	mg/L	n	0	2	2	2	2	2	2	NE
			min - max		0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	
	vanadium	mg/L	n	1	3	2	3	2	1	3	NE
			min - max	0.0032 J	ND - 0.0065 J	ND - 0.0036	0.0031 - 0.009	ND - 0.012	ND	0.0031 - 0.0056 J	
	zinc	mg/L	n	8	32	19	10	2	1	35	0.11 (H)
			min - max	0.0059 - 0.062	0.0001 U - 0.058	0.0001 U - 0.091 [a]	0.0064 - 0.14	0.073 - 0.14	0.051	0.0014 - 0.072	

Table 3
Surface Water and Leachate Analytical Results
Ordot Dump
Territory of Guam

	Analyte	Units		Sample Identification and Location							Guam Water Quality Standards (GWQS)
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 Lonfit River Upstream	SW-2 Lonfit River Downstream	SW-5 Leachate Stream South	SW-7 Leachate Pond South	SW-9 Leachate Stream Southeast	SW-10 Leachate Stream West	
VOCs	acetone	µg/L	n	0	2	2	2	2	1	2	NE
			min - max		5 U - 2 JB	5 U - 2 JB	5 U - 5 JB	5 U - 8 JB	5 U	5 U - 10 U	
	2-butanone	µg/L	n	0	2	2	2	2	2	2	NE
			min - max		5 U - 6 JB	5 U - 8 JB	5 U - 12 B	5 U - 10 U	5 U - 10 U	5 U - 10 U	
	carbon disulfide	µg/L	n	0	2	2	2	2	2	2	NE
			min - max		5 U	5 U	5 U	5 U - 1 J	5 U	5 U	
	chlorobenzene	µg/L	n	0	1	1	1	1	1	1	21000
			min - max		5 U	5 U	5 U	3 J	5 U	5 U	
	chloroethane	µg/L	n	0	1	1	1	1	1	1	NE
			min - max		5 U	5 U	5 U	5 U	J	5 U	
	1,1-dichloroethane	µg/L	n	0	1	1	1	1	1	1	NE
			min - max		5 U	5 U	5 U	5 U	J	5 U	
	ethylbenzene	µg/L	n	0	1	1	1	1	1	1	29000
			min - max		5 U	5 U	5 U	5 U	5 U	5 U	
	2-hexanone	µg/L	n	0	1	1	1	1	1	1	NE
			min - max		5 U	5 U	5 U	5 U	5 U	5 U	
	4-methyl-2-pentanone	µg/L	n	0	1	1	1	1	1	1	NE
			min - max		5 U	5 U	5 U	5 U	5 U	5 U	
	methylene chloride	µg/L	n	0	2	2	2	2	2	2	1600
			min - max		5 U	5 U - 2JB	5 U	5 U	5 U	5 U	
	styrene	µg/L	n	0	2	2	2	2	2	2	NE
			min - max		5 U - J	5 U	5 U	5 U	5 U	5 U	
	toluene	µg/L	n	0	1	1	1	1	1	1	200000
			min - max		1 JB	1 JB	1 JB	5 U	5 U	5 U	
	vinyl acetate	µg/L	n	0	1	1	1	1	1	1	NE
			min - max		5 U	5 U	5 U	5 U	5 U	5 U	
	xylenes	µg/L	n	0	1	1	1	1	1	1	NE
			min - max		5 U	5 U	5 U	5 U	5 U	5 U	
SVOCs	diethyl phthalate	µg/L	n	0	1	1	1	1	1	1	120000
			min - max		20 U	20 U	20 U	20 U	J	20 U	
	bis(2-ethylhexyl) phthalate	µg/L	n	0	1	1	1	1	1	1	5.9
			min - max		10 U	10 U	10 U	10 U	10 U	3 JB	
	phenol	µg/L	n	0	1	1	1	1	1	1	4600000
			min - max		10 U	10 U	10 U	10 U	10 U	3 J	
Pesticides	aldrin	µg/L	n	6	0	0	0	0	0	6	0.00014
			min - max	0.2 U						0.2 U	
	BHC-alpha	µg/L	n	6	0	0	0	0	0	6	0.013
			min - max	0.16 U						0.16 U	
	BHC-beta	µg/L	n	6	0	0	0	0	0	6	0.046
			min - max	0.4 U						0.4 U	
	BHC-delta	µg/L	n	6	0	0	0	0	0	6	NE
			min - max	0.2 U						0.2 U	
	BHC-gamma	µg/L	n	6	0	0	0	0	0	6	0.063
			min - max	0.2 U						0.2 U	
	chlordane-alpha	µg/L	n	6	0	0	0	0	0	6	0.0022 [b]
			min - max	0.1 U						0.1 U	
	chlordane-gamma	µg/L	n	6	0	0	0	0	0	6	0.0022 [b]
			min - max	0.1 U						0.1 U	
	4,4'-DDD	µg/L	n	6	0	0	0	0	0	6	0.00084
			min - max	0.4 U						0.4 U	

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	Analyte	Units		SW-0 Confluence of SW-10 and Lonfit River	SW-1 Lonfit River Upstream	SW-2 Lonfit River Downstream	SW-5 Leachate Stream South	SW-7 Leachate Pond South	SW-9 Leachate Stream Southeast	SW-10 Leachate Stream West	Guam Water Quality Standards (GWQS)
				Sample Identification and Location							
Pesticides & PCBs	4,4'-DDE	µg/L	n	6	0	0	0	0	0	6	0.00059
			min - max	0.2 U						0.2 U	
	4,4'-DDT	µg/L	n	8	2	2	2	0	0	8	0.00059
			min - max	0.1 U - 0.4 U	0.1 U	0.1 U	0.1 U			0.1 U - 0.4 U	
	diazinon	µg/L	n	6	0	0	0	0	0	6	NE
			min - max	0.4 U						0.4 U	
	dieldrin	µg/L	n	6	1	1	1	1	1	7	0.00014
			min - max	0.2 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U (0.21)	0.1 U - 0.2U	
	endosulfan sulfate	µg/L	n	0	1	1	1	1	1	1	240
			min - max		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U (0.35)	0.1 U	
	endrin	µg/L	n	6	0	0	0	0	0	6	0.036
			min - max	0.2 U						0.2 U	
	ethion	µg/L	n	6	0	0	0	0	0	6	NE
			min - max	0.4 U						0.4 U	
	heptachlor	µg/L	n	6	0	0	0	0	0	6	0.00021
			min - max	0.24 U						0.24 U	
	malathion	µg/L	n	6	0	0	0	0	0	6	NE
			min - max	4 U						4 U	
	methoxychlor	µg/L	n	6	0	0	0	0	0	6	NE
			min - max	0.2 U						0.2 U	
	naled	µg/L	n	6	0	0	0	0	0	6	NE
			min - max	2 U						2 U	
	parathion, ethyl	µg/L	n	6	0	0	0	0	0	6	NE
			min - max	2 U						2 U	
	parathion, methyl	µg/L	n	6	0	0	0	0	0	6	NE
			min - max	2 U						2 U	
	PCB-1016	µg/L	n	2	2	2	2	0	0	2	0.00017 [c]
			min - max	1 U	1 U	1 U	1 U			1 U	
	PCB-1221	µg/L	n	2	2	2	2	0	0	2	0.00017 [c]
			min - max	2 U	2 U	2 U	2 U			2 U	
	PCB-1232	µg/L	n	2	2	2	2	0	0	2	0.00017 [c]
			min - max	1 U	1 U	1 U	1 U			1 U	
	PCB-1242	µg/L	n	2	3	3	3	1	1	3	0.00017 [c]
			min - max	1 U	0.1 U - 1 U	0.1 U - 1 U	0.1 U (3.84) - 1 U	0.1 U	0.1 U	0.1 U (1.12) - 1 U	
	PCB-1248	µg/L	n	2	2	2	2	0	0	2	0.00017 [c]
			min - max	1 U	1 U	1 U	1 U			1 U	
	PCB-1254	µg/L	n	2	2	2	2	0	0	2	0.00017 [c]
			min - max	1 U	1 U	1 U	1 U			1 U	
	PCB-1260	µg/L	n	2	2	2	2	0	0	2	0.00017 [c]
			min - max	1 U	1 U	1 U	1 U			1 U	
TRPH		mg/L	n	2	2	2	2	0	0	2	NE
			min - max	1000 U	1000 U	1000 U	1000 U			1000 U	

Table 3
Surface Water and Leachate Analytical Results
Ordot Dump
Territory of Guam

	Analyte	Units		Sample Identification and Location							Guam Water Quality Standards (GWQS)
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 Lonfit River Upstream	SW-2 Lonfit River Downstream	SW-5 Leachate Stream South	SW-7 Leachate Pond South	SW-9 Leachate Stream Southeast	SW-10 Leachate Stream West	
Other Parameters	ammonia	mg/L	n	5	4	3	4	0	0	6	3.08 [d]
			min - max	0.031 - 32.2	0.06 U - 0.3	0.3 - 0.4	0.65 - 27.1			14.3 - 65	
	BOD_5	mg/L	n	8	8	7	7	0	0	8	NE
			min - max	1.6 - 14	0.3 J - 23	1.1 - 5.1	1.2 - 18			4 - 65	
	COD	mg/L	n	6	6	7	8	0	0	8	NE
			min - max	34 - 190	10 U - 40	10 U - 67	56 - 270			25 - 290	
	nitrogen as nitrate	mg/L	n	7	6	8	9	0	0	8	0.2
			min - max	0.15 - 13	0.05 U - 0.32	0.23 - 0.85	1.67 - 19.4			0.07 - 36	
	nitrogen as nitrite	mg/L	n	3	2	5	6	0	0	4	NE
			min - max	0.481 - 0.708		0.042 - 0.77	0.04 - 3.4			0.03 - 0.24	
	nitrogen (total Kjeldahl)	mg/L	n	7	8	6	9	0	0	9	NE
			min - max	6.48 - 63	0.15 U - 0.8	0.68 - 0.84	3 - 9.94			16 - 100	
	pH	std. Units	n	8	10	10	10	1	1	10	6.5 - 9
			min - max	7.4 - 8.1	7 - 8.39	6.85 - 8	6 - 8.15	7.8	7.4	2.75 - 7.4	
	phosphorous (total)	mg/L	n	7	7	6	8	0	0	7	0.05 [e]
			min - max	0.1 U - 0.2	0.01 U - 0.54	0.1 U - 0.77	0.02 J - 0.121			0.09 - 0.54	
	TDS	mg/L	n	9	9	8	9	0	0	9	NE
			min - max	210 - 1100	150 - 240	160 - 350	1000 - 1500			560 - 1400	
	TOC	mg/L	n	9	9	8	9	0	0	9	NE
			min - max	2.1 - 45.3	1 U - 3.2	1 - 3.3	19.9 - 47			19.8 - 80	
	TSS	mg/L	n	9	7	7	8	0	0	8	20
			min - max	1 - 19	1 - 220	1 U - 9	1.6 - 66.5			5.3 - 38	

Notes:

[a] Primary sample analytical result was not confirmed by field duplicate

[b] Standard is for Chlordane

[c] Standard is for total PCBs

[d] GWQS for ammonia is pH-dependent. Value shown is for pH of 7.

[e] Value shown is GWQS for ortho-phosphate

n = number of primary analytical result
min - max = range of lowest detected concentration (or reporting limit if not detected) to maximum detected concentration (or reporting limit if not detecte
B = Constituent was detected in the associated laboratory blanl
GWQS = Guam Water Quality Standards (GEPA 2001). GWQS shown are the most stringent of freshwater CMC/CCC and human health (consumption of organism only) criteri
(H) = GWQS is hardness-dependent. Value shown is for a hardness of 100 mg/L
J = Estimated value
NE = QWQS is not established for this constituent
U = The analyte was not detected at the reporting limit showr

Table 4
Historical Groundwater Analytical Results
Ordot Dump
Territory of Guam

	Analyte	Units		Sample Identification and Location									Screening Level (GWQS or PRG)
				GW-1 Municipal Well A-11 Northeast of Site	GW-3 Municipal Well A-12 Northeast of Site	Well 9 (GW-4) Background Well North	GW-5 Downgradient Well South	Well 3 (GW-6) Downgradient Well South	Well 4 Downgradient Well South	Well 8 Downgradient Well South	MW-01 USEPA Well Northeast of Site	MW-02 USEPA Well Northeast of Site	
Metals	aluminum	µg/L	n	2	1	1	1	1	1	1	0	0	50
			min - max	200 U - 41	45	77	837	831	831	831			
	antimony	µg/L	n	2	1	1	1	1	1	1	0	0	6
			min - max	ND - 20 U	20 U	20 U	20 U	20 U	20 U	20 U			
	arsenic	µg/L	n	2	1	1	1	1	1	1	0	0	50
			min - max	ND - 10 U	10 U	10 U	10 U	10 U	10 U	10 U			
	barium	µg/L	n	2	1	1	1	1	1	1	0	0	2000
			min - max	100 U - 6	5	9	190	15	15	15			
	beryllium	µg/L	n	2	1	1	1	1	1	1	0	0	4
			min - max	0.2 U - 5 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U			
	boron	µg/L	n	1	0	0	0	0	0	0	0	0	7300 (PRG)
			min - max	100 U									
	cadmium	µg/L	n	2	1	1	1	1	1	1	0	0	5
			min - max	ND - 4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U			
	calcium	µg/L	n	1	1	1	1	1	1	1	0	0	NE
			min - max	117,900	113,800	53,930	41,610	85,060	85,060	85,060			
	chromium (total)	µg/L	n	2	1	1	1	1	1	1	0	0	100
			min - max	ND - 3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U			
	cobalt	µg/L	n	2	1	1	1	1	1	1	0	0	73 (PRG)
			min - max	ND - 6.8 U	6.8 U	6.8 U	6.8 U	6.8 U	6.8 U	6.8 U			
	copper	µg/L	n	2	1	1	1	1	1	1	0	0	1300 (Primary) 1000 (Secondary)
			min - max	50 U - 6	10	5.9 U	6	34	34	34			
	iron	µg/L	n	2	1	1	1	1	1	1	0	0	300 (Secondary)
			min - max	50 U - 75	65	124	631	895	895	895			
	lead	µg/L	n	2	1	1	1	1	1	1	0	0	15
			min - max	5 U	5 U	5 U	5 U	5 U (5.9)	5 U (5.9)	5 U (5.9)			
	magnesium	µg/L	n	1	1	1	1	1	1	1	0	0	NE
			min - max	4,151	3,215	7,491	31,210	59,130	59,130	59,130			
	manganese	µg/L	n	2	1	1	1	1	1	1	0	0	50 (Secondary)
			min - max	15 U - 1	4	8	87	92	92	92			
	mercury	µg/L	n	2	1	1	1	1	1	1	0	0	2
			min - max	0.2 U - 5.3	1.06 j	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U			
	nickel	µg/L	n	2	1	1	1	1	1	1	0	0	100
			min - max	23 U - 77	23 U	23 U	32	23 U	23 U	23 U			
	potassium	µg/L	n	1	1	1	1	1	1	1	0	0	NE
			min - max	948 U	948 U	948 U	948 U	948 U	948 U	948 U			
	selenium	µg/L	n	2	1	1	1	1	1	1	0	0	50
			min - max	ND - 5 U	5 U	5 U	5 U	5 U	5 U	5 U			
	silver	µg/L	n	2	1	1	1	1	1	1	0	0	100 (Secondary)
			min - max	5.1 U - 26	5.1 U	5.1 U	5.1 U	5.1 U	5.1 U	5.1 U			
	sodium	µg/L	n	1	1	1	1	1	1	1	0	0	NE
			min - max	11.110	8,674	12,880	38,650	62,130	62,130	62,130			
	thallium	µg/L	n	2	1	1	1	1	1	1	0	0	0.5
			min - max	ND - 10 U	10 U	10 U	10 U	10 U	10 U	10 U			
	tin	µg/L	n	2	1	1	1	1	1	1	0	0	22000 (PRG)
			min - max	ND - 17 U	17 U	17 U	17 U	17 U	17 U	17 U			
	vanadium	µg/L	n	2	1	1	1	1	1	1	0	0	260 (PRG)
			min - max	ND - 3.1 U	3.1 U	3.1 U	3.6	6.9	6.9	6.9			
	zinc	µg/L	n	2	1	1	1	1	1	1	0	0	5000 (Secondary)
			min - max	19 - 44	45	20	137	162	162	162			

Table 4
Historical Groundwater Analytical Results
Ordot Dump
Territory of Guam

	Analyte	Units		Sample Identification and Location									Screening Level (GWQS or PRG)
				GW-1 Municipal Well A-11 Northeast of Site	GW-3 Municipal Well A-12 Northeast of Site	Well 9 (GW-4) Background Well North	GW-5 Downgradient Well South	Well 3 (GW-6) Downgradient Well South	Well 4 Downgradient Well South	Well 8 Downgradient Well South	MW-01 USEPA Well Northeast of Site	MW-02 USEPA Well Northeast of Site	
VOCs	acetone	µg/L	n	2	1	1	1	1	1	1	0	0	610 (PRG)
			min - max	J - 10 U (4JB)	3 JB	3 JB	3 JB	3 JB	3 JB	3 JB			
	2-butanone	µg/L	n	2	1	1	1	1	1	1	0	0	1900 (PRG)
			min - max	5 U - 10 U	10 B	10 U	10 B	9 JB	9 JB	9 JB			
	carbon disulfide	µg/L	n	2	1	1	1	1	1	1	0	0	1000 (PRG)
			min - max	5 U	5 U	5 U	5 U	5 U	5 U	5 U			
	chlorobenzene	µg/L	n	1	1	1	1	1	1	1	0	0	110 (PRG)
			min - max	5 U	5 U	5 U	5 U	5 U	5 U	5 U			
	chloroethane	µg/L	n	1	0	0	0	0	0	0	0	0	4.6 (PRG)
			min - max	5 U									
	chloroform	µg/L	n	0	0	0	0	0	0	0	1	1	100
			min - max								ND	30 C	
	1,1-dichloroethane	µg/L	n	1	0	0	0	0	0	0	0	0	810 (PRG)
			min - max	5 U									
	ethylbenzene	µg/L	n	1	1	1	1	1	1	1	0	0	700
			min - max	5 U	5 U	5 U	5 U	5 U	5 U	5 U			
	2-hexanone	µg/L	n	1	0	0	0	0	0	0	0	0	NE
			min - max	139									
	4-methyl-2-pentanone	µg/L	n	1	0	0	0	0	0	0	0	0	13 (PRG)
			min - max	5 U									
	methylene chloride	µg/L	n	2	1	1	1	1	1	1	0	0	4.3 (PRG)
			min - max	5 U	2 JB	5 U	3 JB	5 U	5 U	5 U			
	styrene	µg/L	n	2	1	1	1	1	1	1	0	0	100
			min - max	5 U	5 U	5 U	5 U	5 U	5 U	5 U			
	toluene	µg/L	n	1	1	1	1	1	1	1	0	0	1000
			min - max	5 U	1 JB	1 JB	5 U	1 JB	1 JB	1 JB			
	vinyl acetate	µg/L	n	1	0	0	0	0	0	0	0	0	410 (PRG)
			min - max	5 U									
	xylenes	µg/L	n	1	1	1	1	1	1	1	0	0	10,000
			min - max	5 U	5 U	5 U	5 U	5 U	5 U	5 U			
SVOCs	diethyl phthalate	µg/L	n	1	0	0	0	0	0	0	0	0	29,000 (PRG)
			min - max	20 U									
	di-N-butylphthalate	µg/L	n	0	0	0	0	0	0	0	0	1	3,600 (PRG)
			min - max									5 D	
	2-ethyl-1-hexanol	µg/L	n	0	0	0	0	0	0	0	1	0	NE
			min - max								8 D		
	bis(2-ethylhexyl) phthalate	µg/L	n	1	1	1	1	1	1	1	0	0	6
			min - max	2 JB	2 JB	88	2 JB	5 JB	5 JB	5 JB			
	1(3H) isobenzofuranone	µg/L	n	0	0	0	0	0	0	0	1	1	NE
			min - max								6 D	5 D	
	phenol	µg/L	n	1	1	1	1	1	1	1	0	0	22,000 (PRG)
			min - max	10 U	5 J	10 U	10 U	10 U	10 U	10 U			
Pesticides	aldrin	µg/L	n	6	0	6	0	6	6	6	0	0	0.004 (PRG)
			min - max	0.2 U		0.2 U		0.2 U	0.2 U	0.2 U			
	BHC-alpha	µg/L	n	6	0	6	0	6	6	6	0	0	0.011 (PRG)
			min - max	0.16 U		0.16 U		0.16 U	0.16 U	0.16 U			
	BHC-beta	µg/L	n	6	0	6	0	6	6	6	0	0	0.037 (PRG)
			min - max	0.4 U		0.4 U		0.4 U	0.4 U	0.4 U			
	BHC-delta	µg/L	n	6	0	6	0	6	6	6	0	0	NE
			min - max	0.2 U		0.2 U		0.2 U	0.2 U	0.2 U			
	BHC-gamma	µg/L	n	6	0	6	0	6	6	6	0	0	0.2
			min - max	0.2 U		0.2 U		0.2 U	0.2 U	0.2 U			
	chlordane-alpha	µg/L	n	6	0	6	0	6	6	6	0	0	2[b]
			min - max	0.1 U		0.1 U		0.1 U	0.1 U	0.1 U			
	chlordane-gamma	µg/L	n	6	0	6	0	6	6	6	0	0	2[b]
			min - max	0.1 U		0.1 U		0.1 U	0.1 U	0.1 U			

Table 4
Historical Groundwater Analytical Results
Ordot Dump
Territory of Guam

	Analyte	Units		Sample Identification and Location									Screening Level (GWQS or PRG)
				GW-1 Municipal Well A-11 Northeast of Site	GW-3 Municipal Well A-12 Northeast of Site	Well 9 (GW-4) Background Well North	GW-5 Downgradient Well South	Well 3 (GW-6) Downgradient Well South	Well 4 Downgradient Well South	Well 8 Downgradient Well South	MW-01 USEPA Well Northeast of Site	MW-02 USEPA Well Northeast of Site	
Pesticides & PCBs	4,4'-DDD	µg/L	n	6	0	6	0	6	6	6	0	0	0.28 (PRG)
			min - max	0.4 U		0.4 U		0.4 U	0.4 U	0.4 U			
	4,4'-DDE	µg/L	n	6	0	6	0	6	6	6	0	0	0.2 (PRG)
			min - max	0.2 U		0.2 U		0.2 U	0.2 U	0.2 U			
	4,4'-DDT	µg/L	n	6	0	6	0	6	6	6	0	0	0.2 (PRG)
			min - max	0.4 U		0.4 U		0.4 U	0.4 U	0.4 U			
	diazinon	µg/L	n	6	0	6	0	6	6	6	0	0	33 (PRG)
			min - max	0.4 U		0.4 U		0.4 U	0.4 U	0.4 U			
	dieldrin	µg/L	n	7	0	6	0	6	6	6	0	0	0.0042 (PRG)
			min - max	0.1 U - 0.2 U		0.2 U		0.2 U	0.2 U	0.2 U			
	endosulfan sulfate	µg/L	n	1	0	0	0	0	0	0	0	0	220 (PRG)
			min - max	0.1 U									
	endrin	µg/L	n	6	0	6	0	6	6	6	0	0	2
			min - max	0.2 U		0.2 U		0.2 U	0.2 U	0.2 U			
	ethion	µg/L	n	6	0	6	0	6	6	6	0	0	18 (PRG)
			min - max	0.4 U		0.4 U		0.4 U	0.4 U	0.4 U			
	heptachlor	µg/L	n	6	0	6	0	6	6	6	0	0	0.4
			min - max	0.24 U		0.24 U		0.24 U	0.24 U	0.24 U			
	malathion	µg/L	n	6	0	6	0	6	6	6	0	0	730 (PRG)
			min - max	4 U		4 U		4 U	4 U	4 U			
	methoxychlor	µg/L	n	6	0	6	0	6	6	6	0	0	40
			min - max	0.2 U		0.2 U		0.2 U	0.2 U	0.2 U			
	naled	µg/L	n	6	0	6	0	6	6	6	0	0	73
			min - max	2 U		2 U		2 U	2 U	2 U			
	parathion, ethyl	µg/L	n	6	0	6	0	6	6	6	0	0	220 (PRG)
			min - max	2 U		2 U		2 U	2 U	2 U			
	parathion, methyl	µg/L	n	6	0	6	0	6	6	6	0	0	220 (PRG)
			min - max	2 U		2 U		2 U	2 U	2 U			
	PCB-1242	µg/L	n	1	0	0	0	0	0	0	0	0	0.5 [b]
			min - max	1 U									
Other Parameters	cyanide	µg/L	n	1	1	1	1	1	1	1	0	0	200
			min - max	10 U	16	10 U	10 U	10 U	10 U	10 U			
	pH	µg/L	n	2	1	1	1	1	1	1	0	0	6.5 - 8.5 (Secondary)
			min - max	6.75 - 6.90	6.71	7.26	6.27	6.8	6.8	6.8			

Notes:

[a] Standard is for Chlordane

[b] Standard is for total PCBs

Screening levels are GWQS Water Quality Criteria for Groundwater, if established, or EPA Region 9 PRGs.

n = number of primary analytical results

min - max = range of lowest detected concentration (or reporting limit if not detected) to maximum detected concentration (or reporting limit if not detected).

B = Constituent was detected in the associated laboratory blank

GWQS = Guam Water Quality Standards (GEPA 2001).

J = Estimated value

NE = GWQS or PRG is not established for this constituent.

U = The analyte was not detected at the reporting limit shown.

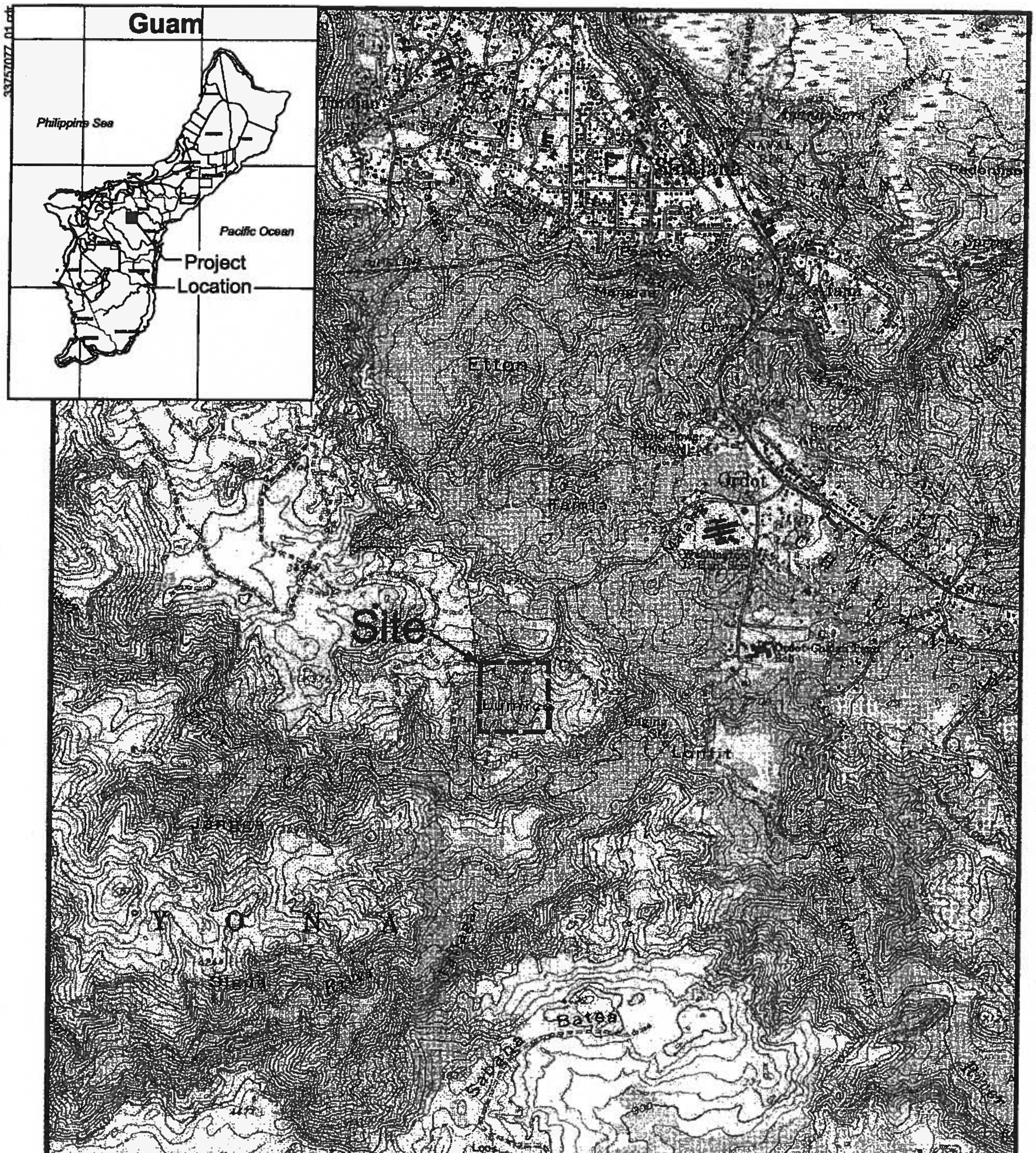
Table 5
Historical Sediment Analytical Data With Organic Compounds
Ordot Dump
Territory of Guam

Analysis	Analyte	Units	Sample Identification and Location						Preliminary Remediation Goal (PRG)
			SS-1 Lonfit River Upstream	SS-3 Leachate Stream West	SS-5 Leachate Stream South	SS-7 Leachate Pond South	SS-9 Leachate Stream Southeast	SS-11 Lonfit River Downstream	
Metals	aluminum	mg/kg	13,700	7,440	21,500	12,200	12,900	14,000	76000 (RS)
	anitimony	mg/kg	1 U	1 U (1.2)	1 U	1	1 U	1 U	0.3 (GW)
	arsenic	mg/kg	0.9	0.5	1.1	0.6	0.9	0.9	0.39 (RS)
	barium	mg/kg	252	91	49.1	38	22.9	129	82 (GW)
	beryllium	mg/kg	0.3	0.3 U	0.3 U	0.3 U (0.3)	0.3 U	0.2	3 (GW)
	boron	mg/kg	16.7	23.8	31	18.8	15	17	16000 (RS)
	cadmium	mg/kg	0.05	0.1	0.05 U	0.1	0.2	0.05	0.4 (GW)
	chromium (total)	mg/kg	30.8	16.4	46.1	24.3	20.3	24.1	2 (GW)
	cobalt	mg/kg	25.2	17	14.8	15.3	9.3	19.3	900 (RS)
	copper	mg/kg	33.7	23.7	29.7	30.5	26.2	28.9	3100 (RS)
	iron	mg/kg	19,400	13,000	36,600	14,900	14,600	20,800	23000 (RS)
	manganese	mg/kg	1,370	2,350	936	360	373	402	1800 (RS)
	lead	mg/kg	12	32	6.8	34	24	11	400 (RS)
	mercury	mg/kg	3.2	2.6	4.4	3.1	2.2	1.1	23 (RS)
	nickel	mg/kg	2 U (52.3)	22.1	26.4	26.4	17.2	37	7 (GW)
	selenium	mg/kg	ND	ND	ND	ND	ND	ND	0.3 (GW)
	silver	mg/kg	ND	ND	ND	ND	ND	ND	2 (GW)
	thallium	mg/kg	ND	ND	ND	ND	ND	ND	5.2 (RS)
	tin	mg/kg	1 U	1 U (1.4)	1.7	1 U	1 U (1.2)	1 U	47000 (RS)
	vanadium	mg/kg	47.7	27.8	58.2	42.3	30.8	34.6	300 (GW)
	zinc	mg/kg	26.2	0.5 U (108)	35.5	53.8	54.6	27	620 (GW)
Volatile Organic Compounds (VOCs)	acetone	ug/kg	50 U	50 U	50 U	50 U	50 U	50 U	800 (GW)
	chlorobenzene	ug/kg	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	70 (GW)
	chloroethane	ug/kg	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	3000 (RS)
	fluorotrichloromethane	ug/kg	6.8 (7.6)	2.5 U	11.3 (12.2)	2.5 U	2.5 U	2.5 U	390000 (RS)
	methylene chloride	ug/kg	35.6 (11.0)	80.5 (30.6)	30.6 (54.6)	37.0 (67.0)	55.8 (64.8)	29.0 (25.0)	1 (GW)
	o-xylene	ug/kg	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	10000 (GW)
	styrene	ug/kg	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	200 (GW)
	1,1,2,2-tetrachloroethane	ug/kg	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	0.2 (GW)
	toluene	ug/kg	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	600 (GW)

Table 5
Historical Sediment Analytical Data With Organic Compounds
Ordot Dump
Territory of Guam

Analysis	Analyte	Units	Sample Identification and Location						Preliminary Remediation Goal (PRG)
			SS-1 Lonfit River Upstream	SS-3 Leachate Stream West	SS-5 Leachate Stream South	SS-7 Leachate Pond South	SS-9 Leachate Stream Southeast	SS-11 Lonfit River Downstream	
Pesticides	BHC-Gamma	ug/kg	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	0.5 (GW)
	dieldrin	ug/kg	4.0 U	4.0 U	4.0 U	4.0 U	22.6 (35.2)	4.0 U	0.2 (GW)
	heptachlor epoxide	ug/kg	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	30 (GW)
Base/Neutral Semi-volatile Organic Compounds (SVOCs)	aniline	ug/kg	400 U	400 U	400 U (2,002)	400 U	400 U	400 U	85000 (RS)
	benzo (a) anthracene	ug/kg	400 U	400 U	400 U	400 U	400 U	400 U	80 (GW)
	bis (2-ethylhexyl) phthalate	ug/kg	400 U	400 U	400 U	400 U	1,396 (1,524)	400 U	35000 (RS)
	butyl benzyl phthalate	ug/kg	972 (400 U)	400 U	3,240 (400 U)	400 U (1,800)	2,513 (8,001)	400 U	810000 (GW)
	chrysene	ug/kg	400 U	400 U	400 U	400 U	400 U	400 U	8000 (GW)
	diethyl phthalate	ug/kg	400 U	400 U	400 U	400 U	400 U	400 U	49000000 (RS)
	di-n-octyl phthalate	ug/kg	400 U	400 U	400 U	400 U	400 U	400 U	2400000 (RS)
	fluoranthene	ug/kg	400 U	400 U	400 U	400 U	400 U (1,676)	400 U	210000 (GW)
	pyrene	ug/kg	400 U	400 U	400 U	400 U	400 U (1,674)	400 U	210000 (GW)

<u>Notes</u>:
Concentrations in parentheses are for corresponding duplicate sample.
GW = soil screening level for protection of groundwater (from EPA Region 9 PRG Table)
mg/kg = milligrams per kilogram
ND = not detected, reporting limit is not available
PRG = Preliminary remediation goal from EPA Region 9 Table
RS = PRG for residential soil
U = not detected at reporting limit shown
ug/kg = micrograms per kilogram



Source: USGS 1975 Agana quadrangle map.

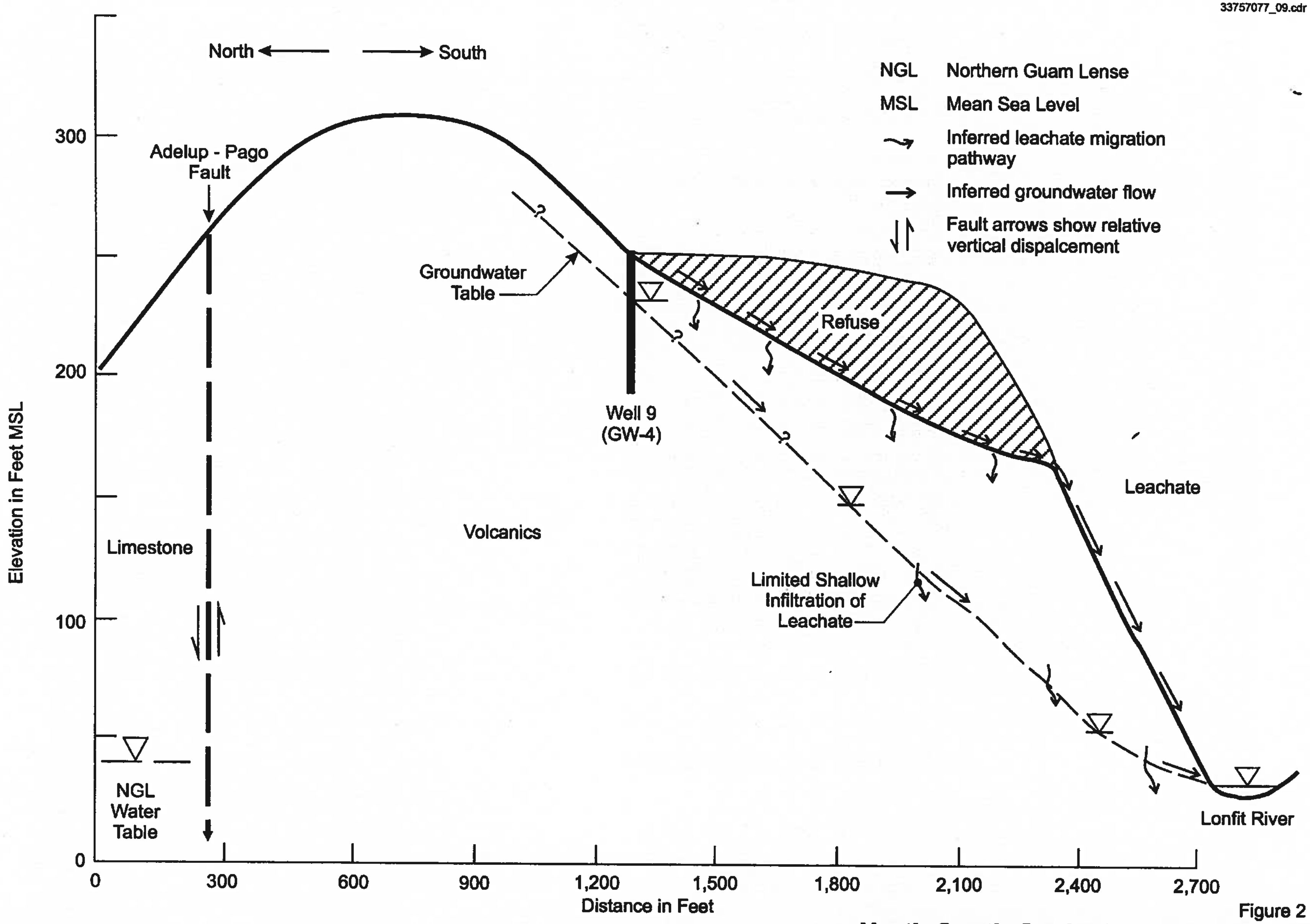
0 2,000 4,000
Approximate Scale in Feet

Job No. 33757077

Figure 1
Site Location Map

Ordot Dump
Ordot-Chalan Pago, Guam

33757077_09.cdr

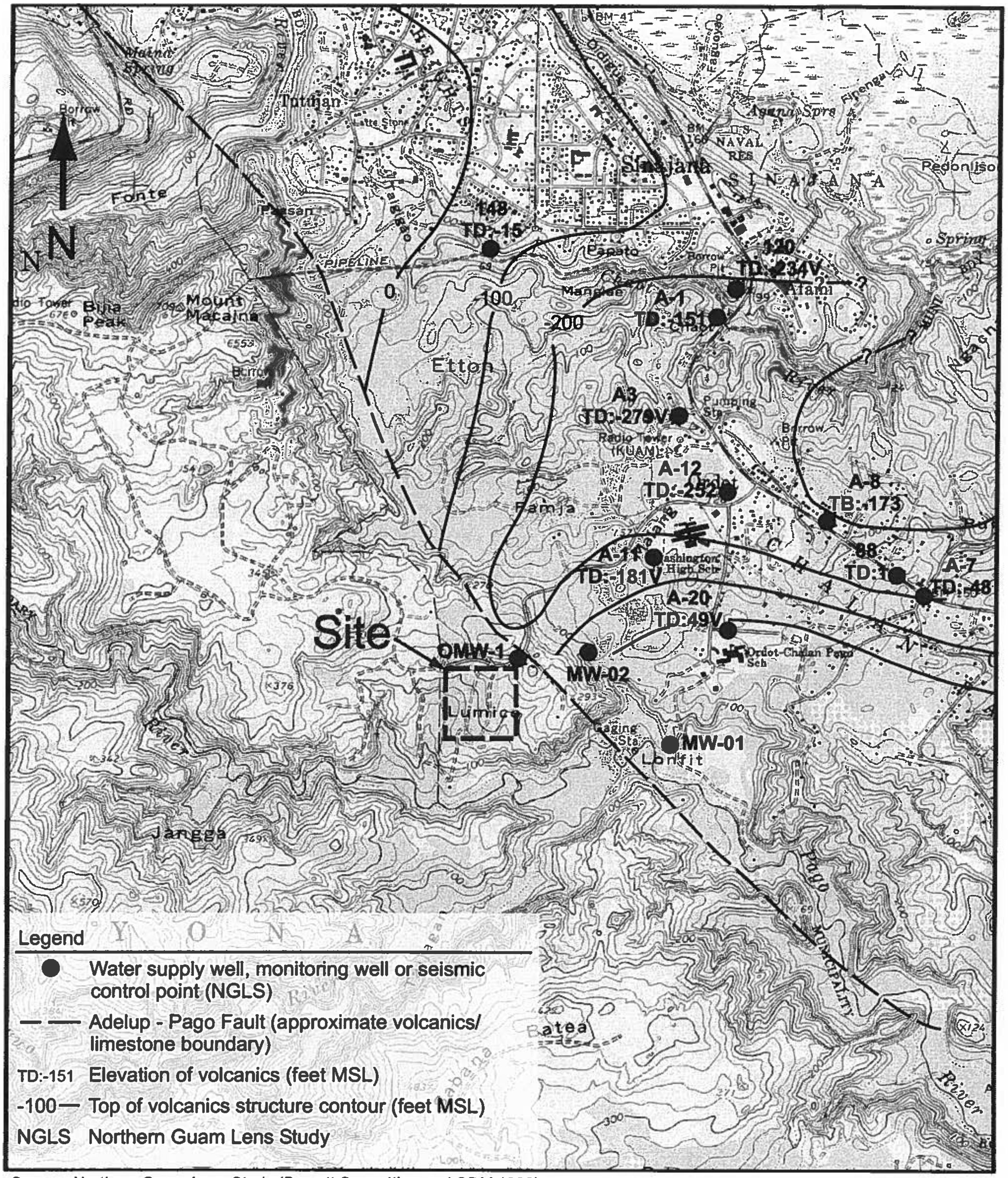


Job No. 33757077

Figure 2

North-South Geologic Cross Section

Ordot Dump
Ordot-Chalan Pago, Guam



Source: Northern Guam Lens Study (Barrett Consulting and CDM 1982)
Base Map: USGS 1975 Agana quadrangle map.

0 2,000 4,000

Approximate Scale in Feet

Job No. 33757077

Figure 3

Structure Contour Map on Top of Volcanic Rocks

Ordot Dump
Ordot-Chalan Pago, Guam

Reference: *Guam ortho photos, Sheet 33, 1994.*
Job No. 33757077

Figure 4
Monitoring Well Locations

Ordot Dump
Ordot-Chalan Pago, Guam

33757077_13.cdr

Reference: *Guam ortho photos, Sheet 33, 1994.*

Job No. 33757077

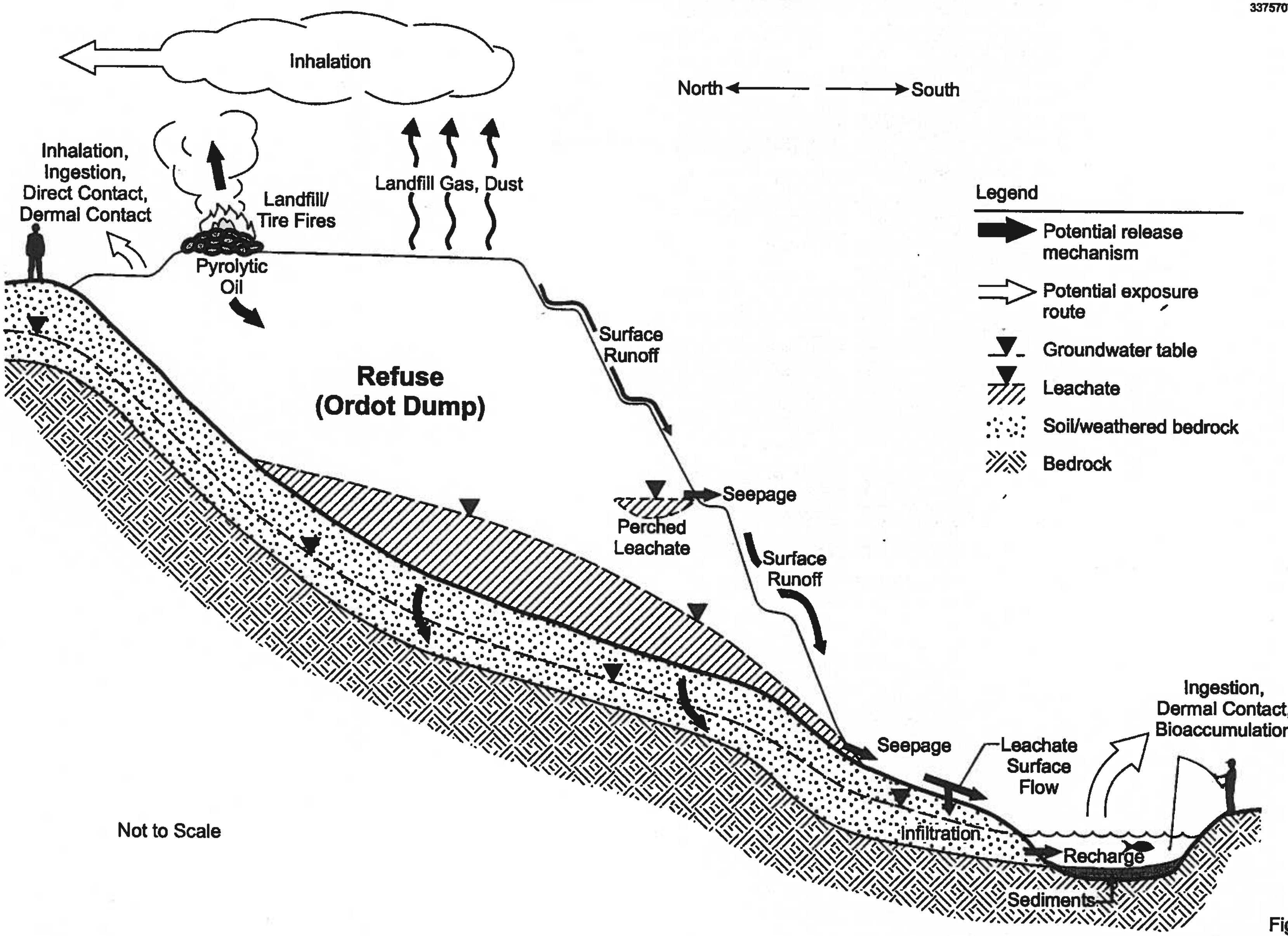
Figure 5

Historic Leachate, Surface Water, and Sampling Locations

Ordot Dump

Ordot-Chalan Pago, Guam

33757077_10.cdr



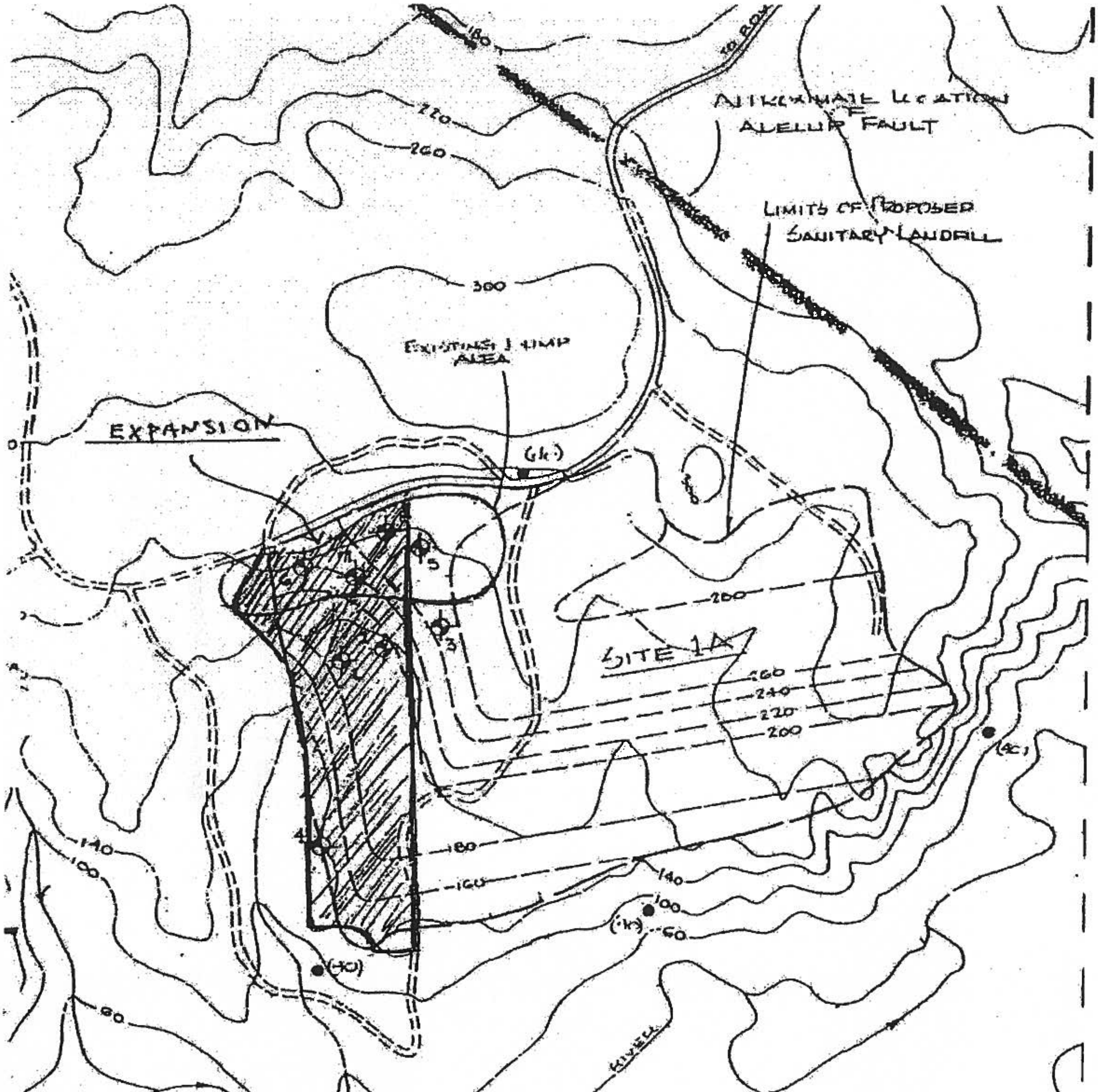
Job No. 33757077

Figure 6
Preliminary Conceptual Site Model

Ordot Dump
Ordot-Chalan Pago, Guam

APPENDIX A

Boring Logs



KEY:

TEST BORING LOCATION

RECOMMENDED OBSERVATION WELL LOCATION
D)— DEPTH IN FEET

▲ RECOMMENDED SURFACE WATER MONITORING LOCATION

REFERENCES:

1.) PRELIMINARY EVALUATION OF SANIT LANDFILL SITES BY G/T/A '6/'5

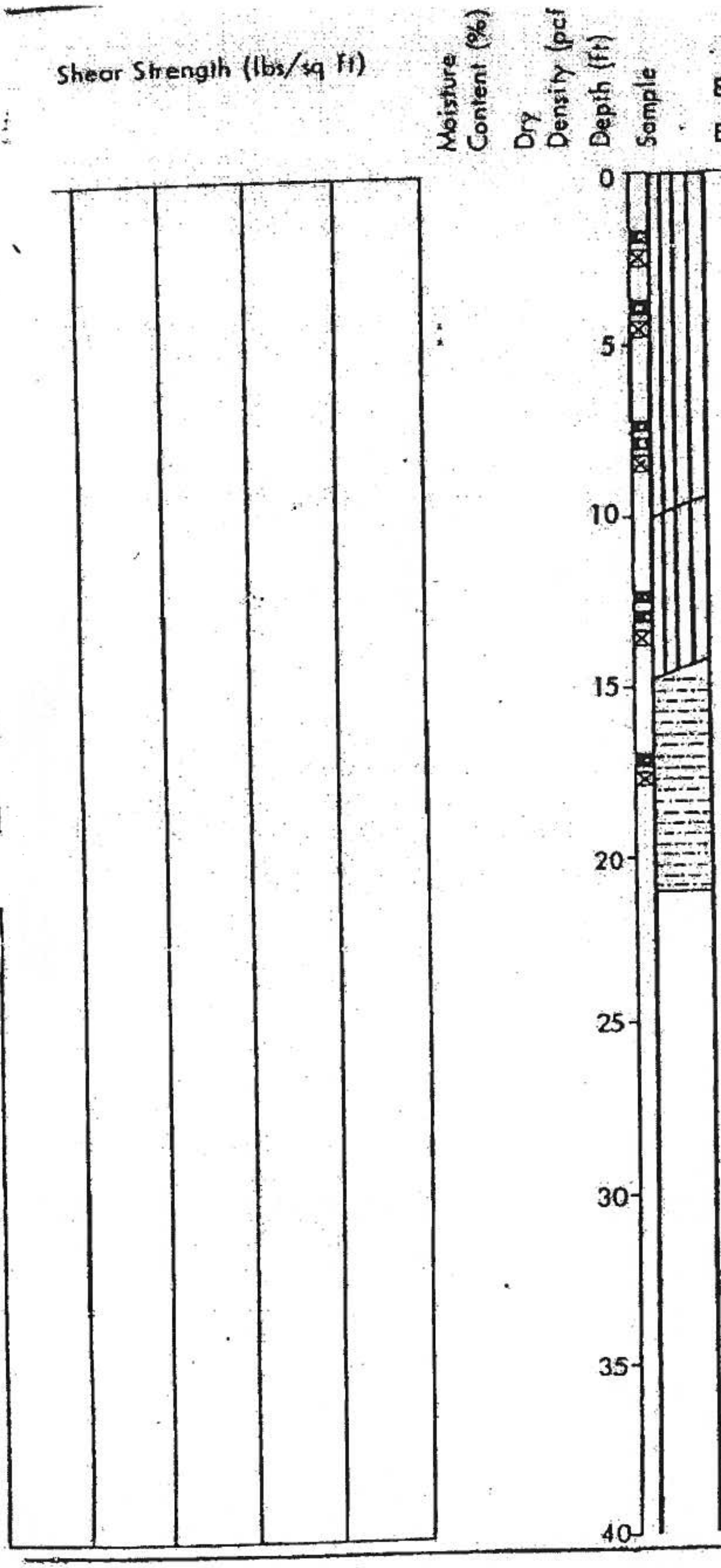
2.) U.S.G.S. 'GEOLOGY' OF GUA

FIGURE 1

LOG OF BORING 1

Equipment 6" Flight Auger

Elevation 164 Date 6/24/70



MOTTLED RED BROWN SILT (MH)
stiff, moist, with abundant small rock fragments

MOTTLED GRAY RED SILT (MH)
medium stiff, moist, with occasional rock fragments

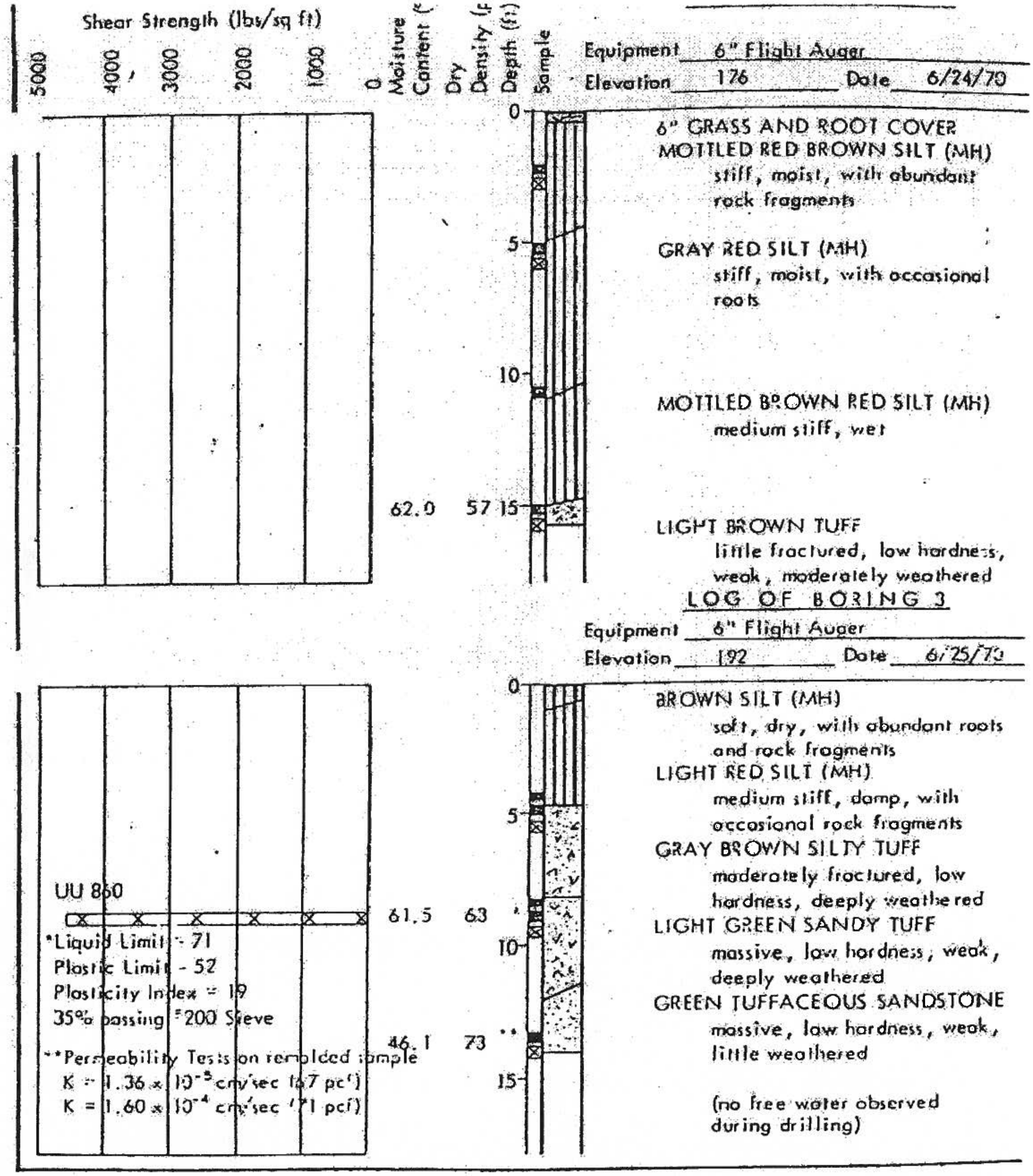
BLUE GRAY TUFFACEOUS SILTSTONE
closely fractured, low hardness, weak, moderately weathered, wet
grading hard, strong, little weathered at 17.3'

(no free water observed during drilling)

ORDOT DISPOSAL SITE NO. 1

LOG OF BORING NO. 1

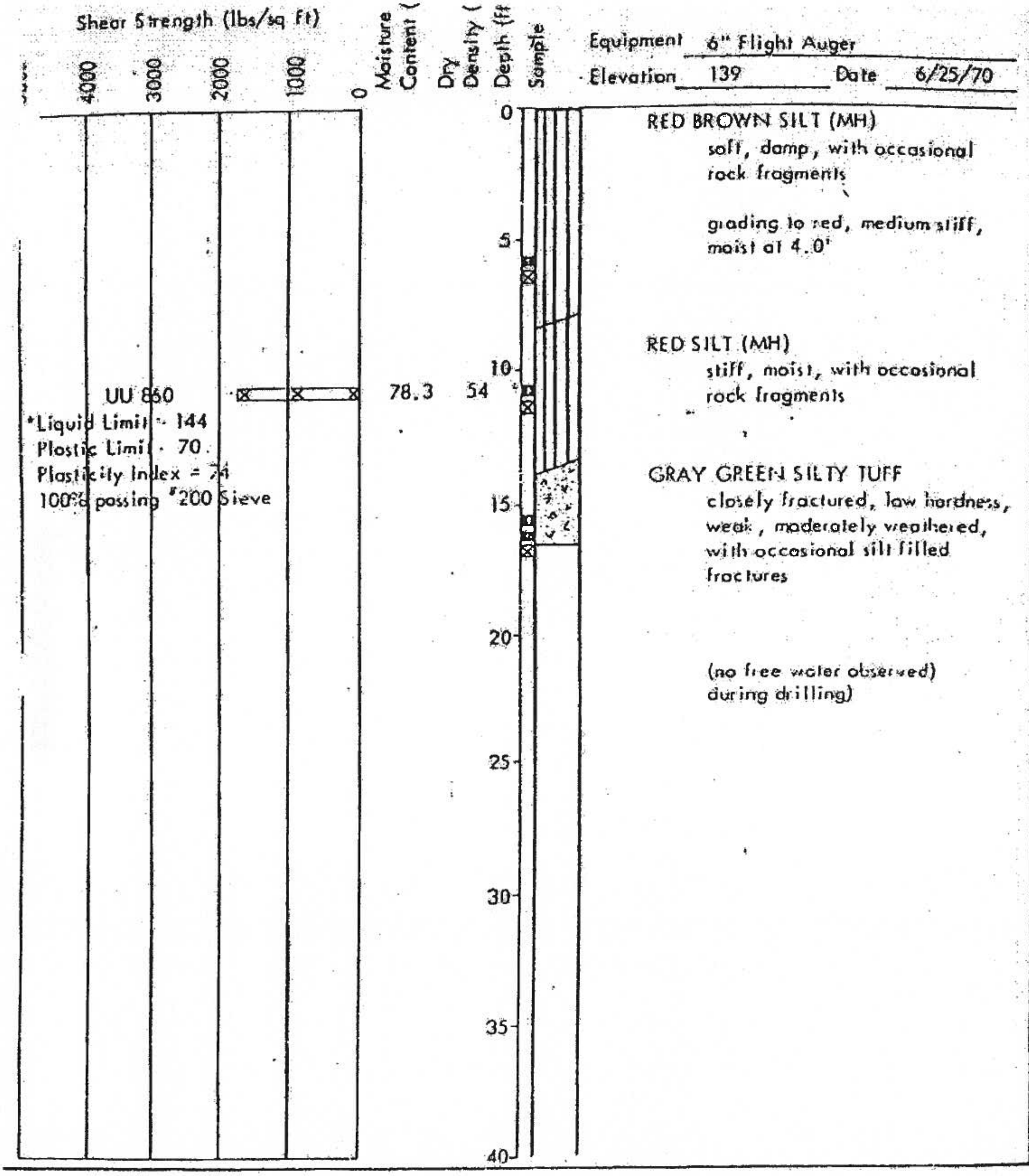
FIG. 2



ORDOT DISPOSAL SITE NO. 1

LOG OF BORING NO. 2

FIG. 3



ORDOT DISPOSAL SITE NO. 1

LOG OF BORING NO. 4

FIG. 4

LOG OF BORING 5

Shear Strength (lbs/sq ft) | Moisture Content (% | Dry Density (p | Depth (ft) | Sample

Equipment 6" Flight Auger

Elevation 230 Date 6/25/70

0

BLACK REFUSE
uncompacted, loose,
with occasional soil and rock

5

10

Fill

15

20

RED BROWN SILT (MH)
stiff, wet

25

LIGHT GREEN SILTY TUFF
low hardness, weak, weathere

30

(no free water observed)
during drilling)

35

40

ORDOT DISPOSAL SITE NO. 1
LOG OF BORING NO. 5

FIG.

A-5

Shear Strength (lbs/sq ft)

Moisture Content (%) | Dry Density (pcf) | Depth (ft) | Sample

Equipment 6" Flight Auger

Elevation 229 Date 6/25/70

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 35, 40

GRAY REFUSE
uncompacted, loose

FILL

RED BROWN SILT (MH)
stiff, wet

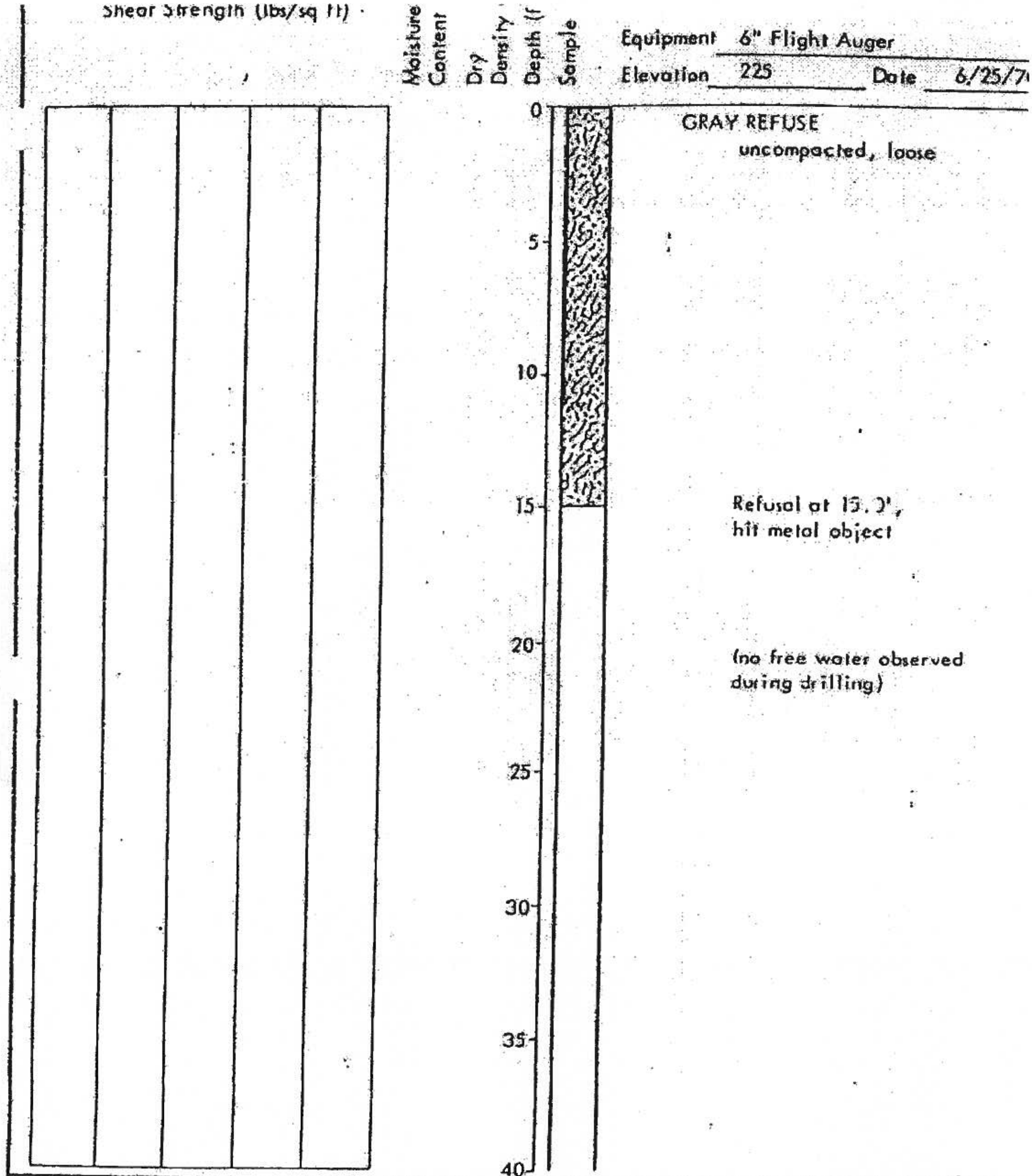
LIGHT GREEN SILTY TUFF,
low hardness, weak, weathered

(no free water observed
during drilling)

ORDOT DISPOSAL SITE NO. 1

LOG OF BORING NO. 6

FIG. 6

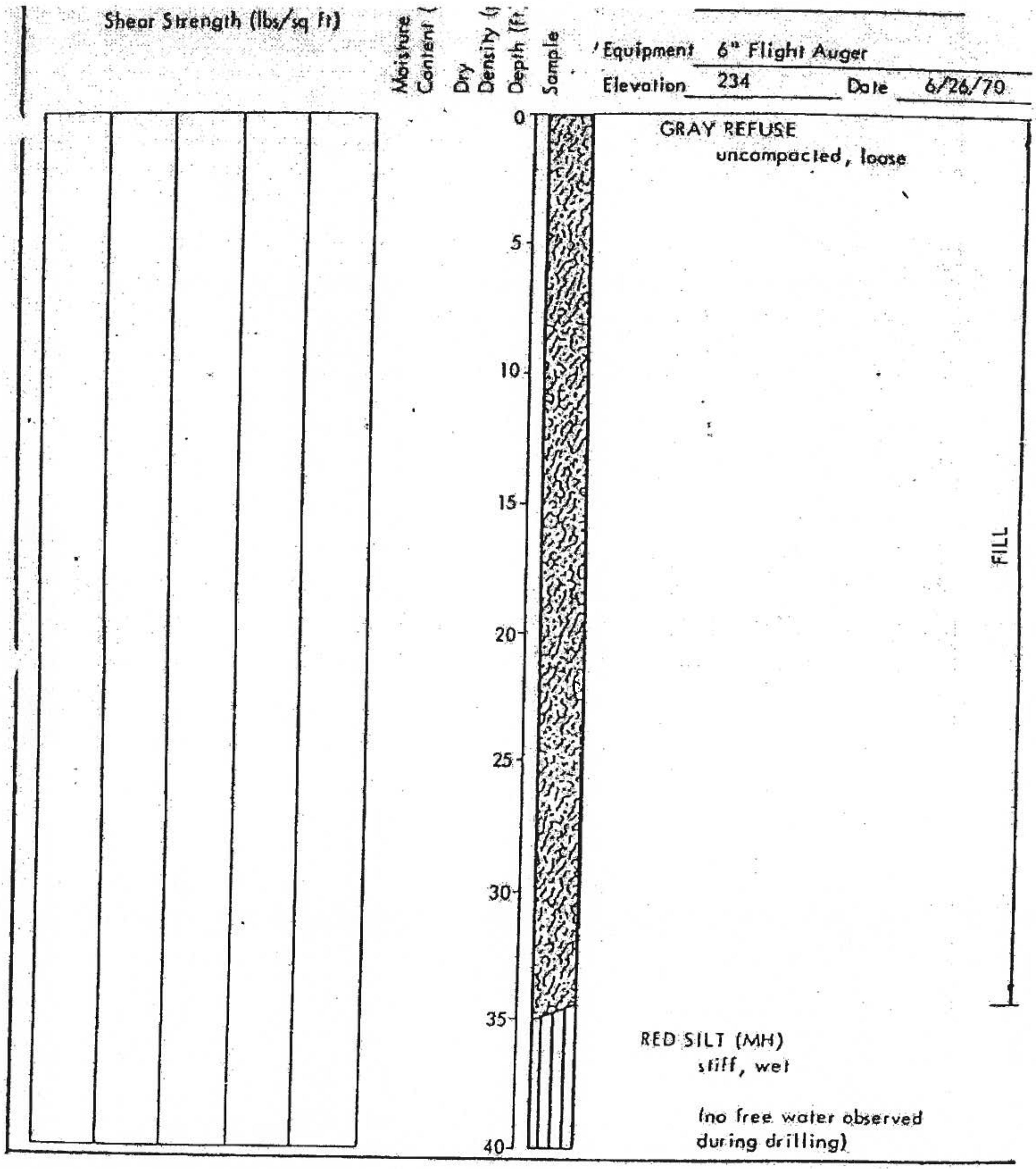


ORDOT DISPOSAL SITE NO. 1

LOG OF BORING NO. 7

FIG

A-7



ORDOT DISPOSAL SITE NO. 1

LOG OF BORING NO. 8

FIG. 8

Area: ORDOT, GUAM
Location: RAMIREZ ROAD + "MOL Hwy"
Drilled By: Pacific Drilling Inc.
Elevation: 48.0

Date: 7/7/92 Start: 1315 Finish: [illegible]
Logged By: JLD Reviewed By: GRM Date: 7/8/92
Sampling Method: GRAB - w/ Sieve
Amb. Temp (°F): > 75°

METHOD OF DRILLING: ☐ Hollow Stem Auger Other: Rotary/Air-Foam ☐ Directional Boring

Size of Bit: 15 1/4" & 9 5/8" Type of Bit: Tri Cove - Rock Hammer wt. ___ lb. Drop ___ in.
Total Depth: 133 Depth of Groundwater/Time/Date: 33' Driller 1150 07/08/92

Surface Description

Field Data OVA/ Other	Sample Number	Blow Counts/6"	Depth	Well Completion Diagram	Soil Group Symbol (USCS)	Description
			0	Grout, Riser, Centralizer		Drilled 15 1/4" Hole (Ground Surface - 8 1/2' BGS); Set 10' 10" ID Steel Casing w/ 2 sx. cmt w/ 10% aggregate Per GEPA request. Reddish White & White Limestone Slightly Weathered
	1	785				
		105	10	Filter Pack, Screen		
		216				Buff LS Biosparite; Buff ; Fresh; Coral Massive
		327				
		180				
	2	211				Limestone Biosparudite; Yellowish Tan; Fresh coralline, massive
		275	20			
		232				
		257				
		248				
		284				
		320	30			
		400				▼ Driller
		727				
	3	378				Limestone Argillaceous Biosparudite; Yellowish Tan & Med Reddish Brown (Mottled) w/ LS Yellowish Tan & Argillaceous Matrix medium reddish brown; Fresh; massive, porous, vuggy
		327				
		400				
		378	40			
	4	266				
		257				Limestone; Increasing Yellow w/ decrease in Argillaceous Matrix.
		266				
		180				
	5	180	50			Limestone; Biosparudite; Tan Massive
		56				
		360		Caving		Limestone; Increasing Brown w/occ Intbds of dark greenish gray and bright brn.
	6	78				
		62				
		59	60			
	7	232				

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WELL DESIGN

Casing Size/Schedule: 4" - 80
Casing Slot Size: 0.
Length of Screened Interval: 35 1/2

Maximum Bore Hole Angle: N/A
Length of Blank Interval: 20
Total Length of Casing: 55 1/2
Amount/Size of Filter Pack: 43' - 2/12

Amount of Cement: 9'
Amount of Bentonite: 2 1/2 Buckets
Surface Completion: ___

ORDOT 7.1-8 6/92

Project: INSTALLATION   Project No: 62220.70   Logged By: [illegible]   Date:
Reviewed By: GRM   Date: 8/11/92

Surface Description

Field Data OVA/ Other	Sample Number	Blow Counts/6"	Depth	Well Completion Diagram	Soil Group Symbol (USCS)	Description
		59	60			
	7	232 240				Limestone Increasing Brown
		109				Increasing Reddish Brown
		97				Brownish Yellow
	8	126	70			
		163				Limestone: Yellowish Brown
		153				Increasing Brown
		87				Increasing white
	9	70				
		110	80			
		184				Limestone: Argillaceous Increasing Orng Red
		120				Increasing White Biosparite
		107				
	10	171				
	11	180 240	90			Limestone Slight Increasing Brown w/ clay Interbeds @ 93'
		175				
		156				Limestone - White, hard, dense, no odor
	12	184				: Biosparite
		167				
		179	100			Limestone Slight Increase in Brown Argillaceous Interbeds
		156				
	13	135				Limestone - White
		107				Limestone - Argillaceous w/ Incr Red Intb.
		218				
		288	110			Limestone - Increasing Argillaceous w/ Red Cl and slow drilling (Balled-up Bit)
	14	184 120				
		59				Limestone - Increasing White
	15	56				
	16	74	120			Limestone - Increasing Red
		135				
		156				
		110				
	17	98				Limestone Increasing Brown
		87	130			
	18	63 25				Limestone - White, hard, dense, no odor
			140			

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Project:
Area: ORDOT, GUAM
Location: "TOP OF HILL"
Drilled By: PACIFIC DRILLING, INC.
Elevation: 158.07' STEEL CSG.

Date: 7/16/92 Start: 1346 Finish: 1614
Logged By: GRM, JLD Reviewed By: JLD, GRM Date: 7/16/92
Sampling Method: GRAB
Amb. Temp (°F): 90

METHOD OF DRILLING: ☐ Hollow Stem Auger Other: AIR-FOAM ☐ Directional Boring

Size of Bit: 9 5/8" + 15 1/4" Type of Bit: TRI CONE ROCK Hammer: wt. ___ lb. Drop ___ in.
Total Depth: 263' Depth of Groundwater/Time/Date: ___ / ___ / ___

Surface Description: Jungle

Field Data OVA/ Other	Sample Number	ROP FT/HR	Depth	Well Completion Diagram	Soil Group Symbol (USCS)	Description
			0			Drilled 15 1/4" Hole (Ground Surface → 29' BGS) SET 30' 10" ID STEEL CASING w/ 10 SX cmt.
						Red Brn CLAY
						LIMESTONE Yellowish Brown
			10			LIMESTONE Lt Yellowish Brown well indurated slightly argillaceous, SPARRY
			20	GROUT 112 BGS to +3 AGS		
		300				LIMESTONE Yellow Brn
		211	30			
		171				
		276				
		290				LIMESTONE White
		218				
		171				
		232	40			
		172		PVC RISER PIPE		
		200				LIMESTONE Incr Brnsh Red
		218				
		167				LIMESTONE Wh - TAN
		126	50			
		153				
		171				
		167				
		122				
		155	60			LIMESTONE Buff - TAN
		133				

COPY

WELL DESIGN
Casing Size/Schedule: 4"/80
Casing Slot Size:
Length of Screened Interval: 100

Maximum Bore Hole Angle:
Length of Blank Interval: 115
Total Length of Casing: 215
Amount/Size of Filter Pack: - 2/12

Amount of Cement:
Amount of Bentonite:
Surface Completion:

ORDOT 7.1-6 6/92

Project: ORDOT LANDFILL MW INSTALLATION

Project No: 62220.70

Logged By: GRM, JLD Date: 7/6/92

Reviewed By: JLD, GRM Date: 7/6/92

Surface Description: Jungle

Field Data OVA/ Other	Sample Number	ROP (FT/HR)	Depth	Well Completion Diagram	Soil Group Symbol (USCS)	Description
		122				
		156	60			
		133				
		189				
		150				LIMESTONE... Buff
		211				
	1	200	70			
		116				
		153				
		200				
		78				LIMESTONE Incr. White
	2	112	80			LIMESTONE TAN
		160				
		141				LIMESTONE Incr White
		156				LIMESTONE TAN
	3	248				LIMESTONE Incr Brnsh Red w/ Incr Arg %
	4	206				in Fast Drilling Interval
		138	90			
		160				LIMESTONE TAN
		144				
		160				LIMESTONE White
	5	116				
		120	100			
		138				LIMESTONE Incr TAN
		184				
		203				
		211				
	6	187	110			
		189				
		171				LIMESTONE Incr White
		126				
		160				
	7	146	120			
		163				LIMESTONE Incr TAN
		211				
		557				LIMESTONE Brnsh Red w/ Incr Arg %
		257				
	8	276	130			
		175				LIMESTONE Decr Reddish hues w/ decr Arg %
		130				
		179				LIMESTONE White
	9	288				
		237				
		189				LIMESTONE TAN
		257	140			
	10	257				LIMESTONE Incr Reddish Brn (140'-148' BGS)
		260				
		288				
		163				
			150			LIMESTONE TAN & White

Well Completion Diagram: GROUT to SURFACE; PVC RISER PIPE ([illegible]); CLASS H Cement Grout; Bent; Bent; MONTEREY #2 SAND to 109' BGS; Screen 212 - 112' BGS

COPY

Project: ORDOT LANDFILL INSTALLATION   Project No: 62220.70   Logged By: GWM, JLD   Date:

Reviewed By: JLD, GWM   Date: 7/6/92

Surface Description: Jungle

Field Data OVA/Other	Sample Number	ROP (ft-hr)	Depth	Well Completion Diagram	Soil Group Symbol (USCS)	Description
		162				
		160	150			Limestone White, Microsparite, well Indurat
	11	199				
		225				Limestone – Incr. Tan
	12	194				
		184				Limestone – White
		360	160			
	13	360				Limestone – Tan ▼ Driller 7/6/92
		276				Limestone – Incr Reddish Brn, Argillaceous,
	14	480				prob clay clogged porosity.
		232				
	15	313	170			Limestone – Incr Reddish hues from Arg
		189				matrix
		180				Limestone – Tan
	16	342				
		288				Limestone – Reddish Brn w/ Arg Mtrx
		135	180			Limestone – Incr. White
	17	240				
		276				Limestone – Tan
		313				Limestone – Reddish Brn w/ Arg Mtrx
	18	317				
		211				
		167	190			Limestone – Incr. White
		360				
	19	450				Limestone – Tan w/ Yellow Intbds.
		300				
		171				Limestone – Incr. Red
		232	200			
	20	153				Limestone – Incr. White
		225				
		423				
		450				Limestone – Incr Reddish w/ Incr Arg Mtrx.
		313	210			
		205				Limestone – Incr Yellow – Tan, decr in
	21	276				Arg %
		163				
		276				Limestone – Incr White – Yellow
	22	240	220			
		200				
		171				Limestone – Lt Tan
		200				
	23	240				
		257	230			
		271				Limestone Incr. Red w/ Incr Arg Mtrx.
		271				
		276				
		480				
		400	240			

Well Completion Diagram: Sand 208' – 198'; Screen 213' – 203'; Sand & grout to 208'; PVC end caps; Cavings; Cavings

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ORDOT 7.2-1 8/92

Project: ORDOT LANDFILL MW INSTALLATION

Project No: 62220.70

Logged By:

Reviewed By: JD, CRM

Date: 7/ 6/92

Surface Description

Field Data OVA/ Other	Sample Number	ROP FT-HR-1	Depth	Well Completion Diagram	Soil Group Symbol (USCS)	Description
		400	240			
		260				Limestone - Arg Mtx covers Reddish Clr:
		220				Framework is wh - lt tan w/occ ylw.
	26	184				
		327				Limestone - ... White - Tan
		306				
		318	250	CAVING	CAVING	
		327				
	27	225				As Above
		313				
		156				
	28	167	260			White - Lt tan SPARRY LIMESTONE well Indurated
	29	155				TOTAL DEPTH 263'

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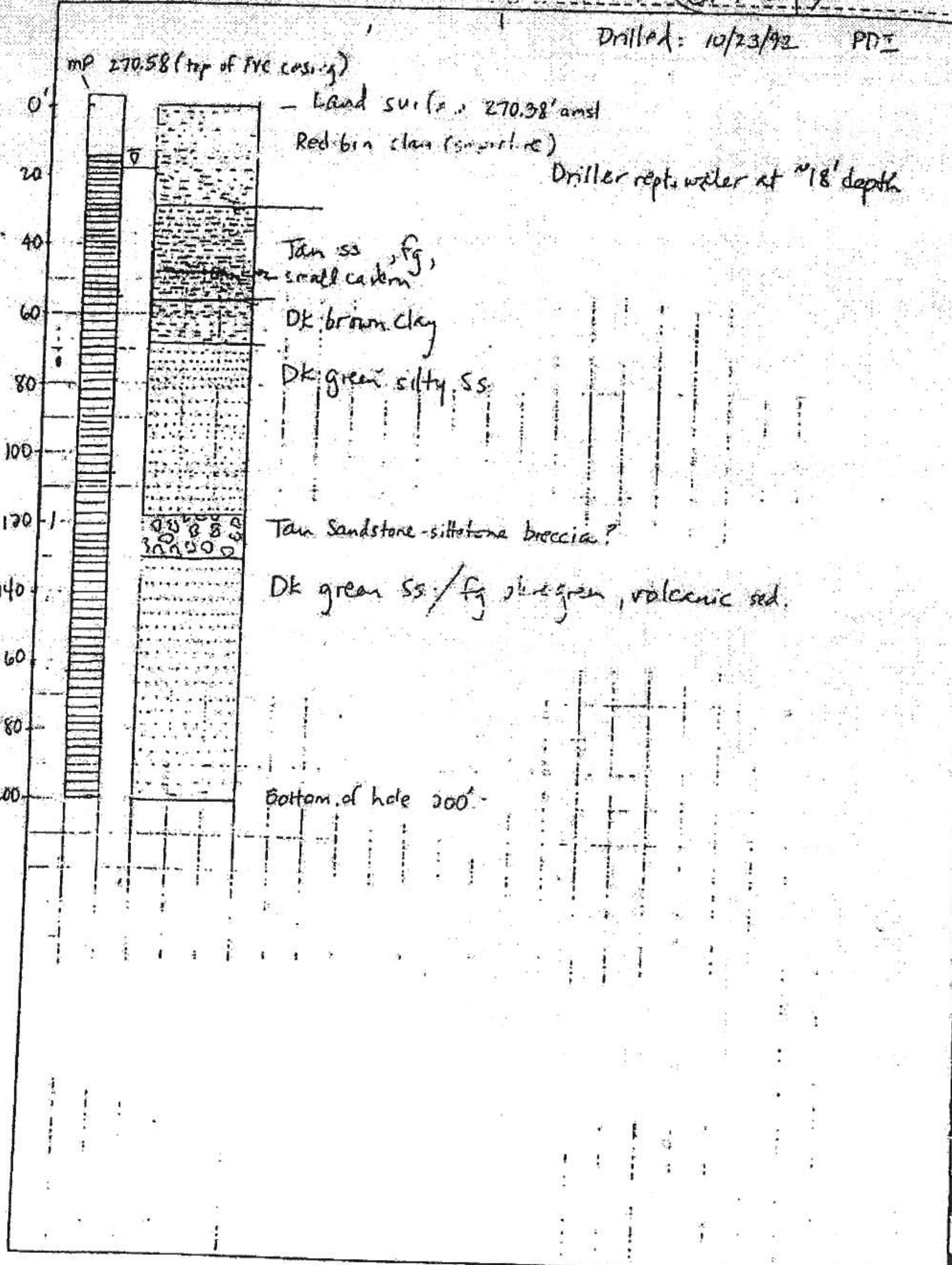
Drill [illegible] well #1 (OMW 1)



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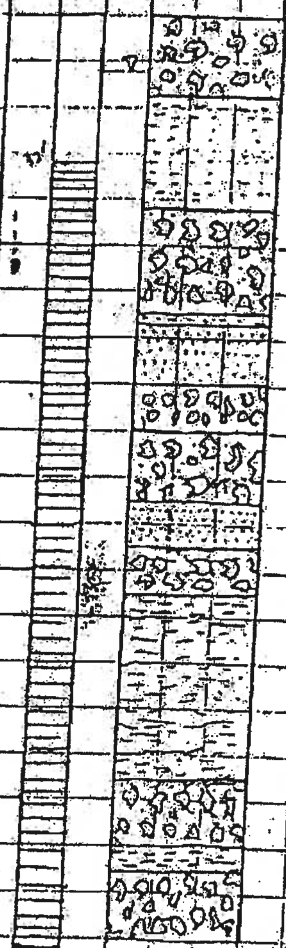
Ordot Monitoring Well #2 (OMW 2)

Drilled: 10/27-28/92 PDI



0 — Land Surface
Breccia, green, tuffaceous

20

Clay, gray to dk blk grn, dense, wet

40

Breccia, gray mud w/ olive grn to gray siltstone

60

Siltstone dk green
Sandstone, red brn to gray green

80

Breccia dk green

100

Breccia tuffaceous

Sandstone

120 — Breccia

140

Siltstone, dk green to black

160

Breccia

180

mudstone

Breccia

200

Bottom of hole 202'

Sheet No. .... of .... Sheets. Prepared by .... Date .... Checked by .... Date ....

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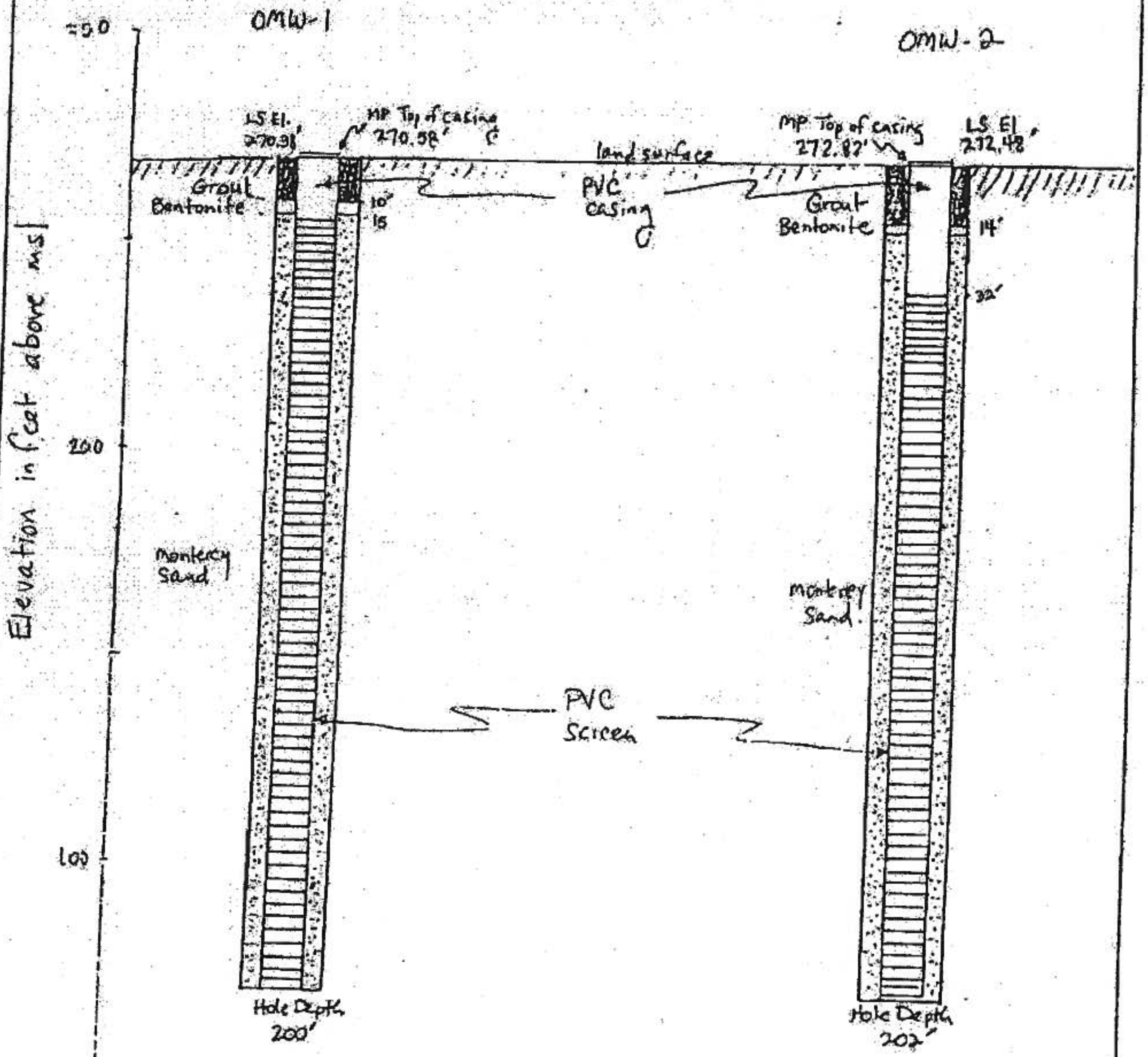
9-913-O
(March 1949)
Sketch Form

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

File ....



AS-BUILT DRAWINGS
ORDOT MONITORING
WELLS

Sheet No. 1 of 1 Sheets. Prepared by GWI .... Date ..... Checked by ..... Date .....

DRDOT MONITORING WELL INFORMATION

	OMW-1	OMW-2
LATITUDE/LONGITUDE	132633/1444458	132618/1444503
MAP	AGANA QUADRANGLE	AGANA QUADRANGLE
MAP SCALE	1:24000	1:24000
ELEVATION OF LAND SURFACE	270.38 FT	272.48 ft
DEPTH OF HOLE	200 FT	202 ft
DIAMETER OF HOLE	9-7/8 IN	9-7/8 IN
DEPTH OF WELL	200 FT	202 ft
CASING INTERVAL	0-15 FT	0-32 FT
CASING DIAMETER	4 IN	4 IN
CASING TYPE	THREADED PVC	THREADED PVC
SCREENED INTERVAL	15-185 FT	32-202 FT
SCREEN DIAMETER	4 IN	4 IN
SCREEN TYPE	THREADED PVC	THREADED PVC
SAND PACK TYPE	RMC LONESTAR #3 MONTEREY SAND	
SAND PACK INTERVAL	12-200 FT	16-202 FT
BENTONITE SEAL INTERVAL	10-12 FT	14-16 FT
CONCRETE SEAL INTERVAL	0-10 FT	0-14 FT
DATE CONSTRUCTION COMPLETED	10/23/92	10/29/92
DRILLER	PACIFIC DRILLING INC	
METHOD	AIR ROTARY	
RIG	SCHRAMM T-685 DHH ROTA-DRILL COMPRESSOR 1000 CFM @ 350 PSI	
WATER LEVEL DATA	YES	YES
PUMP TEST DATA	NO	YES

APPENDIX B

Analytical Results for Leachate, Surface Water, Groundwater, and Sediment

Appendix B	Table 1	Historical Leachate Surface Water Analytical Data
Appendix B	Table 1a	Additional Historical Surface Water and Leachate Analytical Data
Appendix B	Table 2	Historical Groundwater Analytical Data
Appendix B	Table 3	Historical Sediment Data
Appendix B	Table 3a	Additional Historical Sediment Analytical Data

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Metals	aluminum	µg/L	11/10/82	--	591	<200 (591)	<200	358	2,560	174
			3/12/87 f	--	80	75	466	3,583	--	150
			11/7/97	329	171 J	--	4,580	--	--	1,240
			2/10/98	<100	<100	530	160	--	--	130
			3/20/98	320	<100	<100	<100	--	--	270
			9/9/98	180	<100	200	110	--	--	170
	antimony	µg/L	11/10/82	--	nd	nd	nd	nd	nd	nd
			3/12/87 f	--	<20	<20	<20	<20	--	<20
			11/7/97	<20.2	<20.2	--	<20.2	--	--	<20.2
	arsenic	µg/L	10/81	--	--	--	0.0154	--	--	--
			11/10/82	--	nd	nd	nd	nd	nd	nd
			1/84	--	--	--	--	--	0.0157	--
			8/84	--	--	0.0092	--	--	--	--
			4/85	--	0.106	--	--	--	--	--
			3/6/86	--	3.27	--	2.89	--	--	--
			4/21/86	--	5.01	--	5.98	--	--	--
			7/23/86	--	2.67	--	3.33	--	--	--
			9/26/86	--	13.7	--	9.1	--	--	--
			12/22/86	--	8.03	--	8.3	--	--	--
			3/12/87 f	--	<10	<10	<10	<10	--	<10
			3/25/87	--	4.47	--	3.75	--	--	--
			6/3/87	--	3.81	--	4.38	--	--	--
			10/14/87	--	4.88	--	3.61	--	--	--
			12/9/87	--	3.85	--	3.17	--	--	--
			11/7/97	<70	<70	--	<70	--	--	<70
			2/10/98	<10	<10	<10	<10	--	--	<10
			3/20/98	<10	<10	<10	<10	--	--	<10
			9/9/98	<10	<10	<10	<10	--	--	<10

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0	SW-1	SW-2 (SW-11)	SW-5	SW-7	SW-9	SW-10 (SW-3)
					[PGRL-1] {Site 2}	[PGRL-2] {Site 3}	[PGRL-0]		[LFL-3]	{Site 1}
				Confluence of SW-10 and Lonfit River	Lonfit River Upstream	Lonfit River Downstream	Leachate Stream South	Leachate Pond South	Leachate Stream Southeast	Leachate Stream West
Metals	barium	µg/L	10/81	--	--	0.0625	0.4494	--	--	--
			11/10/82	--	<100	<100	111	240	199	138
			8/83	--	--	--	--	--	0.0625	--
			10/83	--	0.625	--	--	--	--	--
			3/6/86	--	41.7	--	52.1	--	--	--
			4/21/86	--	62.5	--	72.9	--	--	--
			7/23/86	--	45.5	--	273	--	--	--
			9/26/86	--	45.5	--	227	--	--	--
			12/22/86	--	45.5	--	227	--	--	--
			3/12/87 f	--	5	4	54	307	--	113
			3/25/87	--	27.8	--	153	--	--	--
			6/3/87	--	153	--	13.9	--	--	--
			10/14/87	--	190	--	17.2	--	--	--
			12/9/87	--	207	--	17.2	--	--	--
			11/7/97	149	7.8 j	--	132	--	--	178
			2/10/98	160	<10	25	110	--	--	170
			3/20/98	160	<10	<10	94	--	--	270
			9/9/98	90	<10	11	140	--	--	190
	beryllium	µg/L	11/10/82	--	<5	<5	<5 (11)	<5	<5	<5
			3/12/87 f	--	<0.2	<0.2	<0.2	<0.2	--	<0.2
			11/7/97	<0.2	<0.2	--	<0.2	--	--	<0.2
	boron	µg/L	11/10/82	--	<100	<100	458	4,980	960	1,020
	cadmium	µg/L	1/81	--	0.0133	0.0128	--	--	--	--
			11/10/82	--	nd	nd	nd	nd	nd	nd
			8/83	--	--	--	1.19	--	--	--
			1/84	--	--	--	--	--	--	--
			3/6/86	--	4.39	--	2.63	--	--	--
			4/21/86	--	2.27	--	4.55	--	--	--
			7/23/86	--	1.28	--	2.56	--	--	--
			9/26/86	--	6.41	--	7.69	--	--	--

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		SW-0	SW-1	SW-2	SW-5	SW-7	SW-9	SW-10
					Sample Identification and Location						
							(SW-11)				(SW-3)
						[PGRL-1]	[PGRL-2]	[PGRL-0]		[LFL-3]	
						{Site 2}	{Site 3}				{Site 1}
					Confluence of SW-10 and Lonfit River	Lonfit River Upstream	Lonfit River Downstream	Leachate Stream South	Leachate Pond South	Leachate Stream Southeast	Leachate Stream West
Metals	cadmium (continued)	µg/L	12/22/86		--	8.89	--	2.22	--	--	--
			3/12/87	f	--	<4.3	<4.3	<4.3	<4.3	--	<4.3
			3/25/87		--	7.4	--	3.7	--	--	--
			6/3/87		--	3.57	--	4.76	--	--	--
			10/14/87		--	4.76	--	4.76	--	--	--
			12/9/87		--	2.38	--	3.57	--	--	--
			9/27/90		--	<0.2	<0.2	--	--	--	<0.2
			9/27/90	f	--	<0.2	<0.2	--	--	--	<0.2
			10/25/90		--	<0.2	<0.2	--	--	--	<0.2
			10/25/90	f	--	<0.2	<0.2	--	--	--	<0.2
			6/8/93		--	<0.2	<0.2	--	--	--	<0.2
			6/8/93	f	--	<0.2	<0.2	--	--	--	<0.2
			6/22/93	f	--	<0.1	--	--	--	--	<0.1
			7/13/93	f	--	<0.1	<0.1	--	--	--	<0.1
			7/28/93	f	--	<0.1	--	--	--	--	<0.1
			8/17/93	f	--	<0.2	<0.2	--	--	--	<0.2
			8/27/93	f	--	<0.2	--	--	--	--	<0.2
			9/3/93	f	--	<0.2	--	--	--	--	<0.2
			9/10/93	f	--	<0.2	--	--	--	--	<0.2
			9/17/93		--	--	--	--	--	--	<0.1
			9/17/93	f	--	<0.1	na	--	--	--	<0.1
			9/24/93		--	<0.1	--	--	--	--	<0.1
			9/24/93	f	--	<0.1	--	--	--	--	<0.1
			10/1/93		--	<0.2	--	--	--	--	<0.2
			10/1/93	f	--	<0.2	--	--	--	--	<0.2
			10/8/93		--	--	--	--	--	--	<0.2
			10/8/93	f	--	<0.2	--	--	--	--	<0.2
			10/15/93	f	--	<0.2	--	--	--	--	<0.2
			12/2/93		--	<0.2	<0.2	--	--	--	<0.2
			12/2/93	f	--	<0.2	<0.2	--	--	--	<0.2

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		SW-0	SW-1	SW-2	SW-5	SW-7	SW-9	SW-10
					Sample Identification and Location						
							(SW-11)				(SW-3)
						[PGRL-1]	[PGRL-2]	[PGRL-0]		[LFL-3]	
						{Site 2}	{Site 3}				{Site 1}
					Confluence of SW-10 and Lonfit River	Lonfit River Upstream	Lonfit River Downstream	Leachate Stream South	Leachate Pond South	Leachate Stream Southeast	Leachate Stream West
Metals	cadmium (continued)	µg/L	6/6/94	f	--	<0.1	<0.1	--	--	--	<0.1
			11/7/97		<1.3	<1.3	--	<1.3	--	--	<1.3
			2/10/98		<1	<1	<1	<1	--	--	<1
			3/20/98		<1	<1	<1	<1	--	--	<1
			9/9/98		<1	<1	<1	<1	--	--	<1
	calcium	µg/L	3/12/87	f	--	42,150	42,720	66,200	85,870	--	103,700
			11/7/97		78,800	41,000	--	62,100	--	--	94,800
			2/10/98		80,000	42,000	55,000	67,000	--	--	77,000
			3/20/98		120,000	44,000	48,000	73,000	--	--	100,000
			9/9/98		87,000	35,000	38,000	7,100	--	--	110,000
	chromium (total)	µg/L	6/80		--	--	0.0083	--	--	--	--
			11/10/82		--	nd	nd	nd	nd	nd	nd
			8/83		--	--	--	0.092	--	--	--
			11/83		--	0.06427	--	--	--	--	--
			10/84		--	--	--	--	--	0.013	--
			3/6/86		--	5.56	--	27.8	--	--	--
			4/21/86		--	4.76	--	4.76	--	--	--
			7/23/86		--	4.17	--	4.17	--	--	--
			9/26/86		--	8.33	--	8.33	--	--	--
			12/22/86		--	9.52	--	4.76	--	--	--
			3/12/87	f	--	<3.7	<3.7	<3.7	11	--	<3.7
			3/25/87		--	5.56	--	5.56	--	--	--
			6/3/87		--	7.14	--	7.14	--	--	--
			10/14/87		--	9.52	--	4.76	--	--	--
			12/9/87		--	9.52	--	4.76	--	--	--
			9/27/90		--	0.5	0.9	--	--	--	2.3
			9/27/90	f	--	<0.3	<0.3	--	--	--	1.9
			10/25/90		--	<0.3	<0.3	--	--	--	1.9
			10/25/90	f	--	<0.3	<0.3	--	--	--	1.5
			6/8/93		--	<0.3	<0.3	--	--	--	1.2

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		SW-0	SW-1	SW-2	SW-5	SW-7	SW-9	SW-10
					Sample Identification and Location						
							(SW-11)				(SW-3)
						[PGRL-1]	[PGRL-2]	[PGRL-0]		[LFL-3]	
						{Site 2}	{Site 3}				{Site 1}
					Confluence of SW-10 and Lonfit River	Lonfit River Upstream	Lonfit River Downstream	Leachate Stream South	Leachate Pond South	Leachate Stream Southeast	Leachate Stream West
Metals	chromium (total) (continued)	µg/L	6/8/93	f	--	<0.3	<0.3	--	--	--	1.2
			6/22/93	f	--	<0.3	--	--	--	--	2.2
			7/13/93	f	--	<0.3	<0.3	--	--	--	1.9
			7/28/93	f	--	<0.3	--	--	--	--	2.1
			8/17/93	f	--	<0.3	<0.3	--	--	--	1.3
			8/27/93	f	--	<0.3	--	--	--	--	2
			9/3/93	f	--	<0.3	--	--	--	--	1.8
			9/10/93	f	--	<0.3	--	--	--	--	2.4
			9/17/93		--	--	--	--	--	--	2.4
			9/17/93	f	--	<0.3	<0.3	--	--	--	2.4
			9/24/93		--	na	--	--	--	--	2.6
			9/24/93	f	--	0.6	--	--	--	--	1.1
			10/1/93		--	1.8	--	--	--	--	1.3
			10/1/93	f	--	0.9	--	--	--	--	1.8
			10/8/93		--	--	--	--	--	--	3.8
			10/8/93	f	--	<0.3	--	--	--	--	4.1
			10/15/93	f	--	<0.3	--	--	--	--	5
			12/2/93		--	<0.3	<0.3	--	--	--	1.2
			12/2/93	f	--	<0.3	<0.3	--	--	--	1.4
			6/6/94	f	--	<0.3	<0.3	--	--	--	2.1
			11/7/97		<1.7	<1.7	--	8.2	--	--	3.1
			2/10/98		<10	<10	<10	<10	--	--	<10
			3/20/98		<10	<10	<10	<10	--	--	<10
			9/9/98		<10	<10	<10	<10	--	--	<10
	cobalt	µg/L	11/10/82		--	nd	nd	nd	nd	nd	nd
			3/12/87	f	--	<6.8	<6.8	<6.8	13	--	<6.8
			11/7/97		4.8	<2.1	--	5	--	--	4
	copper	µg/L	11/1/82		--	84	<50 (69)	<50	159	86	101
			3/12/87	f	--	<5.9	<5.9	10	31	--	<5.9
			9/27/90	u	--	0.8	1.5	--	--	--	3.3

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
					Sample Identification and Location						
Metals	copper (continued)	µg/L	9/1/90	f	--	0.3	0.6	--	--	--	2.1
			10/25/90		--	0.9	1	--	--	--	6.7
			10/25/90	f	--	0.4	0.4	--	--	--	4.9
			6/8/93		--	1	1	--	--	--	2.5
			6/8/93	f	--	1	1	--	--	--	2.6
			6/22/93	f	--	4.1	--	--	--	--	2.2
			7/13/93	f	--	0.4	0.4	--	--	--	2.4
			7/28/93	f	--	0.4	--	--	--	--	3
			8/17/93	f	--	0.3	0.3	--	--	--	10
			8/27/93	f	--	0.3	--	--	--	--	30.8
			9/3/93	f	--	0.3	--	--	--	--	30
			9/10/93	f	--	0.3	--	--	--	--	21.2
			9/17/93		--	--	--	--	--	--	13.5
			9/17/93	f	--	1	na	--	--	--	12
			9/24/93		--	4	--	--	--	--	18.4
			9/24/93	f	--	1.7	--	--	--	--	6.2
			10/1/93		--	1.7	--	--	--	--	36
			10/1/93	f	--	1.2	--	--	--	--	8.5
			10/8/93		--	--	--	--	--	--	17.1
			10/8/93	f	--	0.8	--	--	--	--	6.1
			10/15/93	f	--	0.8	--	--	--	--	4.6
			12/2/93		--	<0.3	<0.3	--	--	--	2.6
			12/2/93	f	--	<0.3	<0.3	--	--	--	2.1
			6/6/94	f	--	2	2	--	--	--	1.7
			11/7/97		13.1	<1.5	--	10.5	--	--	12
	iron	µg/L	11/10/82		--	1,030	258	659	9,660	6,360	1,470
			3/12/87	f	--	106	223	639	39,260	--	243
			9/27/90		--	500	566	--	--	--	2,056
			9/27/90	f	--	14.5	17.3	--	--	--	52.3
			10/25/90		--	43.5	21.3	--	--	--	1,222

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		SW-0	SW-1	SW-2	SW-5	SW-7	SW-9	SW-10
					Sample Identification and Location						
							(SW-11)				(SW-3)
						[PGRL-1]	[PGRL-2]	[PGRL-0]		[LFL-3]	
						{Site 2}	{Site 3}				{Site 1}
					Confluence of SW-10 and Lonfit River	Lonfit River Upstream	Lonfit River Downstream	Leachate Stream South	Leachate Pond South	Leachate Stream Southeast	Leachate Stream West
Metals	Iron (continued)	µg/L	10/25/90	f	--	4.5	4.7	--	--	--	33.5
			6/8/93		--	11.3	107	--	--	--	194
			6/8/93	f	--	4.9	26.6	--	--	--	69.4
			6/22/93	f	--	5	--	--	--	--	86.8
			7/13/93	f	--	1	12.4	--	--	--	79
			7/28/93	f	--	1	--	--	--	--	12
			8/17/93	f	--	8.8	14.4	--	--	--	106
			8/27/93	f	--	1.5	--	--	--	--	154
			9/3/93	f	--	9.5	--	--	--	--	83.1
			9/10/93	f	--	10.9	--	--	--	--	141
			9/17/93		--	--	--	--	--	--	149
			9/17/93	f	--	10.1	na	--	--	--	51.7
			9/24/93		--	1,024	--	--	--	--	769
			9/24/93	f	--	23	--	--	--	--	53.6
			10/1/93		--	1,858	--	--	--	--	938
			10/1/93	f	--	38	--	--	--	--	55
			10/8/93		--	--	--	--	--	--	4,713
			10/8/93	f	--	36	--	--	--	--	646
			10/15/93	f	--	16.4	--	--	--	--	254
			12/2/93		--	154	163	--	--	--	1,625
			12/2/93	f	--	14.7	33.3	--	--	--	122
			6/6/94	f	--	18	22.8	--	--	--	160
			11/7/97		1,190	189	--	4,680	--	--	3,330
			2/10/98		1,200	<100	1,100	220	--	--	4,100
			3/20/98		2,500	<100	<100	<100	--	--	14,000
			9/9/98		360	140	240	170	--	--	530
	lead	µg/L	10/81		--	0.0326	--	--	--	--	--
			1/83		--	--	0.0815	0.0463	--	--	--
			11/10/82		--	<5	<5 (8)	<5	24	10	<5
			4/84		--	--	--	--	--	0.0287	--

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Metals	lead (continued)	µg/L	3/6/86		--	83.3	--	75	--	--	--
			4/21/86		--	19	--	66.7	--	--	--
			7/23/86		--	33.3	--	26.7	--	--	--
			9/26/86		--	33.3	--	33.3	--	--	--
			12/22/86		--	24	--	48	--	--	--
			3/12/87	f	--	<5	<5	<5	18	--	5.3
			3/25/87		--	6.67	--	6.67	--	--	--
			6/3/87		--	7.4	--	7.4	--	--	--
			10/14/87		--	24	--	33.3	--	--	--
			12/9/87		--	33.3	--	22.2	--	--	--
			9/27/90		--	0.7	0.3	--	--	--	2.1
			9/27/90	f	--	1	<0.3	--	--	--	3.1
			10/25/90		--	0.7	0.3	--	--	--	2.1
			10/25/90	f	--	1	<0.3	--	--	--	0.3
			6/8/93		--	<0.6	<0.6	--	--	--	<0.6
			6/8/93	f	--	<0.6	<0.6	--	--	--	<0.6
			6/22/93	f	--	<0.6	--	--	--	--	<0.6
			7/13/93	f	--	<0.5	<0.5	--	--	--	<0.5
			7/28/93	f	--	<0.5	--	--	--	--	<0.5
			8/17/93	f	--	<0.3	<0.3	--	--	--	<0.3
			8/27/93	f	--	<0.3	--	--	--	--	<0.3
			9/3/93	f	--	<0.3	--	--	--	--	<0.3
			9/10/93	f	--	<0.3	--	--	--	--	<0.3
			9/17/93		--	--	--	--	--	--	<0.6
			9/17/93	f	--	<0.6	na	--	--	--	<0.6
			9/24/93		--	<0.6	--	--	--	--	<0.6
			9/24/93	f	--	<0.6	--	--	--	--	<0.6
			10/1/93		--	4.8	--	--	--	--	3.4
			10/1/93	f	--	<0.3	--	--	--	--	<0.3
			10/8/93		--	--	--	--	--	--	3.1

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
					Sample Identification and Location						
Metals	lead (continued)	µg/L	10/8/93	f	--	<0.3	--	--	--	--	<0.3
			10/15/93		--	<0.3	--	--	--	--	<0.3
			12/2/93		--	<0.6	<0.6	--	--	--	<0.6
			12/2/93	f	--	<0.6	<0.6	--	--	--	<0.6
			6/6/94	f	--	<0.6	<0.6	--	--	--	4
			11/7/97		1	<0.5	--	2.6	--	--	1.4
			2/10/98		<5	<5	<5	<5	--	--	<5
			3/20/98		13	9.5	<5	7.9	--	--	6
			9/9/98		<5	<5	<5	<5	--	--	<5
	magnesium	µg/L	3/12/87	f	--	8,745	9,210	54,290	60,290	--	23,580
			11/7/97		22,500	8,430	--	44,300	--	--	24,200
			2/10/98		25,000	9,300	11,000	58,000	--	--	20,000
			3/20/98		32,000	9,000	11,000	64,000	--	--	28,000
			9/9/98		19,000	7,000	8,200	61,000	--	--	25,000
	manganese	µg/L	11/10/82		--	39	24	636	772	1,280	604
			3/12/87	f	--	20	5	142	3,161	--	224
			9/27/90		--	28.1	60.2	--	--	--	364
			9/27/90	f	--	12.6	40	--	--	--	337
			10/25/90		--	28.3	33.9	--	--	--	766
			10/25/90	f	--	20.8	25.4	--	--	--	966
			6/8/93		--	44.2	67.4	--	--	--	100
			6/8/93	f	--	36.1	52.3	--	--	--	100
			6/22/93	f	--	41.7	--	--	--	--	307
			7/13/93	f	--	8.3	8.3	--	--	--	524
			7/28/93	f	--	11	--	--	--	--	306
			8/17/93	f	--	16.4	16.9	--	--	--	205
			8/27/93	f	--	85.4	--	--	--	--	159
			9/3/93	f	--	30.3	--	--	--	--	167
			9/10/93	f	--	33.6	--	--	--	--	83.4
			9/17/93		--	--	--	--	--	--	101

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Metals	manganese (continued)	µg/L	9/17/93	f	--	6.1	na	--	--	--	83.3
			9/24/93		--	na	--	--	--	--	161
			9/24/93	f	--	122	--	--	--	--	87.3
			10/1/93		--	52	--	--	--	--	220
			10/1/93	f	--	12	--	--	--	--	151
			10/8/93		--	--	--	--	--	--	1,113
			10/8/93	f	--	12.5	--	--	--	--	915
			10/15/93		--	10.8	--	--	--	--	582
			12/2/93		--	9	33.2	--	--	--	832
			12/2/93	f	--	3.8	17.4	--	--	--	733
			6/6/94	f	--	8.1	22.8	--	--	--	795
			11/7/97		305	8.6	--	283	--	--	568
			2/10/98		280	25	880	80	--	--	520
			3/20/98		1,100	29	53	48	--	--	660
			9/9/98		240	16	23	88	--	--	140
	mercury	µg/L	11/10/82		--	77	6.2	3.4	32.8	7.1	2.9
			1/83		--	--	0.0018	--	--	--	--
			8/83		--	0.0105	--	0.014	--	0.0208	--
			3/6/86		--	0.22	--	0.467	--	--	--
			4/21/86		--	0.824	--	1.13	--	--	--
			7/23/86		--	1.107	--	0.756	--	--	--
			9/26/86		--	0.915	--	0.976	--	--	--
			12/22/86		--	0.45	--	0.5	--	--	--
			3/12/87	f	--	<0.2	<0.2	<0.2	<0.2	--	<0.2
			3/25/87		--	0.45	--	0.82	--	--	--
			6/3/87		--	0.51	--	0.306	--	--	--
			10/14/87		--	0.625	--	0.4	--	--	--
			12/9/87		--	0.774	--	1.012	--	--	--
			9/27/90		--	<0.3	<0.3	--	--	--	<0.3
			9/27/90	f	--	<0.3	<0.3	--	--	--	<0.3

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Metals	mercury (continued)	µg/L	10/25/90		--	<0.3	<0.3	--	--	--	<0.3
			10/25/90	f	--	<0.3	<0.3	--	--	--	<0.3
			6/8/93		--	nd	nd	--	--	--	nd
			6/8/93	f	--	nd	nd	--	--	--	nd
			6/22/93	f	--	nd	--	--	--	--	nd
			7/13/93	f	--	nd	nd	--	--	--	nd
			7/28/93	f	--	nd	--	--	--	--	nd
			8/17/93	f	--	nd	nd	--	--	--	nd
			8/27/93	f	--	nd	--	--	--	--	nd
			9/3/93	f	--	nd	--	--	--	--	nd
			9/10/93	f	--	nd	--	--	--	--	nd
			9/17/93		--	--	--	--	--	--	nd
			9/17/93	f	--	nd	nd	--	--	--	nd
			9/24/93		--	nd	--	--	--	--	nd
			9/24/93	f	--	nd	--	--	--	--	nd
			10/1/93		--	nd	--	--	--	--	nd
			10/1/93	f	--	nd	--	--	--	--	nd
			10/8/93		--	--	--	--	--	--	nd
			10/8/93	f	--	nd	--	--	--	--	nd
			10/15/93		--	nd	--	--	--	--	nd
			12/2/93		--	nd	nd	--	--	--	nd
			12/2/93	f	--	nd	nd	--	--	--	nd
			6/6/94	f	--	nd	nd	--	--	--	nd
	nickel	µg/L	11/10/82		--	<4	51	<4 (46)	<4	<4	<4
			3/12/87	f	--	<23	<23	<23	<23	--	<23
			9/27/90		--	<0.6	<0.6	--	--	--	6.8
			9/27/90	f	--	<0.6	<0.6	--	--	--	4.6
			10/25/90		--	<0.6	<0.6	--	--	--	3
			10/25/90	f	--	<0.6	<0.6	--	--	--	2.7

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Metals	nickel (continued)	µg/L	6/8/93		--	<0.6	<0.6	--	--	--	19.5
			6/8/93	f	--	<0.6	<0.6	--	--	--	17.5
			6/22/93	f	--	<0.6	--	--	--	--	11.5
			7/13/93	f	--	<0.6	<0.6	--	--	--	10
			7/28/93	f	--	<0.6	--	--	--	--	16.7
			8/17/93	f	--	<0.8	<0.8	--	--	--	10.8
			8/27/93	f	--	<0.8	--	--	--	--	22.7
			9/3/93	f	--	<0.8	--	--	--	--	17.4
			9/10/93	f	--	<0.8	--	--	--	--	22.1
			9/17/93		--	--	--	--	--	--	21.4
			9/17/93	f	--	<0.8	<0.8	--	--	--	20.3
			9/24/93		--	<0.8	--	--	--	--	3.3
			9/24/93	f	--	<0.8	--	--	--	--	3.3
			10/1/93		--	<0.8	--	--	--	--	11.6
			10/1/93	f	--	<0.8	--	--	--	--	7.2
			10/8/93		--	--	--	--	--	--	30
			10/8/93	f	--	<0.8	--	--	--	--	27.3
			10/15/93		--	<0.8	--	--	--	--	28.5
			12/2/93		--	<0.8	<0.8	--	--	--	23.1
			12/2/93	f	--	<0.8	<0.8	--	--	--	16.4
			6/6/94	f	--	<0.8	<0.8	--	--	--	33
			11/7/97		23	<11	--	17.8	--	--	12.4
	potassium	µg/L	3/12/87	f	--	948	948	14,740	22,220	--	15,850
			11/7/97		46,900	1,380	--	68,100	--	--	60,500
			2/10/98		36,000	1,700	3,300	54,000	--	--	28,000
			3/20/98		38,000	1,600	3,300	58,000	--	--	41,000
			9/9/98		24,000	1,400	3,100	92,000	--	--	45,000
	selenium	µg/L	11/10/82		--	nd	nd	nd	nd	nd	nd
			1/83		--	--	--	0.022	--	--	--
			10/83		--	0.0237	0.0178	--	--	--	--

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
					Sample Identification and Location						
Metals	selenium (continued)	µg/L	4/84		--	--	--	--	--	0.0146	--
			3/6/86		--	5.26	--	1.46	--	--	--
			4/21/86		--	5.7	--	4	--	--	--
			7/23/86		--	6.77	--	6.06	--	--	--
			9/26/86		--	4.78	--	4.35	--	--	--
			12/22/86		--	4.49	--	4.42	--	--	--
			3/12/87	f	--	<5	<5	<5	<25	--	<5
			3/25/87		--	3.82	--	5.03	--	--	--
			6/3/87		--	5.21	--	5.45	--	--	--
			10/14/87		--	1.54	--	1.31	--	--	--
			12/9/87		--	1.29	--	1.65	--	--	--
			11/7/97		<125	<125	--	<125	--	--	<125
	silver	µg/L	11/10/82		--	<10	13	<10	<10	<10	<10
			1/83		--	--	0.0023	--	--	--	--
			8/83		--	0.00687	--	--	--	--	--
			10/84		--	--	--	--	--	0.016	--
			3/85		--	--	--	0.00392	--	--	--
			3/6/86		--	8.33	--	4.17	--	--	--
			4/21/86		--	4.44	--	6.67	--	--	--
			7/23/86		--	2.38	--	7.14	--	--	--
			9/26/86		--	9.52	--	9.52	--	--	--
			12/22/86		--	2.22	--	8.89	--	--	--
			3/12/87	f	--	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1
			3/25/87		--	4.76	--	4.76	--	--	--
			6/3/87		--	2.22	--	4.44	--	--	--
			10/14/87		--	6.25	--	4.17	--	--	--
			12/9/87		--	4.17	--	6.25	--	--	--
			9/27/90		--	<0.1	<0.1	--	--	--	<0.1
			9/27/90	f	--	<0.1	<0.1	--	--	--	<0.1
			10/25/90		--	<0.1	<0.1	--	--	--	<0.1

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		Sample Identification and Location					
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Metals	silver (continued)	µg/L	10/25/90 f	–	<0.1	<0.1	–	–	–	<0.1
			6/8/93	–	<0.2	<0.2	–	–	–	<0.2
			6/8/93 f	–	<0.2	<0.2	–	–	–	<0.2
			6/22/93 f	–	<0.2	–	–	–	–	<0.2
			7/13/93 f	–	<0.1	<0.1	–	–	–	<0.1
			7/28/93 f	–	<0.1	–	–	–	–	<0.1
			8/17/93 f	–	<0.2	<0.2	–	–	–	<0.4
			8/27/93 f	–	<0.2	–	–	–	–	<0.4
			9/3/93 f	–	<0.1	–	–	–	–	<0.4
			9/10/93 f	–	<0.2	–	–	–	–	<0.4
			9/17/93	–	–	–	–	–	–	<0.1
			9/17/93 f	–	<0.1	<0.1	–	–	–	<0.1
			9/24/93	–	<0.1	–	–	–	–	<0.1
			9/24/93 f	–	<0.1	–	–	–	–	<0.1
			10/1/93	–	<0.1	–	–	–	–	<0.1
			10/1/93 f	–	<0.1	–	–	–	–	<0.1
			10/8/93	–	–	–	–	–	–	<0.1
			10/8/93 f	–	<0.1	–	–	–	–	<0.1
			10/15/93	–	<0.1	–	–	–	–	<0.1
			12/2/93	–	<0.1	<0.1	–	–	–	<0.1
			12/2/93 f	–	<0.1	<0.1	–	–	–	<0.1
			6/6/94 f	–	<0.1	<0.1	–	–	–	<0.1
			11/7/97	<1.9	<1.9	–	<1.9	–	–	<1.9
	sodium	µg/L	3/12/87 f	–	17,890	19,180	126,600	119,800	–	92,870
			11/7/97	159,000	14,200	–	192,000	–	–	169,000
			2/10/98	160,000	20,000	25,000	230,000	–	–	97,000
			3/20/98	250,000	22,000	31,000	260,000	–	–	160,000
			9/9/98	130,000	18,000	25,000	340,000	–	–	200,000

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		SW-0	SW-1	SW-2	SW-5	SW-7	SW-9	SW-10
					Sample Identification and Location						
						[PGRL-1]	(SW-11) [PGRL-2]	[PGRL-0]		[LFL-3]	(SW-3)
						{Site 2}	{Site 3}				{Site 1}
					Confluence of SW-10 and Lonfit River	Lonfit River Upstream	Lonfit River Downstream	Leachate Stream South	Leachate Pond South	Leachate Stream Southeast	Leachate Stream West
Metals	thallium	µg/L	11/10/82		--	nd	nd	nd	nd	nd	nd
			3/12/87	f	--	<10	<10	<10	<10	<10	<10
			11/7/97		<160	<160	--	<160	--	--	<160
	tin	µg/L	11/10/82		--	nd	nd	nd	nd	nd	nd
			3/12/87		--	<17	<17	<17	<17	<17	<17
	vanadium	µg/L	11/10/82		--	nd	nd	nd	nd	nd	nd
			3/1/87	f	--	5.4	3.6	<3.1	12	--	<3.1
			11/7/97		3.2 J	6.5 J	--	9	--	--	5.6 J
	zinc	µg/L	11/10/82		--	22	<11 (91)	19	140	51	35
			3/12/87	f	--	9	18	31	73	--	9
			9/27/90		--	0.7	1.4	--	--	--	9.5
			9/27/90	f	--	<0.1	0.2	--	--	--	3.6
			10/25/90		--	<0.1	0.2	--	--	--	5.1
			10/25/90	f	--	<0.1	<0.1	--	--	--	2.6
			6/8/93		--	0.3	0.1	--	--	--	2.3
			6/8/93	f	--	0.1	0.1	--	--	--	2.2
			6/22/93	f	--	2.7	--	--	--	--	3.9
			7/13/93	f	--	0.9	0.2	--	--	--	1.7
			7/28/93	f	--	1.4	--	--	--	--	3.1
			8/17/93	f	--	0.7	<0.1	--	--	--	1.2
			8/27/93	f	--	1.1	--	--	--	--	6.2
			9/3/93	f	--	0.8	--	--	--	--	2.2
			9/10/93	f	--	<0.1	--	--	--	--	4.8
			9/17/93		--	--	--	--	--	--	6.5
			9/17/93	f	--	0.1	na	--	--	--	6
			9/24/93		--	na	--	--	--	--	10.6
			9/24/93	f	--	10	--	--	--	--	2.9
			10/1/93		--	3.7	--	--	--	--	22
			10/1/93	f	--	0.1	--	--	--	--	2.9
			10/8/93		--	--	--	--	--	--	16

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date		SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Metals	zinc (continued)	µg/L	10/8/93	f	--	0.1	--	--	--	--	2.2
			10/15/93		--	0.1	--	--	--	--	3.5
			12/2/93		--	<0.1	<0.1	--	--	--	2.3
			12/2/93	f	--	<0.1	<0.1	--	--	--	2.3
			6/6/94	f	--	0.2	0.2	--	--	--	1.4
			11/7/97		29.6	9 j	--	21.8	--	--	40.4
			2/10/98		<50	<50	<50	<50	--	--	<50
			3/20/98		<50	<50	<50	<50	--	--	<50
			9/9/98		<85	<85	<85	<85	--	--	<85
VOCs	acetone	µg/L	11/10/82		--	<5	<5	<5	<5	<5	<5
			3/12/87		--	2 jb	2 jb	5 jb	8 jb	--	<10
	2-butanone	µg/L	11/10/82		--	<5	<5	<5	<5	<5	<5
			3/12/87		--	6 jb	8 jb	12 b	<10	<10	<10
	carbon disulfide	µg/L	11/10/82		--	<5	<5	<5	<5	<5	<5
			3/12/87		--	<5	<5	<5	1 j	<5	<5
	chlorobenzene	µg/L	3/12/87		--	<5	<5	<5	3 j	<5	<5
	chloroethane	µg/L	11/10/82		--	<5	<5	<5	<5	j	<5
	1,1-dichloroethane	µg/L	11/10/82		--	<5	<5	<5	<5	j	<5
	ethylbenzene	µg/L	3/12/87		--	<5	<5	<5	<5	<5	<5
	2-hexanone	µg/L	11/10/82		--	<5	<5	<5	<5	<5	<5
	4-methyl-2-pentanone	µg/L	11/10/82		--	<5	<5	<5	<5	<5	<5
	methylene chloride	µg/L	11/10/82		--	<5	<5	<5	<5	<5	<5
			3/12/87		--	<5	2 jb	<5	<5	<5	<5

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
VOCs	styrene	µg/L	11/10/82	--	j	<5	<5	<5	<5	<5
			3/12/87	--	<5	<5	<5	<5	<5	<5
	toluene	µg/L	3/12/87	--	1 jb	1 jb	1 jb	<5	<5	<5
	vinyl acetate	µg/L	11/10/82	--	<5	<5	<5	<5	<5	<5
	xylenes	µg/L	3/12/87	--	<5	<5	<5	<5	<5	<5
SVOCs	diethyl phthalate	µg/L	11/10/82	--	<20	<20	<20	<20	j	<20
	bis(2-ethylhexyl)phthalate	µg/L	3/12/87	--	<10	<10	<10	<10	<10	3 jb
	phenol	µg/L	3/12/87	--	<10	<10	<10	<10	<10	3 j
Pesticides & PCBs	aldrin	µg/L	6/89	<0.2	--	--	--	--	--	<0.2
			7/89	<0.2	--	--	--	--	--	<0.2
			8/89	<0.2	--	--	--	--	--	<0.2
			9/89	<0.2	--	--	--	--	--	<0.2
			10/89	<0.2	--	--	--	--	--	<0.2
			11/89	<0.2	--	--	--	--	--	<0.2
	BHC-alpha	µg/L	6/89	<0.16	--	--	--	--	--	<0.16
			7/89	<0.16	--	--	--	--	--	<0.16
			8/89	<0.16	--	--	--	--	--	<0.16
			9/89	<0.16	--	--	--	--	--	<0.16
			10/89	<0.16	--	--	--	--	--	<0.16
			11/89	<0.16	--	--	--	--	--	<0.16

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Pesticides & PCBs	BHC-beta	µg/L	6/89	<0.4	--	--	--	--	--	<0.4
			7/89	<0.4	--	--	--	--	--	<0.4
			8/89	<0.4	--	--	--	--	--	<0.4
			9/89	<0.4	--	--	--	--	--	<0.4
			10/89	<0.4	--	--	--	--	--	<0.4
			11/89	<0.4	--	--	--	--	--	<0.4
	BHC-delta	µg/L	6/89	<0.2	--	--	--	--	--	<0.2
			7/89	<0.2	--	--	--	--	--	<0.2
			8/89	<0.2	--	--	--	--	--	<0.2
			9/89	<0.2	--	--	--	--	--	<0.2
			10/89	<0.2	--	--	--	--	--	<0.2
			11/89	<0.2	--	--	--	--	--	<0.2
	BHC-gamma	µg/L	6/89	<0.2	--	--	--	--	--	<0.2
			7/89	<0.2	--	--	--	--	--	<0.2
			8/89	<0.2	--	--	--	--	--	<0.2
			9/89	<0.2	--	--	--	--	--	<0.2
			10/89	<0.2	--	--	--	--	--	<0.2
			11/89	<0.2	--	--	--	--	--	<0.2

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Pesticides & PCBs	chlordane-alpha	µg/L	6/89	<0.1	--	--	--	--	--	<0.1
			7/89	<0.1	--	--	--	--	--	<0.1
			8/89	<0.1	--	--	--	--	--	<0.1
			9/89	<0.1	--	--	--	--	--	<0.1
			10/89	<0.1	--	--	--	--	--	<0.1
			11/89	<0.1	--	--	--	--	--	<0.1
	chlordane-gamma	µg/L	6/89	<0.1	--	--	--	--	--	<0.1
			7/89	<0.1	--	--	--	--	--	<0.1
			8/89	<0.1	--	--	--	--	--	<0.1
			9/89	<0.1	--	--	--	--	--	<0.1
			10/89	<0.1	--	--	--	--	--	<0.1
			11/89	<0.1	--	--	--	--	--	<0.1
	4,4'-DDD	µg/L	6/89	<0.4	--	--	--	--	--	<0.4
			7/89	<0.4	--	--	--	--	--	<0.4
			8/89	<0.4	--	--	--	--	--	<0.4
			9/89	<0.4	--	--	--	--	--	<0.4
			10/89	<0.4	--	--	--	--	--	<0.4
			11/89	<0.4	--	--	--	--	--	<0.4

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Pesticides & PCBs	4,4'-DDE	µg/L	6/89	<0.2	--	--	--	--	--	<0.2
			7/89	<0.2	--	--	--	--	--	<0.2
			8/89	<0.2	--	--	--	--	--	<0.2
			9/89	<0.2	--	--	--	--	--	<0.2
			10/89	<0.2	--	--	--	--	--	<0.2
			11/89	<0.2	--	--	--	--	--	<0.2
	4,4'-DDT	µg/L	6/89	<0.4	--	--	--	--	--	<0.4
			7/89	<0.4	--	--	--	--	--	<0.4
			8/89	<0.4	--	--	--	--	--	<0.4
			9/89	<0.4	--	--	--	--	--	<0.4
			10/89	<0.4	--	--	--	--	--	<0.4
			11/89	<0.4	--	--	--	--	--	<0.4
			2/10/98	<0.1	<0.1	<0.1	<0.1	--	--	<0.1
			3/20/98	<0.1	<0.1	<0.1	<0.1	--	--	<0.1
	diazinon	µg/L	6/89	<0.4	--	--	--	--	--	<0.4
			7/89	<0.4	--	--	--	--	--	<0.4
			8/89	<0.4	--	--	--	--	--	<0.4
			9/89	<0.4	--	--	--	--	--	<0.4
			10/89	<0.4	--	--	--	--	--	<0.4
			11/89	<0.4	--	--	--	--	--	<0.4

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Pesticides & PCBs	dieldrin	µg/L	11/10/82	--	<0.1	<0.1	<0.1	<0.1	<0.1 (0.21)	<0.1
			6/89	<0.2	--	--	--	--	--	<0.2
			7/89	<0.2	--	--	--	--	--	<0.2
			8/89	<0.2	--	--	--	--	--	<0.2
			9/89	<0.2	--	--	--	--	--	<0.2
			10/89	<0.2	--	--	--	--	--	<0.2
			11/89	<0.2	--	--	--	--	--	<0.2
	endosulfan sulfate	µg/L	11/10/82	--	<0.1	<0.1	<0.1	<0.1	<0.1 (0.135)	<0.1
	endrin	µg/L	6/89	<0.2	--	--	--	--	--	<0.2
			7/89	<0.2	--	--	--	--	--	<0.2
			8/89	<0.2	--	--	--	--	--	<0.2
			9/89	<0.2	--	--	--	--	--	<0.2
			10/89	<0.2	--	--	--	--	--	<0.2
			11/89	<0.2	--	--	--	--	--	<0.2
	ethion	µg/L	6/89	<0.4	--	--	--	--	--	<0.4
			7/89	<0.4	--	--	--	--	--	<0.4
			8/89	<0.4	--	--	--	--	--	<0.4
			9/89	<0.4	--	--	--	--	--	<0.4
			10/89	<0.4	--	--	--	--	--	<0.4
			11/89	<0.4	--	--	--	--	--	<0.4

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Pesticides & PCBs	heptachlor	µg/L	6/89	<0.24	--	--	--	--	--	<0.24
			7/89	<0.24	--	--	--	--	--	<0.24
			8/89	<0.24	--	--	--	--	--	<0.24
			9/89	<0.24	--	--	--	--	--	<0.24
			10/89	<0.24	--	--	--	--	--	<0.24
			11/89	<0.24	--	--	--	--	--	<0.24
	malathion	µg/L	6/89	<4	--	--	--	--	--	<4
			7/89	<4	--	--	--	--	--	<4
			8/89	<4	--	--	--	--	--	<4
			9/89	<4	--	--	--	--	--	<4
			10/89	<4	--	--	--	--	--	<4
			11/89	<4	--	--	--	--	--	<4
	methoxychlor	µg/L	6/89	<0.2	--	--	--	--	--	<0.2
			7/89	<0.2	--	--	--	--	--	<0.2
			8/89	<0.2	--	--	--	--	--	<0.2
			9/89	<0.2	--	--	--	--	--	<0.2
			10/89	<0.2	--	--	--	--	--	<0.2
			11/89	<0.2	--	--	--	--	--	<0.2
	naled	µg/L	6/89	<2	--	--	--	--	--	<2
			7/89	<2	--	--	--	--	--	<2
			8/89	<2	--	--	--	--	--	<2
			9/89	<2	--	--	--	--	--	<2
			10/89	<2	--	--	--	--	--	<2
			11/89	<2	--	--	--	--	--	<2

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Pesticides & PCBs	parathion, ethyl	µg/L	6/89	<2	--	--	--	--	--	<2
			7/89	<2	--	--	--	--	--	<2
			8/89	<2	--	--	--	--	--	<2
			9/89	<2	--	--	--	--	--	<2
			10/89	<2	--	--	--	--	--	<2
			11/89	<2	--	--	--	--	--	<2
	parathion, methyl	µg/L	6/89	<2	--	--	--	--	--	<2
			7/89	<2	--	--	--	--	--	<2
			8/89	<2	--	--	--	--	--	<2
			9/89	<2	--	--	--	--	--	<2
			10/89	<2	--	--	--	--	--	<2
			11/89	<2	--	--	--	--	--	<2
	PCB-1016	µg/L	2/10/98	<1	<1	<1	<1	--	--	<1
			3/20/98	<1	<1	<1	<1	--	--	<1
	PCB-1221	µg/L	2/10/98	<2	<2	<2	<2	--	--	<2
			3/20/98	<2	<2	<2	<2	--	--	<2
	PCB-1232	µg/L	2/10/98	<1	<1	<1	<1	--	--	<1
			3/20/98	<1	<1	<1	<1	--	--	<1
	PCB-1242	µg/L	11/10/82	--	<0.1	<0.1	<0.1 (3.84)	<0.1	<0.1	<0.1 (1.12)
			2/10/98	<1	<1	<1	<1	--	--	<1
			3/20/98	<1	<1	<1	<1	--	--	<1
	PCB-1248	µg/L	2/10/98	<1	<1	<1	<1	--	--	<1
			3/20/98	<1	<1	<1	<1	--	--	<1
	PCB-1254	µg/L	2/10/98	<1	<1	<1	<1	--	--	<1
			3/20/98	<1	<1	<1	<1	--	--	<1
	PCB-1260	µg/L	2/10/98	<1	<1	<1	<1	--	--	<1
			3/20/98	<1	<1	<1	<1	--	--	<1
TRPH		µg/L	2/10/98	<1,000	<1,000	<1,000	<1,000	--	--	<1,000
			3/20/98	<1,000	<1,000	<1,000	<1,000	--	--	<1,000

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	SW-0	SW-1	SW-2	SW-5	SW-7	SW-9	SW-10
				Sample Identification and Location						
						(SW-11)				(SW-3)
					[PGRL-1]	[PGRL-2]	[PGRL-0]		[LFL-3]	
					{Site 2}	{Site 3}				{Site 1}
				Confluence of SW-10 and Lonfit River	Lonfit River Upstream	Lonfit River Downstream	Leachate Stream South	Leachate Pond South	Leachate Stream Southeast	Leachate Stream West
Other Parameters	ammonia	mg/L	11/7/97	32.2	<0.06	--	27.1	--	--	42.5
	BOD_5	mg/L	2/10/98	14	2.2	5.1	2.7	--	--	15
			3/20/98	14	23	1.1	1.6	--	--	20
			9/9/98	14	0.93	4.2	10	--	--	4
	COD	mg/L	2/10/98	100	<10	<10	76	--	--	61
			3/20/98	140	20	<10	56	--	--	110
			9/9/98	98	<10	67	170	--	--	160
	cyanide	µg/L	3/12/87	--	<10	<10	<10	<10	--	19
	nitrogen as nitrate	mg/L	7/80	--	--	0.23	--	--	--	--
			12/80	--	0.32	--	--	--	--	--
			5/81	--	--	--	1.67	--	--	--
			2/10/98	0.5	<0.05	0.6	11	--	--	0.8
			3/20/98	0.77	<0.05	0.52	6.8	--	--	0.54
			9/9/98	13	<0.05	0.68	14	--	--	36
	nitrogen as nitrite	mg/L	7/80	--	--	0.05	--	--	--	--
			8/81	--	--	--	0.343	--	--	--
	nitrogen as nitrate+nitrite	mg/L	11/7/97	3.8	<0.03	--	7.1	--	--	2.4
			2/10/98	1.7	<0.05	0.6	11	--	--	0.89
			3/20/98	2.1	<0.05	0.52	6.8	--	--	0.65
			9/9/98	14	<0.05	0.9	21	--	--	36
	nitrogen (total Kjeldahl)	mg/L	11/7/97	41.5	<0.15	--	28.9	--	--	44.2
			2/10/98	38	<0.75	<0.75	3.4	--	--	25
			3/20/98	63	<0.75	<0.75	3	--	--	83
			9/9/98	9.9	<0.75	0.8	38	--	--	22
	nitrogen (total organic)	mg/L	11/7/97	9.3	<0.15	--	1.8	--	--	1.7
	pH	--	11/10/82	--	8	8	7.7	7.8	7.4	7
			3/12/87	--	7.96	6.85	6.2	--	--	2.75
			2/10/98	7.8	8.2	7.5	6	--	--	7.4
			3/20/98	7.5	7	7.8	7.9	--	--	7.3
			9/9/98	7.4	8.1	7.8	7.9			7.3

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location						
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 [PGRL-1] {Site 2} Lonfit River Upstream	SW-2 (SW-11) [PGRL-2] {Site 3} Lonfit River Downstream	SW-5 [PGRL-0] Leachate Stream South	SW-7 Leachate Pond South	SW-9 [LFL-3] Leachate Stream Southeast	SW-10 (SW-3) {Site 1} Leachate Stream West
Other Parameters	phosphorus (total)	mg/L	1/80	--	--	0.77	--	--	--	--
			8/80	--	--	--	0.121	--	--	--
			9/81	--	0.54	--	--	--	--	--
			11/7/97	<0.1j	<0.01	--	0.11 j	--	--	0.09
			2/10/98	<0.1	<0.1	<0.1	<0.1	--	--	<0.1
			3/20/98	<0.1	<0.1	<0.1	0.11	--	--	0.21
			9/9/98	<0.1	<0.1	<0.1	<0.1			<0.1
	TDS	mg/L	11/7/97	862	209	--	1,040	--	--	969
			2/10/98	870	230	280	1,100	--	--	590
			3/20/98	1,100	<25	240	1,000	--	--	900
			9/9/98	370	170	270	1,500			1,400
	TOC	mg/L	11/7/97	45.3	2.8	--	41.6	--	--	48.8
			2/10/98	36.4	<1	3	29.3	--	--	19.8
			3/20/98	39	<1	1.79	19.9	--	--	27
			9/9/98	23	1.2	2.2	47			48
	TSS	mg/L	11/7/97	<10	<10	--	66.5	--	--	21
			2/10/98	2.2	1	1.3	1.8	--	--	11
			3/20/98	19	220	<1	1.6	--	--	27
			9/9/98	2.3	1.3	3.7	3	--	--	5.3

Table 1
Historical Leachate and Surface Water Analytical Data
Ordot Landfill
Territory of Guam

Analyte	Units	Date	Sample Identification and Location						
			SW-0	SW-1	SW-2	SW-5	SW-7	SW-9	SW-10
					(SW-11)				(SW-3)
				[PGRL-1]	[PGRL-2]	[PGRL-0]		[LFL-3]	
				{Site 2}	{Site 3}				{Site 1}
			Confluence of SW-10 and Lonfit River	Lonfit River Upstream	Lonfit River Downstream	Leachate Stream South	Leachate Pond South	Leachate Stream Southeast	Leachate Stream West

Sampling Dates:	References for Data:
11/10/82	Black & Veatch. 1983. Remedial Investigation, Insular Territory Hazardous Waste Sites, Draft Report. May 20.
6/80 through 3/85	Camp, Dresser & McKee, Inc (CDM). 1985. Revised Work Plan Memorandum for Ordot Landfill, Guam. November 20.
3/6/86 through 12/9/87	Water and Environmental Research Institute (WERI) of the Western Pacific University of Guam, USGS funded study
3/12/87	CDM. 1987. Final Initial Site Characterization Report, Ordot Landfill, Island of Guam. November 18.
6/89 through 11/89	WERI. 1989. The Occurrence of Certain Pesticides in Ground and Surface Waters Associated with Ordot Landfill in the Pago River Basin, Guam Mariana Islands. Technical Completion Report No. 72. November.
11/7/97	USEPA/Guam EPA Sampling Event
9/27/90 through 6/6/94	WERI Trace Metals Sampling Program
2/10/98	Unitek Environmental. 1998. Surface Water Sampling Report for February 1998, Ordot Landfill, Ordot, Guam. February 27.
3/20/98	Unitek Environmental. 1998. Surface Water Sampling Report for March 1998, Ordot Landfill, Ordot, Guam. April 27.
9/9/98	UEG Unitek. 1998. Surface Water Sampling Report for September 1998, Ordot Landfill, Ordot, Guam. October 8.

Sample identification given in parentheses is for the corresponding sample location from the November 1982 Remedial Investigation (Black & Veatch, 1983).
Sample identification given in brackets is for the corresponding sample location from the 1980-1985 Guam EPA sampling program (CDM, 1985) and the 1986-1987 WERI study.
Sample identification given in curly brackets is for the corresponding sample location from the 1990-1994 trace metals sampling program (WERI).
Top sample identification is nomenclature used during all other investigations.

Notes:
Detected concentrations are shown in bold.
Concentrations in parentheses are for corresponding duplicate sample, where primary sample result was non-detect and duplicate sample was not.

µg/L = micrograms per liter
mg/L = milligrams per liter
VOCs = volatile organic compounds
SVOCs = semi-volatile organic compounds
PCBs = polychlorinated biphenyls
TRPH = total recoverable petroleum hydrocarbons
BOD_5 = biological oxygen demand (5-day)

COD = chemical oxygen demand
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids
f = field filtered sample (all other samples are or presumed to be unfiltered)
j = detected below reporting limit (number, if given, is estimated)
b = constituent also detected in method blank, indicating laboratory contamination

nd = not detected
-- = not analyzed or not established
<5 = not detected (reporting limit listed)

Table 1a
Historical Leachate and Surface Water Analytical Data
Ordot Dump
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location				
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 Lonfit River Upstream	SW-2 Lonfit River Downstream	SW-5 Leachate Stream South	SW-10 Leachate Stream West
Metals	aluminum	mg/L	7/10/98	--	2.3	--	--	--
			8/17/98	0.34	0.43	0.56	--	0.16
			11/23/98	0.253	0.0196J	0.0477J	--	0.0596J
			12/98	0.38	0.042J	0.139	0.0436J	0.248
			1/99	0.0786J	0.0525J	0.0875J	0.174	0.635
	arsenic	mg/L	7/10/98	--	--	--	--	--
			8/17/98	--	--	--	--	0.012
			11/23/98	--	--	--	--	0.0015J
			12/98	<0.005	<0.005	<0.005	<0.005	<0.005
			1/99	0.0025J	0.0016J	0.0025J	0.002J	0.0031J
	barium	mg/L	7/10/98	--	--	--	0.093	0.33
			8/17/98	--	--	--	0.081	0.44
			11/23/98	0.152	0.00068J	0.0114	0.133	0.176
			12/98	0.0624	0.008J	0.0139	0.134	0.159
			1/99	0.102	0.0042J	0.0092J	0.105	0.194
	cadmium	mg/L	7/10/98	--	--	--	--	--
			8/17/98	--	--	--	--	--
			11/23/98	--	--	--	--	--
			12/98	<0.002	<0.002	<0.002	<0.002	<0.002
			1/99	<0.002	<0.002	<0.002	<0.002	<0.002
	calcium	mg/L	7/10/98	40	36	40	83	120
			8/17/98	32	32	31	83	130
			11/23/98	90.1	38.8	41.8	67.5	86.4
			12/98	64.1	40.6	42	71.8	87.9
			1/99	66.3	40.1	41.7	65.0	86.4

Table 1a
Historical Leachate and Surface Water Analytical Data
Ordot Dump
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location				
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 Lonfit River Upstream	SW-2 Lonfit River Downstream	SW-5 Leachate Stream South	SW-10 Leachate Stream West
Metals	potassium	mg/L	7/10/98	1.8	1.5	3	45	53
			8/17/98	1.7	1.8	2	45	63
			11/23/98	39.1	1.29	2.95	64.3	10.9
			12/98	14.4	1.27	2.64	56.8	28.5
			1/99	26.5	1.25	3.1	49.6	31.2
	sodium	mg/L	7/10/98	26	24	33	260	240
			8/17/98	19	19	20	260	280
			11/23/98	192	18.1	24.2	242	116
			12/98	75.6	16.1	21.6	230	106
			1/99	130	17.5	25.8	217	130
	zinc	mg/L	7/10/98	--	--	--	--	--
			8/17/98	0.062	0.058	--	0.14	0.072
			11/23/98	0.0123	0.005J	0.0033J	0.0111	0.0122
			12/98	0.0059	<.005	<0.005	0.0073	0.0162
			1/99	0.010	0.0034J	0.0036J	0.0064	0.0191
Other Parameters	ammonia	mg/L	7/10/98	0.031	--	--	--	57
			8/17/98	--	--	--	--	65
			11/23/98	22.8	0.3	0.4	7.41	19.1
			12/98	5.48	0.1J	0.3	2.4	14.3
			1/99	16.1	0.2J	0.3	0.55	34.3
	BOD_5	mg/L	7/10/98	1.9	0.51	--	--	12
			8/17/98	1.6	1.2	1.5	1.2	26
			11/23/98	7.6	0.3J	2	18	7.4
			12/98	8.4	<2	<2	6.9	17
			1/99	7.0	1J	2	3	12

Table 1a
Historical Leachate and Surface Water Analytical Data
Ordot Dump
Territory of Guam

	Analyte	Units	Date	SW-0 Confluence of SW-10 and Lonfit River	SW-1 Lonfit River Upstream	SW-2 Lonfit River Downstream	SW-5 Leachate Stream South	SW-10 Leachate Stream West
Other Parameters	COD	mg/L	7/10/98	--	29	47	91	210
			8/17/98	--	--	--	63	290
			11/23/98	110	--	40	77	25
			12/98	34	31	37	270	67
			1/99	190	40	<20	77	86
	nitrate	mg/L	7/10/98	0.15	--	0.77	3.4	0.31
			8/17/98	--	--	--	2.6	0.07
			11/23/98	4.81	--	0.56	15.1	2.81
			12/98	2.89	<0.1	0.54	19.4	3.07
			1/99	2.27	<0.1	0.85	11.7	1.1
	nitrite	mg/L	7/10/98	--	--	0.77	3.4	0.24
			8/17/98	--	--	--	2.6	--
			11/23/98	0.655	--	0.11	0.978	0.03
			12/98	0.481	<0.02	0.097	1.41	0.16
			1/99	0.708	<0.02	0.042	0.04	0.067
	nitrogen (total Kjeldahl)	mg/L	7/10/98	--	--	--	2.7	72
			8/17/98	--	0.8	--	2.9	100
			11/23/98	26	0.68	0.84	9.94	21.4
			12/98	6.48	0.2J	0.68	5.15	16
			1/99	18.7	0.4	0.76	3.7	38.8
	pH	std. units	7/10/98	8	8.3	8	7.8	7.2
			8/17/98	7.8	7.8	7.3	7.6	7.2
			11/23/98	7.71	8.09	7.89	7.8	7.36
			12/98	7.71	7.91	7.68	7.67	7.24
			1/99	8.1	8.39	7.96	8.15	7.39

Table 1a
Historical Leachate and Surface Water Analytical Data
Ordot Dump
Territory of Guam

	Analyte	Units	Date	Sample Identification and Location				
				SW-0 Confluence of SW-10 and Lonfit River	SW-1 Lonfit River Upstream	SW-2 Lonfit River Downstream	SW-5 Leachate Stream South	SW-10 Leachate Stream West
Other Parameters	phosphorous (total)	mg/L	7/10/98	--	--	--	--	--
			8/17/98	--	--	--	--	--
			11/23/98	0.2	--	--	0.02J	0.54
			12/98	<0.1	<0.1	<0.1	<0.1	<0.1
			1/99	<0.1	<0.1	<0.1	<0.1	<0.1
	TDS	mg/L	7/10/98	310	240	350	1300	1300
			8/17/98	210	150	160	1100	1200
			11/23/98	969	227	247	1200	560
			12/98	477	202	250	1150	701
			1/99	637	190	232	1040	755
	TOC	mg/L	7/10/98	2.1	1.9	2.7	26	70
			8/17/98	2.8	3.2	3.3	22	80
			11/23/98	36	2	3.3	33	26
			12/98	15	3.2	2.3	33	21
			1/99	24	2.0	1	20	27
	TSS	mg/L	7/10/98	1	--	1.3	6	38
			8/17/98	3.8	3.8	8.5	2.8	13
			11/23/98	3J	--	--	--	--
			12/98	3J	5	3J	4	12
			1/99	8.0	11	9.0	11	28

Notes:
BOD = biological oxygen demand
mg/L = milligrams per liter
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids
J = detected below reporting limit (number, if given, is estimated)
<0.1 = not detected (reporting limit listed)
-- = not analyzed or not established

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in µg/L)

	Analyte	Date	GW-1 Municipal Well A-11 Northeast of Site	GW-3 Municipal Well A-12 Northeast of Site	GW-4 (Well 9) Background Well North	GW-5 Downgradient Well South	GW-6 (Well 3) Downgradient Well South	Well 4 Downgradient Well South	Well 8 Downgradient Well South	MW-01 USEPA Well Northeast of Site	MW-02 USEPA Well Northeast of Site
			Sample Identification and Location								
Metals	aluminum	11/10/82	<200	--	--	--	--	--	--	--	--
		3/12/87	41	45	77	837	831	831	831	--	--
	antimony	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<20	<20	<20	<20	<20	<20	<20	--	--
	arsenic	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<10	<10	<10	<10	<10	<10	<10	--	--
	barium	11/10/82	<100	--	--	--	--	--	--	--	--
		3/12/87	6	5	9	190	15	15	15	--	--
	beryllium	11/10/82	<5	--	--	--	--	--	--	--	--
		3/12/87	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	--	--
	boron	11/10/82	<100	--	--	--	--	--	--	--	--
	cadmium	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	--	--
	calcium	3/12/87	117,900	113,800	53,930	41,610	85,060	85,060	85,060	--	--
	chromium (total)	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7	<3.7	--	--
	cobalt	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<6.8	<6.8	<6.8	<6.8	<6.8	<6.8	<6.8	--	--
	copper	11/10/82	<50	--	--	--	--	--	--	--	--
		3/12/87	6	10	<5.9	6	34	34	34	--	--
	iron	11/10/82	<50	--	--	--	--	--	--	--	--
		3/12/87	75	65	124	631	895	895	895	--	--

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in µg/L)

	Analyte	Date	GW-1 Municipal Well A-11 Northeast of Site	GW-3 Municipal Well A-12 Northeast of Site	GW-4 (Well 9) Background Well North	GW-5 Downgradient Well South	GW-6 (Well 3) Downgradient Well South	Well 4 Downgradient Well South	Well 8 Downgradient Well South	MW-01 USEPA Well Northeast of Site	MW-02 USEPA Well Northeast of Site
Metals	lead	11/10/82	<5	--	--	--	--	--	--	--	--
		3/12/87	<5	<5	<5	<5	<5 (5.9)	<5 (5.9)	<5 (5.9)	--	--
	magnesium	3/12/87	4,151	3,215	7,491	31,210	59,130	59,130	59,130	--	--
	manganese	11/10/82	<15	--	--	--	--	--	--	--	--
		3/12/87	1	4	8	87	92	92	92	--	--
	mercury	11/10/82	5.3	--	--	--	--	--	--	--	--
		3/12/87	<0.2	1.06 j	<0.2	<0.2	<0.2	<0.2	<0.2	--	--
	nickel	11/10/82	77	--	--	--	--	--	--	--	--
		3/12/87	<23	<23	<23	32	<23	<23	<23	--	--
	potassium	3/12/87	<948	<948	<948	<948	<948	<948	<948	--	--
	selenium	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<5	<5	<5	<5	<5	<5	<5	--	--
	silver	11/10/82	26	--	--	--	--	--	--	--	--
		3/12/87	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	--	--
	sodium	3/12/87	11,110	8,674	12,880	38,650	62,130	62,130	62,130	--	--
	thallium	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<10	<10	<10	<10	<10	<10	<10	--	--
	tin	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<17	<17	<17	<17	<17	<17	<17	--	--
	vanadium	11/10/82	nd	--	--	--	--	--	--	--	--
		3/12/87	<3.1	<3.1	<3.1	3.6	6.9	6.9	6.9	--	--
	zinc	11/10/82	19	--	--	--	--	--	--	--	--
		3/12/87	44	45	20	137	162	162	162	--	--

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in μg/L)

	Analyte	Date	GW-1 Municipal Well A-11 Northeast of Site	GW-3 Municipal Well A-12 Northeast of Site	GW-4 (Well 9) Background Well North	GW-5 Downgradient Well South	GW-6 (Well 3) Downgradient Well South	Well 4 Downgradient Well South	Well 8 Downgradient Well South	MW-01 USEPA Well Northeast of Site	MW-02 USEPA Well Northeast of Site
VOCs	acetone	11/10/82	j	--	--	--	--	--	--	--	--
		3/12/87	<10 (4 jb)	3 jb	3 jb	3 jb	3 jb	3 jb	3 jb	--	--
	2-butanone	11/10/82	<5	--	--	--	--	--	--	--	--
		3/12/87	<10	10 b	<10	10 b	9 jb	9 jb	9 jb	--	--
	carbon disulfide	11/10/82	<5	--	--	--	--	--	--	--	--
		3/12/87	<5	<5	<5	<5	<5	<5	<5	--	--
	chlorobenzene	3/12/87	<5	<5	<5	<5	<5	<5	<5	--	--
	chloroethane	11/10/82	<5	--	--	--	--	--	--	--	--
	chloroform	7/21/92	--	--	--	--	--	--	--	nd	30 c
	1,1-dichloroethane	11/10/82	<5	--	--	--	--	--	--	--	--
	ethylbenzene	3/12/87	<5	<5	<5	<5	<5	<5	<5	--	--
	2-hexanone	11/10/82	139	--	--	--	--	--	--	--	--
	4-methyl-2-pentanone	11/10/82	<5	--	--	--	--	--	--	--	--
	methylene chloride	11/10/82	<5	--	--	--	--	--	--	--	--
		3/12/87	<5	2 jb	<5	3 jb	<5	<5	<5	--	--
	styrene	11/10/82	<5	--	--	--	--	--	--	--	--
		3/12/87	<5	<5	<5	<5	<5	<5	<5	--	--
	toluene	3/12/87	<5	1 jb	1 jb	<5	1 jb	1 jb	1 jb	--	--
	vinyl acetate	11/10/82	<5	--	--	--	--	--	--	--	--
	xylenes	3/12/87	<5	<5	<5	<5	<5	<5	<5	--	--

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in μg/L)

	Analyte	Date	Sample Identification and Location								
			GW-1 Municipal Well A-11 Northeast of Site	GW-3 Municipal Well A-12 Northeast of Site	GW-4 (Well 9) Background Well North	GW-5 Downgradient Well South	GW-6 (Well 3) Downgradient Well South	Well 4 Downgradient Well South	Well 8 Downgradient Well South	MW-01 USEPA Well Northeast of Site	MW-02 USEPA Well Northeast of Site
SVOCs	diethyl phthalate	11/10/82	<20	--	--	--	--	--	--	--	--
	di-N-butylphthalate	7/21/92	--	--	--	--	--	--	--	--	5 d
	2-ethyl-1-hexanol	7/21/92	--	--	--	--	--	--	--	8 d	--
	bis(2-ethylhexyl)phthalate	3/12/87	2 jb	2 jb	88	2 jb	5 jb	5 jb	5 jb	--	--
	1(3H) isobenzofuranone	7/21/92	--	--	--	--	--	--	--	6 d	--
	phenol	3/12/87	<10	5 j	<10	<10	<10	<10	<10	--	5 d
Pesticides & PCBs	aldrin	6/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		7/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		8/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		9/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		10/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		11/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
	BHC-alpha	6/89	<0.16	--	<0.16	--	<0.16	<0.16	<0.16	--	--
		7/89	<0.16	--	<0.16	--	<0.16	<0.16	<0.16	--	--
		8/89	<0.16	--	<0.16	--	<0.16	<0.18	<0.16	--	--
		9/89	<0.16	--	<0.16	--	<0.16	<0.16	<0.16	--	--
		10/89	<0.16	--	<0.16	--	<0.16	<0.16	<0.16	--	--
		11/89	<0.16	--	<0.16	--	<0.16	<0.16	<0.16	--	--
	BHC-beta	6/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		7/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		8/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		9/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		10/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		11/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
	BHC-delta	6/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		7/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		8/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		9/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		10/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		11/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in µg/L)

			Sample Identification and Location								
	Analyte	Date	GW-1 Municipal Well A-11 Northeast of Site	GW-3 Municipal Well A-12 Northeast of Site	GW-4 (Well 9) Background Well North	GW-5 Downgradient Well South	GW-6 (Well 3) Downgradient Well South	Well 4 Downgradient Well South	Well 8 Downgradient Well South	MW-01 USEPA Well Northeast of Site	MW-02 USEPA Well Northeast of Site
Pesticides & PCBs	BHC-gamma	6/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		7/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		8/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		9/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		10/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		11/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
	chlordane-alpha	6/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		7/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		8/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		9/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		10/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		11/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
	chlordane-gamma	6/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		7/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		8/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		9/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		10/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
		11/89	<0.1	--	<0.1	--	<0.1	<0.1	<0.1	--	--
	4,4'-DDD	6/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		7/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		8/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		9/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		10/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		11/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
	4,4'-DDE	6/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		7/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		8/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		9/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		10/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		11/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
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	Analyte	Date	GW-1 Municipal Well A-11 Northeast of Site	GW-3 Municipal Well A-12 Northeast of Site	GW-4 (Well 9) Background Well North	GW-5 Downgradient Well South	GW-6 (Well 3) Downgradient Well South	Well 4 Downgradient Well South	Well 8 Downgradient Well South	MW-01 USEPA Well Northeast of Site	MW-02 USEPA Well Northeast of Site
			Sample Identification and Location								
Pesticides & PCBs	4,4'-DDT	6/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		7/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		8/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		9/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		10/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		11/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
	diazinon	6/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		7/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		8/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		9/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		10/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		11/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
	dieldrin	11/10/82	<0.1	--	--	--	--	--	--	--	--
		6/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		7/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		8/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		9/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		10/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		11/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
	endosulfan sulfate	11/10/82	<0.1	--	--	--	--	--	--	--	--
	endrin	6/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		7/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		8/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		9/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		10/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		11/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in µg/L)

	Analyte	Date	GW-1 Municipal Well A-11 Northeast of Site	GW-3 Municipal Well A-12 Northeast of Site	GW-4 (Well 9) Background Well North	GW-5 Downgradient Well South	GW-6 (Well 3) Downgradient Well South	Well 4 Downgradient Well South	Well 8 Downgradient Well South	MW-01 USEPA Well Northeast of Site	MW-02 USEPA Well Northeast of Site
			Sample Identification and Location								
Pesticides & PCBs	ethion	6/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		7/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		8/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		9/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		10/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
		11/89	<0.4	--	<0.4	--	<0.4	<0.4	<0.4	--	--
	heptachlor	6/89	<0.24	--	<0.24	--	<0.24	<0.24	<0.24	--	--
		7/89	<0.24	--	<0.24	--	<0.24	<0.24	<0.24	--	--
		8/89	<0.24	--	<0.24	--	<0.24	<0.24	<0.24	--	--
		9/89	<0.24	--	<0.24	--	<0.24	<0.24	<0.24	--	--
		10/89	<0.24	--	<0.24	--	<0.24	<0.24	<0.24	--	--
		11/89	<0.24	--	<0.24	--	<0.24	<0.24	<0.24	--	--
	malathion	6/89	<4	--	<4	--	<4	<4	<4	--	--
		7/89	<4	--	<4	--	<4	<4	<4	--	--
		8/89	<4	--	<4	--	<4	<4	<4	--	--
		9/89	<4	--	<4	--	<4	<4	<4	--	--
		10/89	<4	--	<4	--	<4	<4	<4	--	--
		11/89	<4	--	<4	--	<4	<4	<4	--	--
	methoxychlor	6/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		7/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		8/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		9/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		10/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
		11/89	<0.2	--	<0.2	--	<0.2	<0.2	<0.2	--	--
	naled	6/89	<2	--	<2	--	<2	<2	<2	--	--
		7/89	<2	--	<2	--	<2	<2	<2	--	--
		8/89	<2	--	<2	--	<2	<2	<2	--	--
		9/89	<2	--	<2	--	<2	<2	<2	--	--
		10/89	<2	--	<2	--	<2	<2	<2	--	--
		11/89	<2	--	<2	--	<2	<2	<2	--	--

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in µg/L)

	Analyte	Date	GW-1 Municipal Well A-11 Northeast of Site	GW-3 Municipal Well A-12 Northeast of Site	GW-4 (Well 9) Background Well North	GW-5 Downgradient Well South	GW-6 (Well 3) Downgradient Well South	Well 4 Downgradient Well South	Well 8 Downgradient Well South	MW-01 USEPA Well Northeast of Site	MW-02 USEPA Well Northeast of Site
Pesticides & PCBs	parathion, ethyl	6/89	<2	--	<2	--	<2	<2	<2	--	--
		7/89	<2	--	<2	--	<2	<2	<2	--	--
		8/89	<2	--	<2	--	<2	<2	<2	--	--
		9/89	<2	--	<2	--	<2	<2	<2	--	--
		10/89	<2	--	<2	--	<2	<2	<2	--	--
		11/89	<2	--	<2	--	<2	<2	<2	--	--
	parathion, methyl	6/89	<2	--	<2	--	<2	<2	<2	--	--
		7/89	<2	--	<2	--	<2	<2	<2	--	--
		8/89	<2	--	<2	--	<2	<2	<2	--	--
		9/89	<2	--	<2	--	<2	<2	<2	--	--
		10/89	<2	--	<2	--	<2	<2	<2	--	--
		11/89	<2	--	<2	--	<2	<2	<2	--	--
	PCB-1242	11/10/82	<0.1	--	--	--	--	--	--	--	--

Table 2
Historical Groundwater Analytical Data
Ordot Landfill
Territory of Guam
(all results in µg/L)

	Analyte	Date	GW-1	GW-3	GW-4	GW-5	GW-6	Well 4	Well 8	MW-01	MW-02
			Sample Identification and Location								
					(Well 9)		(Well 3)				
			Municipal Well A-11 Northeast of Site	Municipal Well A-12 Northeast of Site	Background Well North	Downgradient Well South	Downgradient Well South	Downgradient Well South	Downgradient Well South	USEPA Well Northeast of Site	USEPA Well Northeast of Site
Other Parameters	cyanide	3/12/87	<10	**16**	<10	<10	<10	<10	<10	--	--
	pH	11/10/82	6.9	--	--	--	--	--	--	--	--
		3/12/87	6.75	6.71	7.26	6.27	6.8	6.8	6.8	--	--

Sampling Dates:
11/10/82
3/12/87
6/89 through 11/89
7/21/92

References for Data:

Black & Veatch. 1983. Remedial Investigation, Insular Territory Hazardous Waste Sites, Draft Report . May 20.
Camp, Dresser & McKee, Inc (CDM). 1987. Final Initial Site Characterization Report, Ordot Landfill, Island of Guam. November 18.
Water and Environmental Research Institute (WERI) of the Western Pacific University of Guam. 1989. The Occurrence of Certain Pesticides in Ground and Surface Waters Associated with Ordot Landfill in the Pago River Basin, Guam Mariana Islands. Technical Completion Report No. 72. November.
URS Consultants, 1992, Monitoring Well Installation and Sampling Field Forms, October 29.

Sample identification given in parentheses is for the corresponding sample location from the 1989 pesticide investigation (WERI).
Top sample identification is nomenclature used during all other investigations.

Notes:
Detected concentrations are shown in bold.
Concentrations in parentheses are for corresponding duplicate sample, where primary sample result was non-detect and duplicate sample was not.

µg/L = micrograms per liter
VOCs = volatile organic compounds
SVOCs = semi-volatile organic compounds
PCBs = polychlorinated biphenyls

-- = not analyzed or not established
<5 = not detected (reporting limit listed)
nd = not detected
j = detected below reporting limit (number, if given, is estimated)

b = constituent also detected in method blank, indicating laboratory contamination
c = analyte detected in field blank
d = field blank not tested

Table 3
Historical Sediment Analytical Data
Ordot Landfill
Territory of Guam
(all results in mg/kg)

	Analyte	Date	SS-1 Lonfit River Upstream	SS-3 Leachate Stream West	SS-5 Leachate Stream South	SS-7 Leachate Pond South	SS-9 Leachate Stream Southeast	SS-11 Lonfit River Downstream
Metals	aluminum	Nov-82	**13,700**	**7,440**	**21,500**	**12,200**	**12,900**	**14,000**
	antimony	Nov-82	<1	<1 (1.2)	<1	**1**	<1	<1
	arsenic	Nov-82	**0.9**	**0.5**	**1.1**	**0.6**	**0.9**	**0.9**
	barium	Nov-82	**252**	**91**	**49.1**	**38**	**22.9**	**129**
	beryllium	Nov-82	**0.3**	<0.3	<0.3	<0.3 (0.3)	<0.3	**0.2**
	boron	Nov-82	**16.7**	**23.8**	**31**	**18.8**	**15**	**17**
	cadmium	Nov-82	**0.05**	**0.1**	<0.05	**0.1**	**0.2**	**0.05**
	chromium (total)	Nov-82	**30.8**	**16.4**	**46.1**	**24.3**	**20.3**	**24.1**
	cobalt	Nov-82	**25.2**	**17**	**14.8**	**15.3**	**9.3**	**19.3**
	copper	Nov-82	**33.7**	**23.7**	**29.7**	**30.5**	**26.2**	**28.9**
	iron	Nov-82	**19,400**	**13,000**	**36,600**	**14,900**	**14,600**	**20,800**
	manganese	Nov-82	**1,370**	**2,350**	**936**	**360**	**373**	**402**
	lead	Nov-82	**12**	**32**	**6.8**	**34**	**24**	**11**
	mercury	Nov-82	**3.2**	**2.6**	**4.4**	**3.1**	**2.2**	**1.1**
	nickel	Nov-82	<2 (52.3)	**22.1**	**26.4**	**26.4**	**17.2**	**37**
	selenium	Nov-82	nd	nd	nd	nd	nd	nd
	silver	Nov-82	nd	nd	nd	nd	nd	nd
	thallium	Nov-82	nd	nd	nd	nd	nd	nd
	tin	Nov-82	<1	<1 (1.4)	**1.7**	<1	<1 (1.2)	<1
	vanadium	Nov-82	**47.7**	**27.8**	**58.2**	**42.3**	**30.8**	**34.6**
	zinc	Nov-82	**26.2**	<0.5 (108)	**35.5**	**53.8**	**54.6**	**27**

References for Data:
Black & Veatch. 1983. Remedial Investigation, Insular Territory Hazardous Waste Sites, Draft Report. May 20.

Notes:
Detected concentrations are shown in bold.
Concentrations in parentheses are for corresponding duplicate sample, where primary sample result was non-detect and duplicate sample was not.
mg/kg = milligrams per kilogram
<5 = not detected (reporting limit listed)

Table 3A
Historical Sediment Analytical Data With Organic Compounds
Ordot Dump
Territory of Guam
(all results in ug/kg)

Analysis	Analyte	Sample Date	Sample Identification and Location SS-1 Lonfit River Upstream	SS-3 Leachate Stream West	SS-5 Leachate Stream South	SS-7 Leachate Pond South	SS-9 Leachate Stream Southeast	SS-11 Lonfit River Downstream
Volatile Organic Compounds (VOCs)	acetone	11/82	<50	<50	<50	<50	<50	<50
	chlorobenzene	11/82	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
	chloroethane	11/82	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
	fluorotrichloromethane	11/82	6.8 (7.6)	<2.5	11.3 (12.2)	<2.5	<2.5	<2.5
	methylene chloride	11/82	35.6 (11.0)	80.5 (30.6)	30.6 (54.6)	37.0 (67.0)	55.8 (64.8)	29.0 (25.0)
	o-xylene	11/82	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
	styrene	11/82	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
	1,1,2,2-tetrachloroethane	11/82	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
	toluene	11/82	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Pesticides	BHC-Gamma	11/82	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
	dieldrin	11/82	<4.0	<4.0	<4.0	<4.0	22.6 (35.2)	<4.0
	heptachlor epoxide	11/82	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Base/Neutral Semi-volatile Organic Compounds (SVOCs)	aniline	11/82	<400	<400	<400 (2,002)	<400	<400	<400
	benzo (a) anthracene	11/82	<400	<400	<400	<400	<400	<400
	bis (2-ethylhexyl) phthalate	11/82	<400	<400	<400	<400	1,396 (1,524)	<400
	butyl benzyl phthalate	11/82	972 (<400)	<400	3,240 (<400)	<400 (1,800)	2,513 (8,001)	<400
	chrysene	11/82	<400	<400	<400	<400	<400	<400
	diethyl phthalate	11/82	<400	<400	<400	<400	<400	<400
	di-n-octyl phthalate	11/82	<400	<400	<400	<400	<400	<400
	fluoranthene	11/82	<400	<400	<400	<400	<400 (1,676)	<400
	pyrene	11/82	<400	<400	<400	<400	<400 (1,674)	<400

Notes:
mg/kg = micrograms per kilograms
J = detected below reporting limit (number, if given, is estimated)
<2.5 = not detected (reporting limit listed)
Concentrations in parentheses are for corresponding duplicate sample.

APPENDIX C

USGS Project Synopsis Report, June 2003.
Impact of Ordot Dump on Water Quality of Lonfit River Basin in Central Guam

USGS PROJECT SYNOPSIS REPORT, JUNE 2003

Title: Impact of Ordot Dump on Water Quality of Lonfit River Basin in Central Guam

Principal Investigators: Gary R.W. Denton, Mohammad Golabi, and H. Rick Wood

Problem and Research Objectives

Guam's only municipal solid waste disposal site is centrally located in the village of Ordot and has been in use for over fifty years. Lacking in the conventional technology built in to modern day sanitary landfills, the site is essentially an open dump covering ~20 acres of the upper Lonfit River valley. The dump was operated by the US Navy at the end of WWII and transferred to the Government of Guam shortly thereafter. Although slated for closure more than 20 years ago, it still receives around 200 tons of solid waste per day from the civilian community. Early records of the types of materials disposed of at the Ordot Dump are nonexistent but are suspected to include the same array of toxic chemicals found at other military dumpsites on island. Today, there is some control over the bulk disposal of industrial chemicals, waste oil, and metallic waste at Ordot Dump. However, household waste is rarely screened and is known to contain a variety of hazardous substances, both biological and chemical. Leachate streams occur in several places around the perimeter of the dump and course their way down gradient into the Lonfit River and out into Pago Bay. Their chemical composition is largely unknown and their impact on the local environment in terms of ecology, agriculture, and human health remains to be investigated.

The objectives of this project were to characterize the primary biological and chemical contaminants in leachate water emanating from the Ordot Dump and trace their respective movements down the watershed and out into the ocean. This was accomplished by examining surface water and soil interstitial waters at discrete locations between the dump and the coast to determine the distribution and abundance of primary contaminants and identify their differential mobilization rates in surface and subsurface environments.

Methodology

Leachate samples were collected from two separate locations on the southern face of the dump and sent off-island for a one-time analysis of all priority pollutants listed under *Guam Water Quality Standards* (GEPA 2001). The high cost of this analysis precluded further testing.

Surface water samples were taken at monthly intervals from five sites along the Lonfit/Pago river systems between the dump and the ocean. These were analyzed for total coliforms and fecal indicator bacteria (*E. coli* and *Enterococci*), nutrients (NOx, NH_4-N and orthophosphate-P) and heavy metals (Ag, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb and Zn). Samples for nutrient and heavy metal analyses were withdrawn directly into 50 ml polypropylene syringes and filtered through in-line 0.45 µm filters into 100-ml plastic vials.

Monthly subsurface water samples were taken from five sites around the western edge and southern toe of the dump. These were collected using suction cup lysimeters buried to depths of 2, 4 and 6 feet below ground level. Samples were removed from the lysimeters under vacuum and analyzed for bacteria, nutrients and metals without further treatment.

All surface and subsurface water samples were stored on ice in the field. In the laboratory, those required for heavy metal analysis were acidified with analytical grade nitric acid (100 µl/100 ml). All bacteria and nutrient analyses were performed within 6 h and 24-h of collection respectively.

All bacteria counts were made using the Idexx Quantitray® technique. Total coliforms and *E coli* were incubated at 35°C with Colilert® media to their respective color and fluorescent endpoints. *Enterococci* were incubated in Enterolert® at 41°C to a fluorescent endpoint.

Nutrient determinations were made using a multi-channel Flow Injection Analyzer (FIA) (Quickchem 800: Lachat Instruments). The analytical methods were those recommended by the manufacturer and are essentially the same as those described in *Standard Methods,* Part 4500 (APHAWW 1992) with modifications for flow injection analysis. The heavy metal analyses were carried out by conventional flame and flameless atomic absorption spectrometry.

Principal Findings and Significance

Leachate:

The biological and chemical contaminants detected in the leachate samples are listed in Table 1 together with the appropriate surface water and safe drinking water quality standards for Guam. Especially noticeable are the extremely high counts of fecal indicator bacteria, which exceeded the Guam recreational water quality standards by at least three orders of magnitude. Presumably, these elevated numbers reflect unsanitary human wastes (e.g. disposable diapers) and animal carcasses placed in the dump as well as fecal contributions from the large populations of rodents, stray dogs and wild pigs in the area.

Of the 27 chemical contaminants detected in the leachate samples, 12 were found at levels that exceeded one or both of the water quality standards. Nutrient levels were particularly high, especially NH_4-N. In fact, the pungent small of ammonia was very noticeable at one of the leachate collection sites. Copper and Pb were also high in one of the samples compared with their respective surface water quality standard. Both metals are relatively toxic to aquatic organisms. Levels of all detectable metals were several orders of magnitude over and above those normally encountered in uncontaminated river waters (Denton *et al.* 1998).

It is interesting to note that relatively few organic solvents were found in the leachate and no pesticides other than p-dichlorobenzene. Likewise, no PCBs, PAHs, dioxins or furans were detected in either sample.

Bacteria:	Units	Results	Guam Water Quality Standards	
			Surface Waters [a]	Drinking Water
Bacteria:				
Total Coliforms	MPN Index/100 ml	2,419,200	-	0
E. coli	MPN Index/100 ml	137,400	126	0
Enterococci	MPN Index/100 ml	298,100	33	0
Nutrients:				
NOx	µg/l	604	100-500 [b]	10, 1 [c]
NH_4-N	mg/l	503	3.08 [d]	-
Ortho-P	µg/l	166	25-100	-
Metals (total):				
Aluminium	µg/l	1600 - 4,500	1000	50-200
Antimony	µg/l	9.7	-	6
Arsenic	mg/l	0.007 - 0.046	0.15	0.01
Barium	µg/l	85 - 240	-	2000
Boron	mg/l	1.6 - 5	-	-
Chromium	mg/l	0.017 - 0.210	0.210 [e,f]	0.1
Copper	mg/l	0.023 - 0.092	0.012 [f]	1.3
Iron	mg/l	0.68 - 2.9	3.00	0.3
Lead	µg/l	4.7 - 45	3.20	15
Manganese	µg/l	290 - 340	-	50
Nickel	mg/l	0.050 - 0.110	0.052 [f]	0.1
Vanadium	µg/l	26 - 62	-	-
Zinc	mg/l	0.083 - 21	0.11 [f]	5
Pesticides:				
p-dichlorobenzene	µg/l	3.4	-	75
Organic Solvents:				
Acetone	µg/l	17	-	-
Benzene	µg/l	3.1	-	5
Ethylbenzene	µg/l	7.3	-	700
Tetrahydrofuran	µg/l	10	-	-
Toluene	µg/l	18	-	100
cis-1,2-Dichloroethane	µg/l	1.1	-	5
m,p-xylenes	µg/l	8	-	-
o-Xylene	µg/l	3.6	-	-
Others:				
Cyanide	mg/l	0.007 - 0.016	0.0052	0.2
Phenolic Compounds	mg/l	0.074 - 0.155	-	-

a = GWQS for freshwaters only; b = as nitrate nitrogen; c = astrate nitrogen and nitrite nitrogen respectively; d = CriteriChronic Concentration (CCC) at pH 7.0
e = CCC for Cr^{3+} only; f = CCC estimated at total hardness of 100 mg/l; dashes indicate no standards currently available

Table 1: Priority pollutants detected in leachate from Ordot Dump (Dec. '03)

Surface Waters:

The results of the bacterial analysis of surface waters from the Pago-Lonfit River systems are shown in Table 2. As expected, counts for the fecal indicator bacteria, *E. coli* and *Enterococci,* were highest at site 1 near the point of convergence between the river and a major leachate stream. However, these quickly diminished within a few hundred meters downstream and, for *E. coli*, were mostly below the recreational water quality standard at sites 2 and 3. In contrast, the recreational water quality standard for *Enterococci* was exceeded at all sites almost all of the time.

Station #	Distance from Discharge Point (m)	MPN Index/100 ml		
		Total Coliforms	*E. coli*	*Enterococci*
		mean (range)	mean (range)	mean (range)
Leachate Stream	0	2,419,200	137,400	298,100
1	10	38,820 (17,329 - 92,080)	1,553 (391 - 5,012)	4,661 (907 - 17,239)
2	500	11,460 (4,352 - 24,192)	43 (5 - 259)	146 (20 - 703)
3	1,500	1,189 (4,160 - 24,192)	59 (10 - 233)	180 (30 - 816)
4	4,500	17,902 (8,050 - 24,810)	277 (51 - 1,609)	132 (5 - 631)
5	5,000	18,882 (5,850 - 26,130)	441 (20 - 5,794)	153 (20 - 1850)

mean calculated as geometric mean

Table 2: Bacteria in surface waters of the Lonfit-Pago River system (Oct. '02 – May '03)

In general, fecal indicator bacterial counts were poorly correlated with one another both in space and time (Figure 1.). This suggests that they have very different survival times and reproductive capabilities in the environment.

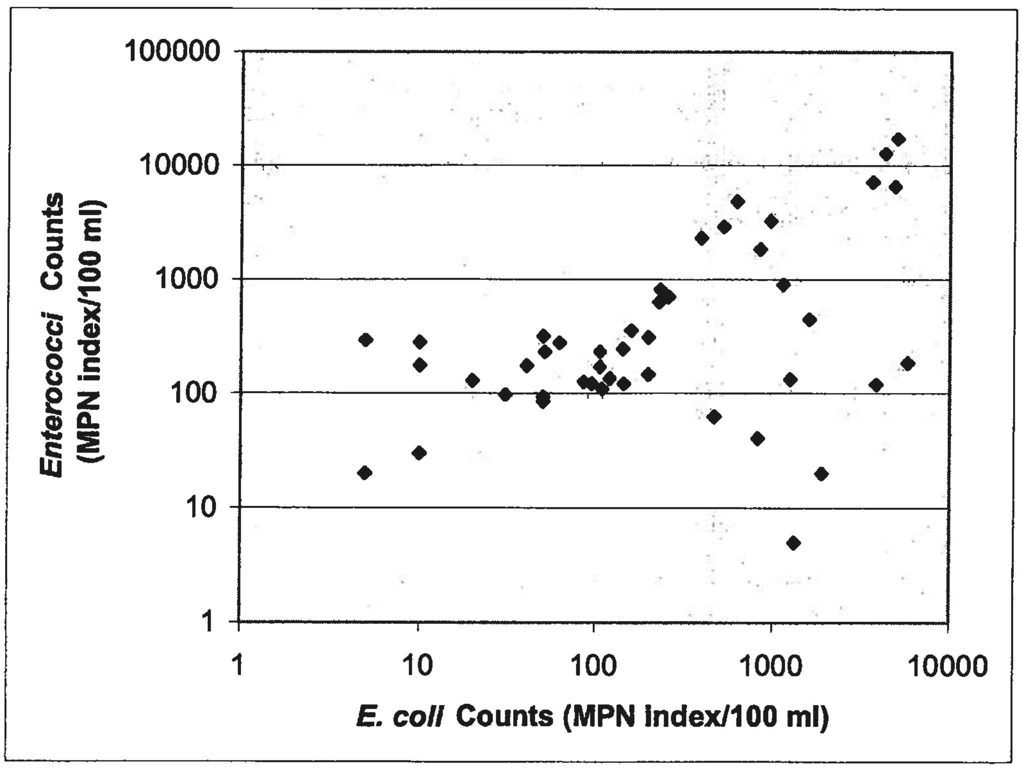

Figure 1: Relationship between *E. coli* and *Enterococci* counts in surface waters of the Lonfit-Pago River System (Oct. '02 – May '03)

On occasions, relatively high fecal indicator bacteria counts were encountered at sites 4 and 5 in the lower reaches of the Pago River and likely reflect seepage from residential septic tanks in the Pago Bay area. There is also a small sewage treatment plant (aerated sludge system) nearby that services 15 or so houses and allows the effluent to percolate into the ground (Ed Reyes, Guam Waterworks Authority, pers. com.). The data geometric means for both fecal indicators at these sites exceeded the Guam recreational water quality standards.

Nutrient enrichment attributable to runoff from the dump was only evident at site 1 and only for inorganic nitrogen (Table 3). Levels determined further downstream were reasonably typical of groundwater impacted streams on Guam (Denton *et al.* 1998) except at the coast (site 5) where unusually high levels of NOx and NH_4-N were occasionally detected. Such findings again point towards the domestic wastewater inputs in the lower Pago basin area.

The absence of detectable levels of soluble inorganic phosphorus immediately downstream from the dump was unexpected considering the elevated concentration determined in leachate. Presumably, this nutrient is rapidly scavenged from the water column by iron as it changes oxidation state and precipitates out of solution as the hydrated ferric oxide.

Site #	Distance from Discharge Point (m)	Nutrients (µg/l)		
		NOx-N	Ammonia-N	Orthophosphate-P
		median (range)	median (range)	median (range)
Leachate	0	604	503	166
1	10	2,976 (1,350 - 3,380)	42.2 (41.1 - 43.2)	all <1.0
2	500	358 (229 - 487)	3.1 (1.3 - 6.3)	all <1.0
3	1,500	208 (111 - 305)	3.1 (1.7 - 5.2)	all <1.0
4	4,500	359 (151 - 567)	<1 (<1 - 2.8)	all <1.0
5	5,000	1140 (130 - 10,000)	18 (1.4 - 24.5)	all <1.0

Table 3: Nutrients in surface waters of the Lonfit-Pago River system (Oct. '02 – May '03)

Elevated heavy metal levels in the leachate stream were quickly diluted as they entered the Lonfit River at site 1 and were at normal baseline levels at all sites further downstream (Table 4). Iron and Mn were typically the most common elements detected and were generally followed in decreasing rank order of abundance by Cu>Zn>Pb>Cr and Ni. Levels of Cd, Hg and Ag were consistently below the limits of analytical detection at all sites so far examined.

In all probability, much of the soluble heavy metal load in the leachate stream rapidly partitions out onto suspended particulates upon entering the watershed and ultimately ends up in bottom sediments. These contaminated sediments would be gradually mobilized downstream and dumped in the Pago River estuary and adjacent waters.

It is suggested that sediment cores taken at strategic locations along the Pago-Lonfit River systems and out into Pago Bay would provide a more realistic measure of heavy metal distribution and abundance in this area. Such a sampling program would also provide a better understanding of the potential impact of these contaminants on the biota, particularly the suspension and deposit feeders and those organisms living in intimate contact with bottom deposits.

Metal	Site # (distance from leachate stream)				
	Leachate (0 m)	1 (10 m)	2 (500 m)	3 (1,500 m)	4 (4,500 m)
	mean (range)	mean (range)	mean (range)	mean (range)	mean (range)
Fe	1404 (680 - 2900)	87.0 (12.0 - 646)	16.8 (4.7 - 33.3)	15.8 (3.8 - 27.8)	14.9 (4.2 - 36)
Mn	314 (290 - 340)	272 (83.3 - 966)	21.5 (8.3 - 52.3)	24.3 (7.3 - 73.8)	27.4 (6.6 - 384)
Cu	46.0 (23.0 - 92.0)	5.6 (1.7 - 31)	0.5 (0.2 - 2.0)	0.4 (0.2 - 1.4)	0.4 (0.2 - 2.2)
Zn	1320 (83 - 21,000)	2.8 (1.2 - 6.2)	0.1 (0.1 - 0.5)	0.1 (0.1 - 0.3)	nc (<0.1 - 1.1)
Pb	14.4 (4.7 - 45.0)	nc (<0.3 - 4.0)	nc (<0.3 - 0.3)	nc (<0.3 - 1.0)	nc (<0.3 - 1.4)
Cd	all <0.1	all <0.2	all <0.2	all <0.2	all <0.2
Hg	all <0.1	all <0.3	all <0.3	all <0.3	all <0.3
Ag	all <0.1	all <0.1	all <0.1	all <0.1	all <0.1
Cr	59.7 (17.0 - 210)	2.0 (1.1 - 5.0)	nc (<0.3 - 0.9)	nc (<0.3 - 0.6)	nc (<0.3 - 0.8)
Ni	74.2 (50.0 - 110)	12.9 (2.7 - 33)	all <0.6	all <0.6	all <0.6

Table 4: Heavy metals in surface waters of the Lonfit-Pago River system (Oct. '02 – May '03)

A study of this nature should also include the chemical analysis of biotic representatives, particularly key organisms of ecological and economic importance. This would facilitate the identification of critical contaminant pathways and permit a realistic assessment of any potential health risks to those who harvest any of the aquatic resources in this area for food.

Subsurface Waters:
Bacterial counts in soil pore waters down gradient of the Ordot Dump were surprisingly low considering the extremely high numbers present in leachate (Table 5). Even total coliform counts rarely exceeded 200 per 100 ml sample and were mostly around 2 or less per 100 ml sample.

Soil Depth (feet)	No. Samples	MPN Index/100 ml		
		Total Coliforms	*E. coli*	*Enterococci*
		median (range)	median (range)	median (range)
2	32	2 (<2 - 4740)	<2 (<2 - 20)	<2 (<2 - 400)
4	30	2 (<2 - 7016)	<2 (<2 - 11)	<2 (<2 - 31)
6	36	2 (<2 - 4838)	<2 (<2 - <10)	<2 (<2 - 10)

Table 5: Bacteria in soil pore waters down gradient from Ordot Dump (Oct. '02 – May '03)

Both fecal indicator bacteria were rarely encountered at counts over 10 per 100 ml sample. Whether this is because bacteria in leachate from the dump are physically trapped in the overlying surface soil layers, or consumed by other soil microbes, or both, remains to be established. In any event, the data imply little to no subsurface movement of bacterial pathogens from the dump into the watershed.

It is interesting to note that the frequency with which *E. coli* and *Enterococci* were detected in soil pore water samples was depth related with the fewer detections at six feet than at two feet (Figure 2). In contrast, total coliforms were encountered in approximately 50% of the samples collected at all three depths. It is also noteworthy that *Enterococci* were detected more often than *E. coli* at all soil depths.

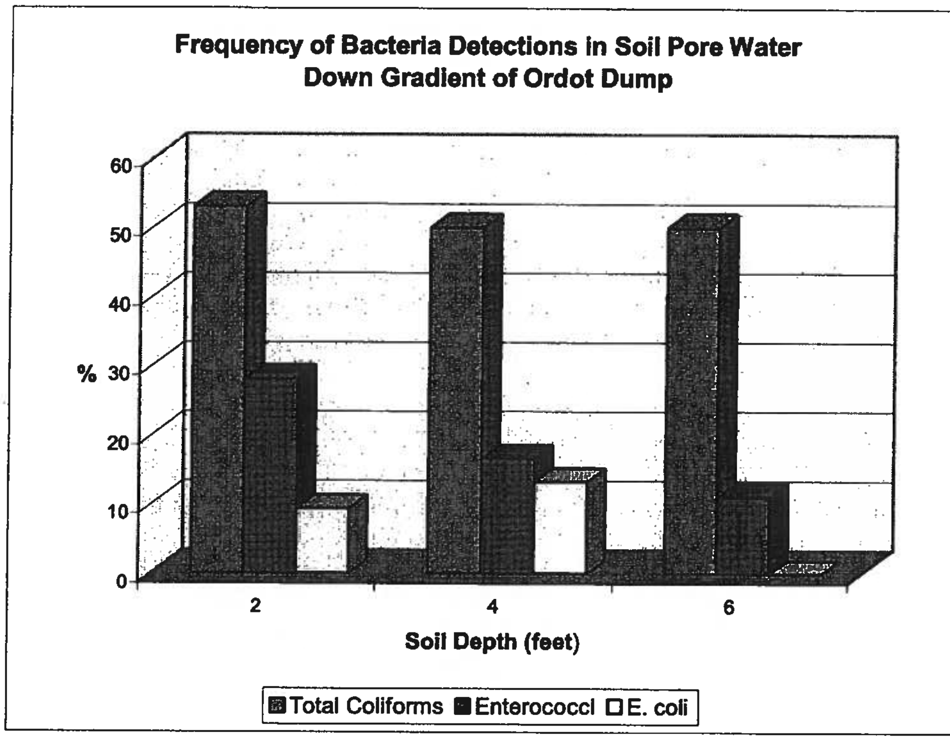

Figure 2: Frequency of bacteria detections in soil pore water down gradient from Ordot Dump (Oct. '02-May '03)

Nutrient levels found in soil pore waters are summarized in Table 6. NOx enrichment was evident in the majority of samples from the shallower depths and occasionally at the deepest level. These findings highlight the mobility of the nitrate anion down through the soil profiles and could account, at least in part, for the relatively lush vegetation growing further down the watershed.

Soil Depth (feet)	No. Samples	Nutrients (µg/l)		
		NOx-N	Ammonia-N	Orthophosphate-P
		median (range)	median (range)	median (range)
2	3	1,270 (339 - 8,124)	5.8 (2.9 - 6.0)	2.9 (1.0 - 16)
4	5	5,990 (10 - 9,510)	32 (2.9 -141)	18 (1.0 - 49)
6	8	740 (5 - 35,455)	11 (4.3 - 35)	8.5 (1.0 - 59)

Table 6: Nutrients in soil pore waters down gradient from Ordot Dump (Oct. '02 – May '03)

Ammonia-N and orthophosphate-P levels were generally low and indicative of a fairly well aerated soil environment at all depths. Both nutrients showed some indication of depth-dependency with the highest levels occurring in samples from the deeper lysimeters. It seems unlikely that the low pore water bacteria counts noted above were related to a nutrient deficiency.

Heavy metal levels in the soil pore water samples have yet to be completed. However, the data thus far collected suggest all elements of interest are at, or close to, the limits of analytical detection with the possible exception of Al, Fe and Mn.

Concluding Remarks and Recommendations:
The results of this preliminary investigation show that leachate streams from the Ordot Dump transport substantial quantities of nitrogen, phosphorus and essential trace elements to the middle reaches of the Lonfit River. The extremely high fecal indicator bacteria content of the runoff also suggests that it could be a major source of human pathogens to the area. The biological impact of relatively high concentrations of certain potentially toxic heavy metals in the leachate requires further evaluation, particularly in the immediate downstream region of the watershed. Edible aquatic resources and potentially useful bioindicator species should be the primary focus of such studies. The subsurface movement of NOx, Al, Fe and Mn from the dump into the watershed is probably considerable. The latter metals could have a significantly negative impact on plant growth down gradient from the dump and warrant further investigation. Concentrations of PCBs, chlorinated pesticides (other than p-dichlorobenzene), PAHs, furans, dioxins, Hg, Cd, and the majority of organic solvents currently classified as priority pollutants by the USEPA, were undetectable in dump leachate and are not considered to be of any immediate importance. However, the continued and regular surveillance of all priority pollutants emanating from the dump is strongly recommended in order to identify any future quantitative and qualitative changes in contaminant concentrations.

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