LES Exhibit 3

Excerpts from NEF #04-019, "Response to NRC Request for Additional Information Regarding the National Enrichment Facility Environmental Report (May 20, 2004) (Hearing File Index document Numbers 69-71) (Sensitive Information Omitted)

Louisiana Energy Services, L.P. ("LES") Exhibit No. 3

Excerpts from NEF #04-019, "Response to NRC Request for Additional Information Regarding the National Enrichment Facility Environmental Report" (May 20, 2004) (Hearing File Index document Numbers 69-71) (Sensitive Information Omitted)

(regarding Contention NIRS/PC EC-1 – Impacts Upon Ground and Surface Water)

Tab	Description
A	Cover Letter; Attachment 1 to NEF #04-019 (pages 1,2, 6-13, 18-20, 30-33, 55-60 only)
B	Attachment 2 to NEF #04-019 (Tables ER RAI 3-1A.2, RAI 3-1C.1, RAI 4.2A.1a, RAI 4.2A.1b, RAI 4.2A.2a, RAI 4.2A.2b, RAI 4.2A.3a, RAI 4.2A.3b only)
C	Attachment 3 to NEF #04-019 (Figures ER RAI 2-2, RAI 4-1.1 to RAI 4-1.5, RAI 6-1C only)
D	Attachment 4 to NEF #04-019 (Letter from J. Mace, U.S. Army Corps of Engineers, to G. Harper Louisiana Energy Services, L.P., Regarding the Absence of Corps of Engineers Jurisdictional Waters on the NEF Site, dated April 29, 2004)
From Attachment 6 (Documentation Supplied in Response to Requests) to NEF #04-019	
E	*Geotechnical Investigation and Engineering Analysis for Waste Control Specialists Inc. Landfill Project, Andrews County, Texas,* prepared by Jack H. Holt, Ph.D. & Associates, Inc., March 12, 1993
F	Grain Size Distribution Test and Permeability Data for Lea County Municipal Landfill, prepared by Weaver Boos Consultants, Inc. (1997-1998)
G	Various Soil Boring Logs Installed at Waste Control Specialists, Inc. Andrews County Landfill Site From 1992-1993, prepared by Terra Dynamic, Inc.
H	*Evaluation of Potential Groundwater Impacts by the WCS Facility in Andrews County, Texas,* prepared by Ken Rainwater, December 1996
I	*Geology of the WCS-Flying W Ranch, Andrews County, Texas,* prepared Thomas M. Lehman and Ken Rainwater, Texas Tech University Water Resources Center, April 2000.
J	Additional Grain Size Distribution Test and Permeability Data for Lea County Municipal Landfill, prepared by Weaver Boos Consultants, Inc. (1997-1998)

Tab	Description
K	Groundwater Non-Radiological Analytical Reports for Monitoring Well MW-2, First, Second, and Third Sampling Event Reports, prepared by Severn Trent Laboratory (11/19/03, 12/22/03, and 5/6/04, respectively)
L	*Hydrogeologic Investigation, Section 32; Township 21 Range 38, Eunice, New Mexico*, prepared by Cook-Joyce, Inc., November 19, 2003
M	*RCRA Permit Application for a Hazardous Waste Storage, Treatment and Disposal Facility, Andrews County, Texas, Section VI, Geology Report*, prepared for Waste Control Specialists, Inc. by Terra Dynamics, Inc., March 1993
N	*Report of Preliminary Subsurface Exploration, Proposed National Enrichment Facility, Lea County, New Mexico*, prepared by MACTEC Engineering and Consulting, Inc., October 17, 2003
O	*Waste Control Specialists, Section VI, Geology Report*, prepared by Cook-Joyce, Inc., and Intera, Inc., February 2004 (includes main body of report, all tables, Figures 6.0-1 through 6.4-17 and Plates 6.2-2 and 6.2-3)

A

NATIONAL
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FACILITY

69

10 CFR 30.6
10 CFR 40.5
10 CFR 70.5

ML041770112
(PACKAGE #)

May 20, 2004

NEF#04-019

ATTN: Document Control Desk
Director
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Louisiana Energy Services, L. P.
National Enrichment Facility
NRC Docket No. 70-3103

Subject: Response to NRC Request for Additional Information Regarding the National Enrichment Facility Environmental Report

References:

1. Letter NEF#03-003 dated December 12, 2003, from E. J. Ferland (Louisiana Energy Services, L. P.) to Directors, Office of Nuclear Material Safety and Safeguards and the Division of Facilities and Security (NRC) regarding "Applications for a Material License Under 10 CFR 70, Domestic licensing of special nuclear material, 10 CFR 40, Domestic licensing of source material, and 10 CFR 30, Rules of general applicability to domestic licensing of byproduct material, and for a Facility Clearance Under 10 CFR 95, Facility security clearance and safeguarding of national security information and restricted data"
2. Letter NEF#04-002 dated February 27, 2004, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Revision 1 to Applications for a Material License Under 10 CFR 70, "Domestic licensing of special nuclear material," 10 CFR 40, "Domestic licensing of source material," and 10 CFR 30, "Rules of general applicability to domestic licensing of byproduct material"
3. Letter dated April 29, 2004, from M. Wong (NRC) to R. Krich (Louisiana Energy Services) regarding "Request for Additional Information Related to the Preparation Of An Environmental Impact Statement For The Louisiana Energy Services Proposed National Enrichment Facility"

By letter dated December 12, 2003 (Reference 1), E. J. Ferland of Louisiana Energy Services (LES), L. P., submitted to the NRC applications for the licenses necessary to authorize construction and operation of a gas centrifuge uranium enrichment facility. Revision 1 to these applications was submitted to the NRC by letter dated February 27, 2004 (Reference 2). By letter dated April 29, 2004 (Reference 3), the NRC requested additional information and clarifications regarding the Environmental Report be provided within 15 working days (i.e., by May 20, 2004).

The Reference 3 letter includes the NRC Request for Additional Information (RAI) covering the National Enrichment Facility (NEF) Environmental Report (ER). This letter transmits the LES responses to these requests.

Enclosure 1 to this letter provides a compact disc (CD-ROM) containing an electronic version of the LES responses and associated tables and figures referenced in the various responses as requested in the Reference 3 letter.

Enclosure 2 to this letter provides a CD-ROM containing a sample calculation to allow the NRC to reproduce the site score results in ER Section 2.1.3.3, XOQDOQ model input files used to generate the air quality impact data from the proposed NEF operation in ER Section 4.6.2.3, and meteorological data supplied by Waste Control Specialists as requested in RAI 2-7A, RAI 4-4A, and RAI 4-11A, respectively.

Attachment 1 to this letter provides the RAIs with the associated LES response.

Attachment 2 to this letter provides Tables referenced in various RAI responses.

Attachment 3 to this letter provides Figures referenced in various RAI responses.

Attachment 4 to this letter provides a copy of a letter dated March 12, 2004, from J. Mace (US Army Corps of Engineers) to G. Harper (Framatome-ANP) regarding the absence of Corps of Engineers' jurisdictional waters on the NEF site.

Attachment 5 to this letter provides a copy of a letter dated April 13, 2004, from R. Krich (Louisiana Energy Services, L.P.) to J. Parker (New Mexico Environment Department) regarding "Registration of X-Ray Radiation Machines for the National Enrichment Facility."

Attachment 6 to this letter provides documents requested in various RAIs.

If you have any questions, please contact me at 630-657-2813.

Respectfully,

Daniel G. Green for

R. M. Krich
Vice President – Licensing, Safety, and Nuclear Engineering

Enclosures:

1. CD-ROM – LES Responses to April 29, 2004, Requests for Additional Information.
2. CD-ROM – Data Files Provided in Response to Requests.

Attachments:

1. LES Responses to April 29, 2004, Request for Additional Information.
2. LES Responses to April 29, 2004, Request for Additional Information: Tables Referenced from Responses.
3. LES Responses to April 29, 2004, Request for Additional Information: Figures Referenced from Responses.
4. LES Responses to April 29, 2004, Request for Additional Information: Letter Dated March 12, 2004, from J. Mace (US Army Corps of Engineers) to G. Harper (Framatome-ANP) Regarding the Absence of Corps of Engineers' Jurisdictional Waters on the NEF Site.
5. LES Responses to April 29, 2004, Request for Additional Information: Letter Dated April 13, 2004, from R. Krich (Louisiana Energy Services, L.P.) to J. Parker (New Mexico Environment Department) Regarding "Registration of X-Ray Radiation Machines for the National Enrichment Facility."
6. LES Responses to April 29, 2004, Request for Additional Information: Documentation Supplied in Response to Requests.

cc: T.C. Johnson, NRC Project Manager (w/o Attachments) (w/o Enclosures)
M.C. Wong, NRC Environmental Project Manager

ATTACHMENT 1

Louisiana Energy Services
Response to April 29, 2004,
Request for Additional Information

Louisiana Energy Services (LES)
Responses to April 29, 2004
Requests for Additional Information

SECTION 1 – INTRODUCTION

Pursuant to 10 CFR 51.45(d), the ER is required to list all the Federal permits, licenses, approvals or other entitlements which must be obtained in connection with the proposed action.

1-1 Permits, Licenses, and Approvals:

A. Provide an update on the status of required permits, licenses and approvals, if available, for the construction and operation of the proposed National Enrichment Facility (NEF). For example, identify any specific air quality permits required by the State of New Mexico. Provide the bases for each such permits.

B. Identify any applicable New Mexico regulations, permits, licenses, or approvals that would be required because of the State Land Swap Arrangement.

- Section 1.2.1 states that the proposed NEF site is currently owned by the State of New Mexico and is being acquired by Louisiana Energy Services (LES) through a State Land Swap Arrangement.

C. Verify that the proposed septic tanks and leach fields would comply with applicable permits, licenses or approvals.

LES Response

A. The following is a status update of those permits required for the NEF. LES will incorporate this update of the status of the required permits, licenses, and approvals in the next revision to the NEF Environmental Report (ER).

National Pollutant Discharge Elimination System (NPDES) Industrial Storm Water Permit

The NEF is eligible to claim the "No Exposure" exclusion for industrial activity of the NPDES storm water Phase II regulations. As such, LES could submit a No Exposure Certification immediately prior to initiating operational activities at the NEF site.

LES also has the option of filing for coverage under the Multi-Sector General Permit (MSGP) because the NEF is one of the 11 eligible industry categories. If this option is chosen, LES will file a Notice of Intent (NOI) with the US Environmental Protection Agency (EPA), Washington, D.C., at least two days prior to the initiation of NEF operations.

A decision regarding which option is appropriate for the NEF will be made in the near term and reflected in a revision to the ER.

NPDES Construction Storm Water Permit

The LES will file for coverage under the NPDES Construction General Permit (CGP). LES will develop a Storm Water Pollution Prevention Plan (SWPPP) and file a Notice of

Intent (NOI) with the US EPA, Washington, D.C., at least two days prior to the commencement of construction activities.

Development of the SWPPP or submittal of the NOI has not yet been completed because it is too early in the regulatory process.

US Army Corp of Engineers Section 404 Permit

By letter dated March 17, 2004, provided as Attachment 4 to this submittal, the US Army Corp of Engineers has notified LES of its determination that there are no jurisdictional waters at the NEF site. Therefore, a Section 404 Permit is not required.

New Mexico Section 401 Permit

The State of New Mexico and the US Army Corp of Engineers have a cooperative agreement between them. Because jurisdictional waters were not identified at the site, a Section 401 Permit is not required.

New Mexico Air Permit

The NEF does not emit levels of air emissions that meet the conditions under New Mexico regulation 20.2.70 NMAC (New Mexico Administrative Code), Operating Permits, which would require an air quality operating permit. The NEF will have emissions for non-exempt equipment below ten (10) pounds per hour and less than twenty-five (25) tons per year of any regulated air contaminant for which there are national or state standards, the threshold limits for which a construction permit would be required. Even though below the threshold limits, LES has prepared and filed a Notice of Intent (NOI) with the New Mexico Air Quality Bureau. The NOI is presently being reviewed by the bureau.

National Emission Standards for Hazardous Air Pollutants (NESHAPs)

The NEF is not subject to any of the standards established by the Clean Air Act for National Emission Standards for Hazardous Air Pollutants (NESHAPs). NEF emission of any hazardous air pollutant is below the regulatory limit. This is also the case under New Mexico regulation 20.2.78 NMAC, Emission Standards for Hazardous Air Pollutants, which has adopted the federal EPA standards by reference.

New Mexico Ground Water Discharge Permit/Plan

LES has prepared and submitted to the New Mexico Water Quality Bureau (NMWQB) a Ground Water Discharge Permit/Plan application for the NEF site. The application includes the NEF septic tanks and leachfields as part of 20.6.2.5000 NMAC, Underground Injection Control. The application is presently undergoing NMWQB review.

New Mexico Hazardous Waste Permit

The State of New Mexico adopted Resource Conservation Recovery Act laws by reference as state hazardous waste regulations under 20.4.1 NMAC, Hazardous Waste Management. LES will be required to file a US EPA Form 8700-12, Notification of Regulated Waste Activity, prior to the generation of materials meeting hazardous waste

2-2 Septic Tanks and Leach Fields:

Provide a detailed description of the septic tanks and leach fields.

- Section 2.1.2.5 states "three septic tanks with a common leach field will be installed onsite." Sections 3.12.1.3.4 and 4.4.7 discuss the effluent discharge systems.

LES Response

The design approach for disposal of sanitary wastes has been modified since the submittal of the ER. LES will incorporate a detailed description of the NEF septic systems in the next revision to the ER. Six septic systems are now planned in lieu of three septic tanks with a common leachfield. Each septic system will consist of a septic tank with one or more leachfields. Refer to Figure ER RAI 2-2, "Planned Septic Tank System Locations," in Attachment 3 to this submittal for the planned location of the six septic tank systems.

The six septic systems are capable of handling approximately 40,125 liters per day (10,600 gallons per day) based on a design number of employees of approximately 420. Based on the actual number of employees, 210, the overall system will receive approximately 20,063 liters per day (5,300 gallons per day). Total annual design discharge will be approximately 14.6 million liters per year (3.87 million gallons per year). Actual flows will be approximately 50 percent of the design values.

The septic tanks will meet manufacturer specifications. Utilizing the percolation rate of approximately 3 minutes per centimeter (8 minutes per inch) established by actual test on the site, and allowing for 76-114 liters (20-30 gallons) per person per day, each person will require 2.7 linear meters (9 linear feet) of trench utilizing a 91.4-centimeter (36-inch) wide trench filled with 61 centimeters (24 inches) of open graded crushed stone. As indicated above, although the site population during operation is expected to be 210 persons, the building facilities are designed by architectural code analysis to accommodate up to 420 persons. Therefore, a total of approximately 975 linear meters (3,200 linear feet) of percolation drain field will be required. The combined area of the leachfields will be approximately 892 square meters (9,600 square feet).

2-3 Treated Effluent Evaporative Basin (TEEB):

A. Provide specific information on the materials and construction methods to be used for the double-lined TEEB.

- Section 4.4.7 describes controls of impacts to water quality including the TEEB which is double-lined with leak detection equipment installed and open to allow evaporation.

B. Describe the methodology used to determine that the basin liner(s) would last the entire life of the proposed NEF.

C. Describe the proposed monitoring system used to determine whether the liner(s) has been breached. Provide specific information on the equipment and its alarm activation and operation system.

D. Describe the proposed mitigating actions to be implemented if the liner(s) fails.

E. Provide the process for decommissioning the TEEB and disposing of the soil and sludge as low-level waste.

- Based on Section 2.1.2.3.4, the TEEB soil/sludge would contain a complexing agent (citrate), Uranium, and other decay product radionuclides from the 30 years of operation.

F. Identify the treatment method(s) used to treat the citrate in the liquid effluent prior to discharging it into the TEEB.

G. Verify that the amount of chelating agent (i.e., citric acid) in the TEEB's soil/sludge would be acceptable for low-level waste disposal.

LES Response

A. Materials and construction methods to be used for the double-lined Treated Effluent Evaporative Basin (TEEB) will be in compliance with current New Mexico Environment Department (NMED) Guidelines for Liner Material and Site Preparation for Synthetically-Lined Lagoons, December 1995.

The TEEB will have two, geosynthetic fabric liners. The geosynthetic liner material will be chemically compatible with potential liquid effluents to be discharged to the TEEB, resistant to sunlight deterioration, and of sufficient thickness to have adequate tensile strength and tear and puncture resistance. The liner material will be selected during final design and may consist of high-density polyethylene (HDPE) or ethylene interpolymer alloy (Coolgard® XR-5® or Ultra Tech®).

Methods that will be used to construct the TEEB, from the bottom up, are as follows.

- A minimum 0.61-meter (2-foot) thick layer of on-site clay-type soils, free from rock, and compacted at optimum moisture content to 95% of Standard Effort, i.e., American Standard for Testing and Materials (ASTM) D698, "Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

(12,400ft-lbf/ft^3 (600kN-m/m^3))," (applicable version at time of design) will be prepared. The plastic limit of the clay will be approximately 20 and the material will be compacted to +3% of its optimum moisture content.

- A geosynthetic fabric liner will be installed on top of the prepared soil layer. This will serve as the secondary (lower) liner.
- Leak collection piping and associated sump and pumping system, to pump any leakage back to the TEEB, will then be placed.
- A geomembrane drainage mat with the imbedded leak collection piping will be added.
- The primary (upper) geosynthetic fabric liner will be installed.
- The primary liner will then be covered by a minimum 0.3-meter (1-foot) thick prepared layer of on-site clay, free of rock, and compacted at optimum moisture content.
- Liner installation will be by manufacturer certified installers and will be installed and tested according to project specifications.

In addition, the TEEB will be enclosed with animal-friendly fencing to prevent wildlife and unauthorized personnel access. It will also be covered by surface netting or other suitable devices, to exclude waterfowl access to basin water.

B. The methodology that will be used to determine that the basin liner(s) will last the entire life of the proposed NEF is as follows:

- A geosynthetic fabric liner determined to be chemically compatible with basin contents will be selected. The selection process will include consultation with liner manufacturers. This will occur during final design.
- The selected liner will have a projected service life in excess of the projected life of NEF.
- Liner thickness will comply with current NMED Guidelines for Liner Material and Site Preparation for Synthetically-Lined Lagoons, December 1995 and with the recommendations of the liner manufacturer.
- Liner material will be ultraviolet resistant and covered by a minimum of 0.3-meter (1-foot) thick prepared layer of on-site clay, free of rock, and compacted at optimum moisture content.
- The liner material will be pre-approved by a professional engineer and the NMED, as required by current NMED Guidelines for Liner Material and Site Preparation for Synthetically-Lined Lagoons, December 1995.
- Site preparation for basin construction will meet or exceed current NMED Guidelines for Liner Material and Site Preparation for Synthetically-Lined Lagoons, December 1995.

- Liner installation will be by manufacturer certified installers and will be installed and tested according to project specifications.

- Lastly, a monitoring plan will be implemented. The monitoring plan will consist of periodic inspections and implementation of corrective measures, if required.

By following the above methodology, the basin liner(s) are expected to last the entire life of the proposed NEF.

C. The proposed monitoring system for determining whether the primary (upper) liner has been breached will be an active liquid-sensor leak detection system. This system is a drain/sump system consisting of collection pipes that will be routed to a monitored sump. If the sump is collecting liquid, a level monitor will alert site staff. Specific information on the equipment, its periodic testing, and its alarm activation and operation system will be determined during final design.

D. Proposed mitigating actions to be implemented upon failure of the primary (upper) liner, detected by the leak detection system are as follows. Damage to the liner will be promptly assessed and corrective action taken to restore the system integrity. The TEEB will be designed with two cells. As such, the cell with the failed liner can be isolated, drained and repaired. During this time period, discharges will be to the cell with the intact liner. Furthermore, the secondary (lower) liner will preclude discharge to the subsurface in the case of a breach in the primary liner. Notifications and corrective measures required by the NMED Ground Water Quality Bureau will be promptly initiated. Given the methods used to construct the TEEB (See the response to RAI 2-3A) which will provide physical separation between the two liners as well as a minimum cover over the upper liner of 0.3 m (1.0 ft) and the liner selection and installation details as specified in the response to RAI 2-3B, catastrophic failure of both TEEB liners is not considered credible.

E. The TEEB is expected to contain low concentrations of uranic materials and decay products in the uppermost soils as residue from the Liquid Effluent Collection and Treatment System. As part of the site closure during the decommissioning process, representative soil samples from across the entire TEEB will be collected and analyzed for radioactive and hazardous constituents. This information will provide the necessary characterization data to develop the waste disposal plan for the transfer of contaminated waste materials to a licensed disposal site. Though the existing low level waste disposal sites (i.e., Barnwell in South Carolina and Envirocare in Utah) do permit limited quantities of waste with chelating agents, the Liquid Effluent Collection and Treatment System by process design is not expected to generate detectable quantities of citric acid (citrate) in the TEEB soil. The sediment and soil over the top of the upper liner and the liner itself will be disposed of, if required, as low level waste. Similarly, the leak detection system components and the lower liner will also be removed and disposed of accordingly. Lastly, the soil under the lower liner will be sampled and disposed of as low-level waste, if required. Excavations and berms will be leveled to restore the land to a natural contour.

F. The decontamination system uses citric acid, a chelating agent, to remove contamination from equipment and components. The concentration of the citric acid is between 5% and 7%. Disposal of spent citric acid results in an input waste stream to the Liquid Effluent Collection and Treatment System that will periodically contain a citric acid solution with dissolved uranic materials. The preliminary design of the Liquid Effluent Collection and Treatment System treats critic acid in the first portion of a multistage process for waste stream conditioning and removal of contaminants. The first stage of this treatment process utilizes a neutralization and precipitation reaction by the addition of a hydroxide (potassium or sodium) as a precipitating agent in the Precipitation Treatment Tank. This action is intended to raise the pH of the liquid waste to a range of 9 to 12. This treatment renders the soluble Uranium compounds insoluble allowing them to precipitate from solution. It also breaks down the citric acid as a chelating agent. Precipitated solids are removed from the treated solution by circulating the treated liquid through a filter press. The filter press separates suspended solids from the liquid. With proper control of pH, no critic acid will remain after this stage of treatment. The downstream stages of liquid treatment after the Precipitation Treatment Tank include a waste evaporator/dryer which will boil the waste liquid to create a clean distillate stream and concentrated waste bottoms. If any weak solutions of critic acid were to be carried over to the evaporator/dryer due to unexpected operating conditions, it will tend to dissociate to carbon dioxide (CO_2) and water when heated. The distillate fraction from the evaporator is collected in the Treated Effluent Monitoring Tanks before being discharged to the TEEB. Polishing demineralizers are provided in the design as a final stage of treatment if the effluents from the Treated Effluent Monitoring Tanks need additional processing before release to the basin. During final design of the Liquid Effluent Collection and Treatment System, process parameters and design requirements will be established to ensure that no detectable quantities of critic acid will be discharged to the TEEB.

G. The processing of liquid waste though the Liquid Effluent Collection and Treatment System will remove citric acid from the waste stream before discharge of the effluent to the TEEB as discussed in the response to RAI 2-3F above. During final design of the Liquid Effluent Collection and Treatment System, process parameters and design requirements will be established to ensure that no detectable quantities of critic acid will be discharged to the TEEB. Soil analysis of the TEEB soil/sludge as part of the decommissioning process will verify that the material is suitable for low-level waste disposal.

2-4 Uranium Byproduct Cylinder (UBC) Storage Pad:

A. Provide additional information which resolves inconsistencies on the UBC storage pad construction.

- Section 1.2.3 states the UBC storage pad is designed to store up to 15,727 UBCs, or about 25 years worth (i.e., tails generation rate is 625-627 UBCs per year). This statement is inconsistent with Section 1.2 which states the proposed NEF would be licensed for 30 years of operation and Section 4.13.3.1.1 which states "the concrete pad to be initially constructed onsite for the storage of UBCs will only be of a size necessary to hold a few years worth of UBCs."

B. Provide the specific size and capacity for the initial concrete storage pad.

C. Identify the planned expansion dates for the storage pad and discuss the impact the periodic expansions of the storage pad would have on operation and maintenance activities.

D. Discuss the potential for regular periodic expansion of the UBC storage pad that could bring construction crews back onto the proposed NEF which could increase the number of personnel exposed to radiological and hazardous events.

- Section 4.13.3.1.1 states the depleted uranium would be temporarily stored onsite in containers on the UBC storage pad. The current schedule calls for completion of construction activities by 2013, which seems inconsistent with the regular periodic expansion of the UBC storage pad.

LES Response

A. There are no inconsistencies concerning the UBC Storage Pad construction information provided in the license application. The UBC Storage Pad will be sized to store up to 15,727 UBCs. This figure was selected to establish a conservative upper bound estimate with respect to UBC Storage Pad dose calculations, UBC Storage Pad sizing, and the decommissioning funding estimate. The yearly UBC generation rate and cumulative number of UBCs for this scenario are provided in Table ER RAI 2-4A.1, "Production for Nominal 30 Years of Operation," in Attachment 2 to this submittal. As shown in Table ER RAI 2-4A.1, the 15,727 UBC estimate includes a six-year ramp up from 66 to 623 UBCs/yr, followed by 19 years at a constant UBC generation rate of 627 UBCs/yr, and lastly, a seven-year ramp down from 561 to 0 UBCs/yr (i.e., a total of 32 years based on the conservative assumption of facility operation up to the full 30 years).

The NEF is, however, applying for a 30-year license which spans the period from initial receipt of licensed material on site until decommissioning is completed. The actual number of UBCs generated over this 30-year license period will be less than the bounding estimate of 15,727 UBCs. This is shown in Table ER RAI 2-4A.2, "Production During 30-Year License Period," in Attachment 2 to this submittal.

The concrete pad will initially be constructed to store the number of UBCs generated over approximately the first five years of full production. If the need arises to store additional UBCs, prior to a deconversion facility becoming available, the storage pad will be expanded in about five years from initial construction to provide an additional five-year capacity. Additional expansions, if required, will provide similar storage capacity increases in five-year increments.

B. The concrete pad will initially be constructed to store the number of UBCs generated over approximately the first 5 years of production. The facility is licensed for 30 years and the incremental storage pad expansions would occur, if necessary, about every five years. Therefore, each expansion would be approximately 1/6 of the total pad size. The total design storage pad area is approximately 8.5 hectares (21 acres); therefore, the initial pad size will be approximately 1.4 hectares (3.5 acres). This size will be adequate to store the initial five years of UBCs that are generated by the NEF. It is the intention of LES to pursue a deconversion option which would preclude the need to expand the storage pad beyond its initial constructed size. Once the deconversion option is established, the shipments to the deconversion facility would approximately match the generation rate, thus precluding the need for additional storage area.

C. The expansions, if required, will occur approximately every five years. Storage pad expansion during facility operation will have negligible impacts on operation and maintenance activities. The construction effort would be adjacent to the existing storage pad segment(s) in use at the time. Construction activities would be coordinated so as not to impact pad operations or maintenance activities associated with storage, inspection, and maintenance of UBCs.

D. The current schedule shows that production from the first cascade is estimated to start in 2008 and completion of facility construction in 2013. The first UBC Storage Pad segment would be completed once the first cascade goes into production or shortly thereafter to store the Uranium byproduct produced by the first cascade. As explained above, subsequent UBC Storage Pad segments would be built only if needed as the facility continues to operate without the ability to send the Uranium byproduct to a deconversion facility.

The potential radiological impact to construction crews for expansion of the UBC Storage Pad by segment has been evaluated. The maximum individual dose to a construction worker is estimated to be about 2.66 mSv (266 mrem). For an estimated work force of 91 people and 47,181 total craft hours for the construction of each pad segment, the collective dose is about 0.208 person-Sv (20.8 person-rem). The dose estimates were based on expected dose rates at various distances from the edge of a full UBC Storage Pad.

Work planning will consider additional As Low As Reasonably Achievable (ALARA) aspects such as the use of temporary shadow shields (i.e., "Jersey Barriers") between the end of an existing storage pad segment containing UBCs and the segment under construction, rotation of work crews, increasing the distance between the closest row of cylinders on the UBC Storage Pad and the construction area by initiating work prior to when the existing storage pad segment is full, and the placement of relatively high dose rate empty (heels only) cylinders on the far side away from the work area. Construction work will be coordinated with routine plant operations and maintenance activities on the UBC Storage Pad to preclude any hazardous events impacting the construction crews. The construction crews will be monitored for radiation exposure and receive appropriate training commensurate with the radiological risk during UBC Storage Pad construction activities.

2-5 Depleted Uranium:

A. Provide LES's determination on whether the depleted uranium is a waste or a resource material.

- Section 4.13.3.1.3 notes that "NRC expects LES to indicate in its proposed NEF license application whether the depleted uranium tails will be treated as a waste or a resource" and that "LES will make a determination as to whether the depleted uranium is a resource or a waste and notify the NRC."

B. Provide an update on actions to identify and finalize a viable disposal path for the depleted uranium.

- Section 4.13.3.1.1 states that LES is committed to aggressively pursue economically viable disposal paths for the disposition of UBCs.

LES Response

A. LES will provide information on the determination on whether the depleted Uranium is a waste or a resource material to the NRC in the near future.

B. Discussions are continuing with Cogema that may potentially lead to a Memorandum of Agreement regarding a contract between Cogema and LES for the deconversion of byproduct produced at the NEF. In addition, LES has been approached by ConverDyn, the company that operates the only Uranium conversion plant in the U.S, and another company in the Uranium business about building a private deconversion facility. In fact, ConverDyn is interested in using the hydrogen fluoride (HF) byproduct from the deconversion plant in its operating Uranium conversion plant. These discussions are continuing.

SECTION 3 – DESCRIPTION OF AFFECTED ENVIRONMENT

Pursuant to 10 CFR 51.45(b), the ER is required to contain a description of the affected environment.

3-1 Geology and Soils:

A. Provide information on the existing soil contamination due to chemicals at the proposed NEF.

- Section 3.3 discusses geological characteristics of the soil, but specific physical or chemical data is lacking.

B. Clarify whether Red Bed Ridge is associated with the Mescalero Escarpment or if it is the result of other structural/erosional activity in Section 3.3.

C. Clarify whether single values estimating the thickness of the geological units represent averages across the proposed NEF site in Table 3.3-1.

D. Provide the average value when a range of depth or thickness is stated for the various materials in Table 3.3-1.

E. Provide a range of values when a single value of thickness is stated.

LES Response

A. ER Section 3.11.1.1 describes ten surface soil samples that were previously collected for initial radiological characterization of the NEF site. Eight additional surface soil samples were subsequently collected and analyzed for both radiological and non-radiological chemical analyses. Radiological chemical analyses included gamma spectrometry, thorium, and Uranium products. Non-radiological chemical analyses included volatiles, semi-volatiles, 8 Resource Conservation and Recovery Act (RCRA) metals, organochlorine pesticides, organophosphorous compounds, chlorinated herbicides and fluoride. Six of the additional eight soil sample locations were selected to represent background conditions at proposed plant structures. The other two sample locations are representative of up-gradient, on-site locations. The eight soil samples and their approximate locations are provided on Figure ER RAI 3-1A, "Soil Sample Locations," in Attachment 3 to this submittal and in Table ER RAI 3-1A.1, "NEF Site Soil Sample Locations," in Attachment 2 to this submittal.

The radiological analytical results for the eight soil samples are provided in Table ER RAI 3-1A.2, "Radiological Chemical Analyses of NEF Site Soil," in Attachment 2 to this submittal. A comparison of the radiological analytical results and the results reported in ER Section 3.11.1.1 shows that the radiological nuclides detected in the eight additional soil samples included the same radiological nuclides detected in the initial ten soil samples. However, two additional radiological nuclides (Th-230 and U-235) were detected in the more recent soil samples. Th-230 was not analyzed in the initial ten soil samples and a lower laboratory measured minimum detectable concentration (MDC) for U-235 was used in the analyses for the eight additional soil samples than was used for the initial ten soil samples. Th-230 is naturally occurring and associated with the decay of U-238. Similar to U-234 and U-238, U-235 is a natural Uranium isotope found in the environment.

The non-radiological analytical results provided for the eight soil samples in Table ER RAI 3-1A.3, "Non-Radiological Chemical Analyses of NEF Site Soil," in Attachment 2 to this submittal indicate that barium, chromium and lead were detected above laboratory reporting limits in all eight soil samples. However, their detected levels are below State of New Mexico Soil Screening Levels as developed by the NMED Hazardous Waste Bureau, the Ground Water Quality Bureau and the Voluntary Remediation Program (Technical Background Document for Development of Soil Screening Levels, Revision 2, February 2004, published by NMED). Other non-radiological parameters were not detected at levels above the laboratory reporting limits.

LES will incorporate the radiological and non-radiological analytical results for the eight samples in the next revision to the ER.

B. The Red Bed Ridge and the Mescalero Escarpment are not associated with one another. LES will revise ER Section 3.3 to clarify that the Red Bed Ridge and the Mescalero Escarpment are not associated and to provide additional information concerning the Red Bed Ridge in the next revision to the ER.

The Red Bed Ridge is a prominent buried ridge developed on the upper surface of the Triassic Dockum Group "red beds." The crest of the buried Red Bed Ridge is approximately 1.6 km (1 mi) or so in width and extends for at least 160.9 km (100 mi) in length from northern Lea County, New Mexico, through western Andrews County, Texas, and southward into Winkler and Ector Counties in Texas. The Red Bed Ridge runs from the northwest to the southeast, just north and northeast of the NEF site through the adjacent Wallach Quarry and Waste Control Specialists (WCS) properties. The designation Red Bed Ridge derives from geologic reports related to site investigations for the nearby WCS facility. Its origin appears to be the result of the relative resistant character of the claystone of the Chinle Formation and to caliche deposits that cap the ridge.

The NEF is located about 6.2 to 9.3 km (10 to 15 mi) southeast of the Mescalero Escarpment. Although the Mescalero Escarpment and the Red Bed Ridge are likely to have originated due to similar geomorphological processes, as both appear to be remnant erosional features, they are not associated with each other.

C, D, and E.

LES will revise ER Table 3.3-1 to clarify the information on depth and thickness of the surficial materials. The revised table is provided as Table ER RAI 3-1C.1, "Geological Units Exposed At, Near, or Underlying the Site," in Attachment 2 to this submittal. Ranges and averages are provided when available. The deeper units are based on information from a single source and ranges or averages are provided, as applicable. The revised table also factors in additional data obtained since the table was originally prepared. Revisions to ER Table 3.3-1 will be incorporated in the next revision to the ER.

3-2 Water Resources:

Provide an explanation for the units of the chemicals listed below U-238 in Table 3.4-3. Specifically, explain the use of negative values.

LES Response

The data listed for U-238 and below in Table 3.4-3 is from the analysis of site ground water for radionuclides. The results listed are levels of radioactivity given first in pCi/L followed by Bq/L in parentheses. Revisions to ER Table 3.4-3 to explain the negative values and clarify the units of the analyses will be incorporated in the next revision to the ER.

Some of the radionuclide results given in Table 3.4-3 are negative. It is possible to calculate radioanalytical results that are less than zero, although negative radioactivity is physically impossible. This result typically occurs when activity is not present in a sample or is present near background levels. Laboratories sometimes choose not to report negative results or results that are near zero. The EPA does not recommend such censoring of results.

The laboratory performing the radioanalytical services for the NEF site follows the recommendations given in EPA Report: EPA 520/1-80-012;1980: Upgrading Environmental Radiation Data; Health Physics Society Committee Report HPSR-1, Washington, D.C. This report recommends that all results, whether positive, negative, or zero, should be reported as obtained.

4-2 Water Resources Impacts:

A. Provide a complete water balance table identifying the estimated flow rates (maximum and minimum) discharged to each of the wastewater basins identified in Section 4.4.7 and the anticipated evaporation, soil adsorption, or evapotranspiration on a monthly basis.

B. Provide the basis for assuming that the sand and gravel layer at the surface is laterally and wholly indurated across the entire proposed NEF site.

- In Section 3.3, it appears there is an assumption being made that the sand and gravel layer at the surface is laterally and wholly indurated across the entire proposed NEF site. The limited information from the geotechnical borings does not support this assumption.

C. Discuss the contaminant pathways in a lateral direction to a groundwater source within the subsurface (i.e., contaminant migration beyond the bounds of the proposed NEF within the sand and gravel layer above the Chinle formation).

- Section 4.4.2 includes discussions on contaminant pathways only in a vertical direction to a groundwater source and not in a lateral direction within the subsurface.

D. Discuss the potential for water or other liquids from spills or pipeline leaks to migrate and flow along the base of the Chinle Formation.

- In the construction of the proposed NEF, the site would be subject to borrow and fill from onsite. The sand and gravel "fill" could be a pathway for water or other liquids from spills or pipeline leaks. The water or liquids may flow along the base of the fill area in an apparent southwesterly direction based on the slope of the Chinle Formation.

E. Provide any impacts to the surrounding land if the site stormwater retention basin overflows.

LES Response

A. Complete water balances for each of the basins identified in ER Section 4.4.7 are provided in Table ER RAI 4-2A.1a, "Water Balance for Treated Effluent Evaporative Basin (Minimum Scenario)," Table ER RAI 4-2A.1b, "Water Balance for Treated Effluent Evaporative Basin (Maximum Scenario)," Table ER RAI 4-2A.2a, "Water Balance for UBC Storage Pad Stormwater Retention Basin (Minimum Scenario)," Table ER RAI 4-2A.2b, "Water Balance for UBC Storage Pad Stormwater Retention Basin (Maximum Scenario)," Table ER RAI 4-2A.3a, "Water Balance for Site Stormwater Detention Basin (Minimum Scenario)," and Table ER RAI 4-2A.3b, "Water Balance for Site Stormwater Detention Basin (Maximum Scenario)," in Attachment 2 to this submittal.

The water balances consider the following components:

- Direct precipitation falling within the basin berms for all 3 basins.

- Stormwater runoff for the UBC Storage Pad Stormwater Retention Basin and the Site Stormwater Detention Basin.

- Other inflows (i.e., discharge from Liquid Effluent Collection and Treatment System for the Treated Effluent Evaporative Basin and cooling tower and heating boiler blowdown for the UBC Storage Pad Stormwater Retention Basin).

- Evaporation for all 3 basins.

- Infiltration for the Site Stormwater Detention Basin. The Treated Effluent Evaporative Basin and the UBC Storage Pad Stormwater Retention Basin are lined. Therefore, infiltration is not considered for these basins.

The water balances include the following inputs and assumptions:

- The minimum and maximum monthly precipitation values are based on data from Hobbs, New Mexico. The annual minimum and maximum precipitation amounts were distributed by month using the average annual distribution by month. Use of the minimum precipitation amounts provides a minimum discharge scenario. Use of the maximum precipitation amounts provides a maximum discharge scenario. These data were used in lieu of ER Table 3.6-1B which provides the extreme maximums and minimums for each month at Hobbs over a 30-year period of record. The information in ER Table 3.6-1B is not representative of what would occur over a very dry or very wet calendar year.

- The discharge from the Liquid Effluent Collection and Treatment System for the Treated Effluent Evaporative Basin was based on the expected average monthly flow.

- The cooling tower blowdown was based on the expected average annual discharge. Monthly distribution will not be available until final design.

- The heating boiler blowbown was based on the expected average annual discharge. This component is relatively small and is not expected to vary significantly month by month.

- Annual evaporation at the site is 203.2 cm (80 in) per year. Monthly distribution was based on information from Roswell, New Mexico.

- Monthly infiltration capacity in the Site Stormwater Detention Basin was conservatively assumed as 61 cm (24 in).

- No credit is taken for outflows from the Site Stormwater Detention Basin through the discharge outlet. Any such flows will eventually infiltrate, evaporate or evapotranspirate.

The tables provide the monthly balance (inflow minus outflow). A positive value indicates that the inflow components exceed the outflow components for the respective basin. A negative value indicates that outflow components will dispose of the entire monthly inflow for the respective basin. The tables also provide the monthly net in the basin. A non-zero value indicates that the basin will contain standing water.

The results for the Treated Effluent Evaporative Basin show that basin outflow due to evaporation will exceed all inflows on a monthly basis for the minimum discharge scenario with the exception of the winter months. Under the maximum discharge scenario, the basin would have standing water in it for most of the year.

The results for the UBC Storage Pad Stormwater Retention Basin show that basin outflow due to evaporation will exceed all inflows on a monthly basis under both discharge scenarios, except for one winter month under the maximum discharge scenario.

The results for the Site Stormwater Detention Basin show that basin outflow due to evaporation and infiltration will exceed all inflows on a monthly basis under both discharge scenarios. Prior to final design of the basin, it is not possible to accurately estimate the distribution of infiltration and evaporation. At this stage in the design, it is reasonable to assume that the basin outflow will be 50 % by infiltration and 50 % by evaporation. Of the amount that infiltrates into the ground, most is expected to eventually return to the atmosphere via evapotranspiration by vegetation growing within and in the vicinity of the basin. As shown in Table ER RAI 4-2A.3, the combination of both potential infiltration and potential evaporation are more than sufficient to dispose of basin inflows on a monthly basis.

B. The five borings are not sufficient to adequately define subsurface conditions for final design purposes, but they are acceptable for judging the feasibility of developing the site. Assuming that the borings are generally representative of subsurface conditions, the site is considered acceptable for the facility structures supported on a system of shallow foundations.

During final design, additional geotechnical investigations will be undertaken to collect more information on the sand and gravel layer.

C. As discussed in ER Section 3.4.15, the nine groundwater exploration borings were performed in the sand and gravel layer above the Chinle Formation and no groundwater was detected. During drilling, only one of the borings produced cuttings that were slightly moist at 1.8 to 4.2 m (6 to 14 ft) below ground surface; other cuttings were very dry. Based on this, it is concluded that a continuous groundwater aquifer does not exist in this layer under the NEF site. Since there is no consistent groundwater in this layer, it does not provide a likely contaminant pathway in the lateral direction.

Due to the lack of groundwater in this layer, potential contamination would travel laterally at very small rates, if at all. The travel time to downstream users through a lateral contaminant pathway would be significant. The lack of ground water in this layer is supported by information from the adjacent Waste Control Specialists (WCS) ground water investigations.

D. During a May 14, 2004, conference call between LES and NRC representatives, the NRC provided a clarification for RAI 4-2D. RAI 4-2D should read: "Discuss the potential for water or other liquids from spills or pipeline leaks to migrate and flow along the top of the Chinle Formation."

Engineered fill will be used during site preparation. The engineered fill will likely be placed against the existing dense sand and gravel layer in some locations, as required.

As discussed in ER Section 3.4.15, the nine groundwater exploration borings were performed in the sand and gravel layer above the Chinle Formation and no groundwater was detected. During drilling, only one of the borings produced cuttings that were slightly moist at 1.8 to 4.2 m (6 to 14 ft) below ground surface; other cuttings were very dry. Based on this, it is concluded that a continuous groundwater aquifer does not exist in the sand and gravel layer under the NEF site. Since there is no consistent groundwater in this layer, it does not provide a likely contaminant pathway in the vertical direction. Addition of on-site fill is not expected to alter this situation.

Due to the lack of groundwater in the sand and gravel layer, potential contamination would travel laterally at very small rates, if at all. The travel time to downstream users through a lateral contaminant pathway, would be significant.

The potential for water or other liquids from spills or pipeline leaks to introduce sufficient amounts of liquid to saturate the sand and gravel layer to a point where significant contaminant migration reaches and flows along the top of the Chinle Formation, is considered unlikely.

E. The Site Stormwater Detention Basin will be designed to accommodate the 24-hour, 100-year return frequency storm. That storm delivers 15.2 cm (6 in) of rain in 24 hours. In addition, the basin has 0.6 m (2 ft) of freeboard beyond the design capacity. The basin will also be designed to discharge post-construction peak flow runoff rates from the outfall that are equal to or less than the pre-construction runoff rates from the site area. The water quality of the discharge will be typical of runoff from building roofs and paved areas from any industrial facility. Except for small amounts of oil and grease typically found in runoff from paved roadways and parking areas, the discharge is not expected to contain contaminants.

During a rainfall event larger than the design basis, the potential exists to overflow the basin if the outfall capacity is insufficient to pass beyond design basis inflows to the basin. Overflow of the basin is an unlikely event. The additional impact to the surrounding land over that which would occur during such a flood alone, is assumed to be small. Therefore, potential overflow of the Site Stormwater Detention Basin during an event beyond its design basis is expected to have a minimal impact to surrounding land.

4-11 Cumulative Impacts:

A. Provide the Walvoord and WCS referenced and unreferenced documentations for air (e.g., meteorological tower data), ground water (e.g., sample well information), and soil (e.g., soil analysis).

- Sections 3.3, 3.4, 4.4.2, and 4.6.4 cite or reference data obtained from WCS (such as Rainwater, 1996; TTU, 2000; WBG, 1998) and other sources (Walvoord, 2002) for the site characteristics.

B. Provide an assessment of the cumulative impacts from the proposed NEF construction and operations in relationship to existing and planned Quarry, Lea County Landfill, and WCS operations including the increase in total suspended particulate.

C. Describe potential releases from the proposed low-level radioactive waste disposal facility planned by WCS.

LES Response

A. LES has provided a compact disc as an enclosure to this submittal containing electronic files for the WCS meteorological data (as received from WCS). Also included are files that provide information on the data channels and units used by WCS. A file listing follows.

Filename: BK0011.TXT – Data from October 15, 1999 to December 8, 2000
Filename: RAD115.TXT – Data from November 24, 2000 to January 4, 2002
Filename: RAD117.TXT – Data from November 28, 2000 to August 29, 2002
Filename: RAD119.TXT – Data from December 29, 2002 to August 5, 2003
Filename: WCS Meteorological DataFormat.doc – Format of provided data

The document referenced by Walvoord, 2002, is copyrighted by the American Geophysical Union. The following is the information necessary to obtain a copy:

Deep Arid System Hydrodynamics, 1. Equilibrium States and Response Times in Thick Desert Vadose Zones, Water Resources Research, Vol. 38, No. 12, pp. 44-1 to 44-15, M.A. Walvoord, M.A. Plummer, and F.M. Phillips, 2002,

Copies of the following documents referenced in the ER are enclosed in Attachment 6 of this submittal:

Rainwater, 1996	Evaluation of Potential Groundwater Impacts by the WCS Facility in Andrews County, Texas, Prepared for Andrews Industrial Foundation, K. Rainwater, December 1996.
TTU, 2000	Geology of the WCS-Flying W Ranch, Andrews County, Texas, Prepared for Andrews Industrial Foundation, Texas Tech University Water Resources Center, April 2000.

WBG, 1998 Atomic Vapor Laser Isotope Separation (AVLIS), New Mexico, Technical Appendices, submitted by the State of New Mexico and Waste Control Specialists, LLC.

Copies of additional reports prepared by others that are enclosed in Attachment 6 include:

RCRA Permit Application for a Hazardous Waste Storage, Treatment and Disposal Facility, Andrews County, Texas, Section VI, Geology Report, prepared for Waste Control Specialists, Inc., prepared by Terra Dynamics Incorporated, March 1993.

Waste Control Specialists, 2002 Annual Groundwater Monitoring Report, prepared for Waste Control Specialists, LLC, prepared by Cook-Joyce, Inc., January 25, 2003.

Waste Control Specialists, Section VI, Geology Report, prepared for Waste Control Specialists, prepared by Cook-Joyce, Inc. and Intera, Inc., February 2004. (Includes main body of report, all tables, Figures 6.0-1 through 6.4-17 and Plates 6.2-2 and 6.2-3)

Copies of reports prepared for LES in support of the NEF that are enclosed in Attachment 6 include:

Hydrogeologic Investigation, Section 32; Township 21 Range 38, Eunice, New Mexico, prepared for Lockwood Greene Engineering & Construction, prepared by Cook-Joyce, Inc., November 19, 2003.

Report of Preliminary Subsurface Exploration, Proposed National Enrichment Facility, Lea County, New Mexico, prepared for Lockwood Greene, prepared by MACTEC Engineering and Consulting, Inc., October 17, 2003.

Groundwater Radiological Analytical Report for Monitoring Well MW-2, First Sampling Event, analyzed by Framatome ANP Environmental Laboratory, October 30, 2003.

Groundwater Radiological Analytical Report for Monitoring Well MW-2, Second Sampling Event, analyzed by Framatome ANP Environmental Laboratory, November 26, 2003.

Groundwater Radiological Analytical Report for Monitoring Well MW-2, Third Sampling Event, analyzed by Framatome ANP Environmental Laboratory, April 27, 2004.

Groundwater Non-radiological Analytical Report for Monitoring Well MW-2, First Sampling Event, analyzed by Severn Trent Laboratory, November 19, 2003.

Groundwater Non-radiological Analytical Report for Monitoring Well MW-2, Second Sampling Event, analyzed by Severn Trent Laboratory, December 22, 2003.

Groundwater Non-radiological Analytical Report for Monitoring Well MW-2, Third Sampling Event, analyzed by Severn Trent Laboratory, May 6, 2004.

Soil Radiological Analytical Report, First Sampling Event, analyzed by Framatome ANP Environmental Laboratory, November 5, 2003.

Soil Radiological Analytical Report, Second Sampling Event, analyzed by Framatome ANP Environmental Laboratory, April 27, 2004.

Soil Non-Radiological Analytical Report, Second Sampling Event, analyzed by Severn Trent Laboratory, April 29, 2004.

B. An assessment of cumulative impacts of the proposed NEF, in combination with neighboring facilities, during construction and operation is provided in ER Section 2.3. In particular, the assessment includes a discussion on potential decrements in air quality due to increase in total suspended particulates (TSPs). Most cumulative impacts (i.e., TSPs and noise) will occur during the eight-year construction period of the NEF with the majority occurring during the peak three-year period of site preparation and major building construction. Construction related cumulative impacts will, however, be transient. In addition, a lack of nearby receptors will limit any adverse impacts during this three-year period. Cumulative impacts during operation of the NEF will be less.

LES is not aware of any planned changes in future operations at the nearby quarry or the landfill. WCS is in the process of preparing a license application for a low-level radioactive waste disposal facility. Depending on whether WCS receives a license, some additional construction may occur at some point in the future at WCS.

C. WCS is presently planning to submit their low-level radioactive waste disposal facility license application later this year. It is expected that this application will provide information on potential releases from the proposed low-level radioactive waste disposal facility. Accordingly, information on potential releases from this planned facility is not available at this time. It is expected that cumulative effects of the operation of the low-level radioactive waste facility and the NEF will be addressed as part of the licensing process for the WCS facility.

SECTION 6 – ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

Pursuant to 10 CFR Part 20, licensees are required to conduct surveys to demonstrate compliance and that radioactive material in effluent discharges are kept as low as reasonably achievable.

6-1 Water Resources:

A. Discuss the reason for the lack of any radiological or chemical sampling of the septic tank and leach field in Section 6.1.2.

B. If such monitoring is planned, provide information on the program.

C. Provide the locations of all groundwater sampling wells on Figure 6.1-2.

- Figure 6.1-2 legend indicates that groundwater samples would be taken at two locations to be determined at a later date. Groundwater would be sampled for radionuclides, metals, organics and pesticides. No rationale is provided for where the groundwater wells that would be necessary to take the samples would be located in orientation to the proposed NEF and to each other.

D. Clarify which of these wells would act as a background well and which aquifer is being sampled.

E. Clarify whether background monitoring well location would consider and avoid potential cross contamination from WCS and other surrounding industrial activities.

F. Describe the discharges that would occur from the outfall of the site stormwater detention basin (Item 7 on Figure 6.1-1).

G. Describe the water quality features of the discharges, the surface feature receiving the discharge from this outfall, and any impacts on the highway or surrounding facilities (e.g., Lea County Landfill).

H. Provide a discussion on any impacts of discharges from the outfall of the diversion ditch and associated mitigative measures (Item 5 on Figure 6.1-1).

I. Justify why the lower limits of detection (LLD) shown in Table 6.2-1 are higher than EPA action limits for some of the proposed analyses.

- Table 6.2-1 shows the LLD for metals to be 5 parts per million (ppm) whereas the EPA limit for lead is 0.5 ppm.

J. Describe how the surface water testing program complies with the State of New Mexico Standards for Interstate and Intrastate Surface Waters.

LES Response

A. The septic systems will receive only typical sanitary wastes. No plant process related effluents will be introduced into the septic systems. Each septic tank will, however, be periodically sampled (prior to pumping) and analyzed for isotopic Uranium. The septic tanks are upstream of the leachfields. Any Uranium that is in the system that could reach the leachfields would be detected in the septic tanks. Therefore, no sampling will be performed at the leachfields. No chemical sampling of the septic systems is planned because no plant process related effluents will be introduced into the septic system.

B. The septic tank monitoring described in RAI 6-1A will be included in the site environmental monitoring program.

C. The locations of the groundwater sampling (monitoring) wells are shown on Figure ER RAI 6-1C, "Groundwater Monitoring Well Locations," in Attachment 3 to this submittal. The rationale for the locations is based on the slope of the red bed surface at the base of the shallow sand and gravel layer and the groundwater gradient in the 70 m (230 ft) groundwater zone to the south under the NEF site and proximity to key site structures. Two monitoring wells will be located down-gradient of the site basins, two will be located down-gradient of the UBC Storage Pad and one will be located up-gradient of the UBC Storage Pad and all site facilities.

D. The background monitoring well, MW-1, is shown on Figure ER RAI 6-1C. Monitoring at this location will occur in both the shallow sand and gravel layer on top of the red bed and in the 70-m (230-ft) groundwater zone. Groundwater in the sand and gravel layer was not encountered at the NEF site during groundwater investigations. Although not an aquifer, it will be monitored since it is the shallowest layer under the NEF site. The 70-m (230-ft) zone contains the first occurrence of groundwater beneath the NEF. Although not strictly meeting the definition of an aquifer, which requires that the unit be able to transmit "significant quantities of water under ordinary hydraulic gradients," this layer will also be monitored.

E. The background monitoring well, MW-1, is located on the NEF property, up-gradient of the NEF and cross-gradient from the WCS facility. This location is intended to avoid potential contamination from both facilities, i.e., NEF and/or WCS.

With respect to other surrounding industrial activities, the Wallach Quarry and the Sundance Services "produced water" lagoons north of the NEF site have some potential to introduce contaminants that could reach MW-1. The contaminants of concern for those facilities should be readily differentiated from potential contaminants from the NEF.

F. The normal discharge from the basin will be through evaporation and infiltration into the ground. During high precipitation runoff events, some discharge may occur from the outfall. The basin and outfall are designed to discharge post-construction peak flow runoff rates from the outfall during these high runoff events that are equal to or less than the pre-construction runoff rates from the site area.

G. The water quality of the discharge will be typical of runoff from building roofs and paved areas from any industrial facility. Except for small amounts of oil and grease typically found in runoff from paved roadways and parking areas, the discharge is not expected to contain contaminants. The surface feature receiving the discharge is the north side of New Mexico Route 234. Several culverts presently exist under the road that transmit runoff to the south side of the road. Since post-construction flows will not increase over pre-construction flows, there will be no additional impact on the highway or surrounding facilities.

H. The purpose of the diversion ditch is to safely divert surface runoff from the area upstream of the NEF around the east and west sides of the NEF structures during extreme precipitation events. There is no retention or attenuation of flow associated with this feature. The east side will divert surface runoff into the Site Stormwater Detention Basin. The basin is designed to provide no flow attenuation for this component of flow. The west side will divert surface runoff around the site where it will continue on as overland flow. Since there are no modifications or attenuation of flows, there are no adverse impacts and no mitigative measures are required.

I. In the next revision to the ER, Table 6.2-1 will be revised to reflect that the lower limits of detection (LLD) for all analyses listed in Table 6.2-1 will meet the applicable EPA limits.

J. The basins at the NEF do not meet the definition of "surface water" in the State of New Mexico. Waste water treatment systems, treatment ponds or lagoons are not surface waters of the State, unless they were originally constructed in waters of the State or resulted in the impoundment in surface waters of the State. State of New Mexico Standards for Interstate and Intrastate Surface Waters provide an anti-degradation policy applicable to defined surface waters and are not applicable to the NEF surface water testing program, because the basins do not meet the definition of "surface waters" in the State of New Mexico. In addition, as determined by the US Army Corps of Engineers, there are no jurisdictional surface waters in the area (See the response for RAI 1-1A).

ATTACHMENT 2

Louisiana Energy Services
Response to April 29, 2004,
Request for Additional Information

Tables Referenced from Responses

B

ATTACHMENT 2

Louisiana Energy Services
Response to April 29, 2004,
Request for Additional Information

Tables Referenced from Responses

Table ER RAI 3-1A.2 Radiological Chemical Analyses of NEF Site Soil

Analytical Results Bq/kg (pCi/kg)									Comparative Soil Concentration Bq/kg (pCi/kg) (From ER Section 3.11.1.1)
Sample No.	**SS-2**	**SS-6**	**SS-9**	**SS-11**	**SS-12**	**SS-13**	**SS-15**	**SS-16**	
Nuclide[1]									
AcTh-228	6.7 (181)	5.6 (151)	6.2 (168)	6.5 (175)	7.6 (205)	6.4 (172)	5.8 (156)	7.4 (201)	8.1 (218)[2]
Cs-137	4.3 (115.5)	3 (80.7)	3.1 (84)	3.1 (83.5)	2.1 (57.6)	1.2 (32.6)	2.7 (74)	3.3 (89.9)	2.82 (76.3)[3]
K-40	137.8 (3720)	140 (3780)	135.2 (3650)	138.9 (3750)	133.7 (3610)	135.6 (3660)	143 (3860)	139.6 (3770)	130 (3,500)[2]
Th-228	5.4 (146)	7.7 (207)	5.7 (154)	6.5 (175)	7.7 (207)	7.4 (199)	7.8 (211)	7.4 (200)	8.1 (218)[2]
Th-230	5.8 (157)	5.0 (136)	5.9 (160)	5.7 (155)	6 (163)	5.5 (149)	6 (161)	6.8 (183)	NA[4]
Th-232	7.6 (204)	6 (163)	6.1 (164)	6.7 (181)	7.3 (196)	7.2 (194)	7.7 (207)	7 (188)	8.1 (218)[2]
U-234	5.9 (159.2)	6.1 (165)	6.2 (168.4)	6.1 (165.4)	5.9 (159.4)	5.3 (143)	6.0 (161.5)	6.1 (165.4)	12 (333)[2]
U-235	0.24 (6.6)	0.25 (6.7)	0.39 (10.6)	0.43 (11.6)	0.41 (11.1)	0.36 (9.7)	0.28 (7.5)	0.24 (6.4)	NA[4]
U-238	5.4 (146.8)	5.9 (158)	6 (161.2)	6.2 (168.5)	6 (162.5)	5.8 (157.6)	5.8 (156.4)	5.7 (152.8)	12 (333)[2]

Notes:

1. No other nuclides were detected above their laboratory measured MDC.
2. Typical lower end range value.
3. Average in NEF site soils. Credited to past weapons testing fallout.
4. Typical soil concentration data is not available.

Table ER RAI 3-1C.1 Geological Units Exposed At, Near, or Underlying the Site

Formation	Geologic Age	Descriptions	Estimates for the NEF Site Area(1)	
			Depths: m (ft)	Thickness: m (ft)
Topsoils	Recent	Silty fine sand with some fine roots - eolian	Range: 0 to 0.6 (0 to 2) Average: 0 to 0.4 (0 to 1.4)	Range: 0.3 to 0.6 (1 to 2) Average: 0.4 (1.4)
Mescalero Sands/ Blackwater Draw Formation	Quaternary	Dune or dune-related sands	Range (sporadic across site): 0 to 3 (0 to 10) Average: NA(4)	Range (sporadic across site): 0 to 3 (0 to 10) Average: NA(5)
Gatuña/ Antlers Formation	Pleistocene/ mid-Pliocene	Pecos Valley alluvium: Sand and silty sand with interbedded caliche near the surface and a sand and gravel base layer	Range: 0.3 to 17 (1 to 55) Average: 0.4 to 12 (1.4 to 39)	Range: 6.7 to 16 (22 to 54) Average: 12 (38)
Mescalero Caliche	Quaternary	Soft to hard calcium carbonate deposits	Range: 1.8 to 12 (6 to 38) Average: 3.7 to 8 (12 to 26)	Range: 0 to 6 (0 to 20) Average (all 14 borings)(2): 1.4 (5) Average (five borings that encountered caliche): 4.3 (14)
Chinle Formation	Triassic	Claystone and silty clay: red beds	Range: 7 to 340 (23 to 1,115) Average: 12 to 340 (39 to 1,115)	Range: 323 to 333 (1,060 to 1,092) Average: 328 (1,076)
Santa Rosa Formation	Triassic	Sandy red beds, conglomerates and shales	Range: 340 to 434 (1,115 to 1,425) Average: NA(4)	Range: NA(3) Average: 94 (310)
Dewey Lake	Permian	Muddy sandstone and shale red beds	Range: 434 to 480 (1,425 to 1,575) Average: NA(4)	Range: NA(3) Average: 46 (150)

Notes:

1. Range of depths is below ground level to shallowest top and deepest bottom of geological unit determined from site boring logs, unless noted.

   Average depths are below ground level to average top and average bottom of geological unit determined from site boring logs, unless noted.

   Range of thickness is from the smallest thickness to the largest thickness of geological unit determined from site boring logs, unless noted.

   Average thickness is the average as determined from site boring logs, unless noted.

   Bottom of Chinle Formation, top and bottom of Santa Rosa Formation and top and bottom of Dewey Lake Formation are single values from a deep boring just south of the NEF.

2. Caliche is not present at some locations of the site. Where not present in a particular boring, a thickness of '0' m (ft) was used in calculating the average.
3. Range of thickness is not available.
4. Average depths are not available.
5. Average thickness is not available.

Table ER RAI 4-2A.1a Water Balance for Treated Effluent Evaporative Basin
(Minimum Scenario)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m^3 (gal)	Treated Effluent Inflow to Basin m^3 (gal)	Total Inflow to Basin m^3 (gal)	Evaporation per Month cm (in)	Potential Evaporation Outflow from Basin m^3 (gal)	Balance Inflow – Outflow m^3 (gal)	Net In Basin m^3 (gal)
JAN	0.5 (0.2)	40 (10,508)	211 (55,824)	251 (66,332)	4.2 (1.7)	128 (33,694)	124 (32,638)	124 (32,638)
FEB	0.7 (0.3)	56 (14,711)	211 (55,824)	267 (70,535)	10.1 (4.0)	307 (81,069)	-40 (-10,534)	84 (22,104)
MAR	0.5 (0.2)	40 (10,508)	211 (55,824)	251 (66,332)	22.4 (8.8)	679 (179,292)	-428 (-112,96)	0 (0)
APR	0.8 (0.3)	64 (16,813)	211 (55,824)	275 (72,636)	28.0 (11.0)	850 (224,625)	-575 (-151,989)	0 (0)
MAY	2.6 (1.0)	207 (54,641)	211 (55,824)	418 (110,465)	24.5 (9.6)	743 (196,241)	-325 (-85,775)	0 (0)
JUN	2.0 (0.8)	159 (42,032)	211 (55,824)	370 (97,856)	23.4 (9.2)	710 (187,664)	-340 (-89,808)	0 (0)
JUL	2.4 (0.9)	191 (50,438)	211 (55,824)	402 (106,262)	22.1 (8.7)	670 (177,045)	-268 (-70,783)	0 (0)
AUG	2.5 (1.0)	199 (52,540)	211 (55,824)	410 (108,364)	20.7 (8.2)	628 (166,018)	-218 (-57,655)	0 (0)
SEP	3.0 (1.2)	247 (65,149)	211 (55,824)	458 (120,973)	19.9 (7.8)	604 (159,688)	-147 (-38,715)	0 (0)
OCT	1.4 (0.5)	111 (29,422)	211 (55,824)	323 (85,246)	12.2 (4.8)	371 (98,018)	-48 (-12,772)	0 (0)
NOV	0.9 (0.3)	72 (18,914)	211 (55,824)	283 (74,738)	8.8 (3.5)	267 (70,655)	15 (4,083)	15 (4,083)
DEC	0.7 (0.3)	56 (14,711)	211 (55,824)	267 (70,535)	6.9 (2.7)	209 (55,135)	58 (15,400)	74 (19,483)
Totals	17.8 (7.0)	1,440 (380,389)	2,536 (669,884)	3,975 (1,050,273)	203.2 (80.0)	6,167 (1,629,144)		

Table ER RAI 4-2A.1b Water Balance for Treated Effluent Evaporative Basin (Maximum Scenario)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m^3 (gal)	Treated Effluent Inflow to Basin m^3 (gal)	Total Inflow to Basin m^3 (gal)	Evaporation per Month cm (in)	Potential Evaporation Outflow from Basin m^3 (gal)	Balance Inflow – Outflow m^3 (gal)	Net in Basin m^3 (gal)
JAN	2.0 (0.8)	163 (43,174)	211 (55,824)	375 (98,998)	4.2 (1.7)	128 (33,694)	247 (65,304)	247 (65,304)
FEB	2.8 (1.1)	229 (60,444)	211 (55,824)	440 (116,268)	10.1 (4.0)	307 (81,069)	133 (35,199)	380 (100,503)
MAR	2.0 (0.8)	163 (43,174)	211 (55,824)	375 (98,998)	22.4 (8.8)	679 (179,292)	-304 (-80,294)	76 (20,209)
APR	3.2 (1.3)	261 (69,079)	211 (55,824)	473 (124,903)	28.0 (11.0)	850 (224,625)	-377 (-99,722)	0 (0)
MAY	10.5 (4.1)	850 (224,507)	211 (55,824)	1,061 (280,331)	24.5 (9.6)	743 (196,241)	318 (84,090)	318 (84,090)
JUN	8.1 (3.2)	654 (172,698)	211 (55,824)	865 (228,521)	23.4 (9.2)	710 (187,664)	155 (40,857)	473 (124,947)
JUL	9.7 (3.8)	784 (207,237)	211 (55,824)	996 (263,061)	22.1 (8.7)	670 (177,045)	326 (86,016)	799 (210,963)
AUG	10.1 (4.0)	817 (215,872)	211 (55,824)	1,028 (271,696)	20.7 (8.2)	628 (166,018)	400 (105,677)	1,199 (316,640)
SEP	12.5 (4.9)	1,013 (267,681)	211 (55,824)	1,225 (323,505)	19.9 (7.8)	604 (159,688)	620 (163,817)	1,819 (480,458)
OCT	5.7 (2.2)	458 (120,888)	211 (55,824)	669 (176,712)	12.2 (4.8)	371 (98,018)	298 (78,694)	2,116 (559,151)
NOV	3.6 (1.4)	294 (77,714)	211 (55,824)	505 (133,538)	8.8 (3.5)	267 (70,655)	238 (62,883)	2,354 (622,034)
DEC	2.8 (1.1)	229 (60,444)	211 (55,824)	440 (116,268)	6.9 (2.7)	209 (55,135)	231 (61,133)	2,586 (683,167)
Totals	73.1 (28.8)	5,916 (1,562,914)	2,536 (669,884)	8,451 (2,232,798)	203.2 (80.0)	6,167 (1,629,144)		

Table ER RAI 4-2A.2a Water Balance for UBC Storage Pad Stormwater Retention Basin
(Minimum Scenario)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m³ (gal)	Blowdown Inflow to Basin m³ (gal)	Total Inflow to Basin m³ (gal)	Evaporation per Month cm (in)	Potential Evaporation Outflow from Basin m³ (gal)	Balance Inflow – Outflow m³ (gal)	Net in Basin m³ (gal)
JAN	0.5 (0.2)	398 (105,080)	1,604 (423,875)	2,002 (528,955)	4.2 (1.7)	3,061 (808,650)	-1,059 (-279,695)	0 (0)
FEB	0.7 (0.3)	557 (147,112)	1,604 (423,875)	2,161 (570,987)	10.1 (4.0)	7,365 (1,945,661)	-5,203 (-1,374,674)	0 (0)
MAR	0.5 (0.2)	398 (105,080)	1,604 (423,875)	2,002 (528,955)	22.4 (8.8)	16,287 (4,302,999)	-14,285 (-3,774,044)	0 (0)
APR	0.8 (0.3)	636 (168,128)	1,604 (423,875)	2,241 (592,003)	28.0 (11.0)	20,406 (5,391,000)	-18,165 (-4,798,998)	0 (0)
MAY	2.6 (1.0)	2,068 (546,415)	1,604 (423,875)	3,673 (970,290)	24.5 (9.6)	17,827 (4,709,774)	-14,154 (-3,739,484)	0 (0)
JUN	2.0 (0.8)	1,591 (420,319)	1,604 (423,875)	3,195 (844,194)	23.4 (9.2)	17,048 (4,503,936)	-13,853 (-3,659,742)	0 (0)
JUL	2.4 (0.9)	1,909 (504,383	1,604 (423,875)	3,514 (928,258)	22.1 (8.7)	16,083 (4,249,089)	-12,570 (-3,320,831)	0 (0)
AUG	2.5 (1.0)	1,989 (525,399)	1,604 (423,875)	3,593 (949,274)	20.7 (8.2)	15,082 (3,984,439	-11,488 (-3,035,165)	0 (0)
SEP	3.0 (1.2)	2,466 (651,495)	1,604 (423,875)	4,070 (1,075,370)	19.9 (7.8)	14,507 (3,832,511)	-10,436 (-2,757,142)	0 (0)
OCT	1.4 (0.5)	1,114 (294,223)	1,604 (423,875)	2,718 (718,098)	12.2 (4.8)	8,904 (2,352,437)	-6,186 (-1,634,338)	0 (0)
NOV	0.9 (0.3)	716 (189,144)	1,604 (423,875)	2,320 (613,019)	8.8 (3.5)	6,418 (1,695,715)	-4,098 (-1,082,696)	0 (0)
DEC	0.7 (0.3)	557 (147,112)	1,604 (423,875)	2,161 (570,987)	6.9 (2.7)	5,009 (1,323,246)	-2,847 (-752,259)	0 (0)
Totals	17.8 (7.0)	14,398 (3,803,888)	19,253 (5,086,500)	33,651 (8,890,388)	203.2 (80.0)	147,996 (39,099,456)		

Table ER RAI 4-2A.2b Water Balance for UBC Storage Pad Stormwater Retention Basin (Maximum Scenario)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m³ (gal)	Blowdown Inflow to Basin m³ (gal)	Total Inflow to Basin m³ (gal)	Evaporation per Month cm (in)	Potential Evaporation Outflow from Basin m³ (gal)	Balance Inflow – Outflow m³ (gal)	Net in Basin m³ (gal)
JAN	2.0 (0.8)	1,634 (431,723)	1,604 (423,875)	3,239 (855,598)	4.2 (1.7)	3,061 (808,650)	178 (46,948)	178 (46,948)
FEB	2.8 (1.1)	2,288 (604,412)	1,604 (423,875)	3,892 (1,028,287)	10.1 (4.0)	7,365 (1,945,661)	-3,472 (-917,374)	0 (0)
MAR	2.0 (0.8)	1,634 (431,723)	1,604 (423,875)	3,239 (855,598)	22.4 (8.8)	16,287 (4,302,999)	-13,049 (-3,447,400)	0 (0)
APR	3.2 (1.3)	2,615 (690,757)	1,604 (423,875)	4,219 (1,114,632)	28.0 (11.0)	20,406 (5,391,000)	-16,187 (-4,276,368)	0 (0)
MAY	10.5 (4.1)	8,497 (2,244,960)	1,604 (423,875)	10,102 (2,668,835)	24.5 (9.6)	17,827 (4,709,774)	-7,725 (-2,040,939)	0 (0)
JUN	8.1 (3.2)	6,536 (1,726,893)	1,604 (423,875)	8,141 (2,150,768)	23.4 (9.2)	17,048 (4,503,936)	-8,907 (-2,353,168)	0 (0)
JUL	9.7 (3.8)	7,844 (2,072,271)	1,604 (423,875)	9,448 (2,496,146)	22.1 (8.7)	16,083 (4,249,089)	-6,635 (-1,752,942)	0 (0)
AUG	10.1 (4.0)	8,171 (2,158,616)	1,604 (423,875)	9,775 (2,582,491)	20.7 (8.2)	15,082 (3,984,439)	-5,307 (-1,401,949)	0 (0)
SEP	12.5 (4.9)	10,132 (2,676,684)	1,604 (423,875)	11,736 (3,100,559)	19.9 (7.8)	14,507 (3,832,511)	-2,771 (-731,953)	0 (0)
OCT	5.7 (2.2)	4,576 (1,208,825)	1,604 (423,875)	6,180 (1,632,700)	12.2 (4.8)	8,904 (2,352,437)	-2,724 (-719,737)	0 (0)
NOV	3.6 (1.4)	2,941 (777,102)	1,604 (423,875)	4,546 (1,200,977)	8.8 (3.5)	6,418 (1,695,715)	-1,873 (-494,738)	0 (0)
DEC	2.8 (1.1)	2,288 (604,412)	1,604 (423,875)	3,892 (1,028,287)	6.9 (2.7)	5,009 (1,323,246)	-1,116 (-294,958)	0 (0)
Totals	73.1 (28.8)	59,155 (15,628,378)	19,253 (5,086,500)	78,408 (20,714,878)	203.2 (80.0)	147,996 (39,099,456)		

Table ER RAI 4-2A.3a Water Balance for the Site Stormwater Detention Basin (Minimum Scenario)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m^3 (gal)	Evaporation + Infiltration per Month cm (in)	Potential Evaporation Outflow from Basin m^3 (gal)	Balance Inflow – Outflow m^3 (gal)	Net in Basin m^3 (gal)
JAN	0.5 (0.2)	2,376 (627,763)	65.2 (25.7)	47,460 (12,538,487)	-45,084 (-11,910,723)	0 (0)
FEB	0.8 (0.3)	3,564 (941,645)	71.1 (28.0)	51,763 (13,675,498)	-48,199 (-12,733,853)	0 (0)
MAR	0.5 (0.2)	2,376 (627,763)	83.3 (32.8)	60,686 (16,032,835)	-58,310 (-15,405,072)	0 (0)
APR	0.8 (0.3)	3,564 (941,645)	89.0 (35.0)	64,804 (17,120,837)	-61,240 (-16,179,192)	0 (0)
MAY	2.5 (1.0)	11,881 (3,138,817)	85.4 (33.6)	62,226 (16,439,611)	-50,345 (-13,300,793)	0 (0)
JUN	2.0 (0.8)	9,505 (2,511,054)	84.4 (33.2)	61,447 (16,233,773)	-51,942 (-13,722,719)	0 (0)
JUL	2.3 (0.9)	10,693 (2,824,936)	83.0 (32.7)	60,482 (15,978,925)	-49,789 (-13,153,990)	0 (0)
AUG	2.5 (1.0)	11,881 (3,138,817)	81.7 (32.2)	59,480 (15,714,276)	-47,600 (-12,575,459)	0 (0)
SEP	3.0 (1.2)	14,257 (3,766,581)	80.9 (31.8)	58,905 (15,562,348)	-44,648 (-11,795,767)	0 (0)
OCT	1.3 (0.5)	5,940 (1,569,409)	73.2 (28.8)	53,303 (14,082,273)	-47,363 (-12,512,865)	0 (0)
NOV	0.8 (0.3)	3,564 (941,645)	69.8 (27.5	50,817 (13,425,551)	-47,253 (-12,483,906)	0 (0)
DEC	0.8 (0.3)	3,564 (941,645)	67.8 (26.7)	49,407 (13,053,082)	-45,843 (-12,111,437)	0 (0)
Totals	17.8 (7.0)	83,166 (21,971,722)	934.7 (368.0)	680,782 (179,857,498)		

Table ER RAI 4-2A.3b Water Balance for the Site Stormwater Detention Basin (Maximum Scenario)

Month	Precipitation cm (in)	Total Precipitation Inflow to Basin m³ (gal)	Evaporation + Infiltration per Month cm (in)	Potential Evaporation Outflow from Basin m³ (gal)	Balance Inflow – Outflow m³ (gal)	Net In Basin m³ (gal)
JAN	2.0 (0.8)	9,445 (2,495,360)	65.2 (25.7)	47,460 (12,538,487)	-38,014 (-10,043,127)	0 (0)
FEB	2.8 (1.1)	13,223 (3,493,504)	71.1 (28.0)	51,763 (13,675,498)	-38,540 (-10,181,994)	0 (0)
MAR	2.0 (0.8)	9,445 (2,495,360)	83.3 (32.8)	60,686 (16,032,835)	-51,241 (-13,537,475)	0 (0)
APR	3.2 (1.3)	15,112 (3,992,576)	89.0 (35.0)	64,804 (17,120,837)	-49,692 (-13,128,261)	0 (0)
MAY	10.5 (4.1)	49,115 (12,975,871)	85.4 (33.6)	62,226 (16,439,611)	-13,111 (-3,463,740)	0 (0)
JUN	8.1 (3.2)	37,781 (9,981,439)	84.4 (33.2)	61,447 (16,233,773)	-23,666 (-6,252,333)	0 (0)
JUL	9.7 (3.8)	45,337 (11,977,727)	83.0 (32.7)	60,482 (15,978,925)	-15,145 (-4,001,198)	0 (0)
AUG	10.1 (4.0)	47,226 (12,476,799)	81.7 (32.2)	59,480 (15,714,276)	-12,254 (-3,237,477)	0 (0)
SEP	12.5 (4.9)	58,560 (15,471,231)	80.9 (31.8)	58,905 (15,562,348)	-345 (-91,117)	0 (0)
OCT	5.7 (2.2)	26,447 (6,987,008)	73.2 (28.8)	53,303 (14,082,273)	-26,856 (-7,095,266)	0 (0)
NOV	3.6 (1.4)	17,001 (4,491,648)	69.8 (27.5)	50,817 (13,425,551)	-33,816 (-8,933,904)	0 (0)
DEC	2.8 (1.1)	13,223 (3,493,504)	67.8 (26.7)	49,407 (13,053,082)	-36,184 (-9,559,579)	0 (0)
Totals	73.1 (28.8)	341,918 (90,332,027)	934.7 (368.0)	680,782 (179,857,498)		

C

ATTACHMENT 3

Louisiana Energy Services
Response to April 29, 2004,
Request for Additional Information

Figures Referenced from Responses

The following figures are referenced in responses to various RAIs:

- Figure ER RAI 2-1, Location of Current CO_2 Line.
- Figure ER RAI 2-2, Planned Septic Tank System Locations.
- Figure ER RAI 2-7C.1, Aerial View of Eddy County Site.
- Figure ER RAI 2-7D.1, Contributions by Grouped Criteria.
- Figure ER RAI 2-7D.2, Contributions by Criteria.
- Figure ER RAI 3-1A, Soil Sample Locations.
- Figure ER RAI 3-3, Comparison of Wind Direction Data.
- Figure ER RAI 3-4A, County Map, Proposed Area of Critical Environmental Concern (ACEC), Lesser Prairie Chicken.
- Figure ER RAI 4-1.1, Aerial View.
- Figure ER RAI 4-1.2, View to the Northwest.
- Figure ER RAI 4-1.3, View to the East.
- Figure ER RAI 4-1.4, View to the South.
- Figure ER RAI 4-1.5, View to the West.
- Figure ER RAI 4-4D, Release Point Locations.
- Figure ER RAI 6-1C, Groundwater Monitoring Well Locations.

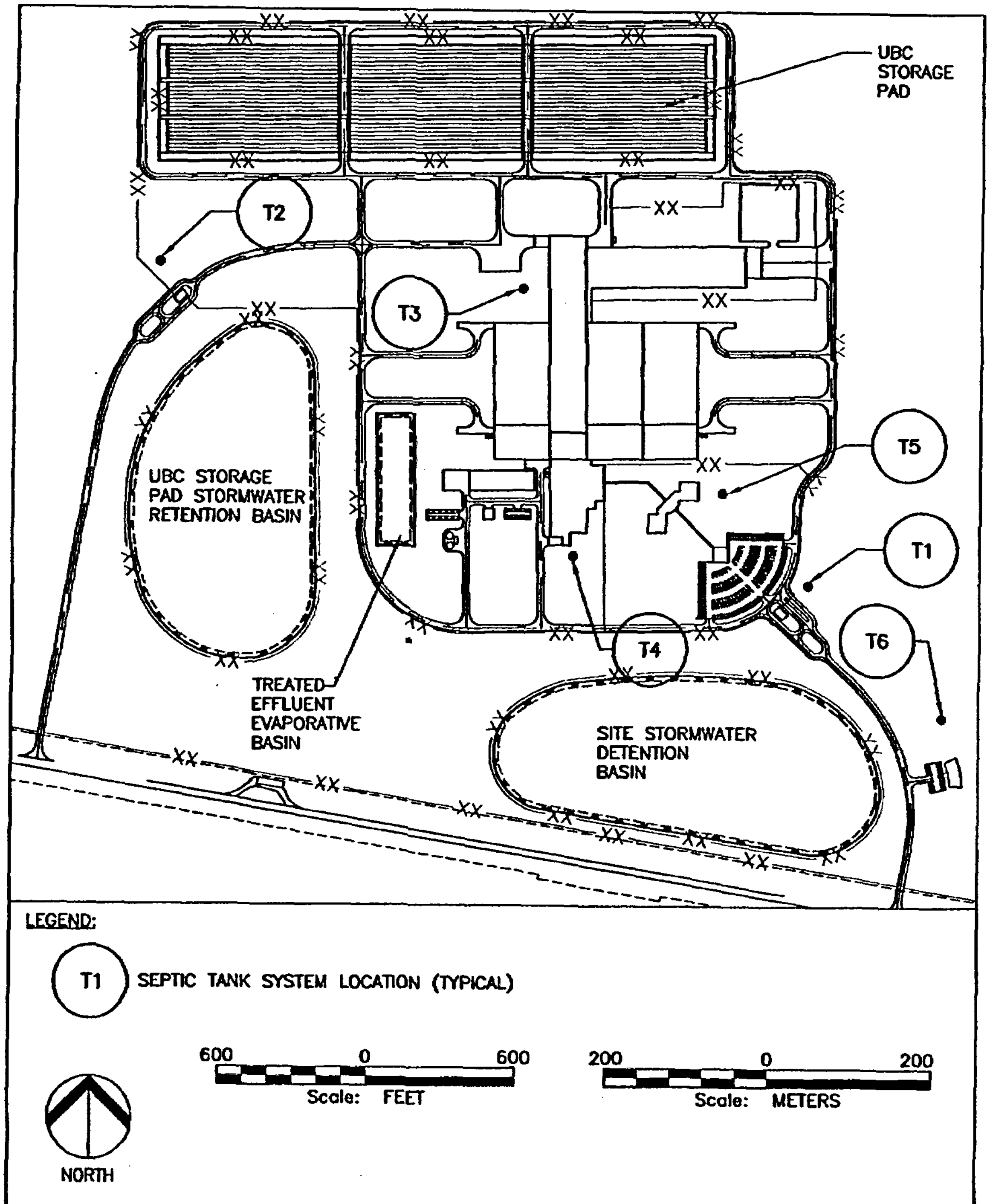
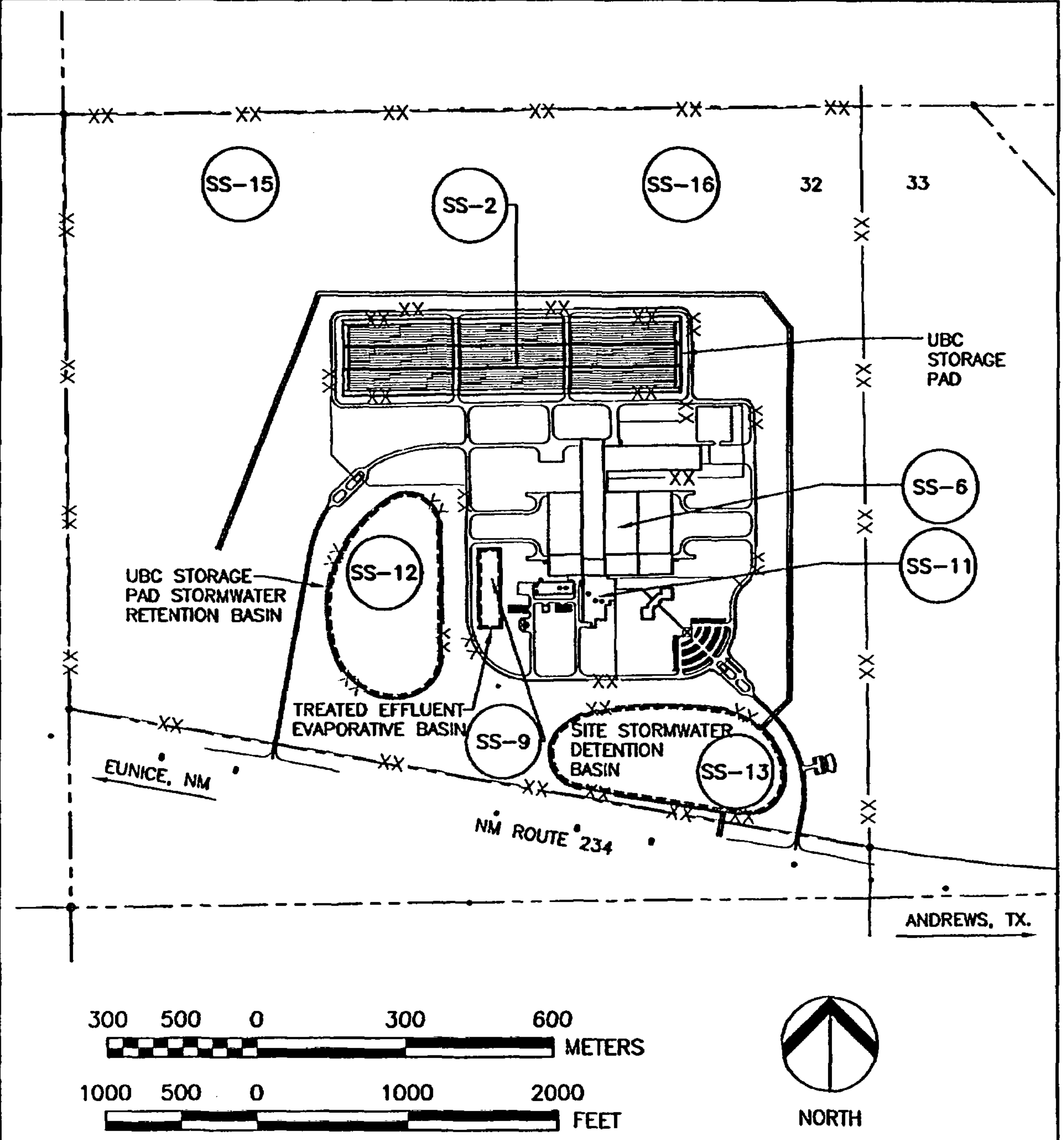


FIGURE ER RAI 2-2

DATE: 5/20/04

PLANNED SEPTIC TANK SYSTEM LOCATIONS

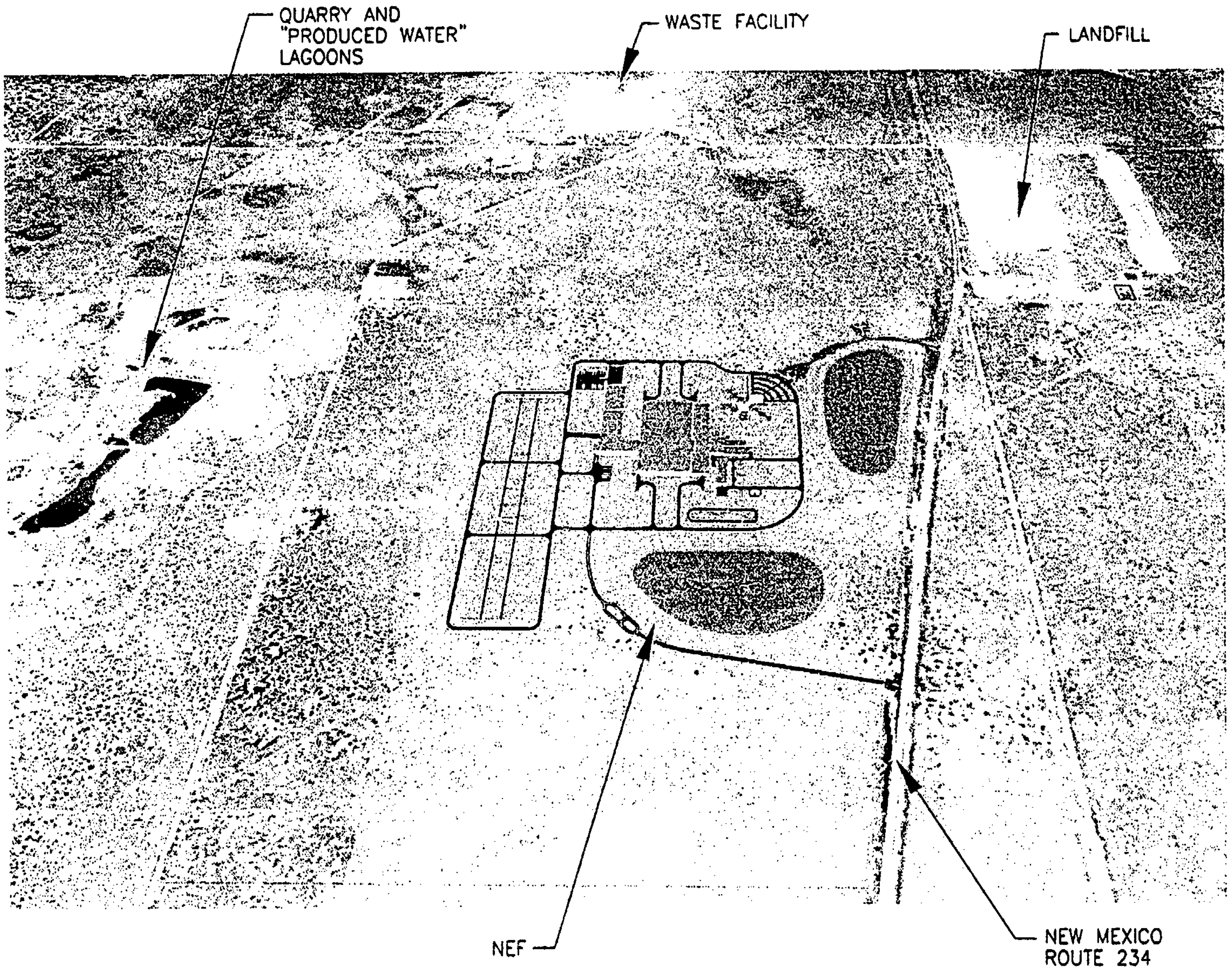


LEGEND:

(SS-2) SOIL SAMPLE (TYPICAL)

NOTE: THE APPROXIMATE SOIL SAMPLE LOCATIONS ARE SHOWN. FOR EXACT LOCATIONS, REFER TO TABLE ER RAI 3-1A.1

FIGURE ER RAI 3-1A	SOIL SAMPLE LOCATIONS
DATE: 5/20/04	



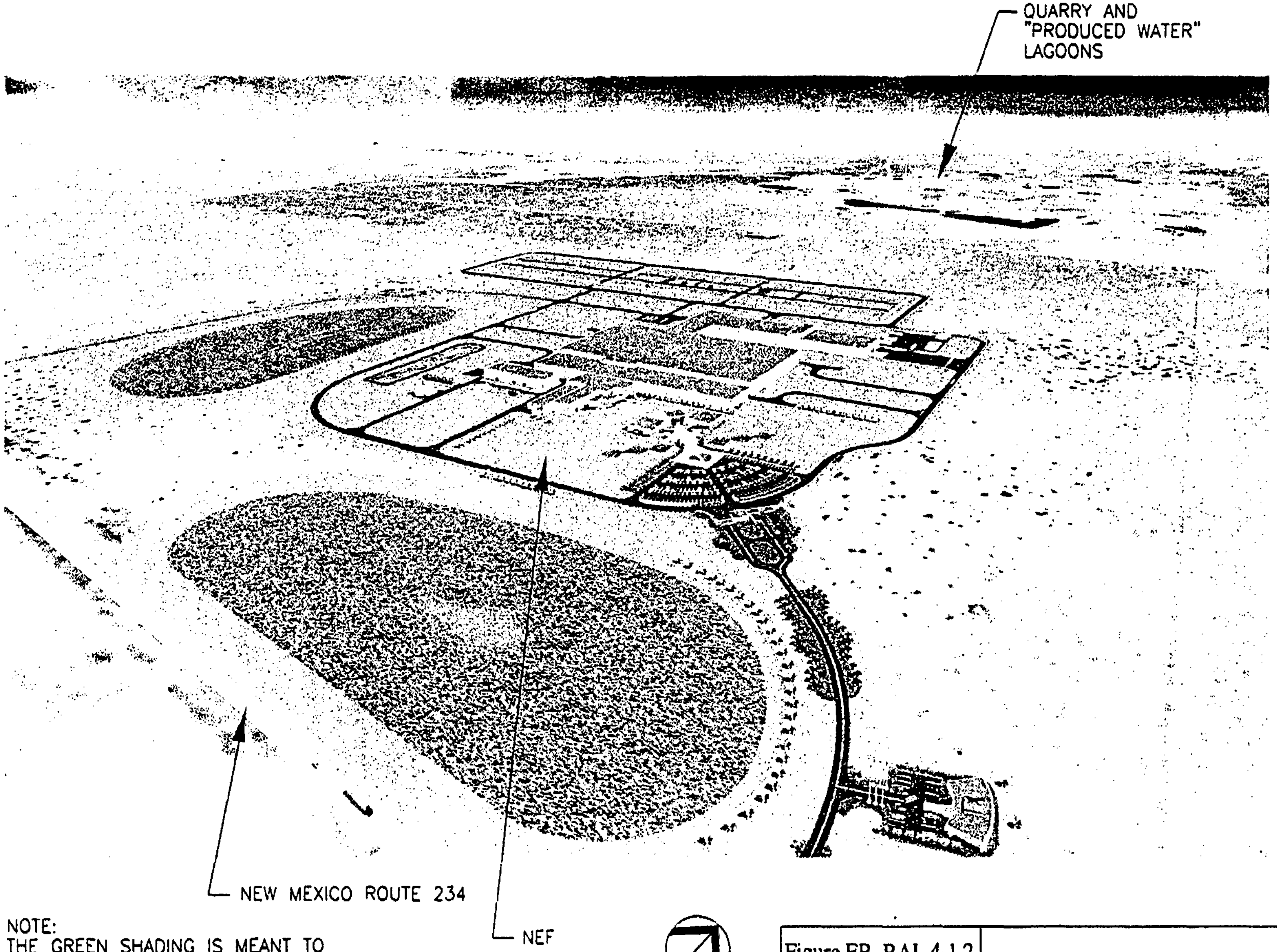
NOTE:
THE GREEN SHADING IS MEANT TO HIGHLIGHT THE NEF FOOTPRINT. IT IS NOT INDICATIVE OF VEGETATION.

NORTH

Figure ER RAI 4-1.1

DATE: 5/20/04

AERIAL VIEW

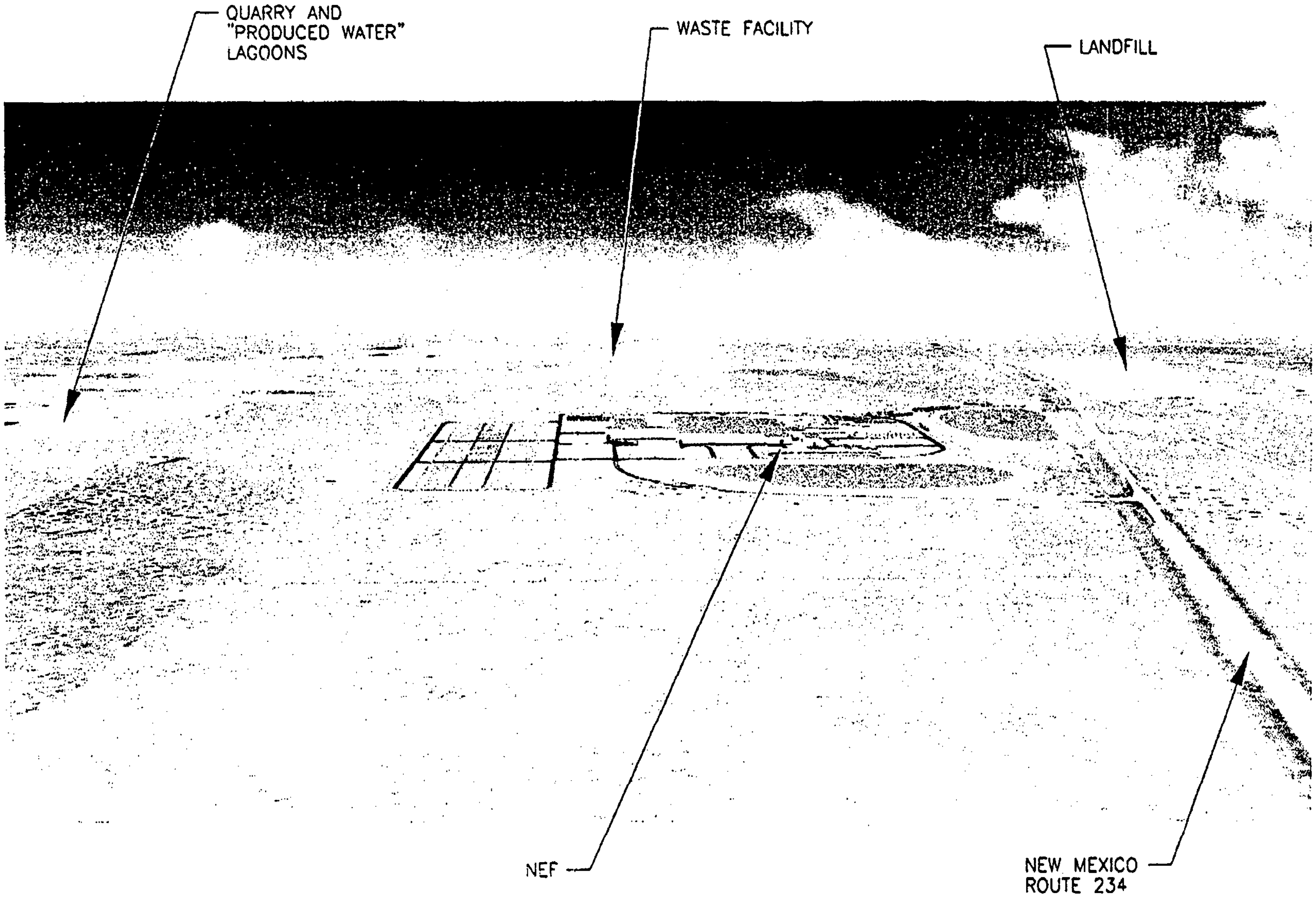


NOTE:
THE GREEN SHADING IS MEANT TO HIGHLIGHT THE NEF FOOTPRINT. IT IS NOT INDICATIVE OF VEGETATION.

Figure ER RAI 4-1.2

DATE: 5/20/04

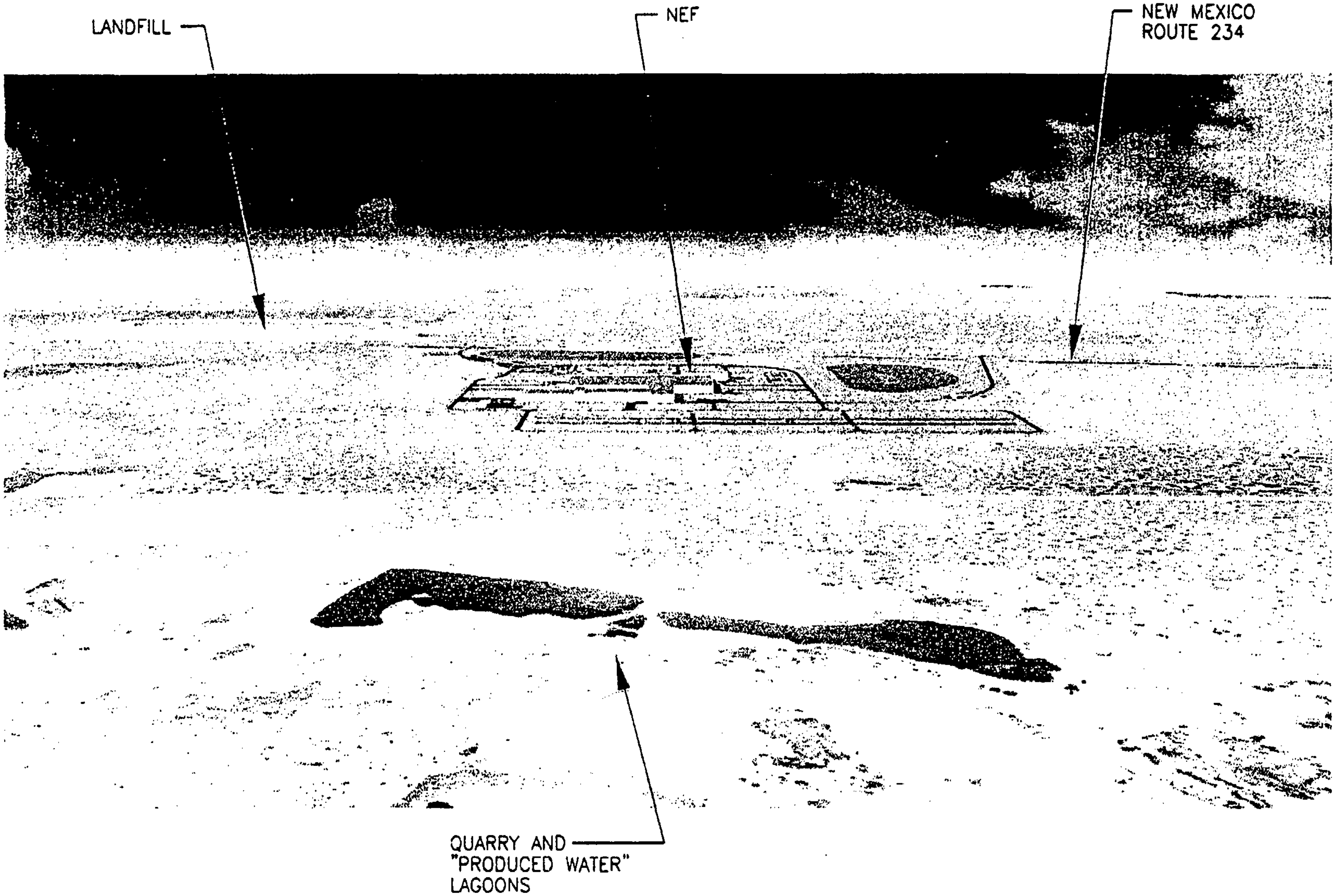
VIEW TO THE NORTHWEST



NOTE:
THE GREEN SHADING IS MEANT TO HIGHLIGHT THE NEF FOOTPRINT. IT IS NOT INDICATIVE OF VEGETATION.

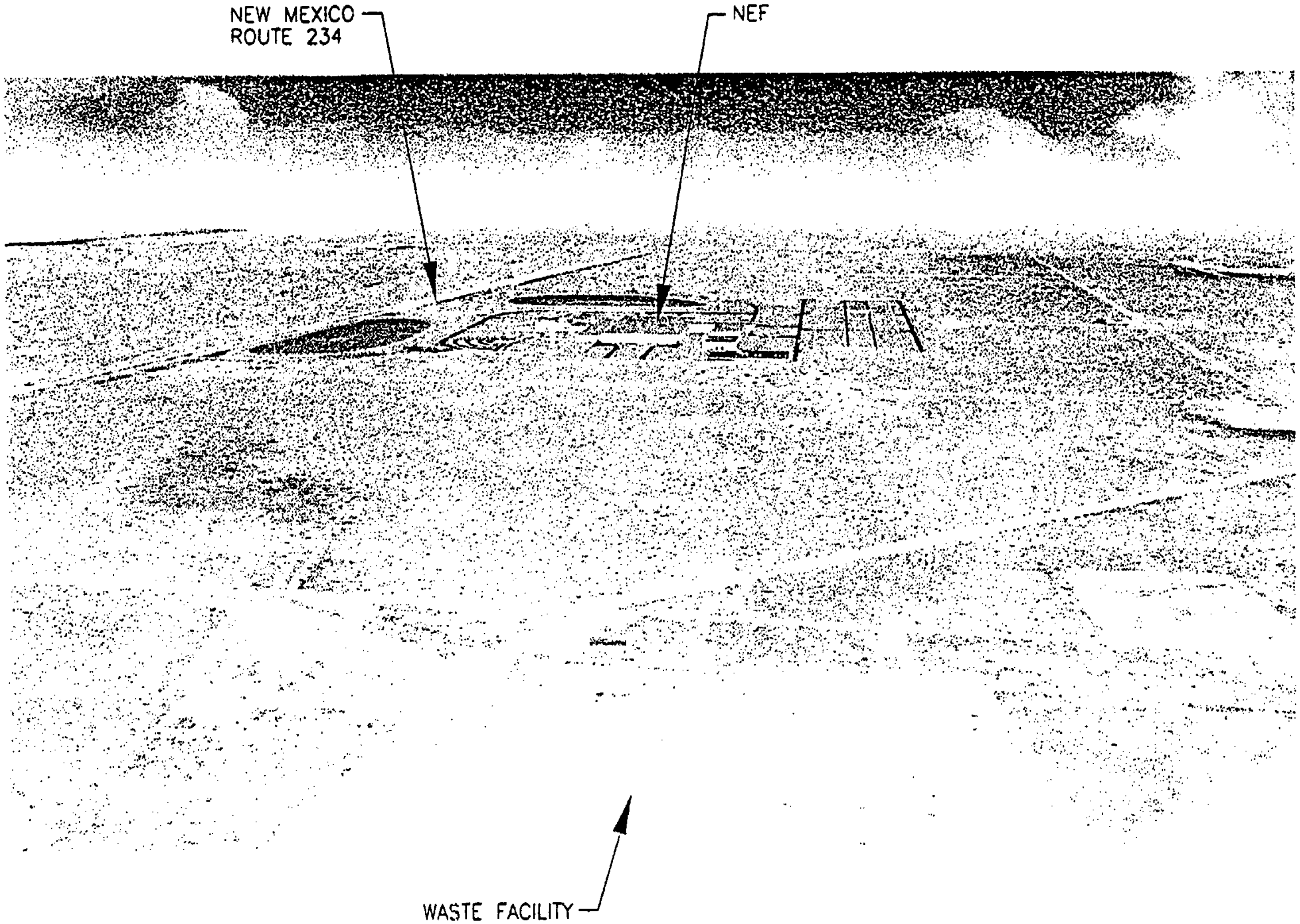
NORTH

Figure ER RAI 4-1.3	VIEW TO THE EAST
DATE: 5/20/04	



NOTE:
THE GREEN SHADING IS MEANT TO HIGHLIGHT THE NEF FOOTPRINT. IT IS NOT INDICATIVE OF VEGETATION.

Figure ER RAI 4-1.4	VIEW TO THE SOUTH
DATE: 5/20/04	



NOTE:
THE GREEN SHADING IS MEANT TO HIGHLIGHT THE NEF FOOTPRINT. IT IS NOT INDICATIVE OF VEGETATION.

NORTH

Figure ER RAI 4-1.5

DATE: 5/20/04

VIEW TO THE WEST

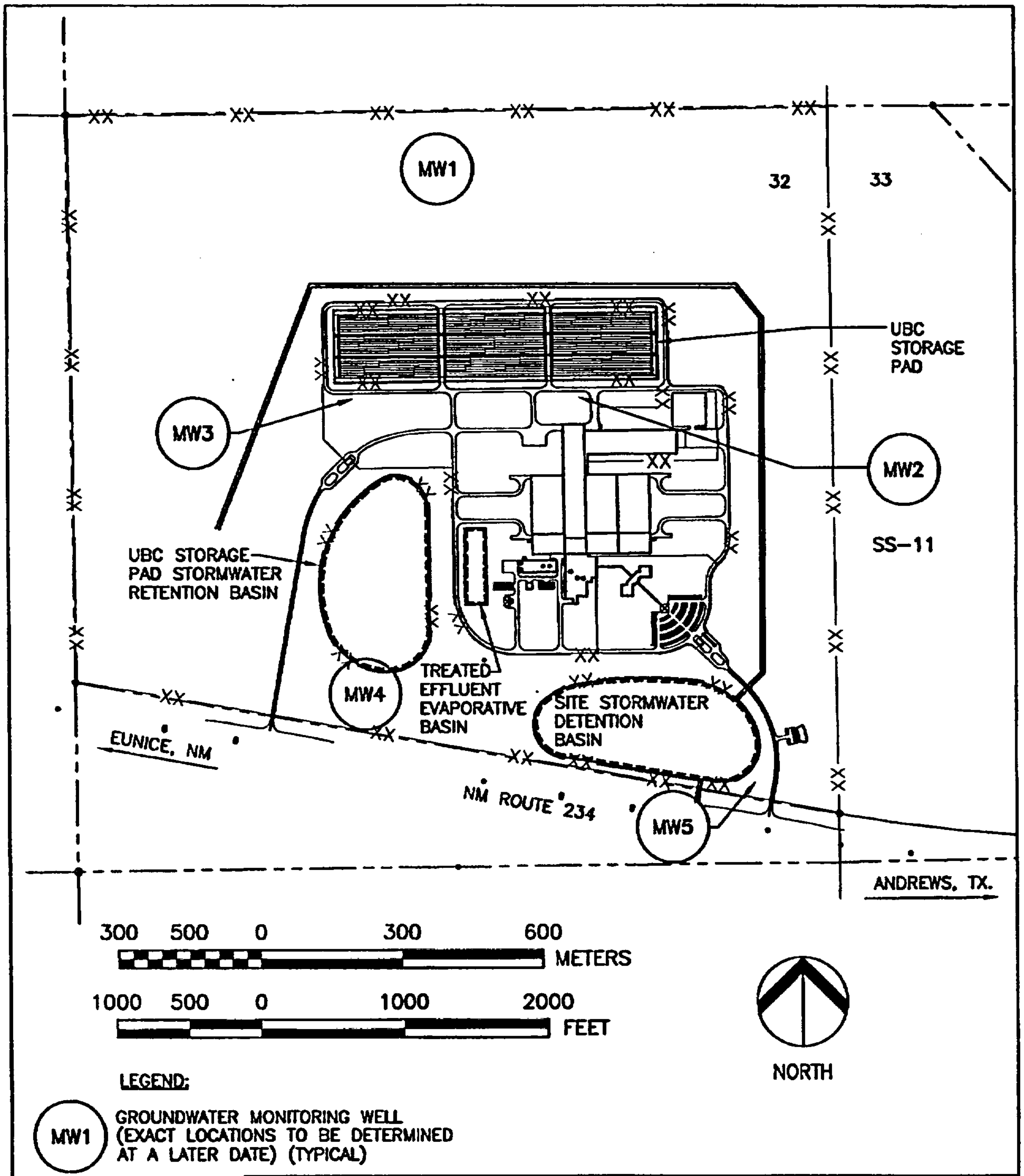


FIGURE ER RAI 6-1C

DATE: 5/20/04

GROUNDWATER MONITORING
WELL LOCATIONS

D

ATTACHMENT 4

Louisiana Energy Services
Response to April 29, 2004,
Requests for Additional Information

Letter Dated March 12, 2004, from J. Mace (US Army Corps of Engineers)
to G. Harper (Framatome-ANP)
Regarding the Absence of Corps of Engineers' Jurisdictional Waters on the NEF Site

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
EL PASO REGULATORY OFFICE
PO BOX 6096
FORT BLISS TX 79906-0096

March 17, 2004

Operations Division
Regulatory Branch

George Harper
FRAMATONE ANP, INC.
Solomon Pond Park, 400 Donald Lynch Blvd
Marlborough, MA 01752

Dear Mr. Harper:

This replies to the March 15, 2004, field inspection that I conducted with you and Denise Gallegos regarding the proposed National Enrichment Facility in Eunice, Lea County, New Mexico. We have assigned Action No. 2004 00170 to this activity. The proposed construction site is located in Section 32, Range 38 East, Township 21 South.

We have evaluated the information you provided and studied the project description, other records, and documents available to us. Additionally, as referenced, I visited the site on March 15, 2004. We concur with your findings that no waters of the United States are located within the project site and that there are no Corps of Engineers' jurisdictional waters on the site. Therefore, the project is not regulated under the provisions of Section 404 of the Clean Water Act and a Department of the Army permit will not be required.

Our disclaimer of jurisdiction is only for Section 404 of the Federal Clean Water Act. Other Federal, state and local laws may apply to the activities. Therefore, you should also contact other Federal, state and local regulatory authorities to determine whether the activities may require other authorizations or permits.

This jurisdictional determination will be valid for 5 years from the date of this letter unless new information warrants revision of the determination within that time.

If you have any questions, please feel free to contact me at (915) 568-1359 or e-mail me at james.e.mace@usace.army.mil. For more information about the regulatory program, please see our web site at www.spa.usace.army.mil/reg.

Sincerely,

Mace

James E. Mace
Chief, El Paso Regulatory Office

Copies furnished:

El Paso
NMED

The following documents are provided in this attachment in response to requests contained in RAI 3-4B, RAI 3-4C, and RAI 4-11:

- Atomic Vapor Laser Isotope Separation (AVLIS), New Mexico, Technical Appendices, submitted by the State of New Mexico and Waste Control Specialists, LLC.
- Evaluation of Potential Groundwater Impacts by the WCS Facility in Andrews County, Texas, Prepared for Andrews Industrial Foundation, K. Rainwater, December 1996.
- Geology of the WCS-Flying W Ranch, Andrews County, Texas, Prepared for Andrews Industrial Foundation, Texas Tech University Water Resources Center, April 2000.
- Groundwater Non-radiological Analytical Report for Monitoring Well MW-2, First Sampling Event, analyzed by Severn Trent Laboratory, November 19, 2003.
- Groundwater Non-radiological Analytical Report for Monitoring Well MW-2, Second Sampling Event, analyzed by Severn Trent Laboratory, December 22, 2003.
- Groundwater Non-radiological Analytical Report for Monitoring Well MW-2, Third Sampling Event, analyzed by Severn Trent Laboratory, May 6, 2004. ✓
- Groundwater Radiological Analytical Report for Monitoring Well MW-2, First Sampling Event, analyzed by Framatome ANP Environmental Laboratory, October 30, 2003. ✓
- Groundwater Radiological Analytical Report for Monitoring Well MW-2, Second Sampling Event, analyzed by Framatome ANP Environmental Laboratory, November 26, 2003. ✓
- Groundwater Radiological Analytical Report for Monitoring Well MW-2, Third Sampling Event, analyzed by Framatome ANP Environmental Laboratory, April 27, 2004. ✓
- Hydrogeologic Investigation, Section 32; Township 21 Range 38, Eunice, New Mexico, prepared for Lockwood Greene Engineering & Construction, prepared by Cook-Joyce, Inc., November 19, 2003.
- Lesser Prairie-Chicken (Tympanuchus pallidicinctus), Area of Critical Environmental Concern (ACEC), A Petition to the New Mexico BLM, by Ken Stinnett.
- Lesser Prairie-Chicken Surveys on the National Enrichment Facility Proposed Project Site, Eagle Environmental, Inc., May 2004
- RCRA Permit Application for a Hazardous Waste Storage, Treatment and Disposal Facility, Andrews County, Texas, Section VI, Geology Report, prepared for Waste Control Specialists, Inc., prepared by Terra Dynamics Incorporated, March 1993.
- Report of Preliminary Subsurface Exploration, Proposed National Enrichment Facility, Lea County, New Mexico, prepared for Lockwood Greene, prepared by MACTEC Engineering and Consulting, Inc., October 17, 2003.
- Soil Radiological Analytical Report, First Sampling Event, analyzed by Framatome ANP Environmental Laboratory, November 5, 2003.

- Soil Radiological Analytical Report, Second Sampling Event, analyzed by Framatome ANP Environmental Laboratory, April 27, 2004.

- Soil Non-Radiological Analytical Report, Second Sampling Event, analyzed by Severn Trent Laboratory, April 29, 2004.

- Waste Control Specialists, 2002 Annual Groundwater Monitoring Report, prepared for Waste Control Specialists, LLC, prepared by Cook-Joyce, Inc., January 25, 2003.

- Waste Control Specialists, Section VI, Geology Report, prepared for Waste Control Specialists, prepared by Cook-Joyce, Inc. and Intera, Inc., February 2004. (Includes main body of report, all tables, Figures 6.0-1 through 6.4-17 and Plates 6.2-2 and 6.2-3)

AVLIS

USEC
A Global Energy Company

New Mexico

Technical Appendices

Submitted By:

The State of New Mexico
Gary E. Johnson, Governor

WCS

Waste Control Specialists, LLC

E

APPENDIX 45.50-7

JACK HOLT & ASSOCIATES REPORT

GEOTECHNICAL INVESTIGATION
AND
ENGINEERING ANALYSIS
FOR

WASTE CONTROL SPECIALISTS INC.
LANDFILL PROJECT
ANDREWS COUNTY, TEXAS

REPORT FOR:
AM ENVIRONMENTAL, INC.
2525 WALLINGWOOD, SUITE 701
AUSTIN, TEXAS 78746

FILE NO.: 10-25792
12 MARCH 1993

JACK H. HOLT Ph.D. & ASSOCIATES INC.
2220 BARTON SKYWAY
AUSTIN, TEXAS 78704
PH. 512/447-8166

TABLE OF CONTENTS

APPENDIX

GEOTECHNICAL INVESTIGATION
ENGINEERING ANALYSIS
FOR
WASTE CONTROL SPECIALISTS INC.
LANDFILL PROJECT
ANDREWS COUNTY, TEXAS

INTRODUCTION

A Geotechnical Investigation and Engineering Analysis for the above referenced project located in Andrews County, Texas was authorized by Mr. Allen Messenger of A.M. Environmental, Austin, Texas on 15 October 1992. The purpose of the investigation was to determine subsurface soil conditions and materials at the site and to obtain samples for laboratory testing. Based on our boring logs and laboratory tests an engineering analysis was performed to determine foundation stability, slope stability and soil permeability as well as other design parameters for the proposed hazardous waste landfill.

SCOPE

The scope of the project included the following:

1. Reconnaissance of the project site to observe physical features, vegetation and access to the property.

2. Surveying grid system on the site on 500 foot intervals and obtaining elevations at each grid point. Topographic survey of entire site and areas outside the site for a distance of 1000 feet.
3. Mobilization and demobilization of office trailer, storage building, electrical service, equipment, van truck, logging trailers, water tank and drill rigs to the site.
4. Drilling, logging and sampling 55 soil borings using air rotary and air coring to depths of 100 feet to 300 feet.
5. Drilling, logging and sampling 12 soil borings to depths of 45 feet to obtain rock cores.
6. Wrapping and packaging core samples in core boxes and properly storing on site prior to shipping to laboratory. Transporting samples to the laboratory in Austin, Texas.
7. Laboratory testing including but not limited to Unified Soils Classifications, Moisture Contents, Unit Weights, Atterberg Limits, Unconfined Compression Tests, Permeabilities, Triaxial Tests, Consolidation Tests, Moisture/Density Relationships and Direct Shear Tests.
8. Installation of eight monitor wells (4 inch PVC) and six piezometers (2 inch PVC) and coordinating the installation of wells with Terra Dynamics, Inc.
9. Monitoring groundwater levels in open bore holes prior to plugging and in water wells and piezometers.
10. Plugging of all bore holes with cement bentonite slurry.

11. Preparing a written engineering report with grid survey, topographic survey, boring location plan, soil boring logs, laboratory test results and water level data. Preparing engineering analyses including soil permeability, slope stability, foundation stability, settlement analyses and recommendations for landfill design.

LOCATION AND SITE DESCRIPTION

The proposed landfill site is located in Andrews County, Texas approximately 34 miles west of Andrews, Texas on State Highway 176 (see location on State Highway Map - Figure 1). The site is located approximately 0.5 miles north of the Highway on the Flying "W" Diamond Ranch. The initial grid survey area consists of approximately 485 acres of undeveloped ranch land. The landfill area will be 100 acres in size with approximate dimensions of 1100 feet by 4000 feet. The terrain consists of gently sloping grass covered ranch land with scattered small mesquite trees. The proposed landfill site is bordered by a gravel ranch road on the west that parallels the Texas-New Mexico state line. An oil well location exists approximately 2500 feet south of the landfill site. An overhead power line borders the site on the east. The site slopes gradually from north to south changing in surface elevation from approximately 3480 feet to 3440 feet above mean sea level.

Several surface depressions exist on the landfill site and are locally referred to as buffalo wallows. These depressions are believed to have been formed by the dissolution of the carbonaceous caliche deposits near the surface or from natural depressions in the Triassic red bed clay formation below.

SITE SURVEY AND GRID LAYOUT

The project site was selected by Mr. Allen Messenger after preliminary borings indicated shallow depths to red bed clay in the area. Grid layout with approximate size of 6000 feet by 4500 feet was surveyed by Mr. James E. Tompkins, (R.P.S.) Engineering and Surveying of Andrews, Texas. Grid points were staked on the site at 500 foot intervals. Grid points were lettered from north to south A through J and numbered from east to west 1 through 13. The Texas-New Mexico State line running north to south has a bearing of N 0° 0'0"W. The grid lines A through J have a bearing of S 65° 0' 0" E. The grid lines 1 through 13 have a bearing of S 25° 0'0" W.

Additional surveying was performed by Tompkins Engineering and Surveying to provide adequate topographical information both inside and outside the grid to depict surface physical features on a one foot contour interval. The benchmark for the project is located at the state line marker located 1600 feet north of State Highway 176 with an elevation of 3484.75 feet MSL. A Grid Survey and Topography Map is shown in Figure III.

FIELD INVESTIGATION

The drilling and sampling was accomplished with a 1974 Model Midway 1300 and 1977 Model Midway 1500 owned and operated by Scarborough Drilling, Inc. from Lamesa, Texas. These truck mounted rigs are equipped with direct rotary table, 550 CFM air compressors, mud pump, 2 7/8 inch diameter drill stem, 3 1/2 inch drill stem, tri-cone roller bits, drag bits, 3 foot core barrel and 10 foot core barrels.

Initially all holes were continuously sampled by air coring with 4 3/4 inch O.D. Christian Core barrels producing 2 1/8 inch diameter core samples. Where bit wear was excessive in hard limestone or conglomerate then tri-cone roller bits were used until hard layers were penetrated. Where soft layers were encountered and recovery using air coring was poor, split spoon (1.4 inch diameter) samples were obtained using rig pull-down.

The investigation consisted of drilling, logging and sampling a total of 55 bore holes (see Generalized Boring Location Plan - Figure IV). Of the 55 holes a total of 14 holes were continuously air cored in the upper caliche (hard limestone and sandstone deposits) to depths ranging from 9 feet to 53 feet deep. The remaining holes were drilled with straight air rotary in the upper caliche layers and cuttings were continuously sampled, logged and visually classified. All 55 holes were continuously sampled (air coring) from the top of the red bed (Triassic) using both split spoon samples and 2 1/8 I.D.

Christianson core barrels. Continuous coring intervals varied from lengths of 4 feet to 10 feet depending on the type of soils encountered.

The initial investigation consisted of drilling and continuous air coring all bore holes to depths of 100 feet with selected holes extended to depths of 200 feet. At six piezometers and three monitor well locations the bore holes were extended to depths ranging from 260 feet to 300 feet and either continuously cored or air rotary drilled and cuttings were logged to accurately describe the geology and classify the soils. These nine holes were also used for geophysical logging that was coordinated by Terra-Dynamics, Austin, Texas. The geophysical logs and core logs were then compared and correlated by Terra-Dynamics. A total of 12 holes were drilled with a CME 55 Rig equipped with a mud rotary NXB Christianson Wireline system (1.875 diameter core) for the purpose of obtaining rock cores from the upper limestone (caliche) formation. These holes varied in depth from 12 feet to 36 feet below the existing grade. The total recovery as well as Rock Quality Designation (RQD) is shown on the individual boring logs. All rock cores were visually classified and logged in the field and samples were wrapped with plastic and stored in wooden core boxes and transported to the lab. A table depicting boring numbers, grid locations, boring depth and date of boring is shown in the Soil Boring Summary in Appendix II.

All core samples were examined and visually classified, logged in the field prior to wrapping and placing in cardboard core boxes. Grab samples from air rotary cuttings were also visually classified and logged and placed in ziploc plastic bags and stored in cardboard boxes. All core boxes were properly labeled with boring number and grid location, date, sample intervals and transported to the laboratory of Jack H. Holt & Associates, Inc. in Austin, Texas for testing and storage.

LABORATORY TESTING

The laboratory testing program included tests to determine the engineering characteristics and properties of the soil and rock samples obtained from the drilling and sampling program. These tests include soil classification, shear strength, plasticity, density, moisture, grain size analysis, and permeability. All laboratory tests were run in strict accordance with ASTM Standards using up-to-date calibrated testing equipment and apparatus as required by those standards. The laboratory testing program was performed under the supervision and direction of Dr. Jack H. Holt, Ph.D., P.E. Listed below is a list of the specific laboratory tests and their appropriate ASTM Designation:

1. Classification of soils according to the "Unified Soil Classification System" (ASTM D2487-90).
2. Sieve Analysis of soils including Minus No. 200 Mesh Sieve and Hydrometer Analysis (ASTM D-422-63).

3. Moisture Content of Soils (ASTM D-2216-90).
4. Unit Weight Tests.
5. Atterberg Limits Tests including Liquid Limits, Plastic Limits (ASTM D-4318-84).
6. Unconfined Compressive Strength - clay soils (ASTM D-2166-91).
7. Unconfined Compression Tests - rock specimens (ASTM D-2938-68).
8. Triaxial Tests.
9. Permeability Tests using both flexible wall and rigid permeameters (ASTM D-5084-90).
10. Moisture-Density Relationship Tests using Modified Proctor (ASTM D-1557-91) and Standard Proctor (ASTM D-698-91).
11. Consolidation Tests.

The results of all laboratory tests can be found in Appendix I. Laboratory test results are also shown on the individual boring logs at the appropriate depth.

SUBSURFACE CONDITIONS

The subsurface soil conditions are described in more detail by the attached Logs of Borings found in Appendix II. In general the soil conditions consist of a thin (one foot or less) layer of brown organic sandy silt overlying a formation of white or tan caliche. The caliche consists of crumbly to very hard cemented sand, conglomerate limestone rock, sandy silt and gravel. At the base of the caliche strata lies a sand and gravel layer that varies in thickness from 0 feet to 20 feet. The depth of the caliche layer including the sand and gravel strata below ranges from approximately 9 feet to 53 feet across the investigated area.

Below the caliche lies a formation of reddish brown silty clay (red bed clay) that extends to termination of the borings at 100 feet to 300 feet below the existing grade. The red bed clay consists of a highly consolidated impervious mottled reddish brown-gray clay, purple-gray silty clay, and yellowish brown-gray silty clay. Siltstones and sandstones are found at various depths and thicknesses across the grid area and vary in color from red, tan, gray, pink and yellow. The depth to the top of the red bed (Triassic-Dockum Group) varies across the site from 9 feet (B-24) to 53 feet (B-1) and generally averages 12 feet to 30 feet deep through the center of the grid area between Grid Lines C and E.

The red, reddish brown or purple silty clay soils range in moisture content from 2.5% to 25% and generally average 8% to 12% in most of the borings.

Dry density of the clay soils range from 116 PCF to 145 PCF and average 132 PCF.

Liquid Limits of the clays range from 35% to 55%. Plasticity indices vary from 24 to 38. The clays vary in percent passing the #200 Mesh Sieve from 87% to 99.8%.

A total of 36 vertical permeabilities and 6 horizontal permeabilities were run on the reddish brown silty clays, sandstones and siltstones. Vertical permeabilities range from <1.00x 10^{-9} cm/sec to 1.76 x 10^{-8} cm/sec for the clays. Horizontal permeabilities range from 1.63 x 10^{-9} cm/sec to 1.10 x 10^{-8} cm/sec. The siltstones and sandstones found at depths of 56 feet to 90 feet range in vertical permeability from 2.58 x 10^{-8} cm/sec to 1.93 x 10^{-6} cm/sec. The horizontal permeability averages 6.53 x 10^{-7} cm/sec. The siltstone at a depth of 208 feet has a permeability of 2.06 x10^{-8}. The permeability tests were run according to ASTM D-5084-90 using a flexible wall permeameter under a constant head. De-aired tap water and a .005N Ca SO_4 solution was used for the permeant liquid. The permeabilities were calculated on both the inflow and outflow and then averaged for the final result. The plot of Q x L vs T x A x H for selected tests are shown graphically in the Steady State Permeability Plots in Appendix I. Shown in each graph is the plot for both inflow and outflow through the sample. The slope of straight line is the permeability in cm/sec. A summary of permeability test results including boring number, grid location, soil classification, depth are shown in Permeability Test Results, Appendix I.

Unconfined compression test on the clay soils range from 13.9 TSF to 49.7 TSF with an average of 30 TSF.

GROUNDWATER

Water level measurements were made on open bore holes at 24 hours and 48 hours after completion. All borings were found to be dry with the exception of B-7, B-4, B-10, B-20, B-30, B-20, B-41 and B-41S. Groundwater was found at a shallow depths only in borings B-41 and B-41S at 26 feet and 32.4 feet respectively. Groundwater or damp sandstone/siltstone was encountered during the drilling operation only in Borings B-7, B-21 and B-48 at depths ranging from 200 feet to 220 feet below the existing grade.

Piezometers (2 inch PVC pipe) were installed at four locations (B-4, B-7, B-10 and B-20) with screened intervals ranging in depths from 170 feet to 257 feet below the existing grade. Water level measurements ranged from 149.8 feet to 187.8 feet below the existing grade on 14 January 1993.

Additional piezometers were installed at boring B-30 and boring B-39 . These holes were dry at the time of this report. Monitor wells were installed at grid locations 4-G, 9-G, and 6-B to better define saturated zones and obtain hydrological data for various zones. Details on construction of these wells are depicted in the State of Texas, Well Reports in Appendix III. Water level measurements for all piezometers and wells are found in the Water Level Measurements, Appendix III. The groundwater hydrology is discussed in more detail in the Terra Dynamics Report.

FOUNDATION STABILITY

The landfill floor elevation will be established at 3,400 feet. Maximum depth of the waste material will be 76 feet. A 16.5 foot thick cap is planned for the crest section which slopes at 3% grade back to the containment dike. The clay cap will be covered with a filter fabric and 2 feet of top soil. An 8 foot thick liner system will be placed between the waste material and the impervious clay formation. A typical landfill Section is shown below.

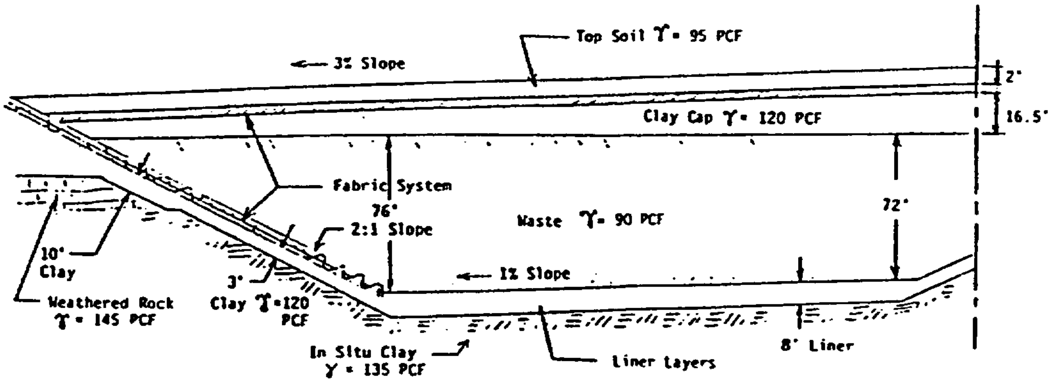


FIGURE VI

Typical Landfill Section

Side walls of the slopes are lined with 10 feet of compacted clay where the sands, gravel and rock exists. The side wall is lined with 3 feet of compacted clay soil where cut into the existing red bed clay. The floor liner is 8 foot thick. Allowable bearing capacities for settlement and slope stability analysis are based on laboratory strength tests of the rock and in-situ clays, siltstones, sandstones and compacted clay liner. Allowable bearing capacities with each stratum are shown together with a corresponding Factor of Safety.

TABLE I

Stratum Description		Allowable Bearing Capacity, PSF	Factor Safety
1.	Compacted silty clay	10,100	2.3
2.	Weathered limestone with layers of rock & sands	35,000	3.5
3.	Natural bedded clay	14,600	3.0

Assuming a maximum waste height of 98.5 feet to include 16.5 feet of compacted clay at the crest and an 8 foot liner, the maximum pressure on the floor will be approximately 9,190 PSF. Considering these conditions, it is apparent the supporting soils have adequate strength to support the landfill with an acceptable margin of safety.

A. Slope Stability - The slope stability of the landfill containment section was analyzed for the periods during construction and after completion. An analysis was made considering a containment side slope of 2:1;

1.5:1 and a slope of 1:1. Computations for stability were based on the following criteria developed from laboratory tests using conservative results.

SLOPE CRITERIA

DEPTHS (FT.)	σ'_3	σ'_1	$\frac{\sigma'_1 + \sigma^1_3}{2}$	$\frac{\sigma'_1 - \sigma'_3}{2}$
29 - 30	34.5	132.0	83.3	48.8
	51.0	208.0	129.5	78.5
23 - 25	34.5	154.0	94.3	59.8
	51.0	200.0	125.5	74.5

WHERE:
σ' = Normal Stress (PSI)
σ_3 = Confining Stress (PSI)

Design parameters:

1. Friction Angle (ϕ) = 36°
2. Unit Weight γ = 135 PCF
3. Effective Cohesive Shear Strength C′ = 260 PSF

The slope stability analysis was made using the computer program (PC STABL 5M) adopted by the Federal Public Road Administration. This program was developed by the University of Purdue under a federal grant program and is widely used throughout the U.S.A.

The computer analysis calculates the ten most critical failure circles based on the selected slope, friction angle ϕ, cohesion and whether or not a compacted clay liner is considered. The analysis computes the factor of safety for each failure circle. A graphical analysis depicting 10 failure circles for each of the failure planes at various slopes are shown in Appendix IV. The most critical condition is highlighted by arrows. Slope conditions were considered without the clay liner and omitting the effects of the cohesive strength of the clays. Listed below in Table II are the results of the analysis.

TABLE II

SUMMARY OF SLOPE STABILITY ANALYSIS

COMPUTER NO. RUN	SLOPE (H:V	ϕ	C' (PSF)	WITH LINER W/O LINER	MINIMUM FACTOR OF SAFETY
1	1:1	36°	260	With Liner	1.54
2	1.5:1	36°	260	W/O Liner	1.52
3	1.5:1	36°	260	With Liner	1.73
4	2:1	36°	No Cohesion	W/O Liner	1.47
5	2:1	36°	No Cohesion	With Liner	1.90
6	2:1	36°	260	W/O Liner	2.36

C' = Effective Cohesive Shear Strength

All of the computer analysis were run with an internal friction angle (ϕ) of 36°. This is considered to be a conservative figure based on laboratory tests of the insitu clays. The analysis clearly shows that a 2:1 slope with or without the compacted clay liner will provide a safe stable condition with a safety factor of 2.36. Computer run number 4 and 5 indicate even under saturated conditions the 2:1 slope would be stable.

B. Settlement Analysis - The groundwater table at the most shallow depth is 150 feet below existing ground surface (as of 2/15/93) and is not a consideration for calculation of settlement. Therefore only elastic settlement is considered and consolidation is not a factor. Since the waste repository is considered as a flexible foundation and therefore the elastic settlement is given by:

$$S_e = C_d \, qB \, (1 - \mu^2{}_s/E_s)$$

Where S_e = elastic settlement
C_d = a parameter accounting for the shape of the load area
q = distributed load
B = width of the foundation
μ_s = Poisson's ratio of the soil
E_s = Young's modulus of the soil

Based on the unit weights given in Figure VI, page 12, the maximum elastic settlement (Se) at the center of the waste repository when the complete landfill is loaded is calculated to be 2.45 inches (see Appendix IV for our calculations).

BORE HOLE GROUTING

All bore hoes were grouted with a cement/bentonite slurry. The bore holes were grouted after all water level measurement were made and drilling was completed on the site. Because of the hard dry clays and the absence of groundwater bore holes generally remained open and there was little or no problem with caving or sloughing. Each hole was measured prior to grouting to verify the depth was within one foot of the original drilling depth. If not, the holes were redrilled with air rotary and the bore hole was grouted immediately by pumping grout through a 2 inch PVC tremmie pipe from bottom to surface.

The grout mixture consisted of a ratio of 94 pounds portland cement per 5 pounds bentonite per 12 gallons of water. The grout was mixed at a local concrete redi-mix company within 2 miles of the site. The grout was poured into the open bore hole from the chute of the redi-mix truck. Where caving or sloughing of holes was a problem than centrifugal pump and tremmie line was used to ensure that grout was forced from bottom to top of the hole.

The original bore hole depth, the depth prior to grouting, date grouted, truck number and amount of cement/bentonite used was recorded by the technician.

REMARKS

This report has been prepared in order to aid in the evaluation of this property and to assist the architect and engineer in the design of the project. It is intended for use with regard to specific projects discussed in general herein and any substantial changes in locations or grades should be brought to our attention so that we may determine how this may affect our conclusions. If during the proposed construction, the soil strata are found to differ from that reported here, we should be notified immediately. This report contains soil boring logs which are for the purpose of arriving at foundation criteria and are not to be used by the excavation contractor in arriving at rock hardness or rock depth. The procedures, tests and recommendations of this investigation and report have been conducted and furnished in accordance with generally accepted professional engineering practices in the field of foundations, engineering soil mechanics and engineering geology. No other warranty is either expressed or implied.

STATE OF TEXAS
JACK HASTON HOLT
35732
REGISTERED PROFESSIONAL ENGINEER

Jack H.
Ph.D., P

JHH/mco

```
                         GRAIN SIZE DISTRIBUTION TEST DATA          Test No.: 13
--------------------------------------------------------------------------------
Date: 12-18-97
Project No.: 95042.10
Project: LEA COUNTY LANDFILL
================================================================================

  ------------------------------------------------------------------------------
                                    Sample Data
--------------------------------------------------------------------------------
Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SILTY CLAY, TR SAND
USCS Class: CL                              Liquid limit: NA
AASHTO Class:                               Plasticity index: NA
--------------------------------------------------------------------------------
                                       Notes
--------------------------------------------------------------------------------
Remarks: BORING: 111  DEPTH: 140.0'

Fig. No.:
--------------------------------------------------------------------------------
                             Mechanical Analysis Data
--------------------------------------------------------------------------------
                       Initial
Dry sample and tare=   456.80
Tare               =     0.00
Dry sample weight  =   456.80
Sample split on number 10 sieve
Split sample data:
  Sample and tare = 50  Tare =  0  Sample weight = 50
  Cumulative weight retained tare= 0
  e for cumulative weight retained= 0
  Sieve          Cumul. Wt.   Percent
                 retained     finer
  # 10             0.00        100.0
  # 20             0.00        100.0
  # 40             0.00        100.0
  # 60             0.10         99.8
  # 100            0.30         99.4
  # 200            0.60         98.8
--------------------------------------------------------------------------------
                             Hydrometer Analysis Data
--------------------------------------------------------------------------------
Separation sieve is number 10
Percent -# 10 based on complete sample= 100.0
Weight of hydrometer sample: 50
Calculated biased weight=  50.00
Automatic temperature correction
  Composite correction at 20 deg C =-3.5

Meniscus correction only= 1
Specific gravity of solids= 2.7
Specific gravity correction factor= 0.989
```

F

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 13

Date: 12-18-97
Project No.: 95042.10
Project: LEA COUNTY LANDFILL

Sample Data

Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SILTY CLAY, TR SAND
USCS Class: CL
Liquid limit: NA
AASHTO Class:
Plasticity index: NA

Notes

Remarks: BORING: 111 DEPTH: 140.0'

Fig. No.:

Mechanical Analysis Data

Initial
Dry sample and tare= 456.80
Tare = 0.00
Dry sample weight = 456.80
Sample split on number 10 sieve
Split sample data:
Sample and tare = 50 Tare = 0 Sample weight = 50
Cumulative weight retained tare= 0
e for cumulative weight retained= 0

Sieve	Cumul. Wt. retained	Percent finer
# 10	0.00	100.0
# 20	0.00	100.0
# 40	0.00	100.0
# 60	0.10	99.8
# 100	0.30	99.4
# 200	0.60	98.8

Hydrometer Analysis Data

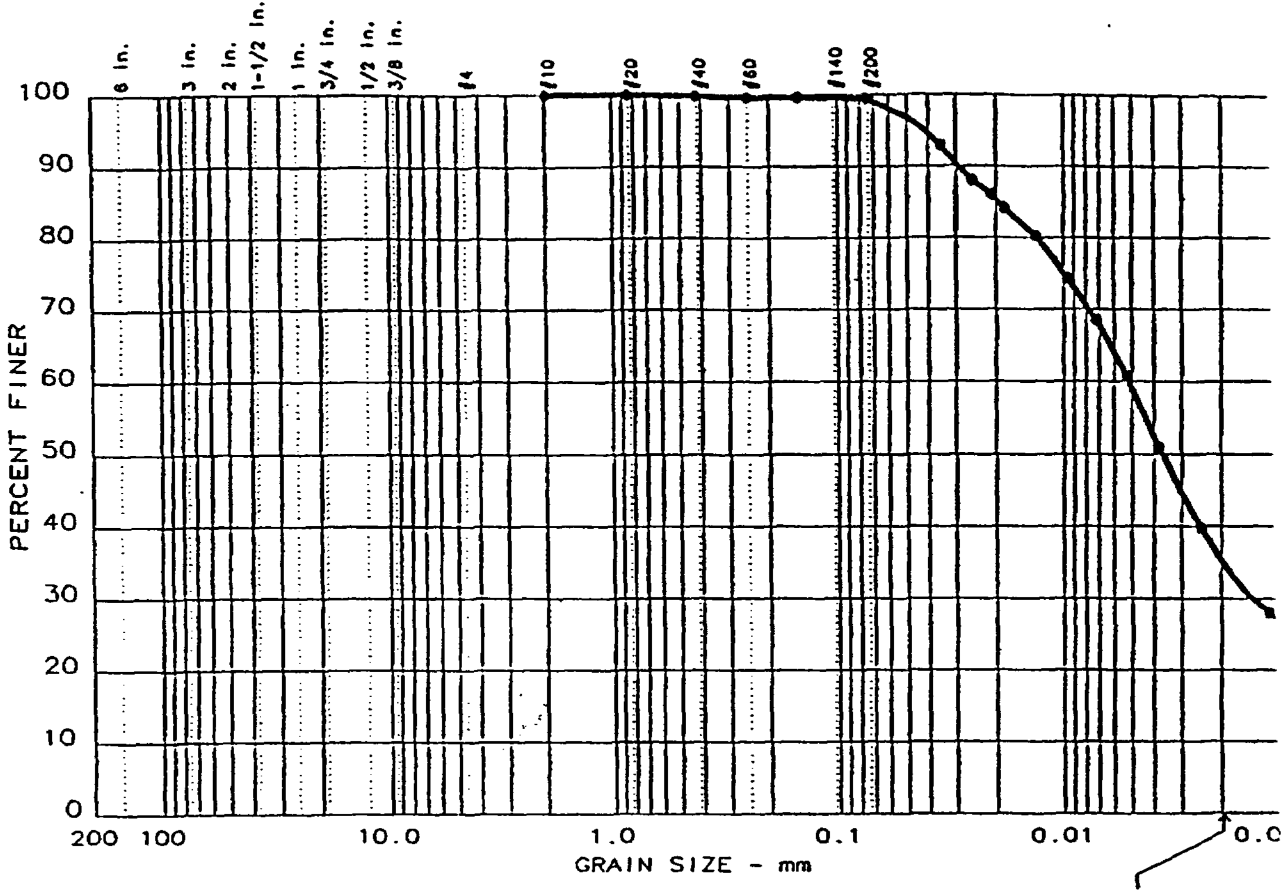
Separation sieve is number 10
Percent -# 10 based on complete sample= 100.0
Weight of hydrometer sample: 50
Calculated biased weight= 50.00
Automatic temperature correction
Composite correction at 20 deg C =-3.5

Meniscus correction only= 1
Specific gravity of solids= 2.7
Specific gravity correction factor= 0.989

```
 Elapsed    Temp,  Actual    Corrected  K        Rm     Eff.   Diameter  Percent
 time, min  deg C  reading   reading                    depth  mm        finer
    1.0     23.0   51.0      48.2       0.0130   52.0    7.8   0.0361    95.3
    2.0     23.0   49.0      46.2       0.0130   50.0    8.1   0.0261    91.7
    3.0     23.0   48.0      45.2       0.0130   49.0    8.3   0.0215    89.[illegible]
    4.0     23.0   47.0      44.2       0.0130   48.0    8.4   0.0188    87.[illegible]
    8.0     23.0   45.0      42.2       0.0130   46.0    8.8   0.0136    83.4
   16.0     23.5   42.0      39.3       0.0129   43.0    9.2   0.0098    77.7
   30.0     23.5   38.0      35.3       0.0129   39.0    9.9   0.0074    69.8
   60.0     23.5   33.5      30.8       0.0129   34.5   10.6   0.0054    60.9
  125.0     24.0   27.0      24.5       0.0128   28.0   11.7   0.0039    48.4
  330.0     24.0   20.5      18.0       0.0128   21.5   12.8   0.0025    35.5
 1410.0     24.0   13.0      10.5       0.0128   14.0   14.0   0.0013    20.7
 2850.0     24.0   10.5       8.0       0.0128   11.5   14.4   0.0009    15.7
-------------------------------------------------------------------------------
                              Fractional Components
-------------------------------------------------------------------------------
Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. =  0.0     % GRAVEL =  0.0   % SAND =  1.2
% SILT = 68.9    % CLAY = 29.9    (% CLAY COLLOIDS = 17.0)

D85=    0.02  D60=    0.005  D50=    0.004
D30=    0.0020
```

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	7	0.0	0.0	0.6	64.1	35.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA			0.0037	0.0014				

MATERIAL DESCRIPTION	USCS	AASHTO
● RED SILTY CLAY, TR SAND	CL	

Project No.: 95042.10

Project: LEA COUNTY LANDFILL

● Location: HOBBS, NEW MEXICO

Date: 12-4-97

Remarks:

BORING: 111

DEPTH: 200.0'

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

```
--------------------------------------------------------------------
Date: 12-4-97
Project No.: 95042.10
Project: LEA COUNTY LANDFILL
====================================================================

--------------------------------------------------------------------
                             Sample Data
--------------------------------------------------------------------
Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SILTY CLAY, TR SAND
USCS Class: CL                      Liquid limit: NA
AASHTO Class:                       Plasticity index: NA
--------------------------------------------------------------------
                               Notes
--------------------------------------------------------------------
Remarks: BORING: 111  DEPTH: 200.0'

Fig. No.:
--------------------------------------------------------------------
                      Mechanical Analysis Data
--------------------------------------------------------------------
                    Initial
Dry sample and tare=   372.50
Tare               =     0.00
Dry sample weight  =   372.50
Sample split on number 10 sieve
Split sample data:
  Sample and tare = 50  Tare =  0  Sample weight = 50
  Cumulative weight retained tare= 0
    e for cumulative weight retained= 0
  Sieve          Cumul. Wt.   Percent
                 retained     finer
  # 10              0.00       100.0
  # 20              0.00       100.0
  # 40              0.10        99.8
  # 60              0.20        99.6
  # 100             0.20        99.6
  # 200             0.30        99.4
--------------------------------------------------------------------
                      Hydrometer Analysis Data
--------------------------------------------------------------------
Separation sieve is number 10
Percent -# 10 based on complete sample= 100.0
Weight of hydrometer sample: 50
Calculated biased weight=  50.00
Automatic temperature correction
  Composite correction at 20 deg C =-4.5

Meniscus correction only= 1
Specific gravity of solids= 2.77
Specific gravity correction factor= 0.974
```

[illegible]

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
1.0	23.0	51.5	47.7	0.0127	52.5	7.7	0.0352	92.9
2.0	23.0	49.0	45.2	0.0127	50.0	8.1	0.0256	88.0
3.0	23.0	48.0	44.2	0.0127	49.0	8.3	0.0211	86.1
4.0	23.0	47.0	43.2	0.0127	48.0	8.4	0.0184	84.1
8.0	23.0	45.0	41.2	0.0127	46.0	8.8	0.0133	80.2
16.0	23.0	42.0	38.2	0.0127	43.0	9.2	0.0097	74.4
30.0	23.0	39.0	35.2	0.0127	40.0	9.7	0.0072	68.5
60.0	23.0	35.0	31.2	0.0127	36.0	10.4	0.0053	60.7
125.0	23.0	30.0	26.2	0.0127	31.0	11.2	0.0038	51.0
330.0	22.0	24.5	20.4	0.0129	25.5	12.1	0.0025	39.8
1410.0	22.0	18.5	14.4	0.0129	19.5	13.1	0.0012	28.1
2850.0	23.0	17.0	13.2	0.0127	18.0	13.3	0.0009	25.7

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0 % GRAVEL = 0.0 % SAND = 0.6
% SILT = 64.1 % CLAY = 35.3 (% CLAY COLLOIDS = 26.4)

D85= 0.02 D60= 0.005 D50= 0.004
D30= 0.0014

PERMEABILITY TEST REPORT

TEST DATA:

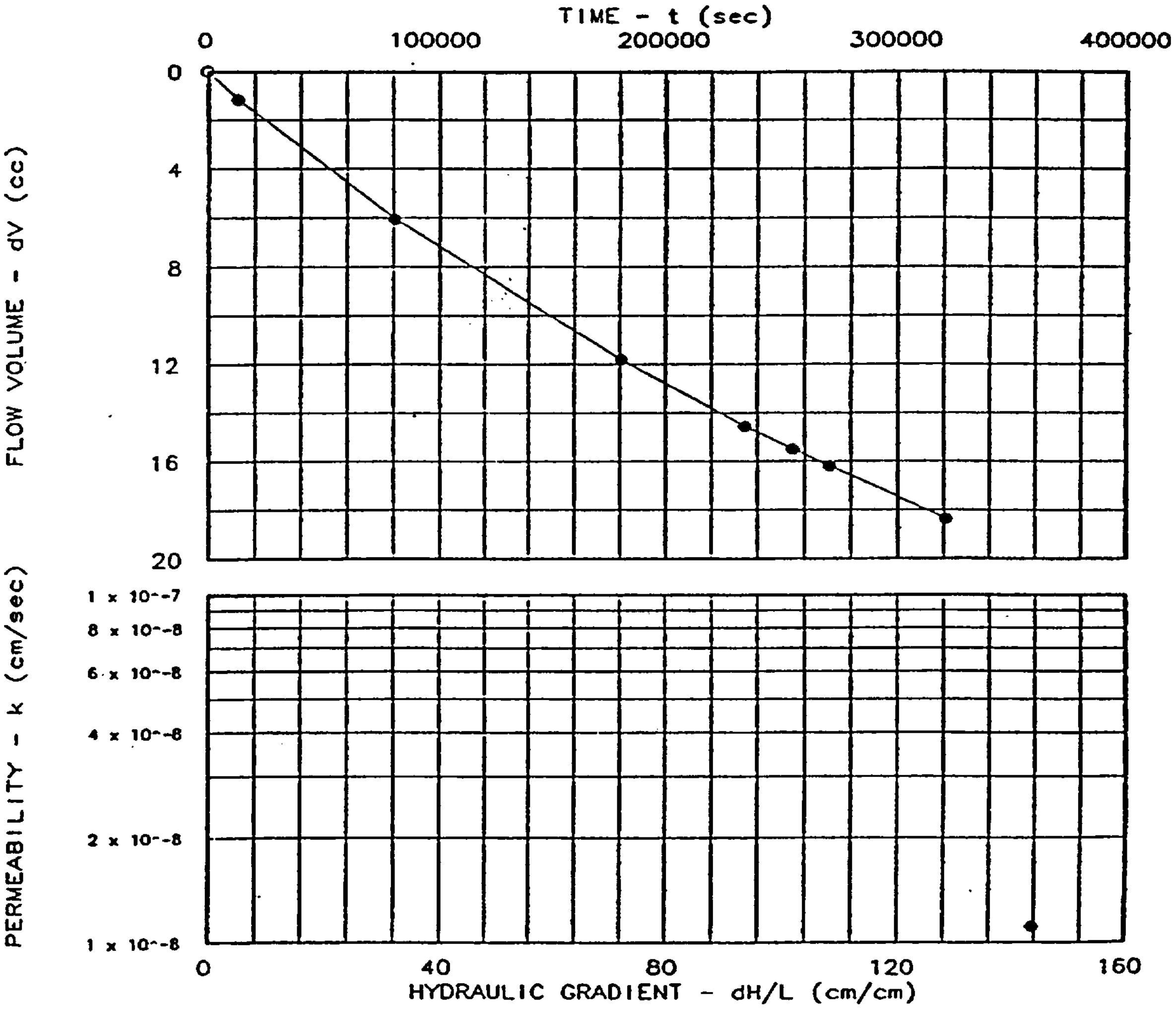
Specimen Height (cm): 5.32
Specimen Diameter (cm): 6.15
Dry Unit Weight (pcf): 115.6
Moisture Before Test (%): 9.7
Moisture After Test (%): 17.1
Run Number: 1 ● 2 ▲
Cell Pressure (psi): 30.0
Test Pressure(psi): 27.0
Back Pressure(psi): 16.1
Diff. Head (psi): 10.9
Flow Rate (cc/sec): 5.58 x 10^-5
Perm. (cm/sec): 1.11 x 10^-8

SAMPLE DATA:

Sample Identification: BORING: 111
DEPTH: 200.0'
Visual Description: RED SILTY CLAY, TR SAND
Remarks:

Maximum Dry Density (pcf):
Optimum Moisture Content (%):

Percent Compaction:
Permeameter type: FLEXIBLE WALL
Sample type: CORE



Project: LEA COUNTY LANDFILL
Location: HOBBS, NEW MEXICO
Date: 12-8-97

PERMEABILITY TEST REPORT
WEAVER BOOS CONSULTANTS, INC.

Project No.: 95042.10
File No.: 95042.10
Lab No.: 3
Tested by: JWM
Checked by: WSG
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name:	LEA COUNTY LANDFILL
e No.:	95042.10
oject Location:	HOBBS, NEW MEXICO
Project No.:	95042.10
Sample Identification:	BORING: 111 DEPTH: 200.0'
Lab No.:	3
Description:	RED SILTY CLAY, TR SAND
Sample Type:	CORE
Max. Dry Dens.:	
Method (D1557/D698):	
Opt. Water Content:	
Date:	12-8-97
Remarks:	

Permeameter Type:	FLEXIBLE WALL
Tested by:	JWM
Checked by:	WSG
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:		After test:	
iameter:	1	2	1	2
Top:	in	in	in	in
Middle:	2.420 in	in	2.431 in	in
Bottom:	in	in	in	in
Average:	2.42 in	6.15 cm	2.43 in	6.17 cm

Length:	1	2	3	1	2	3
	2.094 in	in	in	2.073 in	in	i
Average:	2.09 in	5.32 cm		2.07 in	5.27 cm	

Moisture, Density and Sample Parameters:

	Before test:	After test:
Specific Gravity:	2.77	
Wet Wt. & Tare:	320.70	342.30
Dry Wt. & Tare:	292.30	292.30
Tare Wt.:	0.00	0.00
Moisture Content:	9.7 %	17.1 %
Dry Unit Weight:	115.6 pcf	115.7 pcf
Porosity:	0.3314	0.3307
Saturation:	54.3 %	95.9 %

[illegible]

Cell No.: 3 Panel No.: Positions:

Run Number:	1	2
Cell Pressure:	30.0 psi	0.0 psi
Saturation Pressure:	30.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	27.0 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi		BURET READING-cc		FLOW VOLUME-cc AVERAGE
				IN	OUT	IN	OUT	
S X	12/12/97	13:19:00	0	27.0	17.0	8.10	85.40	0.00
	12/12/97	16:55:00	12,960	27.0	17.0	9.20	84.20	1.15
	12/13/97	11:46:00	80,820	27.0	17.0	14.40	79.60	6.05
	12/14/97	15:33:00	180,840	27.0	17.0	20.40	74.10	11.80
	12/15/97	6:32:00	234,780	27.0	17.0	23.20	71.40	14.55
	12/15/97	12:12:00	255,180	27.0	17.0	24.20	70.50	15.50
	12/15/97	16:36:00	271,020	27.0	17.0	25.00	69.90	16.20
	12/16/97	6:29:00	321,000	27.0	17.0	27.20	67.80	18.35

t Pressure = 27.0 psi Differential Head = 10.9 psi, 763.8 cm H2O
dient = 1.436E 02 Flow rate = 5.583E-05 cc/sec R squared = 0.9930
Permeability, K27.0° = 1.310E-08 cm/sec, K20° = 1.114E-08 cm/sec

```
                    GRAIN SIZE DISTRIBUTION TEST DATA              Test No.: 14
--------------------------------------------------------------------------------
Date: 12-18-97
Project No.: 95042.10
Project: LEA COUNTY LANDFILL
================================================================================

--------------------------------------------------------------------------------
                                 Sample Data
--------------------------------------------------------------------------------
Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SILTY CLAY, TR SAND
USCS Class: CL                         Liquid limit: NA
AASHTO Class: A-4                      Plasticity index: NA
--------------------------------------------------------------------------------
                                    Notes
--------------------------------------------------------------------------------
Remarks: BORING: 111  DEPTH: 485.0'

Fig. No.:
--------------------------------------------------------------------------------
                          Mechanical Analysis Data
--------------------------------------------------------------------------------
                     Initial
Dry sample and tare=   409.50
Tare               =     0.00
Dry sample weight  =   409.50
Sample split on number 10 sieve
Split sample data:
  Sample and tare = 50  Tare =  0  Sample weight = 50
  Cumulative weight retained tare= 0
   e for cumulative weight retained= 0
  Sieve          Cumul. Wt.   Percent
                 retained     finer
  # 4              0.00        100.0
  # 10             0.10        100.0
  # 20             0.90         98.2
  # 40             1.50         97.0
  # 60             2.10         95.8
  # 100            2.80         94.4
  # 200            3.60         92.8
--------------------------------------------------------------------------------
                          Hydrometer Analysis Data
--------------------------------------------------------------------------------
Separation sieve is number 10
Percent -# 10 based on complete sample= 100.0
Weight of hydrometer sample: 50
Calculated biased weight=  50.01
Automatic temperature correction
  Composite correction at 20 deg C =-3.5

Meniscus correction only= 1
Specific gravity of solids= 2.75
```

```
Hydrometer type: 152H   Effective depth L= 16.294964 - 0.164 x Rm

 Elapsed     Temp,  Actual     Corrected   K          Rm     Eff.    Diameter   Percent
 time, min   deg C  reading    reading                       depth   mm         finer
     1.0     23.0   46.0       43.2        0.0128    47.0     8.6    0.0374     84.4
     2.0     23.0   43.5       40.7        0.0128    44.5     9.0    0.0271     79.6
     3.0     23.0   42.0       39.2        0.0128    43.0     9.2    0.0224     76.6
     4.0     23.0   41.0       38.2        0.0128    42.0     9.4    0.0196     74.7
     8.0     23.0   39.0       36.2        0.0128    40.0     9.7    0.0141     70.8
    16.0     23.0   36.0       33.2        0.0128    37.0    10.2    0.0102     64.9
    30.0     23.0   33.0       30.2        0.0128    34.0    10.7    0.0076     59.0
    60.0     23.5   31.0       28.3        0.0127    32.0    11.0    0.0054     55.4
   125.0     24.0   28.0       25.5        0.0126    29.0    11.5    0.0038     49.8
   330.0     24.0   25.0       22.5        0.0126    26.0    12.0    0.0024     43.9
  1410.0     24.0   21.0       18.5        0.0126    22.0    12.7    0.0012     36.1
  2850.0     24.0   19.5       17.0        0.0126    20.5    12.9    0.0009     33.2
-----------------------------------------------------------------------------------------
                             Fractional Components
-----------------------------------------------------------------------------------------
Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. =   0.0     % GRAVEL =   0.0    % SAND =   7.2
% SILT = 51.0      % CLAY = 41.8     (% CLAY COLLOIDS = 34.5)

D85=    0.04  D60=    0.008  D50=    0.004
```

WEAVER BOOS CONSULTANTS, INC.
ENVIRONMENTAL AND GEOTECHNICAL ENGINEERS
520 N. Michigan Ave., Chicago, IL 60611 • (312) 670-0041
1944 N. Griffith Blvd., Unit C, Griffith, IN 46319 • (219) 923-9609

WATER CONTENT DETERMINATION

Project: LEA COUNTY LANDFILL Job No.: 95042.10
Location of Project: HOBBS, NEW MEXICO Date of Testing: 12-4-97 THROUGH 12-18-97
Description of Soil:________ Date of Weighing:________
Tested By: JM

Boring No.	108	108	104	108	109	102	101
Sample No.	215'	100'	60.0'	150.0'	120.0'	20.0'	20.0'
Container No. (cup)	SS	AA	AN	AA	AN	A-12	A-12
Wt. of cup + wet soil	88.9	78.0	92.3	89.5	104.5	143.0	469.1
Wt. of cup + dry soil	82.7	67.9	84.7	82.2	97.3	138.5	451.6
Wt. of cup	14.7	15.1	14.8	15.1	14.9	16.0	15.9
Wt. of dry soil	68.0	52.8	69.9	67.1	82.4	122.5	435.7
Wt. of water	6.2	10.1	7.6	7.3	7.2	4.5	17.5
Water content (w)*%	9.1	19.1	10.9	10.9	8.7	3.7	4.[illegible]

Boring No.							
Sample No.							
Container No. (cup)							
Wt. of cup + wet soil							
Wt. of cup + dry soil							
Wt. of cup							
Wt. of dry soil							
Wt. of water							
Water content (w)* %							

*w = (wt. of water/wt. of dry soil)*100

Remarks:

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ORGANIC AND WATER CONTENT DETERMINATIONS
ASTM D2974

Project: LEA COUNTY LANDFILL
Location of Project: HOBBS, NEW MEXICO
Description of Soil:
Tested By: JM & WSG

Job No.: 95042.10
Date of Testing: 12-16-97 THROUGH 12-18-97
Date of Weighing:
Oven Temperature: 60°C
Furnace Temperature: 440°C

MOISTURE CONTENT

Boring No.	111	103	104	111	110		
Sample No.	140.0'	5.0'	4.0'	485.0'	90.0'		
Container No. (cup)	45	106	222	TZ	45		
Wt. of cup + wet soil	127.8	94.5	118.9	98	188.1		
Wt. of cup + dry soil	121.6	92.9	117.8	89.3	175.1		
Wt. of cup	48.7	51.4	54.4	14.8	48.6		
Wt. of dry soil	72.9	41.5	63.4	74.5	126.5		
Wt. of water	6.2	1.6	1.1	8.7	13		
Water content (w)*%	8.5	3.9	1.7	11.7	10.3		

ORGANIC CONTENT

Boring No.	111	103	104	111	110		
Sample No.	140.0'	5.0'	4.0'	485.0'	90.0'		
Container No. (cup)	45	106	222	190	45		
Init. wt. of cup + oven dry soil	121.6	92.9	117.8	126.9	175.1		
Final wt. of cup + burnt soil	119.4	92.5	117.4	124.3	169.9		
Wt. of cup	48.7	51.4	54.4	52.4	48.6		
Wt. of oven dry soil	72.9	41.5	63.4	74.5	126.5		
Wt. Loss	2.2	0.4	0.4	2.6	5.2		
Organic content (LOI)**%	3.0	1.0	0.6	3.5	4.1		

*w = (wt. of water/wt. of dry soil)*100
**LOI = (wt. loss/wt. of dry soil)*100

Remarks:

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ORGANIC AND WATER CONTENT DETERMINATIONS
ASTM D2974

Project: LEA COUNTY LANDFILL
Location of Project: HOBBS, NEW MEXICO
Description of Soil:
Tested By: JM & WSG

Job No.: 95042.10
Date of Testing: 12-3-97 THROUGH 12-16-97
Date of Weighing:
Oven Temperature: 60°C
Furnace Temperature: 440°C

MOISTURE CONTENT

Boring No.	109	108	111	110	110	111	
Sample No.	80.0'	60.0'	200.0'	350.0'	230.0'	80.0'	
Container No. (cup)	190	106	45	45	106	190	
Wt. of cup + wet soil	113.8	121.8	134.7	124.9	137.5	159.2	
Wt. of cup + dry soil	106.5	117.8	123.7	115.5	131.0	145.5	
Wt. of cup	52.4	51.4	48.7	48.7	51.4	52.4	
Wt. of dry soil	54.1	66.4	75.0	66.8	79.6	93.1	
Wt. of water	7.3	4.0	11.0	9.4	6.5	13.7	
Water content (w)*%	13.5	6.0	14.7	14.1	8.2	14.7	

ORGANIC CONTENT

Boring No.	109	108	111	110	110	111	
Sample No.	80.0'	60.0'	200.0'	350.0'	230.0'	80.0'	
Container No. (cup)	190	106	45	45	106	190	
Init. wt. of cup + oven dry soil	106.5	117.8	123.7	115.5	131.0	145.5	
Final wt. of cup + burnt soil	103.0	117.1	121.4	113.6	129.4	140.6	
Wt. of cup	52.4	51.4	48.7	48.7	51.4	52.4	
Wt. of oven dry soil	54.1	66.4	75.0	66.8	79.6	93.1	
Wt. Loss	3.5	0.7	2.3	1.9	1.6	4.9	
Organic content (LOI)**%	6.5	1.1	3.1	2.8	2.0	5.3	

*w = (wt. of water/wt. of dry soil)*100
**LOI = (wt. loss/wt. of dry soil)*100

Remarks:

WEAVER BOOS CONSULTANTS, INC.
ENVIRONMENTAL AND GEOTECHNICAL ENGINEERS
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SPECIFIC GRAVITY TESTS
ASTM D854

Project: LEA COUNTY LANDFILL
Job No.: 95042.10
Location of Project: HOBBS, NEW MEXICO
Date of Testing: 12-8-97 THROUGH 12-22-
Description of Soil:
Date of Weighing:
Tested By: WSG

Jar No.	1	2	3	4	5	1	1
Boring No.	B-104	B-108	B-109	B-111	B-110	B-110	B-111
Depth	60.0'	60.0'	80.0'	200.0'	350.0'	230.0'	80.0'
Oven Dry Wt. (A) g	130.6	117.8	130.5	110.7	113.7	112.6	111.0
Wt. Pycn & Water (B) g	1440.0	1440.0	1440.0	1440.0	1440.0	1440.7	1440.1
Wt. Pycn, Water & Soil (C) g	1522.3	1514.5	1521.6	1510.8	1512.9	1511.3	1510
Temperature °C	23	23	23	23	23	19.0	23.5
Temp. Correction (D)	0.9993	0.9993	0.9993	0.9993	0.9993	1.0002	0.9992
Specific Gravity	2.70	2.72	2.68	2.77	2.79	2.68	2.70

Jar No.	2	3	4	5	1		
Boring No.	B-111	B-104	B-111	B-103	B-110		
Depth	140.0'	4.0'	485.0'	5.0'	90.0'		
Oven Dry Wt. (A) g	115.7	102.0	110.3	81.3	103.3		
Wt. Pycn & Water (B) g	1440.1	1440.1	1440.1	1440.1	1440.0		
Wt. Pycn, Water & Soil (C) g	1513.0	1504.0	1510.3	1491.6	1505.6		
Temperature °C	23.5	23.5	23.5	23.5	23.0		
Temp. Correction (D)	0.9992	0.9992	0.9992	0.9992	0.9993		
Specific Gravity	2.70	2.68	2.75	2.73	2.74		

$$\text{SPECIFIC GRAVITY}_{20^\circ} = \frac{A \times D}{A + B - C}$$

Remarks:

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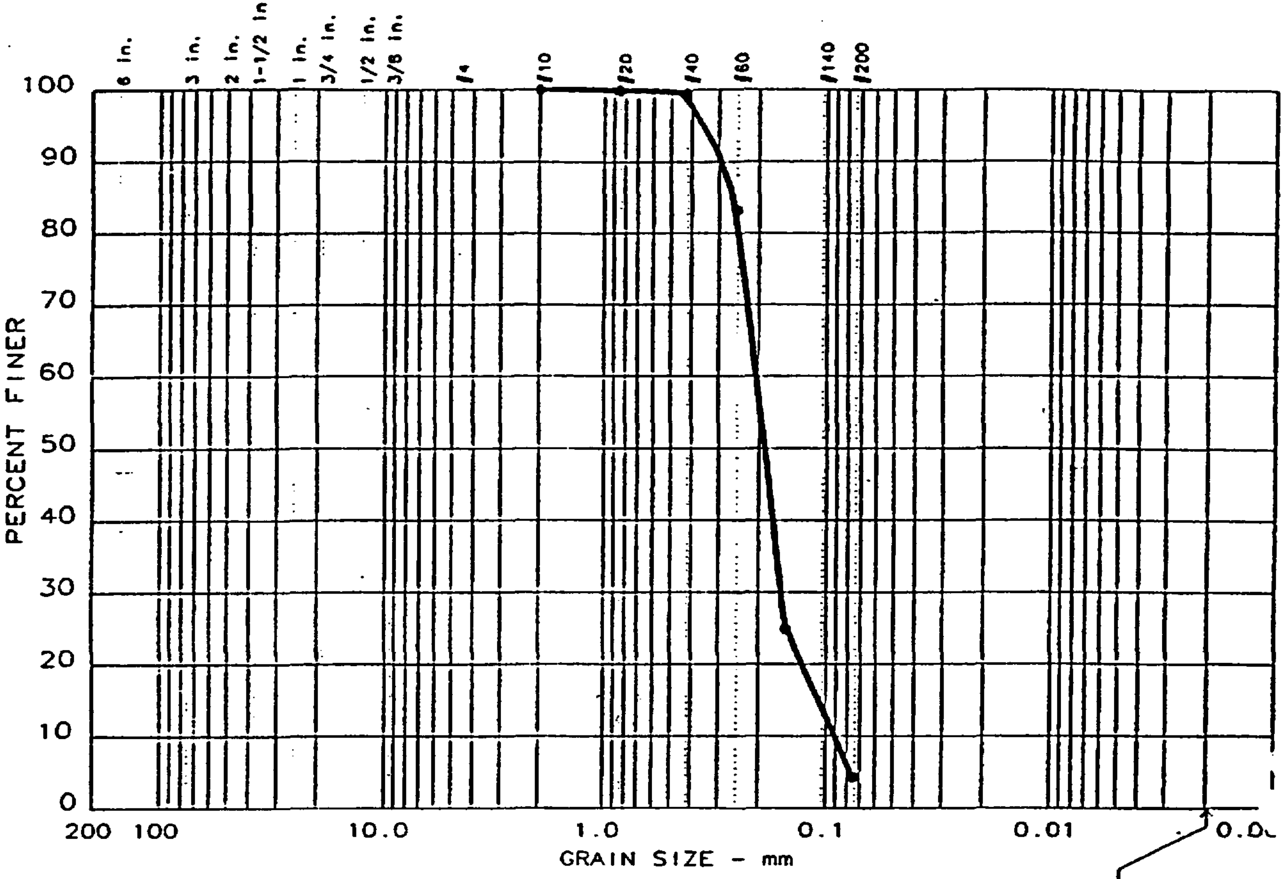
GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	18	0.0	0.0	95.7	4.3	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA	0.258	0.204	0.187	0.157	0.107	0.0902	1.34	2.3

MATERIAL DESCRIPTION	USCS	AASHTO
● REDISH BROWN SAND	SP	A-3

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 1-7-98

Remarks:
SAND #1
3.0' BGS

GRAIN SIZE DISTRIBUTION TEST REPORT
WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.:

Date: 1-7-98
Project No.: 95042.10
Project: LEA COUNTY LANDFILL

Sample Data

Location of Sample: HOBBS, NEW MEXICO
Sample Description: REDISH BROWN SAND
USCS Class: SP
Liquid limit: NA
AASHTO Class: A-3
Plasticity index: NA

Notes

Remarks: SAND #1 3.0' BGS

Fig. No.:

Mechanical Analysis Data

	Initial
Dry sample and tare=	423.80
Tare =	0.00
Dry sample weight =	423.80

Tare for cumulative weight retained= 0

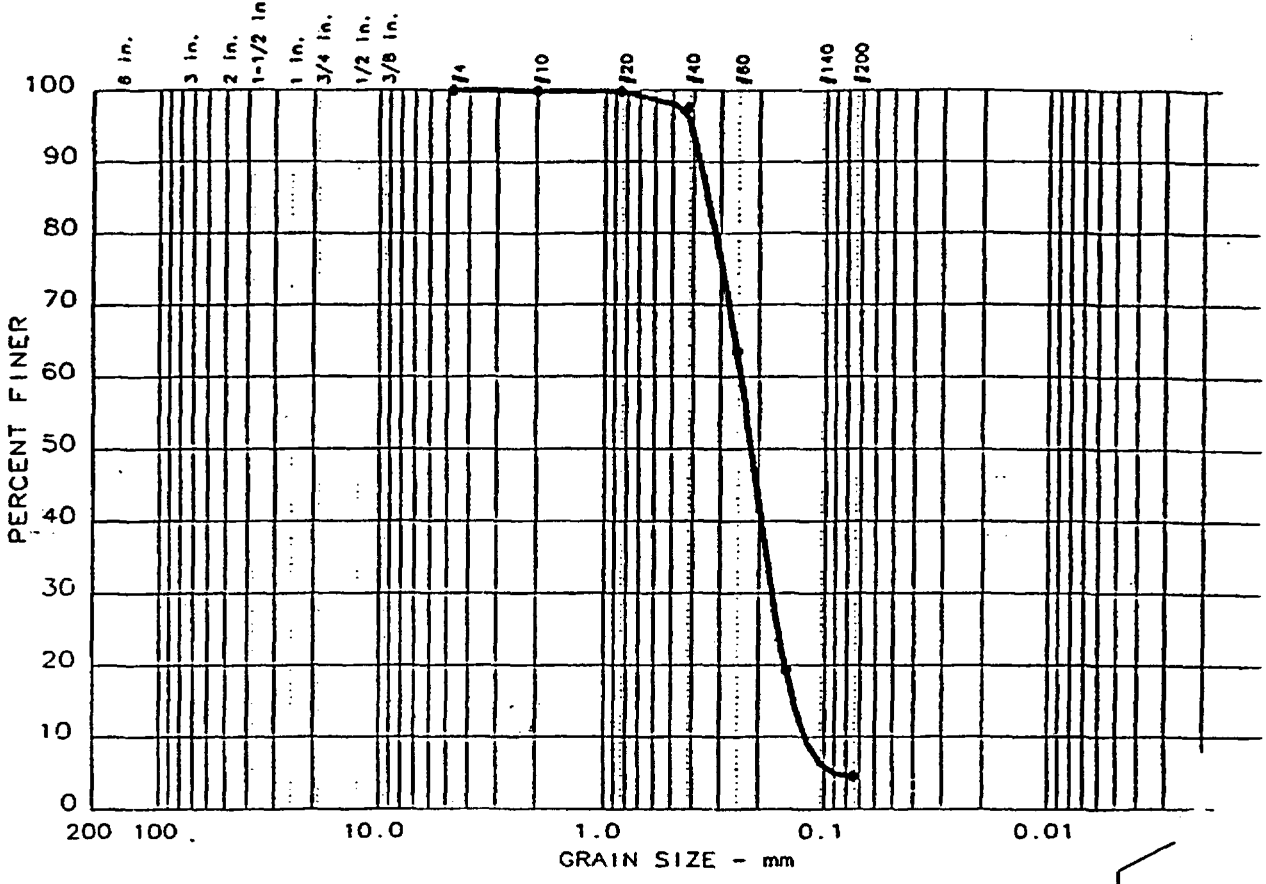
Sieve	Cumul. Wt. retained	Percent finer
# 10	0.00	100.0
20	0.30	99.9
# 40	2.60	99.4
# 60	71.20	83.2
# 100	318.10	24.9
# 200	405.40	4.3

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0 % GRAVEL = 0.0 % SAND = 95.7
% FINES = 4.3

D85= 0.26 D60= 0.204 D50= 0.187
D30= 0.1567 D15= 0.10715 D10= 0.09016
Cc = 1.3351 Cu = 2.2620

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	16	0.0	0.0	95.4	4.6	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA	0.343	0.240	0.216	0.173	0.139	0.122	1.02	2.0

MATERIAL DESCRIPTION	USCS	AASHTO
● RED SAND	SP	A-3

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 1-7-98

Remarks:

SAND #3

SURFACE

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Figure No. _____

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 16

Date: 1-7-98
Project No.: 95042.10
Project: LEA COUNTY LANDFILL

Sample Data

Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SAND
USCS Class: SP
Liquid limit: NA
AASHTO Class: A-3
Plasticity index: NA

Notes

Remarks: SAND #3 SURFACE

Fig. No.:

Mechanical Analysis Data

Initial
Dry sample and tare= 418.70
Tare = 0.00
Dry sample weight = 418.70
Tare for cumulative weight retained= 0

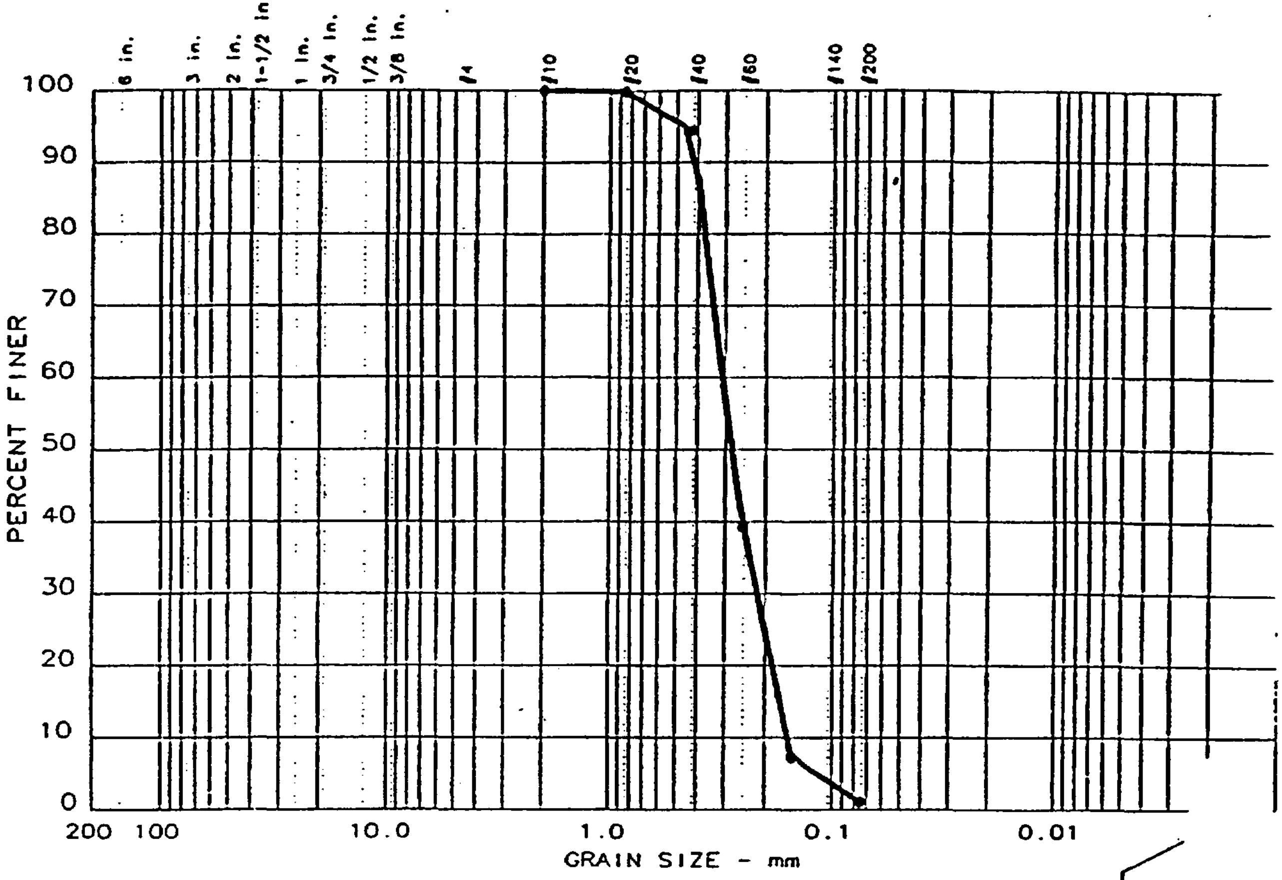
Sieve	Cumul. Wt. retained	Percent finer
# 4	0.00	100.0
10	0.30	99.9
20	0.70	99.8
# 40	10.60	97.5
# 60	152.50	63.6
# 100	337.70	19.3
# 200	399.60	4.6

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0 % GRAVEL = 0.0 % SAND = 95.4
% FINES = 4.6

D85= 0.34 D60= 0.240 D50= 0.216
D30= 0.1732 D15= 0.13868 D10= 0.12218
Cc = 1.0233 Cu = 1.9634

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	17	0.0	0.0	98.9	1.1	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA	0.389	0.308	0.280	0.215	0.169	0.156	0.96	2.0

MATERIAL DESCRIPTION	USCS	AASHTO
● RED SAND	SP	A-3

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 1-7-98

Remarks:
SAND #5
SURFACE

GRAIN SIZE DISTRIBUTION TEST REPORT
WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 17

Date: 1-7-98
Project No.: 95042.10
Project: LEA COUNTY LANDFILL

Sample Data

Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SAND
USCS Class: SP
AASHTO Class: A-3
Liquid limit: NA
Plasticity index: NA

Notes

Remarks: SAND #5 SURFACE

Fig. No.:

Mechanical Analysis Data

Initial
Dry sample and tare= 438.70
Tare = 0.00
Dry sample weight = 438.70
Tare for cumulative weight retained= 0

Sieve	Cumul. Wt. retained	Percent finer
# 10	0.00	100.0
20	0.60	99.9
# 40	24.40	94.4
# 60	266.30	39.3
# 100	406.60	7.3
# 200	434.00	1.1

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0 % GRAVEL = 0.0 % SAND = 98.9
% FINES = 1.1

D85= 0.39 D60= 0.308 D50= 0.280
D30= 0.2153 D15= 0.16904 D10= 0.15649
Cc = 0.9605 Cu = 1.9702

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1944 N. Griffith Blvd., Unit C, Griffith, IN 46319 • (219) 923-9609

Constant Head Permeability Test (ASTM D 2434)

Project: LEA COUNTY LANDFILL
Job No.: 95042.10
Location of Project: HOBBS, NM
Date of Testing: JAN. 6, 1998
Description of Soil: RED SAND
Tested By.: WSG

Sample Number	Reading Number	Sample Information		Date Tested	Head h, cm	Time Start	Time End	Total time t, sec	Total Flow Q, ml	K=(QL)/Aht cm/sec	Average K
		Length, cm	Area, cm2								
SAND #1	1	11.0	81.07	1/6/98	99.70			540	190	4.79E-04	
3.0' BGS	2	11.0	81.07	1/6/98	99.70			660	210	4.33E-04	
	3	11.0	81.07	1/6/98	99.70			600	180	4.08E-04	
	Average										4.40E-04

c:\projects\95042\10\conhd1.xls

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200 S. Michigan Ave., Chicago, IL 60604 • (312) 922-1030
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Constant Head Permeability Test (ASTM D 2434)

Project: LEA COUNTY LANDFILL
Job No.: 95042.10
Location of Project: HOBBS, NM
Date of Testing: JAN. 6, 1998
Description of Soil: RED SAND
Tested By.: WSG

Sample Number	Reading Number	Sample Information		Date Tested	Head h, cm	Time Start	Time End	Total time t, sec	Total Flow Q, ml	K=(QL)/Aht cm/sec	Average K
		Length, cm	Area, cm2								
SAND #3	1	10.0	81.07	1/6/98	99.70			300	110	4.54E-04	
SURFACE	2	10.0	81.07	1/6/98	99.70			300	90	3.71E-04	
	3	10.0	81.07	1/6/98	99.70			300	85	3.51E-04	
	Average										3.92E-04

c:\projects\95042\10\conhd3.xls

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944 N. Griffith Blvd., Unit C, Griffith, IN 46319 • (219) 923-9609

Constant Head Permeability Test (ASTM D 2434)

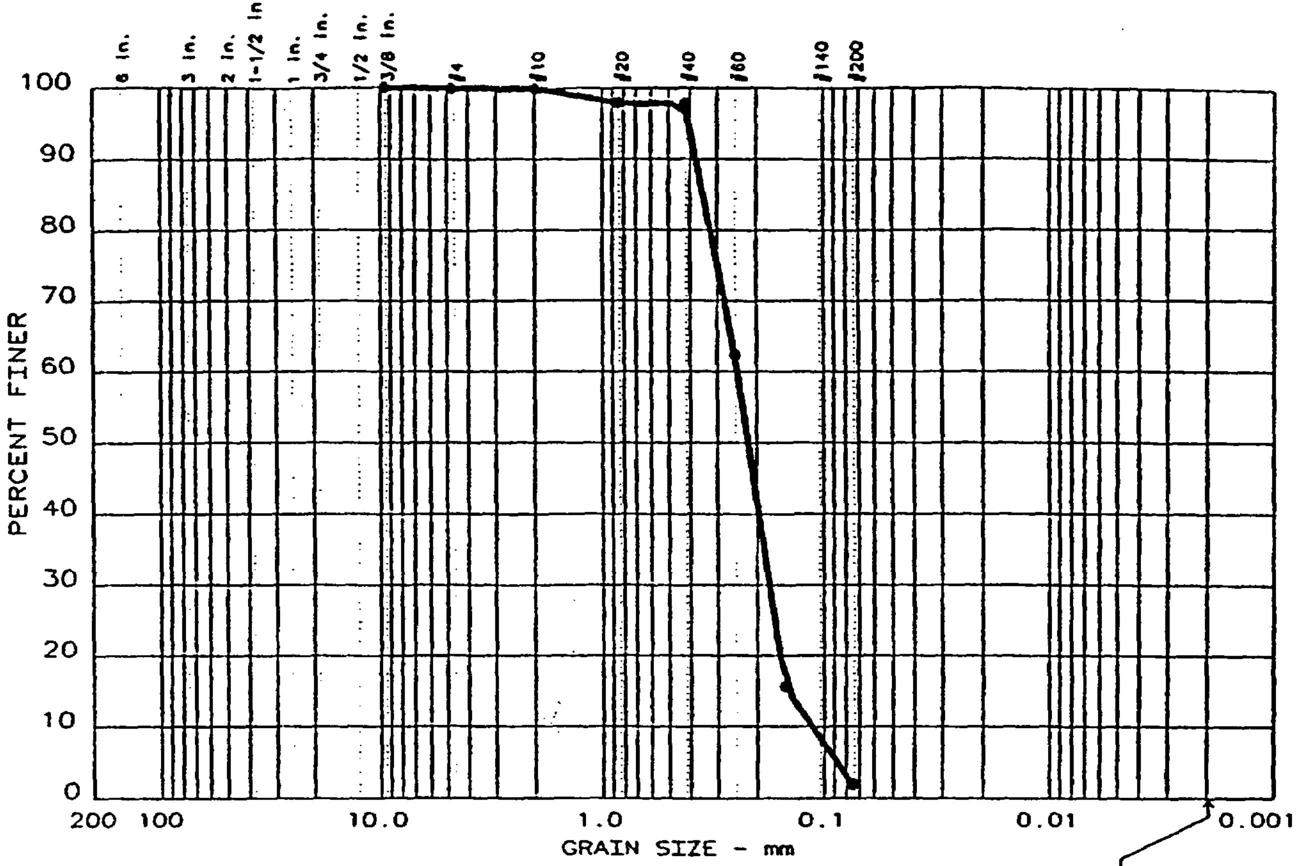
Project: LEA COUNTY LANDFILL
Location of Project: HOBBS, NM
Description of Soil: RED SAND

Job No.: 95042.10
Date of Testing: JAN. 6, 1998
Tested By.: JWM

Sample Number	Reading Number	Sample Information Length, cm	Area, cm2	Date Tested	Head h, cm	Time Start	Time End	Total time t, sec	Total Flow Q, ml	K=(QL)/Aht cm/sec	Average K
SAND #5	1	10.0	81.07	1/6/98	99.70			540	180	4.12E-04	
SURFACE	2	10.0	81.07	1/6/98	99.70			540	170	3.89E-04	
	3	10.0	81.07	1/6/98	99.70			540	165	3.78E-04	
	Average										3.93E-04

c:\projects\95042\10\conhd5.xls

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	5	0.0	0.0	98.0	2.0	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.349	0.244	0.218	0.175	0.144	0.112	1.13	2.2

MATERIAL DESCRIPTION	USCS	AASHTO
● REDDISH BRN SAND, TR SILT	SP	A-3

Project No.: 0016-02-05
Project: LEA COUNTY LANDFILL
● Location: LEA COUNTY, ILLINOIS

Date: 7-21-98

Remarks:
SAMPLE: 1A
UNWASHED
BORING: 500S OW

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

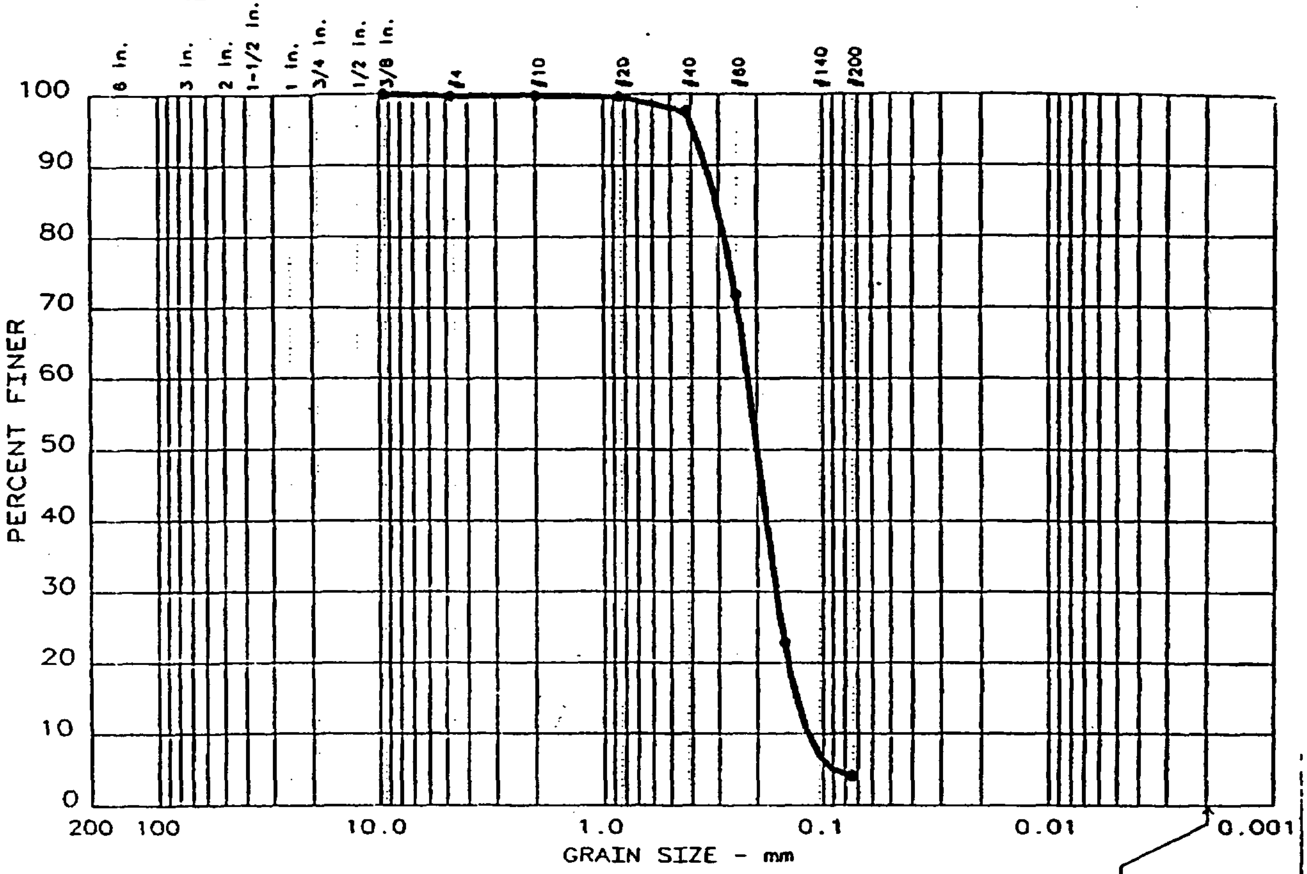
Figure No. ______

```
==========================================================================
                        GRAIN SIZE DISTRIBUTION TEST DATA        Test No.: 5
--------------------------------------------------------------------------
Date: 7-21-98
Project No.: 0016-02-05
Project: LEA COUNTY LANDFILL
==========================================================================

--------------------------------------------------------------------------
                                 Sample Data
--------------------------------------------------------------------------
Location of Sample: LEA COUNTY, ILLINOIS
Sample Description: REDDISH BRN SAND, TR SILT
USCS Class: SP                       Liquid limit:
AASHTO Class: A-3                    Plasticity index:
--------------------------------------------------------------------------
                                    Notes
--------------------------------------------------------------------------
Remarks: SAMPLE: 1A  UNWASHED
         BORING: 500S  0W
Fig. No.:
--------------------------------------------------------------------------
                          Mechanical Analysis Data
--------------------------------------------------------------------------
                         Initial
Dry sample and tare=    323.20
Tare               =      0.00
Dry sample weight  =    323.20
Tare for cumulative weight retained= 0
  Sieve            Cumul. Wt.   Percent
                   retained     finer
  0.375 inches        0.00       100.0
    4                 0.10       100.0
  # 10                0.30        99.9
  # 20                6.80        97.9
  # 40                7.20        97.8
  # 60              121.50        62.4
  # 100             272.50        15.7
  # 200             316.80         2.0
--------------------------------------------------------------------------
                           Fractional Components
--------------------------------------------------------------------------
Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. =  0.0     % GRAVEL =  0.0    % SAND = 98.0
% FINES =  2.0

D85=   0.35  D60=   0.244  D50=   0.218
D30=   0.1754  D15=   0.14421  D10=  0.11194
Cc =   1.1285  Cu =   2.1752
```

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	6	0.0	0.2	95.7	4.1	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.308	0.220	0.200	0.163	0.132	0.117	1.03	1.9

MATERIAL DESCRIPTION	USCS	AASHTO
● REDDISH BRN SAND, TR SILT	SP	A-3

Project No.: 0016-02-05
Project: LEA COUNTY LANDFILL
● Location: LEA COUNTY, ILLINOIS

Date: 7-21-98

Remarks:

SAMPLE: 2A

UNWASHED

BORING: 500S 210W

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

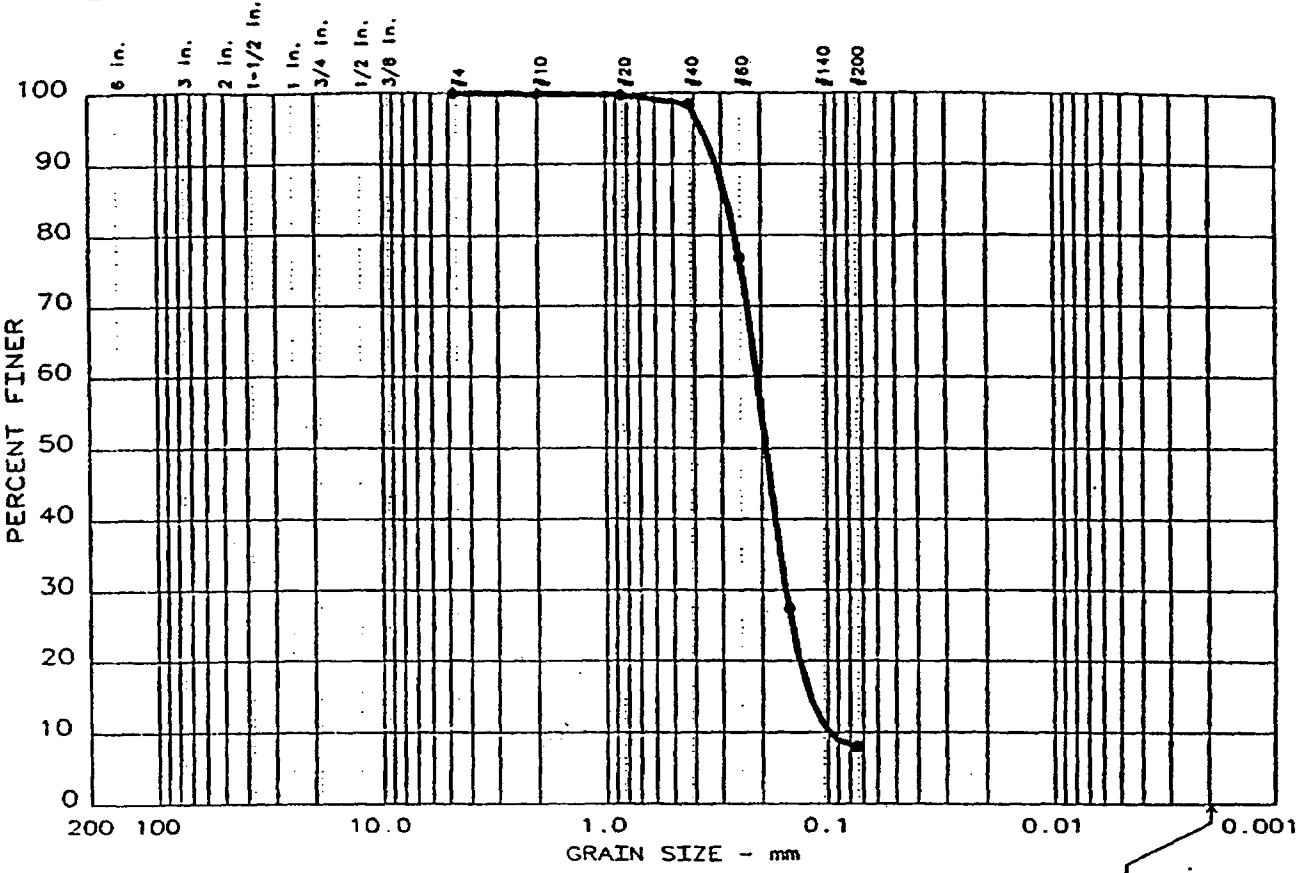
Figure No. ______

```
                     GRAIN SIZE DISTRIBUTION TEST DATA          Test No.: 6
-----------------------------------------------------------------------------
Date: 7-21-98
Project No.: 0016-02-05
Project: LEA COUNTY LANDFILL
============================================================================

----------------------------------------------------------------------------
                                 Sample Data
-----------------------------------------------------------------------------
Location of Sample: LEA COUNTY, ILLINOIS
Sample Description: REDDISH BRN SAND, TR SILT
USCS Class: SP                       Liquid limit:
AASHTO Class: A-3                    Plasticity index:
-----------------------------------------------------------------------------
                                    Notes
-----------------------------------------------------------------------------
Remarks: SAMPLE: 2A  UNWASHED
         BORING: 500S  210W
Fig. No.:
-----------------------------------------------------------------------------
                           Mechanical Analysis Data
-----------------------------------------------------------------------------
                    Initial
Dry sample and tare=   312.90
Tare               =     0.00
Dry sample weight  =   312.90
Tare for cumulative weight retained= 0
  Sieve           Cumul. Wt.   Percent
                   retained     finer
  0.375 inches       0.00       100.0
     4               0.50        99.8
     10              0.70        99.8
  # 20               1.30        99.6
  # 40               7.50        97.6
  # 60              88.20        71.8
  # 100            241.30        22.9
  # 200            300.10         4.1
-----------------------------------------------------------------------------
                            Fractional Components
-----------------------------------------------------------------------------
Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. =  0.0    % GRAVEL =  0.2   % SAND = 95.7
% FINES =  4.1

D85=   0.31  D60=   0.220  D50=   0.200
D30=   0.1633  D15=   0.13213  D10=  0.11722
Cc =   1.0328  Cu =   1.8793
```

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	7	0.0	0.0	92.0	8.0	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.284	0.209	0.190	0.155	0.120	0.0986	1.16	2.1

MATERIAL DESCRIPTION	USCS	AASHTO
● REDDISH BRN SAND, TR SILT	SP-SM	A-3

Project No.: 0016-02-05
Project: LEA COUNTY LANDFILL
● Location: LEA COUNTY, ILLINOIS

Date: 7-21-98

Remarks:

SAMPLE: 3A

UNWASHED

BORING: 500S 700W

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

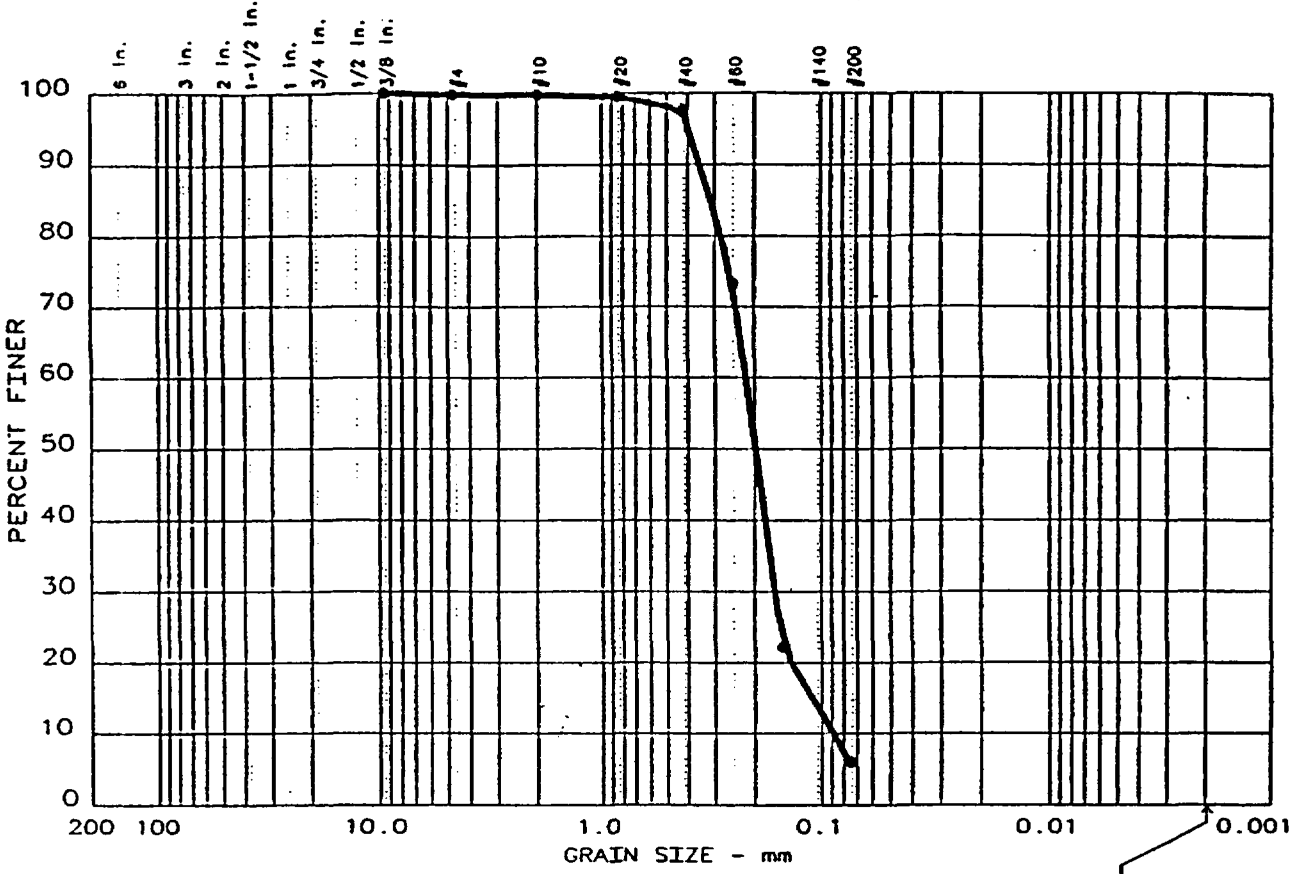
Figure No. ______

```
                       GRAIN SIZE DISTRIBUTION TEST DATA       Test No.: 7
------------------------------------------------------------------------------
Date: 7-21-98
Project No.: 0016-02-05
Project: LEA COUNTY LANDFILL
==========================================================================

----------------------------------------------------------------------------
                                 Sample Data
------------------------------------------------------------------------------
Location of Sample: LEA COUNTY, ILLINOIS
Sample Description: REDDISH BRN SAND, TR SILT
USCS Class: SP-SM                     Liquid limit:
AASHTO Class: A-3                     Plasticity index:
------------------------------------------------------------------------------
                                    Notes
------------------------------------------------------------------------------
Remarks: SAMPLE: 3A  UNWASHED
         BORING: 500S  700W
Fig. No.:-
------------------------------------------------------------------------------
                           Mechanical Analysis Data
------------------------------------------------------------------------------
                    Initial
Dry sample and tare=   298.20
Tare               =     0.00
Dry sample weight  =   298.20
Tare for cumulative weight retained= 0
  Sieve            Cumul. Wt.   Percent
                    retained     finer
  # 4                  0.00      100.0
    10                 0.50       99.8
    20                 0.90       99.7
  # 40                 4.70       98.4
  # 60                69.20       76.8
  # 100              216.40       27.4
  # 200              274.30        8.0
------------------------------------------------------------------------------
                            Fractional Components
------------------------------------------------------------------------------
Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. =  0.0    % GRAVEL =  0.0    % SAND = 92.0
% FINES =  8.0

D85=    0.28  D60=    0.209  D50=    0.190
D30=    0.1545  D15=    0.11995  D10=  0.09863
Cc =    1.1574  Cu =    2.1208
```

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	8	0.0	0.1	93.8	6.1	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.313	0.219	0.198	0.162	0.110	0.0880	1.36	2.5

MATERIAL DESCRIPTION	USCS	AASHTO
● REDDISH BRN SAND, TR SILT	SP-SM	A-3

Project No.: 0016-02-05
Project: LEA COUNTY LANDFILL
● Location: LEA COUNTY, ILLINOIS

Date: 7-21-98

Remarks:

SAMPLE: 4A

UNWASHED

BORING: 500S 1200W

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

```
                    GRAIN SIZE DISTRIBUTION TEST DATA           Test No.: 8
--------------------------------------------------------------------------------
Date: 7-21-98
Project No.: 0016-02-05
Project: LEA COUNTY LANDFILL
================================================================================

--------------------------------------------------------------------------------
                                 Sample Data
--------------------------------------------------------------------------------
Location of Sample: LEA COUNTY, ILLINOIS
Sample Description: REDDISH BRN SAND, TR SILT
USCS Class: SP-SM                      Liquid limit:
AASHTO Class: A-3                      Plasticity index:
--------------------------------------------------------------------------------
                                    Notes
--------------------------------------------------------------------------------
Remarks: SAMPLE: 4A  UNWASHED
         BORING: 500S 1200W
Fig. No.:
--------------------------------------------------------------------------------
                          Mechanical Analysis Data
--------------------------------------------------------------------------------
                            Initial
Dry sample and tare=   319.40
Tare               =     0.00
Dry sample weight  =   319.40
Tare for cumulative weight retained= 0
  Sieve              Cumul. Wt.   Percent
                     retained     finer
  0.375 inches          0.00       100.0
     4                  0.40        99.9
     10                 0.70        99.8
  # 20                  1.70        99.5
  # 40                  7.60        97.6
  # 60                 85.40        73.3
  # 100               248.40        22.2
  # 200               300.00         6.1
--------------------------------------------------------------------------------
                            Fractional Components
--------------------------------------------------------------------------------
Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. =  0.0     % GRAVEL =  0.1    % SAND = 93.8
% FINES =  6.1

D85=   0.31  D60=   0.219  D50=   0.198
D30=   0.1620  D15=   0.10952  D10=  0.08800
Cc =   1.3630  Cu =   2.4860
```

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Constant Head Permeability Test (ASTM D 2434)

Project: **Lea County Landfill**
Location of Project: **Lea County, Ilinois**
Description of Soil: **Reddish Brn Sand, TR Silt**
Classification: **USCS: SP AASHTO: A-3**
Remarks: **Sample: 1 Washed**
Boring: 500S 0W

Job No.: **0016-02-05**
Date of Testing: **7-17-98**
Tested By.: **JWM**

Sample Number	Reading Number	Sample Information		Date Tested	Head h, cm	Time Start	Time End	Total time t, sec	Total Flow Q, ml	K=(QL)/Aht cm/sec	Average K
		Length, cm	Area, cm2								
	1	7.0	20.27	7/17/98	119.00			300	690	6.67E-03	
	2	7.0	20.27	7/17/98	119.00			840	1570	5.42E-03	
	3	7.0	20.27	7/17/98	119.00			360	595	4.80E-03	
	4	7.0	20.70	7/17/98	119.00			420	650	4.40E-03	
	Average										5.32E-03

PERMEABILITY TEST REPORT

TEST DATA:

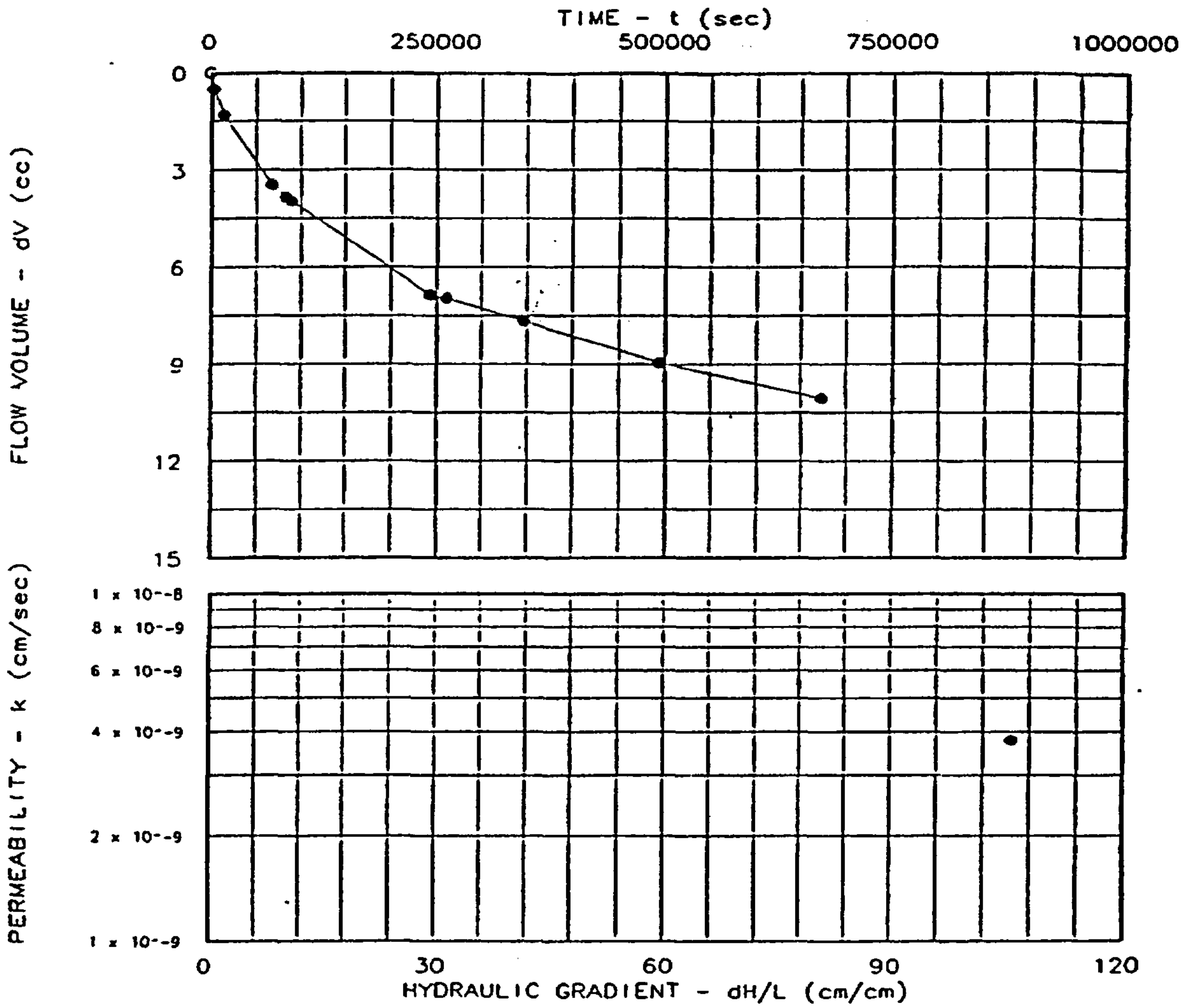
Specimen Height (cm): 7.29
Specimen Diameter (cm): 6.07
Dry Unit Weight (pcf): 114.7
Moisture Before Test (%): 15.9
Moisture After Test (%): 23.7
Run Number: 1 ● 2 ▲
Cell Pressure (psi): 36.0
Test Pressure(psi): 27.0
Back Pressure(psi): 16.0
Diff. Head (psi): 11.0
Flow Rate (cc/sec): 1.36 x 10--5
Perm. (cm/sec): 3.78 x 10--9

SAMPLE DATA:

Sample Identification: BORING: 111
DEPTH: 80.0'
Visual Description: RED SILTY CLAY, TR SAND
Remarks:

Maximum Dry Density (pcf):
Optimum Moisture Content (%):

Percent Compaction:
Permeameter type: FLEXIBLE WALL
Sample type: CORE



Project: LEA COUNTY LANDFILL
Location: HOBBS, NEW MEXICO
Date: 12-16-97

PERMEABILITY TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Project No.: 95042.10
File No.: 95042.10
Lab No.: 2
Tested by: JWM
Checked by: WSG
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

ect Name:	LEA COUNTY LANDFILL
No.:	95042.10
ject Location:	HOBBS, NEW MEXICO
Project No.:	95042.10
Sample Identification:	BORING: 111 DEPTH: 80.0'
Lab No.:	2
Description:	RED SILTY CLAY, TR SAND
Sample Type:	CORE
Max. Dry Dens.:	
Method (D1557/D698):	
Opt. Water Content:	
Date:	12-16-97
Remarks:	
Permeameter Type:	FLEXIBLE WALL
Tested by:	JWM
Checked by:	WSG
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:		After test:	
ameter:	1	2	1	2
Top:	in	in	in	in
Middle:	2.389 in	in	2.510 in	in
Bottom:	in	in	in	in
Average:	2.39 in	6.07 cm	2.51 in	6.38 cm

	Before test:			After test:		
Length:	1	2	3	1	2	3
	2.870 in	in	in	2.898 in	in	in
Average:	2.87 in	7.29 cm		2.90 in	7.36 cm	

Moisture, Density and Sample Parameters:

	Before test:	After test:
Specific Gravity:	2.70	
Wet Wt. & Tare:	448.90	479.40
Dry Wt. & Tare:	387.40	387.40
Tare Wt.:	0.00	0.00
Moisture Content:	15.9 %	23.7 %
Dry Unit Weight:	114.7 pcf	102.9 pcf
Porosity:	0.3194	0.3894
Saturation:	91.3 %	100.5 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 2 Panel No.: Positions:

Run Number:	1	2
Cell Pressure:	36.0 psi	0.0 psi
Saturation Pressure:	35.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	27.0 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	GAUGE PRESSURE-psi OUT	BURET READING-cc IN	BURET READING-cc OUT	FLOW VOLUME-cc AVERAGE
S X	12/23/97	13:03:00	0	27.0	17.0	7.80	77.50	0.00
	12/23/97	14:02:00	3,540	27.0	17.0	8.30	77.00	0.50
	12/23/97	17:03:00	14,400	27.0	17.0	9.20	76.30	1.30
	12/24/97	7:48:00	67,500	27.0	17.0	11.80	74.60	3.45
	12/24/97	12:10:00	83,220	27.0	17.0	12.20	74.20	3.85
	12/24/97	13:30:00	88,020	27.0	17.0	12.30	74.10	3.95
	12/26/97	8:39:00	243,360	27.0	17.0	15.80	71.80	6.85
	12/26/97	13:37:00	261,240	27.0	17.0	15.90	71.70	6.95
	12/27/97	13:08:00	345,900	27.0	17.0	16.60	71.00	7.65
	12/29/97	6:16:00	493,980	27.0	17.0	18.00	69.80	8.95
	12/31/97	8:03:00	673,200	27.0	17.0	19.20	68.80	10.05

Test Pressure = 27.0 psi Differential Head = 11.0 psi, 770.1 cm H2O
Gradient = 1.056E 02 Flow rate = 1.359E-05 cc/sec R squared = 0.88804
Permeability, K27.0° = 4.449E-09 cm/sec, K20° = 3.783E-09 cm/sec

PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 6.79
Specimen Diameter (cm): 6.20
Dry Unit Weight (pcf): 118.0
Moisture Before Test (%): 11.0
Moisture After Test (%): 17.0

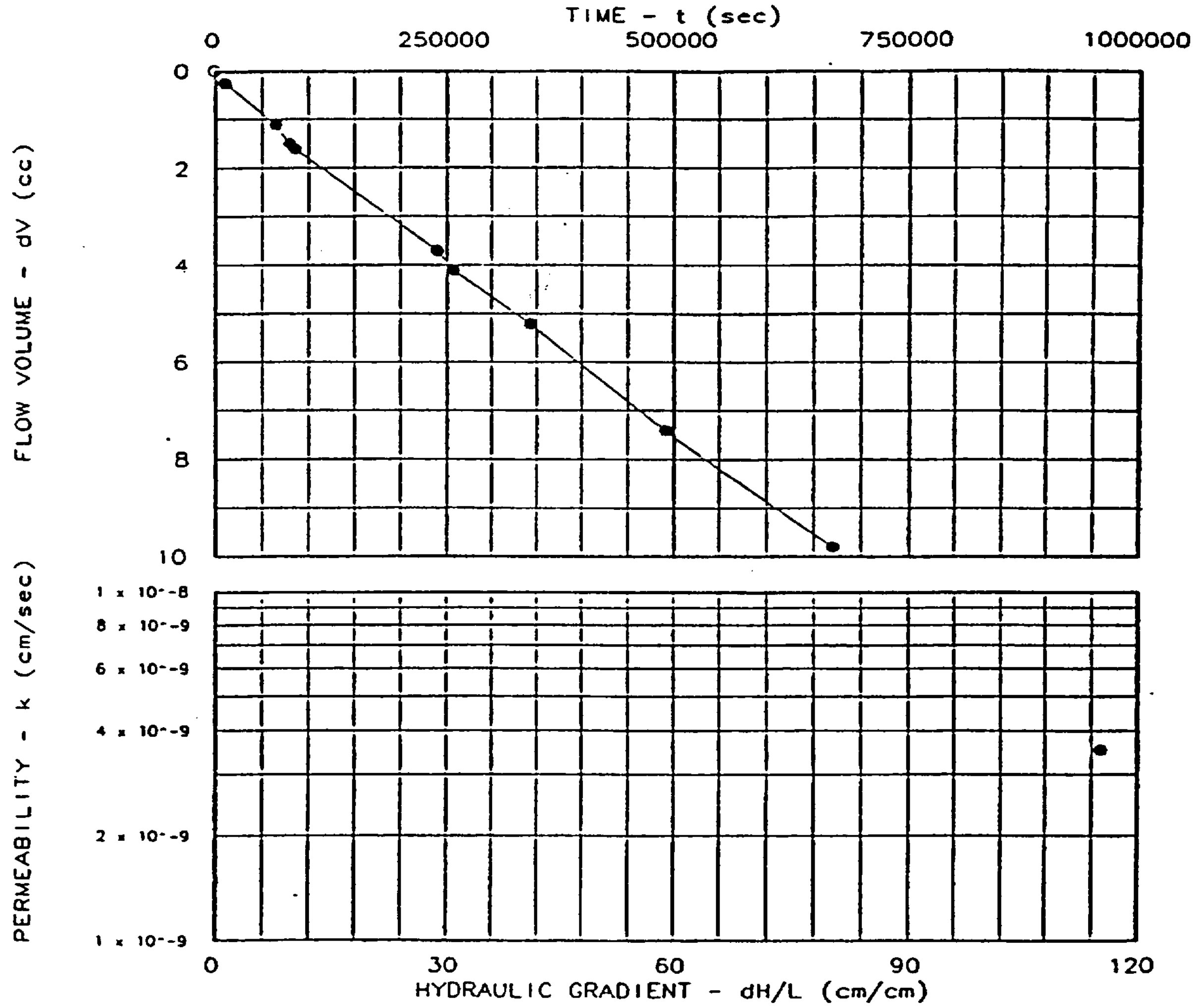
Run Number:	1 ●	2 ▲
Cell Pressure (psi):	38.0	
Test Pressure(psi):	27.0	
Back Pressure(psi):	15.9	
Diff. Head (psi):	11.1	
Flow Rate (cc/sec):	1.44 x 10^-5	
Perm. (cm/sec):	3.52 x 10^-9	

SAMPLE DATA:

Sample Identification: BORING: 111
DEPTH: 140.0'
Visual Description: RED SILTY CLAY, TR SAND
Remarks:

Maximum Dry Density (pcf):
Optimum Moisture Content (%):

Percent Compaction:
Permeameter type: FLEXIBLE WALL
Sample type: CORE



Project: LEA COUNTY LANDFILL
Location: HOBBS, NEW MEXICO
Date: 12-16-97

PERMEABILITY TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Project No.: 95042.10
File No.: 95042.10
Lab No.: 3
Tested by: JWM
Checked by: WSG
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name: LEA COUNTY LANDFILL
File No.: 95042.10
Project Location: HOBBS, NEW MEXICO
Project No.: 95042.10
Sample Identification: BORING: 111
DEPTH: 140.0'
Lab No.: 3
Description: RED SILTY CLAY, TR SAND
Sample Type: CORE
Max. Dry Dens.:
Method (D1557/D698):
Opt. Water Content:
Date: 12-16-97
Remarks:

Permeameter Type: FLEXIBLE WALL
Tested by: JWM
Checked by: WSG
Test type: CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
Diameter:	1	2		1	2	
Top:	in	in		in	in	
Middle:	2.440 in	in		2.463 in	in	
Bottom:	in	in		in	in	
Average:	2.44 in	6.20 cm		2.46 in	6.26 cm	
Length:	1	2	3	1	2	3
	2.675 in	in	in	2.690 in	in	in
Average:	2.68 in	6.79 cm		2.69 in	6.83 cm	

Moisture, Density and Sample Parameters:

	Before test	After test
Specific Gravity:	2.70	
Wet Wt. & Tare:	430.00	453.20
Dry Wt. & Tare:	387.30	387.30
Tare Wt.:	0.00	0.00
Moisture Content:	11.0 %	17.0 %
Dry Unit Weight:	118.0 pcf	115.1 pcf
Porosity:	0.3002	0.3170
Saturation:	69.4 %	99.0 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 2 Panel No.: Positions:

Run Number:	1	2
Cell Pressure:	38.0 psi	0.0 psi
Saturation Pressure:	35.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	27.0 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	GAUGE PRESSURE-psi OUT	BURET READING-cc IN	BURET READING-cc OUT	FLOW VOLUME-cc AVERAGE
S X	12/23/97	14:03:00	0	27.0	17.0	5.70	83.10	0.00
	12/23/97	17:04:00	10,860	27.0	17.0	6.10	83.00	0.25
	12/24/97	7:49:00	63,960	27.0	17.0	7.00	82.20	1.10
	12/24/97	12:11:00	79,680	27.0	17.0	7.40	81.80	1.50
	12/24/97	13:31:00	84,480	27.0	17.0	7.50	81.70	1.60
	12/26/97	8:40:00	239,820	27.0	17.0	9.60	79.60	3.70
	12/26/97	13:38:00	257,700	27.0	17.0	10.00	79.20	4.10
	12/27/97	13:09:00	342,360	27.0	17.0	11.00	78.00	5.20
	12/29/97	6:17:00	490,440	27.0	17.0	13.00	75.60	7.40
	12/31/97	8:04:00	669,660	27.0	17.0	15.20	73.00	9.80

Test Pressure = 27.0 psi Differential Head = 11.1 psi, 782.3 cm H2O
Gradient = 1.151E 02 Flow rate = 1.439E-05 cc/sec R squared = 0.99888
Permeability, K27.0° = 4.143E-09 cm/sec, K20° = 3.523E-09 cm/sec

PERMEABILITY TEST REPORT

TEST DATA:

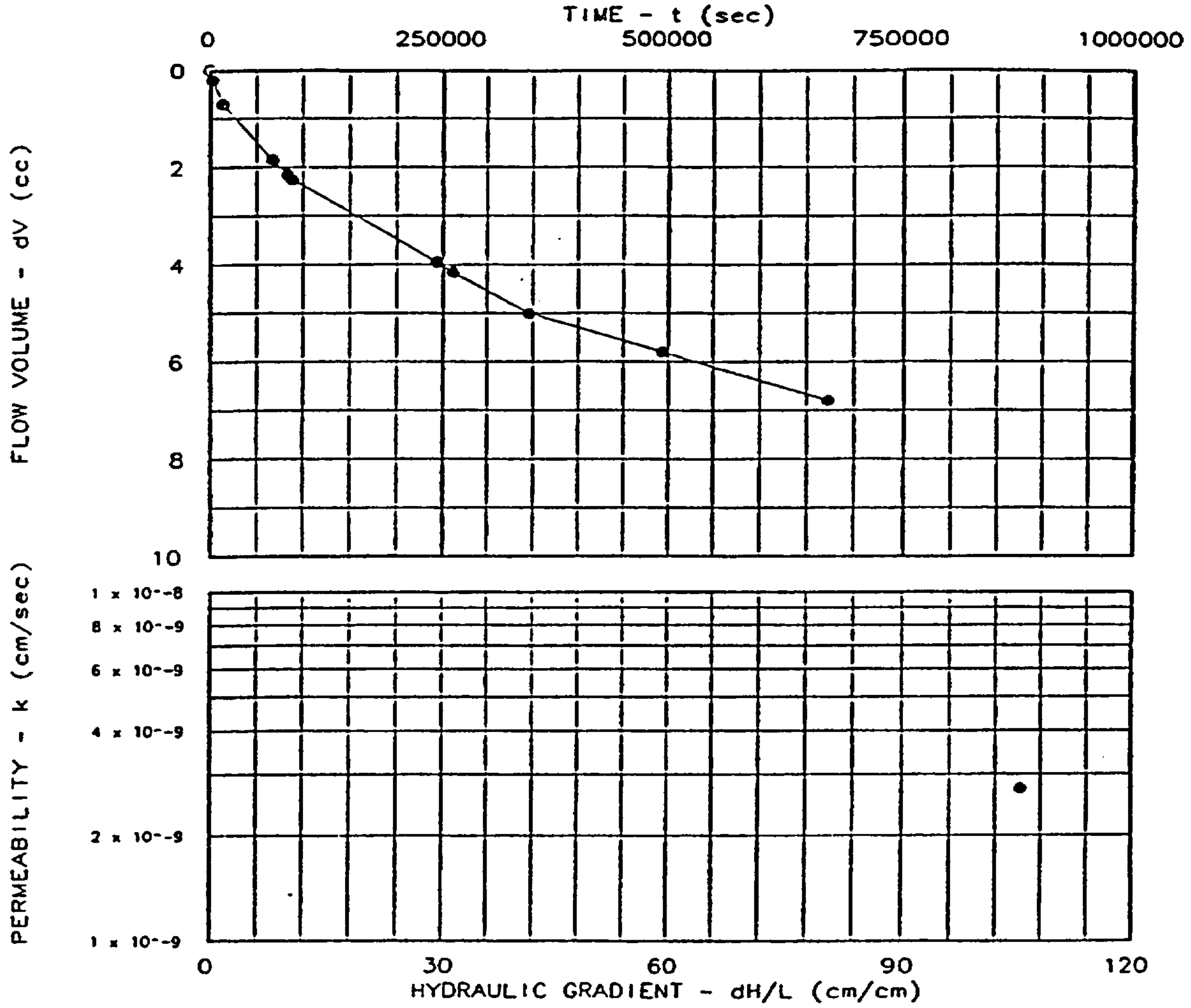
Specimen Height (cm): 7.43
Specimen Diameter (cm): 5.99
Dry Unit Weight (pcf): 108.6
Moisture Before Test (%): 14.6
Moisture After Test (%): 24.7
Run Number: 1 ● 2 ▲
Cell Pressure (psi): 39.0
Test Pressure(psi): 27.0
Back Pressure(psi): 15.9
Diff. Head (psi): 11.1
Flow Rate (cc/sec): 9.54 x 10--6
Perm. (cm/sec): 2.73 x 10--9

SAMPLE DATA:

Sample Identification: BORING: 111
DEPTH: 485.0'
Visual Description: RED SILTY CLAY, TR SAND
Remarks:

Maximum Dry Density (pcf):
Optimum Moisture Content (%):

Percent Compaction:
Permeameter type: FLEXIBLE WALL
Sample type: CORE



Project: LEA COUNTY LANDFILL
Location: HOBBS, NEW MEXICO
Date: 12-16-97

Project No.: 95042.10
File No.: 95042.10
Lab No.: 4
Tested by: JWM
Checked by: WSG
Test: CH - Constant head

PERMEABILITY TEST REPORT

EAVER BOOS CONSULTANTS, INC.

PERMEABILITY TEST DATA

PROJECT DATA

[illegible]ject Name: LEA COUNTY LANDFILL
[illegible] No.: 95042.10
Project Location: HOBBS, NEW MEXICO
Project No.: 95042.10
Sample Identification: BORING: 111
DEPTH: 485.0'
Lab No.: 4
Description: RED SILTY CLAY, TR SAND
Sample Type: CORE
Max. Dry Dens.:
Method (D1557/D698):
Opt. Water Content:
Date: 12-16-97
Remarks:

Permeameter Type: FLEXIBLE WALL
Tested by: JWM
Checked by: WSG
Test type: CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
[illegible]ameter:	1	2		1	2	
Top:	in	in		in	in	
Middle:	2.360 in	in		2.430 in	in	
Bottom:	in	in		in	in	
Average:	2.36 in	5.99 cm		2.43 in	6.17 cm	
Length:	1	2	3	1	2	3
	2.925 in	in	in	2.922 in	in	in
Average:	2.93 in	7.43 cm		2.92 in	7.42 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.75	
Wet Wt. & Tare:	418.00	454.80
Dry Wt. & Tare:	364.70	364.70
Tare Wt.:	0.00	0.00
Moisture Content:	14.6 %	24.7 %
Dry Unit Weight:	108.6 pcf	102.5 pcf
Porosity:	0.3675	0.4028
Saturation:	69.2 %	100.7 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 4 Panel No.: Positions:

Run Number:	1	2
Cell Pressure:	39.0 psi	0.0 psi
Saturation Pressure:	35.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	27.0 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi		BURET READING-cc		FLOW VOLUME-cc AVERAGE
				IN	OUT	IN	OUT	
S X	12/23/97	13:04:00	0	27.0	17.0	7.70	84.40	0.00
	12/23/97	14:03:00	3,540	27.0	17.0	7.90	84.20	0.20
	12/23/97	17:04:00	14,400	27.0	17.0	8.60	83.90	0.70
	12/24/97	7:49:00	67,500	27.0	17.0	10.00	83.00	1.85
	12/24/97	12:11:00	83,220	27.0	17.0	10.30	82.70	2.15
	12/24/97	13:31:00	88,020	27.0	17.0	10.40	82.60	2.25
	12/26/97	8:41:00	243,420	27.0	17.0	12.00	80.80	3.95
	12/26/97	13:39:00	261,300	27.0	17.0	12.20	80.60	4.15
	12/27/97	13:09:00	345,900	27.0	17.0	13.00	79.70	5.00
	12/29/97	6:18:00	494,040	27.0	17.0	13.80	78.90	5.80
	12/31/97	8:04:00	673,200	27.0	17.0	14.70	77.80	6.80

Test Pressure = 27.0 psi Differential Head = 11.1 psi, 782.7 cm H2O
Gradient = 1.054E 02 Flow rate = 9.538E-06 cc/sec R squared = 0.93547
Permeability, K27.0° = 3.208E-09 cm/sec, K20° = 2.728E-09 cm/sec

WEAVER BOOS CONSULTANTS, INC.
ENVIRONMENTAL AND GEOTECHNICAL ENGINEERS
200 S. Michigan Ave., Chicago, IL 60604 • (312) 922-1030
14 N. Griffith Blvd., Unit C, Griffith, IN 46319 • (219) 923-9603

Constant Head Permeability Test (ASTM D 2434)

Project: LEA COUNTY LANDFILL
Job No.: 95042.10
Location of Project: HOBBS, NM
Date of Testing: JAN. 28, 1998
Description of Soil:
Tested By.: JWM
Boring No.: B105

Sample Number	Reading Number	Sample Information		Date Tested	Head h, cm	Time Start	Time End	Total time t, sec	Total Flow Q, ml	K=(QL)/Aht cm/sec	Average K
		Length, cm	Area, cm2								
39	1	7.0	20.27	1/28/98	121.9			300	385	3.64E-03	
	2	7.0	20.27	1/28/98	121.9			420	410	2.77E-03	
	3	7.0	20.27	1/28/98	121.9			360	295	2.32E-03	
	Average										2.91E-03

WEAVER BOOS CONSULTANTS, INC.
ENVIRONMENTAL AND GEOTECHNICAL ENGINEERS

200 S. Michigan Ave., Chicago, IL 60604 • (312) 922-1030
14 N. Griffith Blvd., Unit C, Griffith, IN 46319 • (219) 923-9609

Constant Head Permeability Test (ASTM D 2434)

Project: LEA COUNTY LANDFILL
Job No.: 95042.10
Location of Project: HOBBS, NM
Date of Testing: JAN. 28, 1998
Description of Soil:______
Tested By.: JWM
Boring No.: B111

Sample Number	Reading Number	Sample Information		Date Tested	Head h, cm	Time Start	Time End	Total time t, sec	Total Flow Q, ml	K=(QL)/Aht cm/sec	Average K
		Length, cm	Area, cm2								
39	1	7.0	20.27	1/28/98	121.9			660	410	1.76E-03	
	2	7.0	20.27	1/28/98	121.9			660	350	1.50E-03	
	3	7.0	20.27	1/28/98	121.9			720	325	1.28E-03	
	Average										1.51E-03

WEAVER BOOS CONSULTANTS, INC.
ENVIRONMENTAL AND GEOTECHNICAL ENGINEERS
200 S. Michigan Ave., Chicago, IL 60604 • (312) 922-1030
44 N. Griffith Blvd., Unit C, Griffith, IN 46319 • (219) 923-9609

Constant Head Permeability Test (ASTM D 2434)

Project: LEA COUNTY LANDFILL
Job No.: 95042.10
Location of Project: HOBBS, NM
Date of Testing: JAN. 28, 1998
Description of Soil: ______
Tested By.: JWM
Boring No.: B111

Sample Number	Reading Number	Sample Information		Date Tested	Head h, cm	Time Start	Time End	Total time t, sec	Total Flow Q, ml	K=(QL)/Aht cm/sec	Average K
		Length, cm	Area, cm2								
35	1	7.0	20.27	1/28/98	121.9			840	745	2.51E-03	
	2	7.0	20.27	1/28/98	121.9			600	460	2.17E-03	
	3	7.0	20.27	1/28/98	121.9			600	435	2.05E-03	
	Average										2.25E-03

WEAVER BOOS CONSULTANTS, INC.
ENVIRONMENTAL AND GEOTECHNICAL ENGINEERS
200 S. Michigan Ave., Chicago, IL 60604 • (312) 922-1030
4 N. Griffith Blvd., Unit C, Griffith, IN 46319 • (219) 923-9609

Constant Head Permeability Test (ASTM D 2434)

Project: LEA COUNTY LANDFILL
Location of Project: HOBBS, NM
Description of Soil:______
Boring No.: B105

Job No.: 95042.10
Date of Testing: JAN. 28, 1998
Tested By.: JWM

Sample Number	Reading Number	Sample Information		Date Tested	Head h, cm	Time Start	Time End	Total time t, sec	Total Flow Q, ml	K=(QL)/Aht cm/sec	Average K
		Length, cm	Area, cm2								
38	1	7.0	20.27	1/28/98	121.9			840	50	1.69E-04	
	2	7.0	20.27	1/28/98	121.9			840	25	8.43E-05	
	Average										8.43E-05

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ENVIRONMENTAL AND GEOTECHNICAL ENGINEERS
200 S. Michigan Ave., Chicago, IL 60604 • (312) 922-1030
4 N. Griffith Blvd., Unit C, Griffith, IN 46319 • (219) 923-9600

Constant Head Permeability Test (ASTM D 2434)

Project: LEA COUNTY LANDFILL
Job No.: 95042.10
Location of Project: HOBBS, NM
Date of Testing: JAN. 28, 1998
Description of Soil:
Tested By.: JWM
Boring No.: B105

Sample Number	Reading Number	Sample Information		Date Tested	Head h, cm	Time Start	Time End	Total time t, sec	Total Flow Q, ml	K=(QL)/Aht cm/sec	Average K
		Length, cm	Area, cm2								
9	1	7.0	20.27	1/28/98	121.9			600	395	1.87E-03	
	2	7.0	20.27	1/28/98	121.9			600	350	1.65E-03	
	3	7.0	20.27	1/28/98	121.9			660	345	1.48E-03	
	Average										1.67E-03

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Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 11/19/92

Boring No.: B-2

Grid No.: 7-C

Log By: A. WEEGAR

Drilling Method & Bit Sizes:
0'-38' MUD ROTARY
38'-TD AIR ROTARY

Survey Data:
Northing: 7650.8990
Easting: 12296.2097
Ground Surface Elev. (MSL):
3,479.43

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): 2" SS
2 1/8" CB

Driller: LANE SCARBOROUGH

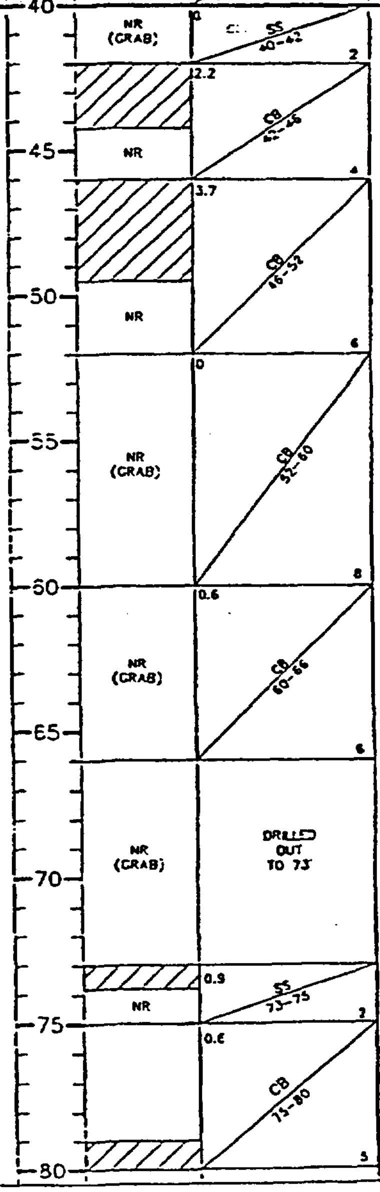
Total Depth: 215' BGL

Remarks: MUD ROTARY BOREHOLE DRILLED ON 1/11/93 NEXT TO ORIGINAL BOREHOLE. LOG IS COMPOSITE OF BOTH BOREHOLES.

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Interval

<u>Silty CLAY (CL)</u>: continued from previous page.

less plastic, more friable below 52'; sl. moist to dry.



Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 11/19/92

Boring No.: B-2

Grid No.: 7-C

Log By: A. WEEGAR

Drilling Method & Bit Sizes:
0'-38' MUD ROTARY
38'-TD AIR ROTARY

Survey Data:
Northing: 7650.8990
Easting: 12296.2097
Ground Surface Elev. (MSL):
3,479.43

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): 2" SS
2 1/8" CB

Driller: LANE SCARBOROUGH

Total Depth: 215' BGL

Remarks: MUD ROTARY BOREHOLE DRILLED ON 1/11/93 NEXT TO ORIGINAL BOREHOLE. LOG IS COMPOSITE OF BOTH BOREHOLES.

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Interval

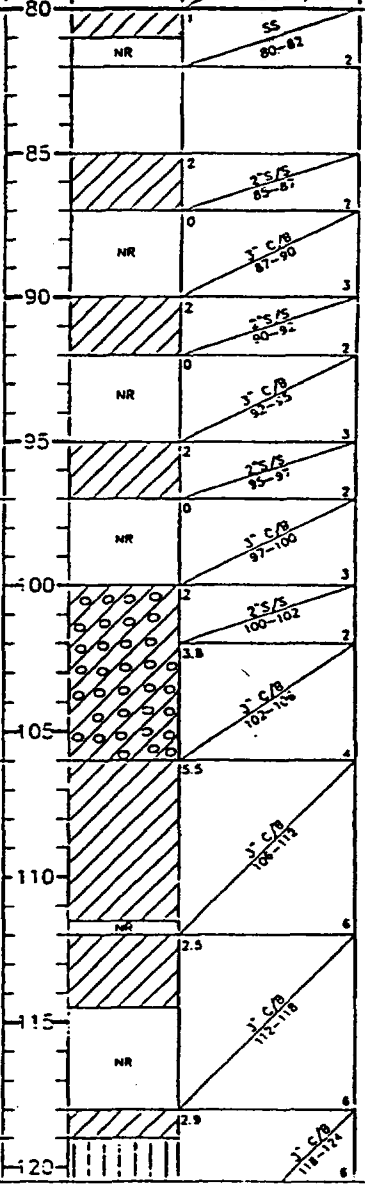
Silty CLAY (CL): continued from previous page.

——?——?——?——

97' – 105' **Silty CLAY (CL):** claystone; mottled dk. red, brownish yellow and occasional inclusions of pale yellow; no longer laminated; appears as accreted clasts; rusty red dendritic pattern throughout – possible organic remnants; v. hard; dry; pale yellow inclusions are silty; isolated silty partings throughout.

106' – 119' **Silty CLAY (CL):** same as above; pale yellow silty inclusions are now stratified in occasional intervals of < 0.10' thick; crumbly due to increased silt in matrix; dry.

119' – 140' SEE COMMENTS NEXT PAGE



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Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 11/19/92	Boring No.: B-2	Grid No.: 7-C

Log By: A. WEEGAR

Drilling Method & Bit Sizes:
0'-38' MUD ROTARY
38'-TD AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): 2" SS
2 1/8" CB

Driller: LANE SCARBOROUGH

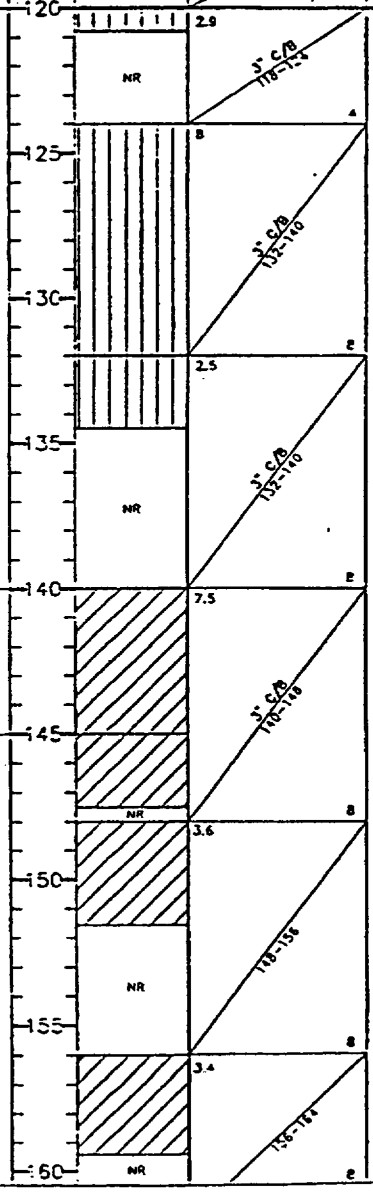
Total Depth: 215' BGL

Survey Data:
Northing: 7650.8990
Easting: 12296.2097
Ground Surface Elev. (MSL):
3,479.43

Remarks: MUD ROTARY BOREHOLE DRILLED ON 1/11/93 NEXT TO ORIGINAL BOREHOLE. LOG IS COMPOSITE OF BOTH BOREHOLES.

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
119' - 140'	SILTSTONE (ML): white; carbonate cemented silt; vfg biotite and mica flakes; v.hard; laminated and cross - bedded w/ yellow inclusions and yellow along bedding boundaries; mica and biotite flakes concentrated at bedding boundaries.
140' - 145'	Silty CLAY (CL): interbedded claystone reddish brown; light and dk. silt fragments throughout; hard; dry. light gray carbonate cemented layers throughout — these layers have irregular boundaries but do not disrupt prevailing bedding structure.
145' - 184'	CLAY (CL): claystone; reddish brown with apparent tubes filled with light gray claystone; hard; slight moisture; slightly slippery.

Depth (feet) | Graphic Log | Recovered Ft. / Ft. Sampled | Stratigraphic Interval



FILE NAME: A-LOG7C.DWG

Terra Dynamics Incorporated **SOIL BORING LO**

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 11/19/92

Boring No.: B-2

Grid No 7-C

Log By: A. WEEGAR

Drilling Method & Bit Sizes:
0'-38' MUD ROTARY
38'-TD AIR ROTARY

Survey Data:
Northing: 7650.8990
Easting: 12296.2097
Ground Surface Elev. (MSL):
3,479.43

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

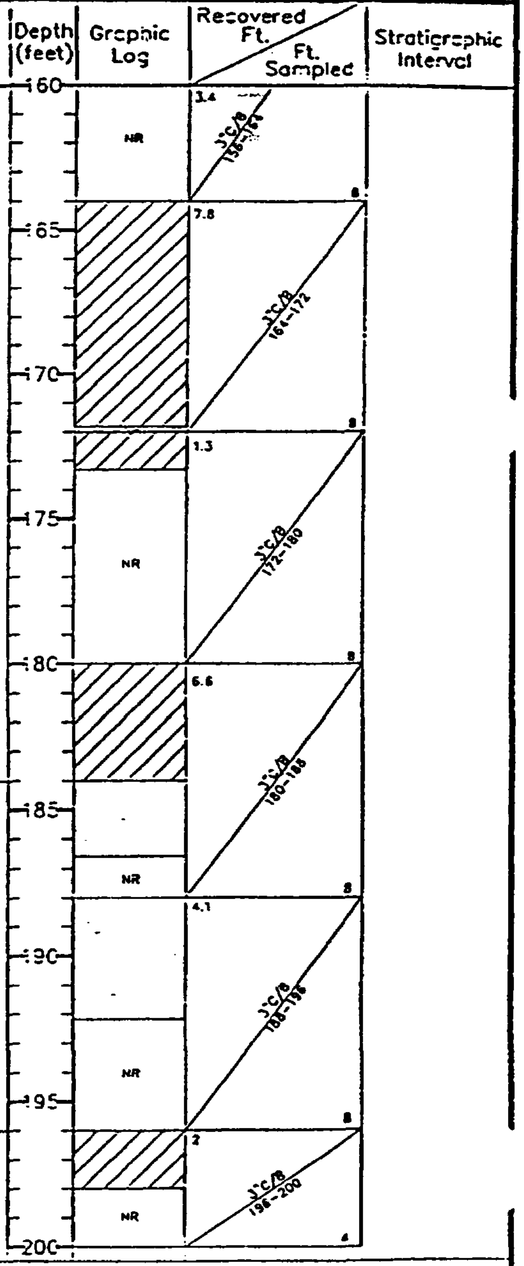
Sample Method(s): 2" SS
2 1/8" CB

Driller: LANE SCARBOROUGH

Total Depth: 215' BGL

Remarks: MUD ROTARY BOREHOLE DRILLED ON 1/11/93 NEXT TO ORIGINAL BOREHOLE. LOG IS COMPOSITE OF BOTH BOREHOLES.

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	
	CLAY (CL): continued from previous page.
184' - 192"	Silty SAND (SM): sandstone; v. pale brown; vfg sand; carb. cemented; vfg pink and dk. mineral frags.; vfg-fg mica flakes; hard; dry.
196" - 200'	CLAY (CL): claystone; reddish brown; w/ tubes & layers of light gray claystone; hard; sl moisture; sl slippery.



FILE NAME: A-LOG7C.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 11/19/92

Boring No.: B-2

Grid No.: 7-C

Log By: A. WEEGAR

Drilling Method & Bit Sizes:
0'-38' MUD ROTARY
38'-TD AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): 2" SS
2 1/8" CB

Driller: LANE SCARBOROUGH

Total Depth: 215' BGL

Survey Data:
Northing: 7650.8990
Easting: 12296.2097
Ground Surface Elev. (MSL):
3,479.43

Remarks: MUD ROTARY BOREHOLE DRILLED ON 1/11/93 NEXT TO ORIGINAL BOREHOLE. LOG IS COMPOSITE OF BOTH BOREHOLES.

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Interval
200'-215'	Silty CLAY (CL): v. dark maroon silty claystone, with occasional light greenish gray mottling and pink dendritic mottling; brittle; dry.	200		DRILL OUT TO 215' - LOG CUTTINGS	
		205			
	Gradational color change to dusky red below 210'.	210			
TOTAL DEPTH=215'		215			
		220			
		225			
		230			
		235			
		240			

FILE NAME: A-LOG7C.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

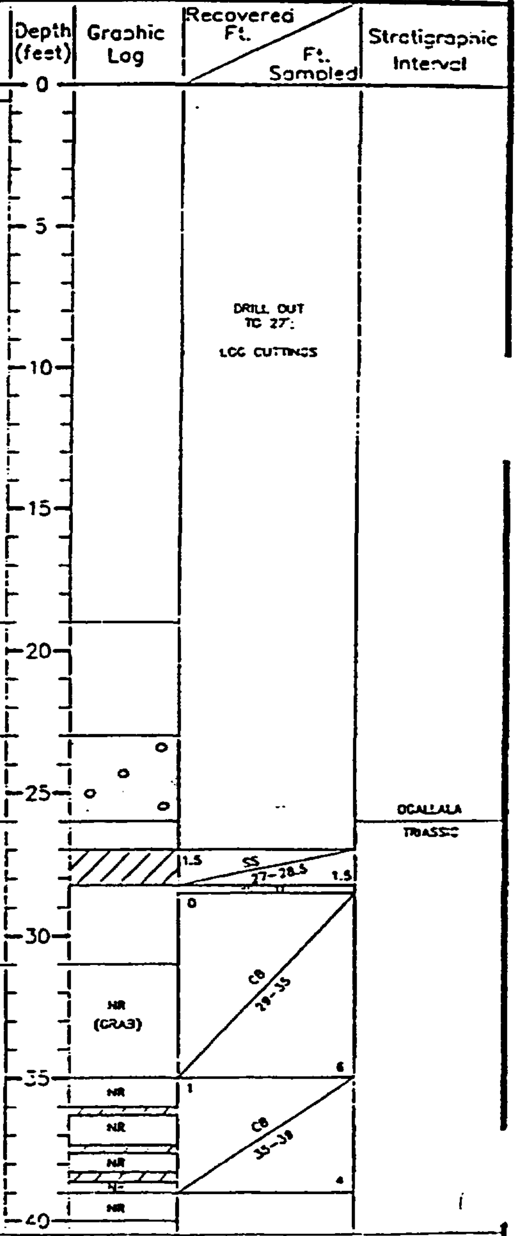
Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 01/18/93
Boring No.: B-43
Grid No.: 7-D

Log By: A. WEEGAR
Drilling Method & Bit Sizes: AIR ROTARY
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL
Driller:
Total Depth: 100'

Survey Data:
Northing: 7197.7520
Easting: 12084.9454
Ground Surface Elev. (MSL): 3,471.23

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0'–0.6'	TOP SOIL: brown; silty sand; organic material; moist.
0.6'–19'	CALICHE: yellowish pink; calcium carbonate; cemented silt and vfg sand; gravel frags.; mod. hard; dry. – hard streaks below 7.5'.
19'–23'	CALICHE: yellowish white; calcium carbonate cemented sand and gravel; sand is fg quartz and feldspar; angular to subrounded; gravel is dark, pink and opaque quartzite and feldspar; angular to subrounded; mod. soft; dry.
23'–26'	Gravelly SAND (SW): pinkish tan; vfg to cg quartz feldspar sand; subrounded to rounded; dark, pink and opaque quartz and feldspar gravel; subrounded to rounded; loose; dry.
26'–31'	Silty CLAY (CL): maroon; silty claystone; blocky fracture; non plastic; dry.
31'–61'	Silty CLAY (CL): dusky red claystone with dendritic mottling of yellow, tan and gray; sl. soapy; blocky fracture; mod. dense; dry



FILE NAME: A-LOG70.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 01/18/93

Boring No.: B-43

Grid No.: 7-D

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 7197.7520
Easting: 12084.9454

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

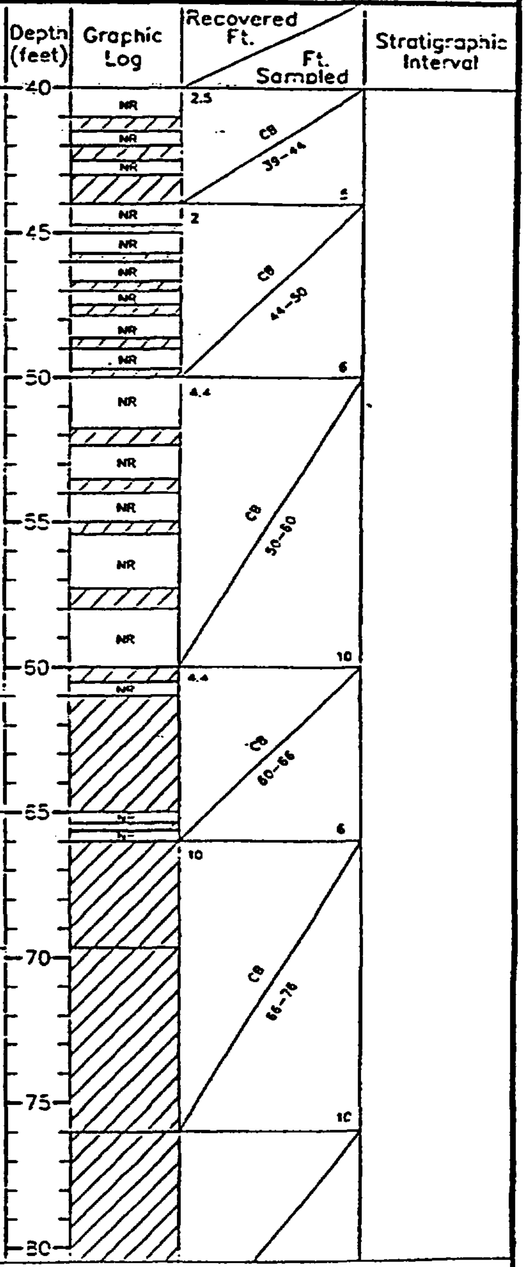
Ground Surface Elev. (MSL): 3,471.23

Driller:

Total Depth: 100'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
	- reduced purple color below 57'; possible vertical fracture with black mineralization along fracture plane at 57'; crumbly to 61'.
61'–65'	<u>Silty CLAY (CL)</u>: rusty red silty claystone with greenish gray inclusions increasing in content toward base; blocky fracture; dry.
65'–69.8'	<u>Silty CLAY (CL)</u>: purplish red with heavy mottling of greenish gray inclusions; crumbly; dry.
69.8'–96'	<u>Very Silty CLAY (CL)</u>: rusty red v. silty claystone with subtle large mottling of yellow; greenish gray layers and inclusions of calcium carbonate rich material (from 71'–76'); trace dark inclusions; blocky fracture; dry.



FILE NAME: A-LOG73.DWG

Terra Dynamics Incorporated

SOIL BORING LO

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 01/18/93

Boring No.: B-43

Grid No. 7-D

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:

Northing: 7197.7520
Easting: 12084.9454

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

Ground Surface Elev. (MSL): 3,471.23

Driller:

Total Depth: 100'

Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

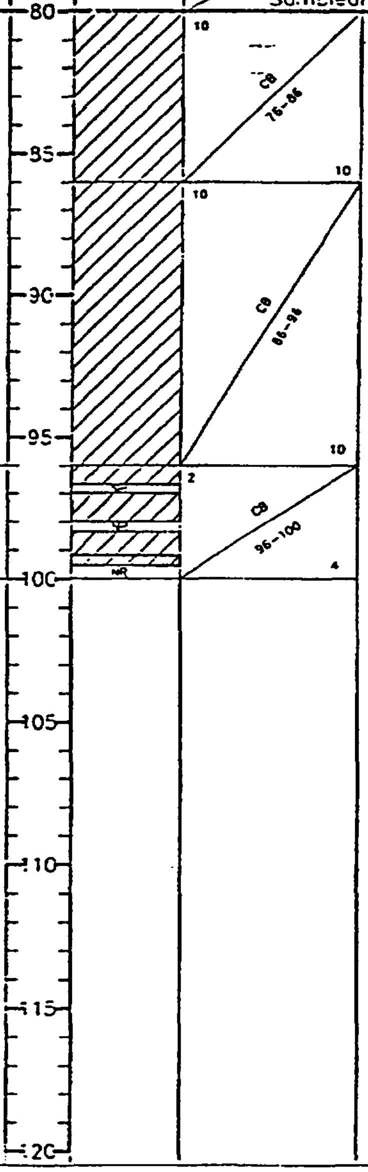
- possible primary slickenside 84'.

- possible primary slickenside 95'.

96'-100' CLAY (CL): purple with maroon mottling; sl. soapy; crumbly; dry.

TOTAL DEPTH = 100'

Depth (feet) | Graphic Log | Recovered Ft. / Ft. Sampled | Stratigraphic Interval



FILE NAME: A-LOG7D.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 11/19 – 11/20/92	Boring No.: B-3	Grid No.: 7-E

Log By: A. WEEGAR

Drilling Method & Bit Sizes:
0'-16' MUD ROTARY
0'-TD AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): 2"SS & 3"CB

Driller: JOHN/LANE SCARBOROUGH

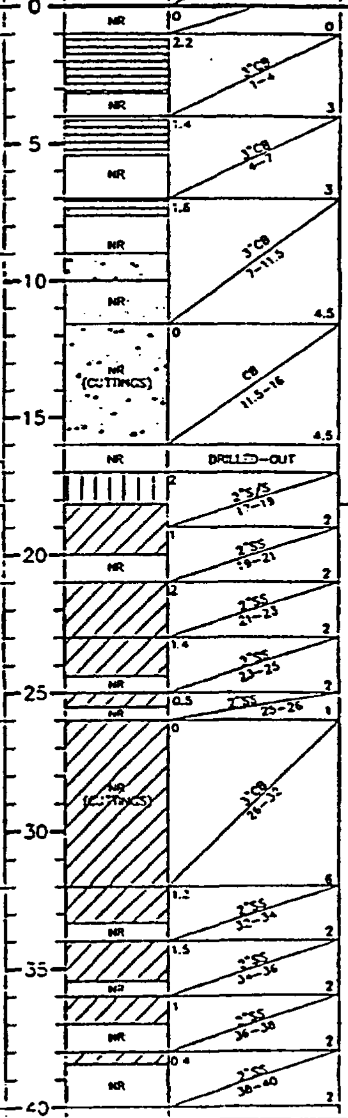
Total Depth: 100' BGL

Survey Date:
Northing: 6744.4660
Easting: 11873.6823
Ground Surface Elev. (MSL): 3,465.56

Remarks: MUD ROTARY BOREHOLE DRILLED ON 1/9/93 NEXT TO ORIGINAL BOREHOLE. LOG IS COMPOSITE OF BOTH BOREHOLES.

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0' – 1'	TOP SOIL
1' – 7'	CALICHE (SM): pinkish white carbonate cemented silt & sand; v. hard; chalky; sand grains are vfg – cg white, pink, opaque and black (granitic).
9' – 16.5'	Silty SAND AND GRAVEL (SM): v. pale brown; vfg – fg sand; white, pink and opaque grains (granitic); silt throughout; carbonate and quartzite gravel throughout; loose; dry. OGALLALA FM.; basal contact based on driller.
16.5' – 18.2'	Clayey SILT (ML): v. pale brown; loose w/ inclusions of caliche & gravel; dry.
18.2' – 20'	Silty CLAY (CL): mottled dk. red, brownish yellow, and occasional inclusions of pale yellow claystone; crumbly; dry.
21' – 26'	CLAY (CL): dusky red claystone; hard; stiff; sl. moist; v. dense; slippery; basal contact based on driller.
26' – 32'	Silty CLAY (CL): reddish brown; crumbly; horizontally oriented dk. frags throughout; dry; basal contact based on driller.
32' – 40'	CLAY (CL): mottled red-brown; hard; firm; v. dense; slippery; basal contact from driller.

Depth (feet) | Graphic Log | Recovered Ft. / Ft. Sampled | Stratigraphic Interval



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FILE NAME: A-LOG7E.DWG

Terra Dynamics Incorporated

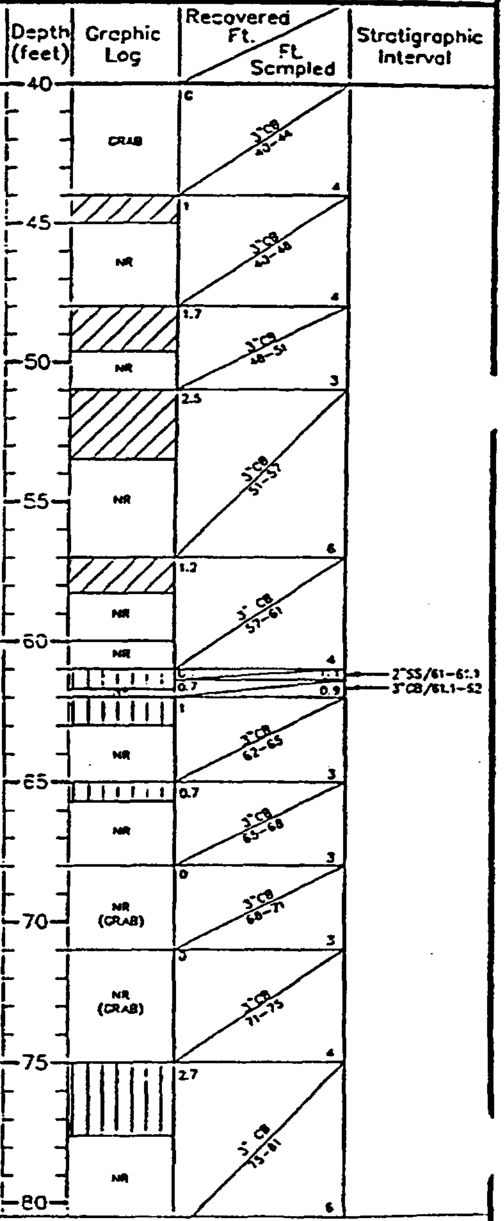
SOIL BORING L

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 11/19 – 11/20/92	Boring No.: B-3	Grid No.: 7-E

Log By: A. WEEGAR	Drilling Method & Bit Sizes: 0'-16' MUD ROTARY 0'-TD AIR ROTARY	Survey Data: Northing: 6744.4660 Easting: 11873.6823 Ground Surface Elev. (MSL): 3,465.56
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS	Sample Method(s): 2"SS & 3"CB	
Driller: JOHN/LANE SCARBOROUGH	Total Depth: 100' BGL	

Remarks: MUD ROTARY BOREHOLE DRILLED IN 1/9/93 NEXT TO ORIGINAL BOREHOLE. LOG IS COMPOSITE OF BOTH BOREHOLES.

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
40' – 60'	Silty CLAY (CL): reddish brown; claystone w/ silt parting and inclusion; dendritic pattern common; silt partings and inclusions are light gray; black carbonated leaf fragment along parting; hard; crumbly; dry; basal contact from driller.
60' – 65.7''	Clayey Silt (ML): gray and red siltstone with yellow claystone laminations; vfg mica frags. within siltstone; silt-sized dark frags. throughout; hard; mod. crumbly; increased clay content toward base; dry.
68' – 74''	Silty CLAY (CL): dusky red and mottled w/ weak red claystone interbedded w/ light reddish brown siltstone; mica frags. throughout siltstone; dk. frags. throughout; crumbly; mod. hard; lighter colors common along dendritic pattern within claystone; dry.
75' – 91.5''	Silty CLAY (CL): dusky red and mottled w/ weak red claystone interbedded w/ light reddish brown siltstone; mica frags. throughout siltstone; dk. grags. throughout; crumbly; mod. hard; lighter colors common along dendritic pattern within claystone; light gray claystone filled tubes below 85'; hard; mod. dense; dry; cross-bedded below 85'.



FILE NAME: A-LOG7E.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 11/19 - 11/20/92

Boring No.: B-3

Grid No.: 7-E

Log By: A. WEEGAR

Drilling Method & Bit Sizes:
0'-16' MUD ROTARY
0'-TD AIR ROTARY

Survey Data:
Northing: 6744.4660
Easting: 11873.6823
Ground Surface Elev. (MSL):
3,465.56

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

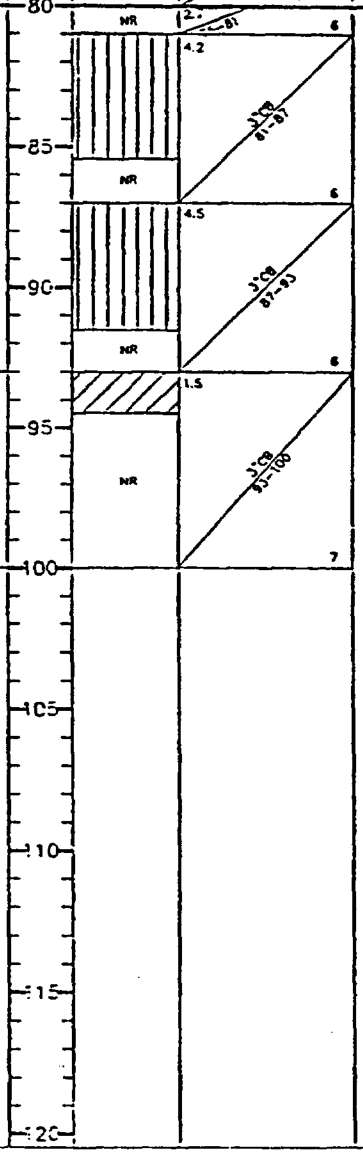
Sample Method(s): 2"SS & 3"CB

Driller: JOHN/LANE SCARBOROUGH

Total Depth: 100' BGL

Remarks: MUD ROTARY BOREHOLE DRILLED ON 1/9/93 NEXT TO ORIGINAL BOREHOLE. LOG IS COMPOSITE OF BOTH BOREHOLES.

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Interval
Silty CLAY (CL): same as above.	80			
93" - 94.5" CLAY (CL): dk. reddish gray claystone; hard; v. dense; dry.				
TOTAL DEPTH AT 100'				



FILE NAME: A-LOG7E.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LO

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 11/20 – 11/22/92

Boring No.: B-4

Grid No.: 7-G

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA TEXAS

Sample Method(s): 2" SS
CONTINUOUS: 2⅛" CB

Driller:

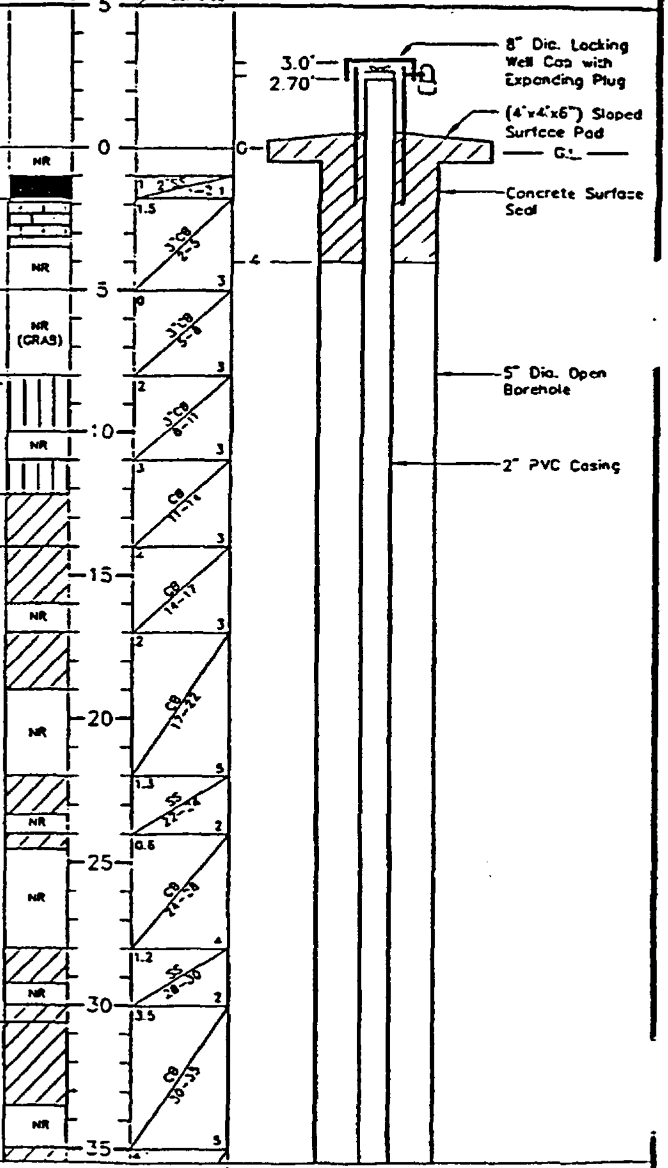
Total Depth: 270' BGL

Survey Data:
Northing: 5838.2525
Easting: 11451.1737
Ground Surface Elev. (MSL): 3,444.17
Top of PVC Casing Elev.: 3,446.21

Remarks: CORE FROM 0'–230' DESCRIBED ON 11/27/92; GEOPHYSICAL LOG HOLE DRILLED ON 1/23/93 20' FROM 7-G CORE HOLE – LOG CUTTINGS FROM 230'–270'

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	
0'–1.5'	TOP SOIL: reddish brown sandy silt; vfg mica frags.; root material; crumbly; dry.
1.9'–3.5'	CALICHE: pinkish white; carb. cemented silt and sand; v. hard; chalky; vfg some grains of white, pink, black & opaque (granitic) material; some quartzite gravel; dry.
5'–8'	CALICHE: reddish brown & pale brown; same as above; dry; basal contact from driller.
BASE OF OGALLALA – TRIASSIC TOP	
8'–12.2'	Clayey SILT (ML): laminated pink siltstone and weak red claystone; dk. silt frags. throughout; crumbly; dry.
12.2'–14'	Silty CLAY (CL): weak red claystone; with siltstone along partings and as inclusions; mod. dense; sl. crumbly; hard; sl. slippery.
14'–30.7'	Silty CLAY (CL): mottled reddish brown and white claystone; contorted and dendritic; siltstone as partings and inclusions; hard; dense; dry.
30.7' – 51.8'	Silty CLAY (CL): weak red and pale red mottled siltstone; trace vfg mica frags.; carbonized leaf frags.; hard; mod. crumbly; blocky; soapy; dry.

Lithic Log | Depth (feet) | Recovered Ft. / Ft. Sampled | Well Design



FILE NAME: A-LOG7GA.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 11/20 - 11/22/92

Boring No.: B-4

Grid No.: 7-G

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

Sample Method(s): 2" SS CONTINUOUS: 2½" CS

Driller:

Total Depth: 270' BGL

Survey Data:
Northing: 5838.2625
Easting: 11451.1737
Ground Surface Elev. (MSL): 3,444.17
Top of PVC Casing Elev.: 3,446.21

Remarks: CORE FROM 0'-230' DESCRIBED ON 11/27/92; GEOPHYSICAL LOG HOLE DRILLED ON 1/23/93 20' FROM 7-G CORE HOLE - LOG CUTTINGS FROM 230'-270'

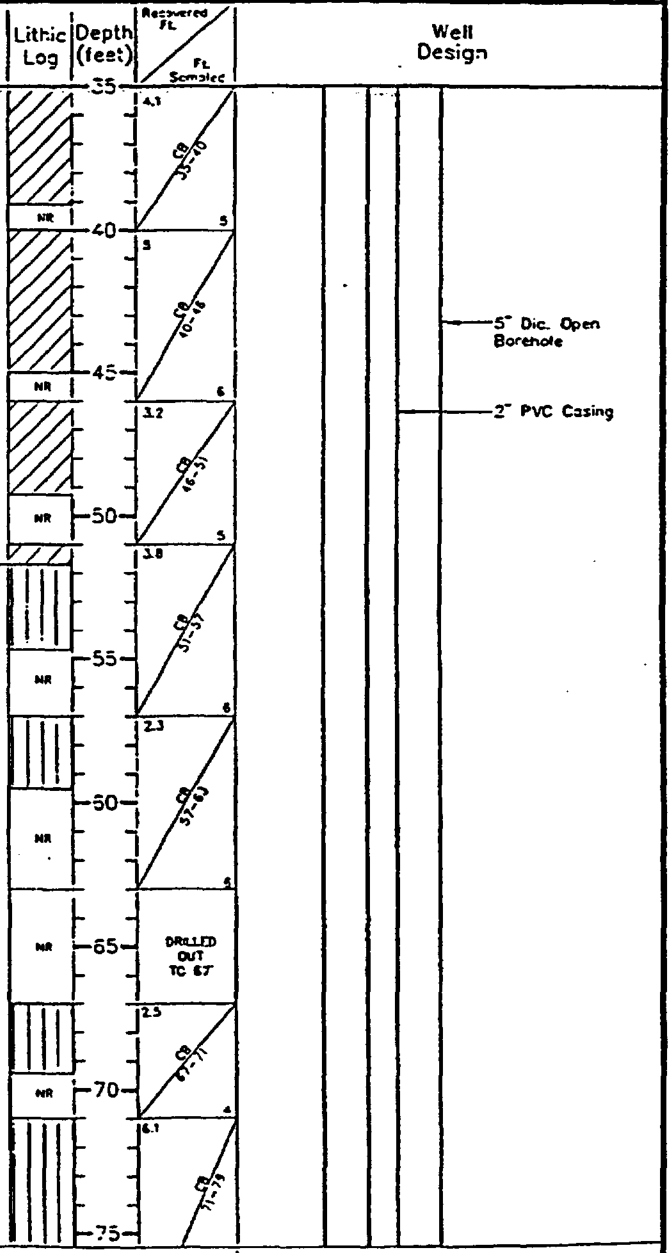
Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

Silty CLAY (CL): same description as previous page.

dk reddish gray (purple) below 46' w/dendritic pattern and inclusions of brownish yellow

51.8'-77' Clayey SILT (ML): light gray siltstone; laminated and cross-laminated w/ weak red; vfg mica frags.; mod. dense; hard; concoidal fracture to blocky and sl. fissile; dry.

sandy below 67'; vfg sand along cross-laminated partings; vfg - fg mica frags; carb. plant remains and frags.



FILE NAME: A-LOG7GA.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 11/20 - 11/22/92	Boring No.: B-4	Grid No.: 7-G

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): 2" SS
CONTINUOUS: 2½" CB

Driller:

Total Depth: 270' BGL

Survey Data:
Northing: 5838.2625
Easting: 11451.1737
Ground Surface Elev. (MSL): 3,444.17
Top of PVC Casing Elev.: 3,446.21

Remarks: CORE FROM 0'-230'
DESCRIBED ON 11/27/92; GEOPHYSICAL LOG HOLE DRILLED ON 1/23/93 20' FROM 7-G CORE HOLE - LOG CUTTINGS FROM 230'-270'

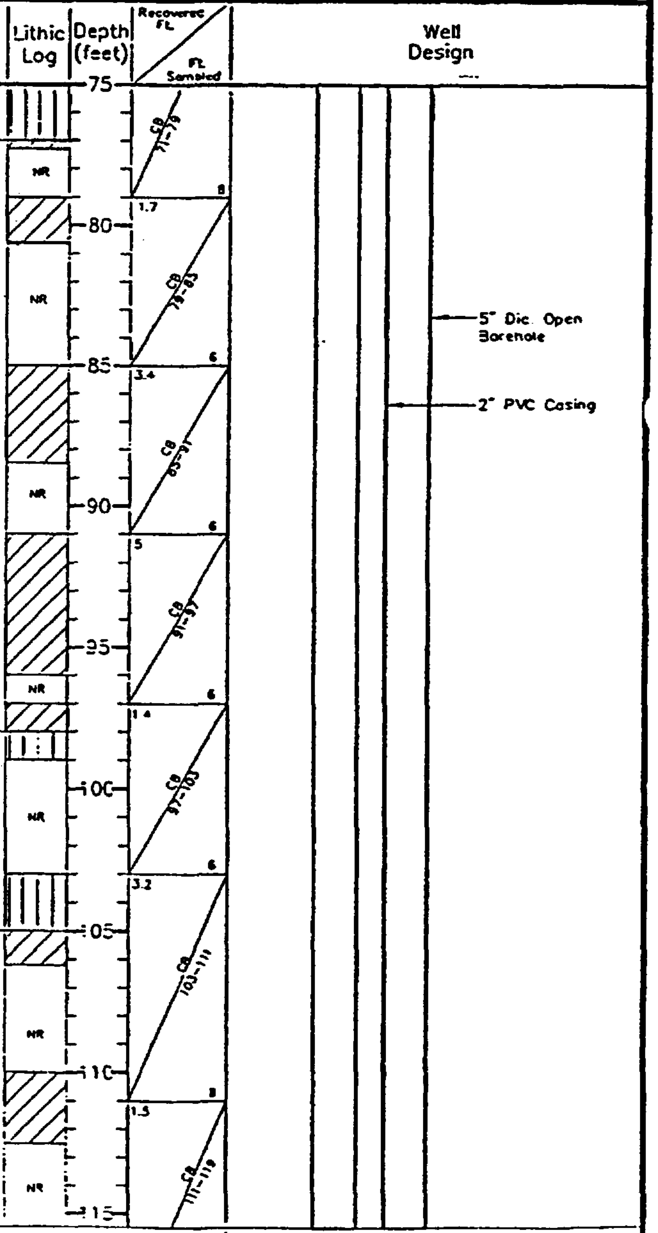
Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

<u></u>Clayey SILT (ML): same as previous page.

77'-98' Silty CLAY (CL): reddish brown; mod. hard; silty laminations w/vfg mica frags; sl. fissile; sl. crumbly, soapy; dry.

98'-105' Clayey SILT (ML): reddish brown and greyish brown siltstone; dendritic and mottled coloration pattern; vfg mica and dk. min. frags. throughout; hard; crumbly, dry, color change to light gray below 103'

105'-171' Silty CLAY (CL): dk. reddish grey siltstone w/light gray mottling and colored tubes; crumbly, mod. dense; mod. hard; soapy, dry.



FILE NAME: A-LOG7GA.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 11/20 - 11/22/92	Boring No.: B-4	Grid No.: 7-G

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

Sample Method(s): 2" SS

CONTINUOUS: 2½" CB

Driller:

Total Depth: 270' BGL

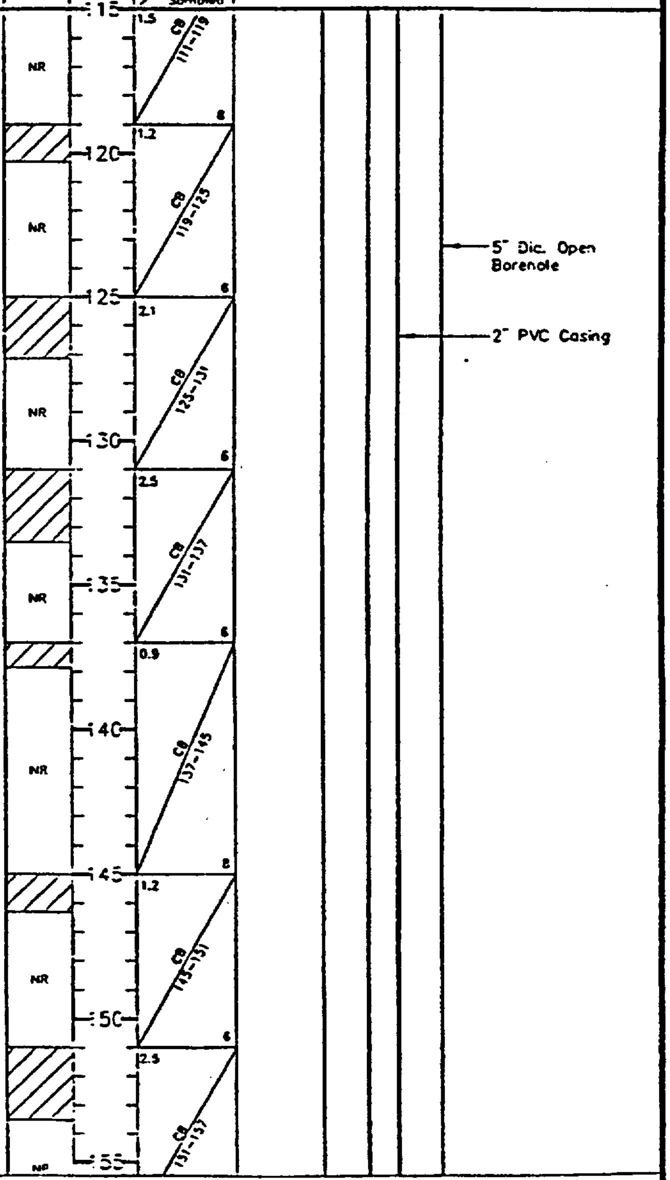
Survey Data:
Northing: 5838.2525
Easting: 11451.1737

Ground Surface Elev. (MSL): 3,444.17

Top of PVC Casing Elev.: 3,446.21

Remarks: CORE FROM 0'-230' DESCRIBED ON 11/27/92; GEOPHYSICAL LOG HOLE DRILLED ON 1/23/93 20' FROM 7-G CORE HOLE - LOG CUTTINGS FROM 230'-270'

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Lithic Log	Depth (feet)	Recovered Ft. / Ft. Sampled	Well Design
Silty CLAY (CL): same as previous page.				



FILE NAME A-LOG7G.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOC

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 11/20 - 11/22/92

Boring No.: B-4

Grid No.: 7-G

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 5838.2625
Easting: 11451.1737

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): 2" SS
CONTINUOUS: 2½" CB

Ground Surface Elev. (MSL): 3,444.17

Driller:

Total Depth: 270' BGL

Top of PVC Casing Elev.: 3,446.21

Remarks: CORE FROM 0'-230'
DESCRIBED ON 11/27/92; GEOPHYSICAL LOG HOLE DRILLED ON
1/23/93 20' FROM 7-G CORE HOLE - LOG CUTTINGS FROM 230'270'

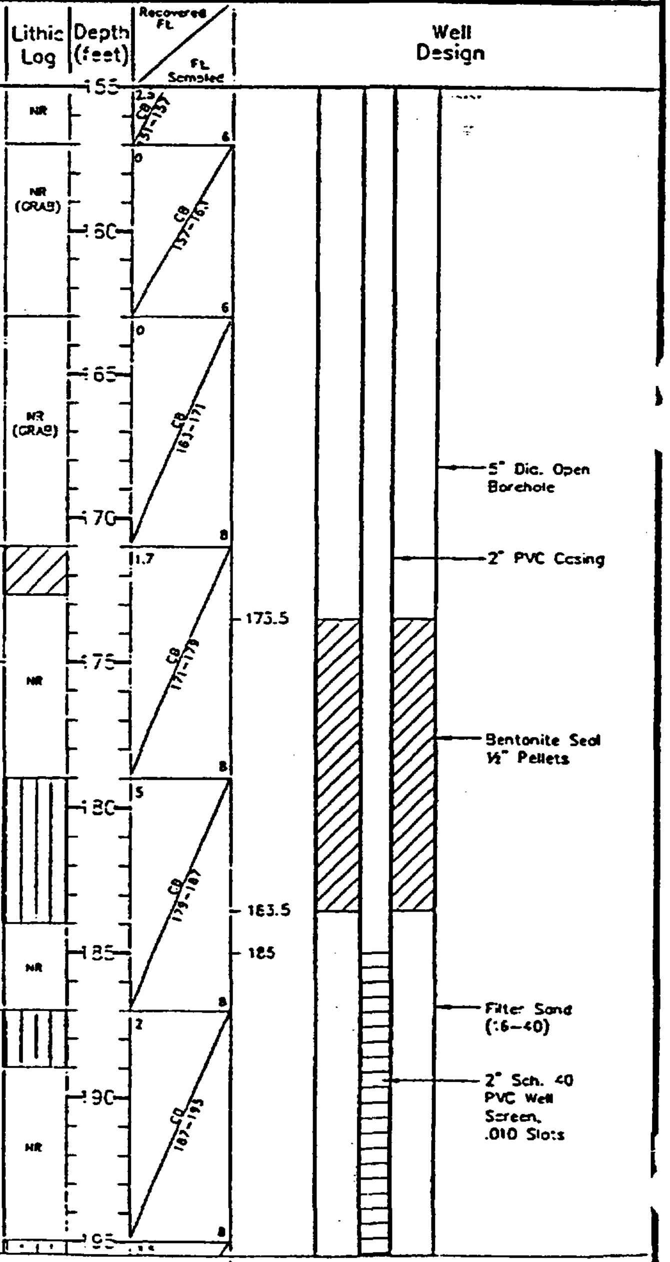
Unified Soil Classification/Description
(Color, Texture, Structure, Grain Size)

<u>Silty CLAY (CL)</u>: same as previous page.

171'-175' <u>Silty CLAY (CL)</u>: mottled and dendritic light olive brown, grayish brown and weak red; crumbly; soapy; dry.

175'-187' <u>Clayey SILT (ML)</u>: reddish brown with tubes, mottling and laminations of light gray; concoidal fracture to crumbly; mod. hard; mod. dense; sl soapy; dry.

187'-203.5' <u>Sandy Clayey SILT (ML)</u>: grading from dk reddish brown to light gray below 191; hard; blocky fracture; cross-laminated; vfg sand frags throughout; moist.



FILE NAME: A-LOG7GA.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 11/20 - 11/22/92

Boring No.: B-4

Grid No.: 7-G

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 5838.2625
Easting: 11451.1737

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): 2" SS
CONTINUOUS: 2⅛" CB

Ground Surface Elev. (MSL): 3,444.17

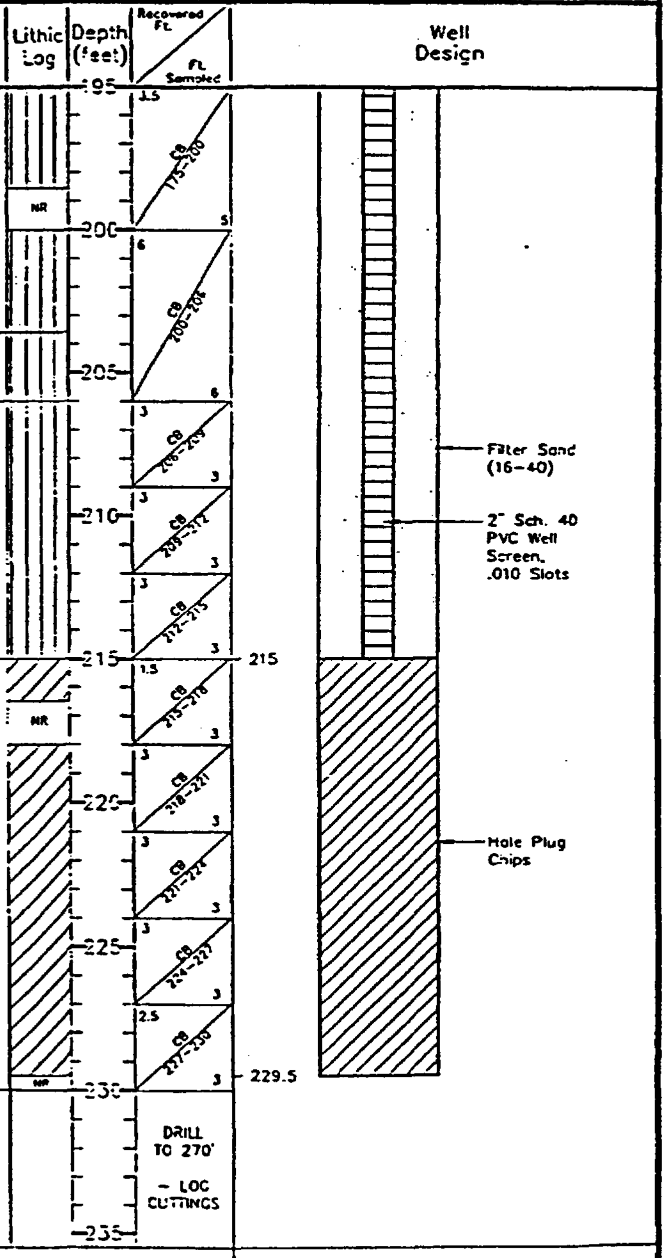
Driller:

Total Depth: 270' BGL

Top of PVC Casing Elev.: 3,446.21

Remarks: CORE FROM 0'-230'
DESCRIBED ON 11/27/92; GEOPHYSICAL LOG HOLE DRILLED ON
1/23/93 20' FROM 7-G CORE HOLE - LOG CUTTINGS FROM 230'-270'

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	
	Sandy Clayey SILT (ML): same as previous page
203.5'-206'	Clayey Silt (ML): red siltstone; mod. hard; crumbly; laminated; vfg mica and dk. min. frags.; dry.
206'-215'	Sandy SILT (ML): light gray siltstone; hard; blocky fracture; cross laminated; vfg sand; vfg pink & dk. min. frags.; moist.
215'-230'	Silty CLAY (CL): red claystone; mod. hard; crumbly; blocky to concoidal fracture; sl. soapy, dry. color change to dusky red below 221'.
230'-250'	Clay (CL): maroon claystone, sl. soapy, crumbly, dry.



FILE NAME: A-LOG7GA.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 11/20 - 11/22/92
Boring No.: B-4
Grid No.: 7-G

Log By: A. WEEGAR
Drilling Method & Bit Sizes: AIR ROTARY
Survey Data:
Northing: 5838.2625
Easting: 11451.1737
Ground Surface Elev. (MSL): 3,444.17
Top of PVC Casing Elev.: 3,446.21

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): 2" SS
CONTINUOUS: 2½" CB

Driller:
Total Depth: 270' BGL

Remarks: CORE FROM 0'-230' DESCRIBED ON 11/27/92: GEOPHYSICAL LOG HOLE DRILLED ON 1/23/93 20' FROM 7-G CORE HOLE - LOG CUTTINGS FROM 230'270'.

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Lithic Log	Depth (feet)	Recovered Ft / Ft Sampled	Well Design
<u>CLAY (CL)</u>: maroon claystone; sl. soapy, crumbly, dry.		235		
		240		
Heavy mottled w/ greenish gray, purple, mustard yellow.		245		
250'-265' <u>SILTY CLAY (CL)</u>: maroon silty claystone w/ heavy mottling of greenish gray, purple and mustard yellow; brittle and crumbly, dry.		250		
- less silt below 255'.		255		
		260		
265'-270' <u>CLAY (CL)</u>: maroon claystone w/ mottling of greenish gray and mustard yellow; soapy, crumbly, dry.		265		
TOTAL DEPTH = 270'		270		
		275		

FILE NAME: A-LOG7GA.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/18/92

Boring No.: B-23

Grid No.: 7-I

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

Sample Method(s): 2" SS, 3" CB

Driller: JOHN SCARBOROUGH

Total Depth: 101'

Survey Data:
Northing: 4932.0522
Easting: 11028.4705
Ground Surface Elev. (MSL): 3,429.13
--

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Intervals
0' - 2'	TOP SOIL: brown silty sand; organic; moist.	0			
2' - 23'	CALICHE: pink; calc. carb. cemented silt with sand and gravel; gradual increase in gravel content with depth; soft; dry.	5 10 15 20		DRILL OUT; LOG CUTTINGS	
23' - 25'	CALICHE: grayish white; gravel frags. throughout; hard; dry.				
25' - 37'	Silty Gravelly SAND (GM): pink and tan; vfg qtz sand and silty sand with red, pink, black and opaque quartzite gravel; sand and gravel is subrounded to well rounded; loose; dry.	25 30 35			OGALLALA
37' - 54'	CLAY (CL): dk brownish red; mod. hard; sl soapy; blocky fracture; moist; basal contact from cuttings	40	▨	1.3 / SS 37-39 / 2 1.8 / SS 39-41 / 2	TRIASSIC

FILE NAME A-LOG71.DWG

Terra Dynamics Incorporated

SOIL BORING LO

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/18/92

Boring No.: B-23

Grid No 7-1

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 4932.0522
Easting: 11028.4705

Ground Surface Elev. (MSL):
3,429.13

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): 2" SS, 3" CB

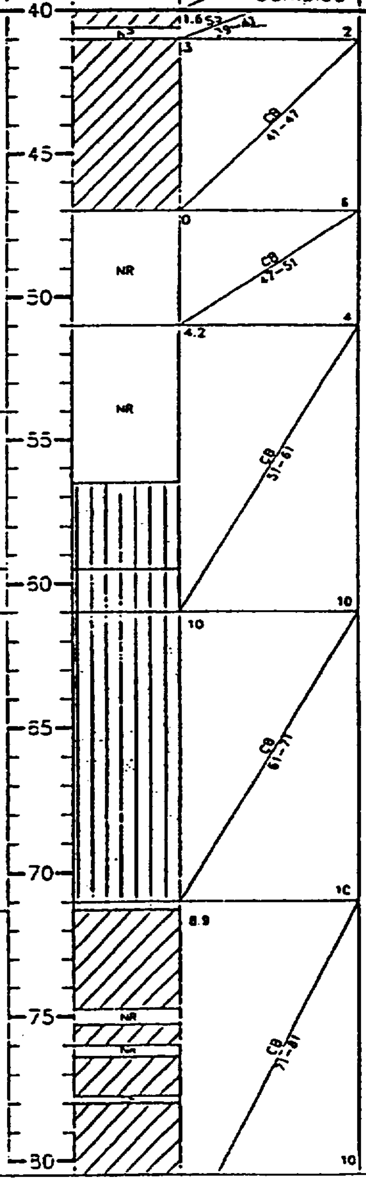
Driller: JOHN SCARBOROUGH

Total Depth: 101'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
54' - 59.5'	Sandy Clayey SILT (ML): light greenish gray clayey siltstone with sand throughout; sand is vfg qtz; mica and biotite flakes throughout; small low-angle cross-bedding; thin interbeds of clay and rounded clay nodules; increased clay content toward base; mod. hard; chalky; blocky fracture; dry.
59.5' - 61'	Clayey SILT (ML): cross-bedded light greenish gray and dusky red clayey siltstone grading into dusky red clayey siltstone; trace small mica frags.; mod. hard; blocky fracture; dry.
61' - 71.2'	Silty SAND (SM): speckled appearance with white, olive and opaque vfg sand grains in greenish gray yellow and white silty matrix; calc. carb. cemented silty sandstone; small biotite and med. mica flakes throughout; low angle cross-bedding w/gray and dusky red silty clay rip-up clasts and layers throughout; mod. hard; dusty; blocky fracture; dry.
71.2' - 101'	Silty CLAY (CL): interbedded dusky red claystone and clayey siltstone; mica frags. within siltstone intervals; increasing clay content toward base; greenish gray infilled tubes and inclusions throughout; mod. hard; sl. soapy; blocky fracture with crumbly zones; dry.

Depth (feet) | Graphic Log | Recovered Ft. / Ft. Sampled | Stratigraphic Intervals



FILE NAME: A-LOG7I.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/18/92

Boring No.: B-23

Grid No.: 7-!

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 4932.0522
Easting: 11028.4705
Ground Surface Elev. (MSL):
3,429.13

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

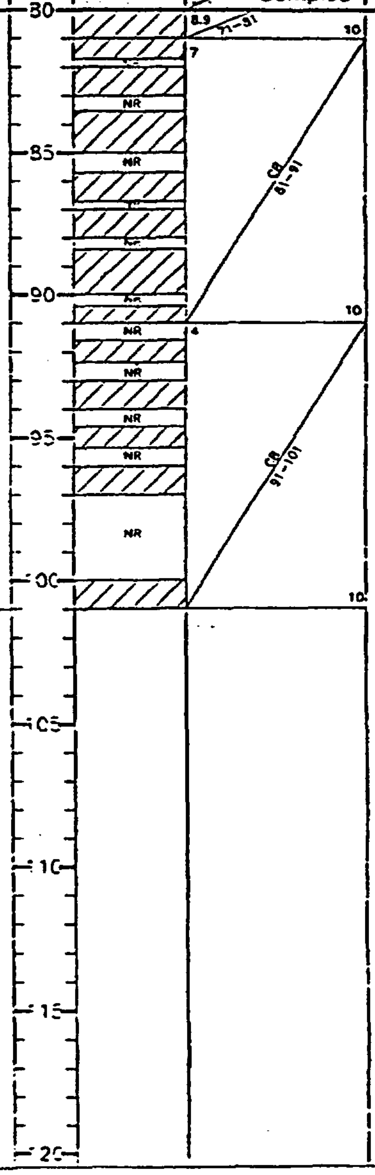
Sample Method(s): 2" SS, 3" CB

Driller: JOHN SCARBOROUGH

Total Depth: 101'

Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Intervals
<u>Silty CLAY (CL)</u>: same as above. TOTAL DEPTH = 101'				



FILE NAME: A-LOG71.DWG

Terra Dynamics Incorporated	**SOIL BORING L**

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 01/23/93
Boring No.: B-49
Grid N 8-B

Log By: R.McGOWEN
Drilling Method & Bit Sizes: AIR ROTARY
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL
Driller:
Total Depth: 100'

Survey Data:
Northing: 8315.3752
Easting: 12054.4457
Ground Surface Elev. (MSL): 3,481.91

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Interval
0'-0.8'	TOP SOIL: dk. brown, silt and sand, with organic material, loose, dry.	0		DRILL OUT TO 44'; LOG CUTTINGS	
0.8-6.0'	CALICHE: lt. tan-calcitic cemented sand and silt, vfg-fg quartz sand, soft, dry.	5			
6.0-29'	Silty SAND (SM): reddish-tan, sand and silt, vfg quartz feldspar sand; loose; dry. - caliche cementing scattered 12'-28' - chert frags-pebblesized scattered 23'-26'	10 15 20 25			
29'-36'	CALICHE: calcitic and micritic cemented sand and silt, concretion rings in micrite, sandstone lithoclasts in micritic matrix, sandstone lithclasts have silica concretions, lt. gray, to tan, hard, dry.	30 35			
36'-42.5'	SAND and GRAVEL (SW): lt. red brown, fg quartz sand, quartz pebbles rounded to subrounded to angular, soft, dry	40			

FILE NAME: A-LOG3B.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 01/23/93
Boring No.: B-49
Grid No.: 8-B

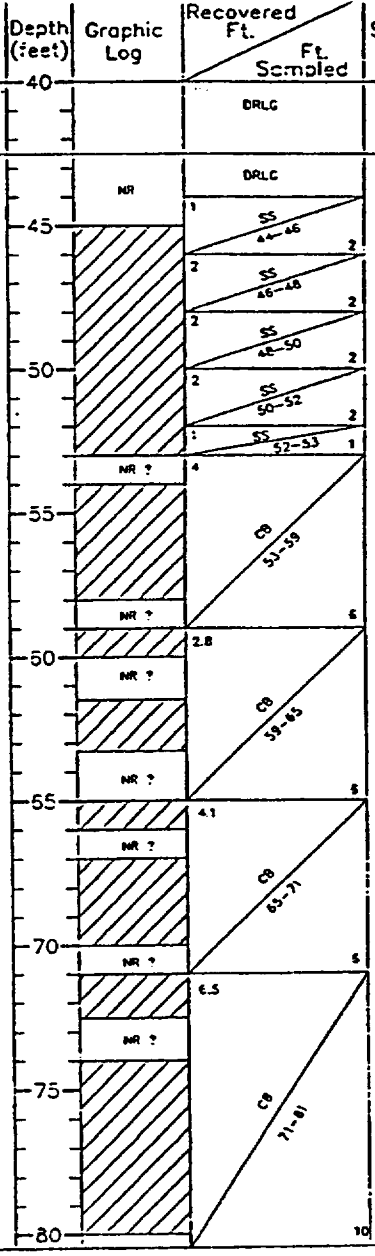
Log By: R. McGOWEN
Drilling Method & Bit Sizes: AIR ROTARY
Survey Date:
Northing: 8315.3752
Easting: 12054.4457
Ground Surface Elev. (MSL): 3,481.91

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller:
Total Depth: 100'

Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)



Stratigraphic Interval

SAND and GRAVEL (SW): same as above.

OGALLALA

TRIASSIC

42.5'-100'

CLAY (CL): red with yellow mottling; dry, plastic.

- purple, red and yellow mottling; 48'-50'
- brittle; dry.
- increase in purple coloring brittle; dry.
- orange red color with red, yellow, greenish-white and purple mottling. appears to have mixed clay clasts
- orange red, red, yellow, purple mottled without clasts; brittle; dry.

FILE NAME A-LOG83.DWG

Terra Dynamics Incorporated

SOIL BORING LC

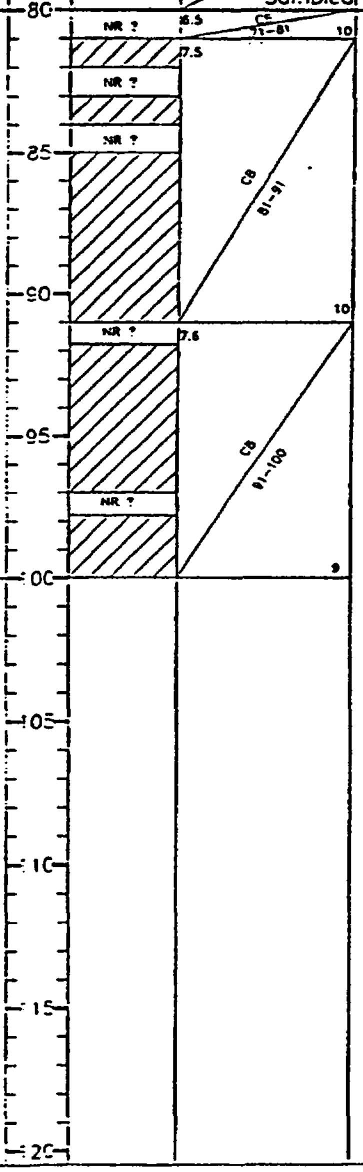
Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 01/23/93
Boring No.: B-49
Grid No.: 8-3

Log By: R. McGOWEN
Drilling Method & Bit Sizes: AIR ROTARY
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL
Driller:
Total Depth: 100'

Survey Data:
Northing: 8315.3752
Easting: 12054.4457
Ground Surface Elev. (MSL): 3,481.91

Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Interval
- vertically oriented fracs at approx. 84'-85'.				
TOTAL DEPTH = 100' - healed fracture oriented 60° from vertical at approx. 99'.				



FILE NAME: A-LOG83.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 01/13/93

Boring No.: B-37

Grid No.: 8-C

Log By: A. WEEGAR/R. McGOWEN

Drilling Method & Bit Sizes: AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

Sample Method(s): CORE BARREL; SPLIT SPOON

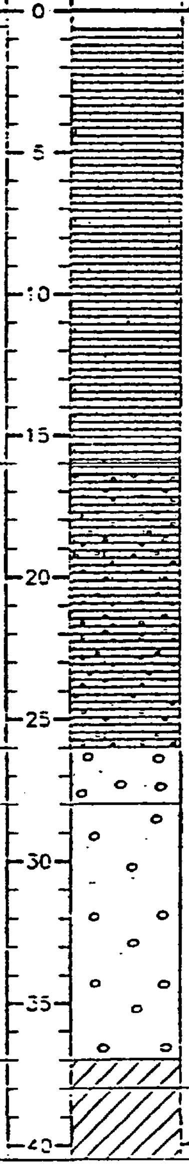
Driller:

Total Depth: 101'

Remarks:

Survey Data:
Northing: 7862.1723
Easting: 11843.1039
Ground Surface Elev. (MSL): 3,477.37

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0'–0.5'	TOP SOIL: sandy silt; organic material; brown.
0.5'–16'	CALICHE: white to lt. tan calcite cemented sand and silt; vfg qtz. sand; with lithoclasts of sandstone in calcite matrix; soft drilling.
16'–26'	CALICHE: gray to tan, micritic and calcitic cemented sand; silt to occasional gravel sandstone lithoclasts with silica concretions around them; lithoclasts cemented with probable dolomite; quartz and feldspar sand and pebbles; silica chips (concoidal).
26'–28'	SAND and GRAVEL (SW): river pea gravel with whitish sand and silt; graded; angular to rounded.
28'–37'	SAND and GRAVEL (SW): river pea gravel with reddish sand and silt; graded; angular to rounded.
37'–61'	CLAY (CL): red clay with sand size calcite inclusions; soft; moist.



Recovered Ft. / Ft. Sampled

DRILLED OUT WITH ROCK BIT TO 38'
–LOG CUTTINGS

2 SS 38–40 2

Stratigraphic Intervals

OGALLALA
TRIASSIC

FILE NAME: A-LOGBC.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 01/13/93

Boring No.: B-37

Grid No.: 8-C

Log By: A. WEEGAR/R. McGOWEN

Drilling Method & Bit Sizes: AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

Sample Method(s): CORE BARREL; SPLIT SPOON

Driller:

Total Depth: 101'

Survey Data
Northing: 7862.1723
Easting: 11843.1039
Ground Surface Elev. (MSL): 3,477.37

Remarks:

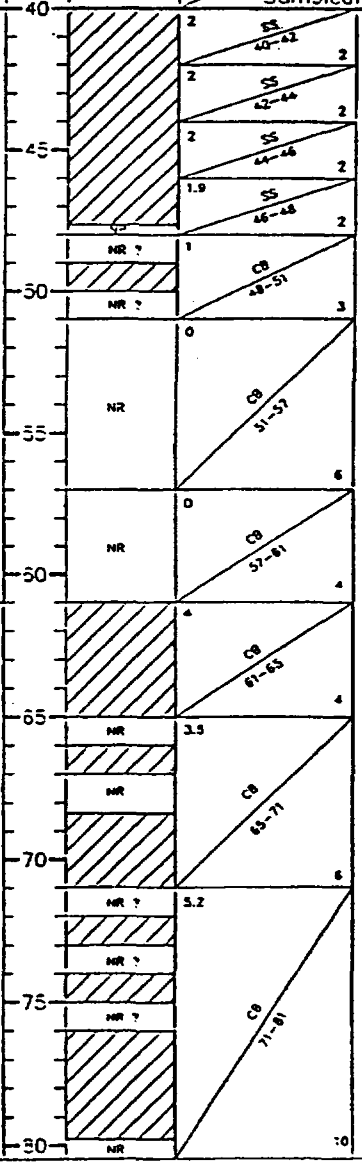
Unified Soil Classification/Description (Color, Texture, Structure, Grain Size) | Depth (feet) | Graphic Log | Recovered Ft. / Ft. Sampled | Stratigraphic Intervals

- yellow mottling bottom 0.3' (41.7-42); less moist.
- gray/green clay nodules at 45' approx. 0.15'.

61'-81'

CLAY (CL): yellowish pink, mottled green, yellow, red and gray clay; dry; brittle; almost talcish.

- red clay with slight yellow mottling; soft plastic; moist.
- reddish orange with yellow mottling and gray/green nodules of clay gradually drying out, over dry (1.6' above base of recovery).
- "poker chip" clay with mica flakes



FILE NAME: A-LOGBC.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

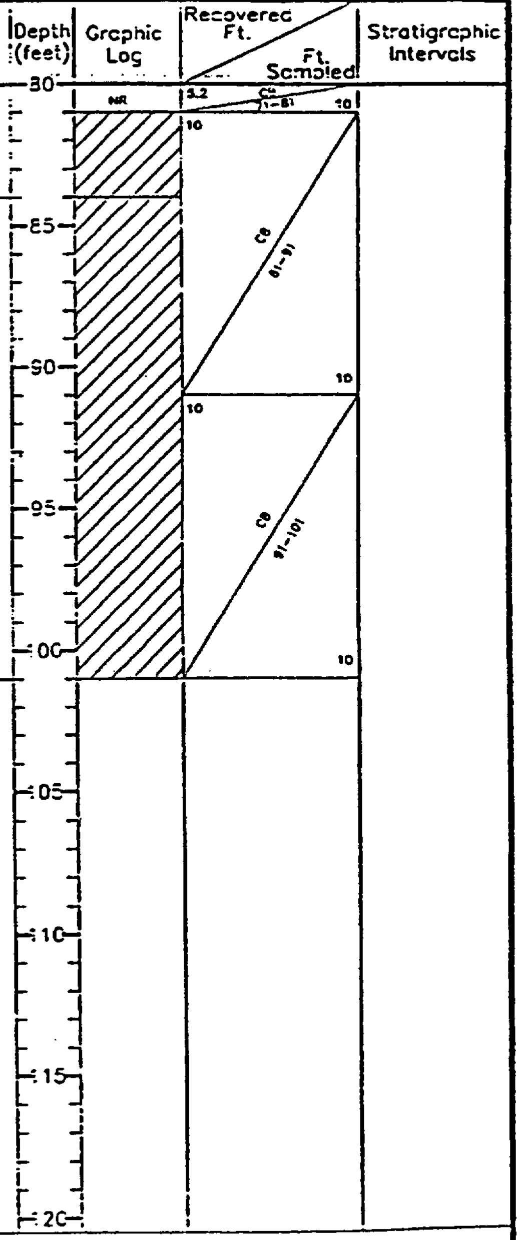
Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 01/13/93
Boring No.: B-37
Grid No.: 8-C

Log By: A. WEEGAR/R. McGOWEN
Drilling Method & Bit Sizes: AIR ROTARY
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): CORE BARREL; SPLIT SPOON
Driller:
Total Depth: 101'

Survey Data
Northing: 7862.1723
Easting: 11843.1039
Ground Surface Elev. (MSL): 3,477.37

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
81'-84'	SILTY CLAY (CL): red clay interbedded with whitish green siltstone.
84'-91'	CLAY (CL): red-orange with green clay nodules scattered; brittle with mica flakes.
TOTAL DEPTH = 101'	



FILE NAME: A-LOG8C.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 12/14-15/92	Boring No.: B-18	Grid No.: 8-D

Log By: A. WEEGAR

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Driller: LANE SCARBOROUGH

Drilling Method & Bit Sizes: AIR ROTARY

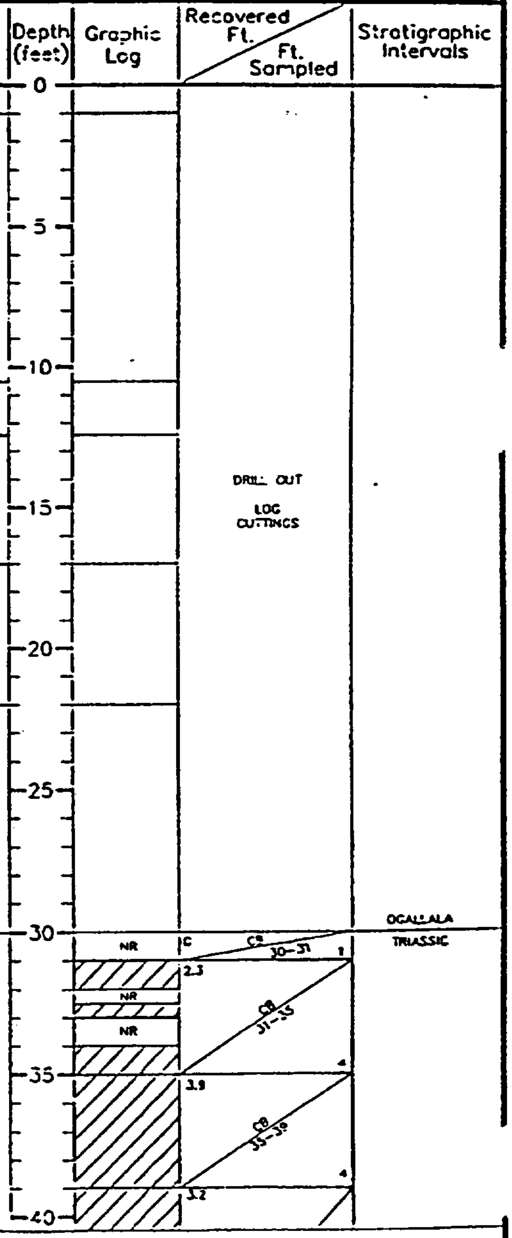
Sample Method(s): CORE BARREL

Total Depth: 100'

Survey Data:
Northing: 7409.0953
Easting: 11631.7184
Ground Surface Elev. (MSL):
3,471.98

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0' - 1'	TOP SOIL: brown silty sand; organic plant material; dry.
1' - 10.5'	CALICHE: pinkish white and greyish tan; calcium carbonate cemented; microcrystalline; v. hard; dry.
10.5' - 12.25'	CALICHE: pinkish white; mod. soft; dry.
12.25' - 17'	CALICHE: pinkish white and greyish tan calcium carbonate cemented; microcrystalline; v. hard; dry.
17' - 22'	CALICHE: light pink calc carb. cemented gravel; white; red, and dk. tan gravel; subrounded to rounded; mod hard; dry.
22' - 30'	Gravelly SAND (SW): pinkish tan; fg - cg qtz. sand; well rounded; subrounded to well rounded quartzite gravel; white, tan, pink and dk. clasts; loose; dry; basal contact with driller.
30' - 45'	CLAY (CL): mottled dusky red, yellow, purple and light gray clay; mod hard; sl. plastic; dense; moist - inceased purple coloration below 35'.



FILE NAME: A-LOG2D.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/14-15/92

Boring No.: B-18

Grid No.: 8-D

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 7409.0953
Easting: 1631.7184
Ground Surface Elev. (MSL):
3,471.98

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): CORE BARREL

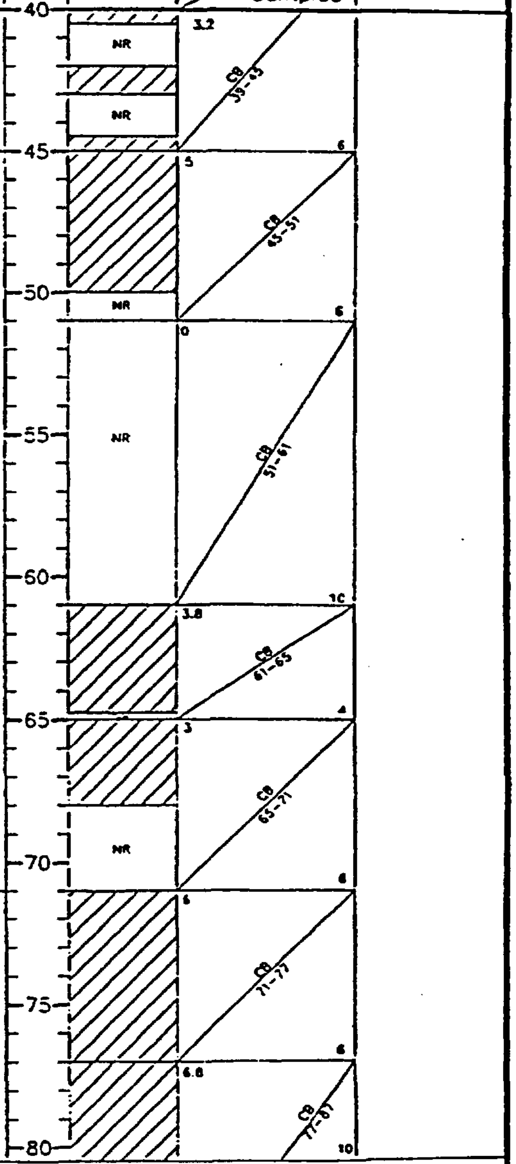
Driller: LANE SCARBOROUGH

Total Depth: 100'

Remarks:

Unified Soil Classification/Description
(Color, Texture, Structure, Grain Size)

Depth (feet) | Graphic Log | Recovered Ft. / Ft. Sampled | Stratigraphic Intervals



<u>CLAY (CL)</u>: maroon clay with slight mottling of light gray and purple; mod. hard; sl. plastic; dense; moist.

45' - 71'' <u>Slightly Silty CLAY (CL)</u>: heavily mottled dusky red, maroon, purple, yellow and gray; hard; blocky fracture; dry with occasional zones of dense, moist clay.

- switched out bits; used pilot bit.

- primarily dusky red with slight gray, tan and purple mottling.

71''-100' <u>Silty CLAY (CL)</u>: mottled dusky red, light gray and purple; trace mica frags.; hard; sl. crumbly; blocky fracture; dry.

FILE NAME: A-LOGBD.DWG

Terra Dynamics Incorporated

SOIL BORING LO

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 12/14-15/92
Boring No.: B-18
Grid No.: 8-D

Log By: A. WEEGAR
Drilling Method & Bit Sizes: AIR ROTARY
Survey Data:
Northing: 7409.0953
Easting: 11631.7184
Ground Surface Elev. (MSL): 3,471.98

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): CORE BARREL

Driller: LANE SCARBOROUGH
Total Depth: 100'

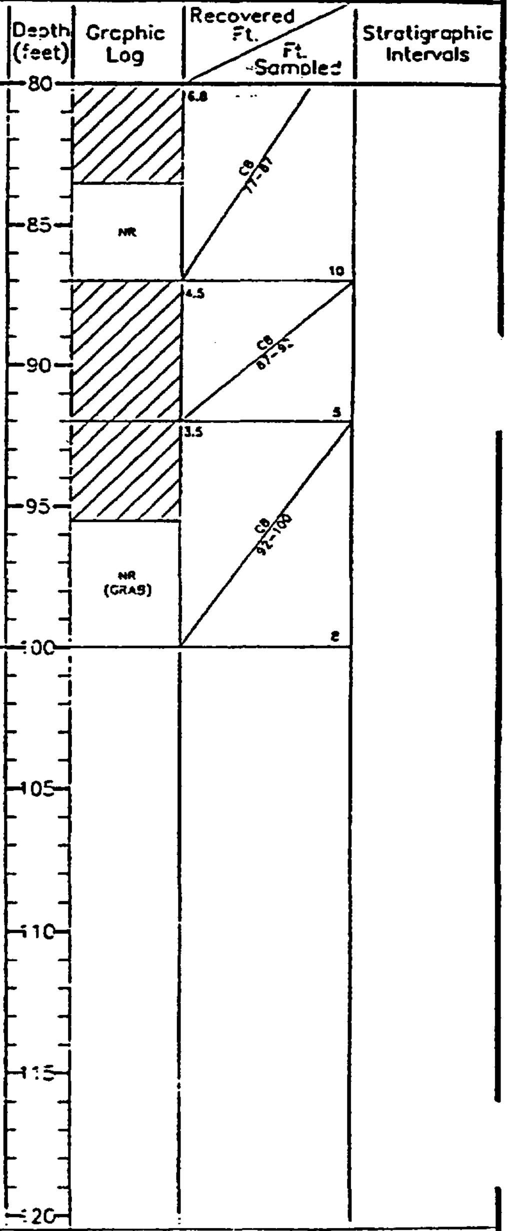
Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

Silty CLAY (CL): same as above.

- becoming increasingly crumbly below 92'

TOTAL DEPTH = 100'



FILE NAME: A-LOG8D.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/20/92

Boring No.: B-32

Grid No.: 8-E

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 6955.8008
Easting: 11420.4446
Ground Surface Elev. (MSL): 3,465.58

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

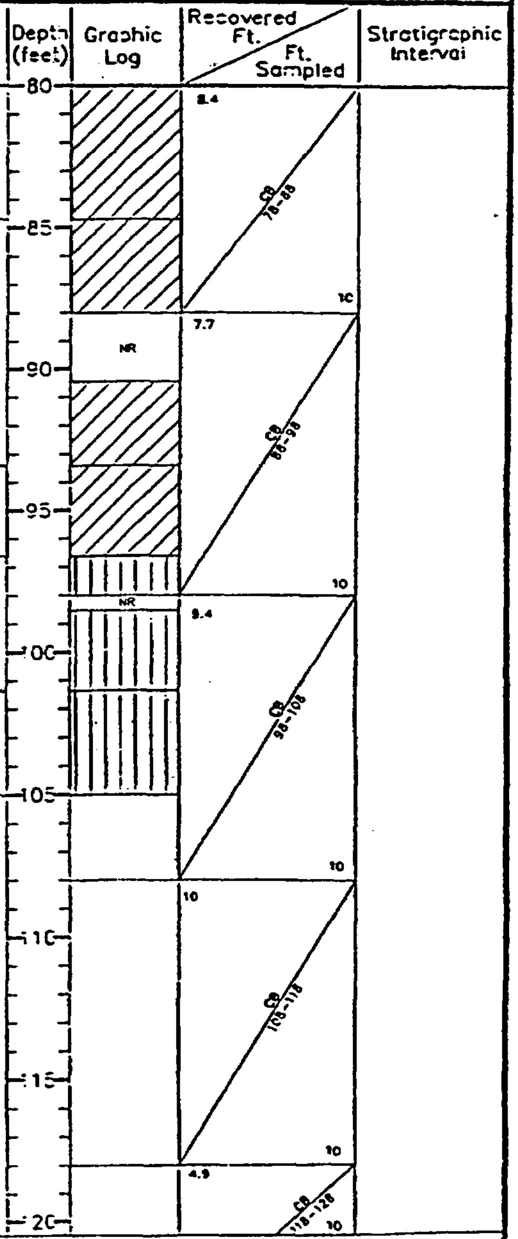
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller: LANE SCARBOROUGH

Total Depth: 134'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
84.9'–93.4'	<u>CLAY (CL)</u>: dark maroon claystone with mottling of pinkish gray and tubes of greenish gray; hard; sl. soapy; blocky fracture; dry.
93.4'–96.8'	<u>CLAY (CL)</u>: purple/grey with mottling of pinkish tan; crumbly; dry.
96.8'–101.4'	<u>Clayey SILTSTONE (ML)</u>: greenish grey clayey siltstone with dk. maroon claystone inclusions and thin layers; blocky and platey fracture; hard; sl. moist.
101.4'–105'	<u>Sandy SILT (ML)</u>: interbedded greenish grey siltstone and dusky red and pinkish yellow silty sandstone; sand is vfg quartz with vfg mica and biotite fragments; sandstone is calc. carb. cemented; hard; blocky fracture; with platey fracture in siltstone intervals; dry.
105'–121.8'	<u>Silty SAND (SM)</u>: white, pink and olive sand with greenish gray and pinkish tan silty matrix; sand is vfg with small to medium mica and biotite flakes; hard; blocky fracture; dry; basal contact.



FILE NAME: A-LOG32.DWG

Terra Dynamics Incorporated

SOIL BORING LO

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/20/92

Boring No.: B-32

Grid No.: 8-E

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 6955.8008
Easting: 11420.4446
Ground Surface Elev. (MSL):
3,465.58

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

Driller: LANE SCARBOROUGH

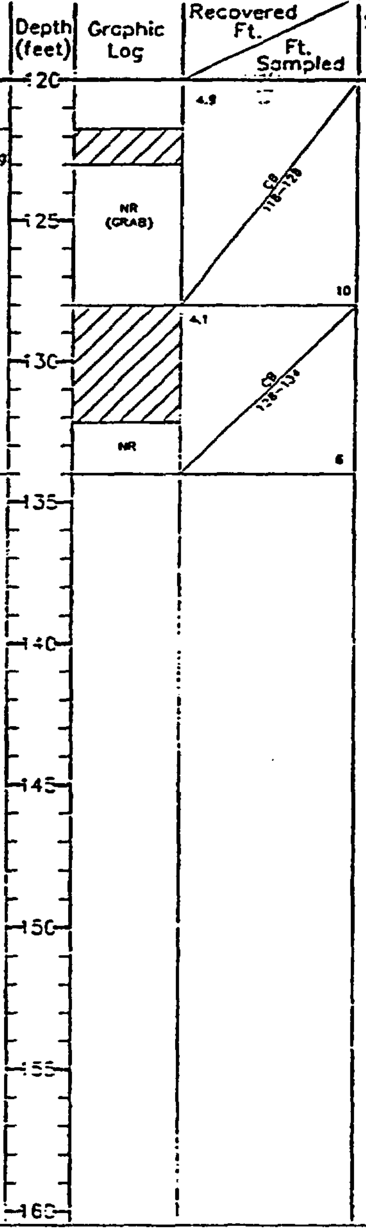
Total Depth: 134'

Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

121.8'–134' Silty CLAY (CL): dusky red & maroon with grayish purple mottling; crumbly; dry.

TOTAL DEPTH = 134'



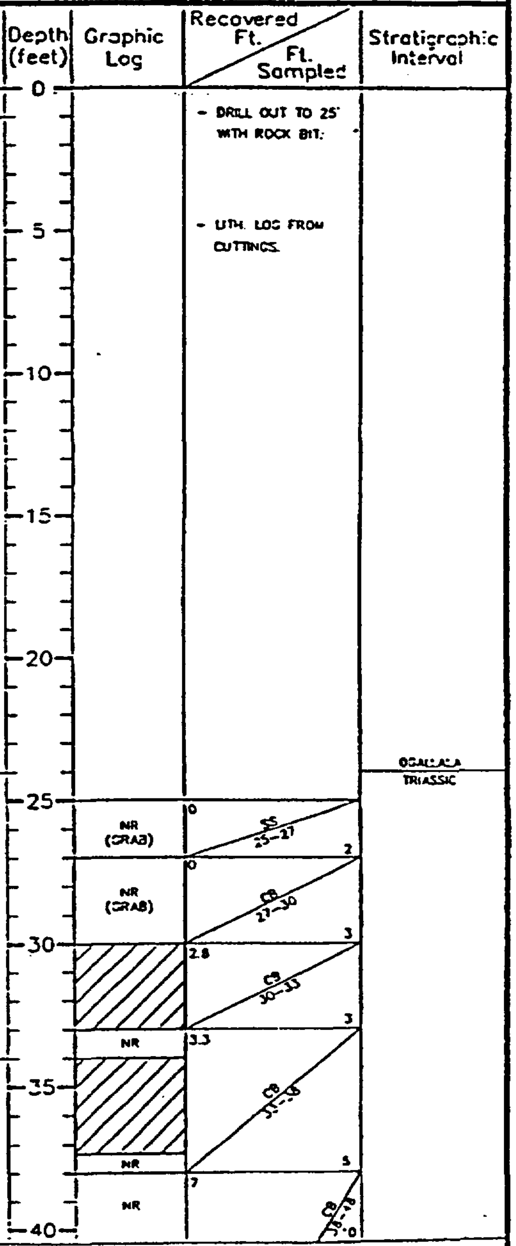
FILE NAME: A-LOGSE.DWG

Terra Dynamics Incorporated	**SOIL BORING LOG**

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 12/22/92	Boring No.: B-33	Grid No.: 8-F

Log By: P. GRANT	Drilling Method & Bit Sizes: AIR ROTARY	Survey Data: Northing: 6502.8105 Easting: 11209.2032 Ground Surface Elev. (MSL): 3,466.96
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS	Sample Method(s): SPLIT SPOON; CORE BARREL	
Driller: LANE SCARBOROUGH	Total Depth: 100'	
Remarks:		

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0'-1'	TOP SOIL: brown; silty sand; moist.
1'-24'	CALICHE: white sandy silt; calcium carb. cement; hard; dry. - Ogallala gravels at 5' are white, pink, black quartzite; mod. hard. - more gravels below 10'; looser below 10'. - gravel and coarse sand strata at 18'; drills easily; light tan cuttings; sl moist. - yellow silty clay in bottom foot of Ogallala with some small rounded gravels.
24'-34'	CLAY (CL): dark reddish-brown claystone; sl plastic; crumbly, dense; sl. moist; yellow mottling; white burrow(?) infillings present; sl. reactive to HCl.
34'-42'	Silty CLAY (CL): reddish-brown silty claystone; green-gray, yellow & white mottling; crumbly; appears slightly bioturbated; not reactive with HCl; dense; dry; sl. soapy; hard.



FILE NAME: A-LOGSF.DWG

Terra Dynamics Incorporated

SOIL BORING LO

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 12/22/92
Boring No.: B-33
Grid No.: 8-F

Log By: P. GRANT
Drilling Method & Bit Sizes: AIR ROTARY
Survey Date:
Northing: 6502.8105
Easting: 11209.2032
Ground Surface Elev. (MSL): 3,466.96

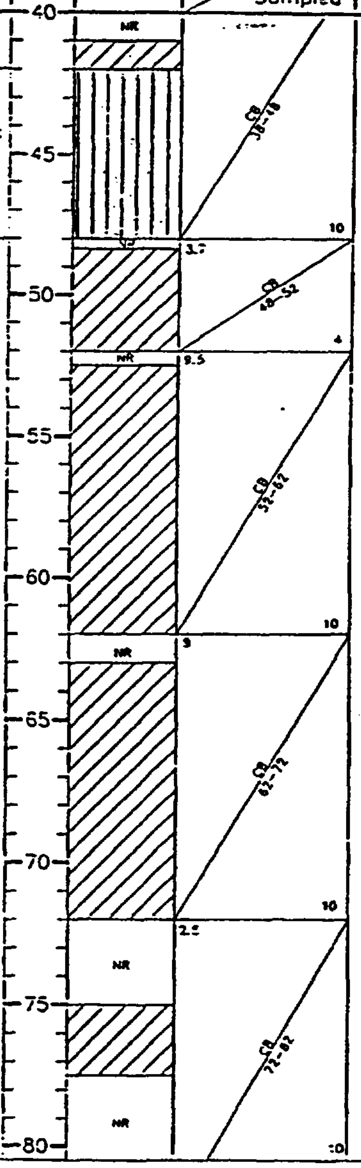
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller: LANE SCARBOROUGH
Total Depth: 100'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
	- gradational to silty sand at 42'.
42'-48'	<u>SILTY SAND (SM)</u>: brownish tan to white; mottled throughout with yellow, brown, gray; v. hard; blocky fract.; f.g. sand to silt with rounded to subangular clasts; calc. carb. cemented grains clear to white to pink; mica flakes; carb.(?) or biotite(?) grains; dry; bedding & cross-bedding present; iron(?) staining; possible borings.
48'-86'	<u>SILTY CLAY (CL)</u>: reddish brown claystone with silt disseminated; yellow & white mottling; dendritic pattern common; no reaction to HCl; hard; blocky fract.; dry. - little silt below 50'. - increasing silty interbeds below 66'; scattered clayey silts (green white); dry. - decreasing silt below 75'.

Depth (feet) | Graphic Log | Recovered Ft. / Ft. Sampled | Stratigraphic Interval



FILE NAME: A-LOGBF.DWG

Terra Dynamics Incorporated

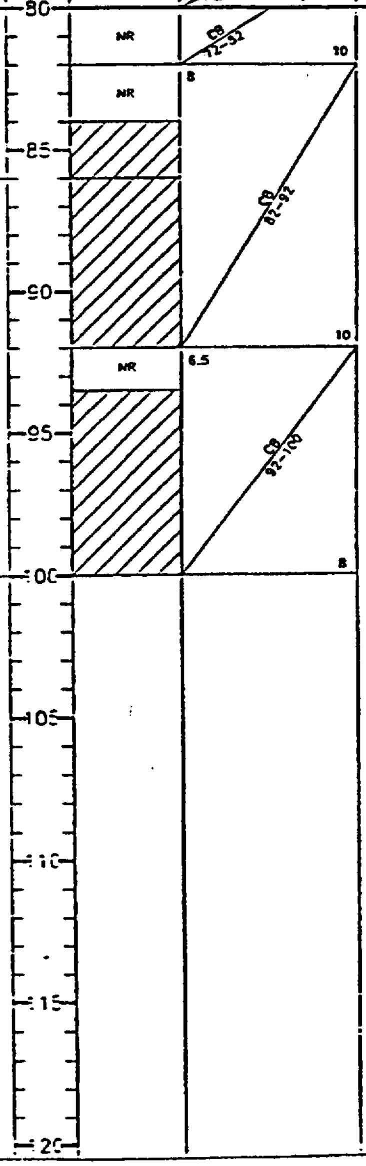
SOIL BORING LOC

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 12/22/92
Boring No.: B-33
Grid N 8-

Log By: P. GRANT
Drilling Method & Bit Sizes: AIR ROTARY
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL
Driller: LANE SCARBOROUGH
Total Depth: 100'
Remarks:

Survey Data:
Northing: 6502.8105
Easting: 11209.2032
Ground Surface Elev. (MSL): 3,466.96

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)		Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigra Interval
	- less silt towards 86'.	80–86			
86'-100'	CLAY (CL): reddish purple; claystone; mod. hard; crumbly; dense; red & brown mottling; dry.	86–100			
	- purple below 90'; sl. plastic.				
TOTAL DEPTH = 100'	- same description as above with slightly reddish purple color in places.				



FILE NAME: A-LOG8F.DWG

Terra Dynamics Incorporated

SOIL BORING

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/18-19/92

Boring No.: B-22

Grid N 8-

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 5596.6570
Easting: 10786.6818

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

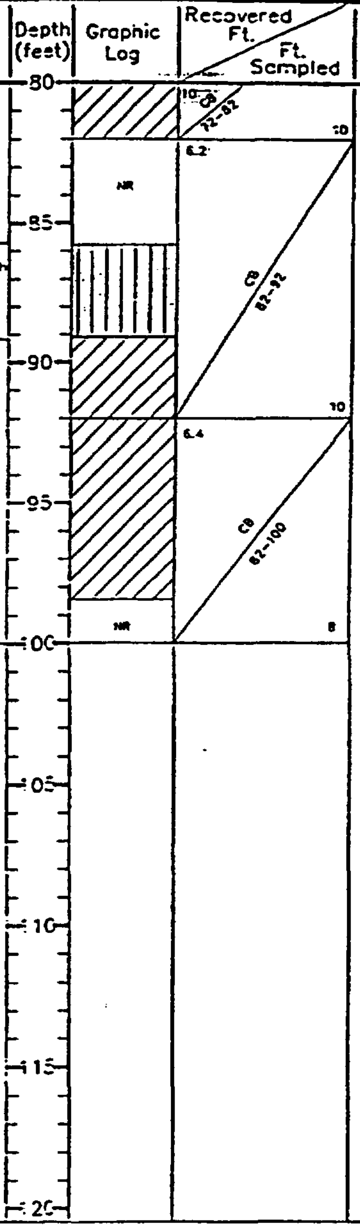
Ground Surface Elev. (MSL): 3,437.08

Driller: LAZARO CASTILLO LANE SCARBOROUGH

Total Depth: 100'

Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	
85.8'-89.1'	<u>Clayey Sandy SILT (ML)</u>: interbedded and cross bedded dk. reddish brown silty clay and light grayish red sandy silt with light greenish gray silty clay in basal 1'; mica frags. throughout; hard; blocky fracture; basal 1' is soapy; dry.
89.1'-100'	<u>Slightly Silty CLAY (CL)</u>: dk. reddish brown with dendritic greenish gray mottling, inclusions and layers throughout; trace vfg mica frags.; carbonized plant material; blocky fracture; sl. soapy; dry.
TOTAL DEPTH = 100'.	



FILE NAME: A-LOGBH.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12-9-92

Boring No.: B-13

Grid No.: 9-C

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY; MUD ROTARY 21.8'-32'

Survey Data:
Northing: 8073.4781
Easting: 11389.9571

Ground Surface Elev. (MSL): 3,476.22

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

Driller: LANE SCARBOROUGH

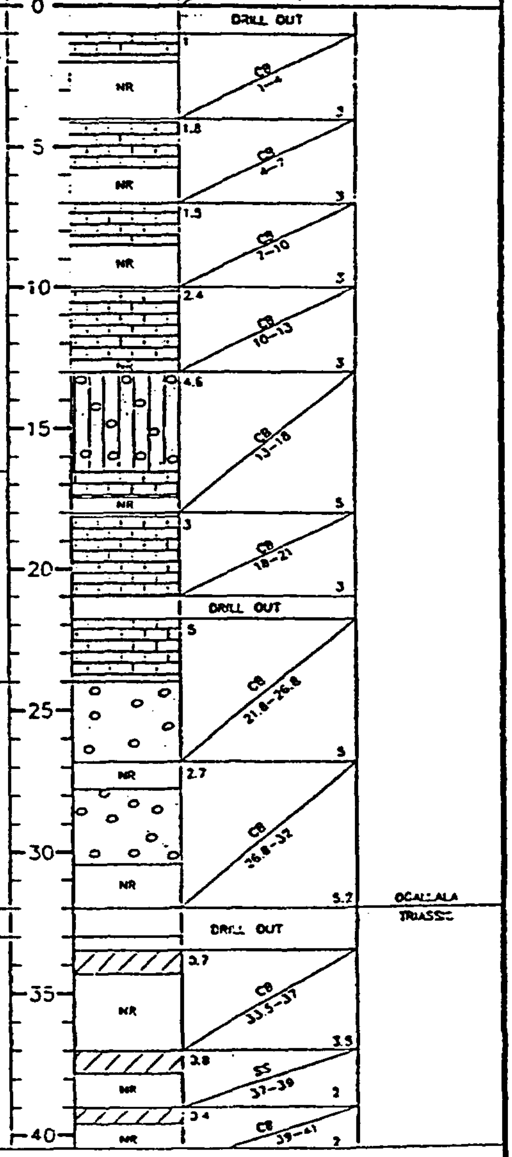
Total Depth: 100'

Remarks: MUD ROTARY BOREHOLE DRILLED ON 1/8/93 NEXT TO ORIGINAL BOREHOLE. LOG IS COMPOSITE OF BOTH BOREHOLES.

Unified Soil Classification/Description
(Color, Texture, Structure, Grain Size)

0' - 1'	TOP SOIL: brown sandy silt; loose; root material; moist.
1' - 16.5'	CALICHE: white and v. light gray calcium carb. cemented silty sand/sandy silt; trace vfg sand-sized pink min. frags. and fg sand and round gravel size dk. min. frags.; hard; crumbly; dry; nature fractures. Increasing sand and dk gravel content below 7'.
16.5' - 28.5'	CALICHE: pink and gray calcium carb. cemented silt; v. hard; blocky fracture; concentric growth rings and apparent nodules; calcite crystal growth in vugs; trace subrounded dk. gravel clast; natural fractures; moist along fractures; basal contact from driller.
24' - 32'	Gravelly SAND (SP): vfg to cg pink gravel w/ red, tan, olive and black/ brown gravel; loose; sand and gravel is subr. to round; gravel is quartzite; basal contact from driller.
32' - 33'	CLAY (CL): gray; mod soft; sl. plastic; soapy; moist.
33' - 80'	CLAY (CL): maroon clay; mod plastic; sticky; soapy; very thin light grey, yellow and black laminations; moist to wet down to about 45'.

Depth (feet) | Graphic Log | Recovered Ft. / Ft. Sampled | Stratigraphic Interval



FILE NAME: A-LOG9C.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12-9-92

Boring No.: B-13

Grid No.: 9-C

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY; MUD ROTARY 21.8'-32'

Survey Data:
Northing: 8073.4781
Easting: 11389.9571

Ground Surface Elev. (MSL): 3,476.22

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

Driller: LANE SCARBOROUGH

Total Depth: 100'

Remarks: MUD ROTARY BOREHOLE DRILLED ON 1/8/93 NEXT TO ORIGINAL BOREHOLE. LOG IS COMPOSITE OF BOTH BOREHOLES.

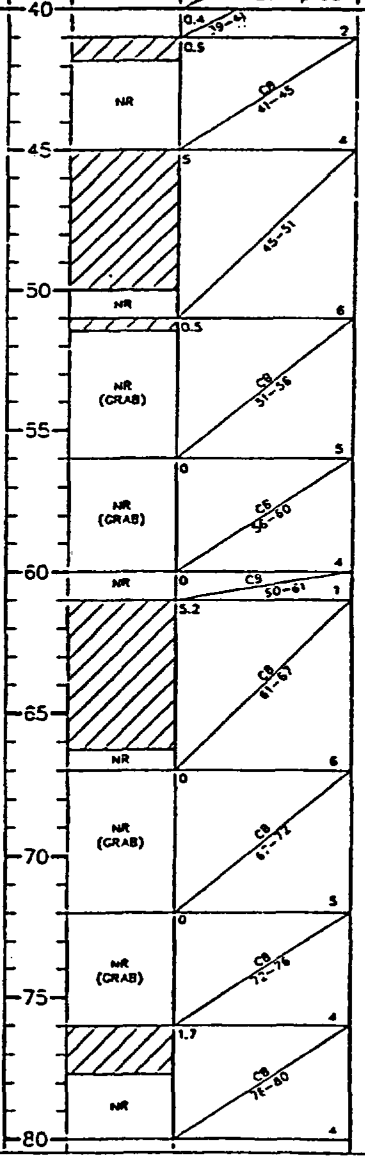
Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Interval

— Drier from 45' - 50'.

— Increased moisture & plasticity below 51'.

— Use clay bit from 56' - 60'.

— Use pilot bit w/ increase shoe separation below 60'.



FILE NAME: A-LOG9C.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12-9-92

Boring No.: 9-13

Grid No.: 9-C

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY; MUD ROTARY 21.8'-32'

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

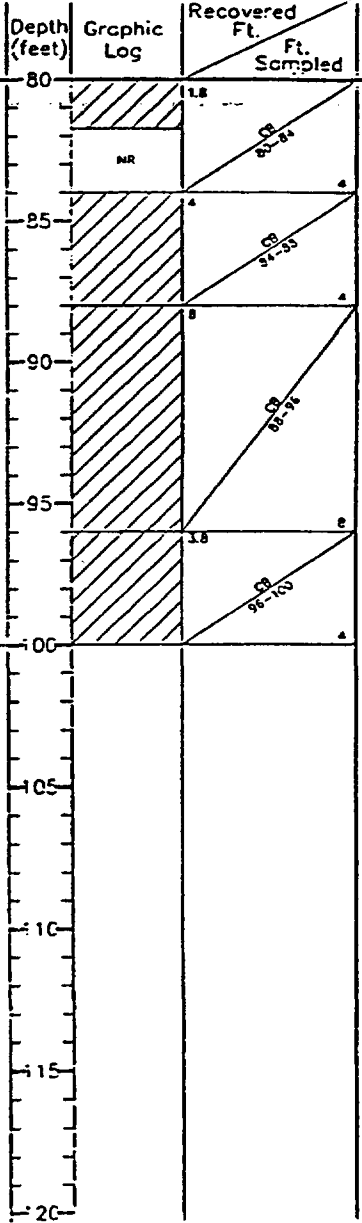
Driller: LANE SCARBORCUGH

Total Depth: 100'

Survey Data:
Northing: 8073.4781
Easting: 11389.9571
Ground Surface Elev. (MSL): 3,476.22

Remarks: MUD ROTARY BOREHOLE DRILLED ON 1/8/93 NEXT TO ORIGINAL BOREHOLE. LOG IS COMPOSITE OF BOTH BOREHOLES.

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	
80-100'	Silty CLAY (CL): purplish maroon w/ yellow & greenish gray mottling; platy fracture, sl. crumbly, sl. soapy, non-plastic; dry.
TOTAL DEPTH AT 100'	



FILE NAME: A-LOG9C.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 12/20/92	Boring No.: B-27	Grid No.: 9-D

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 7620.4057
Easting: 11178.6477
Ground Surface Elev. (MSL): 3,472.74

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

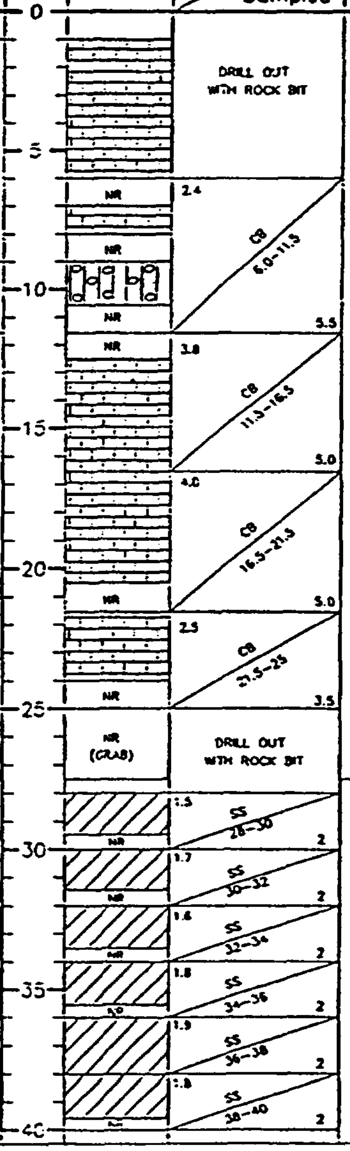
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller: LANE SCARBOROUGH
LAZARO CASTILLO

Total Depth: 100'

Remarks: MUD ROTARTY BOREHOLE DRILLED ON 1/3/93 NEXT TO ORIGINAL BOREHOLE. LOG IS COMPOSITE OF BOTH BOREHOLES.

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0'-1'	TOP SOIL: brown silty sand; organic material; moist.
1'-9'	CALICHE: pinkish, grayish white; calcium carb. cemented silt and vfg pink sand; v. hard; blocky fracture; dry.
9'-11.5'	Silty Gravelly SAND (GM): pinkish white; vfg qtz. sand with white and dark gravel and partial caliche cementation; mod. loose; dry.
11.5'-25'	CALICHE: pink and pinkish gray; microcrystalline calcium carb. cementation with trace vfg pink sand and dark gravel; concentric growth rings; v. hard; dry. - increased gravel content below 22'.
25'-27.5'	Silty Gravelly SAND (GW): dark, white, pink, clear and opaque sand and gravel with pinkish tan silt matrix; sand is subr. to well rd. vfg-cg quartz; gravel is subr.; loose; dry.
27.5'-51.5'	Silty CLAY (CL): dusky red to maroon silty clay with blue/gray mottling throughout; mod. dense; crumbly in upper 4'; sl. plastic & soapy below 31'; moist. - yellow mottling below 37'.



Stratigraphic Interval

OGALLALA
TRIASSIC

FILE NAME: A-LOG90.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

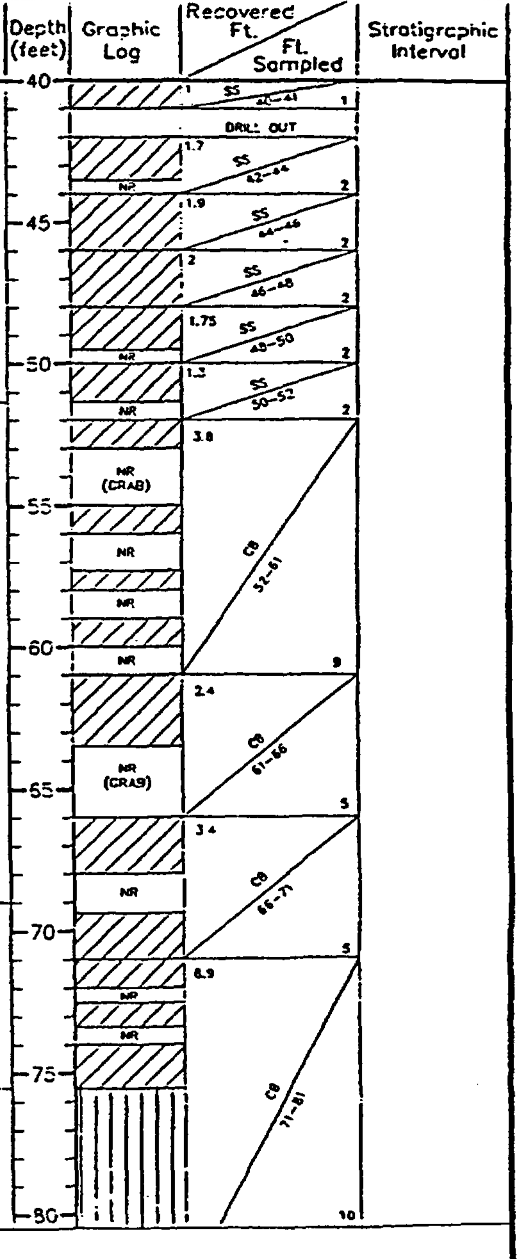
Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 12/20/92
Boring No.: B-27
Grid No.: 9-D

Log By: A. WEEGAR
Drilling Method & Bit Sizes: AIR ROTARY
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL
Driller: LAZARO CASTILLO LANE SCARBOROUGH
Total Depth: 100'

Survey Data:
Northing: 7620.4057
Easting: 11178.6477
Ground Surface Elev. (MSL): 3,472.74

Remarks: MUD ROTARTY BOREHOLE DRILLED ON 1/3/93 NEXT TO ORIGINAL BOREHOLE. LOG IS COMPOSITE OF BOTH BOREHOLES.

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
	<u>Silty CLAY (CL)</u>: same as above.
51.5'–69'	<u>Silty CLAY (CL)</u>: light dusky red silty claystone with light gray, yellow and purple/grey dendritic mottling; hard; blocky fracture; sl. crumbly; dry; basal contact from cuttings.
69'–75.5'	<u>Silty CLAY (CL)</u>: heavily mottled purple/grey/green with dendritic coloration of dusky red; mod. hard claystone; blocky fracture; dry.
75.5'–83.6'	<u>Sandy SILT (ML)</u>: dusky red sandy siltstone with greenish gray mottling in upper 1'; sand is vfg quartz with med. mica and biotite flakes; matrix material reacts with HCl; hard; blocky fracture; sl. chalky; dry



FILE NAME: A-LOG9D.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/20/92

Boring No.: B-27

Grid No.: 9-D

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 7620.4057
Easting: 11178.6477
Ground Surface Elev. (MSL): 3,472.74

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

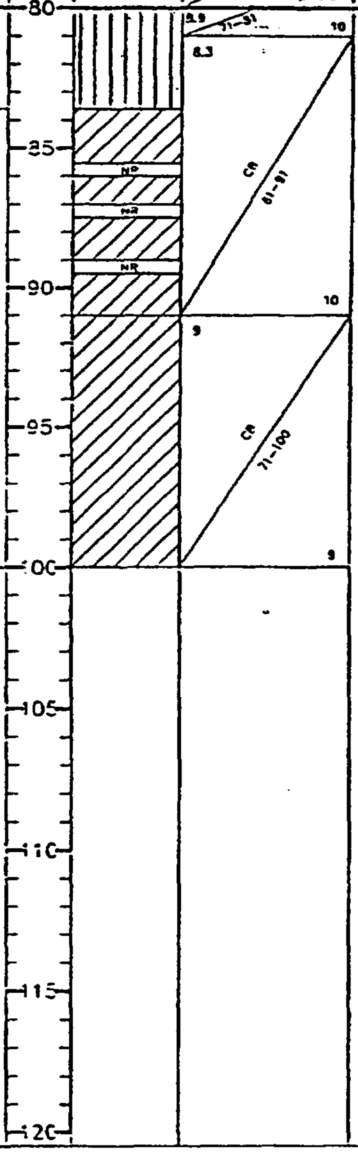
Driller: LAZARO CASTILLO
LANE SCARBOROUGH

Total Depth: 100'

Remarks: MUD ROTARTY BOREHOLE DRILLED ON 1/3/93 NEXT TO ORIGINAL BOREHOLE. LOG IS COMPOSITE OF BOTH BOREHOLES.

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
83.6'–100'	Silty CLAY (CL): variegated dusky red, yellow, dark gray and purple silty claystone with siltstone layers; trace v/g mica frags. in siltstone intervals; blocky fracture; mod. hard; dry.
TOTAL DEPTH = 100'	

Depth (feet) | Graphic Log | Recovered Ft. / Ft. Sampled | Stratigraphic Interval



FILE NAME: A-LOG9D.DWG

Terra Dynamics Incorporated	**SOIL BORING LOG**

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 01/20/93
Boring No.: B-46
Grid No.: 9-E

Log By: A. WEEGAR
Drilling Method & Bit Sizes: AIR ROTARY
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL
Driller:
Total Depth: 101'
Remarks:

Survey Data:
Northing: 7166.5723
Easting: 10968.3576
Ground Surface Elev. (MSL): 3,467.53

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Interval
		0			
0'-2.5'	TOP SOIL: dark brown; clayey sand; v. organic rich; loamy; moist.		NR (GRAB)	DRILL OUT; LOG CUTTINGS	
2.5'-13'	CALICHE: pinkish white calcium carbonate cemented silt and vfg sand; alternatingly hard and soft layers; hard layers are grayish tan micrite with silt and vfg pink sand; trace subrounded pink and opaque gravel; dry.	5 10	NR (GRAB)		
13'-18'	CALICHE: pinkish white calcium carbonate cemented silt and vfg sand; dark, black, opaque and red qtzite gravel frags. throughout; loose; dry.	15	NR (GRAB)		
18'-20.5'	Gravelly SAND (SP): pink vfg quartz sand; black, dark, red and opaque gravel; v. loose; moist.	20	(GRAB)		OGALLALA
20.5'-28'	CLAY (CL): maroon; sl. soapy; dense; sl. plastic; crumbly; trace calcium carbonate nodules; moist.	25	NR (GRAB) ▨	0 / SS 22-24 / 2 2 / SS 24-26 / 2 2 / SS 26-28 / 2	TRIASSIC
28'-37'	CLAY (CL): heavily mottled yellow, bluish gray and purple; sl. soapy; dense; sl. plastic; crumbly; moist-dry.	30 35	▨	2 / SS 28-30 / 2 2 / SS 30-32 / 2 2 / SS 32-34 / 2 2 / SS 34-36 / 2	
37'-40.9'	CLAY (CL): maroon with clasts and trace mottling of grayish purple and yellow; sl. soapy; dense; sl. plastic; crumbly to concoidal fracture; moist.	40	▨	2 / SS 36-38 / 2 2 / SS 38-40 / 2	

FILE NAME: A-LOG3E.DWG

Terra Dynamics Incorporated	**SOIL BORING LO**

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 01/20/93

Boring No.: B-46

Grid No.: 9-E

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 7166.5723
Easting: 10958.3576
Ground Surface Elev. (MSL): 3.467.53

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

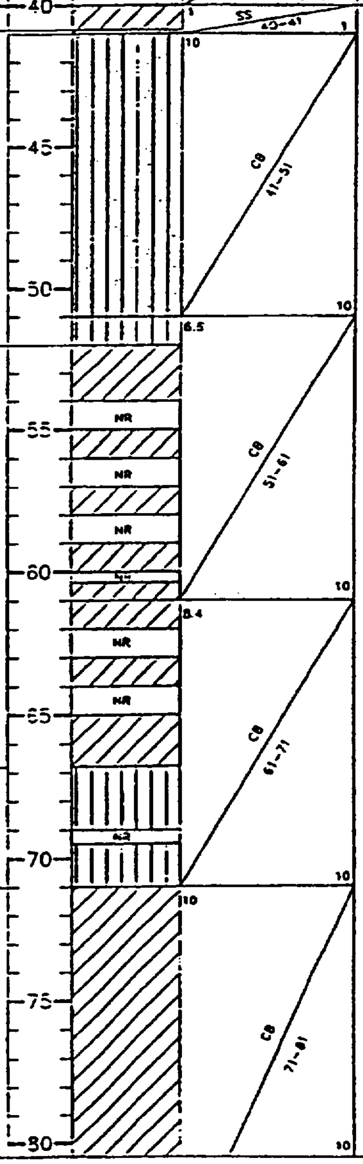
Driller:

Total Depth: 101'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
40.9'-52'	<u>Silty Clayey SAND (SM)</u>: variegated tan, yellow, pink, gray and white siltstone and sandstone with clay laminae and clasts; interbedded and cross-bedded; sand is vfg white quartz and pink feldspar; vfg to cg mica and biotite frags. and flakes; increased sand content below 47'; hard; blocky fracture; calcium carbonate cementation; dry.
52'-66.9'	<u>Silty CLAY (CL)</u>: dark reddish brown and reddish purple silty claystone; with slight purple grey dendritic mottling; greenish gray clasts and worm burrows; dense; blocky fracture to crumbly; dry; gradational change to light dusky red siltstone at base.
66.9'-71'	<u>Clayey SILT (ML)</u>: light dusky red siltstone and claystone; calcite ≋ filled fractures; hard; blocky fracture; dry.
71'-101'	<u>Slightly Silty CLAY (CL)</u>: reddish brown and yellowish tan slightly silty claystone with greenish gray layers and tubes; calcite filled (45°) diagonal fractures common.

Depth (feet) | Graphic Log | Recovered Ft. / Ft. Sampled | Stratigraphic Interval



FILE NAME: A-LOGSE.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 01/20/93

Boring No.: B-46

Grid No.: 9-E

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:

Northing: 7166.5723

Easting: 10958.3576

Ground Surface Elev. (MSL): 3,467.53

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

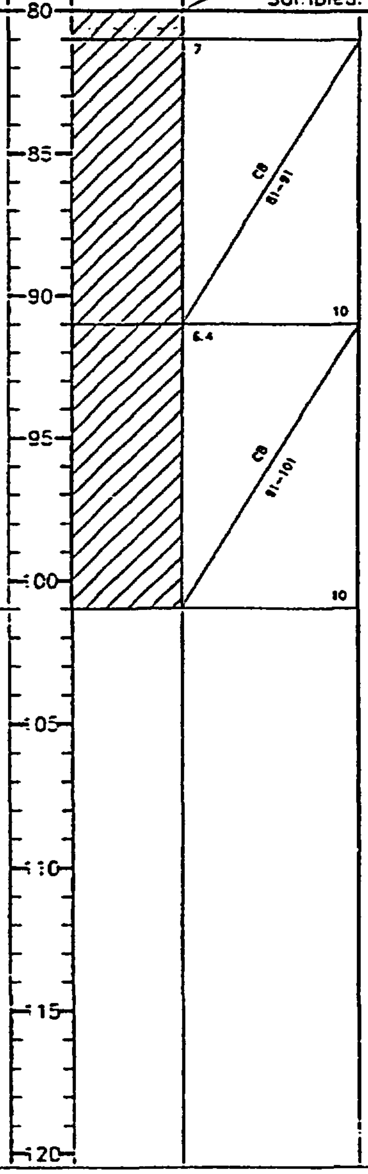
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller:

Total Depth: 101'

Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Interval
Slightly Silty CLAY (CL): same as above.	80			
TOTAL DEPTH = 101'				



FILE NAME: A-LOG9E.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LO

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/16/92; 1/23/93

Boring No.: B-21

Grid Well No.: 9-G(1)

Log By: M. JOHNSON; A. WEEGAR

WELL COMPLETED ON: 1/29/93

Survey Data:
Northing: 6260.8293
Easting: 10544.8903

Ground Surface Elev. (MSL):
3,454.55

Top of PVC Casing Elev.:
3,458.25

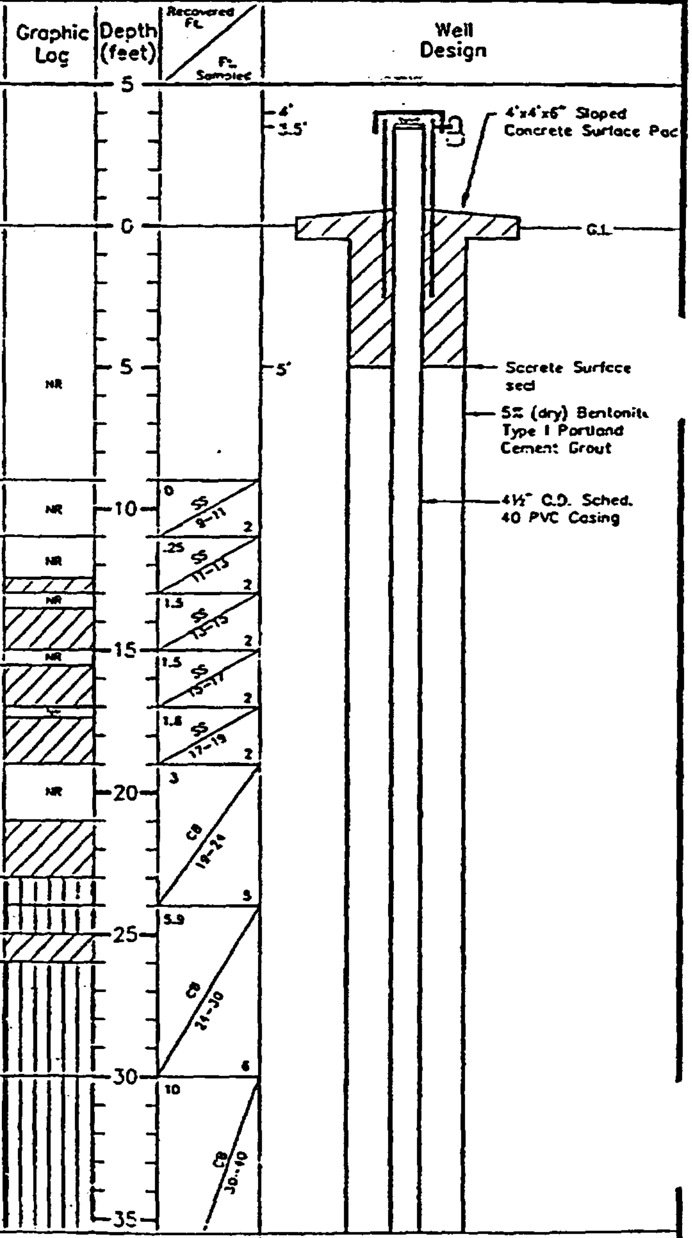
Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY

Total Depth: 170'

Sample Method(s): CONTINUOUS FROM 9' TO 170' USING SPLIT SPOON AND CORE BARREL.

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	
0'-9'	CALICHE: white; some white silty clay, some white pebbles.
9'-11'	CALICHE BASE OF OGALLALA - TRIASSIC TOP
11'-15.5'	Silty CLAY (CL): dusky red; hard; waxy; dry; some whitish-gray mottling.
15.5'-23'	Slightly Silty CLAY (CL): maroon; hard; waxy; dry; some gray mottling.
23'-25'	Slightly Silty SAND (SM): pinkish-red, well sorted vf-fg angular sand; some yellow and green mottling; HCl perm non-reactive; dry.
25'-26'	CLAYEY SAND (SC): white, chalky; HCl reactive; vf sand grains; dry.
26'-30'	Slightly Silty SAND (SM): pinkish-red, vf-fg angular sand grains; HCl perm numerous gray rip-up clasts; some yellow, green mottling; dry; lighter color with depth.
30'-42.5'	Slightly Silty SAND (SM): white, fine grained slightly angular sand; biotite and mica flakes; numerous rip-up white and gray clay clasts; slightly HCl reactive; permeable.



FILE NAME: A-LOG9G1.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/16/92; 1/23/93

Boring No.: B-21

Grid/Well No.: 9-G(1)

Log By: M. JOHNSON; A. WEEGAR

WELL COMPLETED ON: 1/29/93

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY

Total Depth: 170'

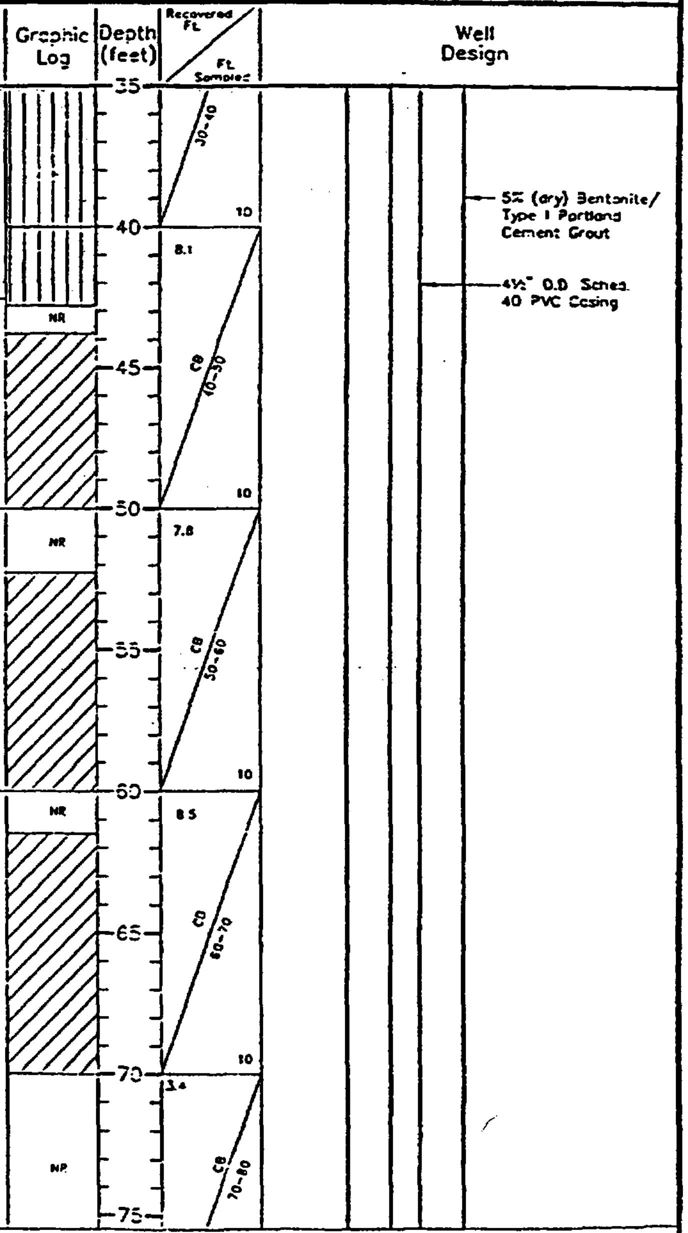
Survey Data:
Northing: 6260.8293
Easting: 10544.8903

Ground Surface Elev. (MSL): 3,454.55

Top of PVC Casing Elev.: 3,458.25

Sample Method(s): CONTINUOUS FROM 9' TO 170' USING SPLIT SPOON AND CORE BARREL.

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
	Slightly Silty SAND (SM): same as above.
42.5'-50'	Silty CLAY (CL): dusky red: mod. hard: dry: numerous silty sand laminations with depth (slightly HCl reactive); some gray, white mottling.
50'-60'	Silty CLAY (CL): dusky red: mod. hard: waxy: dry: white and gray mottling, some vf grained sand near top.
60'-84'	Silty CLAY (CL): dusky red: hard: waxy: dry: white and gray mottling.



FILE NAME: A-LOGSG1.DWG

Terra Dynamics Incorporated

SOIL BORING &
WELL COMPLETION LO

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/16/92; 1/23/93

Boring No.: B-21

Grid/Well No.: 9-G(1)

Log By: M. JOHNSON; A. WEEGAR

WELL COMPLETED ON: 1/29/93

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY

Total Depth: 170'

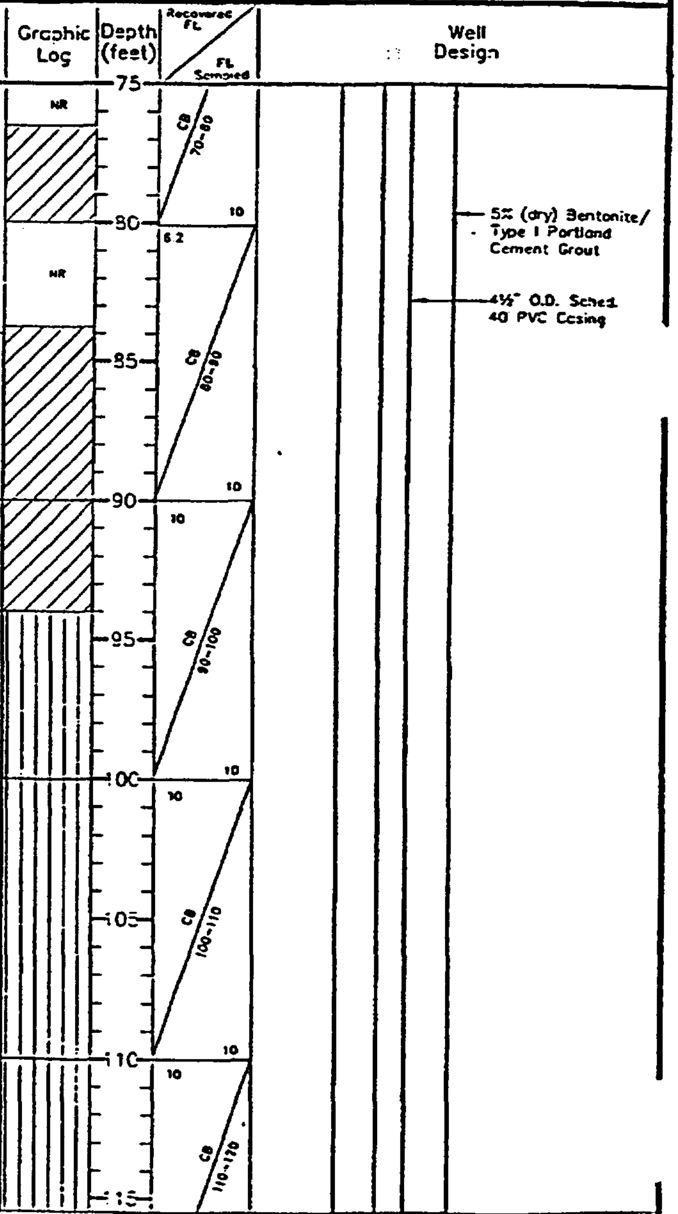
Sample Method(s): CONTINUOUS FROM 9' TO 170' USING SPLIT SPOON AND CORE BARREL.

Survey Data:
Northing: 6260.8293
Easting: 10544.8903

Ground Surface Elev. (MSL): 3,454.55

Top of PVC Casing Elev.: 3,458.25

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
	Silty CLAY (CL): same as above.
84'-90'	Silty CLAY (SM): reddish-brown; hard; dry; brown coloring increasing with depth, some vf sand increasing with depth, some gray mottling; dry.
90'-94'	Silty CLAY (CL): dusky red; hard; dry; some vf sand, gray mottling.
94'-110'	Slightly Silty SAND (SM): grayish white, vf to fg sand, grains are angular; biotite and mica flakes; some yellow, pink and green color, bottom 1 (one) foot more yellow; HCl permeable; dry; v. slightly HCl reactive. - Color becoming tan below 105 ft.; some brown/yellow streaking with depth; rip-up clay clasts (white)
110'-117.5'	Slightly Silty SAND (SM): tan/yellow, fg sand, slightly angular grains; dry, numerous biotite and mica flakes; some gray, brown streaking; slightly HCl reactive; thin brown, yellow lamination.



FILE NAME: A-LOGSG1.DWG

Terra Dynamics Incorporated	**SOIL BORING & WELL COMPLETION LOG**			
Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 12/16/92; 1/23/93	Boring No.: B-21	Grid/Well No.: 9-G(1)

Log By: M. JOHNSON; A. WEEGAR	WELL COMPLETED ON: 1/29/93	Survey Data: Northing: 6260.8293 Easting: 10544.8903 Ground Surface Elev. (MSL): 3,454.55 Top of PVC Casing Elev.: 3,458.25
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS		
Drilling Method & Bit Sizes: AIR ROTARY	Total Depth: 170'	
Sample Method(s): CONTINUOUS FROM 9' TO 170' USING SPLIT SPOON AND CORE BARREL		

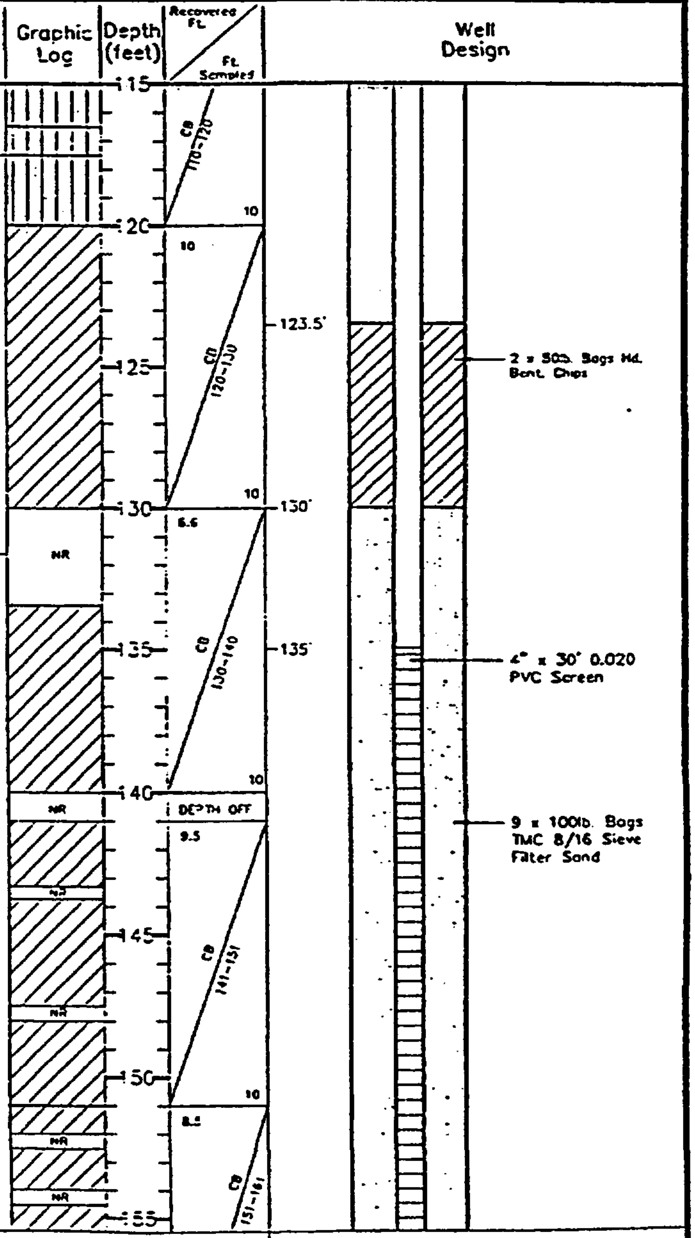
Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

– Red, fg sand, from 116.5' to 117.5'.

117.5'–131.5' Slightly Silty SAND (SM): tan/yellow, fg sand, slightly angular grains; dry; numerous mica and biotite flakes; slightly HCl reactive; thin yellow lamination.

– Red, yellow and gray laminations. Bottom one foot is gray.

131.5'–170' Silty CLAY (CL): dusky red; numerous gray clay clasts (greenish–white) with occasional mustard yellow mottling; mod. hard; blocky fracture to sl. crumbly; dry.



FILE NAME: A-LOG9G1.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LO

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 12/16/92; 1/23/93	Boring No.: B-21	Grid/Well No.: 9-C(1)

Log By: M. JOHNSON; A. WEEGAR

WELL COMPLETED ON: 1/29/93

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY

Total Depth: 170'

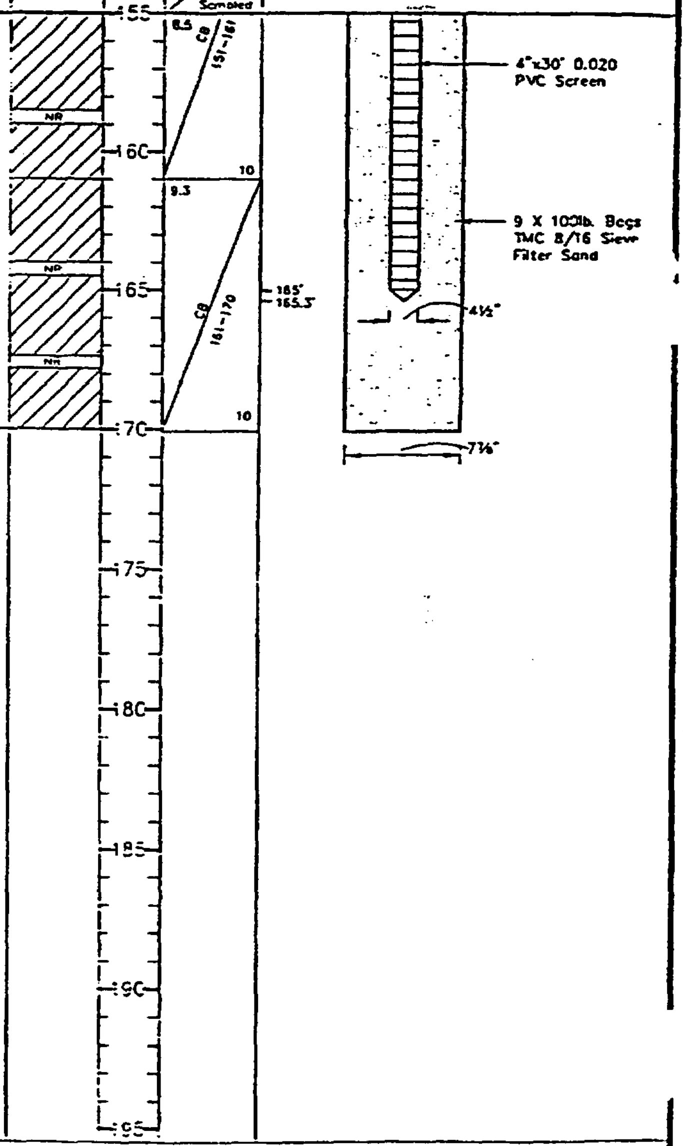
Sample Method(s): CONTINUOUS FROM 9' TO 170' USING SPLIT SPOON AND CORE BARREL

Survey Data:
Northing: 6260.8293
Easting: 10544.8903

Ground Surface Elev. (MSL):
3,454.55

Top of PVC Casing Elev.:
3,458.25

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Graphic Log	Depth (feet)	Recovered Ft / Ft Sampled	Well Design
Silty CLAY (CL): same as above.				
TOTAL DEPTH = 170'				



FILE NAME: A-LOGSG1.DWG

Terra Dynamics Incorporated

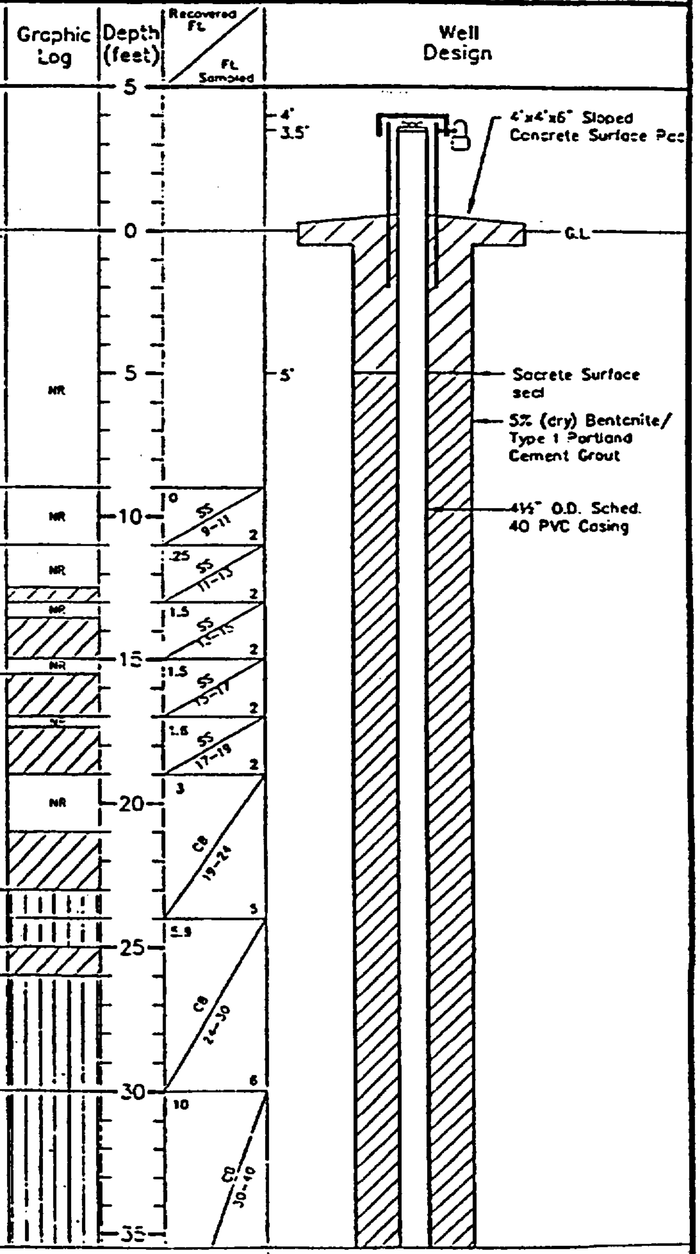
SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 12/16/92: 1/2/93
Boring No.: B-21
Grid/Well No.: 9-G(2)

Log By: M. JOHNSON: A. WEEGAR
WELL COMPLETED ON: 1/25/93
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Drilling Method & Bit Sizes: AIR ROTARY
Total Depth: 223'
Sample Method(s): CONTINUOUS FROM 9' TO 223' USING SPLIT SPOON AND CORE BARREL

Survey Data:
Northing: 6260.8293
Easting: 10544.8903
Ground Surface Elev. (MSL): 3,454.55
Top of PVC Casing Elev.: 3,457.85

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0'-9'	CALICHE: white; some white silty clay, some white pebbles.
9'-11'	CALICHE BASE OF OGALLALA - TRIASSIC TOP
11'-15.5'	Silty CLAY (CL): dusky red; hard; waxy; dry; some whitish-gray mottling.
15.5'-23'	Slightly Silty CLAY (CL): maroon; hard; waxy; dry; some gray mottling.
23'-25'	Slightly Silty SAND (SM): pinkish-red, well sorted vf-fg angular sand; some yellow and green mottling; HCl perm non-reactive; dry.
25'-26'	CLAYEY SAND (SL): white, chalky, HCl reactive; vf sand grains; dry.
26'-30'	Slightly Silty SAND (SM): pinkish-red, vf-fg angular sand grains; HCl perm numerous gray rip-up clasts; some yellow, green mottling; dry; lighter color with depth.
30'-42.5'	Slightly Silty SAND (SM): white, fine grained slightly angular sand; biotite and mica flakes; numerous rip-up white and gray clay clasts; slightly HCl reactive; permeable.



FILE NAME: A-LOG9G2.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LO

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/16/92: 1/2/93

Boring No.: B-21

Grid/Well No.: 9-G(2)

Log By: M. JOHNSON; A. WEEGAR

WELL COMPLETED ON: 1/25/93

Survey Data:
Northing: 6260.8293
Easting: 10544.8903

Ground Surface Elev. (MSL): 3,454.55

Top of PVC Casing Elev.: 3,457.85

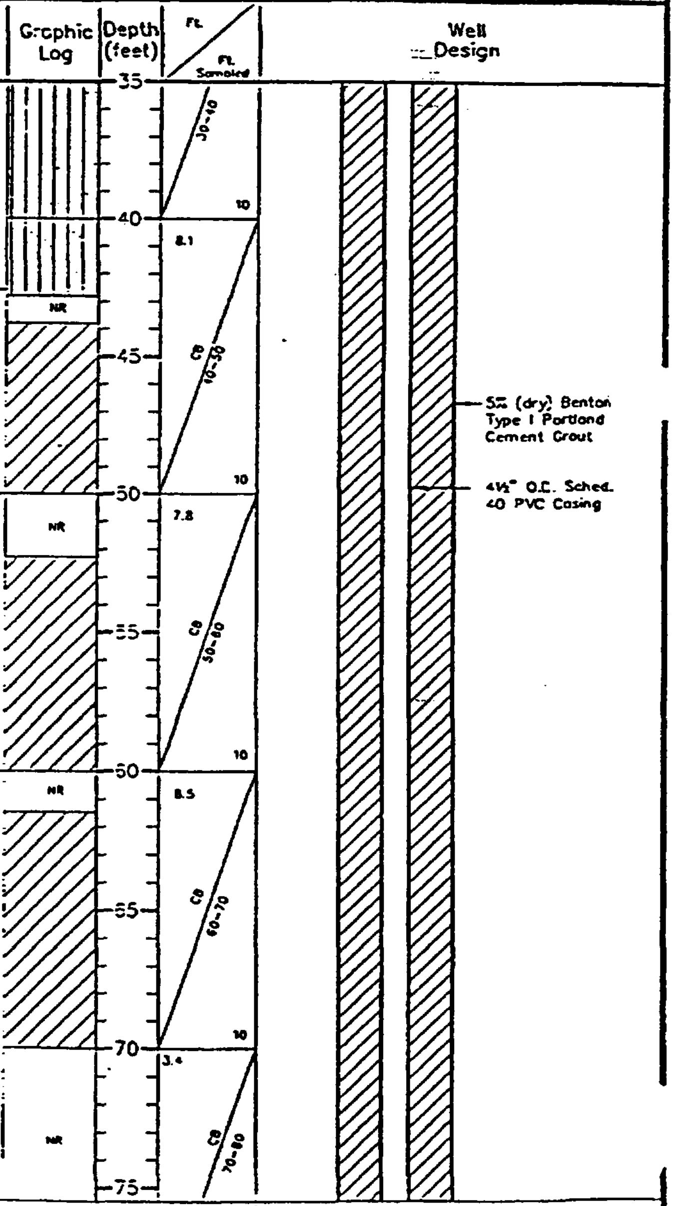
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY

Total Depth: 223'

Sample Method(s): CONTINUOUS FROM 9' TO 223' USING SPLIT SPOON AND CORE BARREL

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
	Slightly Silty SAND (SM): same as above.
42.5'-50'	Silty CLAY (CL): dusky red; mod. hard; dry; numerous silty sand laminations with depth (slightly HCl reactive); some gray, white mottling.
50'-60'	Silty CLAY (CL): dusky red; mod. hard; waxy; dry; white and gray mottling, some vf grained sand near top.
60'-84'	Silty CLAY (CL): dusky red; hard; waxy; dry; white and gray mottling.



FILE NAME: A-LOG9G2.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 12/16/92; 1/2/93
Boring No.: B-21
Grid/Well No.: S-G(2)

Log By: M. JOHNSON; A. WEEGAR
WELL COMPLETED ON: 1/25/93
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Drilling Method & Bit Sizes: AIR ROTARY
Total Depth: 223'
Sample Method(s): CONTINUOUS FROM 9' TO 223' USING SPLIT SPOON AND CORE BARREL

Survey Data:
Northing: 6260.8293
Easting: 10544.8903
Ground Surface Elev. (MSL): 3,454.55
Top of PVC Casing Elev.: 3,457.85

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

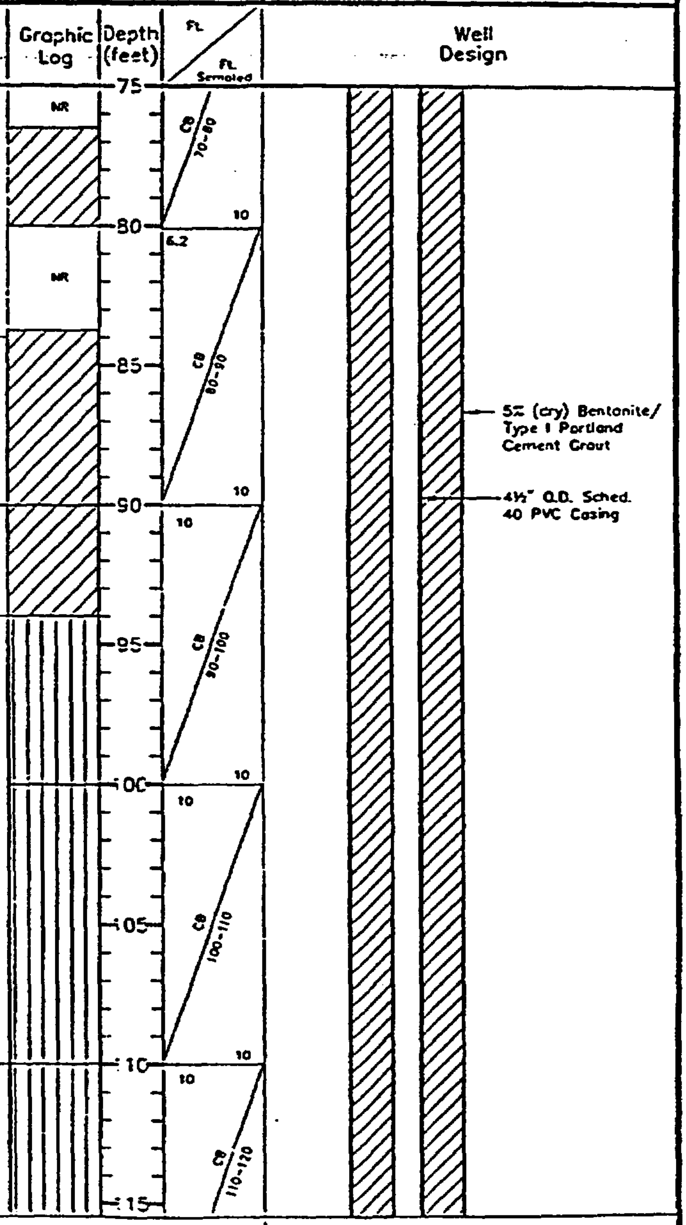
84'–90' Silty CLAY (SM): reddish-brown; hard; dry; brown coloring increasing with depth, some vf sand increasing with depth, some gray mottling; dry.

90'–94' Silty CLAY (CL): dusky red; hard; dry; some vf sand, gray mottling.

94'–110' Slightly Silty SAND (SM): grayish white, vf to fg sand, grains are angular; biotite and mica flakes; some yellow, pink and green color, bottom 1 (one) foot more yellow; HC permeable; dry; v. slightly HCl reactive.

- Color becoming tan below 105 ft.; some brown/yellow streaking with depth; rip-up clay clasts (white)

110'–117.5' Slightly Silty SAND (SM): tan/yellow, fg sand, slightly angular grains; dry; numerous biotite and mica flakes; some gray, brown streaking; slightly HCl reactive; thin brown, yellow lamination.



FILE NAME: A-LOG9G2.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 12/16/92; 1/2/93	Boring No.: B-21	Grid/Well No.: 9-G(2)

Log By: M. JOHNSON; A. WEEGAR

WELL COMPLETED ON: 1/25/93

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY

Total Depth: 223'

Sample Method(s): CONTINUOUS FROM 9' TO 223' USING SPLIT SPOON AND CORE BARREL

Survey Data:
Northing: 6260.8293
Easting: 10544.8903

Ground Surface Elev. (MSL): 3,454.55

Top of PVC Casing Elev.: 3,457.85

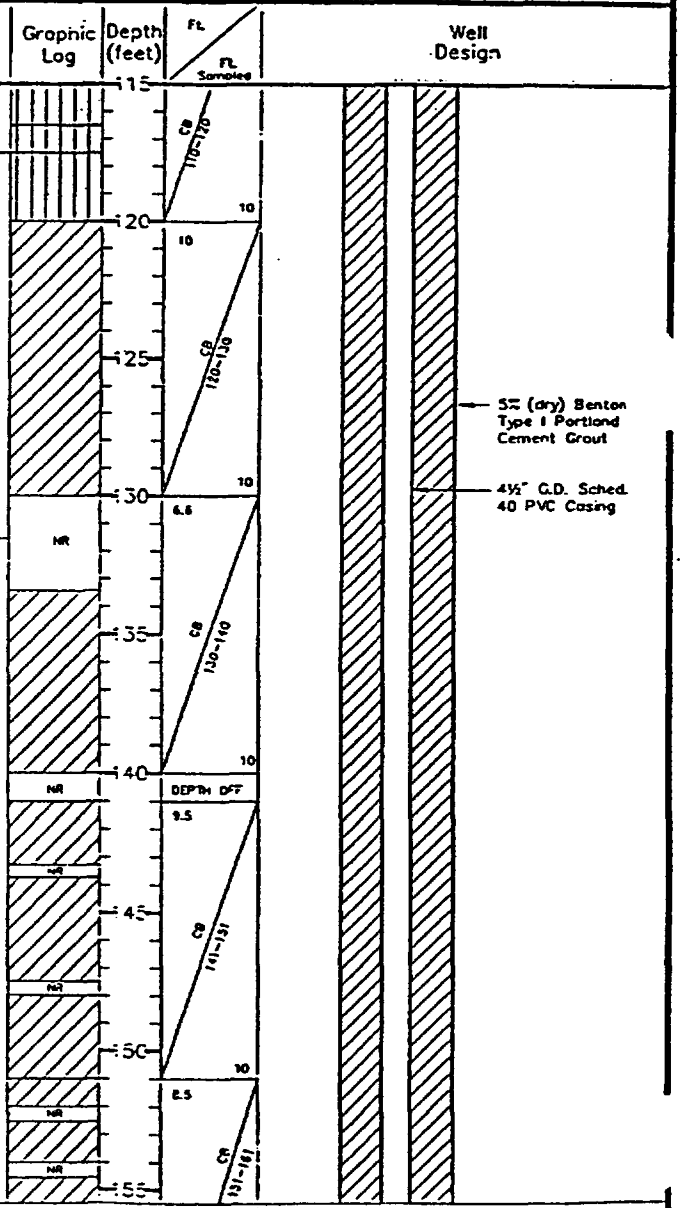
Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

- Red, fg sand, from 116.5' to 17.5'.

117.5'–131.5' Slightly Silty SAND (SM): tan/yellow, fg sand, slightly angular grains; dry, numerous mica and biotite flakes; slightly HCl reactive; thin yellow lamination.

- Red, yellow and gray laminations. Bottom one foot is gray.

131.5'–196' Silty CLAY (CL): dusky red; numerous gray clay clasts (greenish-white) with occasional mustard yellow mottling; mod. hard; blocky fracture to sl. crumbly; dry.



FILE NAME: A-LOG9G2.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/16/92: 1/2/93

Boring No.: B-21

Grid/Well No.: 9-G(2)

Log By: M. JOHNSON; A. WEEGAR

WELL COMPLETED ON: 1/25/93

Survey Data:
Northing: 6260.8293
Easting: 10544.8903

Ground Surface Elev. (MSL):
3,454.55

Top of PVC Casing Elev.:
3,457.85

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY

Total Depth: 223'

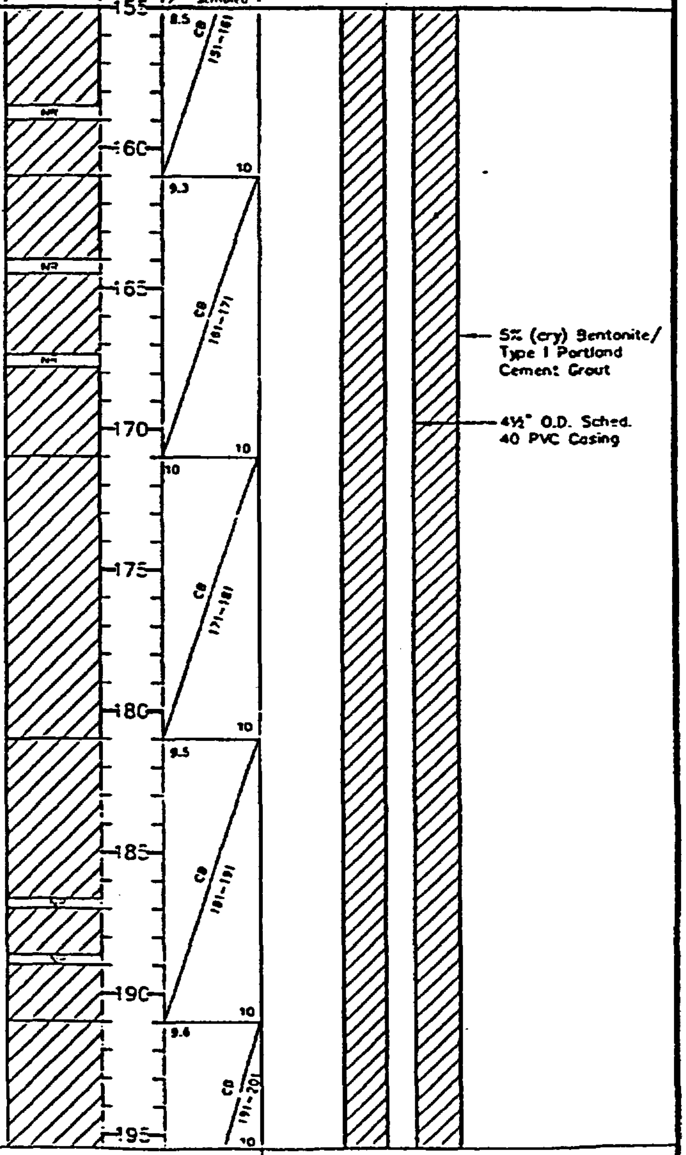
Sample Method(s): CONTINUOUS FROM 9' TO 223' USING SPLIT SPOON AND CORE BARREL

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Graphic Log	Depth (feet)	Ft. / Ft. Sampled	Well Design

Silty CLAY (CL): same as above.

- Increased mustard yellow mottling below 180'.

- 45' slickenside at 186' with calcite crystalization along slip plane; increased greenish grey dendritic mottling below 186'; sl. increased crumbly texture below 186'.



FILE NAME: A-LOG9G2.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/15/92: 1/2/93

Boring No.: B-21

Grid/Well No.: 9-G(2)

Log By: M. JOHNSON: A. WEEGAR

WELL COMPLETED ON: 1/25/93

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY

Total Depth: 223'

Sample Method(s): CONTINUOUS FROM 9' TO 223' USING SPLIT SPOON AND CORE BARREL

Survey Data:
Northing: 6260.8293
Easting: 10544.8903

Ground Surface Elev. (MSL): 3,454.55

Top of PVC Casing Elev.: 3,457.85

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

196'-208.8' Slightly Silty CLAY (CL): heavily mottled primarily greenish gray and purplish gray with dendritic coloring of reddish brown and mustard yellow; sl. soapy; blocky fracture and crumbly; dry.

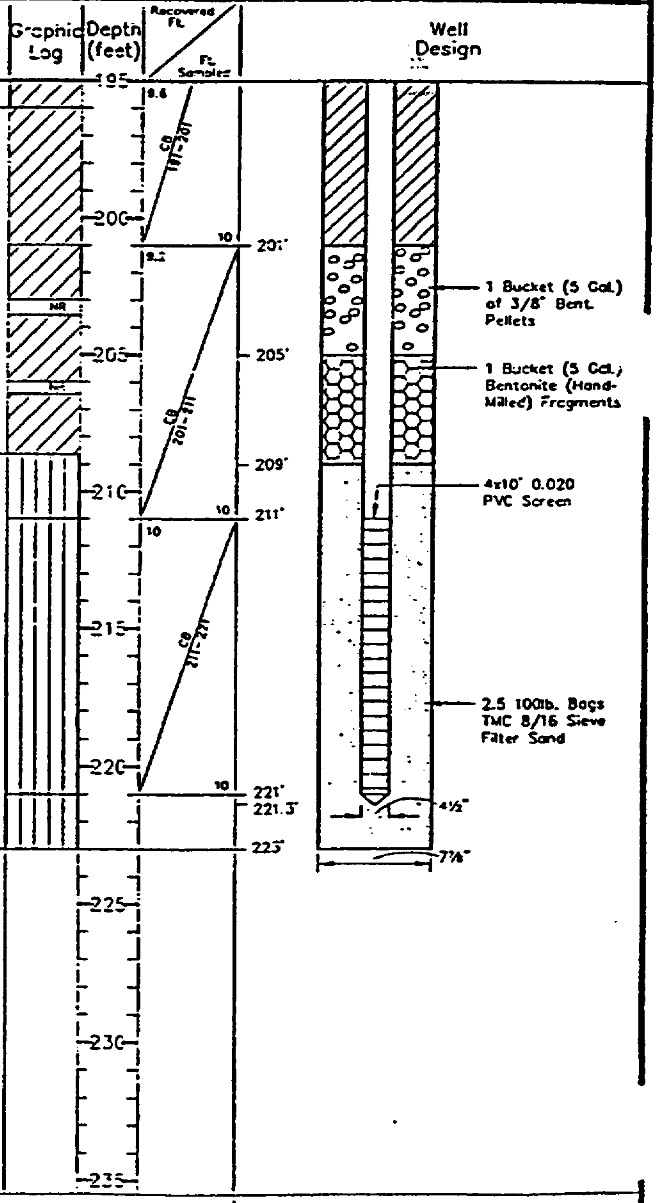
- reduced greenish gray mottling below 201'.

208.8'-223' SILT(ML): greenish grey siltstone; trace vfg mica frags.; hard; blocky fracture; moist.

- reddish brown clayey siltstone layers; clasts and vertical seams from 213'-224'

- faint cross-lamination below 220'.

TOTAL DEPTH = 223'



FILE NAME A-LOG9G2.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/16/92: 1/23/93

Boring No.: B-21

Grid/Well No.: 9-G(3)

Log By: M. JOHNSON: A. WEEGAR

WELL COMPLETED ON: 1/25/93

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY

Total Depth: 300'

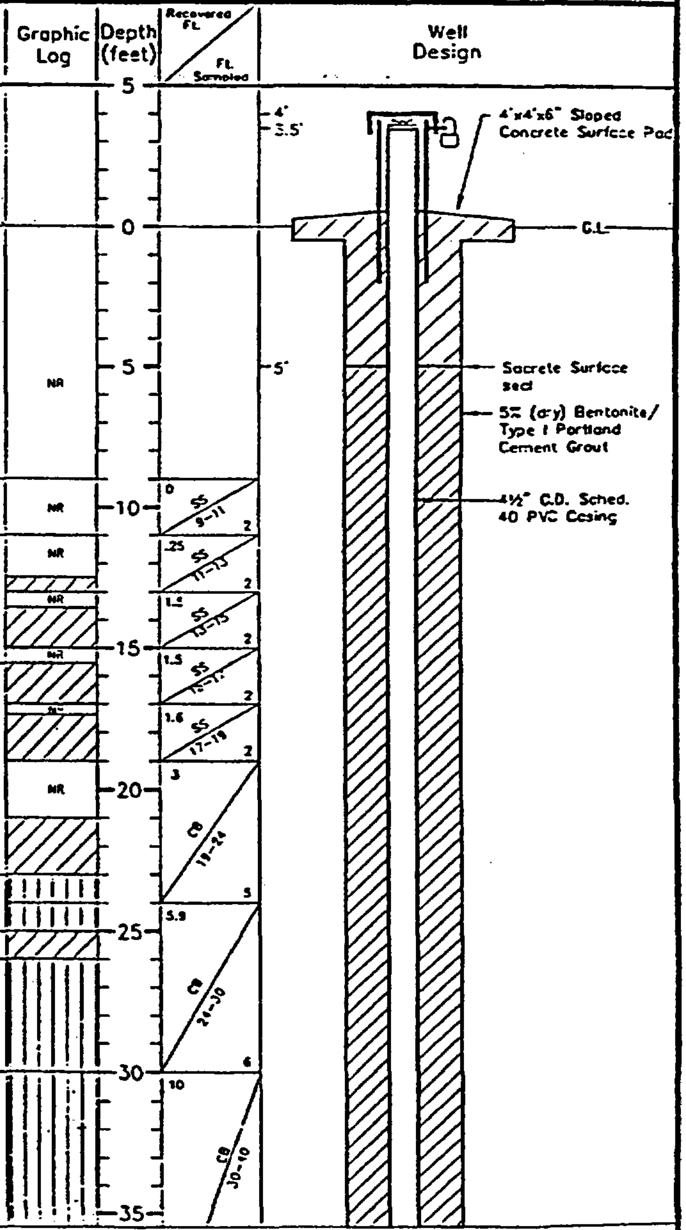
Survey Data:
Northing: 6260.8293
Easting: 10544.8903

Ground Surface Elev. (MSL): 3,454.55

Top of PVC Casing Elev.: 3,457.65

Sample Method(s): CONTINUOUS FROM 9' TO 231' USING SPLIT SPOON AND CORE BARREL: GRAB SAMPLES EVERY 5' FROM 231' TO TD.

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0'-9'	CALICHE: white; some white silty clay, some white pebbles.
9'-11'	CALICHE BASE OF OGALLALA - TRIASSIC TOP
11'-15.5'	Silty CLAY (CL): dusky red; hard; waxy; dry; some whitish-grey mottling.
15.5'-23'	Slightly Silty CLAY (CL): maroon; hard; waxy; dry; some gray mottling.
23'-25'	Slightly Silty SAND (SM): pinkish-red, well sorted vf-fg angular sand; some yellow and green mottling; HCl perm non-reactive; dry.
25'-26'	CLAYEY SAND (SL): white, chalky, HCl reactive; vf sand grains; dry.
26'-30'	Slightly Silty SAND (SM): pinkish-red, vf-fg angular sand grains; HCl perm numerous gray rip-up clasts; some yellow, green mottling; dry, lighter color with depth.
30'-42.5'	Slightly Silty SAND (SM): white, fine grained slightly angular sand; biotite and mica flakes; numerous rip-up white and gray clay clasts; slightly HCl reactive; permeable.



FILE NAME: A-LOG9G.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 12/16/92: 1/23/93	Boring No.: B-21	Grid/Well No.: 9-G(3)

Log By: M. JOHNSON; A. WEEGAR

WELL COMPLETED ON: 1/26/93

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY

Total Depth: 300'

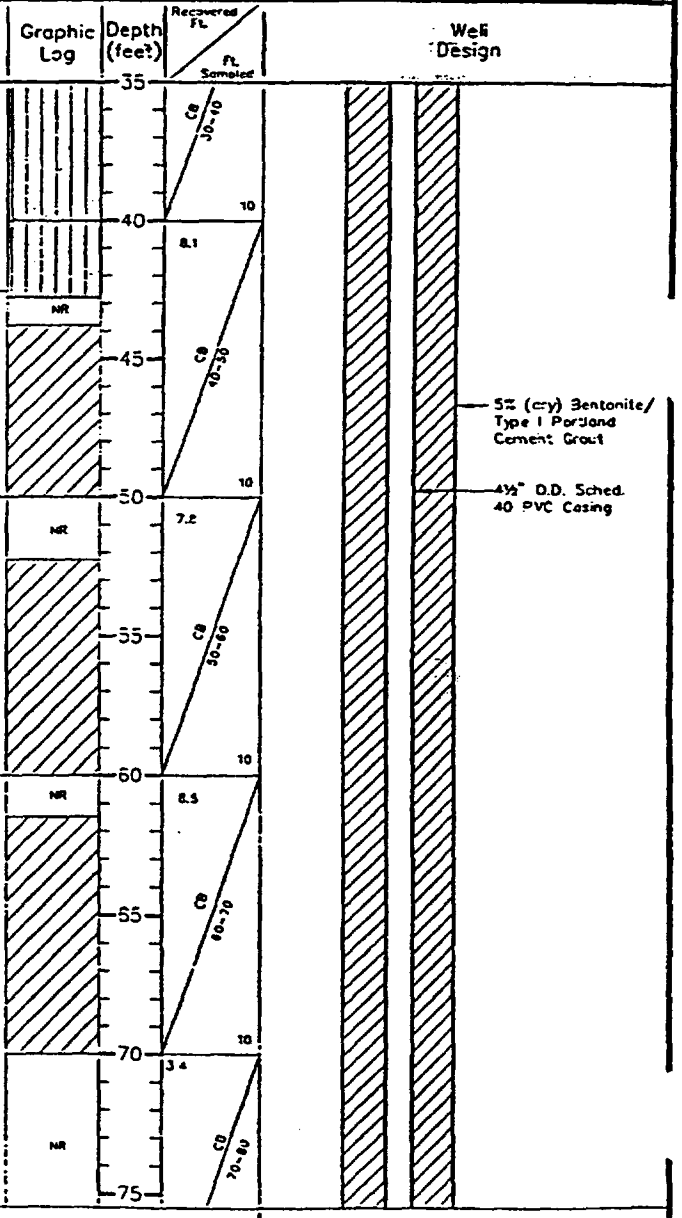
Sample Method(s): CONTINUOUS FROM 9' TO 231' USING SPLIT SPOON AND CORE BARREL: GRAB SAMPLES EVERY 5' FROM 231' TO TD.

Survey Date:
Northing: 6260.8293
Easting: 10544.8903

Ground Surface Elev. (MSL):
3,454.55

Top of PVC Casing Elev.:
3,457.65

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	
	Slightly Silty SAND (SM): same as above.
42.5'–50'	Silty CLAY (CL): dusky red; mod. hard; dry; numerous silty sand laminations with depth (slightly HCl reactive); some gray, white mottling.
50'–60'	Silty CLAY (CL): dusky red; mod. hard; waxy; dry; white and gray mottling, some vf grained sand near top.
60'–84'	Silty CLAY (CL): dusky red; hard; waxy; dry; white and gray mottling.



FILE NAME: A-LOG9G.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 12/16/92: 1/23/93	Boring No.: B-21	Grid/ Well No.: 9-G(3)

Log By: M. JOHNSON; A. WEEGAR

WELL COMPLETED ON: 1/26/93

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY

Total Depth: 300'

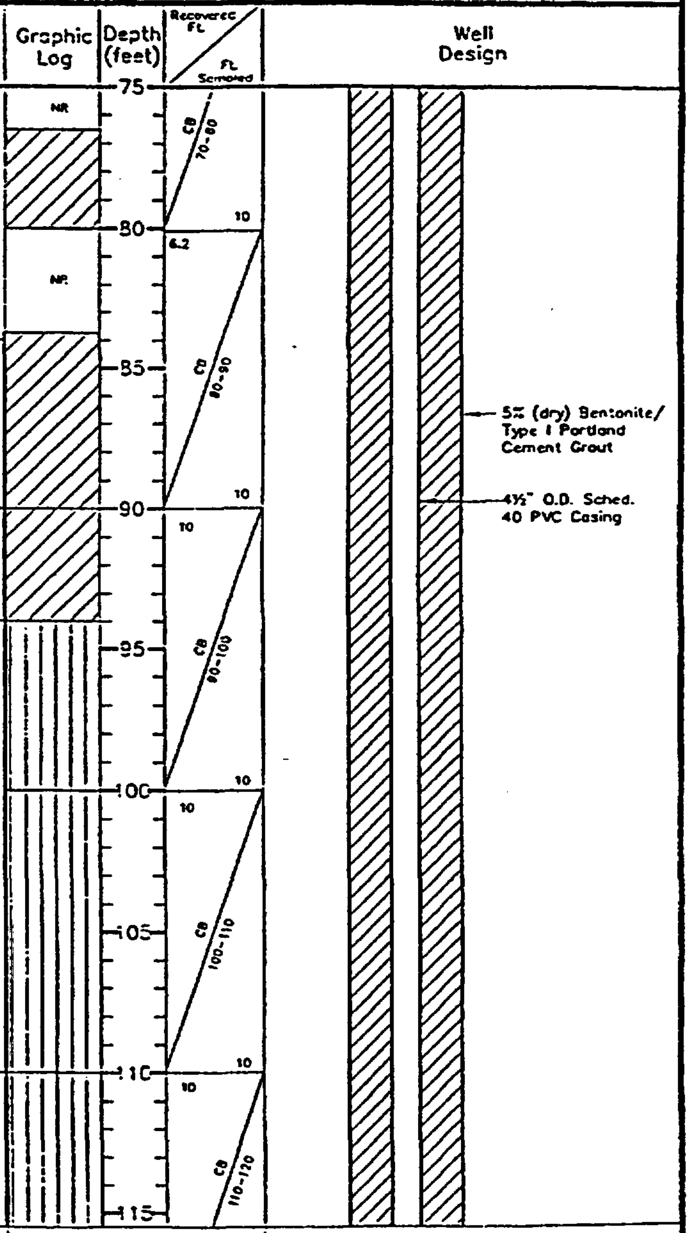
Sample Method(s): CONTINUOUS FROM 9' TO 231' USING SPLIT SPOON AND CORE BARREL; GRAB SAMPLES EVERY 5' FROM 231' TO TD.

Survey Data:
Northing: 6260.8293
Easting: 10544.8903

Ground Surface Elev. (MSL):
3,454.55

Top of PVC Casing Elev.:
3,457.55

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
	Silty CLAY(CL): same as above.
84'-90'	Silty CLAY (SM): reddish-brown; hard; dry; brown coloring increasing with depth, some vf sand increasing with depth, some gray mottling; dry.
90'-94'	Silty CLAY (CL): dusky red; hard; dry; some vf sand, grey mottling.
94'-110'	Slightly Silty SAND (SM): grayish white, vf to fg sand, grains are angular; biotite and mica flakes; some yellow, pink and green color, bottom 1 (one) foot more yellow; HCl permeable; dry; v. slightly HCl reactive. - Color becoming tan below 105 ft.; some brown/yellow streaking with depth; rip-up clay clasts (white).
110'-117.5'	Slightly Silty SAND (SM): tan/yellow, fg sand, slightly angular grains; dry; numerous biotite and mica flakes; some gray, brown streaking; slightly HCl reactive; thin brown, yellow lamination.



FILE NAME: A-LOG9G.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LO

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/16/92; 1/23/93

Boring No.: B-21

Grid/ Well No.: 9-G(

Log By: M. JOHNSON; A. WEEGAR

WELL COMPLETED ON: 1/25/93

Survey Data:
Northing: 6260.8293
Easting: 10544.8903

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Ground Surface Elev. (MSL): 3,454.55

Drilling Method & Bit Sizes: AIR ROTARY

Total Depth: 300'

Top of PVC Casing Elev.: 3,457.65

Sample Method(s): CONTINUOUS FROM 9' TO 231' USING SPLIT SPOON AND CORE BARREL; GRAB SAMPLES EVERY 5' FROM 231' TO TD.

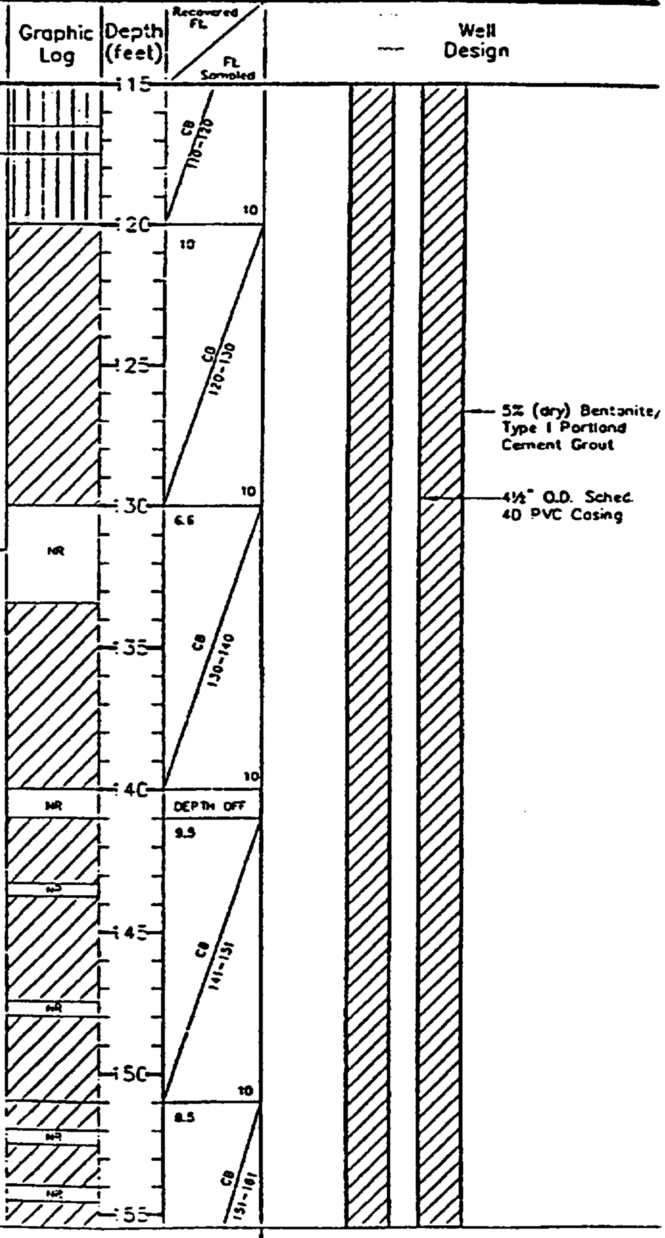
Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

- Red, fg sand, from 116.5' to 17.5'.

117.5'–131.5' <u>Slightly Silty SAND (SM)</u>: tan/yellow, fg sand, slightly angular grains; dry; numerous mica and biotite flakes; slightly HCl reactive; thin yellow lamination.

- Red, yellow and gray laminations. Bottom one foot is gray.

131.5'–196' <u>Silty CLAY (CL)</u>: dusky red; numerous gray clay clasts (greenish-white) with occasional mustard yellow mottling; mod. hard; blocky fracture to sl. crumbly, dry.



FILE NAME A-LOG9C.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 12/16/92: 1/23/93
Boring No.: B-21
Grnd/Well No.: 9-G(3)

Log By: M. JOHNSON: A. WEEGAR
WELL COMPLETED ON: 1/26/93

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY
Total Depth: 300'

Sample Method(s): CONTINUOUS FROM 9' TO 231' USING SPLIT SPOON AND CORE BARREL: GRAB SAMPLES EVERY 5' FROM 231' TO TD.

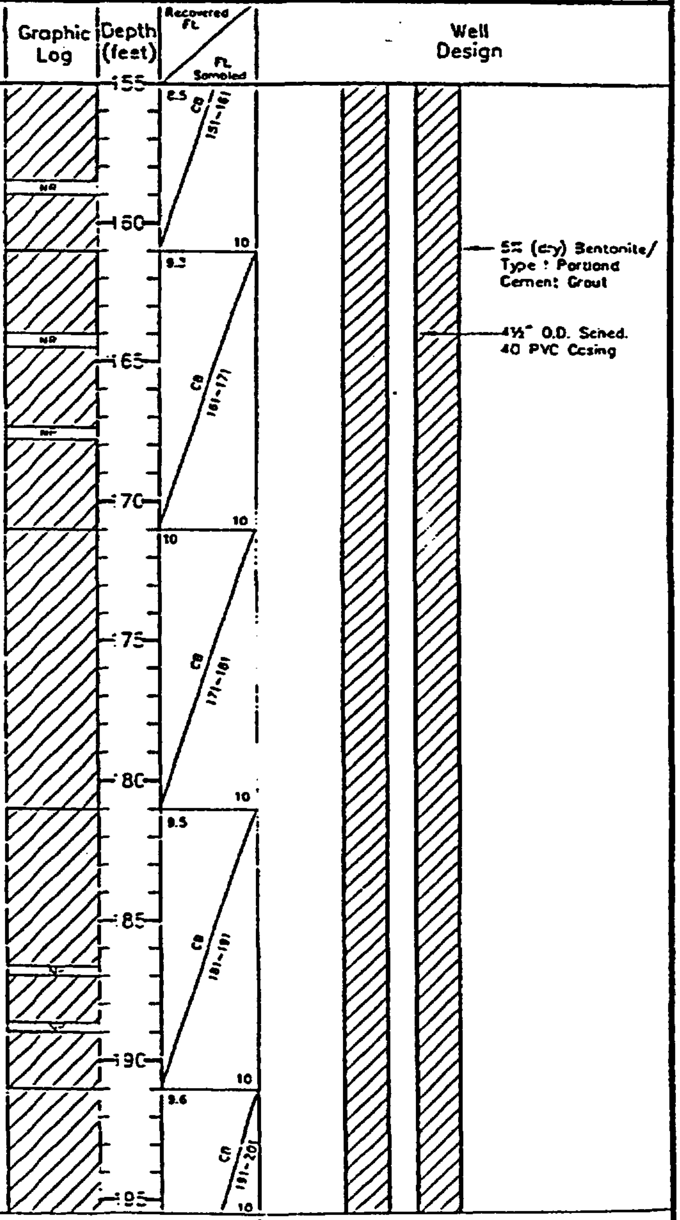
Survey Data:
Northing: 6260.8293
Easting: 10544.8903
Ground Surface Elev. (MSL):
3,454.55
Top of PVC Casing Elev.:
3,457.65

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

Silty CLAY (CL): same as above.

- Increased mustard yellow mottling below 180'.

- 45° slickenside at 186' with calcite crystalization along slip plane: increased greenish gray dendritic mottling below 186'; sl. increased crumbly texture below 186'.



FILE NAME: A-LOG9G.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LO

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 12/16/92; 1/23/93
Boring No.: B-21
Grid/Well No.: 9-G(3)

Log By: M. JOHNSON; A. WEEGAR
WELL COMPLETED ON: 1/26/93

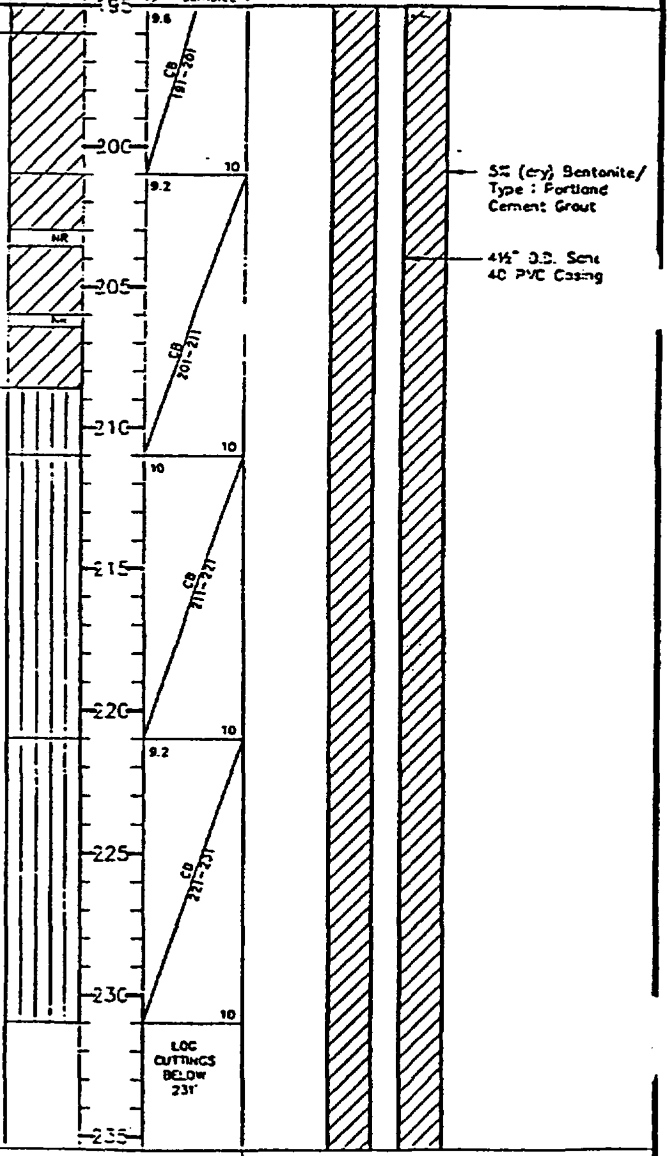
Survey Data:
Northing: 6260.8293
Easting: 10544.8903
Ground Surface Elev. (MSL):
3,454.55
Top of PVC Casing Elev.:
3,457.65

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY
Total Depth: 300'

Sample Method(s): CONTINUOUS FROM 9' TO 231' USING SPLIT SPOON AND CORE BARREL; GRAB SAMPLES EVERY 5' FROM 231' TO TD.

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)		Graphic Log	Depth (feet)	Recovered Ft / Ft. Sampled	Well Design
196'–208.8'	Slightly Silty CLAY (CL): heavily mottled primarily greenish gray and purplish gray with dendritic coloring of reddish brown and mustard yellow; sl. soapy; blocky fracture and crumbly; dry. – reduced greenish gray mottling below 201'.				
208.8'–238'	SILT(ML): greenish grey siltstone; trace vfg mica frags.; hard; blocky fracture; moist. – reddish brown clayey siltstone layers; clasts and vertical seams from 213'–224' – faint cross-lamination below 220'.				



FILE NAME: A-LOG9G.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 12/16/92; 1/23/93	Boring No.: B-21	Grid/Well No.: 9-G(3)

Log By: M. JOHNSON; A. WEEGAR

WELL COMPLETED ON: 1/26/93

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY

Total Depth: 300'

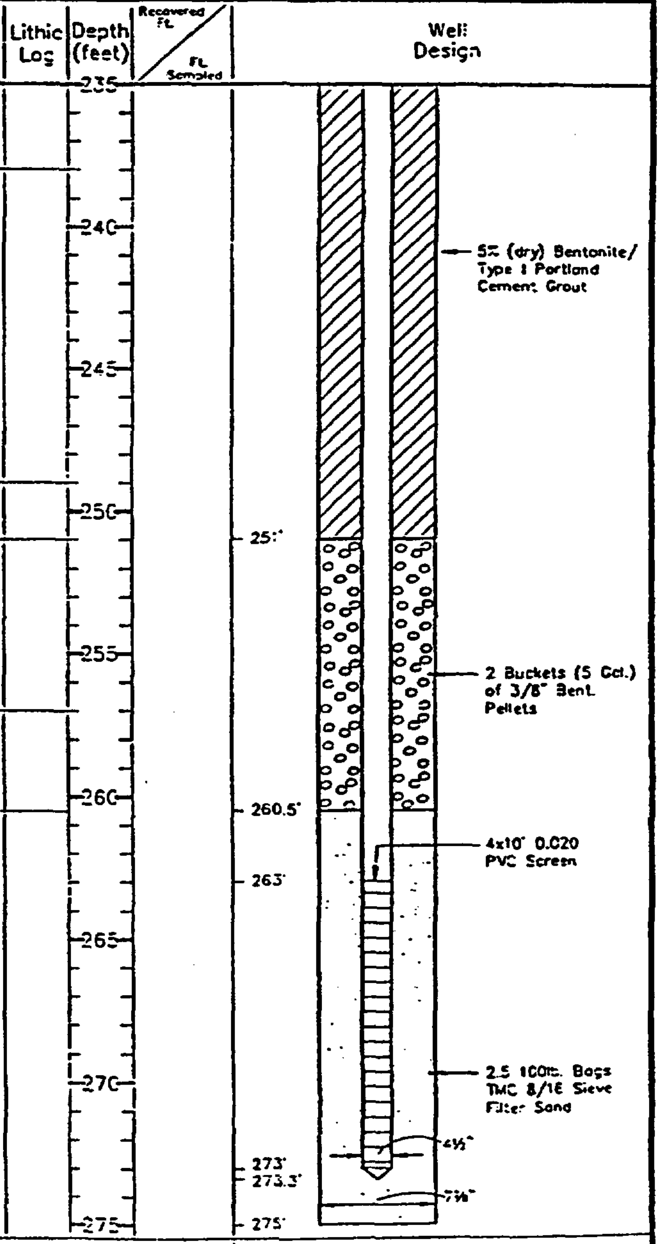
Survey Data:
Northing: 6260.8293
Easting: 10544.8903

Ground Surface Elev. (MSL): 3,454.55

Top of PVC Casing Elev.: 3,457.65

Sample Method(s): CONTINUOUS FROM 9' TO 231' USING SPLIT SPOON AND CORE BARREL; GRAB SAMPLES EVERY 5' FROM 231' TO TD.

Unified Soil Classification/Description (Color, Texture; Structure, Grain Size)	
238'-249'	Silty CLAY (CL): reddish brown and maroon silty claystone with greenish gray mottling.
249'-251'	SILT (ML): greenish gray siltstone.
251'-257'	Silty CLAY (CL): reddish brown and maroon silty claystone with slight purplish gray mottling.
257'-260.5'	Silty CLAY (CL): maroon and purple silty claystone with greenish gray mottling.
260.5'-291'	V. Silty CLAY (ML): reddish brown and maroon very silty claystone with heavy mottling of mustard yellow and purple.



FILE NAME: A-LOG93.DWG

Terra Dynamics Incorporated

SOIL BORING & WELL COMPLETION LO

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 12/16/92; 1/23/93	Boring No.: B-21	Grid/ Well No.: 9-G(3)

Log By: M. JOHNSON; A. WEEGAR

WELL COMPLETED ON: 1/26/93

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Drilling Method & Bit Sizes: AIR ROTARY

Total Depth: 300'

Survey Data:
Northing: 6260.8293
Easting: 10544.8903

Ground Surface Elev. (MSL): 3,454.55

Top of PVC Casing Elev.: 3,457.65

Sample Method(s): CONTINUOUS FROM 9' TO 231' USING SPLIT SPOON AND CORE BARREL; GRAB SAMPLES EVERY 5' FROM 231' TO TD.

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Lithic Log	Depth (feet)	Recovered Ft / Ft Sampled	Well Design
V. Silty CLAY (ML): same as above.		275		
		280		
		285		
		290		
291'-300' Silty CLAY (CL): dark reddish brown silty claystone.				
		295		
TOTAL DEPTH = 300'		300		
		305		
		310		
		315		

FILE NAME: A-LOG93.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 12-10-92
Boring No.: B-14
Grid No.: 9-H

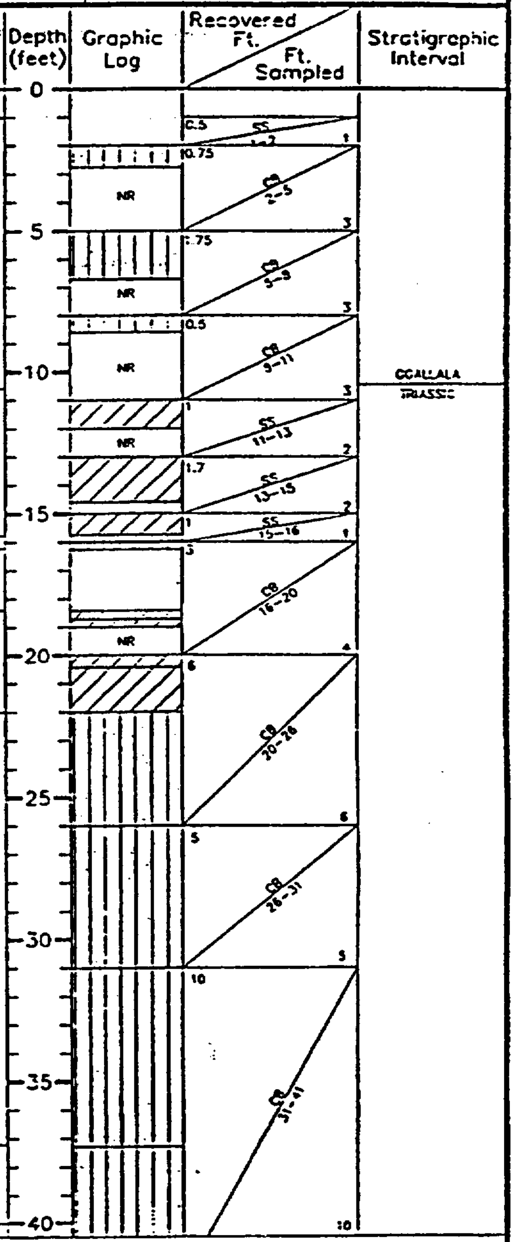
Log By: A. WEEGAR
Drilling Method & Bit Sizes: AIR ROTARY
Survey Data:
Northing: 5807.9313
Easting: 10333.6242
Ground Surface Elev. (MSL): 3,439.66

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller: LANE SCARBOROUGH
Total Depth: 100'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0' - 1'	TOP SOIL: brown silty sand; organic plant material & roots; moist.
1' - 10.5'	CALICHE: pinkish tan sandy silt; mod. hard; crumbly; calcite crystals along laminations and in vugs; dry; basal contact from driller.
10.5' - 15.7'	Silty CLAY(CL): mottled dusky red, yellow, pink and gray; crumbly; non-plastic; carb. plant material; mica frags.; sl. seepy; dry.
15.7' - 16.2'	SILT (SL): greenish gray siltstone; soft; crumbly; chalky; very strong reaction w/ HCl; mica frags; dry.
16.2' - 18.3'	Silty SAND (SM): reddish brown sand w/ greenish gray, silty matrix; sand is granitic fg. subang. to ang.; contains dk. min. frags. and mica frags; mod. hard; crumbly; blocky fracture; strong reaction w/ HCl to matrix; dry.
18.3' - 22'	Silty CLAY (CL): alternating layers of greenish grey and mottled dusky red and yellow; crumbly; soft to mod. hard; blocky fracture; carb. plant material mica frags; dry.
22' - 37.2'	Silty SAND (SM): reddish brown sand w/ greenish grey, silty matrix; sand is granitic fg. subang. to ang.; mod. reaction w/ HCl to matrix; natural vertical fractures; thinnly bedded and cross bedded sandstone and sandy siltstone; mod. perm. to acid; dry.
37.2' - 43'	V. Sandy SILTSTONE (ML): greenish gray siltstone and olive tan sandstone; sand is vfg. subr.; hard; sl. crumbly; mod. reaction to HCl; mica frags.; dk. min frags; horiz. to crossbedded; dry.



FILE NAME: A-LOG3H.DWG

Terra Dynamics Incorporated

SOIL BORING LO

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 12-10-92
Boring No.: B-14
Grid No.: 9-H

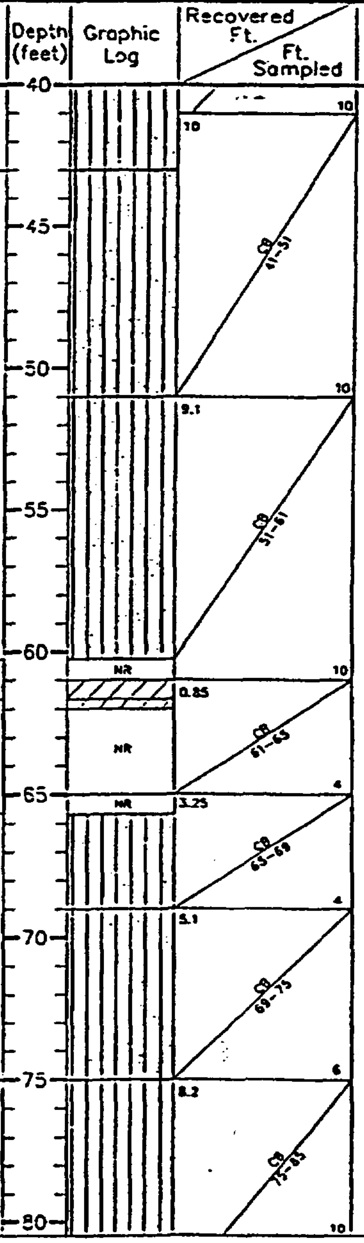
Log By: A. WEEGAR
Drilling Method & Bit Sizes: AIR ROTARY
Survey Data:
Northing: 5807.9313
Easting: 10333.6242
Ground Surface Elev. (MSL): 3,439.66

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller: LANE SCARBOROUGH
Total Depth: 100'

Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	
45' - 60.1'	Silty SAND (SM): olive, red and pink sand w/ greenish gray matrix; sand is vfg - cg angular to subrounded and poorly sorted; mica & dk. min. frags. throughout; mod. hard; sl. crumbly; mod. perm. to HCl; no reaction w/ HCl; horiz. and crossbedded; slightly higher angle x-bedding and larger grain sand than above; apparent weathered iron oxide zone throughout; dry; basal contact from driller
60.1' - 61.70'	CLAY (CL): tannish yellow; soapy; plastic; mod. hard; moist.
61.70' - 65.75'	CLAY (CL): dk. maroon; sl. plastic; soapy; sticky; mod. hard; moist; core jammed in barrel.
? ? ?	
65.75' - 75'	Clayey Sandy SILT (ML): dusky red sandy, clayey siltstone; dk. min. frags. and mica throughout; hard; blocky fracture; no reaction w/ HCl; non - permeable to HCl; dry.
75' - 100'	V. Clayey SILT (ML): dusky red siltstone; hard; conchoidal fracture; mica and dk. min. frags.; thinly laminated; dry; occasional streaks of light greenish gray clay.



Stratigraphic Interval

FILE NAME: A-LOG9H.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12-10-92

Boring No.: B-14

Grid No.: 9-H

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

Driller: LANE SCARBOROUGH

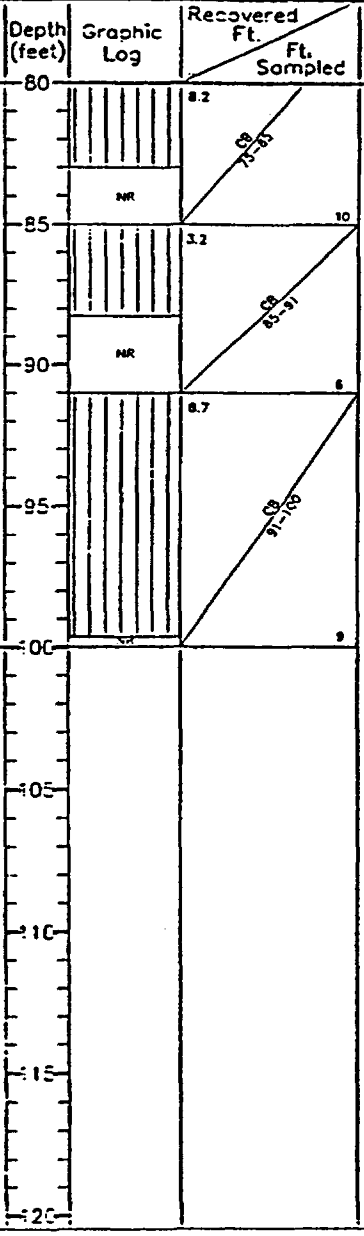
Total Depth: 100'

Survey Data:
Northing: 5807.9313
Easting: 10333.6242

Ground Surface Elev. (MSL): 3,439.66

Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Interval
V. Clayey SILT (ML): same as above.	80			
TOTAL DEPTH = 100'	100			



FILE NAME. A-LOG94.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 01/23/93

Boring No.: B-50

Grid No.: 10-9

Log By: R. McGOWEN

Drilling Method & Bit Sizes: AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

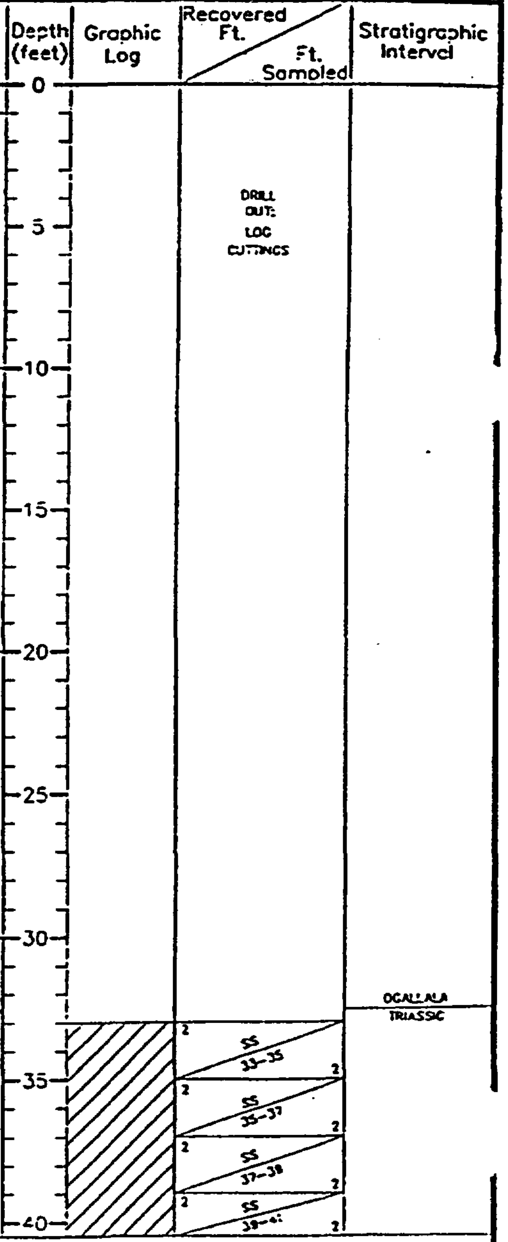
Driller:

Total Depth: 100'

Survey Data:
Northing: 8738.0161
Easting: 11148.0894
Ground Surface Elev. (MSL): 3,480.41

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0.0'-1.0'	TOP SOIL: dk. brown, sand, silt, organic material, loose, dry.
1.0'-10'	CALICHE: lt. tan, calcitic cemented silt and sand, vfg-fg quartz sand, soft, dry. - reddish tan 8'-10'.
10'-20'	SAND (SW): tan to reddish tan vfg-fg quartz sand; scattered calcitic cemented sand clasts; soft; dry.
20'-30'	CALICHE: lt. tan-gray calcitic and micritic cemented sand and silt, vfg-fg quart sand; micritic cement has concretion rings; sandstone lithoclasts with silica concretions in micritic matrix; hard; dry.
30'-32.5'	SAND and GRAVEL (SW): lt. tan,-gray vfg-fg quartz sand and pebbles; pebbles rounded to angular.
32.5'-71.5'	CLAY (CL): red with whitish mottling; friable; soft; dry. - silt nodules approx. 1.5" at 36' and 38'.



FILE NAME: A-LOG10B.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92–152

Date Drilled: 01/23/93

Boring No.: B–50

Grid No.: 10–B

Log By: R. M^c^GOWEN

Drilling Method & Bit Sizes: AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

Driller:

Total Depth: 100'

Survey Data:
Northing: 8738.0161
Easting: 11148.0894
Ground Surface Elev. (MSL):
3,480.41

Remarks:

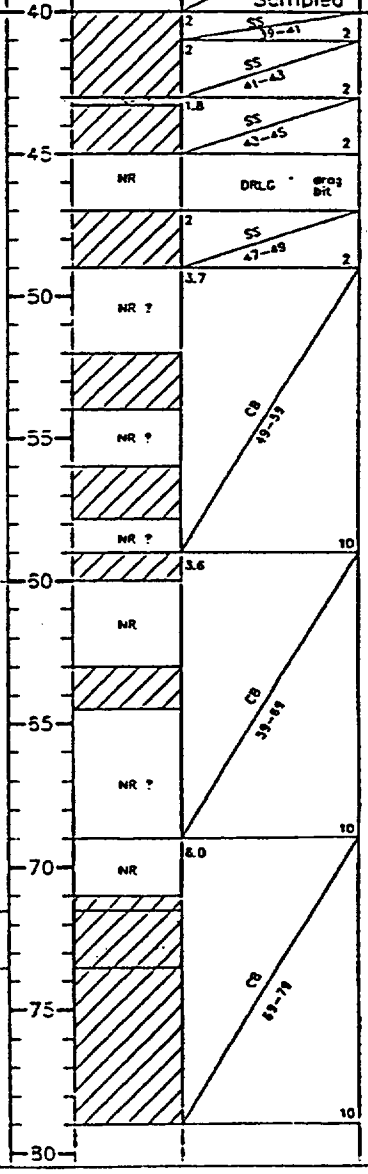
Unified Soil Classification/Description (Color, Texture, Structure, Grain Size) | Depth (feet) | Graphic Log | Recovered Ft. / Ft. Sampled | Stratigraphic Interval

- cohesive; plastic; damp; yellow and purple slight mottling.
- purplish red with yellow at 43'–45'.
- yellow mottling back at 47'.
- healed fracture oriented 30° from vertical.

71.5'–73.5' <u>Silty CLAY (CL)</u>; greenish white nodules (3"–4" nodules); dry; brittle; vertical fractures 72'–73'.

73.5'–100' <u>CLAY (CL)</u>; filled (1/4") frac.; calcite Spar, oriented 60° from verical at 78.0'.

- red orange with yellow and purple mottling and greenish white nodule.



FILE NAME: A–LOG108.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 0[illegible]/24/93

Boring No.: 3-50

Grid No.: 10-3

Log By: R. McGOWEN

Drilling Method & Bit Sizes: AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

Driller:

Total Depth: 100'

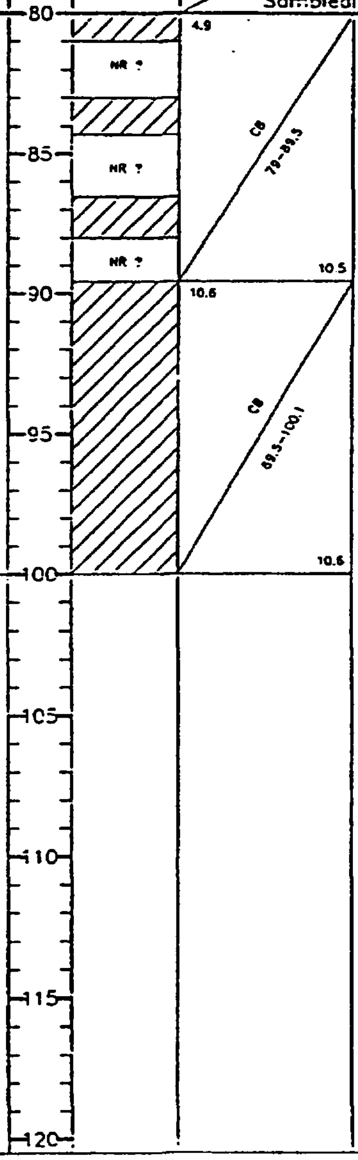
Survey Data:
Northing: 8738.0161
Easting: 11148.0894
Ground Surface Elev. (MSL):
3.480.41

Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Interval

- 1/2" wafer of spary calcite cemented clay and silt.
- approx. 86' red, yellow and purple mottled, no whitish nodules.
- 95'-97' whitish green clay nodules scattered 0.5"-0.75".

TOTAL DEPTH = 100'



FILE NAME. A-LOG10B.DWG

Terra Dynamics Incorporated

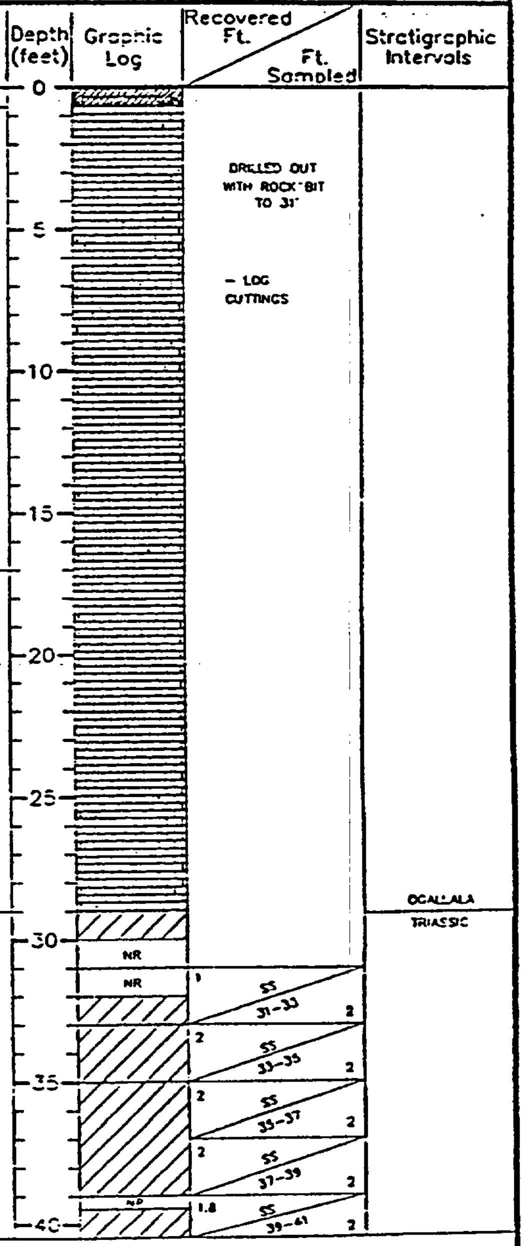
SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 01/12/93
Boring No.: B-36
Grid No.: 10-C

Log By: A. WEEGAR/R. McGOWEN
Drilling Method & Bit Sizes: AIR ROTARY
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): CORE BARREL; SPLIT SPOON
Driller:
Total Depth: 100'
Remarks:

Survey Data:
Northing: 8284.7750
Easting: 10936.8294
Ground Surface Elev. (MSL): 3,475.51

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0'-0.3'	TOP SOIL: dk. brown, loose sand and silt; organic material; moist.
0.3'-17'	CALICHE: whitish to lt. tan, calcite cemented silt and sand; vfg quartz sand; soft.
17'-29'	CALICHE: gray to lt. tan, calcitic-micritic cemented silt and sand; vfg quartz and feldspar sand; micritic fragments show concretions; sandstone lithoclasts with silica rims in calcitic matrix; concoidal silica fragments; hard.
29'-55'	CLAY (CL): red; scattered calcitic sand particles; soft and moist. - small nodules of green clay - absense of calcite grains; less moist.



FILE NAME: A-LOG10C.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 01/13/93
Boring No.: B-36
Grid No.: 10-C

Log By: R. McGOWEN
Drilling Method & Bit Sizes: AIR ROTARY
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): CORE BARREL; SPLIT SPOON
Driller:
Total Depth: 100'
Survey Data:
Northing: 8284.7750
Easting: 10936.8294
Ground Surface Elev. (MSL): 3,475.51
Remarks:

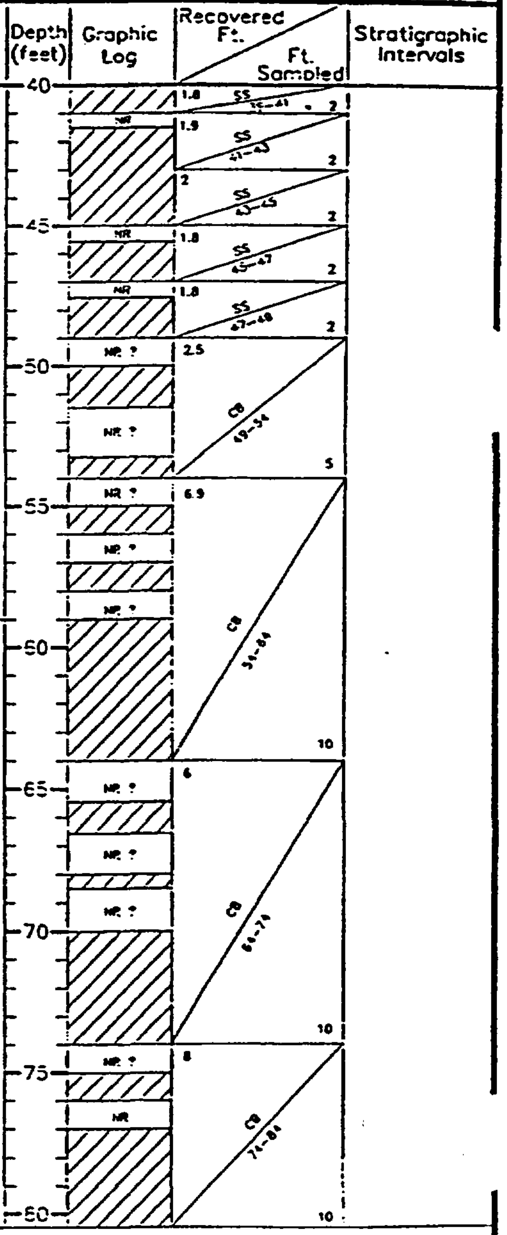
Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

- Purplish color at 41'.
- 30-40% green clay, 41'-42' (Nodular).
- Mostly red clay <10% green.
- Yellow clay mottling
- Less purple color.

59'-85'

CLAY (CL): red-orange with yellow-green mottling and some green nodules.

- Vertical fracture; from 60'-60.8'; black secondary mineralization.
- Quasi brittle.
- Vertical fracture with black mineralization.
- 45° fracture; healed with yellow clay
- Yellow/green clay nodules with purple clay concretions.
- Brittle
- Green clay nodule approx 0.15 ft



FILE NAME: A-LOG10C.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 01/13/93

Boring No.: B-36

Grid No.: 10-C

Log By: R.M^cGOWEN

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 8284.7750
Easting: 10936.8294
Ground Surface Elev. (MSL): 3,475.51

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

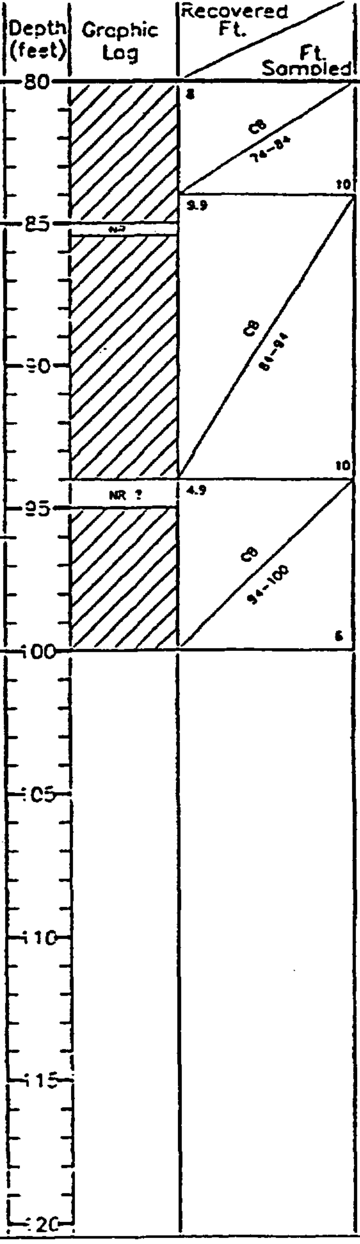
Sample Method(s): CORE BARREL; SPLIT SPOON

Driller:

Total Depth: 100'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
85'–96'	CLAY (CL): pinkish yellow due to increased content of yellow to whitish green clay. – green clay nodules approx. 0.15 ft. – 45° healed fracture 91'. – 30° healed fracture 89' – hard and brittle and dry. – purple 95'–96'
96'–100'	CLAY (CL): orange yellow. – 45° frac. healed 99.5' and 98.5'.
TOTAL DEPTH = 100'	



Stratigraphic Intervals

FILE NAME: A-LOG10C.DWG 1=360

Terra Dynamics Incorporated	SOIL BORING LO

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 01/18/93

Boring No.: B-44

Grid No.: 10-D

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 7831.6956
Easting: 10725.4492
Ground Surface Elev. (MSL):
3,469.62

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

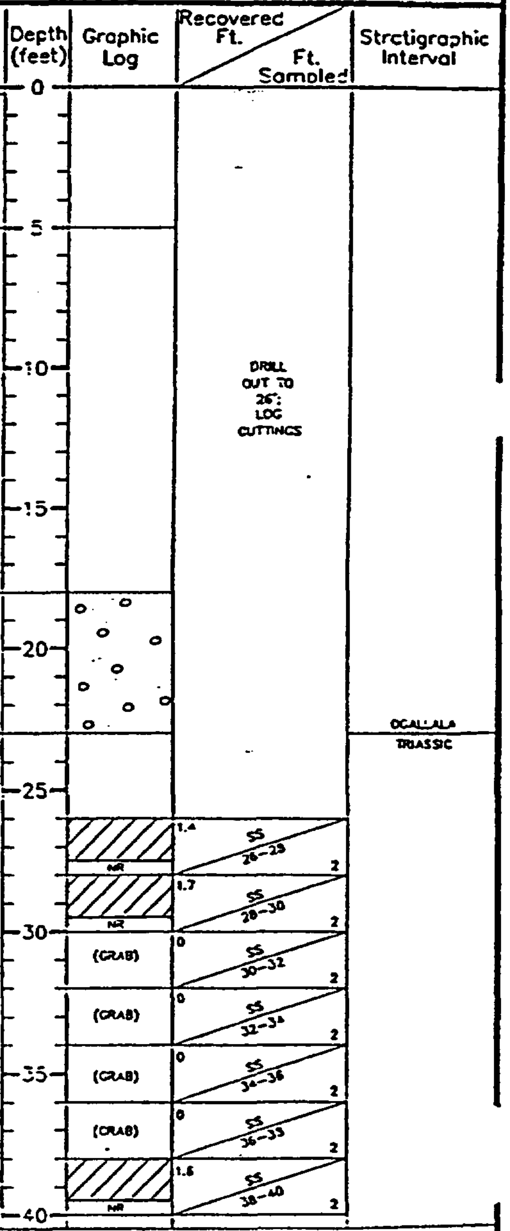
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller:

Total Depth: 100'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0'–0.2'	TOP SOIL: brown; silty sand; organic material; moist.
0.2'–5'	CALICHE: yellowish white; trace dark and pink vfg sand fragments; soft; mod. hard pinkish tan layers; dry.
5'–18'	CALICHE: yellowish white; hard; trace vfg to cg dark and pink sand frags.; dry.
18'–23'	Gravelly SAND (SW): tan; fg to cg sand; angular to subrounded; dark, white, pink and opaque gravel throughout; angular; loose; dry.
23'–42.8'	Silty CLAY (CL): maroon clay; dense; sl. plastic; moist.



FILE NAME: A-LOG10D.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 01/18/93
Boring No.: B-44
Grid No.: 10-D

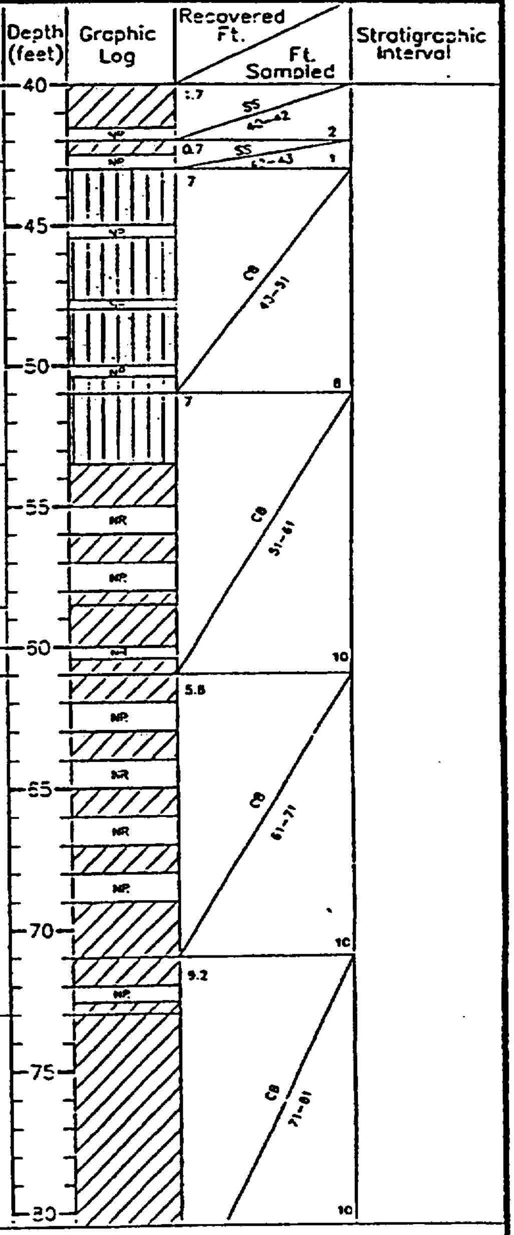
Log By: A. WEEGAR
Drilling Method & Bit Sizes: AIR ROTARY
Survey Data:
Northing: 7831.6956
Easting: 10725.4492
Ground Surface Elev. (MSL): 3,469.62

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller:
Total Depth: 100'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
42.8'-53.4'	Silty SAND (SM): multicolored grayish green, yellow, tan and pink silty sandstone and thin intervals of sandy siltstone; "salt and pepper" appearance of vfg to fg quartz and feldspar sand with fg to cg mica and biotite flakes; gray and yellow clay clasts throughout; increased clay clasts in basal 3'; trace black mineralization along bedding; mod. hard; calcium carbonate cemented; blocky fracture and crumbly, dry.
53.4'-58.6'	Silty CLAY (CL): purple red with heavy mottling of yellow and gray; fg-cg mica frags; crumbly, dry.
58.6'-60'	Silty CLAY (CL): rusty red silty claystone; crumbly, dry
60'-61'	Silty CLAY (CL): purple red with heavy mottling of yellow and grey, vfg mica frags.; tubes and inclusions of silty/sandy material similar to that found at 42.8'-53.4'; crumbly, dry.
61'-73'	Silty CLAY (CL): alternating layers of purple/rusty red and heavily mottled yellow and pinkish red silty claystone; occasional clasts and tubes of greenish gray clay, blocky fracture to crumbly, mod. hard; dry
73'-82'	Silty CLAY (CL): dusky red silty claystone; greenish gray clasts and tubes throughout; dense; blocky fracture; dry. - primary slickenside at 78.5' with calcium carbonate cementation along fracture plane (30'-45' angle).



FILE NAME: A-LOG10D.DWG

Terra Dynamics Incorporated

SOIL BORING LO

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 01/18/93

Boring No.: B-44

Grid No.: 10-D

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:

Northing: 7831.5956

Easting: 10725.4492

Ground Surface Elev. (MSL): 3,469.62

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

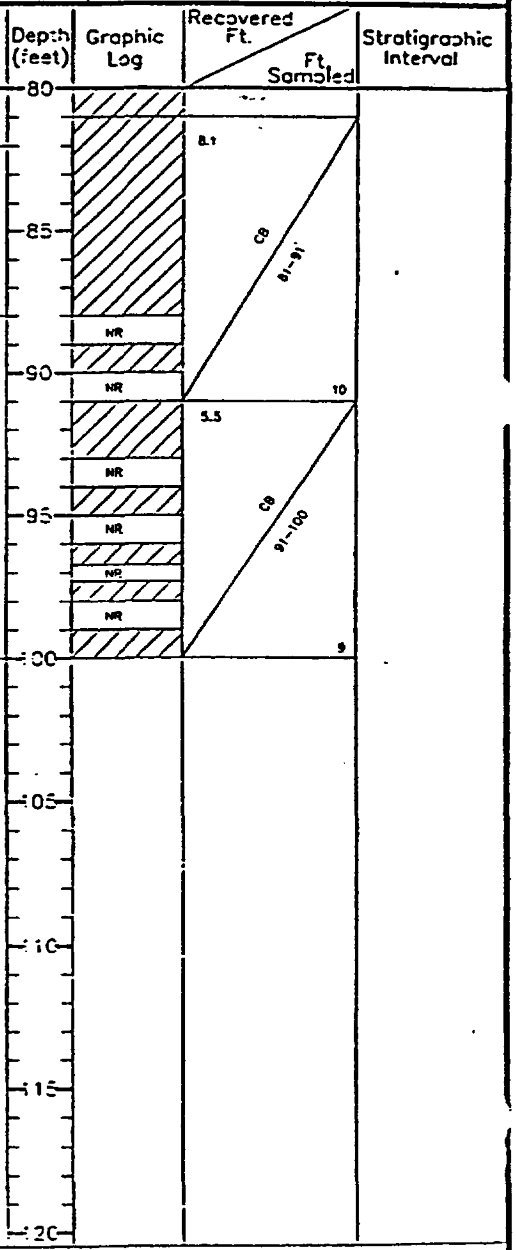
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller:

Total Depth: 100'

Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	
82'-88'	Silty CLAY (CL): rusty red and heavily mottled with yellow and grayish purple; greenish gray clasts and tubes throughout; blocky fracture; dry.
88'-100'	Silty CLAY (CL): purple claystone with yellow and greenish gray mottling; crumbly; greenish grey tubes throughout; dry.
TOTAL DEPTH = 100'	



FILE NAME: A-LOG1CO.DWG

Terra Dynamics Incorporated

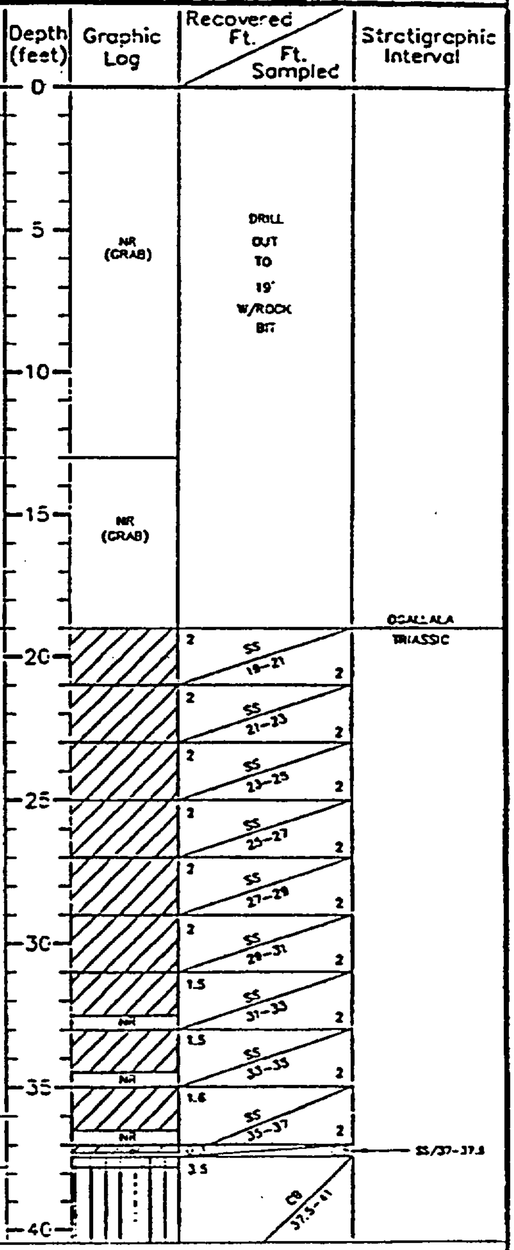
SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 12/16/92
Boring No.: E-19
Grid No.: 10-E

Log By: A. WEEGAR; R. McGOWEN
Drilling Method & Bit Sizes: AIR ROTARY
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL
Driller: LANE SCARBOROUGH
Total Depth: 100'
Remarks:

Survey Data:
Northing: 7378.4802
Easting: 10514.3251
Ground Surface Elev. (MSL): 3,467.75

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0'–1'	– TOP SOIL: brown silty sand; organic material; soft; loose; moist.
1'–13'	CALICHE: pinkish white; calcium carb. cemented; hard; microcrystalline; dry.
13'–19'	Gravelly SAND (SW): pink sand with white, red, black and opaque gravel; sand is vfg–cg quartz; well rounded; gravel is subr. to well rounded quartzite; loose; dry.
19'–36'	Slightly Silty CLAY (CL): dusky red with whitish gray mottling; dense; sl. plastic, moist. – color change to maroon with whitish grey mottling below 21'.
36'–37.9'	Slightly Silty CLAY (CL): dusky red; crumbly; mod. hard; dry.
37.9'–41'	Clayey SILT (ML): greenish white, grey and yellow siltstone; mica frags.; mod. hard; chalky; crumbly; dry



FILE NAME: A-LOG10E.DWG

Terra Dynamics Incorporated

SOIL BORING LO

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 12/16/92
Boring No.: B-19
Grid No 10-E

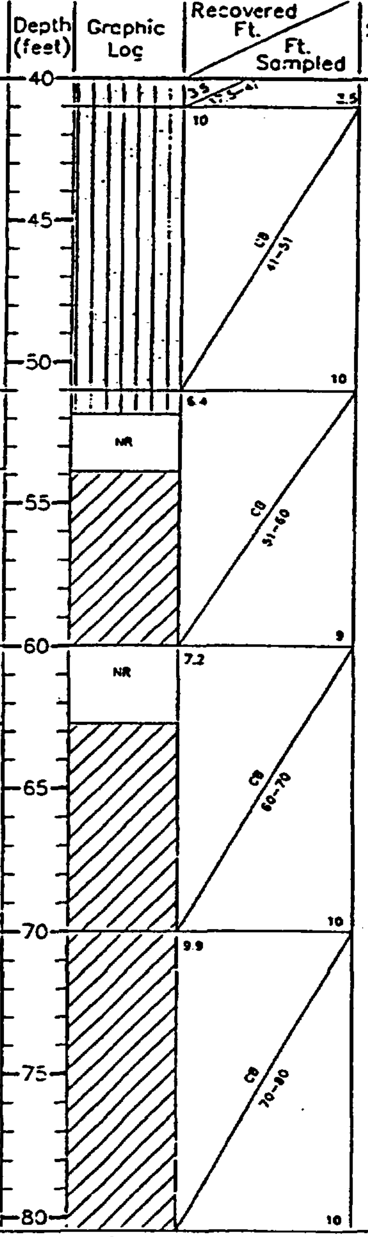
Log By: A. WEEGAR; R. McGOWEN
Drilling Method & Bit Sizes: AIR ROTARY
Survey Data:
Northing: 7378.4802
Easting: 10514.3261
Ground Surface Elev. (MSL): 3,467.76

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller: LANE SCARBOROUGH
Total Depth: 100'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
40'–51'	Silty SAND (SM): speckled appearance of red, pink, white and green sand frags. with white, yellow and green matrix; sand is vfg–fg; subr. to rounded; small to large biotite and mica flakes throughout; mod. perm. to HCl; no reaction with HCl; low angle cross-bedding; mod. hard; chalky; sl. crumbly; dry
51'–53.9'	Silty SAND (SM): top 0.5'; speckled red, white and green sand frags., white, yellow and green matrix; sand fg. uncemented. additional as above, no rip-up clasts; drilling break at 53'.
53.9'–60'	Slightly Silty CLAY (CL): maroon; crumbly; mod. hard; very slightly moist.
60'–62.8'	No sample recovered.
62.8'–70'	Slightly Silty CLAY (CL): dusky red; crumbly; mod. hard; dry; numerous gray-white silty clay clasts with black speckles, (soapy clasts) some silt clasts, (tan).
70'–80'	Slightly Silty CLAY (CL): dusky red; crumbly; mod. hard; dry; gray-white, tan mottling.



Stratigraphic Interval

FILE NAME: A-LOG1CE.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/16/92

Boring No.: B-19

Grid No.: 10-E

Log By: A. WEEGAR; R. M^cGOWEN

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 7378.4802
Easting: 10514.3261

Ground Surface Elev. (MSL): 3,467.76

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

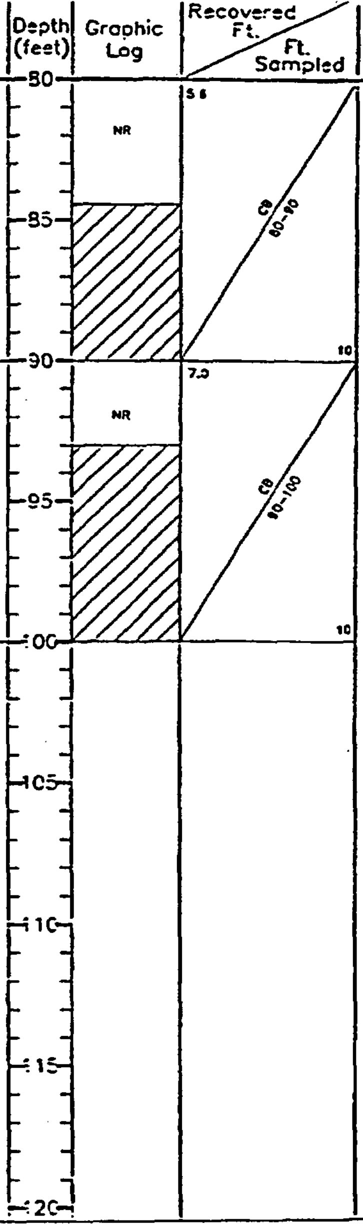
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller: LANE SCARBOROUGH

Total Depth: 100'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
80'-90'	Slightly Silty CLAY (CL): dusky red; slightly maroon; mod. hard; gray-white, tan mottling; crumbly; dry.
90'-100'	Slightly Silty CLAY (CL): maroon; mod. hard; less mottling; slightly sticky, dry.
TOTAL DEPTH = 100'	



Stratigraphic Interval

FILE NAME: A-LOG10E.DWG

Terra Dynamics Incorporated

SOIL BORING LO

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/19/92

Boring No.: B-25

Grid N: 10-F

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 6925.4458
Easting: 10302.9162
Ground Surface Elev. (MSL):
3,467.67

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

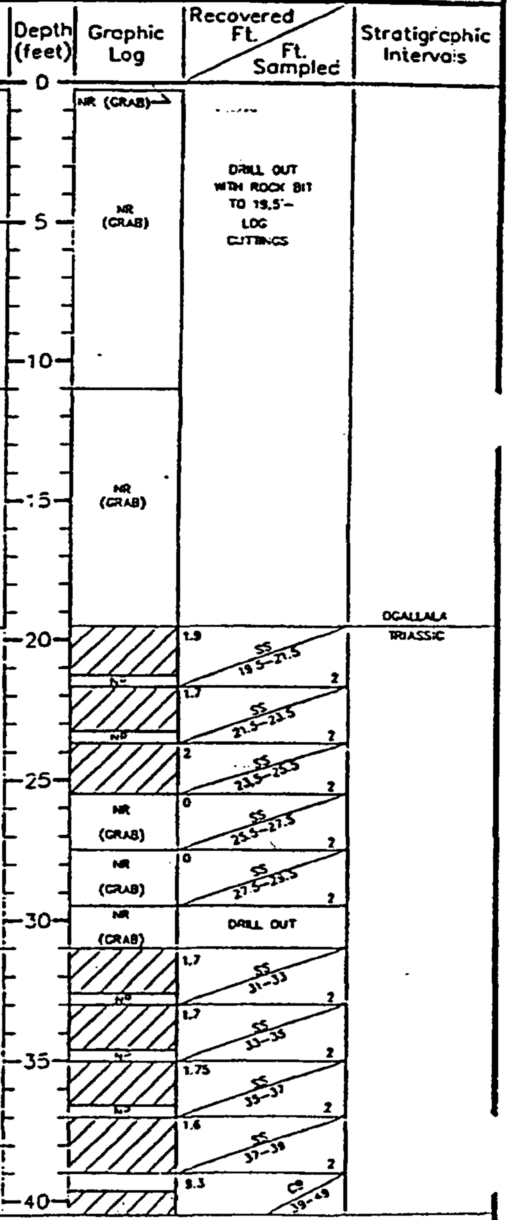
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller: LIZARO CASTILLO
JOHN SCARBOROUGH

Total Depth: 100'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0'-0.3'	TOP SOIL: brown silty sand; organic material; moist;
0.3'-5'	CALICHE: grayish white; calcium carb cemented silt w/ vfg pink sand frags.; concentric growth rings; v. hard; dry
5'-11'	CALICHE: grayish pink; quartz sand and gravel throughout; mod. hard (i.e., softer than above); dry
11'-19.5'	Silty Gravelly SAND (SW): pink and opaque sand grains, white dark and red gravel with pinkish tan silt matrix; sand is vfg-fg; sand and gravel is subrounded to rounded quartz; loose; dry.
19.5'-31'	CLAY (CL): maroon w/mottling of pinkish gray; dense; sl. soapy; blocky fracture; crumbly in upper 2'; moist.
31'-38'	Silty CLAY (CL): dusky red w/ pinkish gray mottling; trace vfg mica frags; mod. dense; moist.
38'-63.2'	Slightly Sandy Silty CLAY (CL): (see next page for description).



FILE NAME: A-LOG10F.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/19/92

Boring No.: B-25

Grid No.: 10-F

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 6925.4458
Easting: 10302.9162
Ground Surface Elev. (MSL):
3,467.67

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

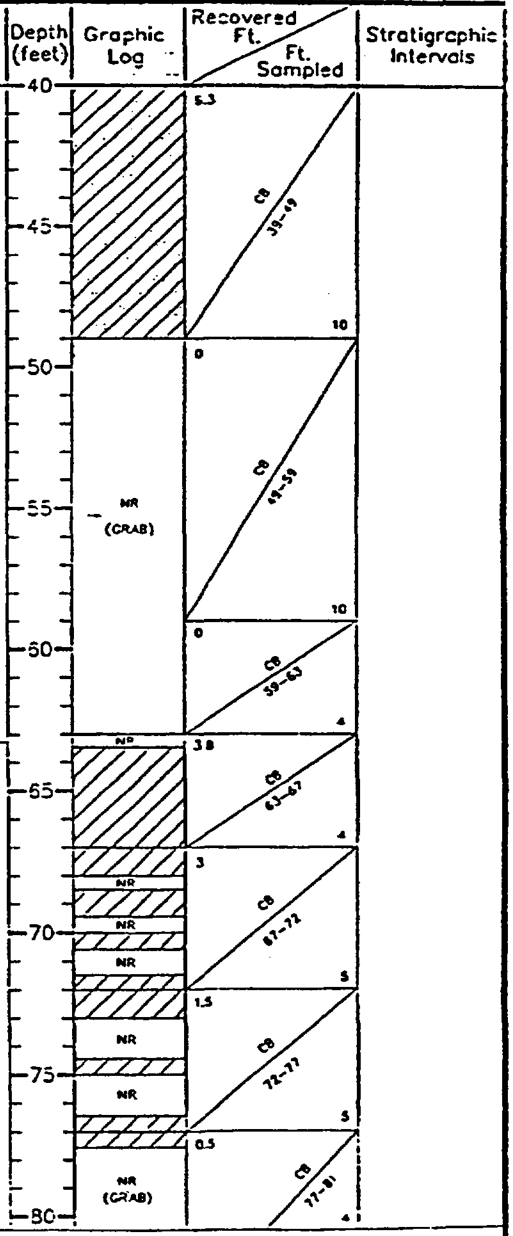
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller: LIZARO CASTILLO
JOHN SCARBOROUGH

Total Depth: 100'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
38'-63.2'	Slightly Sandy Silty CLAY (CL): multicolored mottling of light greenish grey, yellow, dusky red and purple sandy siltstone and claystone; silty claystone clasts and layers floating within a sandy siltstone matrix; sand is vfg quartz with small mica flakes throughout; carb. plant material; calcareous veins throughout; mod. dense; sl. crumbly, blocky fracture; claystone is sl. soapy; dry; becoming siltier toward base.
63.2'-99'	Silty CLAY (CL): interbedded purple and dusky red silty clay with clasts and layers of greenish gray clayey silt; vfg mica frags. within silty layers; carb. plant material common in clayey zones; mod. hard to 67'; very crumbly below 67'; dry.



FILE NAME: A-LOG10F.DWG

R

Terra Dynamics Incorporated

SOIL BORING LO

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/19/92

Boring No.: B-25

Grid No.: 10-F

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:
Northing: 6925.4458
Easting: 10302.9162

Ground Surface Elev. (MSL): 3,467.67

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

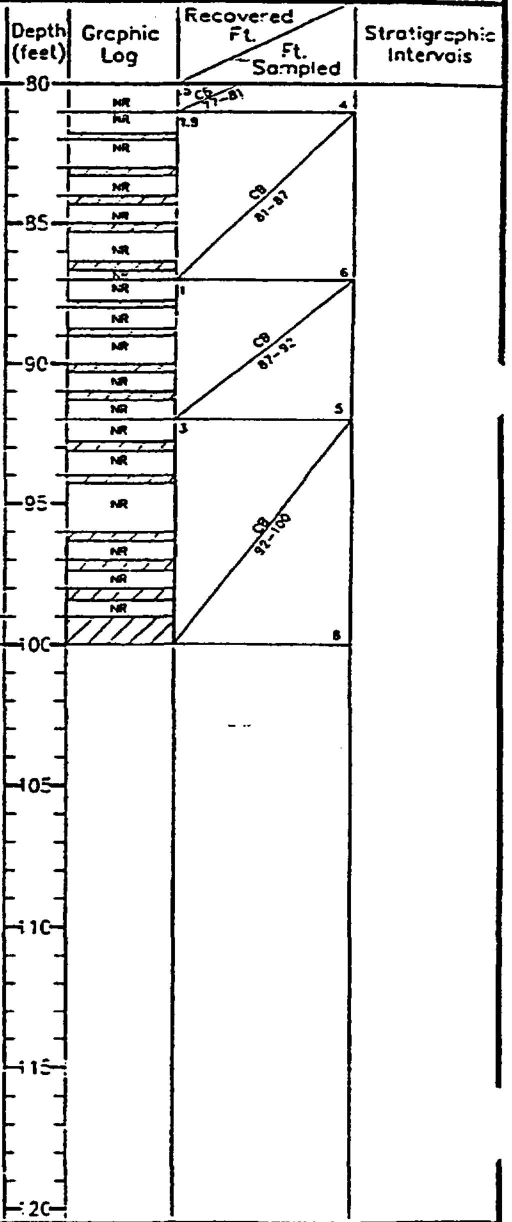
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller: LIZARO CASTILLO
JOHN SCARBOROUGH

Total Depth: 100'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
	Silty CLAY (CL): interbedded purple and dusky red silty clay with clasts and layers of greenish gray clayey silt; vfg mica frags. within silty layers; carb. plant material common in clayey zones; very crumbly; dry.
99 – 100	Very Silty CLAY (CL): dusky red with light greenish gray inclusions; dense; slightly soapy.
TOTAL DEPTH AT 100'	



FILE NAME: A-LOG10F.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 01/11/93
Boring No.: B-35
Grid No.: 11-C

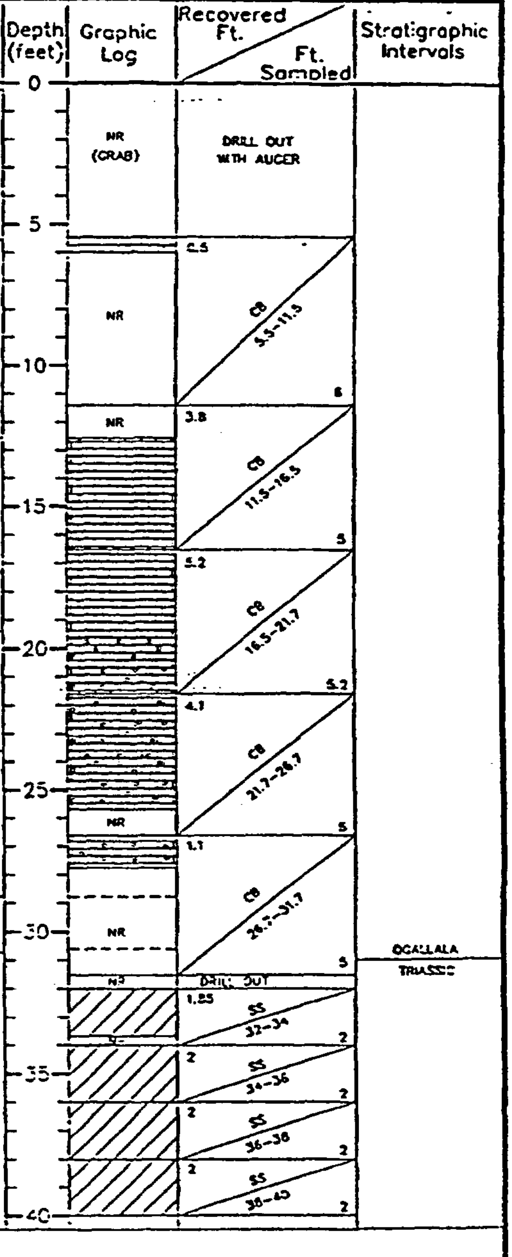
Log By: A. WEEGAR/R. McGOWEN
Drilling Method & Bit Sizes: 0-31.7 MUD ROTARY (HOLT) 31.7- AIR ROTARY (SCARBOROUGH)
Survey Data:
Northing: 8496.1842
Easting: 10483.4609
Ground Surface Elev. (MSL): 3,474.91

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): CORE BARREL; SPLIT SPOON

Driller:
Total Depth: 100'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0'-0.1'	TOP SOIL: brown silty sand; organic material; loose; moist.
0.1'-5.5'	SILT (ML): yellow to light tan caliche cemented silt; mod. soft; dry.
5.5'-12.5'	Gravelly Silty SAND (SM): yellow to light tan calcium cemented silt (same as above); overlying light tan/pink caliche cemented silty sand; overlying caliche cemented pink sand with dark and red gravel; mod soft with increasing hardness towards base.
12.5'-19.3'	CALICHE: pinkish brown calcium carb./dolomitic cemented sand, silt, gravel with concentric growth clasts; appears as growth clasts floating in matrix of silty sandy gravel; sand is vfg-fg quartz and feldspar, gravel is dark and red; v. hard; non-fractured.
19.3'-23.8'	CALICHE: whitish tan calc. carb./dolomitic cemented silty sand with clasts of pink gravelly sand; whitish tan silty sand is vfg qtz. and feldspar with trace dark gravel; pink clasts are granitic vfg sand and gravel; partially healed vertical fracture; v. hard.
23.8'-28.7'	CALICHE: pinkish tan sand with gravel; sand is vfg-fg qtz. and feldspar; sub rounded; gravel is angular red, black and opaque; trace vugs (<2 mm) and diagonal fractures; reduced cementation in basal 0.5'; v hard; basal contact from drill-break.
28.7'-30.7'	Sandy GRAVEL (GW): pink sand with opaque, white, dark and red gravel and cobbles; sand is vfg; gravel and cobbles angular to well rounded; v. loose; basal contact from drill break; red clay below 30.7'.
30.7'-42'	CLAY (CL): dusky red; hard; dense; with white calc. carb. inclusions; moist; yellow and purple mottling below 38'.



FILE NAME: A-LOG11C.DWG

Terra Dynamics Incorporated

SOIL BORING L(

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 01/11/93
Boring No.: B-35
Grid N 11-C

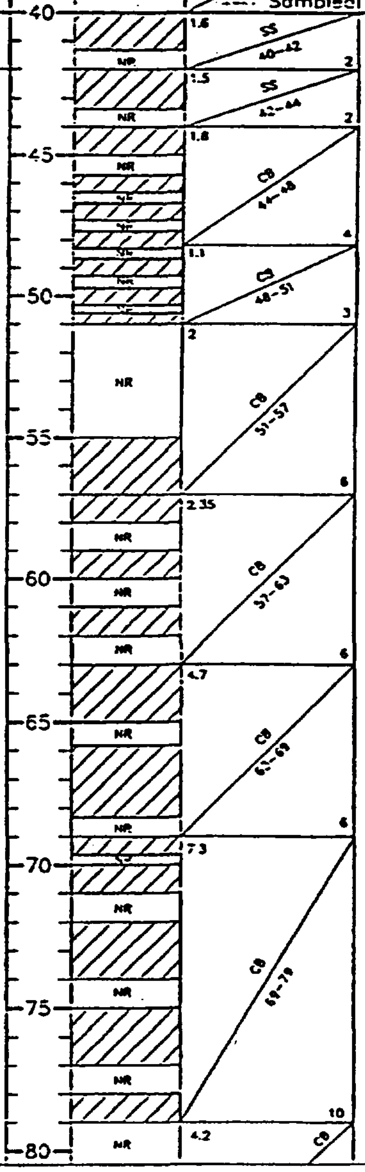
Log By: A. WEEGAR/R. M^cGOWEN
Drilling Method & Bit Sizes:
0-31.7 MUD ROTARY (HOLT)
31.7- AIR ROTARY (SCARBOROUGH)
Survey Data:
Northing: 8496.1842
Easting: 10483.4609
Ground Surface Elev. (MSL): 3,474.91

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): CORE BARREL; SPLIT SPOON

Driller:
Total Depth: 100'

Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)		Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Intervals
42'-100'	<u>CLAY (CL)</u>: heavily mottled purple, gray and yellow; claystone; mod. hard; brittle; primarily blocky fracture with some zones of fissile claystone; greenish gray inclusions throughout; trace ferros oxide nodules; dry. - calc. carb. cemented layers and nodules common below 69'.				



FILE NAME: A-LOG11C.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 01/11/93	Boring No.: B-35	Grid No.: 11-C

Log By: A. WEEGAR/R. McGOWEN

Drilling Method & Bit Sizes:
0-31.7 MUD ROTARY (HOLT)
31.7- AIR ROTARY (SCARBOROUGH)

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): CORE BARREL; SPLIT SPOON

Driller:

Total Depth: 100'

Remarks:

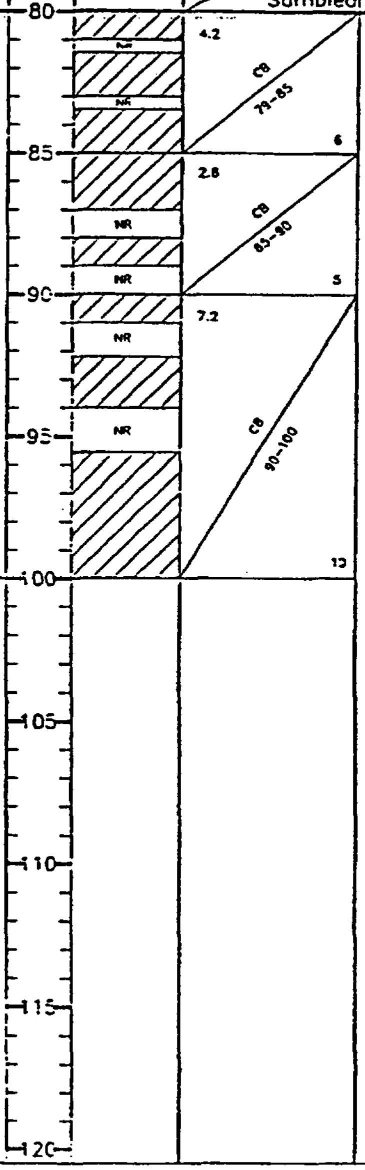
Survey Data:
Northing: 8496.1842
Easting: 10483.4609
Ground Surface Elev. (MSL): 3,474.91

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size) | Depth (feet) | Graphic Log | Recovered Ft. / Ft. Sampled | Stratigraphic Intervals

CLAY (CL): same as above.

- vertical fracture at 82'-83'; indications of ferros oxide mineralization along fracture plane.
- green clay nodule approx. 0.2 ft.
- purplish color; rubbly; upper 1.0 ft.
- green clay nodule approx. 0.1 ft.
- scattered green clay nodules; 0.05'-0.1'.

TOTAL DEPTH = 100'



FILE NAME: A-LOG11C.DWG

Terra Dynamics Incorporated
AUSTIN, TEXAS
(512) 795-8183

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 12/16-12/18/92	Boring No.: B-20	Grid/Well No.: 11-D

Log By: A. WEEGAR; P. GRANT
0-130' 130' TO TD

Driller:

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Total Depth: 275'

Drilling Method & Bit Sizes: AIR ROTARY

Sample Method(s): 2"SS + 3"CB; GRAB SAMPLES EVERY 5' FROM
CONTINUOUS: 201' TO TD

Survey Data:
Northing: 8042.8943
Easting: 10272.5320

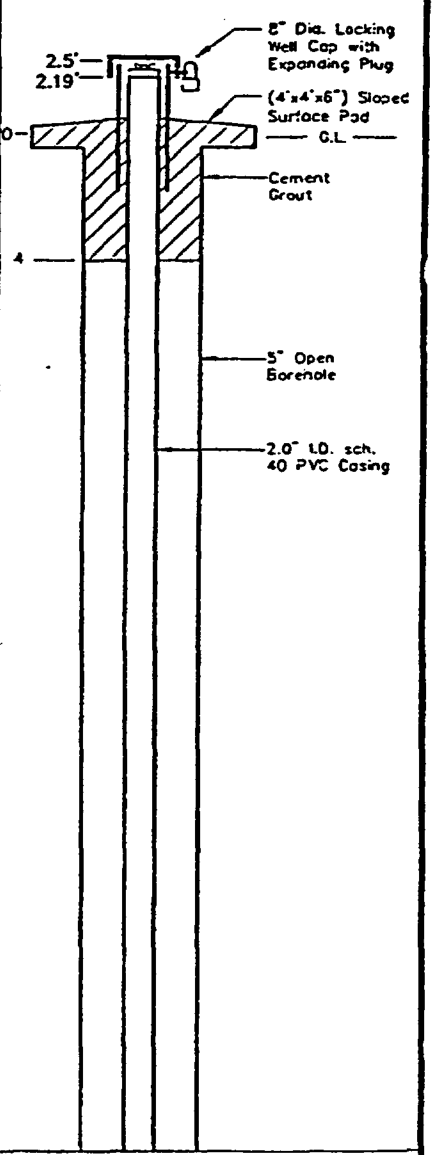
Ground Surface Elev. (MSL): 3,470.04

Top of PVC Casing Elev.: 3,472.23

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	
0'-1'	TOP SOIL: brown silty sand; loose; organic material; moist
1'-7'	CALICHE: pinkish white; calc. carb. cemented silt with vfg sand; sand grains are pink and opaque; mod. hard; crumbly; chalky; dry.
7'-18'	CALICHE: brownish gray & pinkish brown; microcrystalline with calcite crystals; vfg to cg sand throughout; sand is brown, red and opaque qtz; subrounded-well rounded; v. hard; dry.
18'-20'	CALICHE: pinkish white; calc. carb. cemented sand and gravel; sand is vfg-cg, subr. to rd. qtz.; gravel is red, black, white and opaque, subr. to rd. quartzite; mod. hard; dry.
20'-22'	Gravelly SAND (SW): pinkish tan; vfg-cg qtz. sand; subr. to rd.; gravel is white, black, red and opaque quartzite; subr. to rd.; loose; dry.
	BASE OF OGALLALA - TRIASSIC TOP
22'-46'	CLAY (CL): maroon with greenish gray and purple mottling; mod. hard; dense; sl. plastic; blocky fracture; moist. - no mottling below 24'

Depth (feet)	Recovered Ft. / Ft. Sampled
0-22	DRILL-CUT W/ROCK BIT NR (GRAB)
22-24	SS 22-24: 2 / 2
24-26	SS 24-26: 2 / 2
26-28	SS 26-28: 2 / 2
28-30	SS 28-30: 1.5 / 2
30-32	SS 30-32: 2 / 2
32-34	SS 32-34: 2 / 2
34-36	SS 34-36: 2

Well Design



File Name: A-LOG11D.DWG

Terra Dynamics Incorporated
AUSTIN, TEXAS
(512) 795-8183

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 12/16-12/18/92
Boring No.: B-20
Grid/Well No.: 11-D

Log By: A. WEEGAR; P. GRANT
0-130' 130' TO TD
Driller:
Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS
Total Depth: 275'
Drilling Method & Bit Sizes: AIR ROTARY
Sample Method(s): 2"SS + 3"CB; GRAB SAMPLES EVERY 5' FROM
CONTINUOUS: 201' TO TD

Survey Data:
Northing: 8042.8943
Easting: 10272.5320
Ground Surface Elev. (MSL):
3,470.04
Top of PVC Casing Elev.:
3,472.23

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

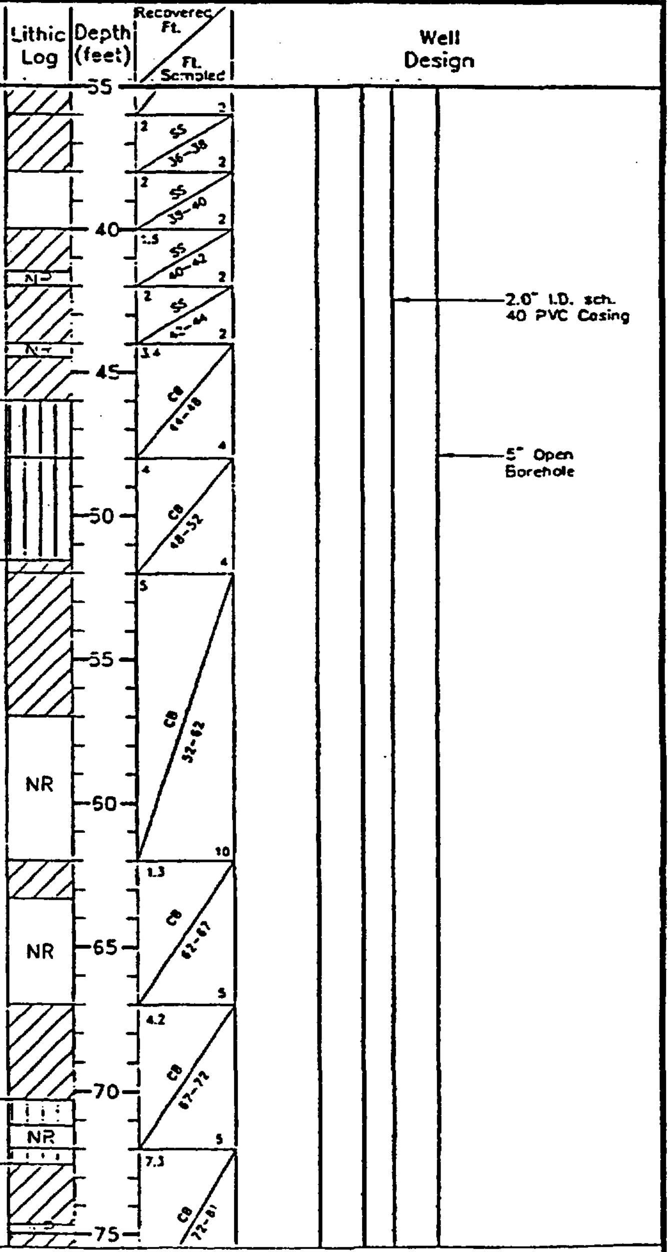
- color change to dusky red with gray infilled tubes and inclusions below 36'

46'-51.6' Sandy SILT (ML): speckled mottling dusky red and greenish gray; trace vfg sand grains, mica and biotite flakes throughout; mod. hard; blocky fracture; increased sand content.

51.6'-70.3' Silty CLAY (CL): dusky red with yellow, grey and purple mottling; carbonaceous plant material; mod. hard; sl. soapy; blocky fracture; dry

70.3'-72.5' Clayey SILT (ML): heavily mottled dusky red and purple silty clay and light pinkish grey clayey silt; convoluted bedding structure; mica frags. within silty zones; mod. hard; back fracture; dry.

72.5'-80' Slightly Silty CLAY (CL): dusky red with slight mottling of yellow and grey; claystone; mod. hard; dense; blocky fracture; dry; basal contact from cutting.



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Terra Dynamics Incorporated

AUSTIN, TEXAS (512) 795-8183

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/16-12/18/92

Boring No.: B-20

Grid/Well No.: 11-D

Log By: A. WEEGAR; P. GRANT
0-130' 130'. TO TD

Driller:

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Total Depth: 275'

Drilling Method & Bit Sizes: AIR ROTARY

Sample Method(s): 2"SS + 3"CB: GRAB SAMPLES EVERY 5' FROM
CONTINUOUS: 201' TO TD

Survey Data:
Northing: 8042.8943
Easting: 10272.5320

Ground Surface Elev. (MSL):
3,470.04

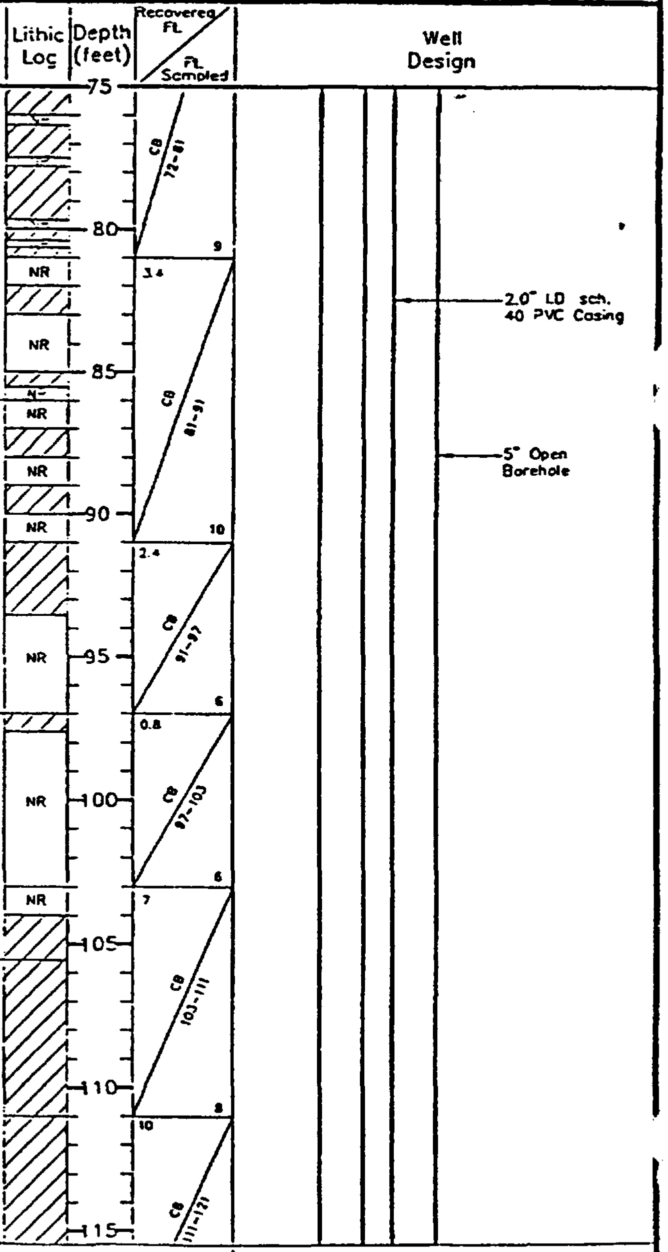
Top of PVC Casing Elev.:
3,472.23

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

85'-97' Silty CLAY (CL): purple with light gray mottling; crumbly; dry.

97'-105.6' CLAY (CL): purple with slight gray mottling; hard; v. dense; sl. plastic; moist.

105.6'-151' Silty CLAY (CL): dusky red silty claystone mottled with grey & pink in a dendritic pattern; contains inclusions of greenish grey silt; hard; mod. dense; blocky fracture; dry.



File Name: A-LOG2C.DWG

Terra Dynamics Incorporated
AUSTIN, TEXAS
(512) 795-8183

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/16-12/18/92

Boring No.: B-20

Grid/Well No.: 11-D

Log By: A. WEEGAR; P. GRANT
0-130' 130' TO TD

Driller:

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Total Depth: 275'

Drilling Method & Bit Sizes: AIR ROTARY

Sample Method(s): 2"SS + 3"CB; GRAB SAMPLES EVERY 5' FROM
CONTINUOUS: 201' TO TD

Survey Data:
Northing: 8042.8943
Easting: 10272.5320

Ground Surface Elev. (MSL):
3,470.04

Top of PVC Casing Elev.:
3,472.23

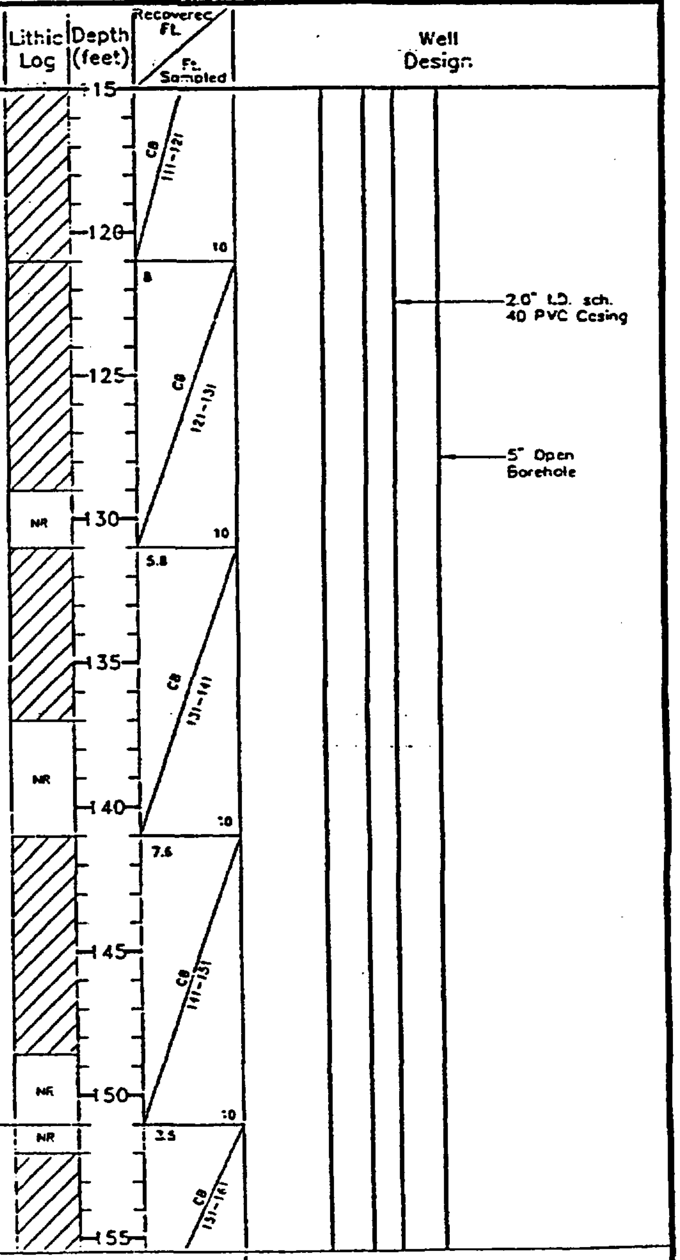
Unified Soil Classification/Description
(Color, Texture, Structure, Grain Size)

Silty CLAY (CL) cont.; same description as previous page.

- 0.1' green-gray clayey silt (ML); dry

- 0.25' greenish- grey silty clay (CL); dry.

151'-162.5' CLAY (CL); reddish purple with gray-green mottling and inclusions throughout; mod. hard; mod. dense; sl. plastic; dry.



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Terra Dynamics Incorporated
AUSTIN, TEXAS (512) 795-8183

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/16-12/18/92

Boring No.: B-20

Grid/Well No.: 11-D

Log By: A. WEEGAR; P. GRANT
0-130' 130' TO TD

Driller:

Drilling Company:
SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Total Depth: 275'

Drilling Method & Bit Sizes: AIR ROTARY

Sample Method(s): 2"SS + 3"CB; GRAB SAMPLES EVERY 5' FROM
CONTINUOUS: 201' TO TD

Survey Date:
Northing: 8042.8943
Easting: 10272.5320

Ground Surface Elev. (MSL):
3,470.04

Top of PVC Casing Elev.:
3,472.23

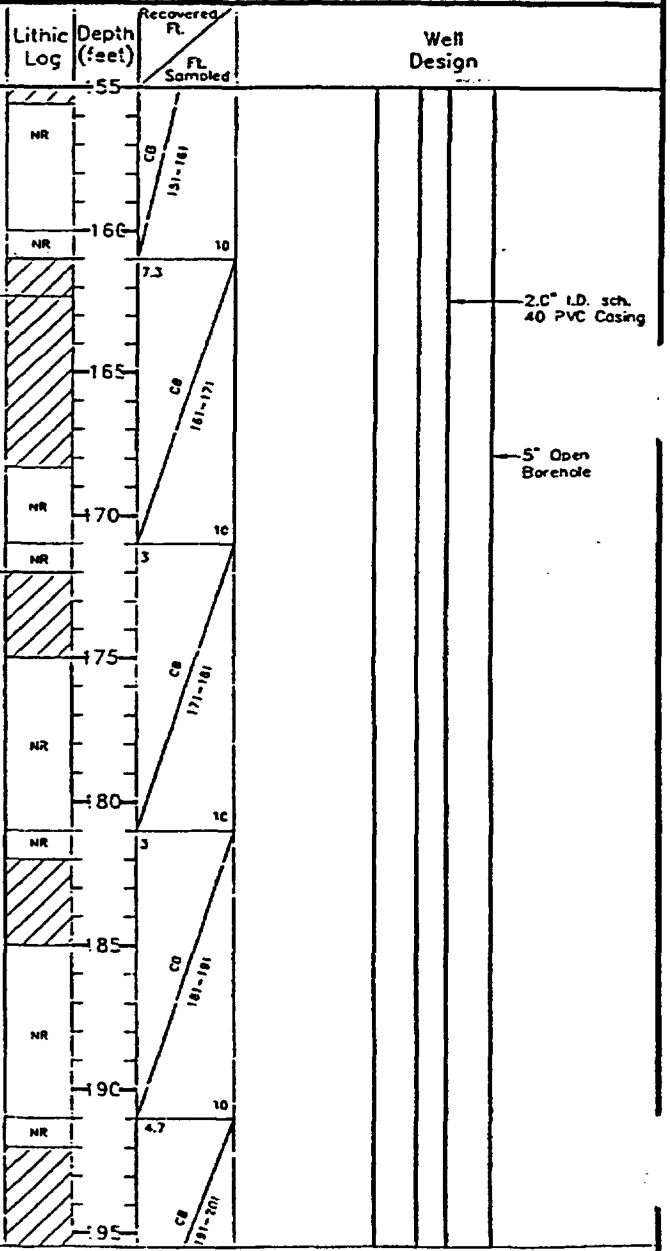
Unified Soil Classification/Description
(Color, Texture, Structure, Grain Size)

162.3'-172' CLAY (CL): grayish-purple claystone with gray-green mottling and larger inclusions throughout; mod. hard; dense; sl. plastic; finely veined with calcite(?) filled fractures; dry.

172'-243' CLAY (CL): reddish purple with gray-green mottling and scattered inclusions; mod. hard; mod. dense; sl. plastic; scattered calcite(?) filled veins; dry.

(CL) same as above but with few veins.

(CL) same as above but no veins.
drill rate-2 min./ft.



File Name: A-LOG2G.DWG

Terra Dynamics Incorporated
AUSTIN, TEXAS (512) 795-8183

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 12/16-12/18/92
Boring No.: B-20
Grid/Well No.: 11-D

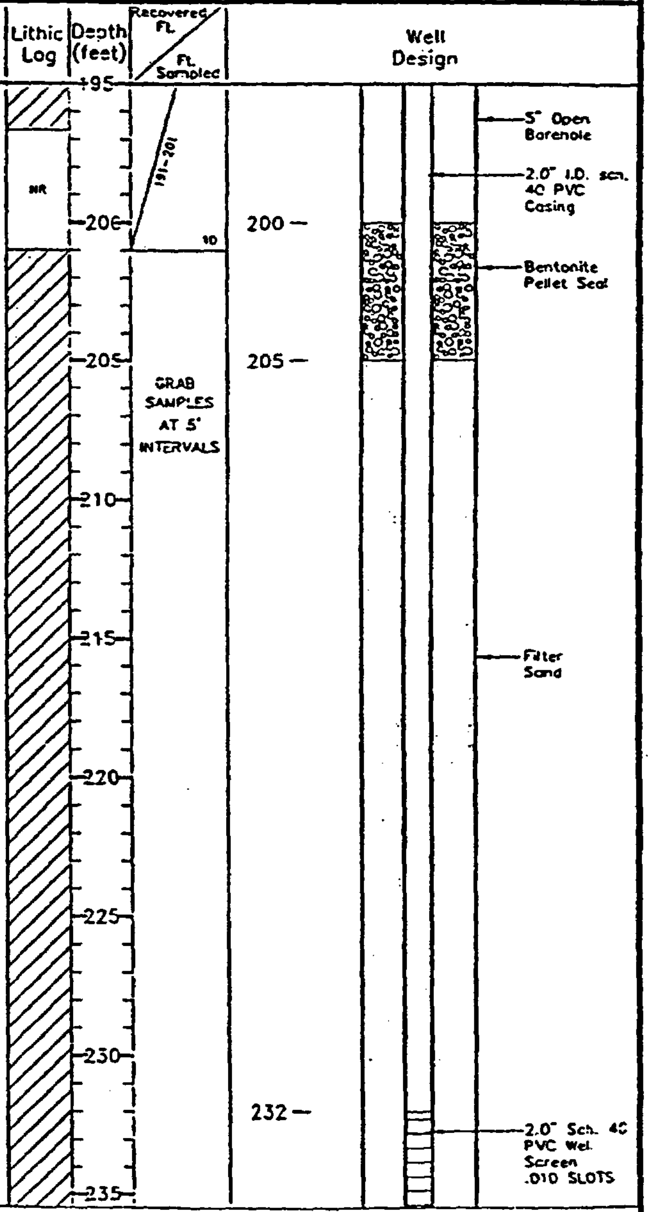
Log By: A. WEEGAR; P. GRANT 0-130' 130' TO TD
Driller:
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Total Depth: 275'
Drilling Method & Bit Sizes: AIR ROTARY
Sample Method(s): 2"SS + 3"CB; GRAB SAMPLES EVERY 5' FROM
CONTINUOUS: 201' TO TD

Survey Data:
Northing: 8042.8943
Easting: 10272.5320
Ground Surface Elev. (MSL):
3,470.04
Top of PVC Casing Elev.:
3,472.23

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

CLAY (CL): same as above.

at 201' switch over to drag bit(fishtail bit) to drill down until cuttings show sand; bagged cuttings every 5'; reamed out to 5".



File Name: A-LOG20.DWG

Terra Dynamics Incorporated
AUSTIN, TEXAS (512) 795-8183

SOIL BORING & WELL COMPLETION LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 12/16-12/18/92

Boring No.: B-20

Grid/Well No.: 11-D

Log By: A. WEEGAR; P. GRANT
0-130' 130' TO TD

Driller:

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Total Depth: 275'

Drilling Method & Bit Sizes: AIR ROTARY

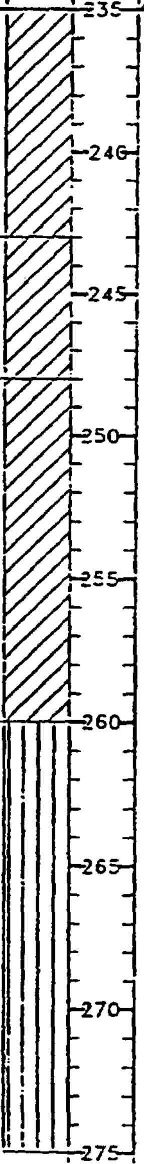
Sample Method(s): 2"SS + 3"CB; GRAB SAMPLES EVERY 5' FROM
CONTINUOUS: 201' TO TD

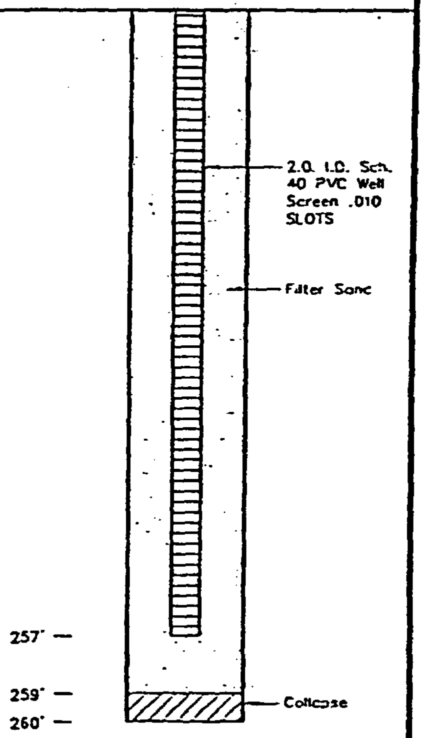
Survey Data:
Northing: 8042.8943
Easting: 10272.5320

Ground Surface Elev. (MSL): 3,470.04

Top of PVC Casing Elev.: 3,472.23

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Lithic Log	Depth (feet)	Recovered Ft. / Ft. Sampled	Well Design
at 239' cuttings color lightened, but still (CL) as above.		235		
243'-248' Silty CLAY (CL): light tan color plus previous dark clay.				
248'-260' CLAY (CL): reddish purple with gray-green mottling and scattered inclusions; mod. hard; mod. dense; sl. plastic; dry.				
260'-275' Clayey SILTSTONE (ML): dusky red and tan siltstone with claystone interbeds; greenish gray mottling throughout; increased greenish gray siltstone below 270 feet; brittle; trace of vfg. mica frags.; dry.				
Total Depth = 275 feet		275		



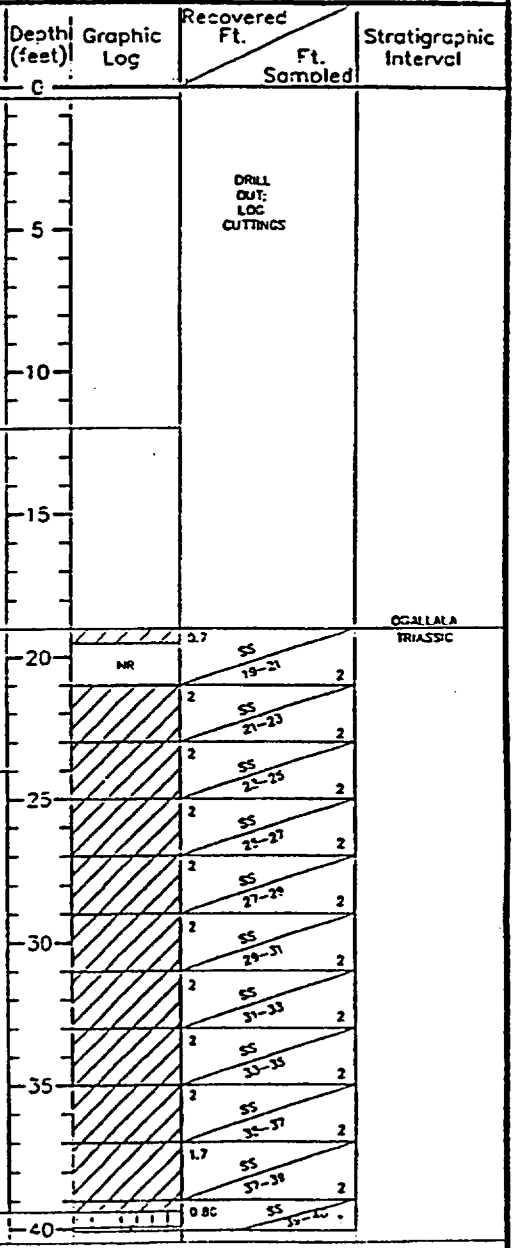


File Name: A-LOG20.DWG

Terra Dynamics Incorporated	**SOIL BORING LOG**

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 01/20/93
Boring No.: B-45
Grid No.: 11-E
Log By: A. WEEGAR
Drilling Method & Bit Sizes: AIR ROTARY
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL
Driller:
Total Depth: 100'
Survey Data:
Northing: 7590.39
Easting: 10860.29
Ground Surface Elev. (MSL): 3,468.3
Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0'-0.4'	TOP SOIL: brown; silty sand; organic material; moist.
0.4'-12'	CALICHE: pinkish white; calc. carb. cemented quartz silt and sand; mod. hard; trace dark, red and opaque quartz gravel frags.; dry.
12'-15'	Sandy SILT (ML): pink; quartz silt and sand; slight calc. carb. cementation; loose; dry.
15'-24'	Silty CLAY (CL) reddish brown silty clay with white powdery calc carbonate in layers along vertical fractures disseminated throughout; dense; sl. plastic; moist.
24'-39.4'	Silty CLAY (CL): reddish brown silty clay with grayish tan and bluish gray mottling and casts; dense; sl. plastic; moist. - trace mottling below 31'.



FILE NAME: A-LOG112.DWG

Terra Dynamics Incorporated

SOIL BORING LO

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 01/20/93

Boring No.: B-45

Grid No. 11-E

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:

Northing: 7590.39

Easting: 10860.29

Ground Surface Elev. (MSL):

3,458.3

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

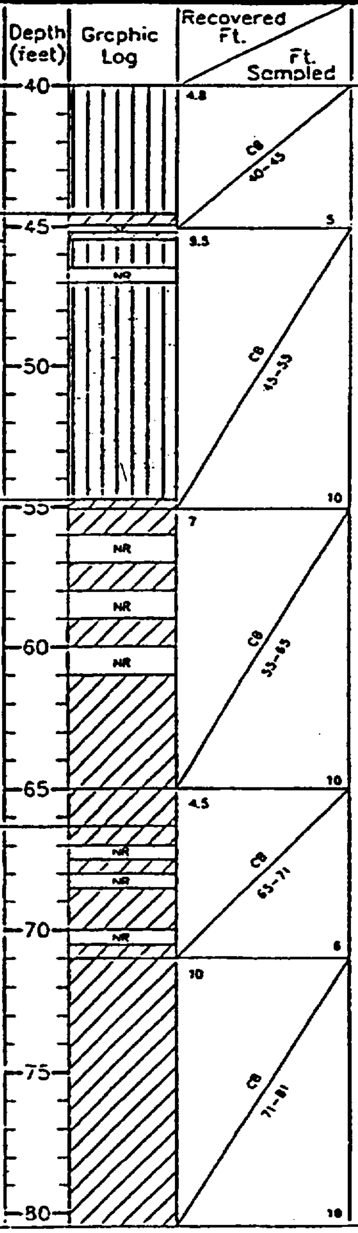
Sample Method(s): SPLIT SPOON; CORE BARREL

Driller:

Total Depth: 100'

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
39.4'–44.6'	<u>Sandy Cl SILT (ML)</u>: mottled tan, brown and rusty red clayey siltstone with sand; vfg white quartz sand grains throughout; trace vfg mica frags.; black mineralization throughout; mod hard; blocky fracture; crumbly 42'–43.5'; dry.
44.6'–45.5'	<u>Sandy Silty CLAY (CL)</u>: mustard to greenish gray claystone; silt and vfg quartz sand throuhout;.
45.5'–47.6'	<u>Sandy Clayey SILT (ML)</u>: yellow, tan and gray clayey siltstone with white and opaque vfg quartz sand grains and vfg mica frags.; mod hard; horizontally laminated; blocky fracture and crumbly; dry.
47.6'–54.9'	<u>Silty Sand (SM)</u>: yellow and grayish tan siltstone matrix with vfg white opaque and pink quartz and feldspar sand grains; vfg to cg mica and biotite flakes throughout; cross-bedded; blocky fracture; dry.
54.9'–66.2'	<u>Silty CLAY (CL)</u>: dark red silty claystone with bluish grey mottling; greenish gray elliptical zones and apparent worm burrows below 62'; burrows have sandy material incorporated into center portion of burrow; trace black mineralization througout; blocky to concoidal fracture; dense; mod. hard; dry
56.2'–100'	<u>Slightly Silty CLAY (CL)</u>: dark red claystone with purple and grey mottling throughout; yellow and mustard coloration below 59' with greenish gray clasts and worm holes below 70'; trace black mineralization througout; mod hard; sl. sandy; blocky fracture; dry - diagonal fractures from 71'–79', fractures are at 45°and bidirectional (> and <); healed with calc. carb. cementation and clay; occasional drilling-induced slickensides



Stratigraphic Interval

FILE NAME: A-LOG11E.DWG

Terra Dynamics Incorporated	**SOIL BORING LOG**

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 01/20/93

Boring No.: B-45

Grid No.: 11-E

Log By: A. WEEGAR

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:

Northing: 7590.39

Easting: 10860.29

Ground Surface Elev. (MSL): 3,468.3

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

Driller:

Total Depth: 100'

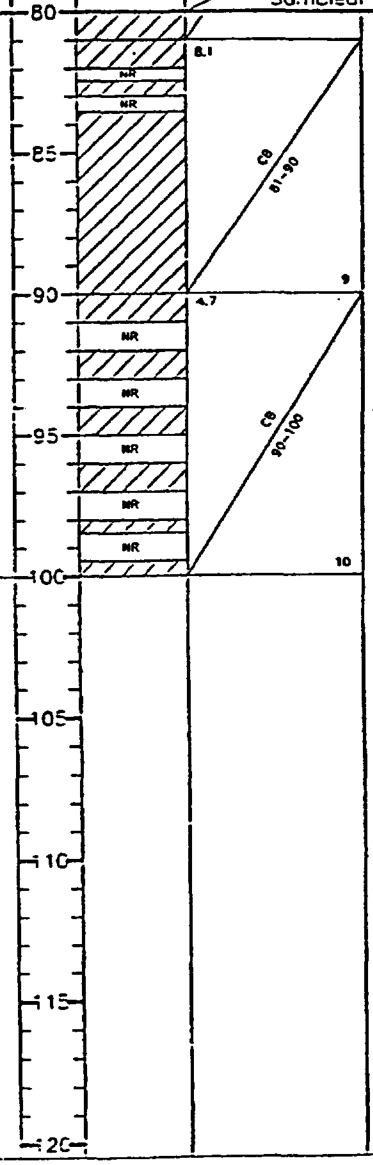
Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Interval

Slightly Silty CLAY (CL): same as above.

– increased purple color and crumbly below 91'.

TOTAL DEPTH = 100'



FILE NAME A-LOG11E.DWG

Terra Dynamics Incorporated	**SOIL BORING LO**

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 1/24/93	Boring No.: B-51	Grid N 12-

Log By: R. M^c^GOWEN

Drilling Method & Bit Sizes: AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

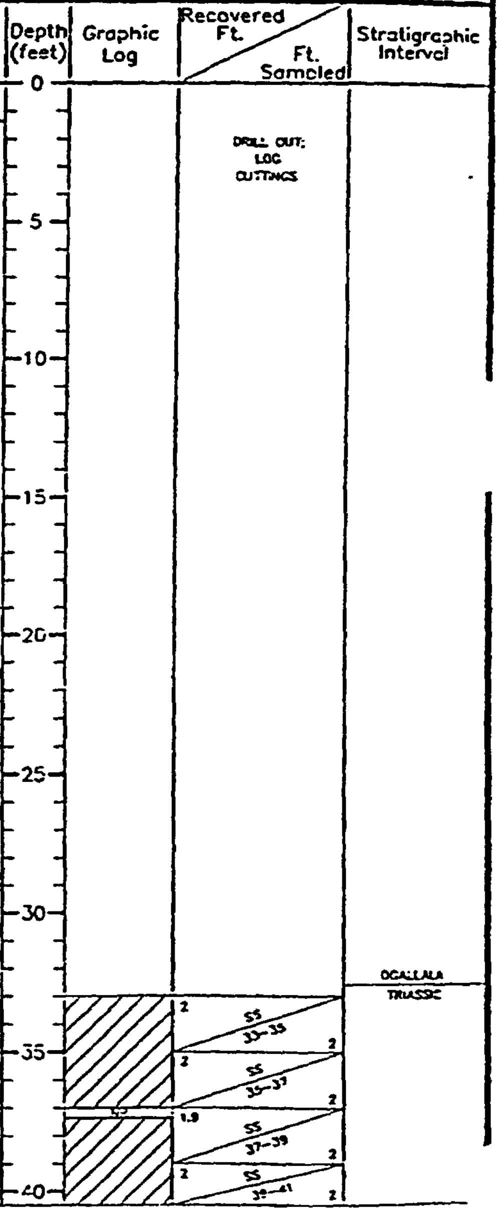
Driller:

Total Depth: 100'

Survey Data:
Northing: 9160.6675
Easting: 10241.7105
Ground Surface Elev. (MSL):
3,475.71

Remarks:

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0.0'-1.3'	TOP SOIL: dk. brown, sand, silt; organic material; loose; dry.
1.3'-19'	SAND (SW): lt. tan to red tan, vfg-fg sand, with scattered clasts of calcitic cemented sand and silt; soft; loose; dry.
19'-29'	CALICHE: lt. tan-gray calcitic micritic cemented sand and silt, vfg-fg qtz sand; sandstone lithoclasts with silica concretions in micritic matrix; concretion rings in micrite; hard; brittle; dry
29'-32.5'	SAND and GRAVEL (SW): tan-lt. brown, sand, fg quartz to quartz pebbles and cobbles; rounded to angular; soft; dry.
32.5'-37'	CLAY (CL): red with white mineralization (flaky, nonreactive to HCl), and some silt; soft; moist
37'-100'	CLAY (CL): red with yellow mottling; soft; dry. - red, yellow, and purple mottling at 39'



FILE NAME: A-LOG129.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 1/24/93

Boring No.: B-51

Grid No.: 12-B

Log By: R. M^cGOWEN

Drilling Method & Bit Sizes: AIR ROTARY

Survey Data:

Northing: 9160.6675

Easting: 10241.7105

Ground Surface Elev. (MSL): 3,475.71

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

Driller:

Total Depth: 100'

Remarks:

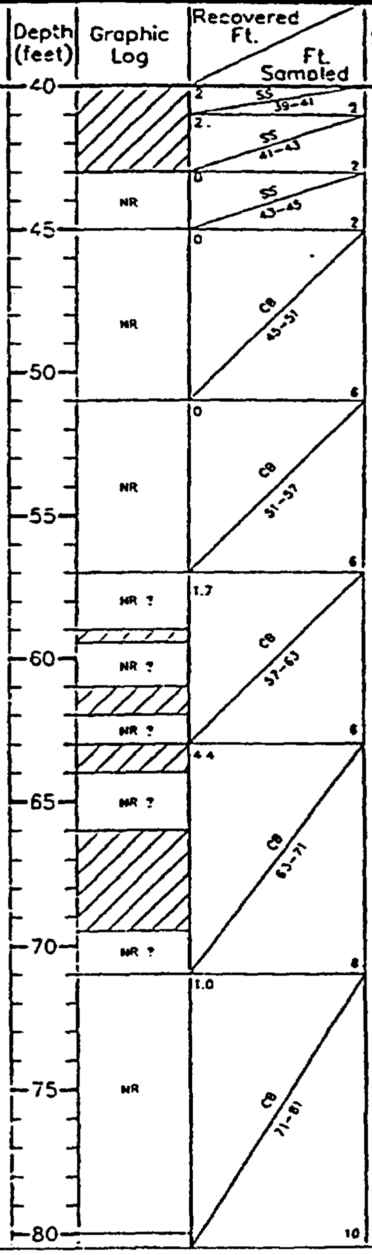
Unified Soil Classification/Description
(Color, Texture, Structure, Grain Size)

Stratigraphic Interval

<u>CLAY(CL)</u>: same as above.

- red, yellow and purple mottled; from 59' to 59.5' was hard calcitic cemented clay-broken and watered(hard and brittle).

- from 61' to 61.2' was red, yellow, and purple mottles; brittle; dry.



FILE NAME: A-LOG128.DWG

Terra Dynamics Incorporated

SOIL BORING LO

Location: ANDREWS CO. LANDFILL SITE

Project No.: 92-152

Date Drilled: 1/24/93

Boring No.: 8-51

Grid 12-

Log By: R. McGOWEN

Drilling Method & Bit Sizes: AIR ROTARY

Drilling Company: SCARBOROUGH DRILLING, INC.
LAMESA, TEXAS

Sample Method(s): SPLIT SPOON; CORE BARREL

Driller:

Total Depth: 100'

Survey Data:
Northing: 9160.6675
Easting: 10241.7105
Ground Surface Elev. (MSL):
3,475.71

Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)

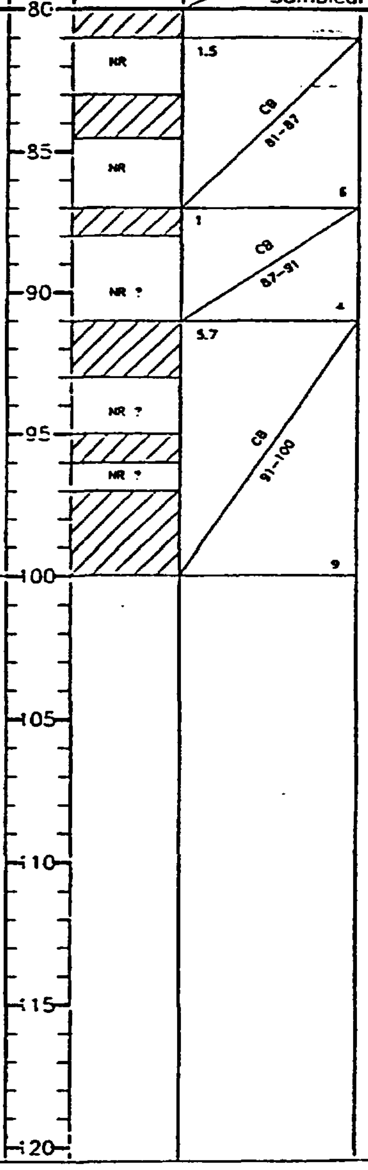
Depth (feet) | Graphic Log | Recovered Ft. / Ft. Sampled | Stratigraphic Interval

CLAY (CL): same as above.

– rubble – 81'–87'

– red, yellow and purple mottled with whitish green clay nodules.

TOTAL DEPTH = 100'



FILE NAME: A-LOG129.DWG

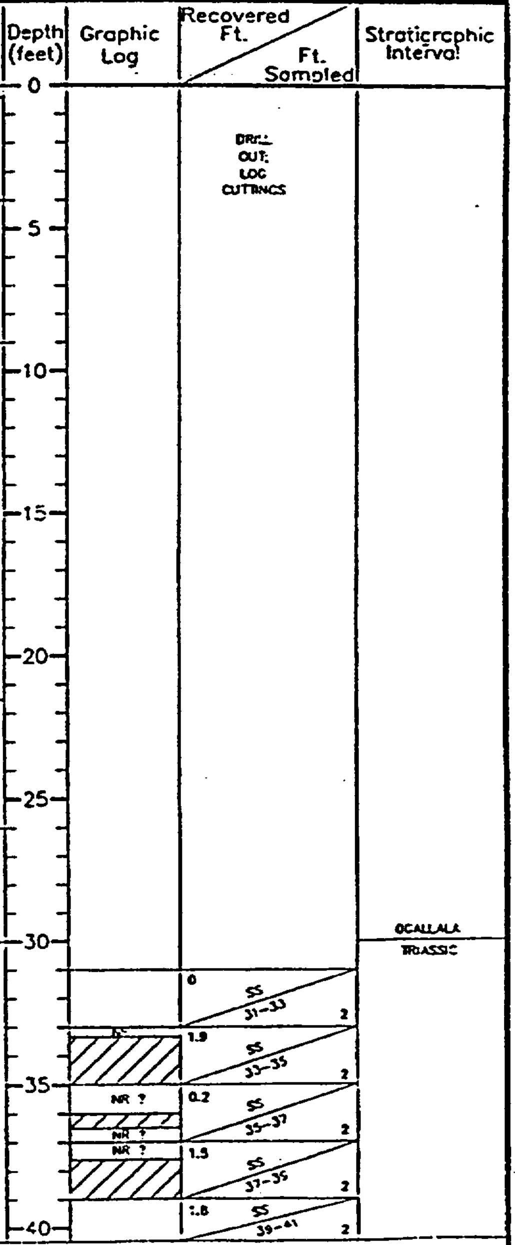
Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 01/24/93
Boring No.: B-52
Grid No.: 12-C
Log By: R. McGOWEN
Drilling Method & Bit Sizes: AIR ROTARY
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL
Driller:
Total Depth: 100'
Remarks:

Survey Data:
Northing: 8707.59
Easting: 10003.09
Ground Surface Elev. (MSL):
3.473.3

	Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)
0.0'–0.5'	TOP SOIL: dk. brown, sand, silt; organic material ; loose; dry.
0.5'–4.0'	CALICHE: lt. tan; calcitic cemented sand and silt; vfg quartz sand; soft; dry.
4.0'–9.0'	SAND and SILT (SM): lt. tan to lt. brown, vfg-fg quartz with scattered clasts of calcite cemented sand and silt; soft; dry.
9.0'–21.5'	CALICHE: lt. tan-gray, calcitic and micritic cemented sand and silt; vfg-fg quartz sand; concretion rings in micrite frags.; sandstone lithoclasts with silica concretion; hard; dry.
21.5'–26'	Silty SAND (SW): lt. tan, vfg quartz sand; sorted; rounded; soft; dry.
26'–30'	SAND and GRAVEL (SW): reddish brown, fg-mg quartz sand, rounded and sorted, pebbles and cobbles; quartz rounded to angular; poorly sorted; soft; dry.
30'–77'	CLAY (CL): red, purple, and yellow mottled; plastic; damp. - dry, plastic; less purple 37'-39'.



FILE NAME: A-LCG12C.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

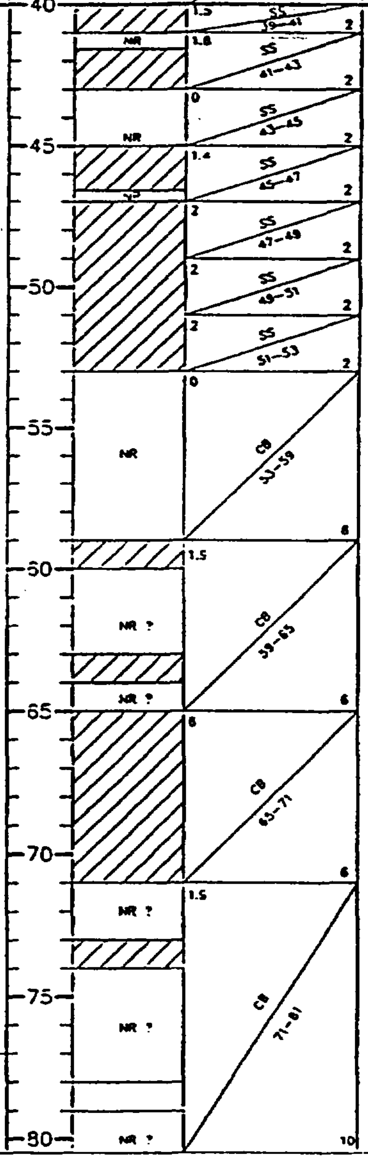
Location: ANDREWS CO. LANDFILL SITE
Project No.: 92-152
Date Drilled: 01/24/93
Boring No.: B-52
Grid No.: 12-C

Log By: R. McGOWEN
Drilling Method & Bit Sizes: AIR ROTARY
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS
Sample Method(s): SPLIT SPOON; CORE BARREL
Driller:
Total Depth: 100'

Survey Data:
Northing: 8707.59
Easting: 10003.09
Ground Surface Elev. (MSL): 3,473.3

Remarks:

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Interval



- red, purple and yellow mottling white silt nodule 0.75" at approx. 41.5'; plastic; dry.

- scattered nodules of yellow to white clay.

- red, purple and yellow mottling; no nodules.

- red-orange with yellow and purple mottling; dry; brittle.

- 0.75 ft. red-orange clay with yellow and purple mottling.

77'-81' SANDSTONE (SM): red-orange and white, vfg quartz sand with calcite cement and mica flakes; hard; brittle; dry.

FILE NAME: A-LOG12C.DWG

Terra Dynamics Incorporated

SOIL BORING LOG

Location: ANDREWS CO. LANDFILL SITE	Project No.: 92-152	Date Drilled: 01/24/93	Boring No.: B-52	Grid No.: 12-C

Log By: R. McGOWEN	Drilling Method & Bit Sizes: AIR ROTARY	Survey Data: Northing: 8707.59 Easting: 10003.09 Ground Surface Elev. (MSL): 3,473.3
Drilling Company: SCARBOROUGH DRILLING, INC. LAMESA, TEXAS	Sample Method(s): SPLIT SPOON; CORE BARREL	
Driller:	Total Depth: 100'	
Remarks:		

Unified Soil Classification/Description (Color, Texture, Structure, Grain Size)	Depth (feet)	Graphic Log	Recovered Ft. / Ft. Sampled	Stratigraphic Interval

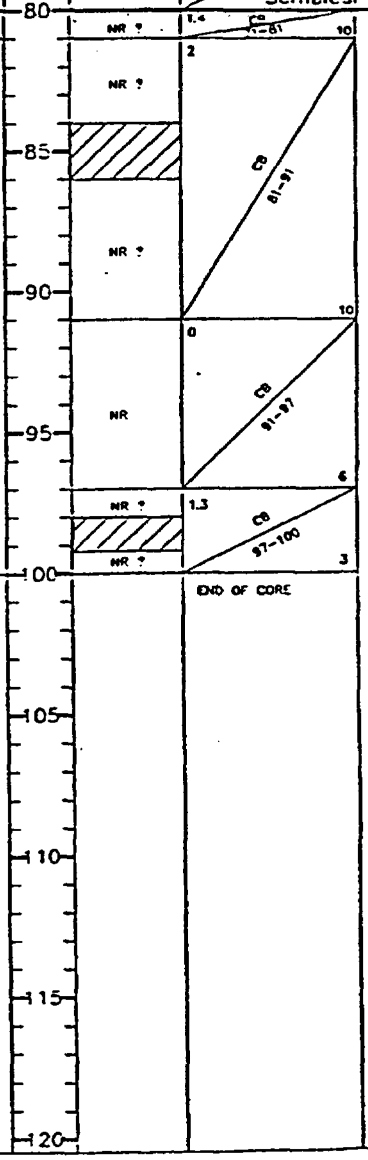
- plugged core bit

81'–100' **CLAY (CL):** red, yellow and purple mottled, dry, brittle.

- purple cuttings.

- purple clay with nodule approx. 2" of greenish white clay.

TOTAL DEPTH = 100'



FILE NAME: A-LOG12C.DWG

Evaluation of Potential Groundwater Impacts by the WCS Facility in Andrews County, Texas

by

Ken Rainwater, Ph.D., P.E.
4208 65th Street
Lubbock, Texas 79413

Prepared for

The Andrews Industrial Foundation
204 N.E. First Street
Andrews, Texas 79714

December, 1996

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Evaluation of Potential Groundwater Impacts by the WCS Facility in Andrews County, Texas

by

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Prepared for

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Andrews, Texas 79714

December, 1996

Executive Summary

The Andrews Industrial Foundation retained Dr. Ken Rainwater to evaluate the suitability of the Waste Control Specialists, Inc. waste treatment, storage, and disposal facility currently under construction in western Andrews County with respect to its potential impact on local and regional groundwater resources. The site was already permitted for acceptance of hazardous wastes, and a new permit for low-level radioactive wastes is sought. Special concern was placed on the possible presence of the Ogallala aquifer at the site location. The identification of the presence or absence of the Ogallala aquifer at the site was based on the definition of an aquifer as containing sufficient saturated permeable material to yield water to wells. The study approach included review of permit documents, site visits, public meeting attendance, inspection of core samples, evaluation of water quality sampling, and review of published descriptions of local and regional hydrogeologic information.

A report was delivered to the Foundation in December, 1996, with these conclusions:

[1] The presence of a thick Triassic clay layer near the ground surface at the site makes it an excellent location for a properly designed and constructed landfill.

[2] A thin stratum at the site was originally identified as the Ogallala formation, but it does not contain sufficient water for classification of the formation as an aquifer.

[3] Previous publications and recent field study of the local hydrogeologic conditions in Andrews County show that the Ogallala aquifer is not present, and the shallow permeable formation is actually the Antlers Sandstone.

[4] Publications about the regional hydrologic conditions in the Southern High Plains implied the presence of water in the Ogallala formation throughout Andrews County, but the assumed saturated thicknesses in the western portion are not well supported by field data.

[5] The siltstone layers in the Dockum group appear to be the uppermost water-bearing zone and may be acceptable for monitoring, but their low permeability and possibly limited extent do not meet the traditional definition of an aquifer.

[6] If properly constructed and operated, the landfill should have no impact on usable groundwater in Andrews County.

It is recommended that the Foundation continue to pursue the use of this site as a waste treatment, storage, and disposal facility. Proper design, construction, and operation should allow the site to serve its purpose without damage to groundwater resources.

Evaluation of Potential Groundwater Impacts by the WCS Facility in Andrews County, Texas

Objective and Approach

The primary objective of this report is to evaluate the suitability of the western Andrews County site for the Waste Control Specialists (WCS) facility with specific concern to the site's impact on groundwater resources. This report was commissioned by the Andrews Industrial Foundation, Inc. (AIF), as an independent, impartial review of the suitability of the site for development as a hazardous waste treatment and disposal facility. Drs. Lloyd Urban and Ken Rainwater originally collaborated in this study beginning in 1993, and each produced reports based on data available at that time. The site received its permit in 1994, and construction began in 1996. During 1996, Drs. Tom Lehman, Harold Gurrola, and Priyantha Jayawickrama were brought in to address related geological and geotechnical issues as the site owners pursued a permit for low-level radioactive waste disposal at this site. Dr. Rainwater composed this report as an update of the 1993 document, while the other scientists and engineers provided their own documents as appropriate to the AIF. The WCS site is located at the western boundary of Andrews County, north of state highway 176 and east of the Texas-New Mexico border. Due to the lack of dependable fresh surface water, groundwater resources are precious in this county. The major water-bearing aquifer in the Southern High Plains of Texas is the Ogallala formation, which supplies water for agricultural and domestic purposes for much of the region. Site selection for landfill installations for safe, long-term disposal of hazardous materials in this region must minimize or completely prevent future deterioration of this water resource. The state agency with regulatory jurisdiction for this project is the Texas Natural Resource Conservation Commission (TNRCC), and this agency actively enforces waste management regulations with intent of groundwater protection.

A special concern of this report is determination of the local characteristics of the Ogallala formation and other shallow permeable strata, as expressed in the geologic setting and the storage and transmission of water. Many citizens are concerned with the protection of the Ogallala aquifer in the High Plains of Texas as the primary water source for irrigation, rural families, and many municipalities. Some use the presence of the Ogallala aquifer as a reason to oppose any industrial and/or waste disposal projects that involve hazardous chemicals that may somehow enter the aquifer. There is debate as to whether the Ogallala aquifer is actually physically present at the WCS site. The definition of an aquifer is given by Freeze and Cherry (1979) as "a saturated permeable geologic unit that can transmit significant amounts of water under ordinary hydraulic gradients," and also states that "an aquifer is permeable enough to yield economic quantities of water to wells" (p. 47). Todd (1980) defined an aquifer as "a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs" (p. 25). The operative words in these two definitions are "saturated" and "permeable," implying water must be present in adequate amounts to move through the geologic stratum. This investigation of the subsurface hydrogeologic conditions at the proposed WCS site specifically considers whether the formation, whether or not it is the Ogallala, at this location fits both these criteria for definition as an aquifer.

The approach taken in this study can be described as a series of tasks. These tasks are summarized in the following list:

[1] Review of the 1993 permit documents and recent site-specific hydrogeologic data;
[2] Visits to the WCS site;
[3] Attendance at TNRCC public meeting in Andrews to hear local concerns;
[4] Inspection of core samples collected during subsurface investigation;
[5] Recommendation and evaluation of water quality sampling and analyses; and
[6] Review of regional and local hydrogeologic information.

In this report, the efforts and results associated with each task are briefly presented in separate sections. It should be noted that this updated report benefits greatly from the recent work by Dr. Tom Lehman on the description of the local geologic setting (Lehman, 1996). The last section of the report summarizes the major conclusions and recommendations appropriate to the information reviewed.

Review of Permit Documents and Recent Monitoring Data

Copies of Volumes II, IV, and V of the "RCRA Permit Application For A Hazardous Waste Storage, Treatment, and Disposal Facility" (AME, 1993) were provided by the design firm, AM Environmental, Inc. (AME), of Austin, Texas. The material of concern to the groundwater evaluation in these volumes included the landfill engineering design documents (Vol. II), geotechnical investigation results and groundwater monitoring plan (Vol. IV), and local geologic and hydrogeologic descriptions (Vol. V). These documents were submitted to the TNRCC for regulatory review. This report does not constitute another form of regulatory approval, but does provide additional expert evaluation of the environmental suitability of the site for the proposed facility. The regulatory agency is also interested in protection of groundwater resources, and the permit application contains much useful site-specific information for evaluation of the possible impacts, if any, of the site on the local and regional groundwater. The principal points associated with the local groundwater are summarized in this section. AME also provided summaries of the results of groundwater monitoring events since 1993 (Messenger, personal communication). The regional geologic evaluation by Lehman (1996) was also used in evaluation of this information.

The main strength of this specific location for a hazardous waste landfill is the presence of a thick natural clay (or claystone) layer at less than 30 ft below the ground surface. This red clay material is referred to as the upper portion of the Triassic Dockum Group, sometimes referred to separately as the Chinle formation. The upper surface of this formation has a local topographic high directly beneath the proposed site as shown in Figure 1 (AME, 1993). Lehman (1996) demonstrated that this local high is actually part of regional "Red Bed Ridge" that extends from eastern New Mexico through western Andrews County southward to Winkler and Ector Counties. At the WCS site, the clay layer is over 200 ft thick, with three to four separate interbedded siltstone/sandstone layers. The hydraulic conductivities of the clay and siltstone were measured in the laboratory at $1.76\text{x}10^{-8}$ cm/sec ($5.0\text{x}10^{-5}$ ft/d or $3.7\text{x}10^{-4}$ gpd/ft^2) and $3.20\text{x}10^{-6}$ cm/sec ($9.1\text{x}10^{-3}$ ft/d or $6.8\text{x}10^{-2}$ gpd/ft^2), respectively. The natural permeability of the clay is in the range of design hydraulic conductivity for engineered landfill liner materials. The selection of the landfill

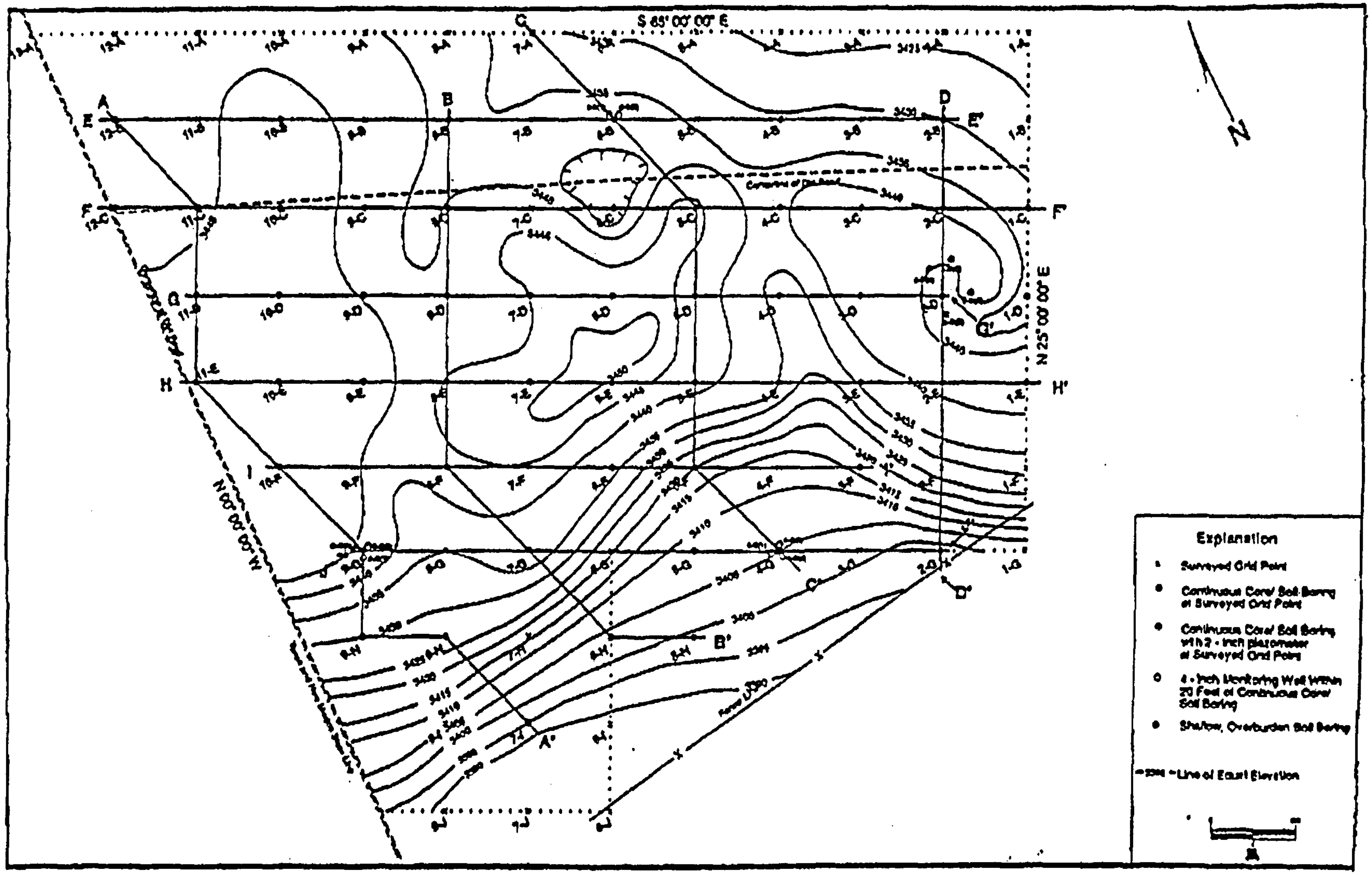

Figure 1. Topographic contour map of the upper surface of the Dockum group beneath the WCS site [Source: AME (1993)]

dimensions takes advantage of the shallow depth to this low permeability material by locating the bottom of the landfill excavation within the Triassic clay, completely penetrating the more permeable materials above the top of the Dockum group. The constructed landfill double liner system will rest atop the Triassic clay. The conventional double liner system includes two geomembranes, two compacted clay layers, and one leachate collection layer and one leachate detection layer. Unless the Triassic clay has significant fractures, it should provide a good foundation for the landfill construction.

The geotechnical investigation of the proposed site included collection of cores from a large number of borings and installation of several monitoring wells in suspected water-bearing zones. As previously stated, the Ogallala aquifer is the principal regional freshwater aquifer. In the geologic descriptions in the permit application, the geologic material above the Triassic clay was referred to as the typical Ogallala formation, with a caliche caprock overlying a layer of permeable alluvial sands and gravels, but the thickness of the permeable sands and gravels was usually less than 15 ft. Based on close examination of the gravels in the exposure of the formation at the WCS site and other outcrops in Andrews County, Lehman (1996) identified this material beneath the caprock as the Antlers Sandstone, not the Ogallala formation. The Antlers Sandstone has sufficient sand and gravel content with limited cementation to have significant permeability, but the thin formation apparently is not continuously saturated over significant areal extent in this vicinity.

Due to the low average rainfall amounts, the local high in the elevation of the top of the Dockum group, and the undulating shape of the top of the Dockum group, the permeable sediments atop the Triassic clay do not store significant amounts of water in this western part of Andrews County. Saturated sediments were only encountered beneath a local depression referred to as a "buffalo wallow," and it was concluded that a similar depression existed in the top of the Dockum beneath the surface depression, trapping the water in a small volume. Domestic and windmill wells that exist in the area do not produce much water during dry periods. Although the Ogallala formation was initially identified at the site, that identification was in error. No matter what the shallow permeable formation is named, it apparently does not hold and transmit sufficient amounts of water for development of wells. Control of stormwater drainage at the site may affect the storage of water in the formation beneath the "buffalo wallow," other natural depressions, or constructed impoundments if the collected runoff is kept on site and allowed to infiltrate.

Within the Dockum group, three or four separate siltstone layers were encountered in the grid of borings. These materials were found to have laboratory-measured hydraulic conductivities two orders of magnitude higher than the claystone. Screened monitoring wells were established in these zones at several locations within the grid. The water levels in these wells were measured several times between November, 1992 and April, 1995. A complete listing, Table A-1, is provided in the Appendix summarizing the well identities (based on original boring grid locations), top-of-casing elevations, screened intervals, depths to water, and water surface elevations for monitoring events by AME (Messenger, personal communication). Table 1 was derived by grouping monitoring wells with approximately similar screened interval locations. These groups roughly align with the identification of three possibly continuous siltstone layers. Groups A and B are most likely the first siltstone, while groups C and D roughly correspond to the second and third siltstone layers, respectively. The lateral and vertical extents of these layers are not completely known.

Inspection of Tables A-1 and 1 allows several important conclusions. First, when bailed to dryness, the water levels in the wells typically took several weeks to return to static levels. This delay indicated either low local permeability, little water volume in storage, or both controlled the return of water to the screened interval. Second, the equilibrated water surface elevations at most of the monitoring wells with similar depths of screen were not close enough to imply hydraulic continuity. For example, only well pairs 4-C and 5-C in group B, 4-G2 and 9-G2 in group C, and 4-G3 and 9-G3 in group D had water surface elevations within a few feet of each other. Third, the height of the water columns above the tops of the screens at wells 7-G, 2-G, 11-D, 6-B1, and 6-B2 were 44.3, 67.4, 107.13, 41.7, and 98.75 ft, respectively. These values indicate that the water in the siltstones at those locations was under pressurized confined conditions, yet the permeability or discontinuity still restricted the flow.

Table 1. Well Screened Intervals and Water Level Elevations Observed on April 19, 1995

Group with Similar Intervals	Well	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Water Surface Elevation (ft)
A	9-G1	3330.17	3325.17	dry
B	5-E	3312.28	3302.28	dry
	5-C	3307.94	3287.94	3288.12
	4-C	3307.55	3285.55	3288.79
	4-G1	3294.56	3264.56	3260.65
	6-B1	3295.66	3285.66	3337.36
C	7-G	3262.72	3232.72	3307.15
	11-D	3241.07	3216.07	3348.20
	4-G2	3249.69	3219.68	3245.16
	9-G2	3248.99	3238.99	3242.36
	6-B2	3220.26	3210.26	3319.01
D	2-G	3214.93	3189.93	3282.33
	4-G3	3202.11	3197.11	3194.10
	9-G3	3197.02	3187.02	3193.06

The total dissolved solids (TDS) contents of the water samples taken from these wells were significantly higher (>1,800 mg/L) than typical regional values for the Ogallala aquifer (~500 mg/L). In addition, the TDS values varied significantly between the wells in these layers, possibly indicating little if any flow between the well locations. The upper siltstone layer was identified as the "uppermost aquifer" for monitoring purposes. Due to the difficulties in static water level equilibration and development, dedicated sampling pumps were recommended for future monitoring well installations. Further discussion of the hydrogeologic and geochemical data will be given in a later section of this report.

Site Visits

On July 28, 1993, Drs. Lloyd Urban and Ken Rainwater visited the proposed site. Allen Messenger and Andy Witteveld of AME conducted the tour. The site is currently part of the Flying W Diamond Ranch, a short distance east of Eunice, New Mexico. The property is used as a working ranch, with limited development for oil and gas wells. The grid of soil borings was still evident at the surface, as were the existing monitor wells. Mr. Witteveld described the bailer-development procedure he was using to encourage increased flow in the screened intervals of the wells. He also provided preliminary water quality data from sampling events since the preparation of the permit documents. Mr. Bill Vance, ranch manager, took the group over to the Monument Draw area on the other side of the state line for viewing of the 20- to 30-ft high cutbank of the draw. He also identified the Baker Spring location within the draw. No recent flow was evident at the spring.

During 1996, several visits to the site were made by Drs. Rainwater, Urban, Lehman, Gurrola, and Jayawickrama. On July 17, 1996, Drs. Rainwater, Urban, and Lehman visited the WCS site for their first view of the initial cell excavation, hosted by AME. Over the next three months, various combinations of the five scientists and engineers made additional visits to the site to gather geological and geophysical information about the vicinity.

Public Meeting in Andrews

At the request of the AIF, Drs. Urban and Rainwater attended a public meeting held by the TNRCC at the High School Auditorium in Andrews, Texas, on the evening of September 30, 1993. The purpose of the public meeting was to give local residents opportunity to ask questions of the TNRCC about the landfill and the permitting process. It was apparent that civic group support for the project was quite high, and that the AIF and AME had spent considerable effort describing the facility design to the residents. The TNRCC staff raised no questions at that time.

Inspection of Core Samples

On October 4, 1993, Dr. Rainwater visited the office of Jack H. Holt, Ph.D., and Associates, Inc. (JHA) with Mr. Witteveld to visually examine core samples from selected borings. Cores 6-B and 9-G, which are shown in Figure 1, represent locations in which almost all of the different lithological were penetrated. Of particular concern in this examination was the condition of the red claystone. In the samples from both cores, the red claystone core was typically continuous (few fracture planes not attributable to the sampling process), solid, and tight. As indicated by the results of the laboratory hydraulic conductivity tests, the claystone was probably naturally compacted by the weight of overburden during deposition. The zones identified as siltstone and sandstone were typically grayish or white cohesive materials with fine grains of silt or sand visible on the outside of the cores. The presence of the sand and silt apparently accounts for the higher hydraulic conductivities of these materials relative to that of the claystone. However, the siltstone and sandstone did not appear to have enough porosity to allow significant flow under typical natural gradients.

Recommendation and Evaluation of Water Quality Samples

AME provided the results of the analyses of water samples collected on July 23, 1993, from wells 2-G, 7-G, 11-D, and 6-B1. The surface locations of these wells are shown in Figure 1. The samples were analyzed for several water quality parameters, including some major ions, pH, and TDS. The major ion analyses are of primary concern to this report since ionic composition of groundwater sometimes provides clues about hydraulic connections in the local subsurface. For example, water quality in an aquifer generally deteriorates with distance from the point of recharge, as more materials are dissolved. Also, the nature and amount of dissolved species can indicate the rock types through which the water moved. Table 2 summarizes the results of the analyses. The concentrations of the ionic species were given by the laboratory in mg/L, and then converted to milliequivalents/L (meq/L) to check for electroneutrality. The condition of electroneutrality in a water solution requires that the sum of the meq/L of cations must equal the sum of the meq/L of anions. The "ion %" column lists the portion that each ionic constituent comprises in the major cations or anions as appropriate. The analyses for this sample set included all of the typical major ions in natural waters except for bicarbonate (HCO_3).

Table 2 shows that there was little similarity in the waters from the four wells. The measured TDS varied from 1800 to 5500 mg/L. In each sample, sodium (Na) was the dominant cation and sulfate (SO_4) was the dominant anion, but the relative concentrations varied by a factor of almost 3. It is possible to check a major ion analysis by comparing the measured and calculated TDS values. The measured TDS is normally done with a conductivity meter based on the ionic strength of the solution. The calculated TDS is found by summing the total mg/L of the cations

Table 2. Water Quality Analyses for Samples Collected 7/23/93

Well	2-G			7-G			11-D			6B-1			26-40-602(Ogallala)		
Constituent	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %
Cations															
Ca	28	1.40	4.1	64	3.20	4.2	60	3.00	6.1	7	0.35	1.3	78	3.90	53.3
Mg	20	1.65	4.8	58	4.77	6.3	51	4.20	8.5	11	0.91	3.3	21	1.73	23.6
Na	710	30.87	90.5	1560	67.83	88.8	960	41.74	84.7	590	25.65	94.0	36	1.57	21.4
K	8	0.19	0.6	22	0.56	0.7	13	0.32	0.6	15	0.37	1.4	5	0.13	1.7
Total	766	34.1	100.0	1704	76.36	100.0	1084	49.26	100.0	623	27.28	100.0	140	7.32	100.0
Anions															
Cl	200	5.63	17.1	1157	32.59	38.6	290	8.17	24.4	200	5.63	23.1	39	1.10	15.3
SO4	1300	27.08	82.3	2460	51.25	60.7	1200	25.00	74.7	900	18.75	76.9	39	0.81	11.3
HCO3	nr			nr			nr			nr			304	4.98	69.4
NO3	12	0.19	0.6	33	0.53	0.6	19	0.31	0.9	0	0.00	0.0	18	0.29	4.0
Total	1512	32.91	100.0	3650	84.37	100.0	1509	33.48	100.0	1100	24.38	100.0	400	7.19	100.0
Neutral															
SiO2	11			13			11			13			43		
TDS(meas)	2600			5500			4000			1800			431		
TDS(sum)	2289			5367			2604			1736			583		
TDS Error(%)	6.4			1.2			21.1			1.8			15.0		
Ion Error(%)		1.8			5.0			19.1			5.6			0.9	

Well 24-40-602 (Ogallala) - Flying W Diamond Ranch well, sampled by TWDB on 10/10/1990, included for comparison

TDS Error(%) = 100 |TDS(sum) - TDS(meas)| / [TDS(sum) + TDS(meas)]

Ion Error(%) = 100 |Total Cations(meq/L)-Total Anions(meq/L)| / [Total Cations(meq/L)+Total Anions(meq/L)]

nr = not run

(Ca, Mg, Na, and K), the anions (Cl, SO_4, NO_3), and neutral compounds (SiO_2). The TDS (meas) and TDS (sum) should agree within 5 percent, as shown for wells 7-G and 6B-1. Electroneutrality is checked by comparing the total meq/L of the cations with the total meq/L of the anions in what is called the ion balance error. The ion balance error should also be less than 5 percent for an acceptable analysis, as it is for wells 2-G and 7-G. When these two checks are not consistent for all the analyses, especially when the TDS (sum) is less than the TDS (meas) for all the samples, it is quite possible that one or more other significant ions should be analyzed in the samples. Other errors could have taken place in one or more of the analyses which were performed on the samples. Dr. Rainwater suggested to Mr. Witteveld that bicarbonate should be added to the list of analyses for the next round of samples. A fifth water sample is included in Table 2 for comparison of typical local shallow groundwater quality to that in the Dockum group. Well 26-40-602 is located on the Flying W Diamond Ranch near state highway 176, and this well is occasionally monitored and sampled by the Texas Water Development Board (TWDB). The well is referred to as an "Ogallala" well by the TWDB.

A second set of samples was collected by AME on September 21, 1993, from wells 2-G, 7-G, 11-D, 6B-1, and 6B-2. Table 3 summarizes the results of the ion analyses. Comparison of Tables 2 and 3 show limited agreement between the two sets of analyses of wells 2-G, 7-G, 11-D, and 6B-1. This disagreement is not surprising, considering the difficulty of purging and sampling the wells in these siltstone layers. It is possible that there were sampling, handling, or analytical errors between the two sample sets, but it is also possible that the chemical composition of the water in the vicinity of each well has not been homogenized by mechanical mixing due to flow. This question would hopefully be resolved as additional samples were collected from these wells in subsequent monitoring events. The TDS values for well 2-G were similar, while the TDS values were higher in September for wells 7-G, 11-D, and 6B-1. Well 6B-2 showed very poor agreement between TDS (meas) and TDS (sum), and only well 7-G had acceptable agreement between TDS (meas) and TDS (sum).

With the addition of HCO_3 to the ion analyses, it was hoped that the ion balance errors

Table 3. Water Quality Analyses for Samples Collected 9/21/93

Well	2-G			7-G			11-D			6B-1			6B-2			26-40-602(Ogallala)		
Constituent	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %
Cations																		
Ca	53	2.65	12.2	170	8.50	10.4	156	7.80	16.0	28	1.40	8.4	33	1.65	11.5	78	3.90	53.3
Mg	25	2.06	9.5	55	4.53	5.5	33	2.72	5.6	11	0.91	5.5	12	0.99	6.9	21	1.73	23.6
Na	387	16.83	77.4	1560	67.83	82.6	870	37.83	77.8	324	14.09	84.9	264	11.48	80.2	36	1.57	21.4
K	8	0.20	0.9	49	1.25	1.5	11	0.28	0.6	8	0.20	1.2	8	0.20	1.4	5	0.13	1.7
Total	473	21.74	100.0	1834	82.11	100.0	1070	48.62	100.0	371	16.60	100.0	317	14.32	100.0	140	7.32	100.0
Anions																		
Cl	200	5.63	15.6	1700	47.89	45.7	590	16.62	32.1	210	5.92	16.6	200	5.63	21.8	39	1.10	15.3
SO4	1300	27.08	75.0	2600	54.17	51.7	1600	33.33	64.4	1200	25.00	70.1	740	15.42	59.6	39	0.81	11.3
HCO3	190	3.11	8.6	150	2.46	2.3	100	1.64	3.2	290	4.75	13.3	290	4.75	18.4	304	4.98	69.4
NO3	18	0.29	0.8	12	0.19	0.2	10	0.16	0.3	0	0.00	0.0	4	0.06	0.2	18	0.29	4.0
Total	1708	36.12	100.0	4462	104.71	100.0	2300	51.75	100.0	1700	35.67	100.0	1234	25.87	100.0	400	7.19	100.0
Neutral																		
SiO2	10			22			10			11			12			43		
TDS(meas)	2700			6900			4600			1900			2600			431		
TDS(sum)	2191			6318			3380			2082			1563			583		
TDS Error(%)	10.4			4.4			15.3			4.6			24.9			15.0		
Ion Error(%)		24.9			12.1			3.1			36.5			28.7			0.9	

Well 24-40-602 (Ogallala) - Flying W Diamond Ranch well, sampled by TWDB on 10/10/1990, included for comparison

TDS Error(%) = 100 |TDS(sum)-TDS(meas)| / [TDS(sum)+TDS(meas)]

Ion Error(%) = 100 |Total Cations(meq/L)-Total Anions(meq/L)| / [Total Cations(meq/L)+Total Anions(meq/L)]

would be reduced. In this sample set, however, only the analyses from well 11-D met the 5 percent limit. It is difficult to identify a specific explanation for the larger ion balance errors. Analytical laboratories sometimes have difficulty with these balances in saline waters due to the differing concentration ranges measurable in the different ion procedures. The cations are normally quantified in elemental analyses by atomic spectrophotometry, which requires dilution of the sample, while anions may be analyzed by ion chromatography, titrations, colorimetry, or ion specific electrode methods which may or may not require dilution. The different methods are sometimes interfered with by high concentrations of other compounds. In any case, the accuracy of these analyses is in question. However, it is possible to make some useful comparisons. The ion percentages were used to visually compare ion grouping among these water samples using a trilinear, or Piper, diagram (Freeze and Cherry, 1979) in Figure 2. From this figure, the waters at all of the Dockum group wells are classified as Na-SO_4+Cl dominated solutions. Note that the sample from well 26-40-602 plots far away from the Dockum samples, as a Ca+Mg-HCO_3 water. The 26-40-602 water is essentially a much "younger" water, more recently recharged from the atmosphere. Although the Dockum water samples show somewhat similar ionic distributions, the large differences in their TDS values cannot be directly correlated to a reasonable flow phenomenon in the siltstone.

Three more monitoring events occurred in October, 1993, January, 1994, and March, 1994. The results of these sampling events are summarized in Tables 4, 5, and 6, respectively. The results from these three events compare somewhat more closely overall than the first two sampling events. The ion and TDS balance errors often exceeded the 5 percent target, but the TDS values are much more comparable across events. In addition, the concentrations of the ionic constituents in each well are much more similar across events. When plotted on trilinear diagrams, the results are practically identical to those in Figure 2 within the scale of that configuration, so additional figures are not provided. The improved consistency is encouraging, and does not change the conclusions drawn in the previous paragraph.

In summary, the ionic analyses of the sampled wells were useful in describing the potential

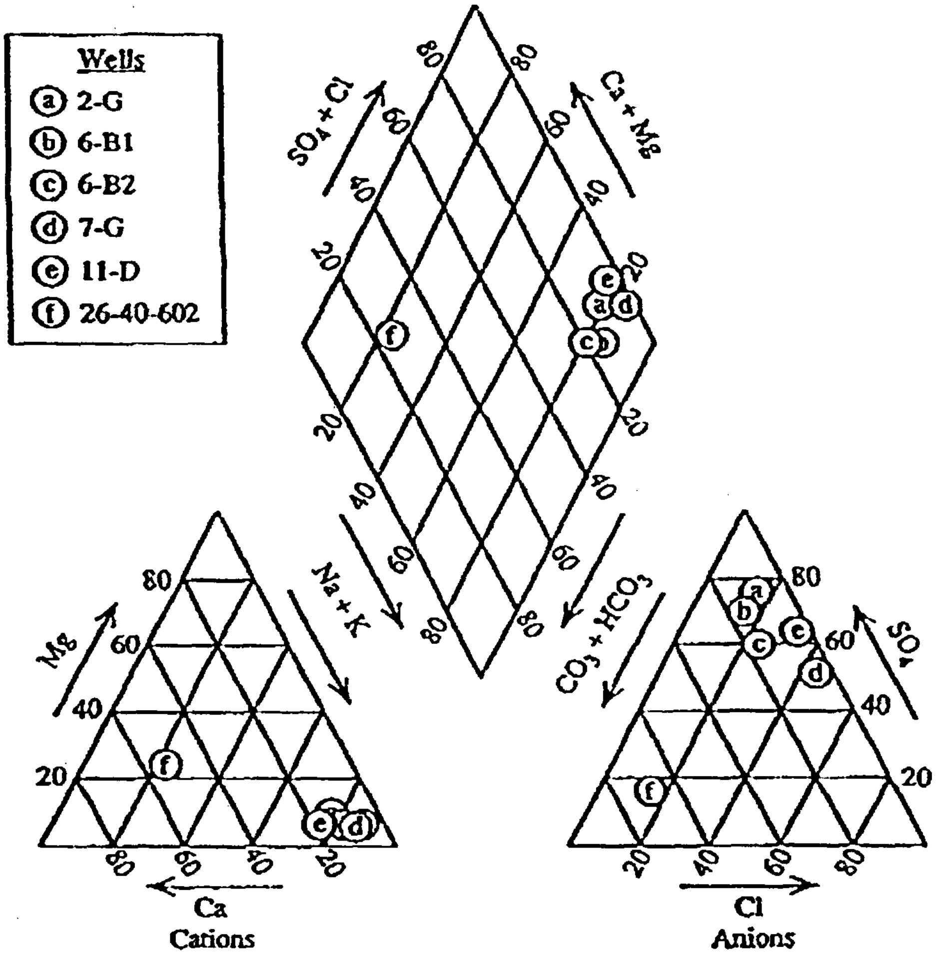

Figure 2. Trilinear Representation of Major Ion Analyses

Table 4. Water Quality Analyses for Samples Collected 10/20/93

Well	2-G			7-G			11-D			6B-1			6B-2			26-40-602(Ogallala)		
Constituent	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	icn %	mg/L	meq/L	ion %	mg/L	meq/L	ion %
Cations																		
Ca	72	3.60	10.4	126	6.30	6.3	158	7.90	12.6	42	2.10	8.5	33	1.65	4.4	78	3.90	53.3
Mg	36	2.96	8.6	106	8.72	8.7	68	5.60	9.0	17	1.40	5.7	15	1.23	3.3	21	1.73	23.6
Na	640	27.83	80.4	1940	84.35	84.0	1120	48.70	77.9	480	20.87	84.9	800	34.78	91.9	36	1.57	21.4
K	8	0.20	0.6	41	1.05	1.0	11	0.28	0.5	8	0.20	0.8	7	0.18	0.5	5	0.13	1.7
Total	756	34.59	100.0	2213	100.42	100.0	1357	62.47	100.0	547	24.57	100.0	855	37.85	100.0	140	7.32	100.0
Anions																		
Cl	180	5.07	11.2	1300	36.62	34.4	550	15.49	21.1	190	5.35	18.9	200	5.63	15.3	39	1.10	15.3
SO4	1700	35.42	78.1	3200	66.67	62.5	2700	56.25	76.5	880	18.33	64.7	1260	26.25	71.3	39	0.81	11.3
HCO3	190	3.11	6.9	150	2.46	2.3	100	1.64	2.2	280	4.59	16.2	300	4.92	13.4	304	4.98	69.4
NO3	110	1.77	3.9	52	0.84	0.8	10	0.16	0.2	3	0.05	0.2	1	0.02	0.0	18	0.29	4.0
Total	2180	45.38	100.0	4702	106.58	100.0	3360	73.54	100.0	1353	28.32	100.0	1761	36.82	100.0	400	7.19	100.0
Neutral																		
SiO2	10			12			11			13			12			43		
TDS(meas)	2500			6700			4400			1800			2500			431		
TDS(sum)	2946			6927			4728			1913			2628			583		
TDS Error(%)	8.2			1.7			3.6			3.0			2.5			15.0		
Ion Error(%)		13.5			3.0			8.1			7.1			1.4			0.9	

Well 24-40-602 (Ogallala) - Flying W Diamond Ranch well, sampled by TWDB on 10/10/1990, included for comparison

TDS Error(%) = 100 |TDS(sum)-TDS(meas)| / [TDS(sum)+TDS(meas)]

Ion Error(%) = 100 |Total Cations(meq/L)-Total Anions(meq/L)| / [Total Cations(meq/L)+Total Anions(meq/L)]

Table 5. Water Quality Analyses for Samples Collected 1/26-27/94

Well	2-G			7-G			11-D			6B-1			6B-2			26-40-602(Ogallala)		
Constituent	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %
Cations																		
Ca	94	4.70	7.7	186	9.30	8.3	194	9.70	13.7	46	2.30	4.9	34	1.70	2.9	78	3.90	53.3
Mg	42	3.46	5.7	104	8.56	7.6	19	1.56	2.2	9	0.74	1.6	9	0.74	1.2	21	1.73	23.6
Na	1200	52.17	85.9	2150	93.48	83.1	1350	58.70	83.2	1000	43.48	92.7	1300	56.52	95.3	36	1.57	21.4
K	17	0.43	0.7	44	1.13	1.0	24	0.61	0.9	15	0.38	0.8	13	0.33	0.6	5	0.13	1.7
Total	1353	60.77	100.0	2484	112.46	100.0	1587	70.57	100.0	1070	46.90	100.0	1356	59.29	100.0	140	7.32	100.0
Anions																		
Cl	200	5.63	11.5	1500	42.25	37.0	730	20.56	27.2	230	6.48	21.9	230	6.48	13.2	39	1.10	15.3
SO4	1900	39.58	80.8	3300	68.75	60.2	2500	52.08	68.8	890	18.54	62.6	1800	37.50	76.6	39	0.81	11.3
HCO3	190	3.11	6.4	150	2.46	2.2	130	2.13	2.8	280	4.59	15.5	300	4.92	10.0	304	4.98	69.4
NO3	41	0.66	1.3	42	0.68	0.6	56	0.90	1.2	0	0.00	0.0	5	0.08	0.2	18	0.29	4.0
Total	2331	48.99	100.0	4992	114.14	100.0	3416	75.68	100.0	1400	29.61	100.0	2335	48.98	100.0	400	7.19	100.0
Neutral																		
SiO2	11			12			12			14			12			43		
TDS(meas)	2700			7100			4500			1900			2700			431		
TDS(sum)	3695			7488			5015			2484			3703			583		
TDS Error(%)	15.6			2.7			5.4			13.3			15.7			15.0		
Ion Error(%)		10.7			0.7			3.5			22.6			9.5			0.9	

Well 24-40-602 (Ogallala) - Flying W Diamond Ranch well, sampled by TWDB on 10/10/1990, included for comparison

TDS Error(%) = 100 |TDS(sum)-TDS(meas)| / [TDS(sum)+TDS(meas)]

Ion Error(%) = 100 |Total Cations(meq/L)-Total Anions(meq/L)| / [Total Cations(meq/L)+Total Anions(meq/L)]

Table 6. Water Quality Analyses for Samples Collected 3/17-18/94

Well	2-G			7-G			11-D			6B-1			6B-2			26-40-602(Ogallala)		
Constituent	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %	mg/L	meq/L	ion %
Cations																		
Ca	84	4.20	8.9	200	10.00	7.6	180	9.00	9.3	31	1.55	3.7	30	1.50	3.0	78	3.90	53.3
Mg	26	2.14	4.5	98	8.07	6.1	56	4.61	4.8	19	1.56	3.7	12	0.99	1.9	21	1.73	23.6
Na	930	40.43	85.6	2600	113.04	85.5	1900	82.61	85.3	890	38.70	91.6	1100	47.83	94.2	36	1.57	21.4
K	19	0.49	1.0	45	1.15	0.9	23	0.59	0.6	17	0.43	1.0	17	0.43	0.9	5	0.13	1.7
Total	1059	47.26	100.0	2943	132.26	100.0	2159	96.81	100.0	957	42.24	100.0	1159	50.75	100.0	140	7.32	100.0
Anions																		
Cl	220	6.20	15.0	1640	46.20	40.7	610	17.18	25.5	230	6.48	23.7	230	6.48	17.8	39	1.10	15.3
SO4	1500	31.25	75.6	3100	64.58	56.9	2300	47.92	71.0	780	16.25	59.6	1200	25.00	68.7	39	0.81	11.3
HCO3	191	3.13	7.6	148	2.43	2.1	125	2.05	3.0	278	4.56	16.7	298	4.89	13.4	304	4.98	69.4
NO3	48	0.77	1.9	13	0.21	0.2	22	0.35	0.5	0	0.00	0.0	0	0.00	0.0	18	0.29	4.0
Total	1959	41.35	100.0	4901	113.42	100.0	3057	67.50	100.0	1288	27.29	100.0	1728	36.36	100.0	400	7.19	100.0
Neutral																		
SiO2	11			12			11			14			12			43		
TDS(meas)	2660			7300			4650			1790			2700			431		
TDS(sum)	3029			7856			5227			2259			2899			583		
TDS Error(%)	6.5			3.7			5.8			11.6			3.6			15.0		
Ion Error(%)		6.7			7.7			17.8			21.5			16.5			0.9	

Well 24-40-602 (Ogallala) - Flying W Diamond Ranch well, sampled by TWDB on 10/10/1990, included for comparison

TDS Error(%) = 100 |TDS(sum)-TDS(meas)| / [TDS(sum)+TDS(meas)]

Ion Error(%) = 100 |Total Cations(meq/L)-Total Anions(meq/L)| / [Total Cations(meq/L)+Total Anions(meq/L)]

for flow and mixing in the sampled siltstone. Although the TDS and ion error values are higher than those typically accepted in fresh water analyses, they are not uncommon in more saline waters with high ion concentrations that can cause interferences for some of the analytical techniques. These results are sufficient to verify the large difference in quality between the shallow fresh groundwater and the Dockum waters. In addition, the large differences in composition of the Dockum water samples indicate little mixing due to flow in the siltstone.

Review of Geologic and Hydrogeologic Information on Andrews County

As stated previously in this report, protection of existing groundwater resources is of utmost concern in siting and design of hazardous waste facilities. The major high quality groundwater source in the Southern High Plains of Texas is the Ogallala aquifer. In this section, the direct impacts of the WCS facility on the Ogallala aquifer in both the local and regional scale are considered. The site investigation results from the permit application (AME, 1993) and the historical findings published in the professional literature are combined in this evaluation.

As stated previously, the shallow permeable formation in the site vicinity is evaluated under the two aquifer criteria of [1] presence of geologic media that easily transmit water flow and [2] presence of sufficient volume of water for flow to production wells. This section includes discussion of geologic and hydrogeologic information from the AME (1993) permit documents, existing literature descriptions, and the most recent field work by Lehman (1996). Please note that all of the references prior to Lehman (1996) refer to the shallow permeable formation in western Andrews County as the Ogallala formation. Lehman's (1996) clarification is presented at the end of this section.

As reported in the hydrogeologic section in the permit application (AME, 1993), the borings drilled in the subsurface investigation encountered permeable sands and gravels identified as the lower portion of the Ogallala formation. Saturated conditions in these sediments were only rarely encountered, and then only beneath a surface depression. The saturated zone beneath the "buffalo wallow" was not sufficient to allow water to collect in the borehole. The conclusion of the site characterization was that the Ogallala formation is present beneath the site, but the formation does not contain an extensive, continuous volume of water suitable for development. The experience of Mr. Vance with the shallow Ogallala well at the Flying W Diamond Ranch corroborated this view, since the well was known to produce water only sporadically after sizable rainfall events. The mounded shape, as shown in Figure 1, of the top of the Dockum group, apparently encourages water that infiltrates into the shallow permeable formation from the surface to flow away from beneath the WCS site. It is also possible that rainfall may be so low in this location that soil and vegetation combinations in the area may prevent infiltration of significant amounts of water.

Documents describing the Ogallala aquifer conditions in the Andrews County vicinity were obtained from the TWDB and the holdings of the Texas Tech libraries. Six documents directly addressed the groundwater resources in the county, but, as will be shown in the following discussion, little accurate historical information exists that describe the conditions in the western portion of the county.

In 1940, the Texas Board of Water Engineers published a report on the groundwater development in Andrews County (TBWE, 1940). This report was a compilation of drillers' logs, well and test hole reports, and chemical analyses from wells in existence prior to 1940. The reports referred to a few hundred wells in the county, with most of the pumping wells in the eastern two-thirds of the county near the city of Andrews. No wells were shown in the vicinity of the WCS site.

Cronin (1961) presented a report on the occurrence and use of groundwater in the Southern High Plains as part of a joint effort between the U.S. Geological Survey (USGS), TBWE, and the High Plains Underground Water Conservation District. The report included a thorough discussion of the regional lithology as understood at that time and a number of contour maps that showed the elevation of the water table in the Ogallala aquifer, the elevation of the base of the Ogallala, and the saturated thickness of the aquifer across the region. Figure 3, which shows the elevation of the base of the Ogallala, provides no resolution of that quantity in the western one-fifth of Andrews County, implying that acceptably accurate records were not available to the author. Figure 4,

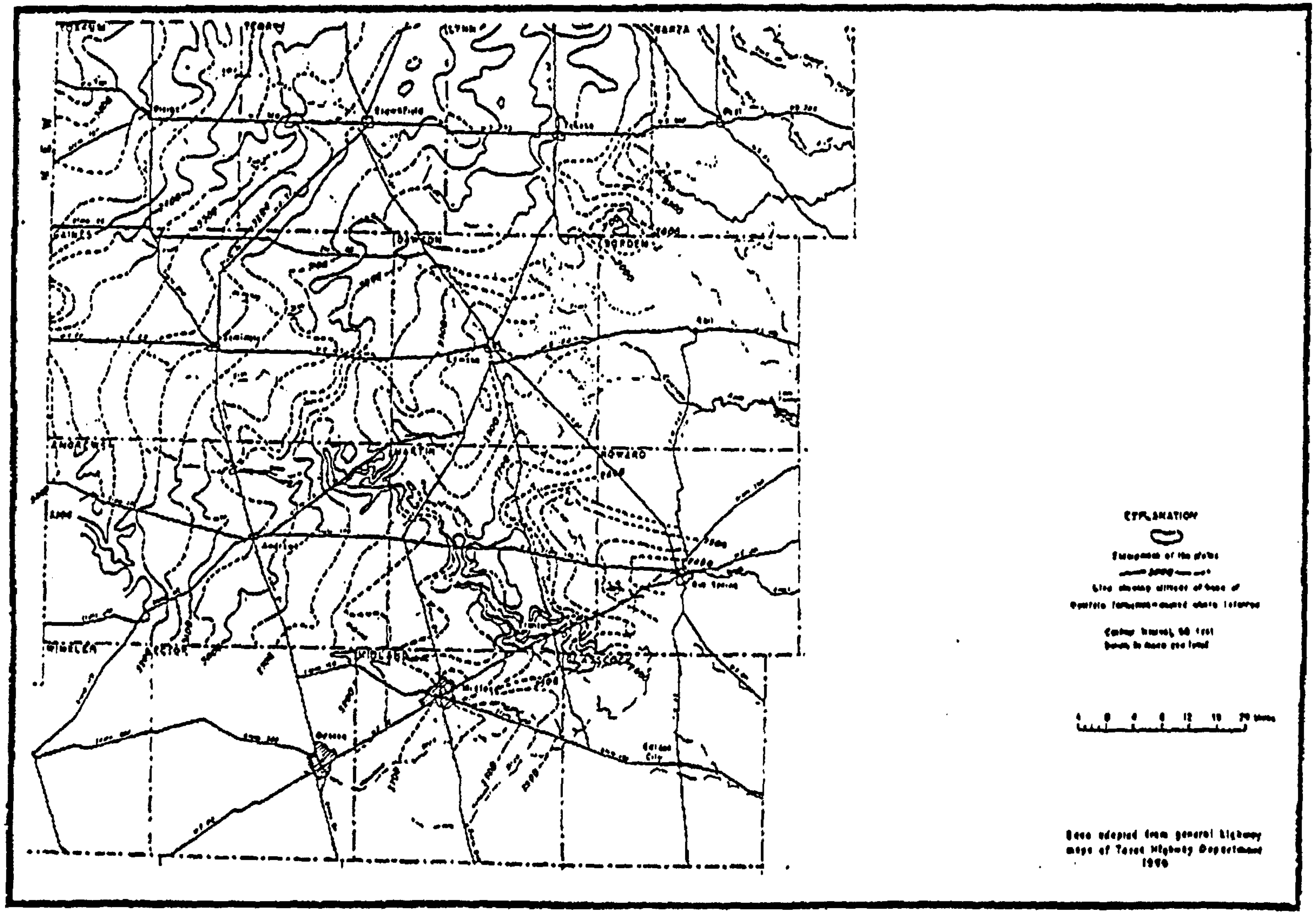

Figure 3. Contour Map of Base of Ogallala Formation. [Source: Cronin (1961)]

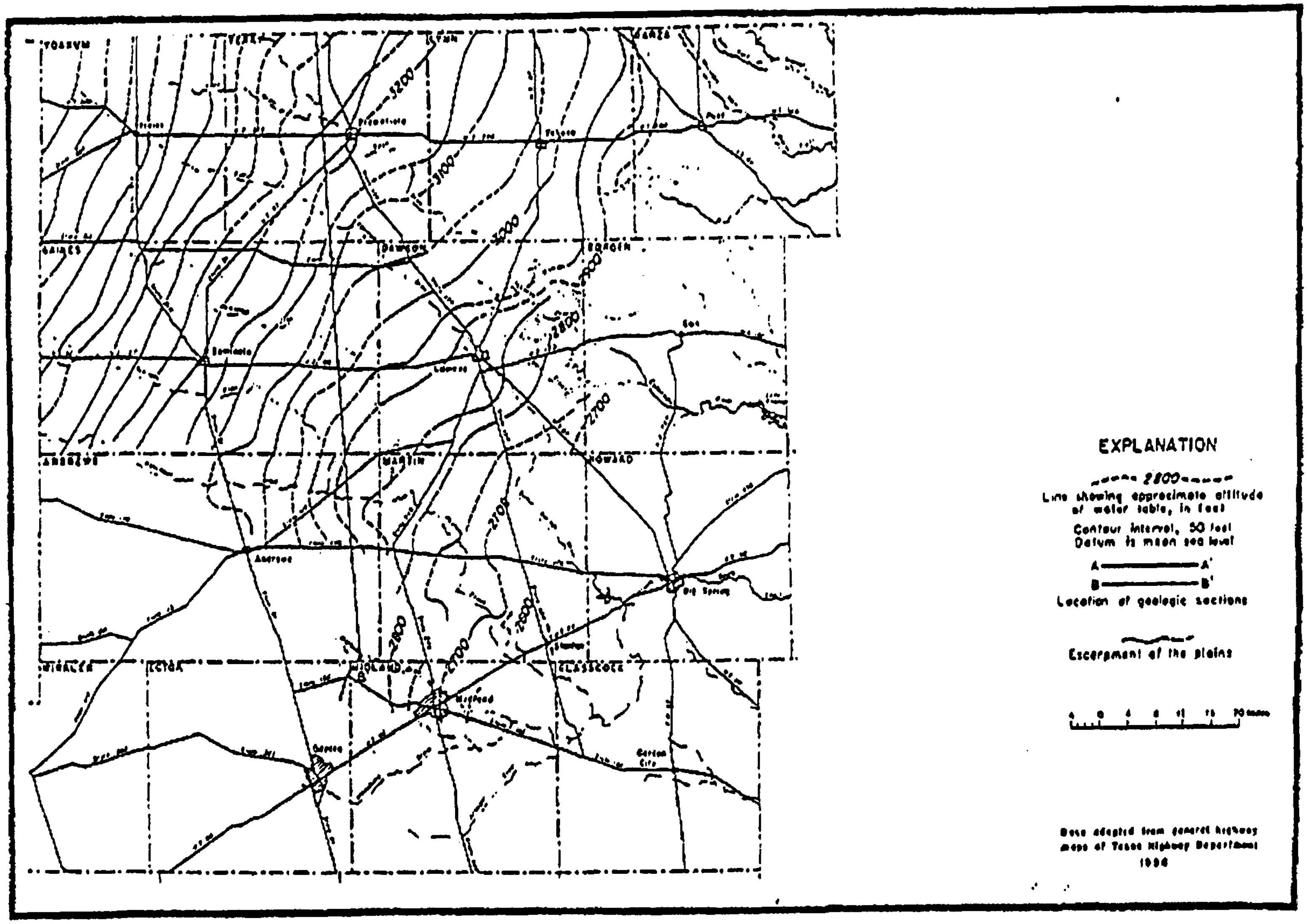

Figure 4. Contour Map of Water Level Elevation in Ogallala Formation. [Source: Cronin (1961)]

which shows the elevation of the water table in 1958, only indicates measured values in the northeast corner of Andrews County. Figure 5, the contour map of saturated thickness in the Ogallala, is directly related to the limited information in Figures 3 and 4. Figure 5 displays the estimated saturated thickness at the intersection of state highway 176 and the state line, near the WCS site, to be 0 (zero) ft. The method used to derive this estimate was not explained in the report. Apparently, the only appreciable Ogallala water storage in Andrews County was believed to be in the eastern portion of the county.

The TWDB is now the state agency that manages the database describing the state's surface and groundwater resources. Within this responsibility, the TWDB monitors groundwater levels and water quality at selected locations around the state. This data is then used in modeling efforts for projections of groundwater usage and storage for periods 20 to 50 years in the future. Three TWDB wells were identified within 2 miles of the WCS site (AME, 1993, Plate VI.A.1). A visit was made on October 4, 1993 to the TWDB office in Austin to obtain the records for these three wells. Well 26-40-201, owned by Mr. Ed Tinsley, is located approximately 1.2 miles northeast of the WCS site. Wells 26-40-601 and 26-40-602 (about 1200 ft east of 26-40-601), both associated with the Flying W Diamond Ranch, are located about 1.4 miles east-southeast of the WCS site. Table 7 summarizes the reported water depth measurements at these wells. Without a site-specific value of the elevation of the base of the Ogallala at wells 26-40-201 and -601, it is impossible to estimate the local saturated thickness. Also, it appears that no water depth measurement was made by the TWDB at well 26-40-602. Therefore, the wells monitored and reported by the TWDB provide no assistance in estimating local storage in the Ogallala aquifer. A total of four water samples have been collected from the three wells since 1974, with the most recent at well 26-40-602 (Table 2). The water quality at wells 26-40-601 and -602 have been quite similar, as would be expected due to their proximity. Well 26-40-201 has about twice the TDS of the other two wells, due to larger concentrations of calcium, sulfate, and chloride.

Ashworth and Flores (1991) of the TWDB published a set of two maps that delineated the areal extents of the major and minor aquifers in Texas, along with a report which described the

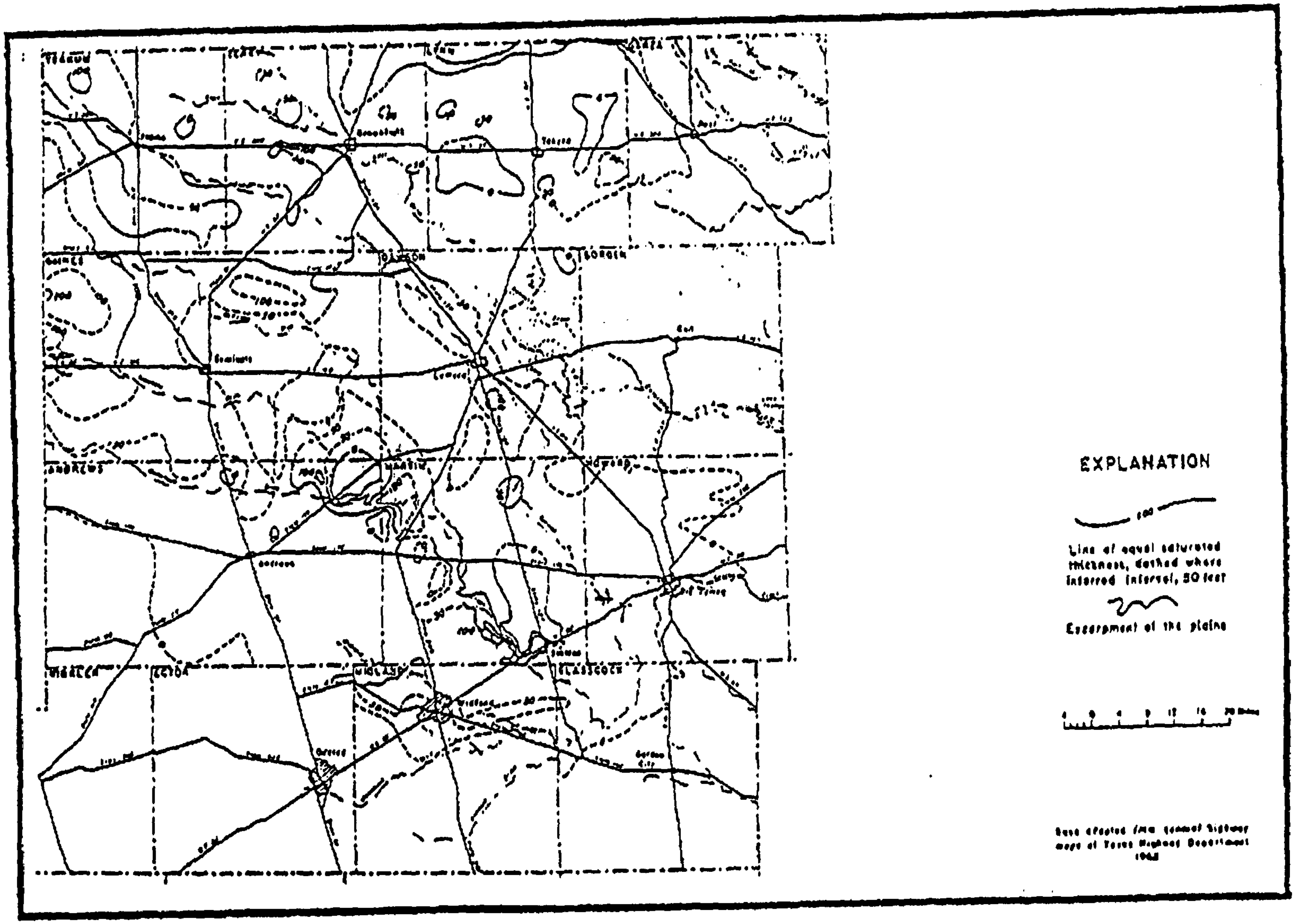

Figure 5. Contour Map of Saturated Thickness in Ogallala Formation. [Source: Cronin (1961)]

Table 7. Water Depth Measurements at TWDB Wells Near WCS Site
(na = information not available)

Well	Depth of Well (ft)	Date Measured	Depth to Water (ft)	Water Surface Elevation (ft)
26-40-201	na	11/25/79 1/13/93	82.47 87.14	3408.53 3403.86
26-40-601	na	12/10/69 1/13/93	78.55 80.03	3411.45 3409.97
26-40-602	80	na	na	na

criteria used to define the aquifer locations on the maps. Figure 6 is a color copy of their major aquifer map, which identifies the presence of the Ogallala aquifer in virtually all of Andrews County. The primary reference for this map was Cronin (1961). According to Ashworth (personal communication), this classification was based on the presence of the geologic formation, with only secondary consideration of the amount of water in storage at any given location. The fact that the western portion of Andrews County is identified as underlain by the Ogallala aquifer does not mean that the formation holds sufficient, if any, water for production. The publication of the maps was intended to show regional distribution of the formations that serve as aquifers across the state, not to define site-specific representation of available water.

Ashworth and others (1991) published an "Evaluation of the Ground-Water Resources in the Southern High Plains of Texas" under the direction of the state legislature as part of a state-wide effort to identify areas with potentially critical problems of groundwater quantity or quality in the next 20 years. This report was supported by the TWDB's on-going computer modeling of the aquifer's response to recharge and withdrawal, later published by Peckham and Ashworth (1993). Ashworth and others (1991) included data describing historical groundwater usage in Andrews County for municipal, agricultural, and industrial purposes as well as contour maps of water level changes and storage in the aquifer. Of particular interest to this study of the WCS site is Figure 7, a regional contour map of the water table elevation that shows that the approximate altitude of the water table in the Ogallala at the WCS location as of 1990 was 3400 ft. This value of 3400 ft cannot be accurate in the site-specific sense for the WCS site, since the elevation of the base of the

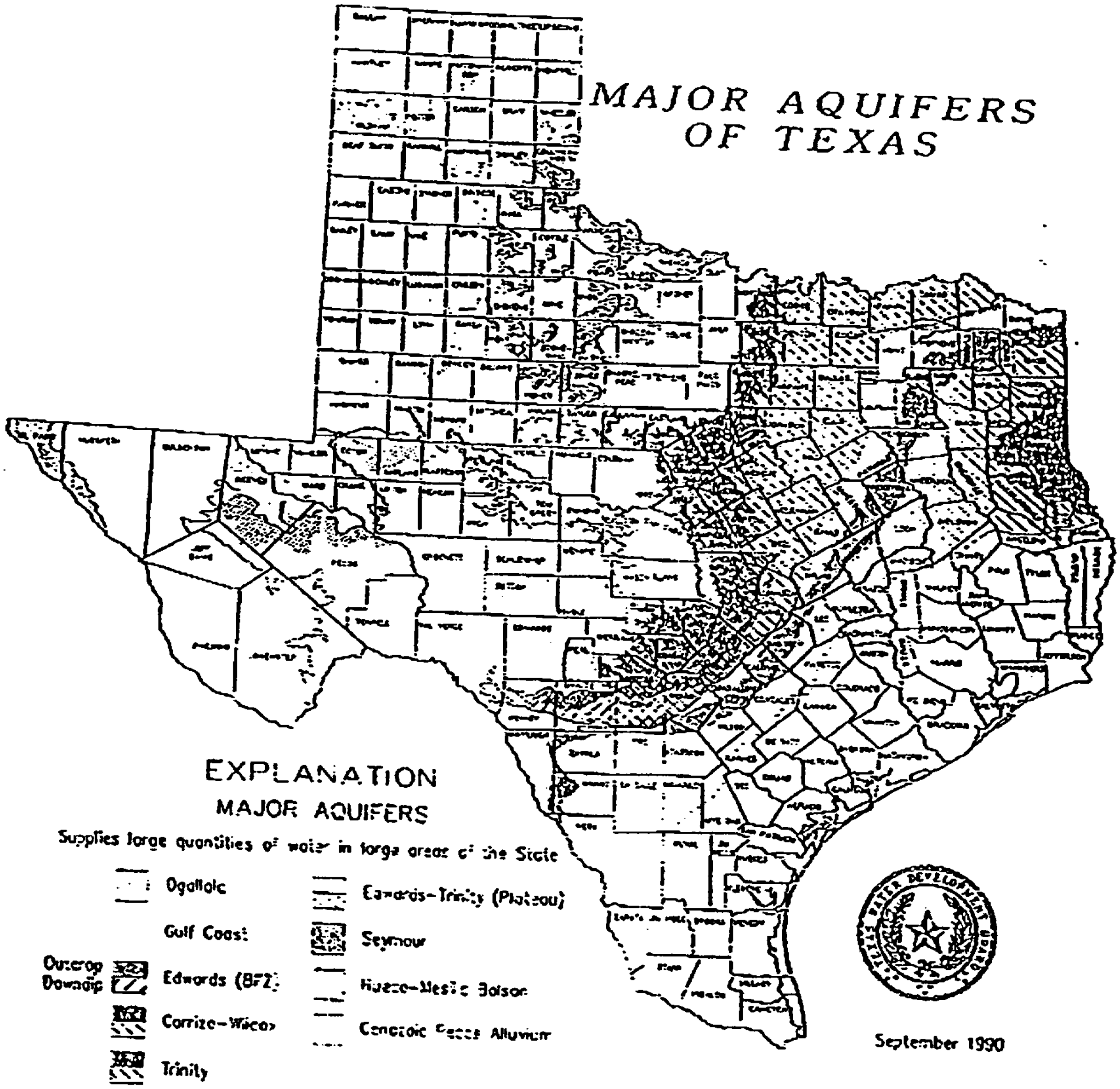

Figure 6. Major Aquifers in Texas. [Source: Ashworth and Flores (1991)]

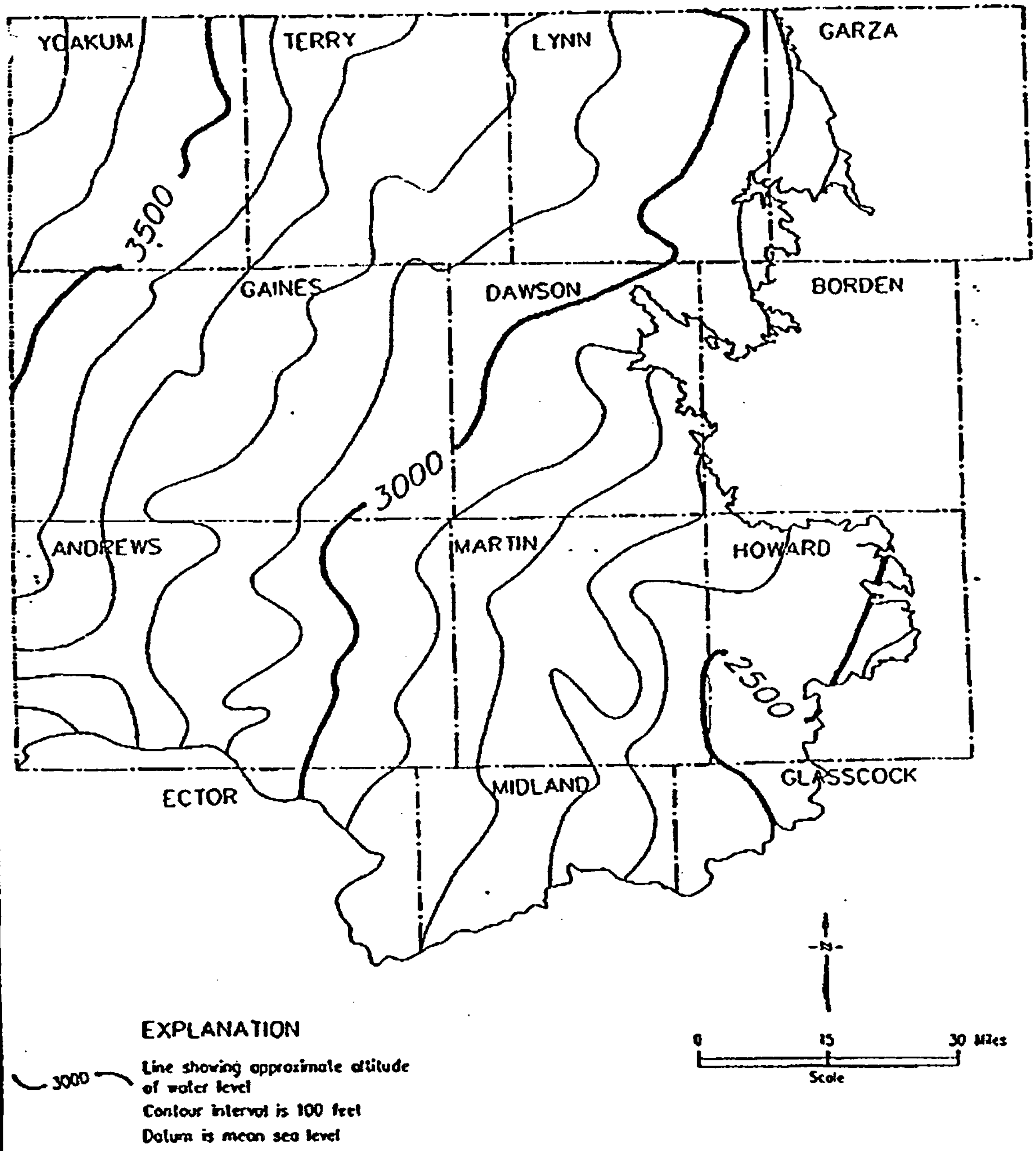

Figure 6

APPROXIMATE ALTITUDE OF WATER LEVELS
IN THE OGALLALA AQUIFER, 1990

Figure 7. Contour Map of Water Levels in Ogallala Formation, 1990
Source: Peckham and Ashworth, 1993)

Ogallala at the WCS site ranges from 3400 to 3450 ft as shown in Figure 1. In addition, Figure 8, a contour map of regional saturated thickness, shows an approximate saturated thickness for 1990 at the WCS site location of 50 ft. This thickness is also not possible at the WCS location since the thickness of the shallow permeable formation is less than 40 ft, most of which is caliche. Again, it is not surprising that the regional information in the report by Ashworth and others (1991) does not accurately represent the conditions at the WCS site. The publication was intended to show regional distribution of the water in the Ogallala formation, not to define site-specific description of storage. The detailed subsurface investigation reported in the permit application (AME, 1993) provides the necessary spatial resolution for description of the site-specific conditions for the proposed WCS facility.

Two very recent publications of the TWDB also included Andrews County within their study areas. Peckham and Ashworth (1993) described their efforts to calibrate a computer model for the behavior of the Ogallala aquifer in terms of changes in storage from 1980 to 1990. The intent of the effort was to align the model's output with the observed changes in water levels during that decade by manipulation of the input to the model, especially local aquifer recharge. The initial 1980 conditions assumed a saturated thickness of approximately 50 ft near the WCS site. The report did not detail how the initial saturated thicknesses were assigned at specific points in the region. It is interesting that the simulation of the 50-yr period from 1990 to 2040 with the calibrated model showed no appreciable change in saturated thickness in the western half of Andrews County. This result implies little withdrawal activity relative to that predicted for counties with more irrigated acreage. Hopkins (1993) summarized regional water quality information for the Ogallala aquifer in Texas. Samples were collected and analyzed over a 6-yr period. The only point of interest in this report is that only 4 wells were sampled in the western third of Andrews County. The scarcity of wells in this poorly productive area limited the number of wells available for analyses.

Lehman (1996) evaluated the literature and field evidence in western Andrews County as a direct attempt to determine the presence or absence of the Ogallala formation at the WCS site. His

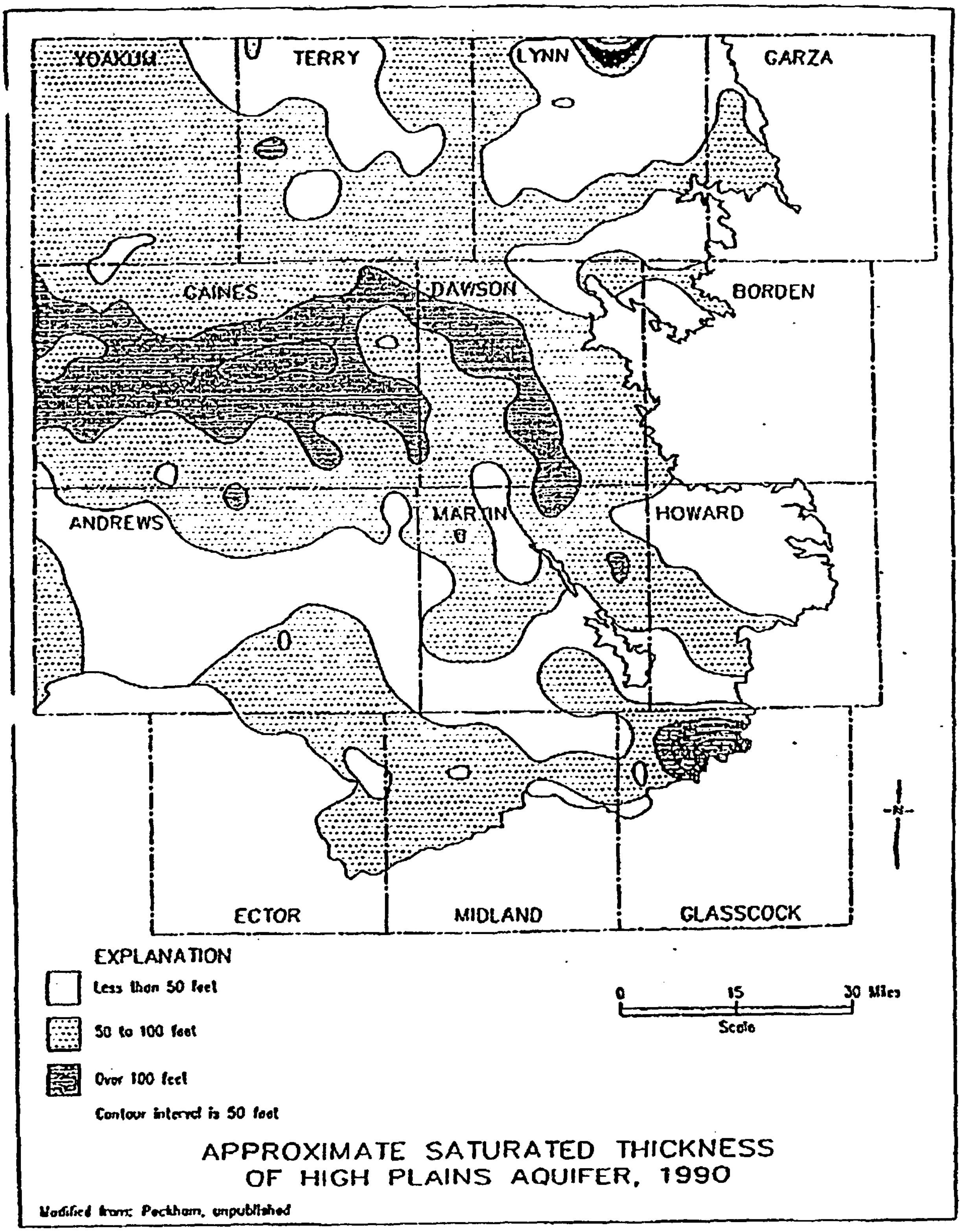

Figure 8. Contour Map of Saturated Thickness in Ogallala Formation, 1990
Source: Peckham and Ashworth, 1993)

study indicated that the "Red Bed Ridge" that makes the WCS site so desirable is a regional feature over 160 km in length and 5 to 10 km in width. His map of the ridge extent is not included with this report due to its large size. The ridge runs from the northwest to the southeast from the state line through Andrews County into Winkler and Ector Counties. It serves as a paleo-drainage divide that separates the Ogallala aquifer on the northeast from the Cenozoic basin fill aquifer to the southwest. Directly above the ridge, the shallow permeable sediments are the Cretaceous Edwards Limestone, Comanche Peak formation, or the Antlers Sandstone. These formations may be overlain by a caprock caliche, which in turn may have a thin veneer of younger sediments. The Ogallala likely pinches out near the line defined by Monument Draw in northern Andrews County, and it may be hydraulically connected to the Cretaceous sediments. However, the lack of developable groundwater resources in western Andrews County south of Monument Draw makes it unlikely that significant flow could move from the WCS site northward to the producing areas in Gaines County. At the WCS site, the shallow permeable formation was positively identified as the Antlers Sandstone by its characteristic gravels and absence of Cretaceous *Gryphaea* shells that occur in the Ogallala formation. The exposure of the Antlers Sandstone at the WCS excavation and other locations in Andrews County show that this formation is permeable, but it does not have significant water storage for development of dependable water wells other than low-flow windmills. In light of these findings, the water wells monitored by the TWDB in the vicinity may also not be in the Ogallala formation. Groundwater collects in the Antlers Sandstone only where the Triassic surface relief allows storage volume. The combination of low rainfall and high evapotranspiration likely limit recharge to this formation in the site vicinity.

In summary, the TWDB and TBWE generated several reports over the years that have included descriptions of the groundwater resources of Andrews County. In all cases, the vast majority of the water in storage was located in the eastern portion of the county. Close examination of the contour maps in these reports results in estimated saturated thickness of the Ogallala at the WCS site to be 0 (zero) ft. The shallow permeable formation at the site was originally identified as the Ogallala in the subsurface investigation. Lehman (1996) showed that the Ogallala formation is not present at the WCS site, nor is it present in a significant portion of Andrews County. No matter what the name of the local shallow permeable formation is, the local high in the upper surface of the Dockum group apparently encourages water that infiltrates, if there is enough for recharge, into this formation to flow away from the site. According to typical definitions of an aquifer, both sufficient permeability and saturated conditions are necessary for a stratum to be an economical water source. The shallow permeable formation at the WCS site does not meet both requirements.

Conclusions and Recommendations

After review of the permit documents and available information about the local hydrogeology, the operation of the WCS facility should have no significant impact on local groundwater resources. The installation of the landfill with its bottom excavated through the Antlers Sandstone formation into the red clays of the Dockum group should prevent transport of contaminants into that shallow permeable formation. The conventional double liner system coupled with the thick Triassic clay foundation provide multiple barriers to contaminant migration. Careful operation of the facility during construction and over its useful life as controlled by state and federal regulations should meet the objectives of safe disposal and protection of the environment.

The Ogallala aquifer does not exist at the site. The shallow permeable formation is more correctly identified as the Antlers Sandstone. This formation does not meet both criteria for classification as an aquifer at this location. The presence of the "Red Bed Ridge" in the Dockum group apparently encourages water that infiltrates into the sands and gravels in the base of the formation to move away to the northeast and southwest. The shallow permeable formation does not contain sufficient water at this location for development with pumping wells. Low rainfall and high evapotranspiration in this area limit the potential for groundwater recharge.

It is recommended that questions about the Ogallala aquifer as this site be considered be put aside as irrelevant based on the available information and landfill design. Emphasis should be placed on the positive features of the site, primarily the proximity of the Triassic clay as the foundation for the landfill bottom, in presentation to regulatory and public groups.

The siltstone layers in the Dockum group, identified as the "uppermost aquifer" for monitoring purposes, also do not fit the two criteria for an aquifer in the water resource development sense. The monitoring wells established in the siltstone are the only alternative for detection of leachate in the remote possibility that the landfill's multiple liner systems fail. The lack of a typical productive aquifer beneath the proposed site is an advantage, since that type of medium could easily transport contaminants if the double liner system failed.

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Appendix

Water Level Measurements Provided by AME (Messenger, personal communication)

Table A-1. Water Level Measurements
(Source, AM Environmental [Messenger, personal communication])

WELL NO./ GRID LOC.	7-G	4-C	2-G	11-D	4-G1	4-G2	4-G3	9-G1	9-G2	9-G3	6-B1	6-B2	5-E	5-C
DATE INSTALLED	12/2/92	12/1/92	12/22/92	12/22/92	1/28/93	2/11/93	1/27/93	1/29/93	1/24/93	1/25/93	1/30/93	1/30/93	1/28/93	1/28/93
T.O.C. ELEV. (FT)	3447.72	3476.55	3439.93	3473.07	3439.56	3439.68	3439.11	3460.17	3459.99	3460.02	3486.66	3482.26	3457.28	3460.94
SCREENED INTERVAL DEPTHS	185-215	169-191	225-250	232-257	145-175	190-220	237-242	130-135	211-221	263-273	191-201	262-272	145-155	173-193
TOP-BOTTOM SCREENED INTERVAL ELEVATIONS	3262.72- 3232.72	3307.55- 3285.55	3214.93- 3189.93	3241.07- 3216.07	3294.56- 3264.56	3249.69- 3219.68	3202.11- 3197.11	3330.17- 3325.17	3248.99- 3238.99	3197.02- 3187.02	3295.66- 3285.66	3220.26- 3210.26	3312.28- 3302.28	3307.94- 3287.94
DATE: 11/30/92														
depth to water	200.15	185.23	—	—	—	—	—	—	—	—	—	—	—	—
water surface elevation	3247.57	3291.32												
DATE: 12/01/92														
depth to water	200.15	187.67	—	—	—	—	—	—	—	—	—	—	—	—
water surface elevation	3247.57	3288.88												
DATE: 12/03/92														
depth to water	214.50	187.80	—	—	—	—	—	—	—	—	—	—	—	—
water surface elevation	3233.22	3288.75												
DATE: 12/10/92														
depth to water	173.10	186.30	—	—	—	—	—	—	—	—	—	—	—	—
water surface elevation	3274.62	3290.25												
DATE: 12/15/92														
depth to water	169.40	187.43	—	—	—	—	—	—	—	—	—	—	—	—
water surface elevation	3278.32	3289.12												
DATE: 12/21/92														
depth to water	—	—	—	248.00	—	—	—	—	—	—	—	—	—	—
water surface elevation				3225.07										
DATE: 12/29/92														
depth to water	157.10	187.60	219.80	183.90	—	—	—	—	—	—	—	—	217.00	—
water surface elevation	3290.62	3288.95	3220.13	3289.17									3240.28	
DATE: 1/10/93														
depth to water	151.45	187.85	181.10	164.40	—	—	—	—	—	—	—	—	183.90	—
water surface elevation	3296.27	3288.70	3258.83	3308.67									3273.38	
DATE: 1/14/93														
depth to water	149.78	187.79	181.03	161.82	—	—	—	—	—	—	—	—	176.15	—
water surface elevation	3297.94	3288.76	3258.90	3311.25									3281.13	

WELL NO./ GRID LOC.	9-O	4-C	2-O	11-D	4-01	4-02	4-03	9-G1	9-02	9-03	6-B1	6-B2	5-E	5-C
T.O.C. ELEV. (FT)	3447.72	3476.55	3439.93	3473.07	3439.56	3439.68	3439.11	3460.17	3459.99	3460.02	3486.66	3482.26	3457.28	3480.94
DATE: 1/17/93														
depth to water	148.88	187.51	181.05	158.58	-----	-----	-----	-----	-----	-----	-----	-----	172.00	-----
water surface elevation	3298.84	3289.04	3258.88	3314.49									3285.28	
DATE: 1/20/93														
depth to water	148.00	187.72	181.08	154.72	-----	-----	-----	-----	-----	-----	-----	-----	167.80	-----
water surface elevation	3299.72	3288.83	3258.85	3318.35									3289.48	
DATE: 1/23/93														
depth to water	147.10	187.60	181.01	151.61	-----	-----	-----	-----	-----	-----	-----	-----	164.55	-----
water surface elevation	3300.62	3288.95	3258.92	3321.46									3292.73	
DATE: 1/27/93														
depth to water	148.92	187.97	184.10	153.47	-----	-----	-----	-----	-----	-----	-----	-----	160.80	-----
water surface elevation	3298.80	3288.58	3255.83	3319.60									3296.48	
DATE: 1/30/93														
depth to water	152.05	188.23	184.45	156.15	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
water surface elevation	3295.67	3288.32	3255.48	3316.92										
DATE: 2/5/93														
depth to water	156.30	188.20	189.80	155.28	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
water surface elevation	3291.42	3288.35	3250.13	3317.79										
DATE: 2/9/93														
depth to water	159.60	187.20	191.10	156.23	179.15	DRY	DRY	DRY	224.40	271.70	162.70	DRY	DRY	DRY
water surface elevation	3288.12	3289.35	3248.83	3316.84	3260.41				3235.59	3188.32	3323.96			
DATE: 2/12/93														
depth to water	157.90	187.75	187.70	153.90	179.10	DRY	245.20	DRY	224.20	270.30	158.15	DRY	DRY	DRY
water surface elevation	3289.82	3288.80	3252.23	3319.17	3260.46		3193.91		3235.79	3189.72	3328.51			
DATE: 2/17/93														
depth to water	154.21	187.95	188.10	150.23	179.15	DRY	245.45	DRY	224.10	270.17	154.77	232.90	DRY	DRY
water surface elevation	3293.51	3288.60	3251.83	3322.84	3260.41		3193.66		3235.89	3189.85	3331.89	3249.36		
DATE: 2/24/93														
depth to water	152.18	187.46	179.52	146.02	DRY	DRY	245.35	DRY	223.70	269.91	152.69	218.20	DRY	DRY
water surface elevation	3295.54	3289.09	3260.41	3327.05			3193.76		3236.29	3190.11	3333.97	3264.06		
DATE: 3/3/93														
depth to water	149.85	187.65	176.98	142.96	DRY	DRY	245.37	DRY	223.43	269.75	151.75	207.00	DRY	DRY
water surface elevation	3297.87	3288.90	3262.95	3330.11			3193.74		3236.56	3190.27	3334.91	3275.26		
DATE: 3/10/93														
depth to water	148.50	187.80	174.70	139.90	179.20	DRY	245.36	DRY	223.13	269.73	151.25	188.80	DRY	DRY
water surface elevation	3299.22	3288.75	3265.23	3333.17	3260.36		3193.75		3236.86	3190.29	3335.41	3293.46		

WELL NO./ GRID LOC.	7-0	4-C	2-G	11-D	4-01	4-02	4-03	9-G1	9-02	9-03	6-B1	6-E2	5-E	5-C
T.O.C. ELEV. (FT)	3447.72	3476.55	3439.93	3473.07	3439.56	3439.68	3439.11	3460.17	3459.99	3460.02	3486.66	3482.26	3457.28	3460.94
DATE: 3/18/93														
depth to water	147.20	187.55	172.10	137.00	179.60	DRY	245.37	DRY	222.76	269.60	150.78	189.23	DRY	DRY
water surface elevation	3300.52	3289.00	3267.83	3336.07	3259.96		3193.74		3237.23	3190.42	3335.88	3293.03		
DATE: 3/30/93														
depth to water	145.13	187.45	169.16	133.85	179.15	203.77	245.40	DRY	222.24	269.48	150.30	179.40	DRY	DRY
water surface elevation	3302.59	3289.10	3270.77	3339.22	3260.41	3235.91	3193.71		3237.75	3190.54	3336.36	3302.86		
DATE: 4/13/93														
depth to water	143.45	187.48	167.86	131.11	179.29	203.90	245.49	DRY	221.70	269.42	150.05	171.21	DRY	195.94
water surface elevation	3304.27	3289.07	3272.07	3341.96	3260.27	3235.78	3193.62		3238.29	3190.60	3336.61	3311.05		3265.00
DATE: 4/28/93														
depth to water	141.63	187.66	163.70	129.04	179.28	202.25	245.50	DRY	221.01	269.28	149.85	164.92	DRY	194.44
water surface elevation	3306.09	3288.89	3276.23	3344.03	3260.28	3237.43	3193.61		3238.98	3190.74	3336.81	3317.34		3266.50
DATE: 5/24/93														
depth to water	140.40	187.52	160.90	126.77	179.28	200.84	245.45	DRY	219.90	269.08	149.58	157.67	DRY	192.33
water surface elevation	3307.32	3289.03	3279.03	3346.30	3260.28	3238.84	3193.66		3240.09	3190.94	3337.08	3324.59		3268.61
DATE: 6/10/93														
depth to water	139.62	187.48	159.05	125.58	179.31	199.97	245.45	DRY	219.16	268.95	149.44	154.45	DRY	191.78
water surface elevation	3308.10	3289.07	3280.88	3347.49	3260.25	3239.71	3193.66		3240.83	3191.07	3337.22	3327.81		3269.16
DATE: 7/14/93														
depth to water	140.20	187.50	159.58	124.60	179.30	198.20	245.38	DRY	218.89	268.68	149.31	150.10	DRY	192.18
water surface elevation	3307.52	3289.05	3280.35	3348.47	3260.26	3241.48	3193.73		3241.10	3191.34	3337.35	3332.16		3268.76
DATE: 7/15/93														
depth to water			232.13								181.34			
water surface elevation			3207.80								3305.32			
DATE: 7/16/93														
depth to water	198.78			225.89										
water surface elevation	3248.94			3247.18										
DATE: 7/23/93														
depth to water	164.01		178.56	149.54							151.74			
water surface elevation	3283.71		3261.37	3323.53							3334.92			
DATE: 8/9/93														
depth to water	150.90	187.60	167.50	128.28	179.30	196.90	245.32	DRY	216.80	268.50	150.30	148.25	DRY	192.22
water surface elevation	3296.82	3288.95	3272.43	3344.79	3260.26	3242.78	3193.79		3243.19	3191.52	3336.36	3334.01		3268.72

WELL NO./ GRID LOC.	7-G	4-C	2-G	11-D	4-G1	4-G2	4-G3	9-G1	9-G2	9-G3	6-B1	6-B2	5-E	5-C
T.O.C. ELEV. (FT)	3447.72	3476.55	3439.93	3473.07	3439.56	3439.68	3439.11	3460.17	3459.99	3460.02	3486.66	3482.26	3457.28	3480.94
DATE: 9/21/93														
depth to water	147.29	187.90	164.28	130.15	179.27	197.40	245.31	DRY	215.30	168.18	149.90	166.32	DRY	192.29
water surface elevation	3300.43	3288.65	3275.65	3342.92	3260.29	3242.28	3193.80		3244.69	3291.84	3336.76	3315.94		3288.65
DATE: 10/13/93														
depth to water	144.78	187.85	162.40	129.10	179.30	193.20	245.30	DRY	214.20	267.90	151.14	154.65	DRY	192.81
water surface elevation	3302.94	3288.70	3277.53	3343.97	3260.26	3246.48	3193.81		3245.79	3192.12	3335.52	3327.61		3288.13
DATE: 10/18/93														
depth to water	144.78	187.85	162.40	129.10	179.30	193.20	245.30	DRY	214.20	267.90	151.14	154.65	DRY	192.81
water surface elevation	3302.94	3288.70	3277.53	3343.97	3260.26	3246.48	3193.81		3245.79	3192.12	3335.52	3327.61		3288.13
DATE: 3/16/94														
depth to water	141.25	187.65	158.05	125.06	179.30	194.99	244.95	DRY	217.78	267.05	149.50	163.20	DRY	192.80
water surface elevation	3306.47	3288.90	3281.88	3348.01	3260.26	3244.69	3194.16		3242.21	3192.97	3337.16	3319.06		3288.14
DATE: 1/17/95														
depth to water	140.76	187.80	158.30	124.90	179.30	194.45	245.01	DRY	217.68	266.98	149.43	163.21	DRY	192.79
water surface elevation	3306.96	3288.75	3281.63	3348.17	3260.26	3245.23	3194.10		3242.31	3193.04	3337.23	3319.05		3288.15
DATE: 4/19/95														
depth to water	140.57	187.76	157.60	124.87	179.31	194.52	245.01	DRY	217.63	266.96	149.30	163.25	DRY	192.82
water surface elevation	3307.15	3288.79	3282.33	3348.20	3260.25	3245.16	3194.10		3242.36	3193.06	3337.36	3319.01		3288.12
Current thickness of water	74.43	3.24	92.40	132.13	0.00	25.48	0.00	0.00	3.37	6.04	51.70	108.75	0.00	0.18

━━━ AM ENVIRONMENTAL RESPONSIBLE FOR WATER LEVEL MEASUREMENTS

▭ depth to water FROM OPEN BORE HOLE

Monitor wells 6-B1 and 2-G were developed to dryness on 7/14/93
Monitor wells 7-G and 11-D were developed to dryness on 7/15/93
Monitor wells 6-B1 and 6-B2 were developed to dryness on 8/9/93
Monitor wells 7-G and 11-D were developed to dryness on 8/10/93
Monitor well 2-G was developed to dryness on 8/11/93
Monitor wells 6B-1, 6B-2, 11-D, 4-C, and 5-C were developed to dryness on 10/18/93
Monitor wells 9G-2, 7-G, 4G-2, and 2-G were developed to dryness on 10/19/93
Approximate site elevation 3484.75 ft

Geology of the WCS – Flying "W" Ranch, Andrews County, Texas

by

Thomas M. Lehman, Ph.D.
and
Ken Rainwater, Ph.D., P.E.
Texas Tech University Water Resources Center
Lubbock, Texas 79409-1022

Submitted to

Andrews Industrial Foundation
700 West Broadway
Andrews, Texas 79714

April, 2000

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Geology of the WCS - Flying "W" Ranch, Andrews County, Texas

1. Introduction

The general geological setting of the WCS - Flying "W" Ranch area in western Andrews County, Texas, has been previously described in permit applications (e.g., AM Environmental, 1993) and unpublished reports (Lehman, 1996a; 1996b). These reports provide an adequate overview of the regional geological setting and a detailed description of the site-specific conditions at the WCS facility. For example, Figure 1 shows the local topography of the "red bed" surface as was determined by the thorough geotechnical investigation done during the design of the WCS facility (AME, 1993). An exploratory drilling program conducted from March through June 1999 has greatly expanded the database on subsurface geologic conditions and groundwater in this area. In this report, some pertinent general information from the earlier documents is repeated, but attention is focussed instead on new detailed information that has resulted from the recent drilling program.

Thirty-five air-rotary boreholes were completed as piezometers on the WCS - Flying "W" Ranch (Figure 2). Three of the boreholes (#22, 23, and 24) were offset and drilled to greater depth (#22B, 23B, 24B). One borehole (#4) partially collapsed and remains problematic. Detailed geologic logs for each of the 35 boreholes are included as an appendix to this report. This report provides the following:

[1] further delineation of the "Red Bed Ridge" beneath the ranch property,

[2] description of each of the geologic units penetrated in the boreholes,

[3] discussion of the relationship between the occurrence of groundwater and subsurface geologic conditions, and

[4] methods used to discriminate deposits of the Ogallala and Antlers Formations.

Several figures are included to document the subsurface geology and groundwater distribution, and are discussed where appropriate in the report. Figure 2 shows the locations of five lithologic cross-sections that are provided as Figures 3 through 7. Figures 8 through 10 map the elevation of the "red beds," the thickness of the Antlers sand, and the areal distribution of saturated thickness.

2. Nature and Origin of the Buried Triassic "Red Bed Ridge"

2.1 General Information

The WCS-Flying "W" Ranch straddles a prominent buried ridge developed on the upper surface of the Triassic Dockum Group "red beds." This feature is referred to informally as the "Red Bed Ridge." Previous reports (e.g., Lehman, 1996a) have described this feature, but the recent drilling program provides additional information on its nature and extent (Figure 8).

The crest of the buried "Red Bed Ridge" is a mile or so in width and extends for at least 100 miles from northern Lea County, New Mexico, through western Andrews County and into Winkler and Ector Counties, Texas. The modern surface topography roughly coincides with the trace of this buried ridge, but is in general more subdued. In Lea County, the buried ridge runs parallel to and less than a mile northeast or southwest of the Mescalero Escarpment (Nicholson and Clebsch, 1961; Ash, 1963; Cronin, 1969), and similarly in Winkler and Ector counties the buried ridge coincides roughly with the western escarpment of the High Plains. The ridge is at least in part a product of structural deformation, as underlying Triassic strata have subsided in response to dissolution of Permian salt beds to the south and west of the ridge, underlying the Monument Draw Trough, San Simon Swale, and Pecos River Valley (Maley and Huffington, 1953; Nicholson and Clebsch, 1961; Anderson, 1980; Baumgardner et al., 1982; Gustavson and Finley, 1985). The ridge also roughly parallels the western margin of the buried Central Basin Platform in underlying Permian strata. However, the ridge is also in part a product of post-Triassic erosion, which has removed part of the Triassic section both northeast and southwest of the ridge. Cretaceous strata are absent southwest of the ridge. To the north and east of the "Red Bed Ridge", the High Plains surface is relatively undisturbed, and underlying Cretaceous and Tertiary strata are gently inclined to the southeast. In contrast, to the south and west of the ridge, dissolution of underlying Permian salt beds has resulted in deformation of the Triassic and Tertiary strata, and the High Plains surface has been locally disrupted by subsidence.

Several authors have commented on the nature and importance of this buried ridge, but it has not received widespread attention. Hawley (1984, pp. 161-162) regarded this as the position of a major drainage divide in the sub-Ogallala topography, and that this divide separated two major fluvial systems throughout Late Cenozoic time. Deposits of the Ogallala Formation lie to the north and east of the buried ridge, while deposits of the ancestral Pecos River (variously mapped as "Cenozoic Basin Fill," Gatuña Formation, or Ogallala Formation) lie to the south and west of this ridge (Reeves, 1972; Kelley, 1980; Hawley, 1984, 1993). Hawley (1993) suggested that use of the name "Ogallala Formation" could be restricted to deposits northeast of this divide, while the name "Gatuña Formation" could be used for equivalent deposits to the southwest. Little or no sediment accumulated on the summit of the buried "Red Bed Ridge", where instead, the "Caprock" Caliche developed directly on the exposed surface of underlying Triassic or Cretaceous strata, or on a thin veneer of eolian sediment. Reeves (1972) indicated that basal Ogallala gravels are present, at least locally on the crest of the ridge, suggesting that it may not have been an effective drainage divide during the later phases of Ogallala deposition. It is apparent that the buried ridge marks the position of a persistent ancient drainage divide between the ancestral Pecos River (to the southwest) and the Brazos and Colorado Rivers (to the northeast). It also roughly coincides with the modern drainage divide.

2.2 WCS - Flying "W" Ranch

The recent drilling program defined the extent of the "Red Bed Ridge" on the ranch area in greater detail than known previously, and provided further evidence for the origin of this feature. Cretaceous strata overlie the summit of the ridge along its length. AM Environmental (1993) had previously reported over 50 boreholes and well logs within the WCS site (Figure 1), and these data points were considered in the construction of the "red bed"-related maps within Andrews County in this report. Weaver Boos & Gordon, Inc. (1997) also provided data at 11 boreholes west of the state line and west of the WCS site. The "Red Bed Ridge" enters the northwest corner of the ranch and extends to the WCS landfill area and southeastward to Windmill Hill (Figure 3). From there, the ridge branches southward to the vicinity of well #30 and eastward to the vicinity of well #26. The southern branch likely terminates south of the ranch boundary, while the eastern branch probably tracks the continuation of the ridge to the south and east. Along the length of the ridge, the "Caprock" Caliche is exposed at or near the land surface, and so generally corresponds to the mapped distribution of the Kimbrough soils or Blakeney and Conger soil association (Figure 2; Conner et al., 1974). Additional drilling is necessary to establish the continued course of the "Red Bed Ridge" to the east; however, it likely continues roughly south and east along the route of State Highway 176 where the Kimbrough and Blakeney-Conger soils are present.

The presence of the "Caprock" Caliche over the entire area, both north and south of the "Red Bed Ridge" suggests that the ridge is not the buried erosional edge of the Caprock Escarpment, one of several possible interpretations of this feature. The ridge was present prior to formation of the "Caprock" Caliche and subsequent erosional retreat of the escarpment of the High Plains. Nevertheless, the absence of Cretaceous strata southwest of the ridge indicates that at least part of the relief on this feature is a result of erosion.

On the WCS - Flying "W" Ranch, and along most of the length of the "Red Bed Ridge", the southwestern flank of the ridge is more steeply inclined than the northeastern flank. The decline in elevation of the basal sand interval of the Antlers Formation southwest of the ridge (e.g., Figure 4, well #15) suggests that some of the relief on the "Red Bed Ridge" is owing to post-Cretaceous/pre-Late Tertiary structural deformation. However, the irregular southern boundary of the ridge indicates that relief is likely not due to faulting, and may more likely reflect a gentle fold.

3. Subsurface Geology

In this following section, each of the geologic units documented in the WCS - Flying "W" Ranch drilling program is described. The formations are given in ascending order (from oldest to youngest). General information on the distribution and characteristics of each unit is provided, followed by information specific to conditions observed in the WCS - Flying "W" Ranch area.

3.1 Chinle Formation (= Cooper Canyon Formation, Dockum Group: Triassic)

3.1.2 General Information

The distribution and regional characteristics of the Triassic Dockum Group were recently reviewed by Lehman (1994a, 1994b). The Dockum Group consists of five formations; in ascending order these are the Santa Rosa, Tecovas, Trujillo, Cooper Canyon, and Redonda Formations. These strata attain their maximum total thickness in excess of 1800 ft in the subsurface of Yoakum County, and are over 1000 ft thick in western Andrews County. The uppermost unit in the Dockum Group was traditionally (but incorrectly) referred to as part of the Chinle Formation in the southern part of the High Plains region. More recently these strata have been identified as the Cooper Canyon Formation (Lehman, 1994; Lehman et al., 1992). These

1989) and Nativ and Gutierrez (1988). The entire local Cretaceous stratigraphic section consists of six formations; in ascending order these are the Antlers, Walnut, Comanche Peak, Edwards, Kiamichi, and Duck Creek Formations. In the Southern High Plains area, Cretaceous strata attain their greatest preserved thickness in the vicinity of Yoakum County where they exceed 220 ft in total thickness. Southward from Yoakum County, the Cretaceous section thins and is absent in some areas of Gaines and Andrews Counties, primarily due to erosion prior to deposition of the Ogallala Formation. In southern Andrews County, and areas further south, Cretaceous strata are thicker and widely exposed.

Only the basal Cretaceous unit, the Antlers Formation, is present in the WCS-Flying "W" Ranch area; although a small outcrop identified as Fort Terrett Formation (equivalent to the Comanche Peak Limestone) is mapped immediately west of the ranch in Section 29 T.21S. (Hobbs Sheet, 1976), and a thick bed of Cretaceous limestone is also exposed on the ranch in the floor of a gravel pit in the west-central part of Section 8 (Block A-39; see Figure 9). This material is also likely a part of the Fort Terrett (= Comanche Peak) limestone. The "basal sand" of the Cretaceous section in the High Plains region is identified as the Antlers Formation, but in older literature is also referred to as the Antlers Sandstone, Trinity Sandstone, or Paluxy Sandstone (see Fisher and Rodda, 1967). It is also referred to informally variously as the "Antlers Sand" or "Trinity Sand." This unit consists of weakly cemented fine to medium-grained quartz sandstone and chert-pebble conglomerate. The Antlers Formation varies regionally from 10 ft to 80 ft in thickness (Nativ and Gutierrez, 1988). The thick areas comprise several linear belts trending approximately southeastwardly across the High Plains, where the Antlers Formation fills erosional channels incised into the underlying "red beds" of the Dockum Group (Fallin, 1989).

3.2.2 WCS - Flying "W" Ranch

No outcrops of the Antlers Formation are found in the WCS - Flying "W" Ranch area, but these deposits are exposed in the walls of the excavation at the WCS facility, and are present within a few feet of the land surface in that vicinity. The Antlers Formation is present only in the northwest and central part of the ranch area where it forms a buried erosional remnant along the crest of the "Red Bed Ridge" (Figure 9). The top of the Antlers Formation is encountered in borings at depths between 5 and 80 ft below ground surface. The subcrop of the buried Antlers

Formation is expressed at the land surface, and corresponds roughly with the area bounded by a subtle increase in slope at a topographic elevation of about 3450 to 3485 ft.

In the WCS - Flying "W" Ranch area, the Antlers Formation attains a maximum thickness of about 70 ft and consists of three stratigraphic units; in ascending order these are [1] a lower coarse-grained gravelly sand, yellowish brown in color (10 YR 7/2 to 7/6), between 10 and 30 ft thick with distinctive multicolored chert gravel, [2] a very fine to fine-grained white (10 YR 8/2) quartzose sand, consisting of nearly pure quartzarenite, 10 to 30 ft thick, and [3] an upper interval of multicolored shale and mudstone, 5 to 45 ft thick. Where the upper shale interval is thickest, it exhibits a stratigraphic sequence with white siltstone (10 YR 8/2) at the base, grading upward to dark red or purple mudstone (10 R 4/4 or 5 YR 8/4 to 6/4), gray (5 Y 7/2) shale, and an upper layer of yellow (10 YR 7/6) calcareous shale or argillaceous limestone. The limestone layer at the top of this interval may actually be the base of the Fort Terrett (= Comanche Peak) limestone. It is exposed at the land surface in the floor of a gravel pit in Section 8 (Block A-39).

The upper shale interval (unit 3, above) is present only where the Antlers Formation exceeds 40 ft in thickness, in the northwestern corner of the WCS - Flying "W" Ranch area and in the central area surrounding Windmill Hill (see Figures 5, 7, and 9). Elsewhere in the area, the Antlers Formation has been thinned or entirely removed by post-Cretaceous erosion, and younger strata rest on the lower sandy strata of the Antlers or on the underlying Dockum Group "red beds". Only the lowermost part of the Antlers Formation (unit 1, above) is present within the WCS Facility boundaries and exposed in the walls of the excavation there.

Groundwater in the WCS - Flying "W" Ranch area is found almost exclusively in the lower sandy part of the Antlers Formation.

3.3 Ogallala Formation (Late Tertiary: Miocene)

3.3.1 General Information

The regional distribution and characteristics of the Ogallala Formation and the Ogallala aquifer are well known (Cronin, 1961; 1969), and have been documented in numerous reports (recently reviewed by Gustavson, 1990; Gustavson et al., 1991). Regionally, the Ogallala Formation thins southward across the High Plains, and so is relatively thin in Andrews County, which lies near the southwestern border of the High Plains. In the southern part of its distribution, the Ogallala Formation does not exceed 100 to 200 ft in thickness (Seni, 1980). On a local scale, the thickness of the Ogallala Formation also varies from relatively thick sections (typically exceeding 100 ft) dominated by gravel and coarse sand, to relatively thin sections (typically less than 100 ft) dominated by finer sand and silt. The thick sections represent fluvial paleo-valley fill deposits that trend southeastwardly across the High Plains. These paleo-valley deposits are marked by higher net thickness of sand and gravel, and a high percentage of sand and gravel (Seni, 1980). Such areas generally correspond to the greatest saturated thickness in the Ogallala aquifer. The broad areas where the Ogallala Formation is relatively thin or absent represent "interfluve" or upland regions between the paleo-valley axes, where fine-grained eolian sediments predominate. The Ogallala Formation is thin or absent over the top of remnant Cretaceous bedrock "highs" on interfluves (e.g., Reeves, 1972), and may never have been deposited in these areas. Where present in interfluve regions, the Ogallala has a low net sand and gravel thickness and low percentage of sand and gravel. The interfluve areas correspond to regions with lower saturated thickness in the Ogallala aquifer (e.g. Peckham and Ashworth, 1993; Nativ and Smith, 1987).

In northern Andrews County, northeast of the "Red Bed Ridge," the Ogallala Formation is relatively thick and consists of fluvial sand and gravel deposits filling the southernmost of the paleo-valleys, which roughly coincides with the present course of Monument Draw in northern Andrews and southern Gaines Counties. The Ogallala Formation is absent from central Andrews County and areas southward where Cretaceous strata are present at or near the land surface in most areas. The "Red Bed Ridge," including the WCS - Flying "W" Ranch area, is an interfluve region.

3.3.2 WCS - Flying "W" Ranch

The Ogallala Formation is not exposed in the WCS - Flying "W" Ranch area, but is present in the subsurface along the north and east sides of the ranch boundary at a depth of 45 to 105 ft below ground surface. In this area, the Ogallala Formation varies from 5 to 40 ft in thickness and rests on Dockum Group "red beds" or locally on the Antlers Formation (see Figures 4, 5, and 6). These deposits consist of yellowish brown (10 YR 8/4) fine to medium-grained sand with granule-pebble gravel. Where the Ogallala deposits are greater than 20 ft thick, an upper interval of very fine to fine-grained sand, slightly pink in color (5 YR 7/4) is present.

Groundwater was found in only three borings that penetrated the Ogallala Formation along the eastern border of the ranch area.

3.4 ?Gatuña Formation ("Cenozoic Basin Fill": Late Tertiary - ?Quaternary)

3.4.1 General Information

Southwest of the "Red Bed Ridge," deposits in part equivalent in age to the Ogallala Formation are present, but these have typically been identified informally as the "Cenozoic Basin Fill" (Maley and Huffington, 1953) or "Cenozoic Pecos Alluvium" (Ashworth and Flores, 1991). They are at least in part equivalent to the Gatuña Formation (Kelley, 1980). Some of these deposits have been mapped as Ogallala Formation (Nicholson and Clebsch, 1961; shown as "To" on the Geologic Atlas of Texas, Hobbs Sheet, 1976), but may more logically be included with the Gatuña Formation, as suggested by Hawley (1993). In the WCS - Flying "W" Ranch area, these deposits predate formation of the overlying "Caprock" Caliche, and therefore are equivalent in age to the Ogallala Formation. Nevertheless, they differ lithologically from sediments of the Ogallala. These deposits will be referred to here as the ?Gatuña Formation, using the question mark to indicate this uncertainty in formation assignment.

The alluvial fill of the Lower Pecos Valley (including the Gatuña Formation) is at least 13 million years old (as old as the basal sediments of the Ogallala Formation; Powers and Holt, 1993; Hawley, 1993), and so downcutting and widening of at least the lower part of the Pecos River Valley must have occurred before or during deposition of the Ogallala Formation. The youngest part of the Gatuña Formation is no older than 600,000 years.

The Pecos River Valley subsided in response to subsurface salt dissolution. A peripheral zone of subsurface (Permian) salt dissolution surrounds the High Plains, with its inner boundary generally coincident with the present escarpment of the High Plains (Gustavson and Simpkins, 1989). This peripheral belt of subsurface salt dissolution underlies the Pecos River Valley. A curvilinear belt of subsurface salt dissolution also coincides with the buried Permian Capitan Reef trend surrounding the Delaware Basin. Salt dissolution has occurred over the buried summit of the artesian reef aquifer (Anderson, 1980; Baumgardner et al., 1982; Reeves, *in* Gustavson et al., 1991). Extensive salt dissolution over the Capitan Reef trend resulted in subsidence of the Monument Draw Trough in Winkler and Ward counties, Texas and in the

Delaware Basin beneath the Pecos River Valley (Maley and Huffington, 1953). Subsidence over the reef trend resulted in a depression now filled with "Cenozoic Basin Fill," referred to locally as the Monument Draw Trough. This belt lies 15 to 20 mi west-southwest of the WCS - Flying "W" Ranch.

3.4.2 WCS - Flying "W" Ranch

The ?Gatuña Formation is exposed on the ranch only in a small area at Baker Spring (Figure 2; Section 28, T.21S.). Approximately 15 to 20 ft of coarse, red, cross-bedded gravelly sand, with scattered large boulders of sandstone and limestone, is exposed along the steep bluff on the north and east side of Baker Spring, overlain by the "Caprock" Caliche. The base of the ?Gatuña Formation is not exposed at this location, but must lie at shallow depth because the Dockum Group "red beds" crop out several hundred feet to the south. The ?Gatuña Formation is present extensively in the subsurface along the southern and southwestern boundary of the ranch area at depths from 45 to 115 ft below ground surface (see Figures 3, 4, 5, and 6). The ?Gatuña deposits are very thin in this area, from 5 to 15 ft, and consist of fine to medium-grained sand and sandstone with granule-pebble gravel. These sediments have a distinctive red coloration (10 R 6/4 to 5 YR 4/6-6/6). Deposits of the ?Gatuña Formation rest on Dockum Group "red beds" everywhere on the WCS - Flying "W" Ranch.

No groundwater was found in the boreholes in the ?Gatuña Formation, although groundwater appears to be discharging from these deposits at Baker Spring (see Figures 3 and 7).

3.5 "Caprock" Caliche (Late Tertiary - ?Quaternary)

3.5.1 General Information

Overlying all pre-Quaternary strata in the High Plains region is a thick bed of hard caliche. This dense layer of pedogenic limestone is often referred to informally as the "Caprock" Caliche in the Southern High Plains region where it overlies the Ogallala Formation. It is usually mapped as part of the Ogallala Formation. However, the term "Caprock" Caliche has not been accepted as a formally recognized stratigraphic unit, because in many areas it consists of several superimposed caliche beds that formed at different times, and includes caliche that formed earlier during deposition of the Ogallala Formation, as well as in more recent times, long after the end of Ogallala deposition (Gustavson et al., 1991). Caliche developed on the surface of older

Cretaceous rocks is mapped simply as "caliche" (shown as "Qcc" on the Geologic Atlas of Texas, Hobbs Sheet, 1976), and not as part of the Ogallala Formation although it is identical in composition and morphology to the "Caprock" Caliche and likely formed at the same time. The term "Caprock" Caliche is used here in quotation marks to reflect this informal status and uncertain correlation.

In areas such as western and southern Andrews County, where the Ogallala Formation is absent or very thin, the "Caprock" is highly brecciated, pisolitic, and silicified; and it formed directly on the eroded surface of older (Cretaceous) strata. Many of the exposures mapped as Ogallala Formation in Andrews County (shown as "To" on the Geologic Atlas of Texas, Hobbs Sheet, 1976) consist in reality only of "Caprock" Caliche developed on top of older Cretaceous strata. In many cases, no actual deposits of the Ogallala Formation are present. In southern Andrews County, and areas farther south, caliche developed on the surface of older Cretaceous rocks is mapped simply as "caliche" (shown as "Qcc" on the Geologic Atlas of Texas, Hobbs Sheet, 1976), and not as part of the Ogallala Formation.

The "Caprock" Caliche formed on the High Plains surface after deposition of the Ogallala Formation (Late Miocene) and at least in part prior to deposition of the Blanco Formation (Late Pliocene). It is likely that formation of the "Caprock" began when the High Plains surface was isolated by erosional incision of the Pecos, Canadian, Brazos, and Colorado rivers (Osterkamp and Wood, 1984).

3.5.2 WCS - Flying "W" Ranch

The "Caprock" Caliche is present over the entire ranch area, and the upper surface of the "Caprock" is exposed at the land surface in many places along crest of the "Red Bed Ridge" where erosion has removed the overlying cover of Quaternary windblown sediment (see Figure 2). Where the "Caprock" is present near the land surface, the thin Kimbrough soil, or Blakeney and Conger soil association, is developed (Conner et al., 1974). A complete section of the "Caprock" is exposed along the north and east sides of Baker Spring, and in several gravel pits (Figure 2; southeast Section 3 and west-central Section 8, Block A-39). The top of the "Caprock" typically lies at a depth of 25 to 50 ft, but is found at nearly 100 ft in the southwest corner of the ranch. The "Caprock" formed on the upper surface of the Antlers, Ogallala, and

?Gatuña Formations and engulfs materials of these formations, particularly in its lower part. It evidently formed on a land surface with substantial topographic relief (see Figures 3 through 7)

The "Caprock" Caliche consists of hard, laminated, and pisolitic caliche with included chert pebbles. It is typically 5 to 10 ft thick, but up to 20 ft thick in a few places. Where the "Caprock" is thick, it has been partially replaced with nodules and layers of opal. It has a dense brown (5 YR 6/4) laminated, pisolitic, and partly silicified upper layer that grades downward into softer lighter colored (5 YR 8/4) caliche. Where it is exposed at the land surface, the "Caprock" has degraded to form a broken rubble with fissure fillings and clasts of dark brown sand. Clasts of degraded caliche form a mantle of colluvium on slopes. In places, this degraded caliche rubble is mapped as "other Quaternary deposits" (Qao) on the Geologic Atlas of Texas Hobbs Sheet (1976).

The "Caprock" Caliche can be distinguished from younger caliche deposits in overlying Quaternary strata (e.g., Blackwater Draw Formation) which are lighter in color, softer, lower in density (owing to higher porosity), include abundant sand, and are not laminated or pisolitic.

The "Caprock" typically lies within the unsaturated zone. Groundwater was found within the "Caprock" Caliche at one location (well #2).

3.6 Blackwater Draw Formation (Quaternary: Pleistocene)

3.6.1 General Information

The regional distribution and characteristics of the Blackwater Draw Formation were reviewed by Reeves (1976) and Holliday (1989). These deposits were formerly referred to as the "windblown cover sand" and are so designated on the Geologic Atlas of Texas (shown as "Qcs" on the Hobbs Sheet, 1976).

The Blackwater Draw Formation is eolian in origin, and forms an extensive mantle over the surface of the High Plains, diminishing in grain size from predominantly sand on the southwestern side of the High Plains to clay on the northeast. Alluvial sediments of the Pecos River Valley served as the source area for windblown sediment transported to the northeast onto the High Plains surface (Holliday, 1989). Modern effective sand-transporting winds blow from the west-southwest (Machenberg, 1984, 1986); grain-size trends and orientation of Pleistocene vegetated dune ridges indicate that this has been the case for most of Quaternary time. Over the past 2 million years, most of the High Plains surface experienced periods of wind erosion and deposition, alternating with periods of stabilization of the surface by vegetation, resulting in soil formation and accumulation of the Blackwater Draw Formation (Holliday, 1989). Radiometric age determinations on ash beds, and interbedded playa deposits demonstrate that deposition of the Blackwater Draw Formation began prior to 1.4 million years ago and continued until at least 100,000 to 50,000 years ago (Gustavson et al., 1991). Interbedding of the Blackwater Draw Formation with radiocarbon-dated playa basin deposits suggests that deposition continued at least locally up to 3000 years ago (Gustavson et al., 1991; Holliday, et al., 1996).

3.6.2 WCS - Flying "W" Ranch

The Blackwater Draw Formation is present at or near the land surface over much of the ranch area, but is absent along the crest of the "Red Bed Ridge", and is buried under younger windblown sand in the northern and southern parts of the ranch (Figure 2). Where these deposits are present at the land surface, the Triomas and Wickett soil association has developed (Conner et al., 1974). A typical section of the upper part of the Blackwater Draw Formation is exposed in the gravel pit along the common southern borders of Sections 16 and 17 (Figure 2; Block A-29). Sediments of the Blackwater Draw Formation are up to 60 ft thick on the north side of area, and as much as 100 ft thick on the south, substantially thicker than previously reported (typically less than 10 ft according to the Geologic Atlas of Texas, Hobbs Sheet, 1976). The upper 5 to 15 ft of these sediments consists of reddish brown (10 R 5/6 to 5 YR 5/6 or 6/6) clayey fine to very fine sand with nodules of soft sandy caliche. Locally, the upper 5 ft is very clayey and contains a dark brown (10 YR 5/2 to 5 YR 6/6) organic surface horizon. Sand grains have iron oxide and clay coatings which give the sediment its distinctive dark red coloration. These grain coatings are a result of soil formation (Holliday, 1989). The lower part of the Blackwater Draw Formation was less affected by soil development (i.e., iron and clay illuviation), and is lighter in color (typically 5 YR 7/4 to 8/4) with many layers of soft sandy caliche. The lower 10 to 20 ft contains some coarse to very coarse sand as well as layers of granule-small pebble gravel, and may be partly alluvial rather than eolian in origin.

The Blackwater Draw Formation typically lies within the unsaturated zone. No groundwater was found in these deposits.

3.7 Playa Deposits (Quaternary: Holocene)

3.7.1 General Information

The origin and history of playa basins on the High Plains has been a subject of study and debate for nearly a century (reviewed by Reeves, in Gustavson, 1990 and Gustavson et al., 1991; Holliday et al., 1996). Playa basins range in size from 30 ft to 1.5 miles in diameter, though most are less than half a mile in diameter, and exhibit up to 30 ft of topographic relief. The basins originated 30,000 to 10,000 years ago, although some may be older, and have partially or completely filled with up to 3 to 30 ft of sediment since that time (Holliday et al., 1996). The basins formed within the eolian "cover sands" of the High Plains (Blackwater Draw Formation) primarily by wind erosion, and hence are larger and more numerous where the "cover sands" are thicker (Holliday et al., 1996). The basins typically hold water temporarily only after extended periods of rainfall, and focussed infiltration of water through the floors of the playas may cause dissolution of shallow soil caliche layers beneath the basin, resulting in subsidence and gradual enlargement of the basins over time (Osterkamp and Wood, 1987; Wood and Osterkamp, 1987). However, Holliday et al. (1996) argued that dissolution-induced subsidence is not generally responsible for the origin of playa basins. Formerly, buffalo (and more recently, cattle) may also have played a role in enlarging the original depressions by transporting mud or dust out of the basins on their hooves and hides. Playa basins are apparently a surficial phenomenon, and do not reflect deep-seated subsidence or salt dissolution.

3.7.2 WCS - Flying "W" Ranch

Playa deposits are found only in one area, south of the WCS facility boundary (Figure 2; vicinity of borehole #19). The deposits consist of 10 ft of dark brown clayey fine sand, underlain by 5 ft of color mottled yellow and brown ("gleyed") clayey fine sand. The deposits occupy a subcircular depression in the land surface, approximately 2000 ft in diameter. This playa basin is not active, since it is not known to accumulate surface runoff, and the deposits appear to be undergoing erosion. An arcuate dune deposit (shown as "Qsd" on the Geologic Atlas, Hobbs Sheet; 1976) bounds the northeastern margin of the depression (see Figures 2 and 4). There are no mapped occurrences of Lipan clay soils (as are typically developed in the bottoms of modern playas in this region) on the ranch area (Conner et al., 1974).

No groundwater was found in playa deposits on the WCS - Flying "W" Ranch.

3.8 Windblown Sand (Quaternary: Holocene)

3.8.1 General Information

Recent deposits of eolian dunes, now mostly stabilized by vegetation, are mapped as "windblown sand sheets, dunes, and dune ridges undivided" (Qsu) on the Geologic Atlas of Texas (Hobbs Sheet, 1976). These are probably equivalent in part to those referred to as the Monahans Formation to the southwest in the Pecos River valley (Green, 1961; Machenberg, 1984). These surficial eolian deposits are younger than the Blackwater Draw Formation that they overlie in many areas, and are typically 5 to 10 ft in thickness. In places these deposits are undergoing active transport as modern dunes, but in most areas they are at least partially stabilized by vegetation.

3.8.2 WCS - Flying "W" Ranch

Windblown sand deposits are present extensively in the north, northeast, and southwest part of the area. Their distribution generally corresponds with the Jalmar and Penwell soil association (Conner et al., 1974). Windblown sand deposits are up to 35 ft thick, and consist of light yellowish brown (5 YR 5/4 to 7.5 YR 6/4) clean, very well sorted sand. In most areas, they form a thin irregular veneer, 5 to 15 ft thick, over the land surface, with the thickest accumulations in northwest-southeast trending vegetated linear dune ridges. These deposits are distinguished from similar sands in the Blackwater Draw Formation by their pale coloration (locally very pale; e.g. 10 YR 8/4), absence of iron oxide grain coatings, and absence of caliche nodules.

Deposits of windblown sand typically lie within the unsaturated zone. No groundwater was found in these deposits on the WCS - Flying "W" Ranch.

4. Geological Control on Groundwater Hydrology

4.1 General Information

Three regional aquifers converge in central Andrews County. The "Ogallala aquifer" extends southward across the Southern High Plains into the northern part of Andrews County (e.g., Cronin, 1969). The "Edwards-Trinity (Plateau) aquifer" extends northward from the Edwards Plateau into southeastern Andrews County (e.g., Ashworth et al., 1991). The "Cenozoic Pecos Alluvium aquifer" extends northward from the Pecos River Valley into southwestern Andrews County (e.g., Ashworth and Flores, 1991). The boundaries between these aquifers are as yet poorly defined in Andrews County. Cretaceous strata on the High Plains, such as documented here on the WCS - Flying "W" Ranch area, are thought to be in hydraulic continuity with the Ogallala Formation; and they are included together as part of the "High Plains aquifer" in many studies (e.g., Knowles et al., 1984; Peckham and Ashworth, 1993) although the nature of cross-formational flow between these units is not well established. In such regional studies, the WCS - Flying "W" Ranch area has been generally included within the distribution of the Ogallala (High Plains) aquifer.

However, the WCS - Flying "W" Ranch area straddles the "Red Bed Ridge," which exerts control on local and regional groundwater flow. The "Red Bed Ridge" probably acts as a regional groundwater divide, separating the Ogallala (High Plains) aquifer to the northeast from the "Cenozoic Basin Fill" aquifer (or the "Cenozoic Pecos Alluvium" aquifer of Ashworth and Flores, 1991) to the southwest. Groundwater flow in the Cenozoic Basin Fill aquifer is to the south-southwest, while flow in the High Plains aquifer is to the east-southeast (Nicholson and Clebsch, 1961). The Triassic bedrock "high" beneath the overlying Cenozoic deposits interrupts the groundwater table in many areas along its length. In northern Lea County, the crest of the "Red Bed Ridge" lies above the water table in the Ogallala Formation to the northeast (Ash, 1963; see his sheet 1, cross-section A-A'). Similarly, in central Lea County, Nicholson and Clebsch (1961, their Plate 2) illustrated several areas where the water table in Cenozoic deposits is interrupted by bedrock highs on the Triassic "Red Bed Ridge". In western Andrews County, the crest of the "Red Bed Ridge" coincides with the belt of 0 to less than 20' saturated thickness in the High Plains aquifer (Knowles et al., 1984).

4.2 WCS - Flying "W" Ranch

Groundwater is not present continuously beneath the WCS - Flying "W" Ranch, but was encountered in 17 of 35 boreholes completed (see Figure 10). Over 60 previous boreholes and well logs, all of which located the "red bed" surface contact without finding water, were reported by AM Environmental (1993) on the WCS site and Weaver Boos & Gordon, Inc. (1997) to the west of the state line, and these data points were also considered in construction of Figure 10. Groundwater occurs in two discrete areas, one in the northwestern corner of the ranch, and the other in the central area surrounding Windmill Hill. In both cases the groundwater occurs almost exclusively (14 of 17 wells) within the basal sand unit of the Antlers Formation, and the limits of observed groundwater (Figure 10) clearly correspond with the subcrop of the Antlers Formation (Figure 9). The two groundwater-bearing areas are not connected, although the complete lateral extent of both areas is yet to be established. The saturated thickness is typically less than 10 ft in each area. The maximum saturated thickness observed is 25 ft in the northwestern area (Figure 10). Both areas are overlain by the upper shale interval of the Antlers Formation (unit 3, above) which could conceivably act as a confining layer (see Figures 3 and 5). However, in most wells the sand interval in the Antlers Formation is not entirely saturated. Water table elevations suggest that groundwater here likely reflects local recharge and not regional lateral flow within the "High Plains aquifer." The many closed surface depressions along the crest of the "Red Bed Ridge" could act as local recharge points (Figure 5). These depressions are not playa basins, but have formed where the "Caprock" Caliche is at or near the land surface (e.g., see areas mapped as Kimbrough soils; Conner et al., 1974) and are known to hold surface runoff after extended periods of rainfall. One artificially deepened depression southeast of Windmill Hill (southeast Section 4, Block A-39) retains a significant amount of surface runoff. High water table elevations beneath the central area suggest that recharge may occur in the area southeast of Windmill Hill (Figure 5, see Figure 10; sections 3 and 8, Block A-39).

These local "pockets" of groundwater do not appear to contribute groundwater southward to the "Cenozoic Pecos Alluvium" (=Gatuña) Aquifer. No groundwater was encountered along the southern border of the WCS - Flying "W" Ranch. The Gatuña Formation was fully penetrated in at least ten borings and no groundwater was found, although water appears to discharge from the Gatuña Formation at Baker Spring. Similarly, in light of the declining water table elevation and declining saturated thickness along the north and east boundaries of the ranch area, the local groundwater "pockets" may also not contribute groundwater northward or eastward to the Ogallala Aquifer.

The absence of groundwater at lower elevations to the south, steep decline in the water table elevation, and low saturated thickness to the north and east together suggest that some barrier to lateral flow of groundwater may exist. The nature of such a barrier is unknown. Alternatively, it is possible that local groundwater flows laterally to the southeast beneath Windmill Hill and discharges at the land surface where the elevation falls below the level of the local water table at incised drainages immediately east of Sections 2 and 9 (Block A-39; see Figure 10, Figures 6 and 7). The incised drainage in the southeast corner of Section 2 flows intermittently eastward to an unnamed saline lake basin about 1 mile east of the WCS - Flying "W" Ranch. Saline lake basins are known to be sites of groundwater discharge on the High Plains (e.g., Wood et al., 1992). However, the incised surface drainage here is not known to be an area of spring discharge, but is dammed at points along its length, where it retains surface runoff. Further exploratory drilling to the north and east of the WCS - Flying "W" Ranch is necessary to firmly establish the limits of groundwater in these areas.

Similarly, it is not clear why the two areas where local groundwater occurs are not connected. The basal sand interval of the Antlers Formation is present continuously between the two areas (Figure 9), and elevations on the land surface, water table, and "red bed" surface suggest that lateral southeastward flow of groundwater could occur between the two areas (Figure 7). No barrier to lateral flow is apparent. Groundwater flowing southeastward from the northwestern area may be intercepted in the subsurface by a southwesterly-directed drainage (Section 16, Block A-29) to discharge at the land surface at Baker Spring (Figure 3). The lack of groundwater in boreholes both north and south of Baker Spring drilled by Weaver Boos & Gordon, Inc. (1997) in Lea County indicate it is also possible that groundwater may flow to Baker Spring from the west or northwest. This uncertainty might be resolved by installation of an additional borehole between well location #16 and the WCS facility (i.e., in the northwest corner of section 25, Block A-29) or west of Baker Spring in Lea County.

5. Discrimination of Ogallala and Antlers Deposits

5.1 General Information

Because of uncertainties regarding the nature of cross-formational flow of groundwater between Cretaceous strata and the Ogallala Formation, it is useful to discriminate these deposits in the subsurface where possible. In recent reports, Cretaceous strata are often not separated from the Ogallala Formation, and these are collectively included in the "High Plains aquifer" (e.g., Knowles et al., 1984; Ashworth et al., 1991; Peckham and Ashworth, 1993). Nevertheless, it may be important to distinguish these strata for regulatory considerations (e.g., Dutton, 1999).

Determining exactly where the Ogallala Formation pinches out in Andrews County is problematic. Existing compilations of water well driller's logs in the area are not very useful in discriminating whether or not the Ogallala Formation is actually present, because in well cuttings the hard caliche layers (such as the "Caprock" Caliche) are difficult for water well drillers to distinguish from Cretaceous limestone beds (such as in the Comanche Peak and Edwards Limestone), and the sand and gravel in the Ogallala Formation is difficult to distinguish from that in the Antlers Formation. The top of the underlying Dockum Group "red beds" is often readily identified in cuttings by water well drillers, and so this interface is often reliably picked on logs.

In well cuttings it is often difficult to distinguish the Antlers Formation from the Ogallala Formation, because both units consist predominantly of poorly cemented sand and gravel. Sands in the Antlers Formation are fine to medium-grained, white to yellow, and highly quartzose, with brightly colored chert pebble gravel, dominantly comprised of pink, red, and black chert, and white quartzite. Sand in the Ogallala Formation is fine to medium-grained and sublithic, with pebble gravel containing clasts of igneous and metamorphic rocks (quartzite, granite, rhyolite, and gneiss), sedimentary rocks (limestone and sandstone), and abraded Cretaceous *Gryphaea* shells (e.g., reviewed by Reeves, 1984).

5.2 WCS - Flying "W" Ranch

The excellent exposure in the walls of the excavation at the WCS facility leaves little doubt that this unit is the Antlers Formation, and not the Ogallala Formation. It is identical in composition to the same unit exposed to the east at Shafter and Whalen Lakes. Similarly, in the surrounding subsurface where the upper shale interval (unit 3, described above) is present at the top of the Antlers Formation, these deposits are readily identified because similar strata are not known to occur in the Ogallala Formation. Nevertheless, in many areas it remains difficult to discriminate the Antlers and Ogallala solely on the basis of well cuttings.

In an effort to systematically discriminate deposits of the Ogallala and Antlers Formations, samples of each unit were obtained from locations where their identification was certain. Two samples of gravel from the base of the Antlers Formation were obtained from definitively mapped exposures (SHA-5 from the western side of Shafter Lake in central Andrews County; FLU-1 from a roadcut on FM 1269 north of Fluvanna in Scurry County). Two samples of gravel were obtained from water wells drilled to the base of the Ogallala Formation (AND-1 and AND-2 from two wells in the Monument Draw paleo-valley adjacent to US Hwy 385 in northcentral Andrews County). These were compared with a sample of gravel (WCS-1) collected from the landfill excavation at the WCS facility. Approximately 1 kg samples were washed, disaggregated, and sieved to separate all pebbles larger than 8 mm (U.S. Standard #4 mesh sieve) for identification. All pebbles were identified as to lithology and counted (n = 247 to 2691) to determine their relative abundance in each sample. The results of this analysis are given in Figure 11.

Samples of the Antlers gravel are distinctive in consisting entirely of clasts of multicolored chert, hydrothermal "vein" quartz, and a few highly indurated dark brown sandstone (possibly quartzite) clasts (pebble types 1 - 8 in Figure 11). Samples of Ogallala gravel also contain these clast types, though in lower relative abundance, because the Ogallala gravel is derived in part from erosion and reworking of the Antlers deposits. Importantly however, samples of Ogallala gravel also contain high percentages of limestone clasts, reworked Cretaceous mollusc shells (e.g., *Gryphaea*), friable yellow, pink, and black sandstone clasts, and porphyritic igneous rock clasts (pebble types 9 - 12 on Figure 11). These are entirely absent in samples of gravel from the Antlers Formation.

Careful inspection of washed cuttings from borings will reveal at least a few of these distinctive clast types if present, and so it is not necessary to sieve, count, and identify all pebbles to obtain an accurate stratigraphic determination. Ogallala sand also typically has a high percentage of lithic grains compared to Antlers sand, which is virtually pure quartzarenite. These criteria were used to distinguish the two deposits over the WCS - Flying "W" Ranch area.

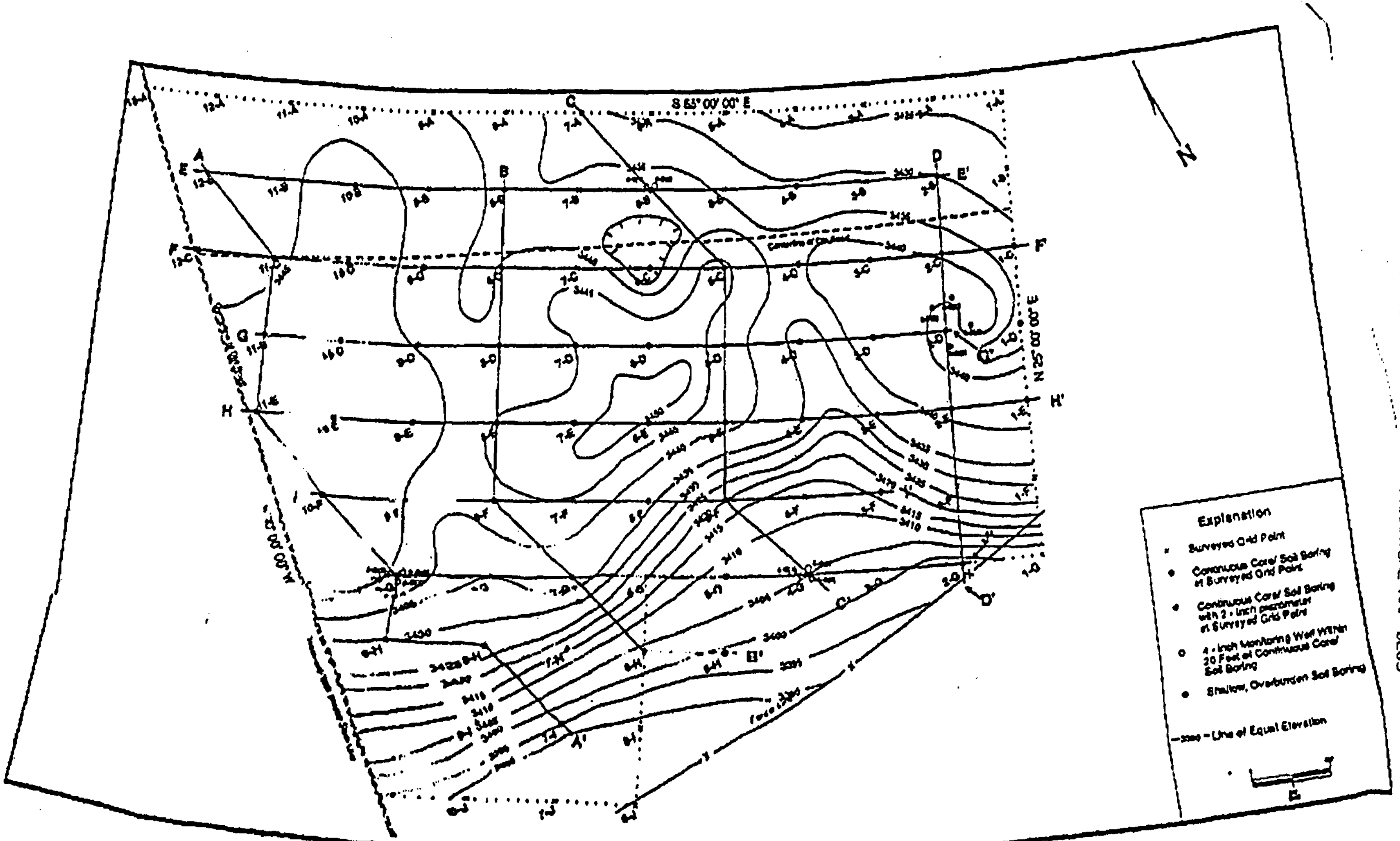

Figure 1. Contour Map of the Dockum ("red beds") Group Surface Beneath the WCS Site [Source: AME (1993)]

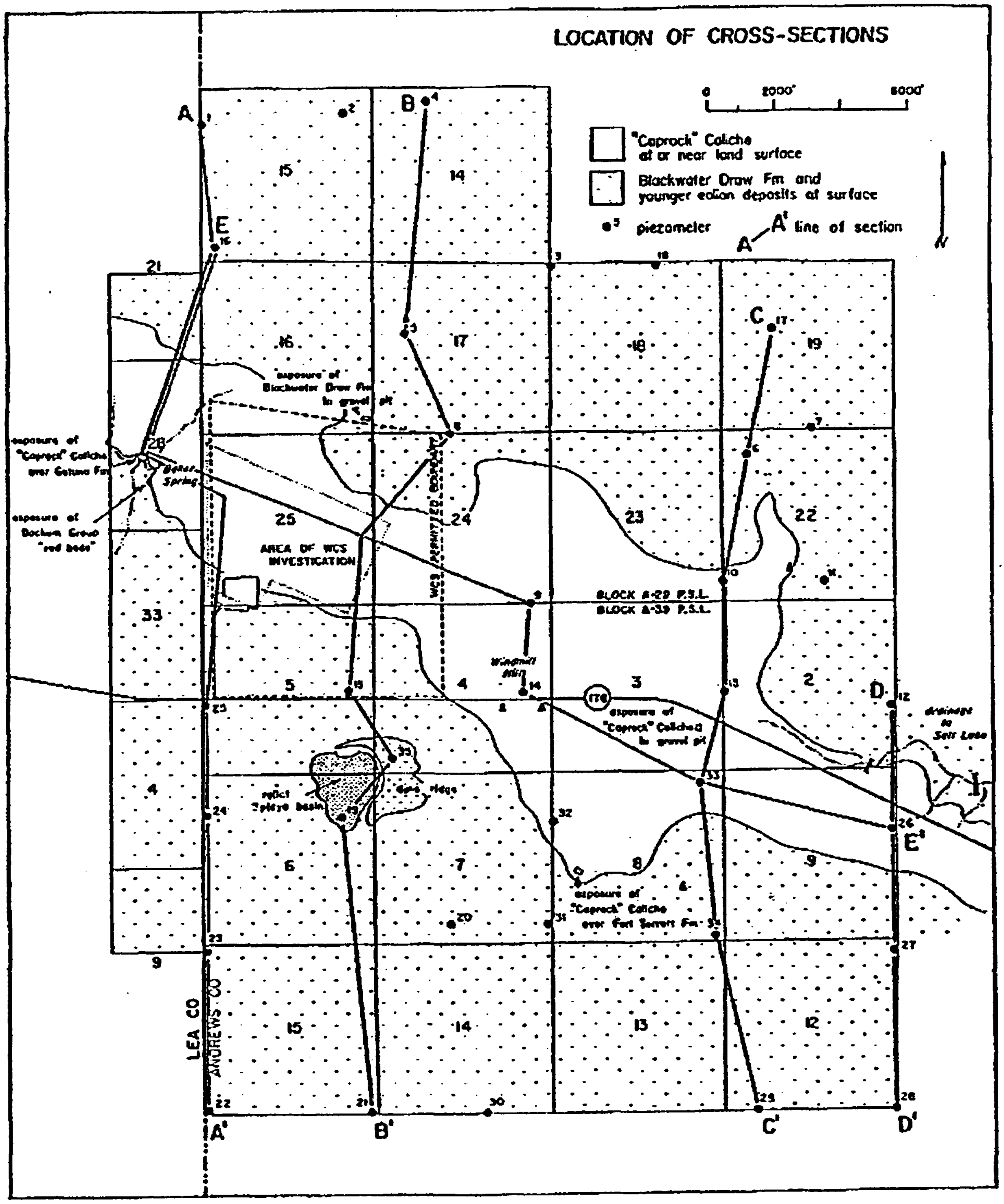

Figure 2. WCS – Flying "W" Diamond Ranch Site Map

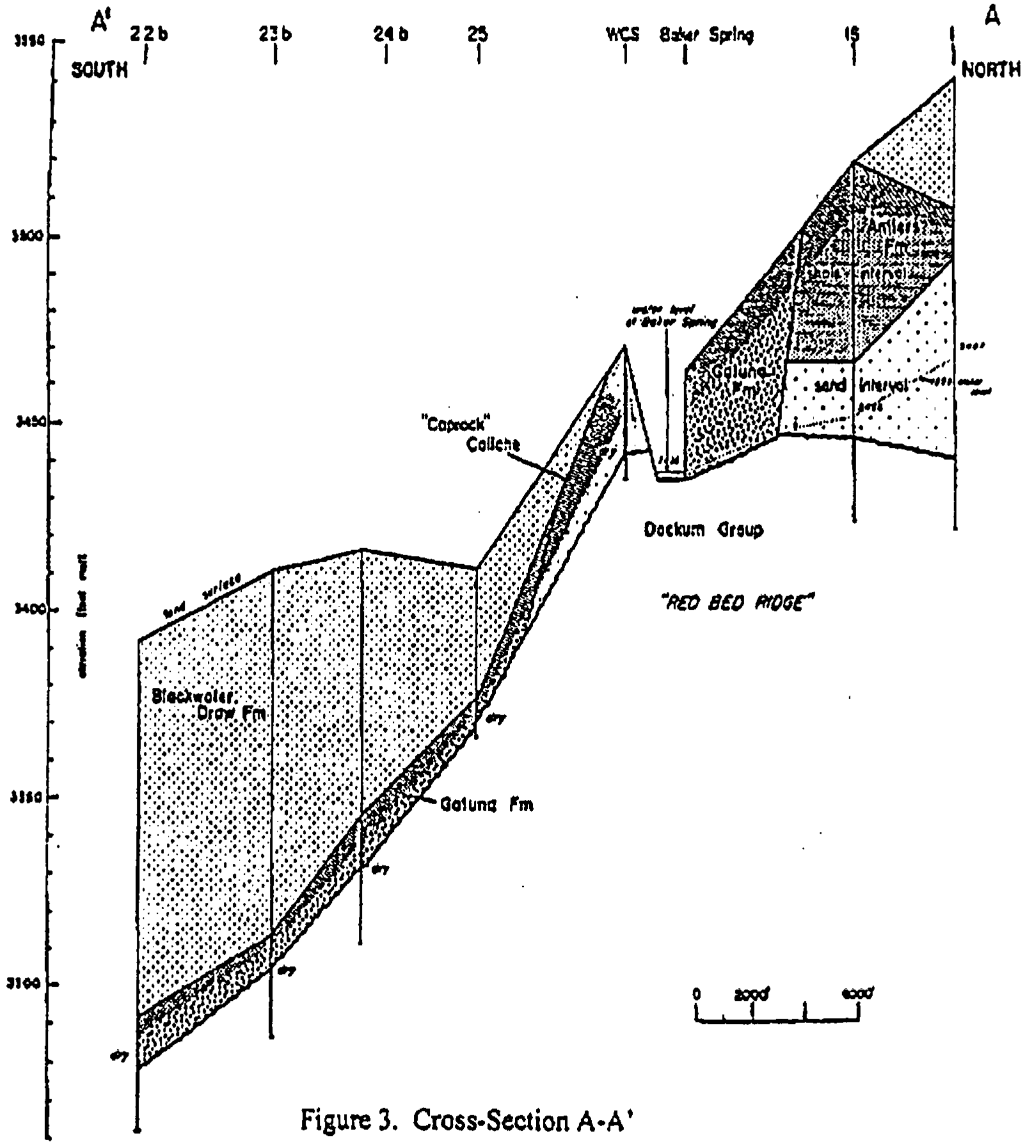

Figure 3. Cross-Section A-A'

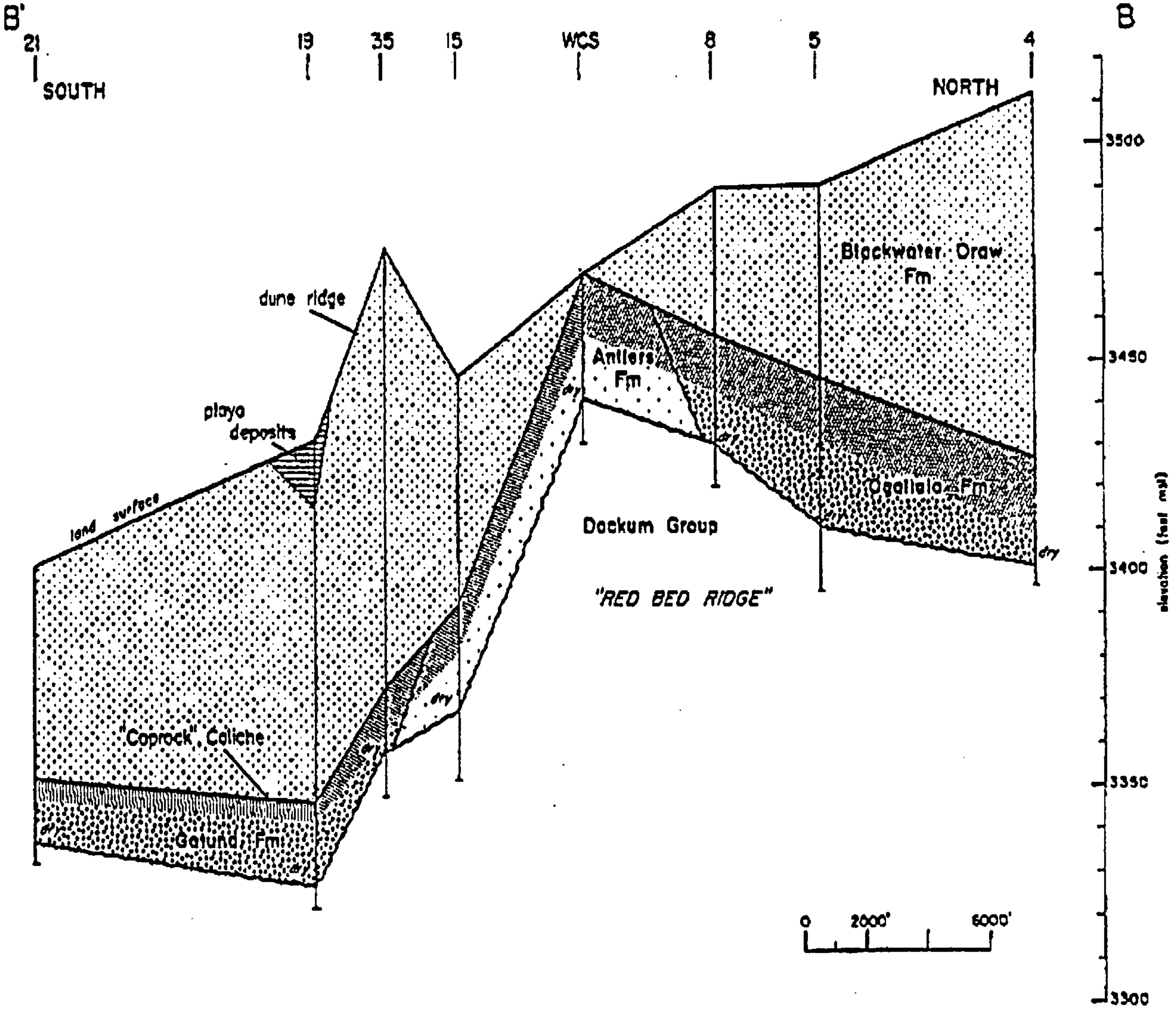

Figure 4. Cross-Section B-B'

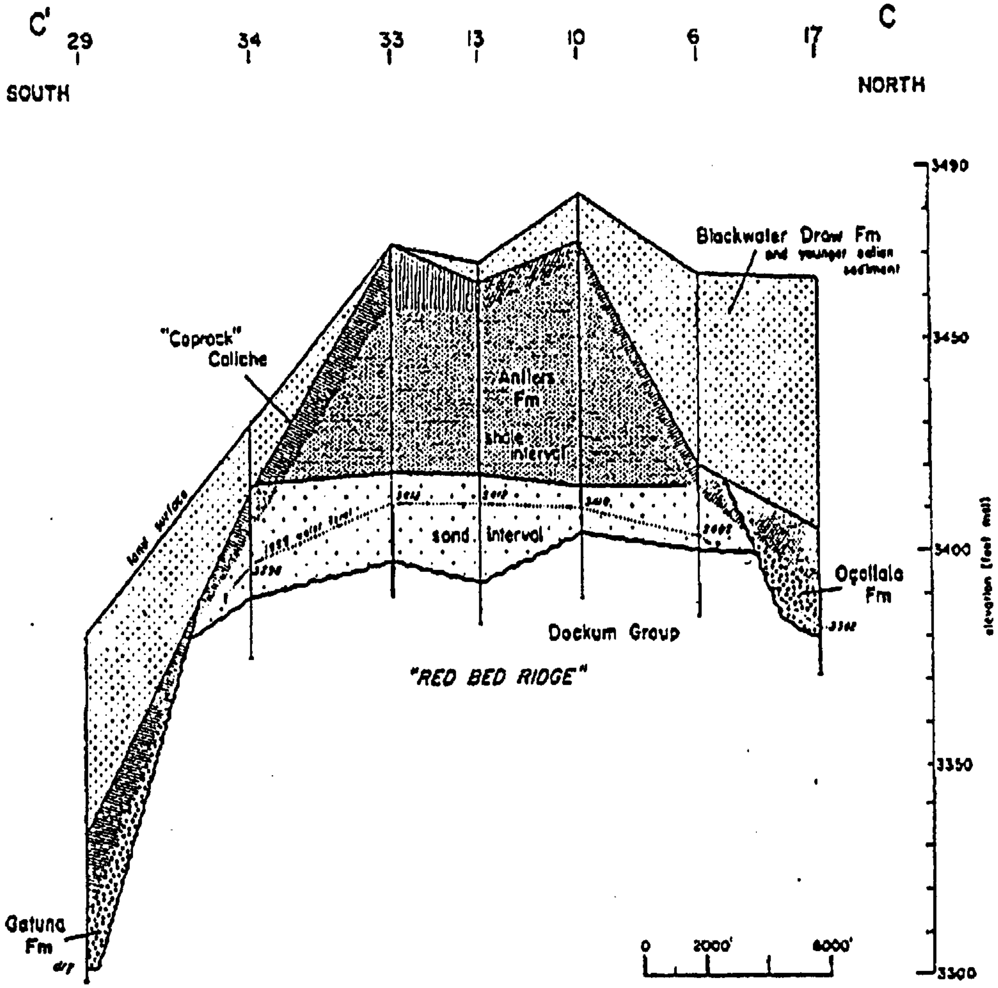

Figure 5. Cross-Section C-C'

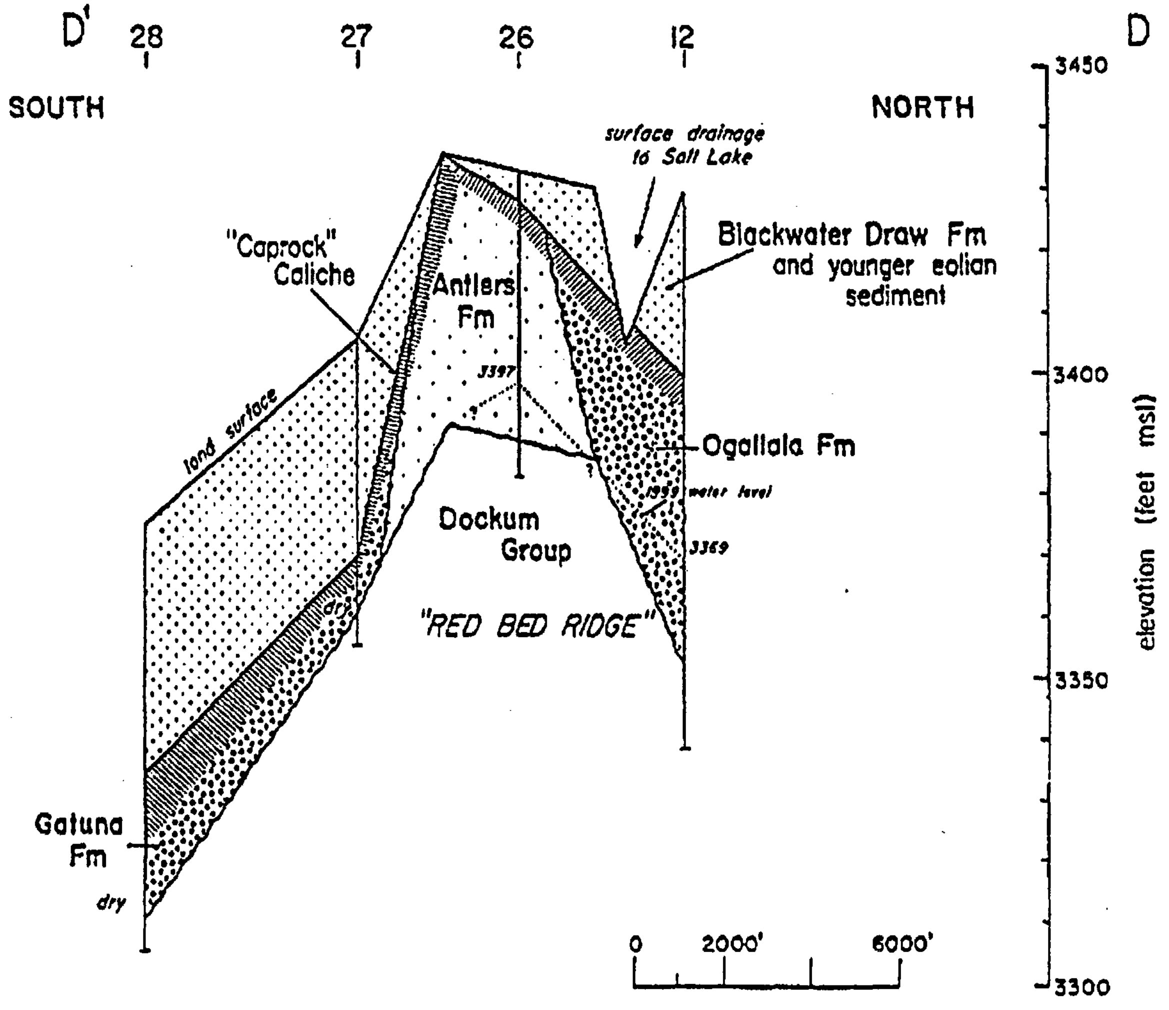

Figure 6. Cross-Section D-D'

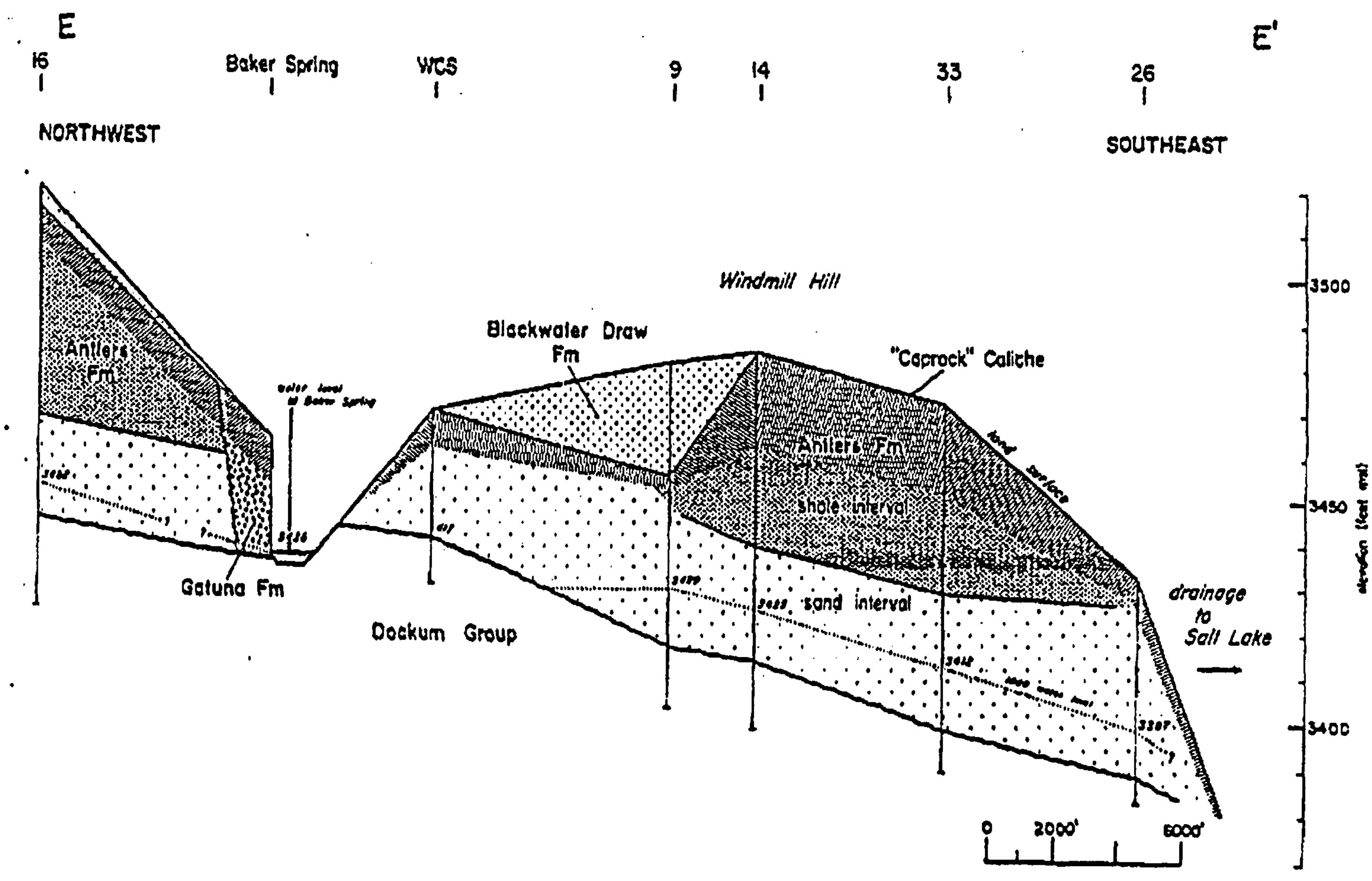

Figure 7. Cross-Section E-E'

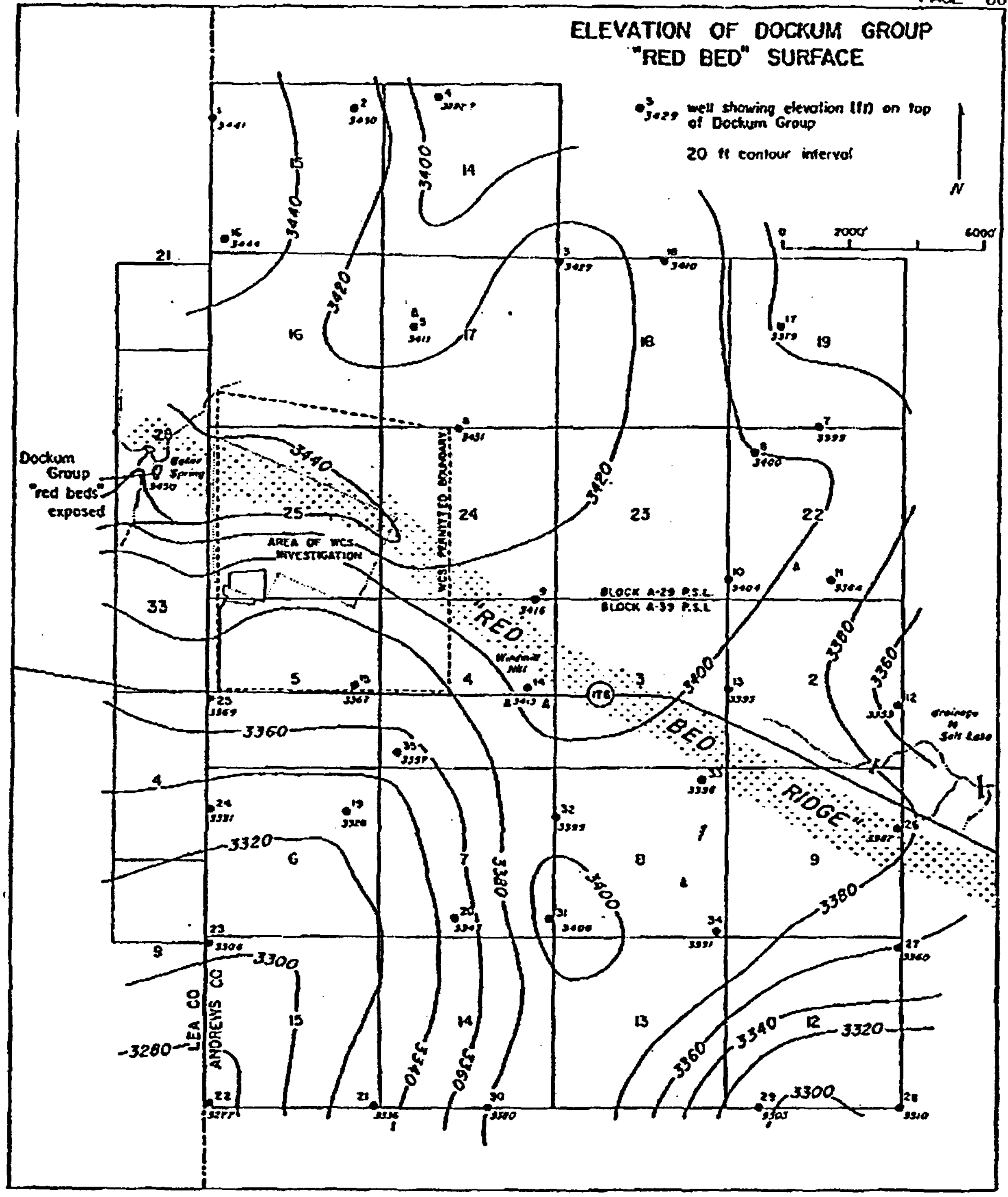

Figure 8. Elevation of Dockum Group “Red Bed” Surface

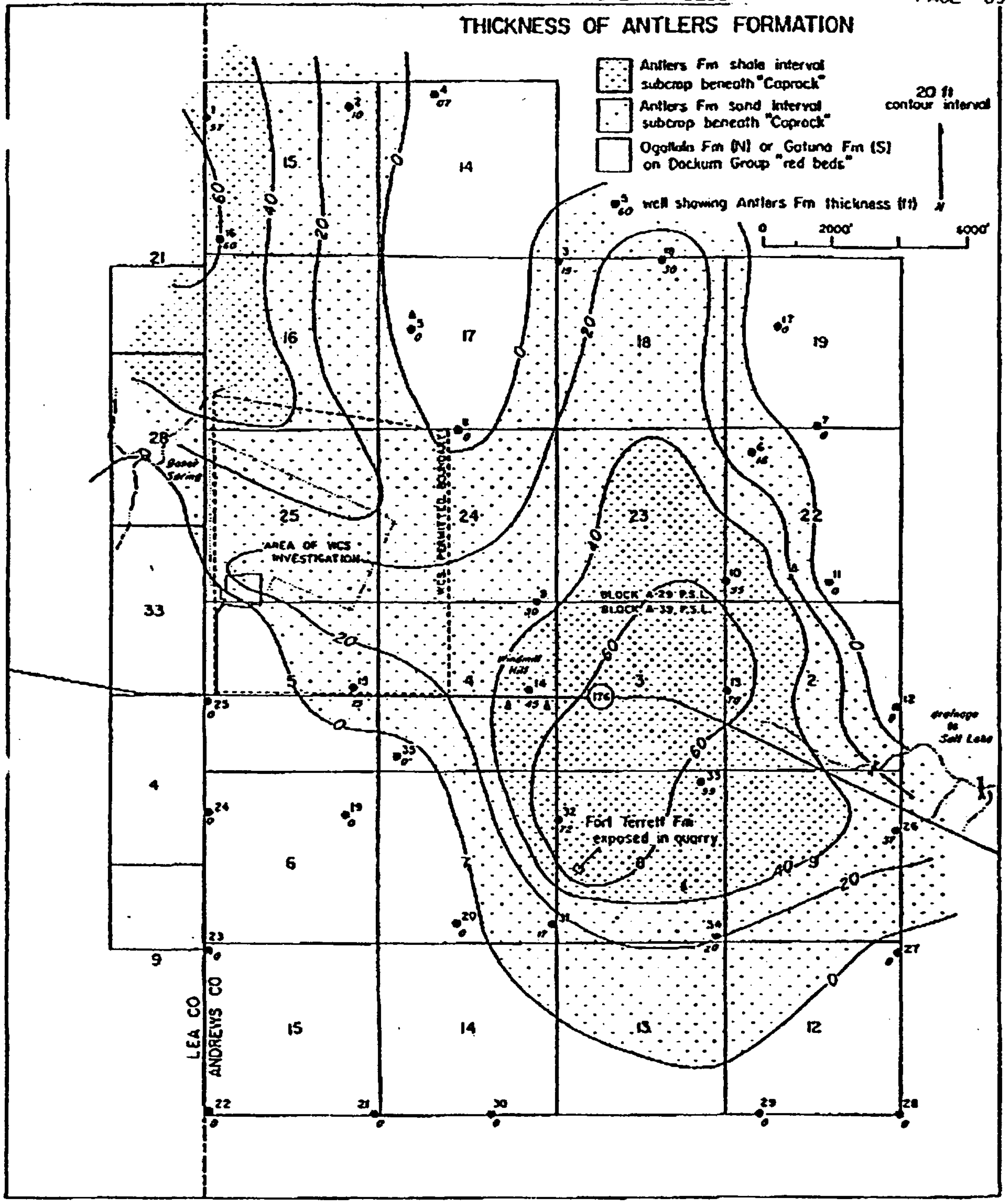

Figure 9. Thickness of Antlers Formation

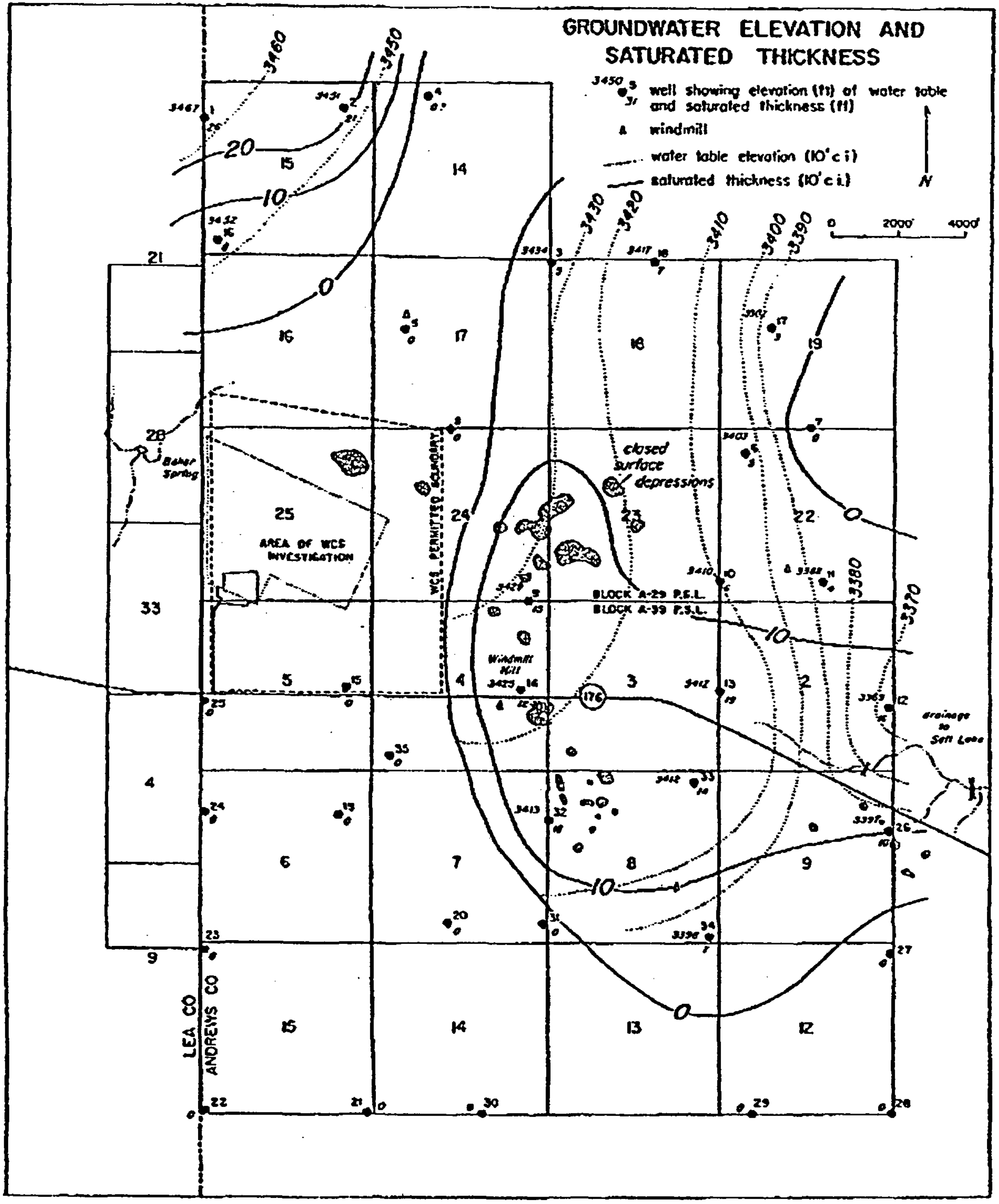

Figure 10. Groundwater Elevation and Saturated Thickness

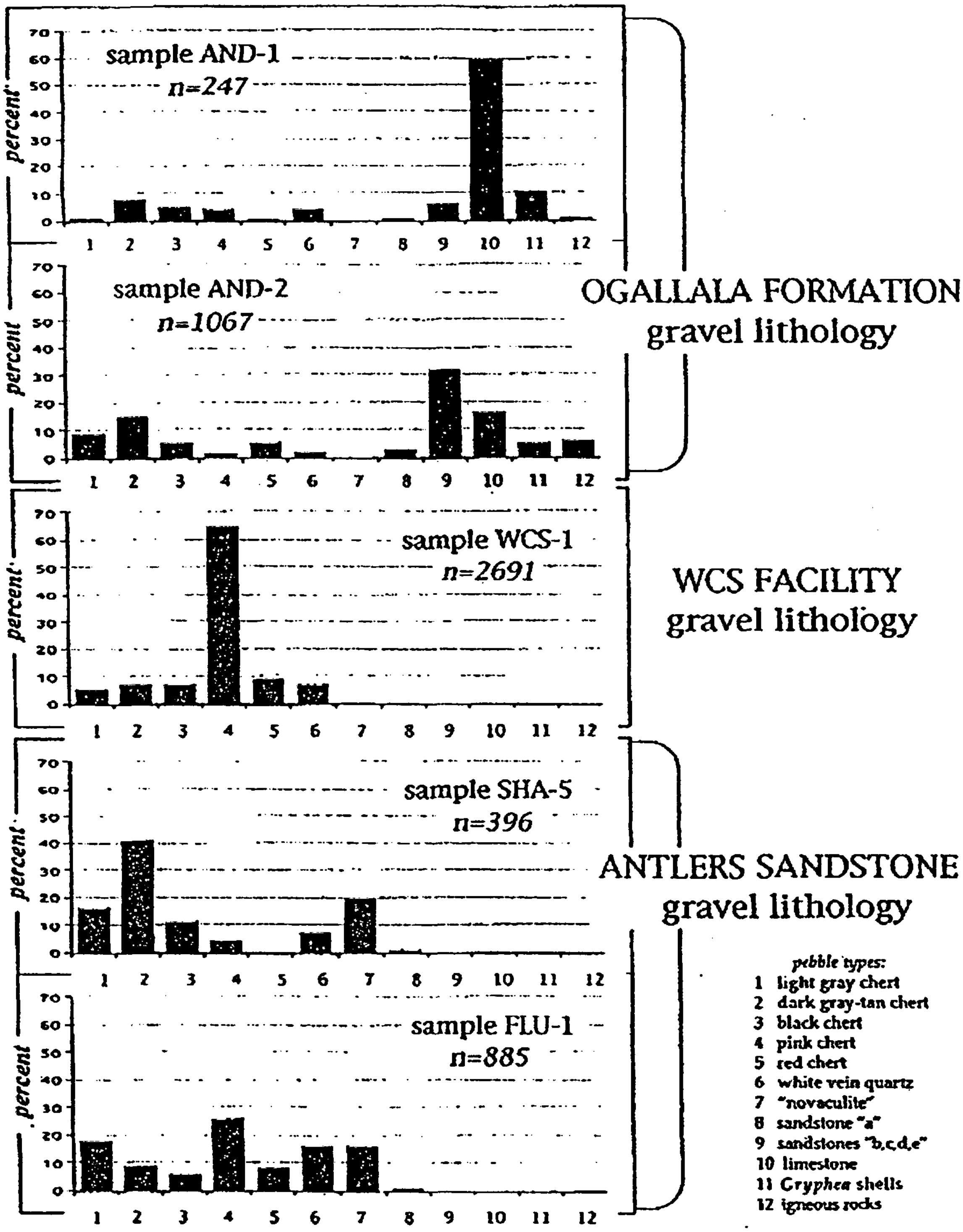

Figure 11. Comparison of Gravel Characteristics in Ogallala and Antlers Formations

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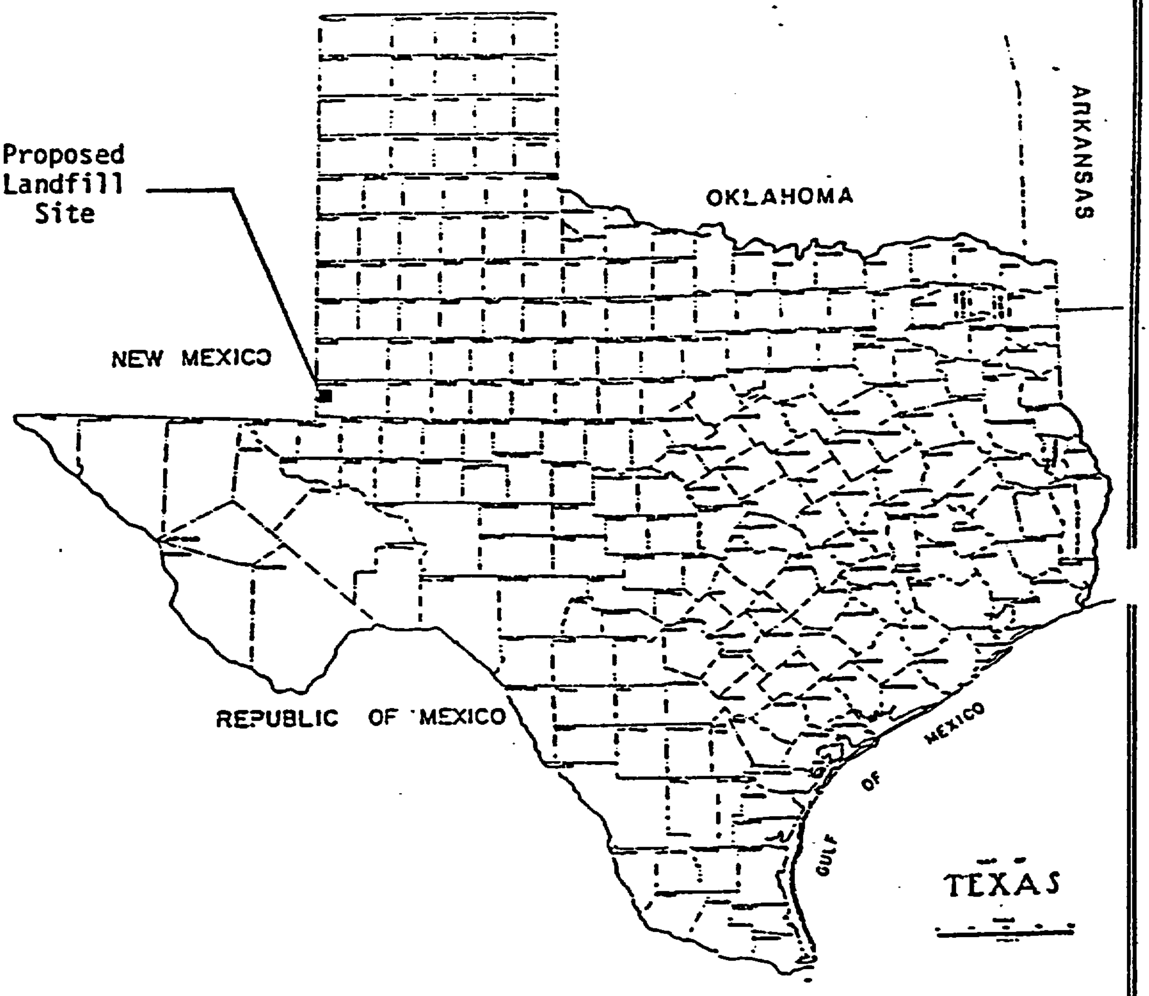
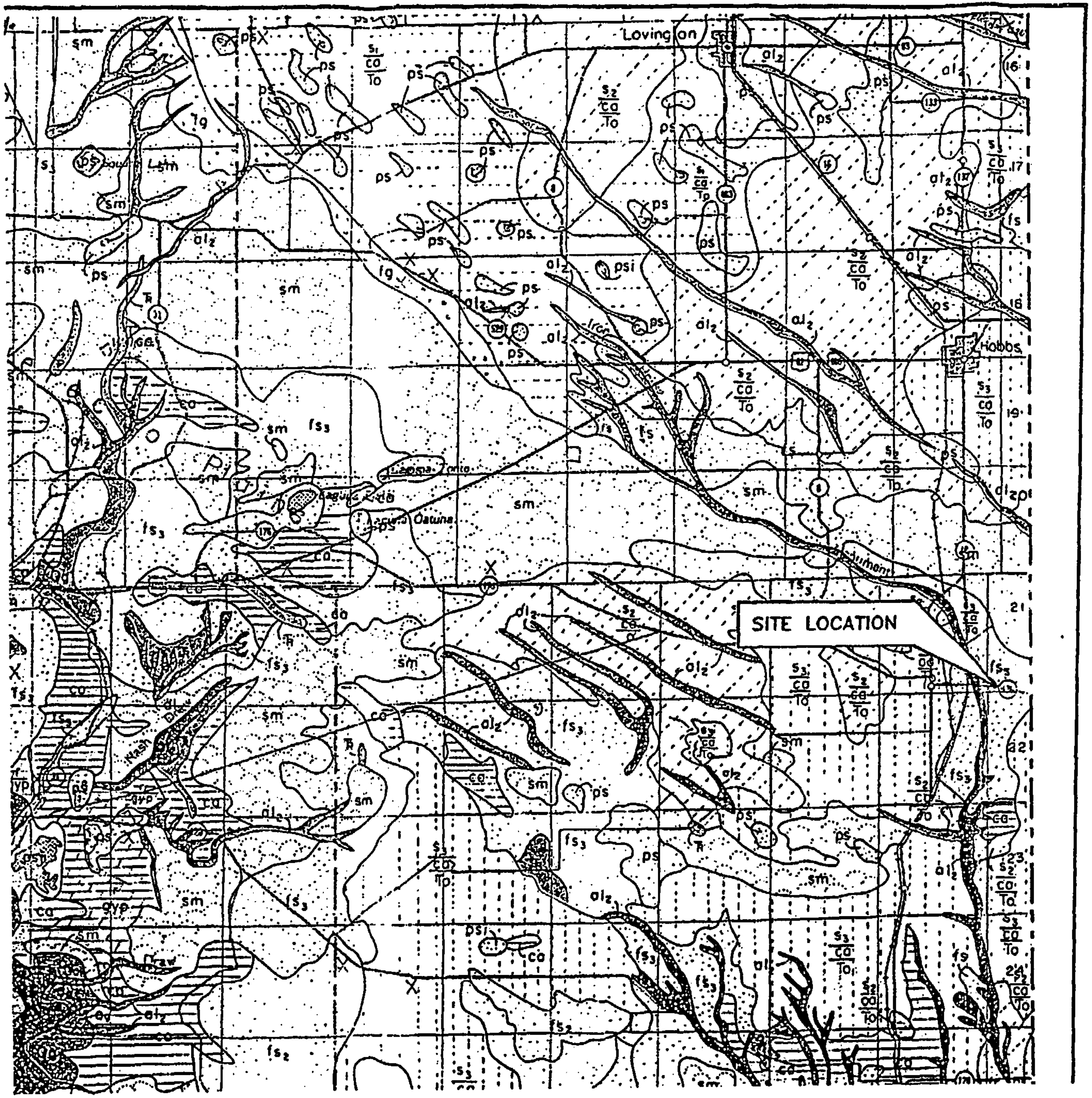


Proposed Andrews Landfill Site
on State of Texas Map
Andrews County, Texas

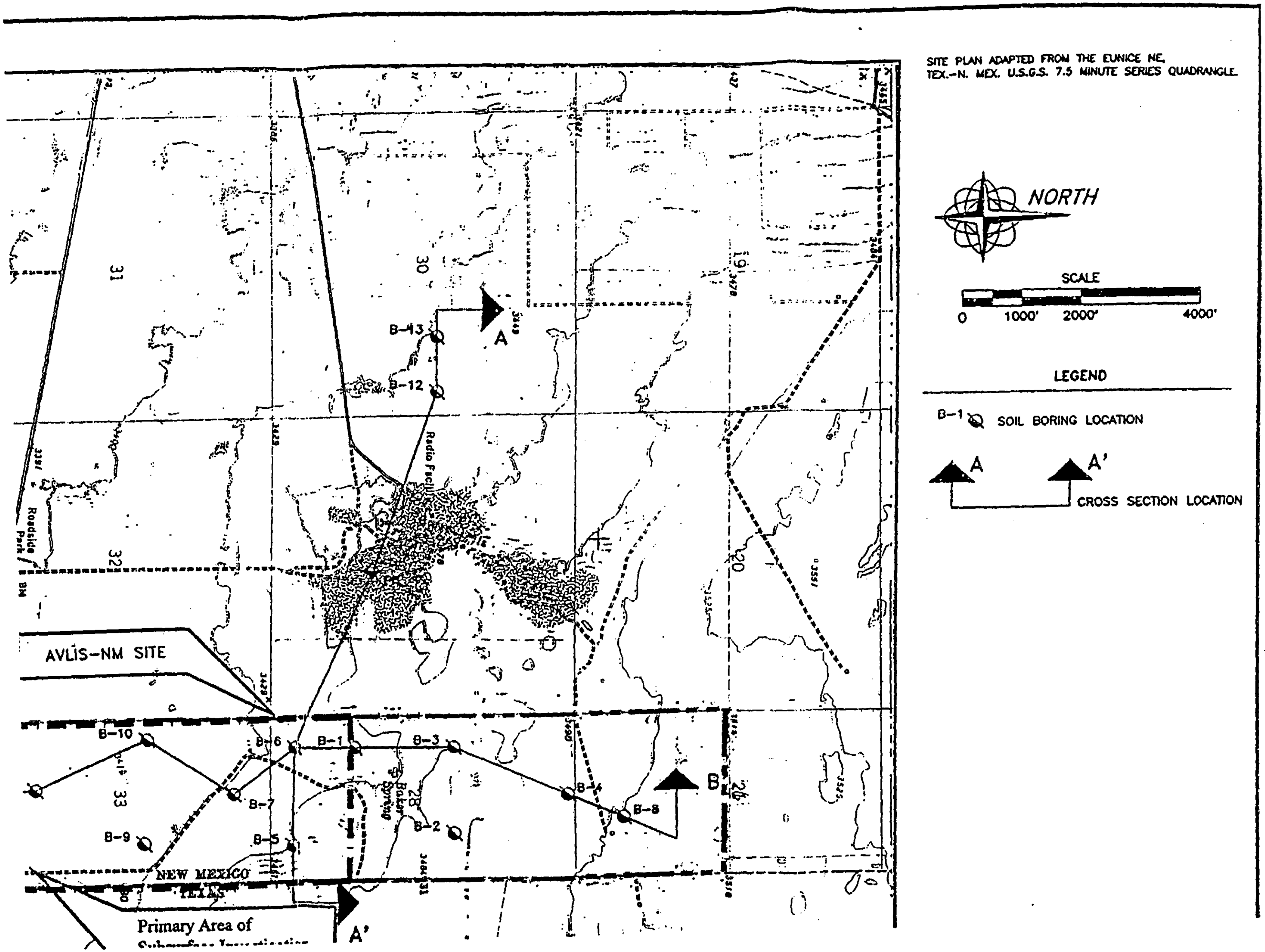
FIGURE I



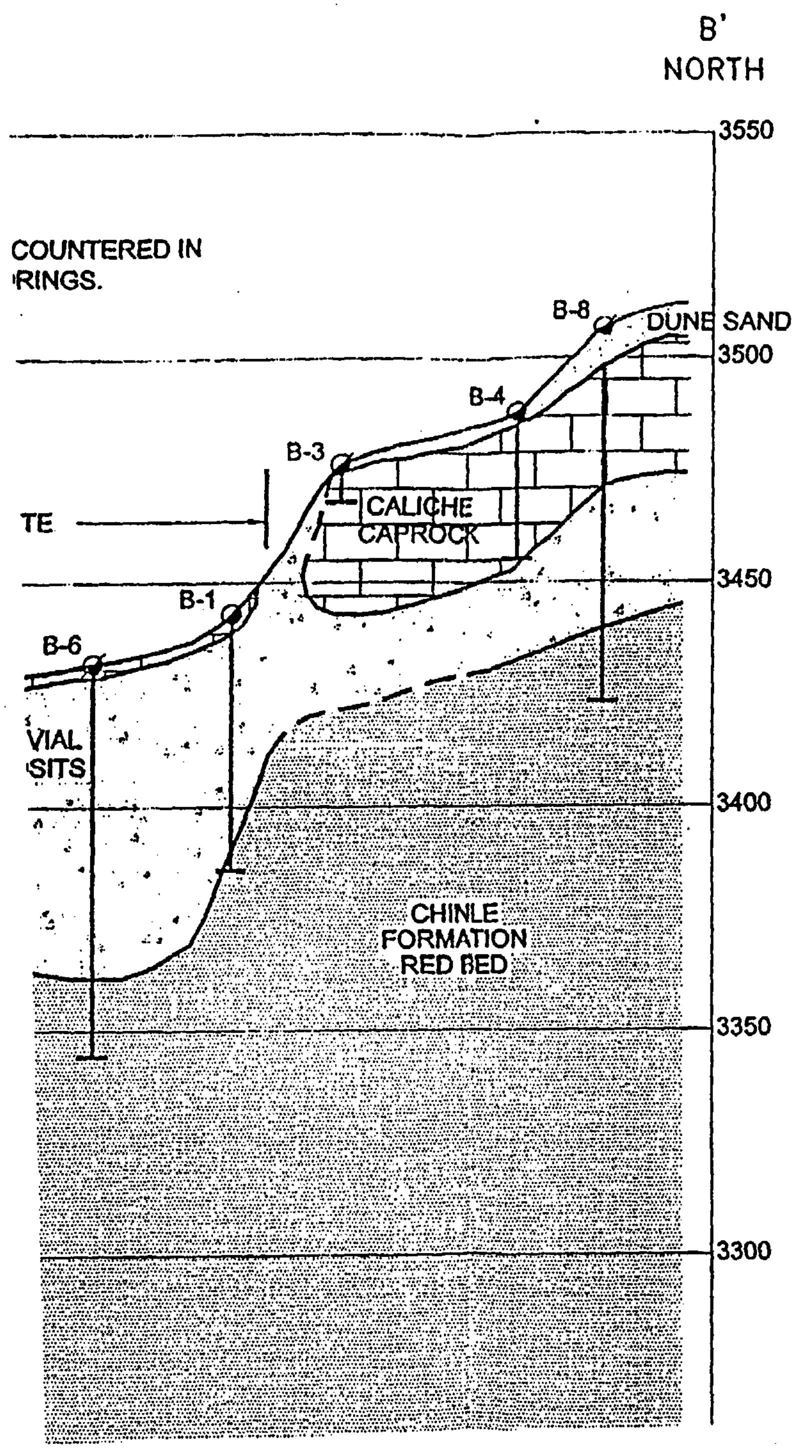
fs **SAND FACIES** — *Sandy alluvium with subordinate amounts of fine gravel, silt, and clay. Forms at least four kinds of ground: 1) On short, steep fans sloping from the mountains of granitic or gneissic rock (e.g., parts of the Florida Mountains), this facies may form a smooth sandy layer a few feet thick covering gravel below; slopes 5 to 20 percent; washes 1 to 10 ft deep may expose underlying gravel. 2) On other short fans, sand facies may form arcuate belt at toe of fan with slopes averaging 10 percent, commonly reworked into coppice dunes 3 to 7 ft high (sm). 3) Other belts of smooth sandy ground commonly slope 5 percent or less and consist of sand mounds approximately 1 ft high over caliche (fs$_4$). 4) Gypsiferous sand (fs$_3$), especially in the Jornada del Muerto, Tularosa Valley and east side of the Pecos Valley. Sand facies absent on the broad Las Palomas surface. Thin fan sand covering pediments is denoted by fs over subscript that identifies underlying formation. Boundary with residual sand, fan gravel, and fan silt is approximate*

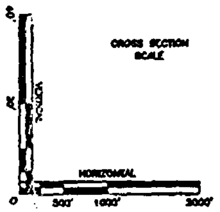
sm **LOOSE SAND IN MOUNDS** — *Coppice dunes, commonly 3 to 7 ft high and 25 to 50 ft in diameter; generally elongated north of east but a local exception lies east of Columbus where elongation is south of east. Age is Holocene. Boundaries fairly accurate*

s_3/ca/To **THICK SAND ON CALICHE ON OGALLALA FORMATION** — *Sand 3 to 5 ft thick. Local mounds. Brownish-red, fine sandy loam over reddish-brown, sandy clay loam; noncalcareous to depths of 3 ft; calcareous subsoil contains filaments of lime carbonate. Where formed, ground is subject to wind erosion. Boundaries approximate*



SITE PLAN ADAPTED FROM THE EUNICE NE, TEX.-N. MEX. U.S.G.S. 7.5 MINUTE SERIES QUADRANGLE.





NOTES:

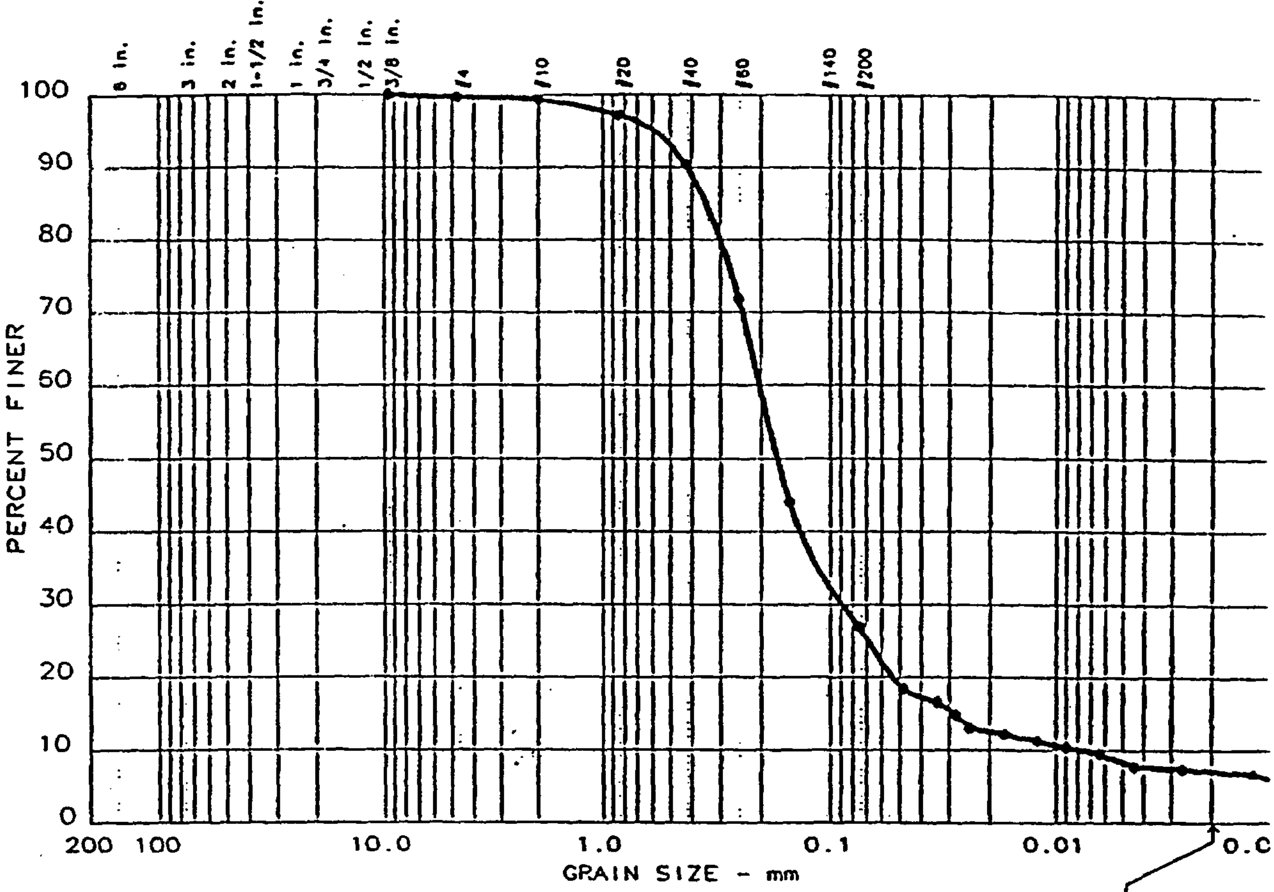
THE DEPTH AND THICKNESS OF THE SUBSURFACE INFORMATION INDICATED ON THE SECTIONS WERE GENERALIZED FROM AND INTERPOLATED BETWEEN THE SOIL BORINGS TO PROVIDE A GENERAL OVERVIEW OF THE SUBSURFACE CONDITIONS. INFORMATION ON ACTUAL SUBSURFACE CONDITIONS EXISTS ONLY AT THE LOCATION AND ON THE DATE OF THE SOIL BORINGS AND IT IS POSSIBLE THAT SUBSURFACE CONDITIONS BETWEEN THE SOIL BORINGS MAY VARY FROM THOSE INDICATED. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE CONDITIONS AT THESE BORING LOCATIONS. FOR MORE DETAILED INFORMATION REFER TO THE BORING LOGS AND LABORATORY TEST RESULTS.

Attachment IV.5.B

Soil Laboratory Analysis

J

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	19	0.0	0.3	72.7	19.9	7.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA	0.343	0.202	0.169	0.0878	0.0281	0.0071	5.35	28.3

MATERIAL DESCRIPTION	USCS	AASHTO
● RED F/C SAND, LITTLE SILT, TR CLAY	SM	A-2-4

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 1-7-98

Remarks:

BORING: B-101

DEPTH: 20.0'

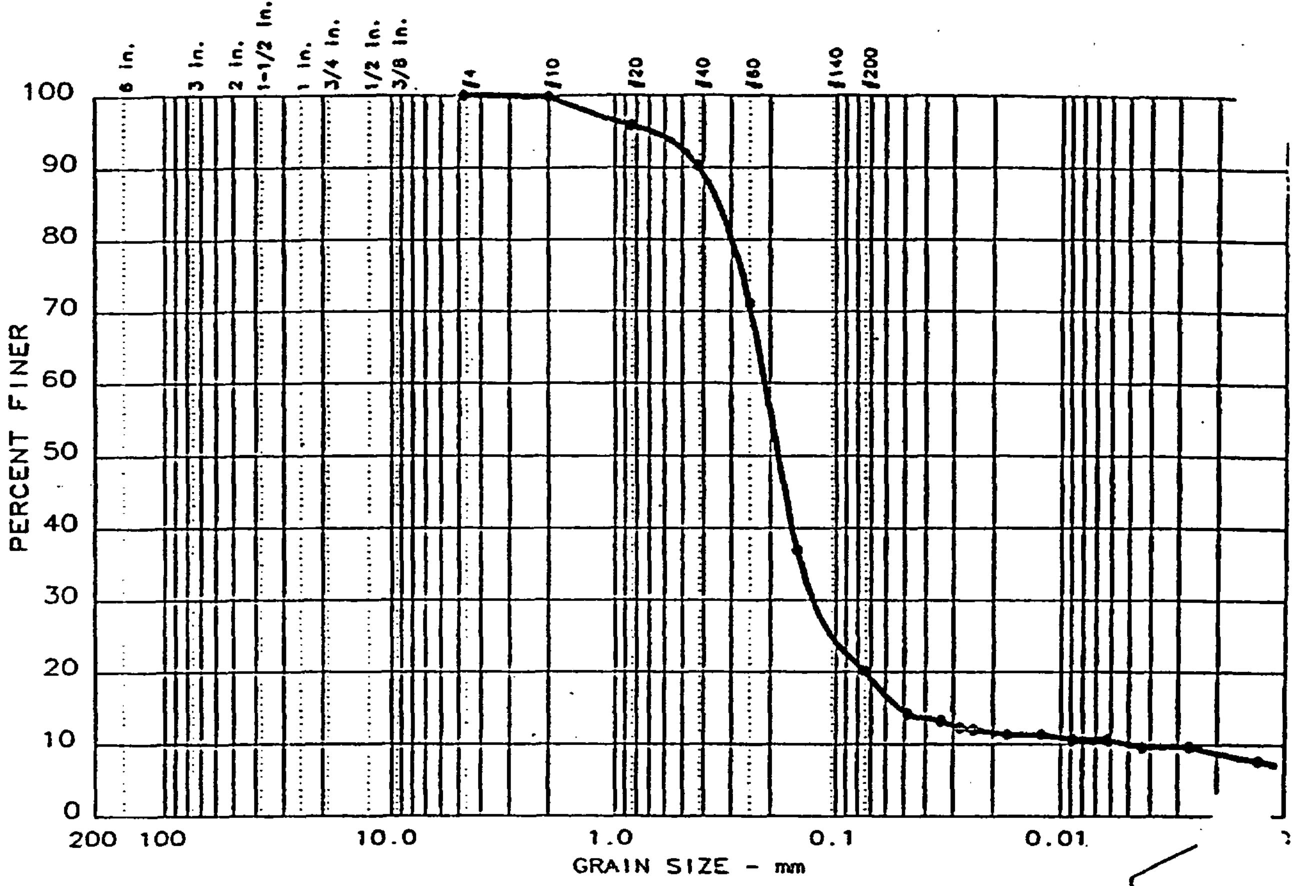
GRAIN SIZE DISTRIBUTION TEST REPORT
WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

```
                    GRAIN SIZE DISTRIBUTION TEST DATA                Test No.: 15
-----------------------------------------------------------------------------
Date: 1-7-98
Project No.: 95042.10
Project: LEA COUNTY LANDFILL
=============================================================================

-----------------------------------------------------------------------------
                                 Sample Data
-----------------------------------------------------------------------------
Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED F/C SAND, LITTLE SILT, TR CLAY
USCS Class: SM                       Liquid limit: NA
AASHTO Class: A-2-4                  Plasticity index: NA
-----------------------------------------------------------------------------
                                    Notes
-----------------------------------------------------------------------------
Remarks: BORING: B-101  DEPTH: 20.0'

Fig. No.:
-----------------------------------------------------------------------------
                          Mechanical Analysis Data
-----------------------------------------------------------------------------
                     Initial
Dry sample and tare=   436.70
Tare               =     0.00
Dry sample weight  =   436.70
Sample split on number 10 sieve
Split sample data:
  Sample and tare = 50  Tare =  0  Sample weight = 50
  Cumulative weight retained tare= 0
   e for cumulative weight retained= 0
  Sieve           Cumul. Wt.   Percent
                  retained     finer
  0.375 inches       0.00       100.0
  # 4                1.20        99.7
  # 10               2.90        99.3
  # 20               1.10        97.2
  # 40               4.50        90.4
  # 60              13.80        71.9
  # 100             27.80        44.1
  # 200             36.40        27.0
-----------------------------------------------------------------------------
                          Hydrometer Analysis Data
-----------------------------------------------------------------------------
Separation sieve is number 40
Percent -# 40 based on complete sample=  90.4
Weight of hydrometer sample: 50
Calculated biased weight=  55.31
Automatic temperature correction
  Composite correction at 20 deg C =-4.5

Meniscus correction only= 1
```

```
Specific gravity correction factor= 0.978
Hydrometer type: 152H   Effective depth L= 16.294964 - 0.164 x Rm

 Elapsed     Temp, Actual    Corrected  K         Rm     Eff.     Diameter  Percent
 time, min   deg C reading   reading                     depth    mm        finer
      1.0    22.0  14.5      10.4       0.0129   15.5    13.8     0.0479    18.4
      2.0    22.0  13.5       9.4       0.0129   14.5    13.9     0.0341    16.6
      3.0    22.0  12.5       8.4       0.0129   13.5    14.1     0.0280    14.9
      4.0    22.0  11.5       7.4       0.0129   12.5    14.2     0.0244    13.1
      8.0    22.0  11.0       6.9       0.0129   12.0    14.3     0.0173    12.2
     16.0    22.0  10.5       6.4       0.0129   11.5    14.4     0.0123    11.3
     30.0    22.0  10.0       5.9       0.0129   11.0    14.5     0.0090    10.5
     60.0    22.0   9.5       5.4       0.0129   10.5    14.6     0.0064     9.6
    125.0    22.0   8.5       4.4       0.0129    9.5    14.7     0.0044     7.8
    330.0    23.0   8.0       4.2       0.0128    9.0    14.8     0.0027     7.4
   1410.0    23.5   7.5       3.8       0.0127    8.5    14.9     0.0013     6.7
   2850.0    22.5   7.0       3.0       0.0128    8.0    15.0     0.0009     5.4
-------------------------------------------------------------------------------
                            Fractional Components
-------------------------------------------------------------------------------
Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. =  0.0     % GRAVEL =  0.3    % SAND = 72.7
% SILT = 19.9     % CLAY =  7.1     (% CLAY COLLOIDS =  5.7)

D85=   0.34  D60=   0.202  D50=   0.169
D30=   0.0878  D15=   0.02809  D10=  0.00714
Cc =   5.3518  Cu =   28.2813
```

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	9	0.0	0.0	79.8	11.4	8.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA	0.342	0.212	0.184	0.127	0.0519	0.0049	15.65	43.2

MATERIAL DESCRIPTION	USCS	AASHTO
● RED SAND, LITTLE SILT, TR CLAY	SC	A-2-4

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 12-22-97

Remarks:
BORING: 102
DEPTH: 20.0'

GRAIN SIZE DISTRIBUTION TEST REPORT
WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

```
                    GRAIN SIZE DISTRIBUTION TEST DATA            Test No.: 9
------------------------------------------------------------------------------
Date: 12-22-97
Project No.: 95042.10
Project: LEA COUNTY LANDFILL
==============================================================================

  ----------------------------------------------------------------------------
                                Sample Data
------------------------------------------------------------------------------
Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SAND, LITTLE SILT, TR CLAY
USCS Class: SC                         Liquid limit: NA
AASHTO Class: A-2-4                    Plasticity index: NA
------------------------------------------------------------------------------
                                   Notes
------------------------------------------------------------------------------
Remarks: BORING: 102  DEPTH: 20.0'

Fig. No.:
------------------------------------------------------------------------------
                         Mechanical Analysis Data
------------------------------------------------------------------------------
                     Initial
Dry sample and tare=   123.00
Tare               =     0.00
Dry sample weight  =   123.00
Sample split on number 10 sieve
Split sample data:
  Sample and tare = 50  Tare =  0  Sample weight = 50
  Cumulative weight retained tare= 0
   e for cumulative weight retained= 0
   ieve          Cumul. Wt.   Percent
                 retained     finer
  # 4               0.00       100.0
  # 10              0.20        99.8
  # 20              2.00        95.8
  # 40              4.80        90.3
  # 60             14.40        71.1
  # 100            31.50        36.9
  # 200            39.90        20.2
------------------------------------------------------------------------------
                         Hydrometer Analysis Data
------------------------------------------------------------------------------
Separation sieve is number 10
Percent -# 10 based on complete sample=  99.8
Weight of hydrometer sample: 50
Calculated biased weight=  50.08
Automatic temperature correction
  Composite correction at 20 deg C =-3.5

Meniscus correction only= 1
Specific gravity of solids= 2.75
```

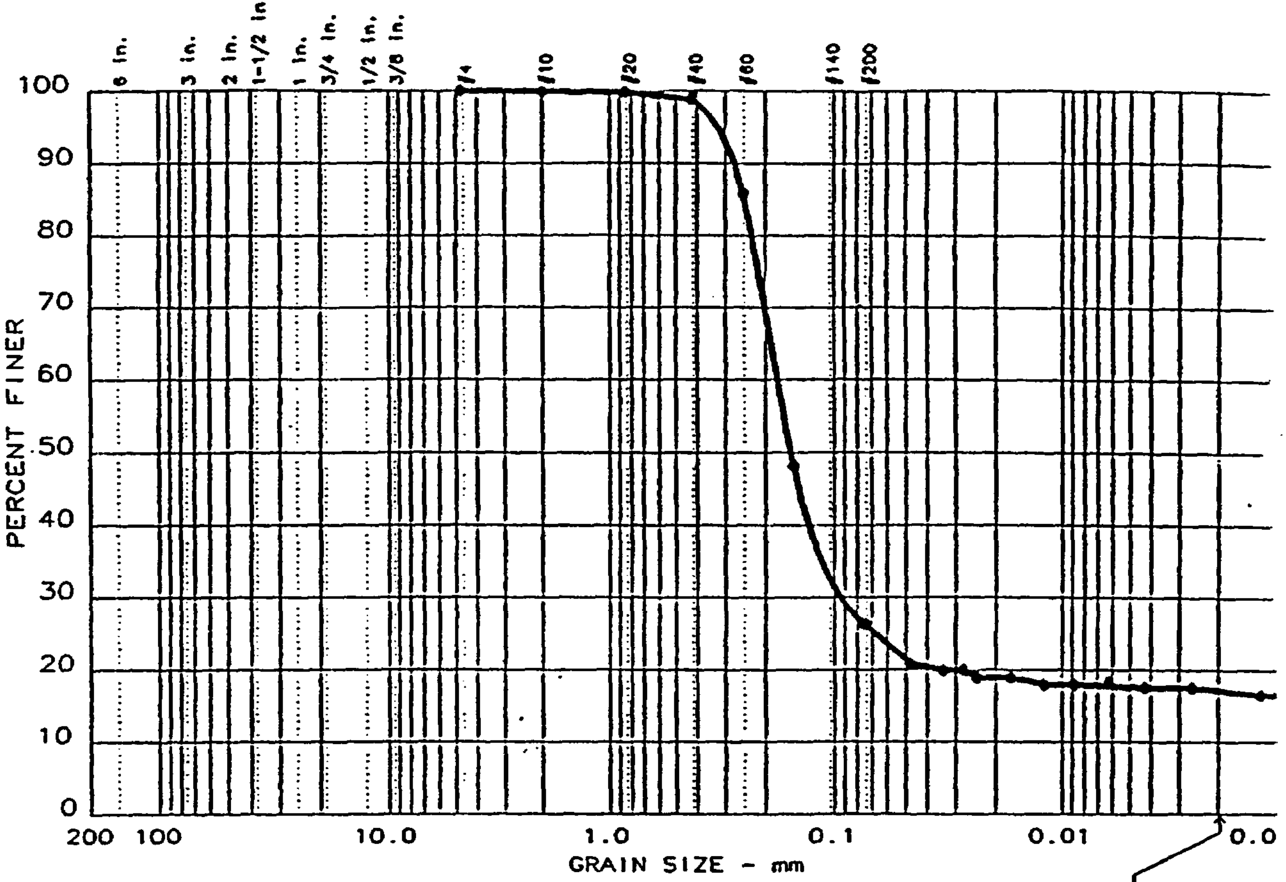
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
1.0	23.5	10.0	7.3	0.0127	11.0	14.5	0.0483	14.3
2.0	23.5	9.5	6.8	0.0127	10.5	14.6	0.0343	13.3
3.0	23.5	9.0	6.3	0.0127	10.0	14.7	0.0281	12.
4.0	23.0	9.0	6.2	0.0128	10.0	14.7	0.0244	12.0
8.0	23.5	8.5	5.8	0.0127	9.5	14.7	0.0172	11.3
16.0	23.5	8.5	5.8	0.0127	9.5	14.7	0.0122	11.3
30.0	24.0	8.0	5.5	0.0126	9.0	14.8	0.0089	10.6
60.0	24.0	8.0	5.5	0.0126	9.0	14.8	0.0063	10.6
125.0	24.0	7.5	5.0	0.0126	8.5	14.9	0.0044	9.7
330.0	24.0	7.5	5.0	0.0126	8.5	14.9	0.0027	9.7
1410.0	24.0	6.5	4.0	0.0126	7.5	15.1	0.0013	7.7
2850.0	24.0	6.0	3.5	0.0126	7.0	15.1	0.0009	6.7

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0 % GRAVEL = 0.0 % SAND = 79.8
% SILT = 11.4 % CLAY = 8.8 (% CLAY COLLOIDS = 7.0)

D85= 0.34 D60= 0.212 D50= 0.184
D30= 0.1274 D15= 0.05188 D10= 0.00490
Cc = 15.6495 Cu = 43.2016

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	10	0.0	0.0	73.6	9.2	17.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA	0.245	0.176	0.154	0.0929				

MATERIAL DESCRIPTION	USCS	AASHTO
● REDISH BRN SAND, LITTLE CLAY, TR SILT	SC	A-2-4

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 12-18-97

Remarks:
BORING: 103
DEPTH: 5.0'

GRAIN SIZE DISTRIBUTION TEST REPORT
WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

```
-------------------------------------------------------------------------------
Date: 12-18-97
Project No.: 95042.10
Project: LEA COUNTY LANDFILL
===============================================================================

-------------------------------------------------------------------------------
                                   Sample Data
-------------------------------------------------------------------------------
Location of Sample: HOBBS, NEW MEXICO
Sample Description: REDISH BRN SAND, LITTLE CLAY, TR SILT
USCS Class: SC                         Liquid limit: NA
AASHTO Class: A-2-4                    Plasticity index: NA
-------------------------------------------------------------------------------
                                      Notes
-------------------------------------------------------------------------------
Remarks: BORING: 103  DEPTH: 5.0'

Fig. No.:
-------------------------------------------------------------------------------
                             Mechanical Analysis Data
-------------------------------------------------------------------------------
                          Initial
Dry sample and tare=    100.50
Tare                =     0.00
Dry sample weight   =   100.50
Sample split on number 10 sieve
Split sample data:
  Sample and tare = 50  Tare =  0  Sample weight = 50
  Cumulative weight retained tare= 0
   e for cumulative weight retained= 0
  Sieve           Cumul. Wt.   Percent
                  retained     finer
  # 4                0.00      100.0
  # 10               0.10       99.9
  # 20               0.10       99.7
  # 40               0.50       98.9
  # 60               7.00       85.9
  # 100             25.90       48.2
  # 200             36.80       26.4
-------------------------------------------------------------------------------
                            Hydrometer Analysis Data
-------------------------------------------------------------------------------
Separation sieve is number 10
Percent -# 10 based on complete sample=  99.9
Weight of hydrometer sample: 50
Calculated biased weight=  50.05
Automatic temperature correction
  Composite correction at 20 deg C =-3.5

Meniscus correction only= 1
Specific gravity of solids= 2.73
```

Hydrometer type: 152H   Effective depth L= 16.294964 - 0.164 x Rm

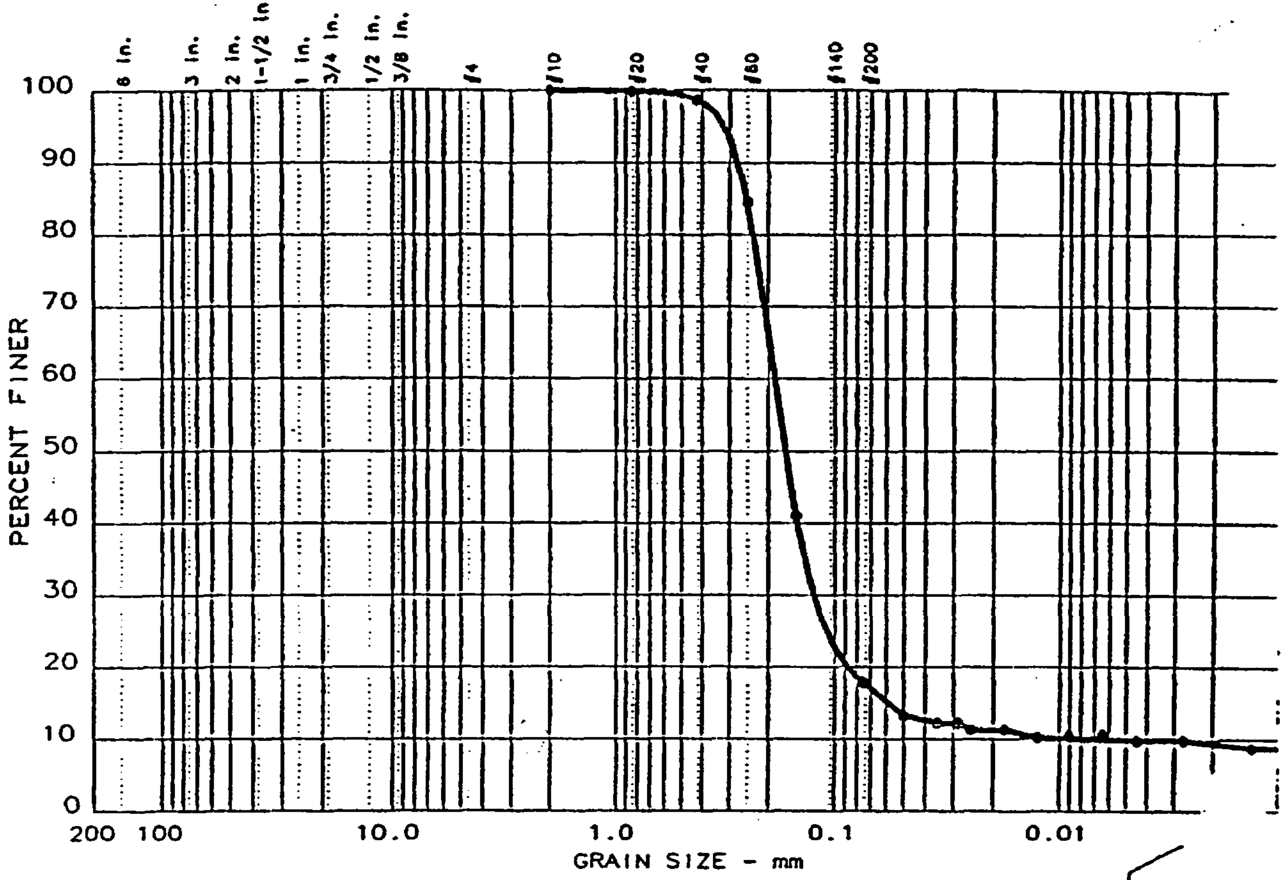
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
1.0	23.0	13.5	10.7	0.0128	14.5	13.9	0.0479	20.9
2.0	23.0	13.0	10.2	0.0128	14.0	14.0	0.0340	20.0
3.0	23.0	13.0	10.2	0.0128	14.0	14.0	0.0277	20.0
4.0	23.0	12.5	9.7	0.0128	13.5	14.1	0.0241	19.0
8.0	23.0	12.5	9.7	0.0128	13.5	14.1	0.0170	19.0
16.0	23.0	12.0	9.2	0.0128	13.0	14.2	0.0121	18.0
30.0	23.0	12.0	9.2	0.0128	13.0	14.2	0.0088	18.0
60.0	23.5	12.0	9.3	0.0128	13.0	14.2	0.0062	18.3
125.0	24.0	11.5	9.0	0.0127	12.5	14.2	0.0043	17.6
330.0	24.0	11.5	9.0	0.0127	12.5	14.2	0.0026	17.6
1410.0	24.0	11.0	8.5	0.0127	12.0	14.3	0.0013	16.6
2850.0	24.0	11.0	8.5	0.0127	12.0	14.3	0.0009	16.6

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0   % GRAVEL = 0.0   % SAND = 73.6
% SILT = 9.2   % CLAY = 17.2   (% CLAY COLLOIDS = 16.6)

D85= 0.25   D60= 0.176   D50= 0.154
D30= 0.0929

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	11	0.0	0.0	82.2	8.4	9.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA	0.251	0.187	0.167	0.124	0.0580	0.0062	13.26	30.0

MATERIAL DESCRIPTION	USCS	AASHTO
● RED SAND, TR SILT & CLAY	SC	A-2-4

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 12-18-97

Remarks:
BORING: 104
DEPTH: 4.0'

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 1

Date: 12-18-97
Project No.: 95042.10
Project: LEA COUNTY LANDFILL

Sample Data

Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SAND, TR SILT & CLAY
USCS Class: SC
Liquid limit: NA
AASHTO Class: A-2-4
Plasticity index: NA

Notes

Remarks: BORING: 104 DEPTH: 4.0'

Fig. No.:

Mechanical Analysis Data

Initial
Dry sample and tare= 160.90
Tare = 0.00
Dry sample weight = 160.90
Sample split on number 10 sieve
Split sample data:
Sample and tare = 50 Tare = 0 Sample weight = 50
Cumulative weight retained tare= 0
e for cumulative weight retained= 0

Sieve	Cumul. Wt. retained	Percent finer
# 10	0.00	100.0
# 20	0.10	99.8
# 40	0.70	98.6
# 60	7.70	84.6
# 100	29.50	41.0
# 200	41.10	17.8

Hydrometer Analysis Data

Separation sieve is number 10
Percent -# 10 based on complete sample= 100.0
Weight of hydrometer sample: 50
Calculated biased weight= 50.00
Automatic temperature correction
Composite correction at 20 deg C =-3.5

Meniscus correction only= 1
Specific gravity of solids= 2.68
Specific gravity correction factor= 0.993

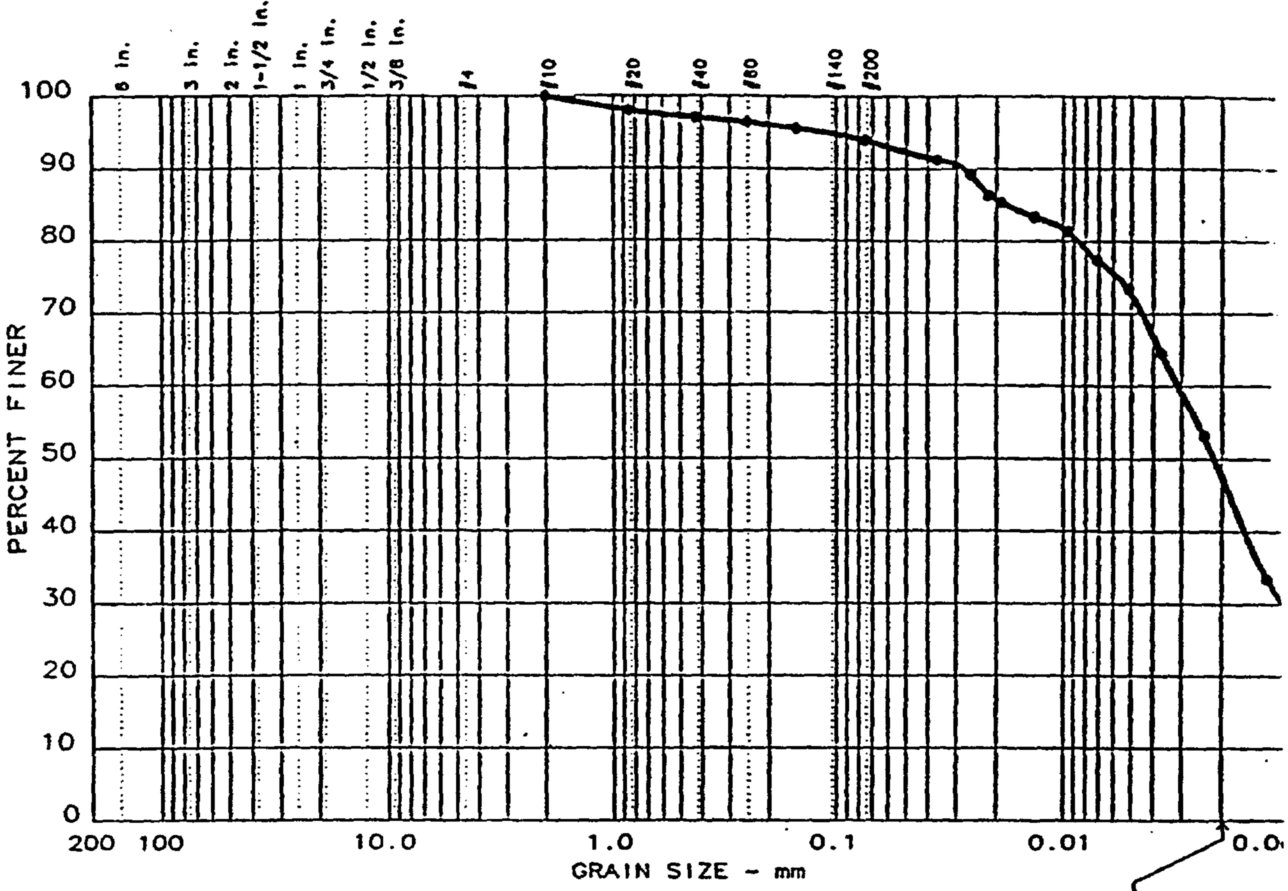
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
1.0	23.0	9.5	6.7	0.0130	10.5	14.6	0.0498	13.2
2.0	23.0	9.0	6.2	0.0130	10.0	14.7	0.0353	12.2
3.0	23.0	9.0	6.2	0.0130	10.0	14.7	0.0288	12.2
4.0	23.0	8.5	5.7	0.0130	9.5	14.7	0.0250	11
8.0	23.0	8.5	5.7	0.0130	9.5	14.7	0.0177	11.3
16.0	23.0	8.0	5.2	0.0130	9.0	14.8	0.0125	10.3
30.0	23.5	8.0	5.3	0.0130	9.0	14.8	0.0091	10.5
60.0	23.5	8.0	5.3	0.0130	9.0	14.8	0.0064	10.5
125.0	24.0	7.5	5.0	0.0129	8.5	14.9	0.0044	9.8
330.0	24.0	7.5	5.0	0.0129	8.5	14.9	0.0027	9.8
1410.0	24.0	7.0	4.5	0.0129	8.0	15.0	0.0013	8.8
2850.0	24.0	7.0	4.5	0.0129	8.0	15.0	0.0009	8.8

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0 % GRAVEL = 0.0 % SAND = 82.2
% SILT = 8.4 % CLAY = 9.4 (% CLAY COLLOIDS = 8.8)

D85= 0.25 D60= 0.187 D50= 0.167
D30= 0.1240 D15= 0.05801 D10= 0.00622
Cc = 13.2587 Cu = 30.0262

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	1	0.0	0.0	6.0	46.3	47.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA			0.0022	0.0010				

MATERIAL DESCRIPTION	USCS	AASHTO
● RED SILTY CLAY, TR SAND	CL	

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 12-10-97

Remarks:
BORING: 104
DEPTH: 60.0'

GRAIN SIZE DISTRIBUTION TEST REPORT
WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

```
------------------------------------------------------------------------------
Date: 12-10-97
Project No.: 95042.10
Project: LEA COUNTY LANDFILL
==============================================================================

------------------------------------------------------------------------------
                                   Sample Data
------------------------------------------------------------------------------
Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SILTY CLAY, TR SAND
USCS Class: CL                         Liquid limit: NA
AASHTO Class:                          Plasticity index: NA
------------------------------------------------------------------------------
                                      Notes
------------------------------------------------------------------------------
Remarks: BORING: 104  DEPTH: 60.0'

Fig. No.:
------------------------------------------------------------------------------
                            Mechanical Analysis Data
------------------------------------------------------------------------------
                     Initial
Dry sample and tare=   447.00
Tare               =     0.00
Dry sample weight  =   447.00
Sample split on number 10 sieve
Split sample data:
  Sample and tare = 50  Tare =  0  Sample weight = 50
  Cumulative weight retained tare= 0
   e for cumulative weight retained= 0
 Sieve              Cumul. Wt.   Percent
                    retained     finer
  # 10                 0.00       100.0
  # 20                 1.00        98.0
  # 40                 1.50        97.0
  # 60                 1.80        96.4
  # 100                2.20        95.6
  # 200                3.00        94.0
------------------------------------------------------------------------------
                            Hydrometer Analysis Data
------------------------------------------------------------------------------
Separation sieve is number 10
Percent -# 10 based on complete sample= 100.0
Weight of hydrometer sample: 50
Calculated biased weight=  50.00
Automatic temperature correction
  Composite correction at 20 deg C =-4.5

Meniscus correction only= 1
Specific gravity of solids= 2.7
Specific gravity correction factor= 0.989
```

```
 Elapsed    Temp, Actual   Corrected  K         Rm     Eff.   Diameter  Percent
 time, min  deg C reading  reading                     depth  mm        finer
    1.0     23.0  50.0     46.2       0.0130   51.0    7.9   0.0365    91.3
    2.0     23.0  49.0     45.2       0.0130   50.0    8.1   0.0261    89.3
    3.0     23.0  47.5     43.7       0.0130   48.5    8.3   0.0216    86.4
    4.0     23.0  47.0     43.2       0.0130   48.0    8.4   0.0188    85.4
    8.0     23.0  46.0     42.2       0.0130   47.0    8.6   0.0134    83.4
   16.0     23.0  45.0     41.2       0.0130   46.0    8.8   0.0096    81.4
   30.0     23.0  43.0     39.2       0.0130   44.0    9.1   0.0071    77.5
   60.0     23.0  41.0     37.2       0.0130   42.0    9.4   0.0051    73.5
  125.0     23.0  36.5     32.7       0.0130   37.5   10.1   0.0037    64.6
  330.0     22.0  31.0     26.9       0.0131   32.0   11.0   0.0024    53.2
 1410.0     22.0  21.0     16.9       0.0131   22.0   12.7   0.0012    33.4
 2850.0     23.0  17.5     13.7       0.0130   18.5   13.3   0.0009    27.0
--------------------------------------------------------------------------------
                              Fractional Components
--------------------------------------------------------------------------------
Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. =  0.0     % GRAVEL =   0.0    % SAND =  6.0
% SILT = 46.3    % CLAY = 47.7    (% CLAY COLLOIDS = 29.1)

D85=   0.02  D60=    0.003  D50=    0.002
D30=   0.0010
```

PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 6.32
Specimen Diameter (cm): 6.39
Dry Unit Weight (pcf): 114.9
Moisture Before Test (%): 10.5
Moisture After Test (%): 17.5

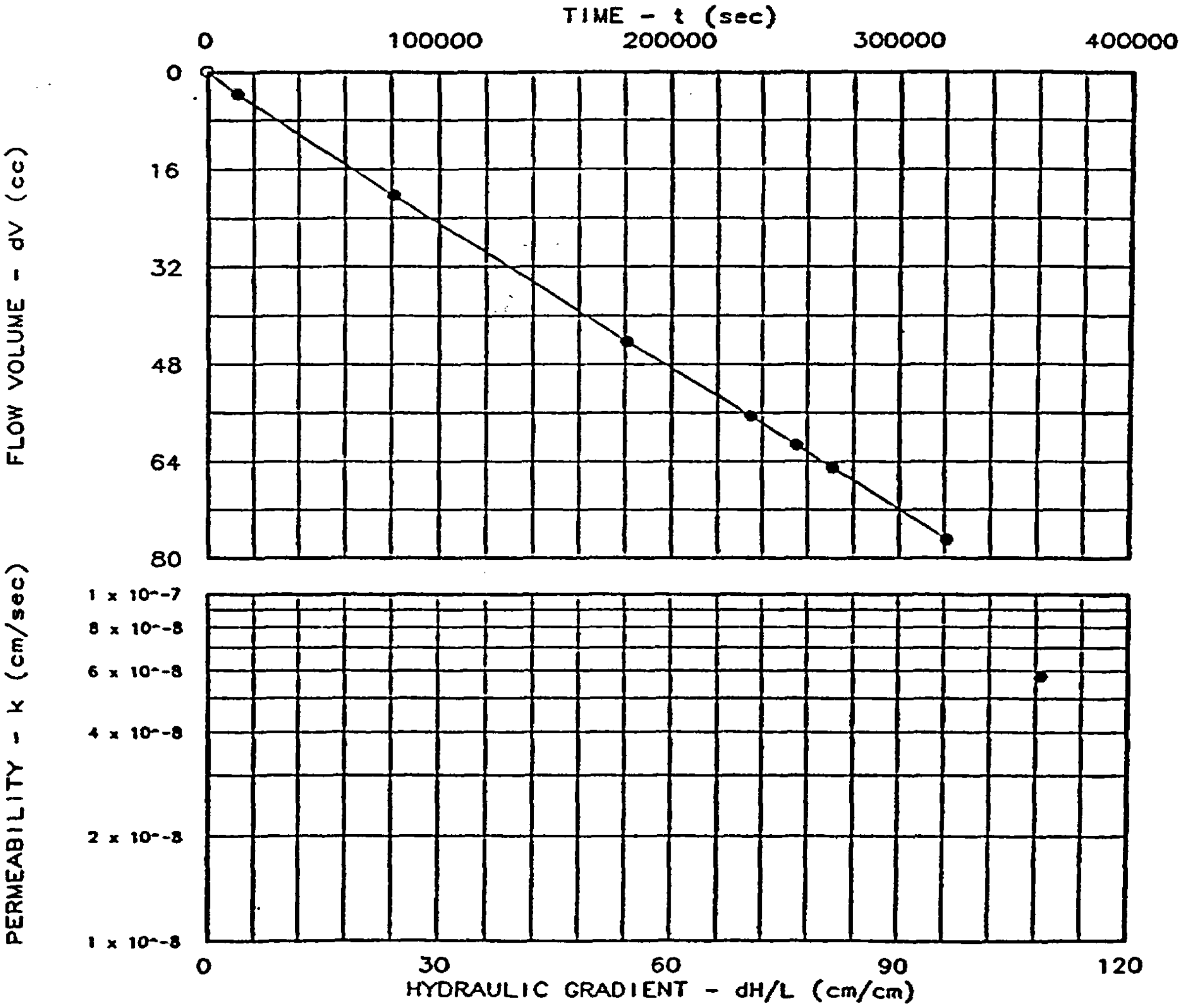
Run Number:	1 ●	2 ▲
Cell Pressure (psi):	30.0	
Test Pressure(psi):	27.0	
Back Pressure(psi):	17.2	
Diff. Head (psi):	9.8	
Flow Rate (cc/sec):	2.37 x 10^-4	
Perm. (cm/sec):	5.79 x 10^-8	

SAMPLE DATA:

Sample Identification: BORING: 104
DEPTH: 60.0'
Visual Description: RED SILTY CLAY, TR SAND
Remarks:

Maximum Dry Density (pcf):
Optimum Moisture Content (%):

Percent Compaction:
Permeameter type: FLEXIBLE WALL
Sample type: CORE



Project: LEA COUNTY LANDFILL
Location: HOBBS, NEW MEXICO
Date: 12-8-97

PERMEABILITY TEST REPORT
WEAVER BOOS CONSULTANTS, INC.

Project No.: 95042.10
File No.: 95042.10
Lab No.: 4
Tested by: JWM
Checked by: WSG
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

P~oject Name: LEA COUNTY LANDFILL
e No.: 95042.10
oject Location: HOBBS, NEW MEXICO
Project No.: 95042.10
Sample Identification: BORING: 104
DEPTH: 60.0'
Lab No.: 4
Description: RED SILTY CLAY,
TR SAND
Sample Type: CORE
Max. Dry Dens.:
Method (D1557/D698):
Opt. Water Content:
Date: 12-8-97
Remarks:

Permeameter Type: FLEXIBLE WALL
Tested by: JWM
Checked by: WSG
Test type: CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:		After test:	
.iameter:	1	2	1	2
Top:	in	in	in	in
Middle:	2.515 in	in	2.506 in	in
Bottom:	in	in	in	in
Average:	2.52 in	6.39 cm	2.51 in	6.37 cm

	Before test:			After test:		
Length:	1	2	3	1	2	3
	2.488 in	in	in	2.498 in	in	in
Average:	2.49 in	6.32 cm		2.50 in	6.34 cm	

Moisture, Density and Sample Parameters:

	Before test:	After test:
Specific Gravity:	2.70	
Wet Wt. & Tare:	411.90	438.00
Dry Wt. & Tare:	372.70	372.70
Tare Wt.:	0.00	0.00
Moisture Content:	10.5 %	17.5 %
Dry Unit Weight:	114.9 pcf	115.2 pcf
Porosity:	0.3185	0.3163
Saturation:	60.8 %	102.2 %

Cell No.: 4 Panel No.: Positions:

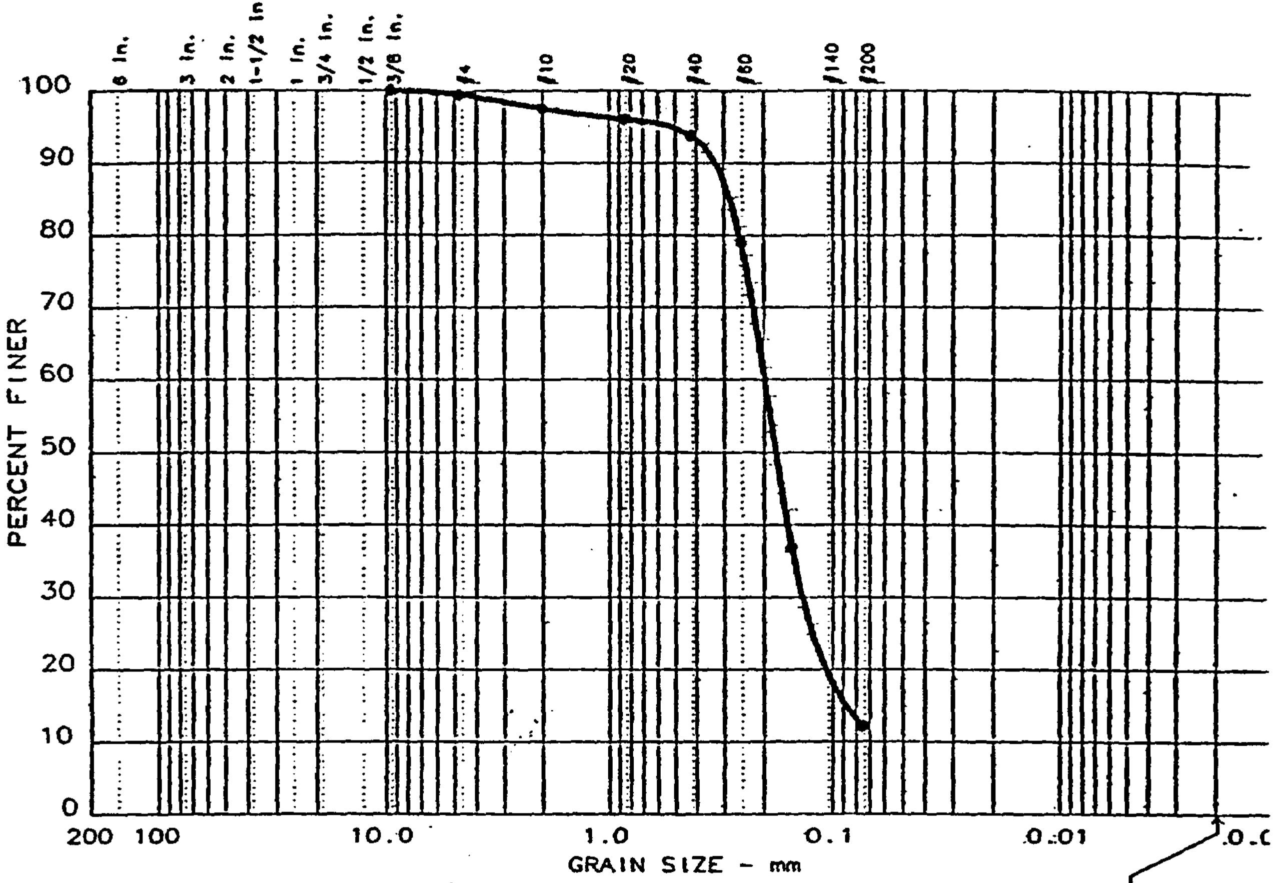
Run Number:	1	2
Cell Pressure:	30.0 psi	0.0 psi
Saturation Pressure:	30.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	27.0 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D S	X R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	GAUGE PRESSURE-psi OUT	BURET READING-cc IN	BURET READING-cc OUT	FLOW VOLUME-cc AVERAGE
S	X	12/12/97	13:19:00	0	27.0	17.0	5.80	84.60	0.00
		12/12/97	16:55:00	12,960	27.0	17.0	9.50	81.00	3.65
		12/13/97	11:46:00	80,820	27.0	17.0	26.50	64.80	20.25
		12/14/97	15:33:00	180,840	27.0	17.0	50.90	41.20	44.25
		12/15/97	6:32:00	234,780	27.0	17.0	63.40	29.20	56.50
		12/15/97	12:12:00	255,180	27.0	17.0	68.10	24.40	61.25
		12/15/97	16:36:00	271,020	27.0	17.0	72.00	20.80	65.00
		12/16/97	6:29:00	321,000	27.0	17.0	84.00	9.00	76.90

t Pressure = 27.0 psi Differential Head = 9.8 psi, 686.2 cm H2O
Gradient = 1.086E 02 Flow rate = 2.370E-04 cc/sec R squared = 0.9999
Permeability, K27.0° = 6.810E-08 cm/sec, K20° = 5.791E-08 cm/sec

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	5	0.0	0.6	87.2	12.2	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA	0.279	0.197	0.176	0.135	0.0869			

MATERIAL DESCRIPTION	USCS	AASHTO
● GRAYISH BRN F/C SAND,LITTLE SILT,TR FINE GRAVEL	SM	A-2-4

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 1-30-98

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Remarks:

BORING: B-105

S-9

Figure No. ______

GRAIN SIZE DISTRIBUTION TEST DATA Test No.: 5

Date: 1-30-98
Project No.: 95042.10
Project: LEA COUNTY LANDFILL

Sample Data

Location of Sample: HOBBS, NEW MEXICO
Sample Description: GRAYISH BRN F/C SAND,LITTLE SILT,TR FINE GRAVEL
USCS Class: SM
Liquid limit: NA
AASHTO Class: A-2-4
Plasticity index: NA

Notes

Remarks: BORING: B-105 S-9

Fig. No.:

Mechanical Analysis Data

Initial
Dry sample and tare= 105.70
Tare = 0.00
Dry sample weight = 105.70
Tare for cumulative weight retained= 0

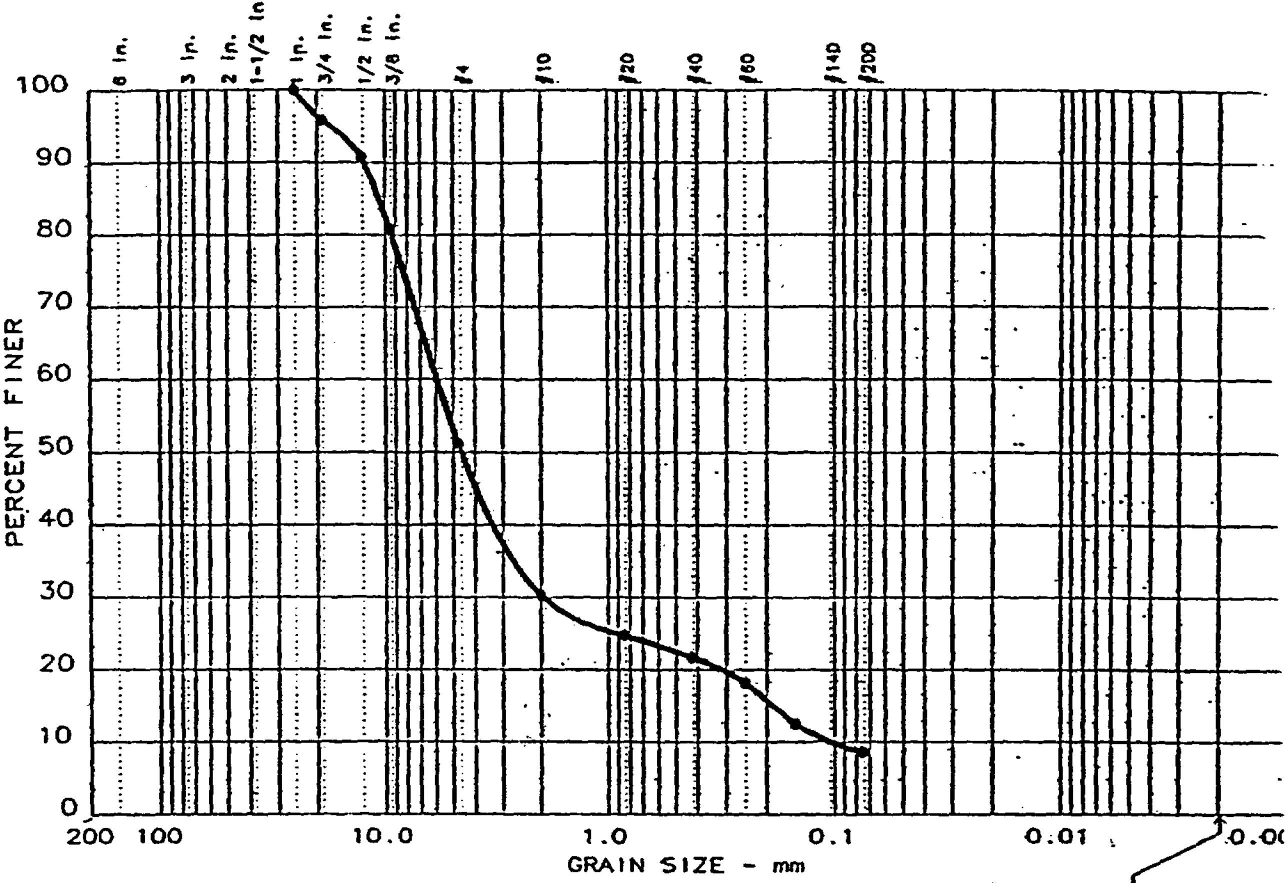
Sieve	Cumul. Wt. retained	Percent finer
0.375 inches	0.00	100.0
4	0.60	99.4
# 10	2.60	97.5
# 20	4.20	96.0
# 40	6.50	93.9
# 60	22.20	79.0
# 100	66.70	36.9
# 200	92.80	12.2

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0 % GRAVEL = 0.6 % SAND = 87.2
% FINES = 12.2

D85= 0.28 D60= 0.197 D50= 0.176
D30= 0.1346 D15= 0.08690

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	6	0.0	48.8	42.6	8.6	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA	10.6	5.90	4.58	1.95	0.186	0.102	6.31	57.5

MATERIAL DESCRIPTION	USCS	AASHTO
● ROSE & WHITE F/C GRAVEL & SAND, TR SILT	GP-GM	A-1-a

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 1-30-98

Remarks:

BORING: B-105

S-38

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

Date: 1-30-98
Project No.: 95042.10
Project: LEA COUNTY LANDFILL

Sample Data

Location of Sample: HOBBS, NEW MEXICO
Sample Description: ROSE & WHITE F/C GRAVEL & SAND, TR SILT
USCS Class: GP-GM
Liquid limit: NA
AASHTO Class: A-1-a
Plasticity index: NA

Notes

Remarks: BORING: B-105 S-38

Fig. No.:

Mechanical Analysis Data

Initial
Dry sample and tare= 229.10
Tare = 0.00
Dry sample weight = 229.10
Tare for cumulative weight retained= 0

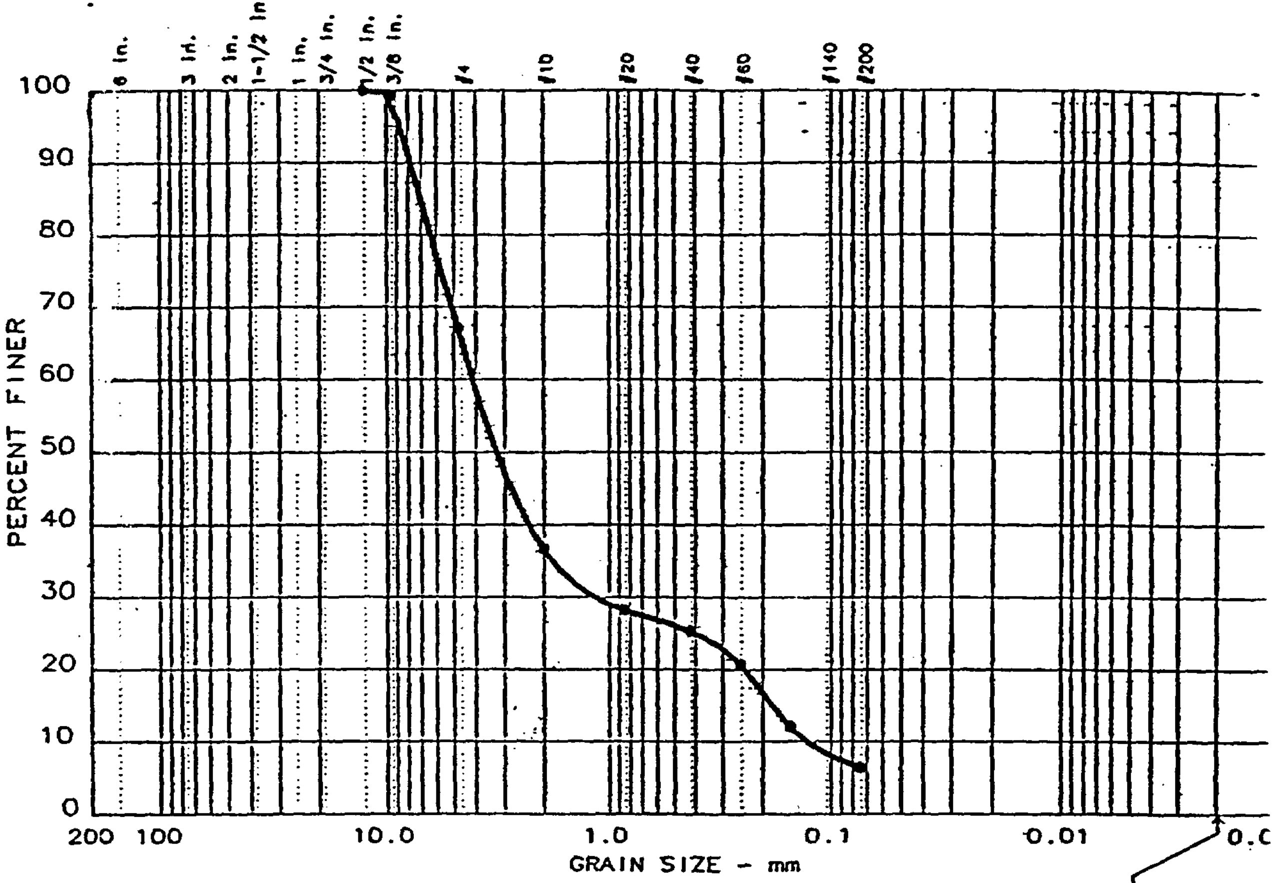
Sieve	Cumul. Wt. retained	Percent finer
1 inches	0.00	100.0
.75 inches	9.50	95.9
0.5 inches	21.20	90.7
0.375 inches	43.70	80.9
# 4	111.70	51.2
# 10	159.70	30.3
# 20	172.40	24.7
# 40	179.30	21.7
# 60	187.30	18.2
# 100	200.20	12.6
# 200	209.30	8.6

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0 % GRAVEL = 48.8 % SAND = 42.6
% FINES = 8.6

D85= 10.56 D60= 5.895 D50= 4.576
D30= 1.9521 D15= 0.18642 D10= 0.10245
Cc = 6.3096 Cu = 57.5440

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	4	0.0	32.9	60.6	6.5	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA	7.00	4.12	3.23	1.16	0.178	0.126	2.60	32.7

MATERIAL DESCRIPTION	USCS	AASHTO
● ROSE & WHITE F/C SAND, SOME F/M GRAVEL, TR SILT	SW-SM	A-1-a

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 1-30-98

Remarks:
BORING: B-105
S-39

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

Date: 1-30-98
Project No.: 95042.10
Project: LEA COUNTY LANDFILL

Sample Data

Location of Sample: HOBBS, NEW MEXICO
Sample Description: ROSE & WHITE F/C SAND, SOME F/M GRAVEL, TR SILT
USCS Class: SW-SM Liquid limit: NA
AASHTO Class: A-1-a Plasticity index: NA

Notes

Remarks: BORING: B-105 S-39

Fig. No.:

Mechanical Analysis Data

Initial
Dry sample and tare= 192.90
Tare = 0.00
Dry sample weight = 192.90
Tare for cumulative weight retained= 0

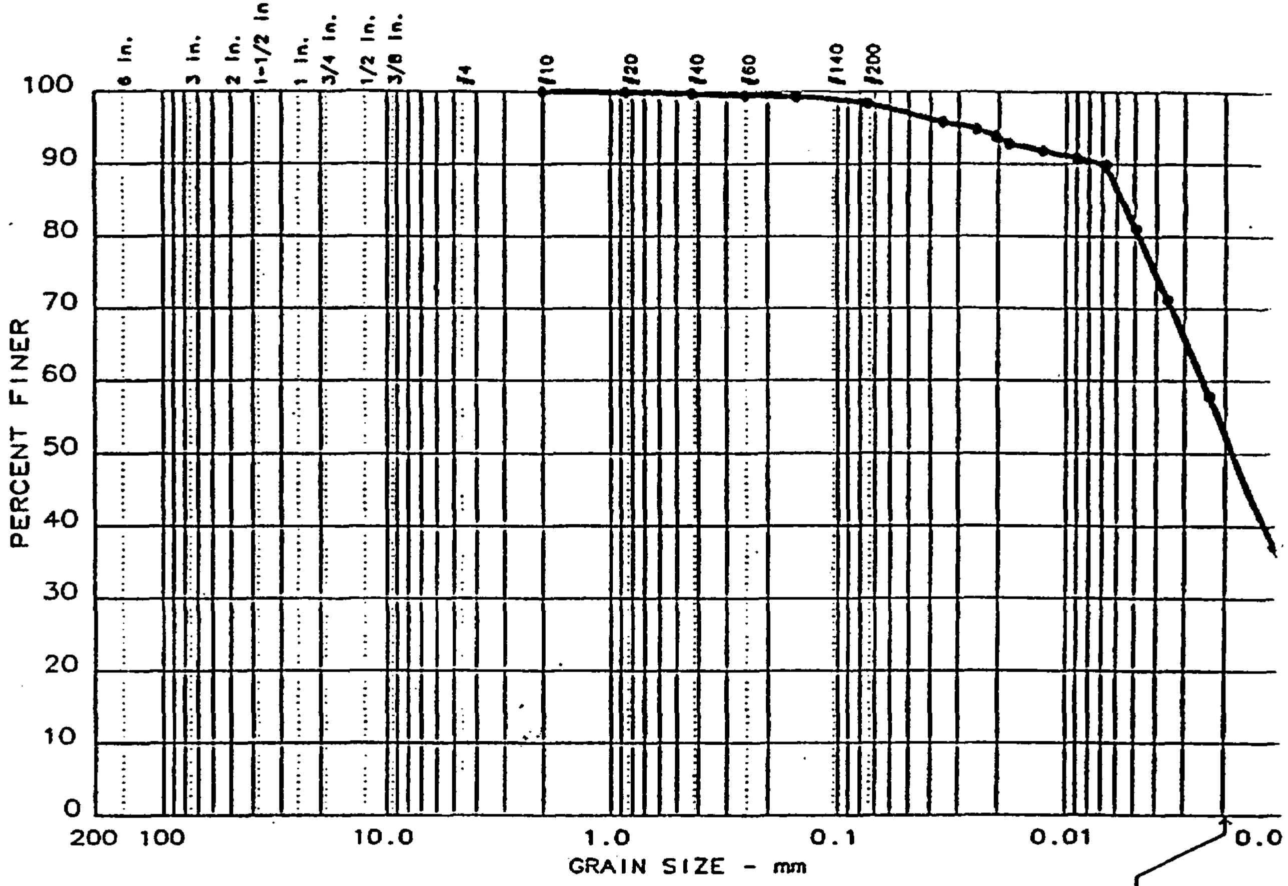
Sieve	Cumul. Wt. retained	Percent finer
0.5 inches	0.00	100.0
.375 inches	1.40	99.3
# 4	63.50	67.1
# 10	122.20	36.7
# 20	138.40	28.3
# 40	144.00	25.3
# 60	153.00	20.7
# 100	169.60	12.1
# 200	180.40	6.5

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0 % GRAVEL = 32.9 % SAND = 60.6
% FINES = 6.5

D85= 7.00 D60= 4.116 D50= 3.232
D30= 1.1601 D15= 0.17762 D10= 0.12575
Cc = 2.6002 Cu = 32.7341

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	2	0.0	0.0	1.6	45.8	52.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA			0.0018	0.0009				

MATERIAL DESCRIPTION	USCS	AASHTO
● RED SILTY CLAY, TR SAND	CL	

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 12-10-97

Remarks:
BORING: 108
DEPTH: 60.0'

GRAIN SIZE DISTRIBUTION TEST REPORT
WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

```
--------------------------------------------------------------------------------
Date: 12-10-97
Project No.: 95042.10
Project: LEA COUNTY LANDFILL
================================================================================

--------------------------------------------------------------------------------
                                  Sample Data
--------------------------------------------------------------------------------
Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SILTY CLAY, TR SAND
USCS Class: CL                          Liquid limit: NA
AASHTO Class:                           Plasticity index: NA
--------------------------------------------------------------------------------
                                     Notes
--------------------------------------------------------------------------------
Remarks: BORING: 108  DEPTH: 60.0'

Fig. No.:
--------------------------------------------------------------------------------
                            Mechanical Analysis Data
--------------------------------------------------------------------------------
                     Initial
Dry sample and tare=   293.70
Tare               =     0.00
Dry sample weight  =   293.70
Sample split on number 10 sieve
Split sample data:
  Sample and tare = 50  Tare =  0  Sample weight = 50
  Cumulative weight retained tare= 0
   e for cumulative weight retained= 0
  Sieve            Cumul. Wt.   Percent
                    retained     finer
  # 10                0.00       100.0
  # 20                0.10        99.8
  # 40                0.20        99.6
  # 60                0.30        99.4
  # 100               0.40        99.2
  # 200               0.80        98.4
--------------------------------------------------------------------------------
                           Hydrometer Analysis Data
--------------------------------------------------------------------------------
Separation sieve is number 10
Percent -# 10 based on complete sample= 100.0
Weight of hydrometer sample: 50
Calculated biased weight=  50.00
Automatic temperature correction
  Composite correction at 20 deg C =-4.5

Meniscus correction only= 1
Specific gravity of solids= 2.72
Specific gravity correction factor= 0.985
```

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
1.0	23.0	52.5	48.7	0.0129	53.5	7.5	0.0353	95.8
2.0	23.0	52.0	48.2	0.0129	53.0	7.6	0.0251	94.8
3.0	23.0	51.5	47.7	0.0129	52.5	7.7	0.0206	93.9
4.0	23.0	51.0	47.2	0.0129	52.0	7.8	0.0180	92.9
8.0	23.0	50.5	46.7	0.0129	51.5	7.8	0.0128	91.9
16.0	23.0	50.0	46.2	0.0129	51.0	7.9	0.0091	90.9
30.0	23.0	49.5	45.7	0.0129	50.5	8.0	0.0067	89.9
60.0	23.0	45.0	41.2	0.0129	46.0	8.8	0.0049	81.1
125.0	23.0	40.0	36.2	0.0129	41.0	9.6	0.0036	71.2
330.0	22.0	33.5	29.4	0.0130	34.5	10.6	0.0023	57.9
1410.0	22.0	23.0	18.9	0.0130	24.0	12.4	0.0012	37.2
2850.0	23.0	19.0	15.2	0.0129	20.0	13.0	0.0009	29.9

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0 % GRAVEL = 0.0 % SAND = 1.6
% SILT = 45.8 % CLAY = 52.6 (% CLAY COLLOIDS = 32.7)

D85= 0.01 D60= 0.002 D50= 0.002
D30= 0.0009

PERMEABILITY TEST REPORT

TEST DATA:

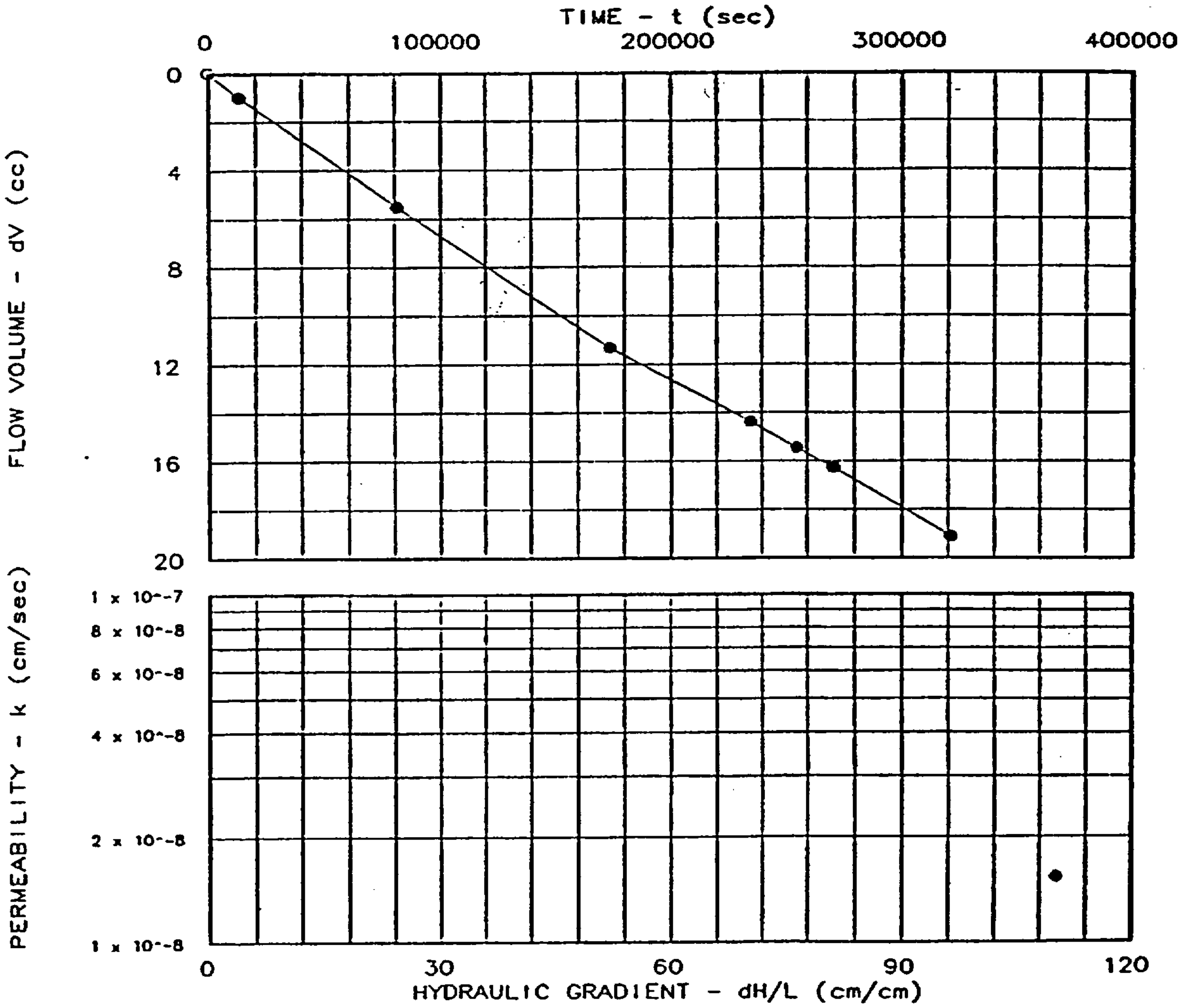
Specimen Height (cm): 6.97
Specimen Diameter (cm): 6.10
Dry Unit Weight (pcf): 137.7
Moisture Before Test (%): 4.7
Moisture After Test (%): 9.0
Run Number: 1 ● 2 ▲
Cell Pressure (psi): 30.0
Test Pressure(psi): 27.0
Back Pressure(psi): 16.1
Diff. Head (psi): 10.9
Flow Rate (cc/sec): 5.82 x 10--5
Perm. (cm/sec): 1.54 x 10--8

SAMPLE DATA:

Sample Identification: BORING: 108
DEPTH: 60.0'
Visual Description: RED SILTY CLAY, TR SAND
Remarks:

Maximum Dry Density (pcf):
Optimum Moisture Content (%):

Percent Compaction:
Permeameter type: FLEXIBLE WALL
Sample type: CORE



Project: LEA COUNTY LANDFILL
Location: HOBBS, NEW MEXICO
Date: 12-8-97

PERMEABILITY TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Project No.: 95042.10
File No.: 95042.10
Lab No.: 2
Tested by: JWM
Checked by: WSG
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name: LEA COUNTY LANDFILL
e No.: 95042.10
.oject Location: HOBBS, NEW MEXICO
Project No.: 95042.10
Sample Identification: BORING: 108
DEPTH: 60.0'
Lab No.: 2
Description: RED SILTY CLAY,
TR SAND
Sample Type: CORE
Max. Dry Dens.:
Method (D1557/D698):
Opt. Water Content:
Date: 12-8-97
Remarks:

Permeameter Type: FLEXIBLE WALL
Tested by: JWM
Checked by: WSG
Test type: CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:		After test:	
. .ameter:	1	2	1	2
Top:	in	in	in	in
Middle:	2.403 in	in	2.401 in	in
Bottom:	in	in	in	in
Average:	2.40 in	6.10 cm	2.40 in	6.10 cm

Length:	1	2	3	1	2	3
	2.745 in	in	in	2.786 in	in	i
Average:	2.75 in	6.97 cm		2.79 in	7.08 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.72	
Wet Wt. & Tare:	471.10	490.70
Dry Wt. & Tare:	450.10	450.10
Tare Wt.:	0.00	0.00
Moisture Content:	4.7 %	9.0 %
Dry Unit Weight:	137.7 pcf	135.9 pcf
Porosity:	0.1889	0.1995
Saturation:	54.5 %	98.5 %

Cell No.: 2 Panel No.: Positions:

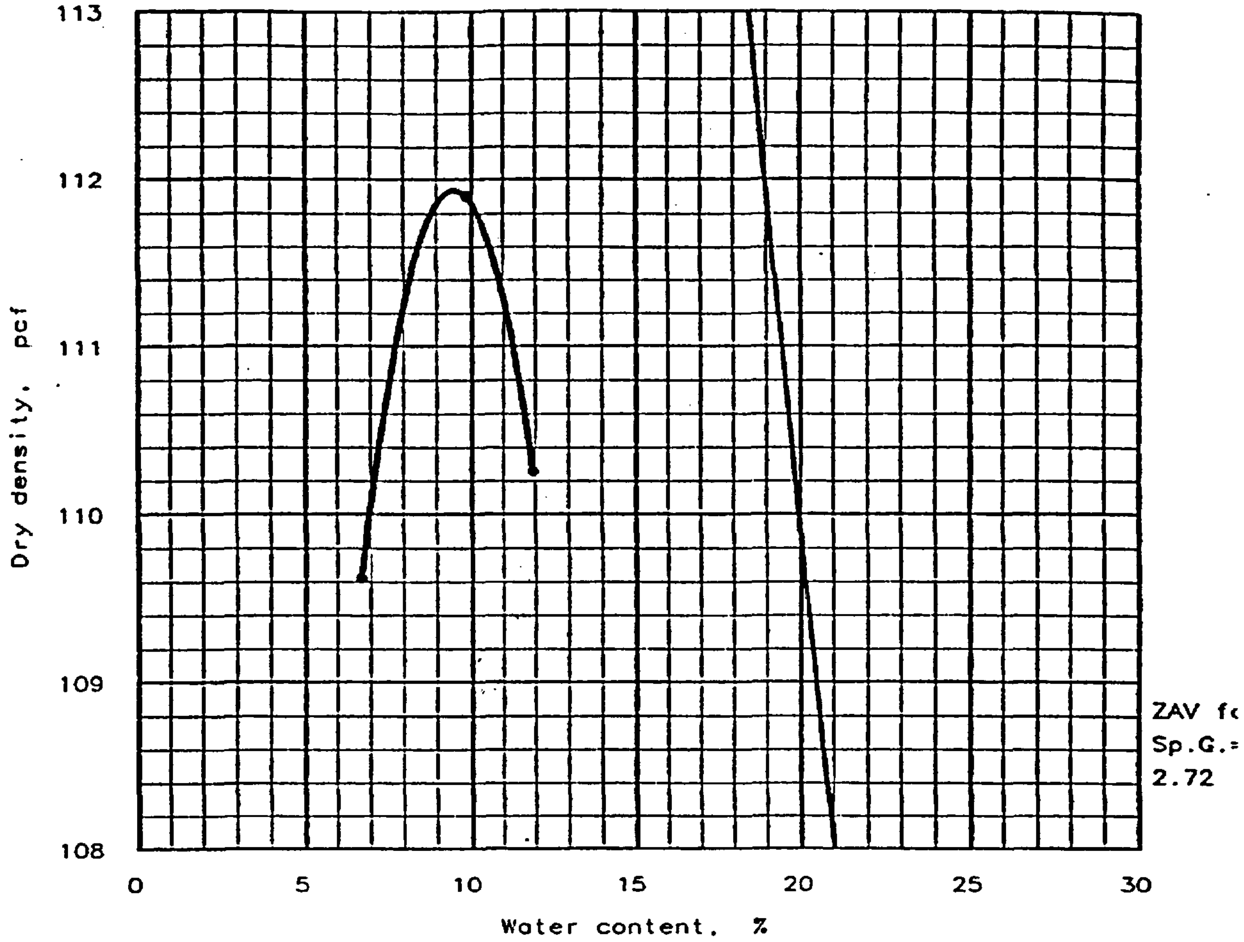
Run Number:	1	2
Cell Pressure:	30.0 psi	0.0 psi
Saturation Pressure:	30.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	27.0 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D S	X R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	GAUGE PRESSURE-psi OUT	BURET READING-cc IN	BURET READING-cc OUT	FLOW VOLUME-cc AVERAGE
S	X	12/12/97	13:18:00	0	27.0	17.0	6.00	86.20	0.00
		12/12/97	16:54:00	12,960	27.0	17.0	7.00	85.20	1.00
		12/13/97	11:45:00	80,820	27.0	17.0	11.60	80.80	5.50
		12/14/97	13:32:00	173,640	27.0	17.0	17.70	75.30	11.30
		12/15/97	6:31:00	234,780	27.0	17.0	20.70	72.20	14.35
		12/15/97	12:11:00	255,180	27.0	17.0	21.80	71.10	15.45
		12/15/97	16:35:00	271,020	27.0	17.0	22.60	70.30	16.25
		12/16/97	6:28:00	321,000	27.0	17.0	25.40	67.40	19.10

Test Pressure = 27.0 psi Differential Head = 10.9 psi, 767.3 cm H2O
Gradient = 1.100E 02 Flow rate = 5.821E-05 cc/sec R squared = 0.9977
Permeability, K27.0° = 1.808E-08 cm/sec, K20° = 1.537E-08 cm/sec

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-91 Procedure A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.2
	USCS	AASHTO						
	CL			2.72			0.0 %	98.

TEST RESULTS	MATERIAL DESCRIPTIO
Maximum dry density = 111.9 pcf Optimum moisture = 9.5 %	RED SILTY CLAY, TR SAND

Project No.: 95042.10

Project: LEA COUNTY LANDFILL

Location: HOBBS, NEW MEXICO

Date: 12-16-97

Remarks:

BORING: 108

DEPTH: 60.0'

MOISTURE-DENSITY RELATIONSHIP TEST

WEAVER BOOS CONSULTANTS, INC.

Fig. No. ______

PROJECT DATA

Date: 12-16-97
ject no.: 95042.10
Project: LEA COUNTY LANDFILL
Location 1: HOBBS, NEW MEXICO
2:
Remarks 1: BORING: 108
2: DEPTH: 60.0'
3:
Material 1: RED SILTY CLAY,
description 2: TR SAND
Elevation or depth:
Fig no:

SPECIMEN DATA

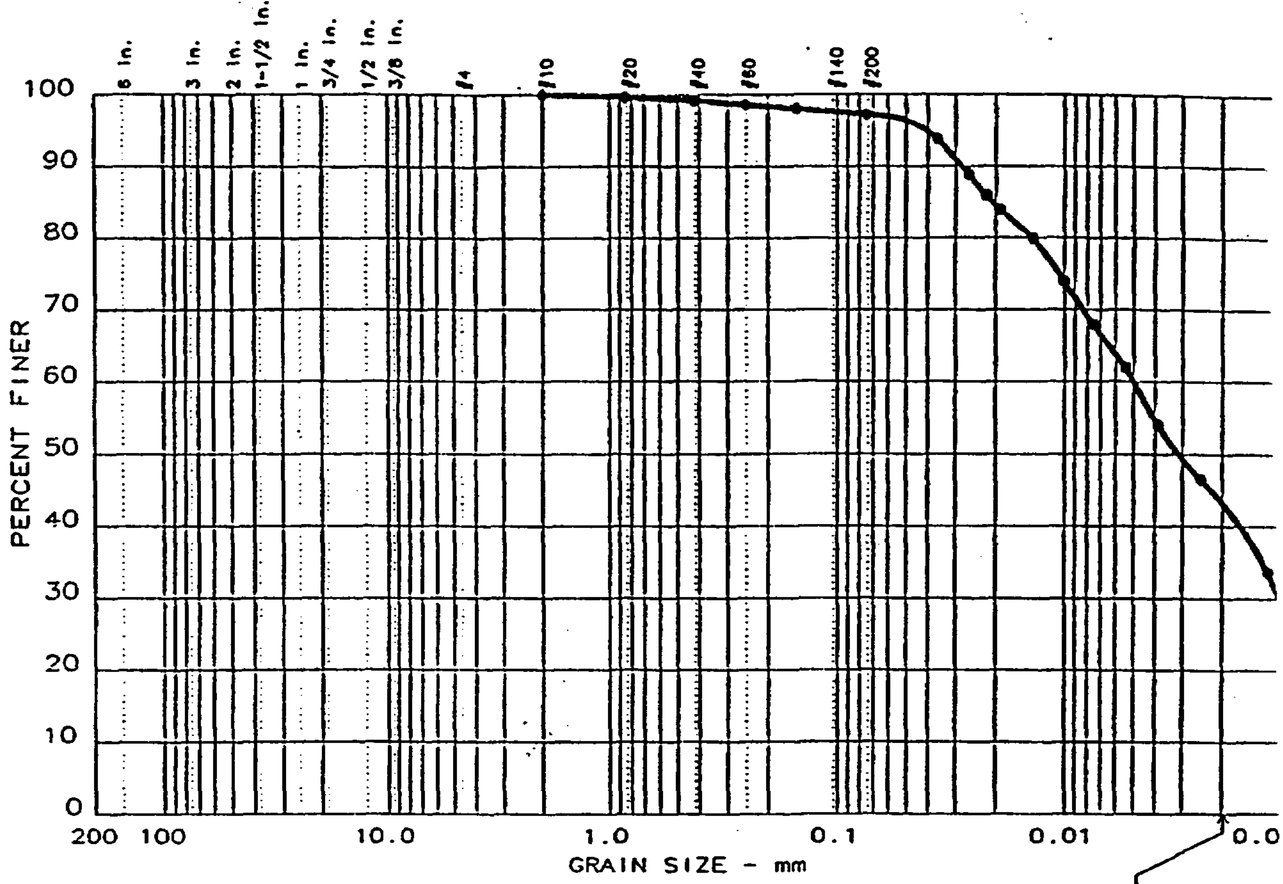
USCS classification: CL
AASHTO classification:
Natural moisture:
Specific gravity: 2.72
Percent retained on No.4 sieve: 0.0
Percent passing No. 200 sieve: 98.4
Liquid limit:
Plastic limit:
Plasticity index:

TEST DATA AND RESULTS

Type of test: Standard, ASTM D 698-91 Procedure A

Max dry den= 111.9 pcf
Opt moisture= 9.5 %

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	3	0.0	0.0	2.8	53.8	43.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA			0.0031	0.0011				

MATERIAL DESCRIPTION	USCS	AASHTO
● RED SILTY CLAY, TR SAND	CL	

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 12-10-97

Remarks:
BORING: 109
DEPTH: 80.0'

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

```
------------------------------------------------------------------------
Date: 12-10-97
Project No.: 95042.10
Project: LEA COUNTY LANDFILL
========================================================================

------------------------------------------------------------------------
                              Sample Data
------------------------------------------------------------------------
Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SILTY CLAY, TR SAND
USCS Class: CL                     Liquid limit: NA
AASHTO Class:                      Plasticity index: NA
------------------------------------------------------------------------
                                 Notes
------------------------------------------------------------------------
Remarks: BORING: 109  DEPTH: 80.0'

Fig. No.:
------------------------------------------------------------------------
                       Mechanical Analysis Data
------------------------------------------------------------------------
                    Initial
Dry sample and tare=  336.20
Tare               =    0.00
Dry sample weight  =  336.20
Sample split on number 10 sieve
Split sample data:
  Sample and tare = 50  Tare =  0  Sample weight = 50
  Cumulative weight retained tare= 0
   e for cumulative weight retained= 0
  Sieve          Cumul. Wt.  Percent
                 retained    finer
  # 10             0.00       100.0
  # 20             0.20        99.6
  # 40             0.40        99.2
  # 60             0.70        98.6
  # 100            1.00        98.0
  # 200            1.40        97.2
------------------------------------------------------------------------
                       Hydrometer Analysis Data
------------------------------------------------------------------------
Separation sieve is number 10
Percent -# 10 based on complete sample= 100.0
Weight of hydrometer sample: 50
Calculated biased weight=  50.00
Automatic temperature correction
  Composite correction at 20 deg C =-4.5

Meniscus correction only= 1
Specific gravity of solids= 2.67
Specific gravity correction factor= 0.995
```

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
1.0	23.0	51.0	47.2	0.0131	52.0	7.8	0.0364	93.9
2.0	23.0	48.5	44.7	0.0131	49.5	8.2	0.0264	88.9
3.0	23.0	47.0	43.2	0.0131	48.0	8.4	0.0219	85.9
4.0	23.0	46.0	42.2	0.0131	47.0	8.6	0.0192	83.9
8.0	23.0	44.0	40.2	0.0131	45.0	8.9	0.0138	80.0
16.0	23.0	41.0	37.2	0.0131	42.0	9.4	0.0100	74.0
30.0	23.0	38.0	34.2	0.0131	39.0	9.9	0.0075	68.0
60.0	23.0	35.0	31.2	0.0131	36.0	10.4	0.0054	62.0
125.0	23.0	31.0	27.2	0.0131	32.0	11.0	0.0039	54.1
330.0	22.0	27.5	23.4	0.0132	28.5	11.6	0.0025	46.6
1410.0	22.0	21.0	16.9	0.0132	22.0	12.7	0.0013	33.7
2850.0	23.0	15.5	11.7	0.0131	16.5	13.6	0.0009	23.2

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0   % GRAVEL = 0.0   % SAND = 2.8
% SILT = 53.8   % CLAY = 43.4   (% CLAY COLLOIDS = 26.7)

D85= 0.02 D60= 0.005 D50= 0.003
D30= 0.0011

PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 5.72
Specimen Diameter (cm): 6.43
Dry Unit Weight (pcf): 107.3
Moisture Before Test (%): 12.3
Moisture After Test (%): 21.8

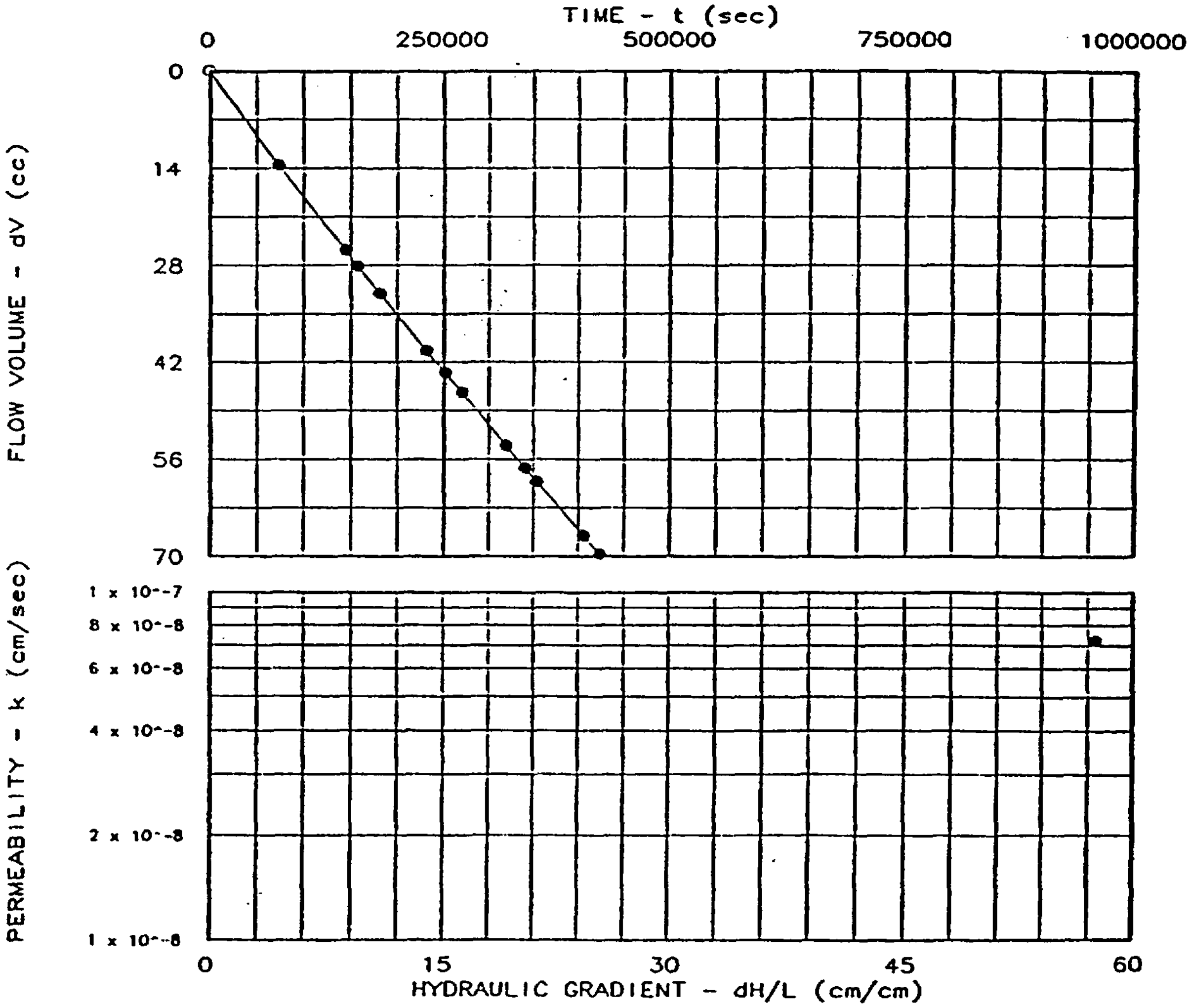
Run Number:	1 ●	2 ▲
Cell Pressure (psi):	30.0	
Test Pressure(psi):	25.0	
Back Pressure(psi):	20.3	
Diff. Head (psi):	4.7	
Flow Rate (cc/sec):	1.59 x 10^-4	
Perm. (cm/sec):	7.25 x 10^-8	

SAMPLE DATA:

Sample Identification: BORING: 109
DEPTH: 80.0'
Visual Description: RED SILTY CLAY, TR SAND
Remarks:

Maximum Dry Density (pcf):
Optimum Moisture Content (%):

Percent Compaction:
Permeameter type: FLEXIBLE WALL
Sample type: CORE



Project: LEA COUNTY LANDFILL
Location: HOBBS, NEW MEXICO
Date: 12-3-97

PERMEABILITY TEST REPORT
WEAVER BOOS CONSULTANTS, INC.

Project No.: 95042.10
File No.: 95042.10
Lab No.: 1
Tested by: JWM
Checked by: WSG
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name:	LEA COUNTY LANDFILL
e No.:	95042.10
oject Location:	HOBBS, NEW MEXICO
Project No.:	95042.10
Sample Identification:	BORING: 109 DEPTH: 80.0'
Lab No.:	1
Description:	RED SILTY CLAY, TR SAND
Sample Type:	CORE
Max. Dry Dens.:	
Method (D1557/D698):	
Opt. Water Content:	
Date:	12-3-97
Remarks:	

Permeameter Type:	FLEXIBLE WALL
Tested by:	JWM
Checked by:	WSG
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:		After test:	
iameter:	1	2	1	2
Top:	in	in	in	in
Middle:	2.531 in	in	2.508 in	in
Bottom:	in	in	in	in
Average:	2.53 in	6.43 cm	2.51 in	6.37 cm

	Before test:			After test:		
Length:	1	2	3	1	2	3
	2.253 in	in	in	2.301 in	in	in
Average:	2.25 in	5.72 cm		2.30 in	5.84 cm	

Moisture, Density and Sample Parameters:

	Before test:	After test:
Specific Gravity:	2.67	
Wet Wt. & Tare:	358.70	389.00
Dry Wt. & Tare:	319.40	319.40
Tare Wt.:	0.00	0.00
Moisture Content:	12.3 %	21.8 %
Dry Unit Weight:	107.3 pcf	107.0 pcf
Porosity:	0.3560	0.3578
Saturation:	59.4 %	104.4 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 1 Panel No.: Positions:

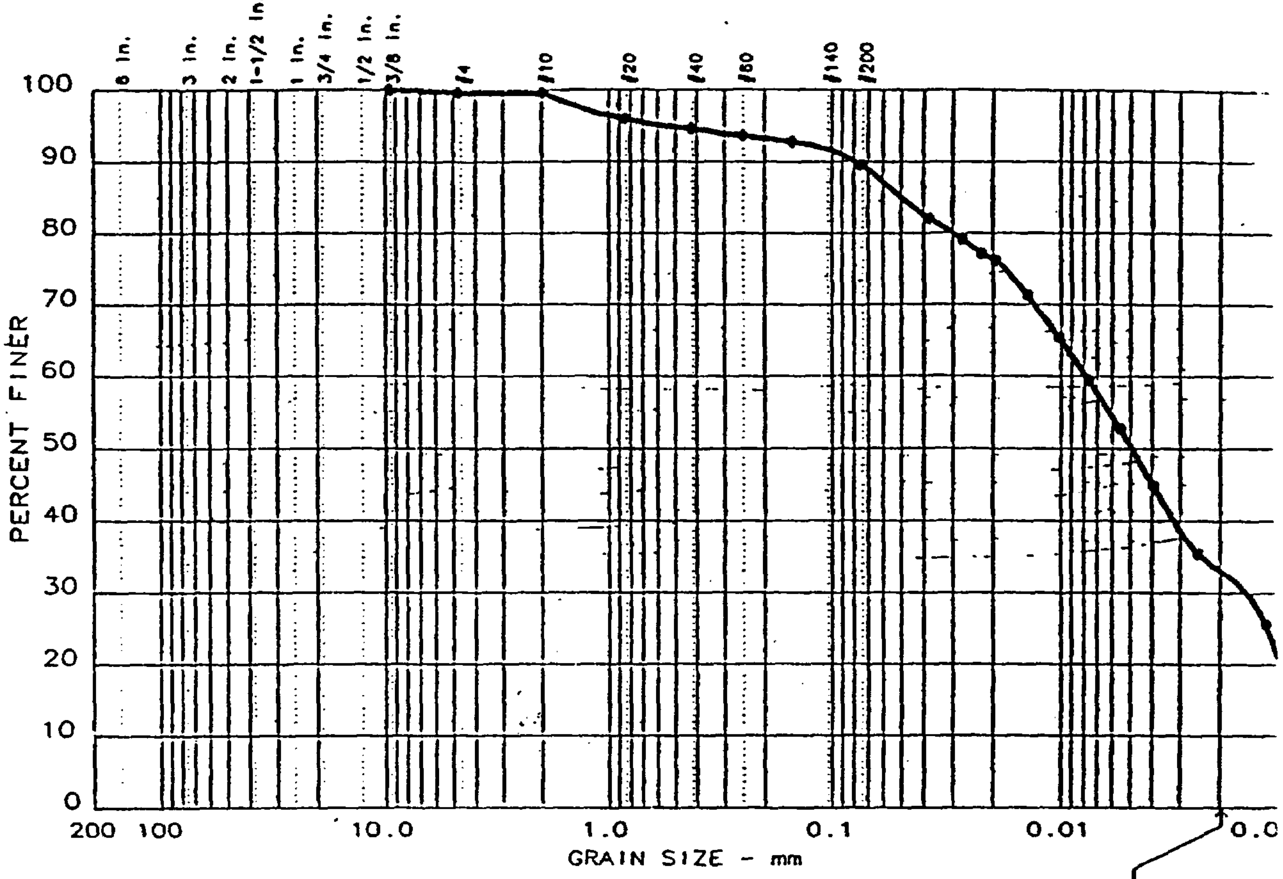
Run Number:	1	2
Cell Pressure:	30.0 psi	0.0 psi
Saturation Pressure:	30.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	27.0 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	 OUT	BURET READING-cc IN	 OUT	FLOW VOLUME-cc AVERAGE
S X	12/ 6/97	14:51:00	0	25.0	20.0	12.00	81.40	0.00
	12/ 7/97	11:10:00	73,140	25.0	20.0	26.30	68.70	13.50
	12/ 8/97	6:50:00	143,940	25.0	20.0	38.80	56.60	25.80
	12/ 8/97	10:34:00	157,380	25.0	20.0	41.20	54.40	28.10
	12/ 8/97	17:08:00	181,020	25.0	20.0	45.10	50.50	32.00
	12/ 9/97	7:15:00	231,840	25.0	20.0	53.40	42.20	40.30
	12/ 9/97	12:39:00	251,280	25.0	20.0	56.70	39.20	43.45
	12/ 9/97	17:48:00	269,820	25.0	20.0	59.70	36.40	46.35
	12/10/97	7:25:00	318,840	25.0	20.0	67.30	28.80	53.9
	12/10/97	13:25:00	340,440	25.0	20.0	70.60	25.60	57.2
	12/10/97	17:01:00	353,400	25.0	20.0	72.60	23.60	59.
	12/11/97	7:32:00	405,660	25.0	20.0	80.50	16.00	66.95
	12/11/97	12:37:00	423,960	25.0	20.0	83.20	13.40	69.60

Test Pressure = 25.0 psi Differential Head = 4.7 psi, 328.8 cm H2O
Gradient = 5.746E 01 Flow rate = 1.590E-04 cc/sec R squared = 0.99911
Permeability, K27.0° = 8.523E-08 cm/sec, K20° = 7.247E-08 cm/sec

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	15	0.0	0.4	10.0	56.5	33.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA			0.0049	0.0015	0.0010			

MATERIAL DESCRIPTION	USCS	AASHTO
● RED SILTY CLAY, LITTLE SAND	CL	A-4

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 12-23-97

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Remarks:

BORING: 110

DEPTH: 90.0'

Figure No. ______

```
--------------------------------------------------------------------------------
Date: 12-23-97
Project No.: 95042.10
Project: LEA COUNTY LANDFILL
================================================================================

--------------------------------------------------------------------------------
                                  Sample Data
--------------------------------------------------------------------------------
Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SILTY CLAY, LITTLE SAND
USCS Class: CL                         Liquid limit: NA
AASHTO Class: A-4                      Plasticity index: NA
--------------------------------------------------------------------------------
                                     Notes
--------------------------------------------------------------------------------
Remarks: BORING: 110  DEPTH: 90.0'

Fig. No.:
--------------------------------------------------------------------------------
                            Mechanical Analysis Data
--------------------------------------------------------------------------------
                     Initial
Dry sample and tare=   427.40
Tare               =     0.00
Dry sample weight  =   427.40
Sample split on number 10 sieve
Split sample data:
  Sample and tare = 50  Tare =  0  Sample weight = 50
  Cumulative weight retained tare= 0
   e for cumulative weight retained= 0
  Sieve          Cumul. Wt.   Percent
                 retained     finer
  0.375 inches      0.00       100.0
  # 4               1.80        99.6
  # 10              1.80        99.6
  # 20              1.80        96.0
  # 40              2.50        94.6
  # 60              3.00        93.6
  # 100             3.40        92.8
  # 200             5.00        89.6
--------------------------------------------------------------------------------
                           Hydrometer Analysis Data
--------------------------------------------------------------------------------
Separation sieve is number 10
Percent -# 10 based on complete sample=  99.6
Weight of hydrometer sample: 50
Calculated biased weight=  50.21
Automatic temperature correction
  Composite correction at 20 deg C =-4

Meniscus correction only= 1
```

Specific gravity correction factor= 0.980
Hydrometer type: 152H   Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
1.0	22.5	45.5	42.0	0.0129	46.5	8.7	0.0379	82.1
2.0	22.5	44.0	40.5	0.0129	45.0	8.9	0.0272	79.1
3.0	22.5	43.0	39.5	0.0129	44.0	9.1	0.0224	77.2
4.0	22.5	42.5	39.0	0.0129	43.5	9.2	0.0195	76.2
8.0	22.5	40.0	36.5	0.0129	41.0	9.6	0.0141	71.3
16.0	22.5	37.0	33.5	0.0129	38.0	10.1	0.0102	65.5
30.0	22.5	34.0	30.5	0.0129	35.0	10.6	0.0076	59.6
60.0	22.5	30.5	27.0	0.0129	31.5	11.1	0.0055	52.8
125.0	22.5	26.5	23.0	0.0129	27.5	11.8	0.0040	45.0
330.0	23.0	21.5	18.2	0.0128	22.5	12.6	0.0025	35.5
1410.0	23.0	16.5	13.2	0.0128	17.5	13.4	0.0012	25.7
2850.0	23.0	10.0	6.7	0.0128	11.0	14.5	0.0009	13.0

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0   % GRAVEL = 0.4   % SAND = 10.0
% SILT = 56.5   % CLAY = 33.1   (% CLAY COLLOIDS = 17.1)

D85= 0.05 D60= 0.008 D50= 0.005
D30= 0.0015 D15= 0.00095

PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.10
Specimen Diameter (cm): 6.36
Dry Unit Weight (pcf): 103.0
Moisture Before Test (%): 13.8
Moisture After Test (%): 24.4

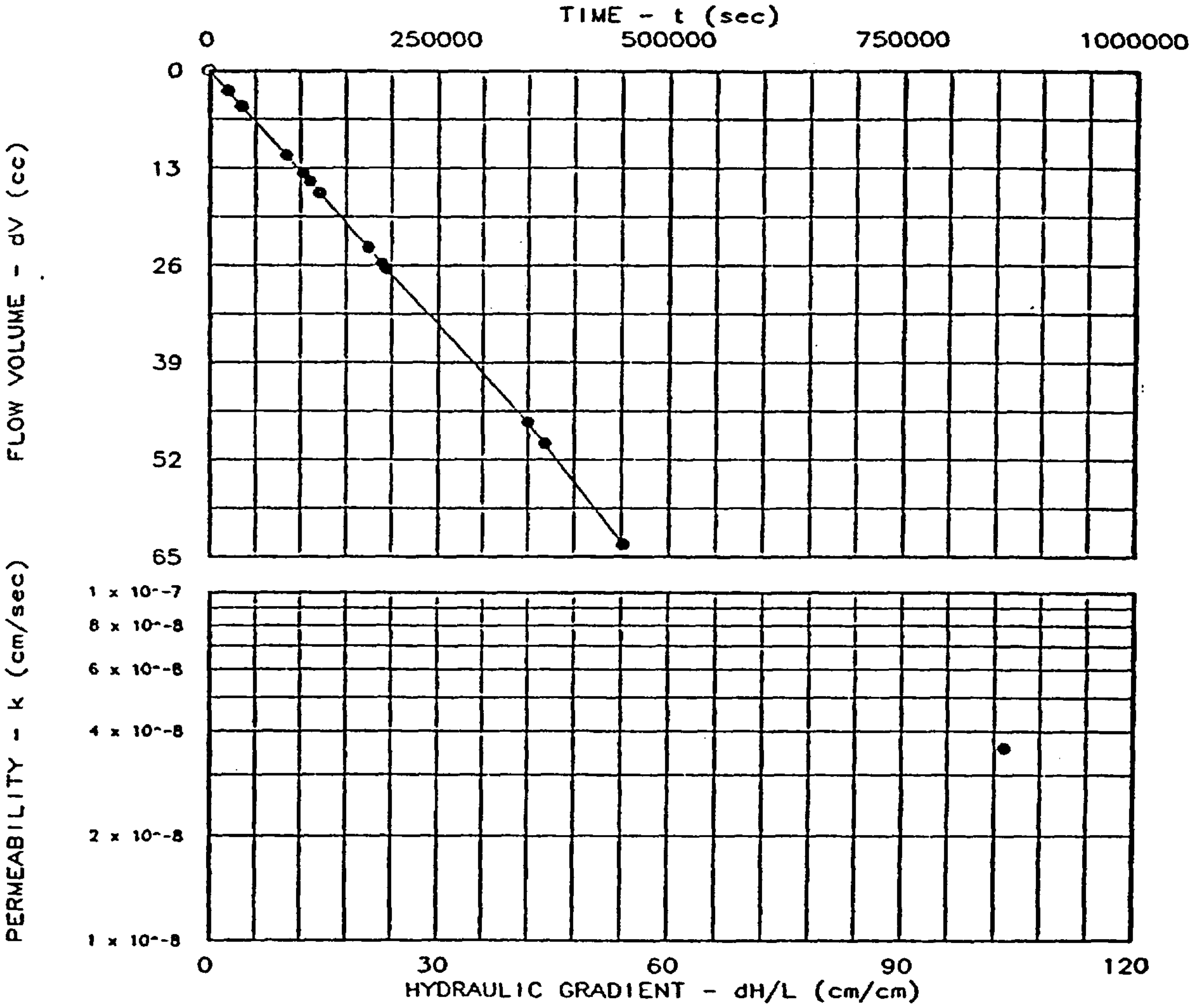
Run Number:	1 ●	2 ▲
Cell Pressure (psi):	35.0	
Test Pressure(psi):	27.0	
Back Pressure(psi):	16.6	
Diff. Head (psi):	10.4	
Flow Rate (cc/sec):	1.38 x 10--4	
Perm. (cm/sec):	3.58 x 10--8	

SAMPLE DATA:

Sample Identification: BORING: 110
DEPTH: 90.0'
Visual Description: RED SILTY CLAY, LI'. SAND
Remarks:

Maximum Dry Density (pcf):
Optimum Moisture Content (%):

Percent Compaction:
Permeometer type: FLEXIBLE WALL
Sample type: CORE



Project: LEA COUNTY LANDFILL
Location: HOBBS, NEW MEXICO
Date: 12-18-97

PERMEABILITY TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Project No.: 95042.10
File No.: 95042.10
Lab No.: 1
Tested by: JWM
Checked by: WSG
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name: LEA COUNTY LANDFILL
e No.: 95042.10
Project Location: HOBBS, NEW MEXICO
Project No.: 95042.10
Sample Identification: BORING: 110
DEPTH: 90.0'
Lab No.: 1
Description: RED SILTY CLAY, LITTLE SAND
Sample Type: CORE
Max. Dry Dens.:
Method (D1557/D698):
Opt. Water Content:
Date: 12-18-97
Remarks:

Permeameter Type: FLEXIBLE WALL
Tested by: JWM
Checked by: WSG
Test type: CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:		After test:	
Diameter:	1	2	1	2
Top:	in	in	in	in
Middle:	2.502 in	in	2.505 in	in
Bottom:	in	in	in	in
Average:	2.50 in	6.36 cm	2.51 in	6.36 cm

	Before test:			After test:		
Length:	1	2	3	1	2	3
	2.795 in	in	in	2.802 in	in	ir
Average:	2.80 in	7.10 cm		2.80 in	7.12 cm	

Moisture, Density and Sample Parameters:

	Before test:	After test:
Specific Gravity:	2.74	
Wet Wt. & Tare:	422.80	462.00
Dry Wt. & Tare:	371.50	371.50
Tare Wt.:	0.00	0.00
Moisture Content:	13.8 %	24.4 %
Dry Unit Weight:	103.0 pcf	102.5 pcf
Porosity:	0.3979	0.4009
Saturation:	57.3 %	99.8 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

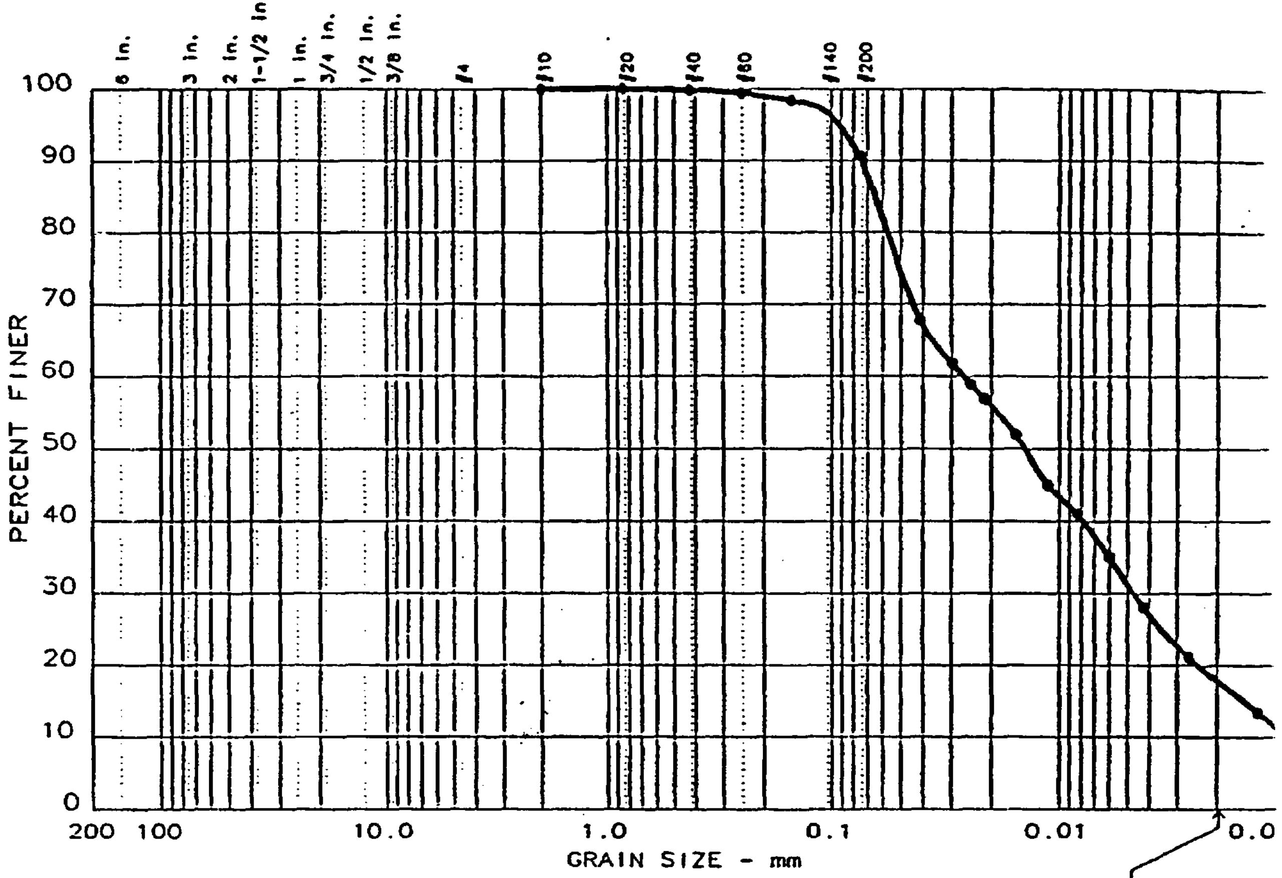
Cell No.: 1	Panel No.:	Positions:
Run Number:	1	2
Cell Pressure:	35.0 psi	0.0 psi
Saturation Pressure:	35.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	27.0 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	 OUT	BURET READING-cc IN	 OUT	FLOW VOLUME-cc AVERAGE
S X	12/22/97	7:32:00	0	27.0	17.0	4.40	80.60	0.00
	12/22/97	13:04:00	19,920	27.0	17.0	7.20	78.00	2.70
	12/22/97	17:15:00	34,980	27.0	17.0	9.20	76.00	4.70
	12/23/97	6:47:00	83,700	27.0	17.0	15.90	69.60	11.25
	12/23/97	11:57:00	102,300	27.0	17.0	18.40	67.20	13.70
	12/23/97	14:02:00	109,800	27.0	17.0	19.40	66.20	14.70
	12/23/97	17:03:00	120,660	27.0	17.0	21.00	64.70	16.25
	12/24/97	7:48:00	173,760	27.0	17.0	28.50	57.60	23.55
	12/24/97	12:10:00	189,480	27.0	17.0	30.60	55.40	25.70
	12/24/97	13:30:00	194,280	27.0	17.0	31.40	54.80	26.4
	12/26/97	8:38:00	349,560	27.0	17.0	52.60	35.00	46.[illegible]
	12/26/97	13:36:00	367,440	27.0	17.0	55.00	31.60	49.80
	12/27/97	13:08:00	452,160	27.0	17.0	69.60	19.20	63.30

Test Pressure = 27.0 psi Differential Head = 10.4 psi, 733.0 cm H2O
Gradient = 1.033E 02 Flow rate = 1.380E-04 cc/sec R squared = 0.99924
Permeability, K27.0° = 4.213E-08 cm/sec, K20° = 3.582E-08 cm/sec

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	5	0.0	0.0	9.4	72.7	17.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA			0.0141	0.0047	0.0015	0.0010	0.86	27.2

MATERIAL DESCRIPTION	USCS	AASHTO
● RED SILTY CLAY, TR SAND	CL	

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 12-10-97

Remarks:

BORING: 110

DEPTH: 230.0'

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

```
------------------------------------------------------------------------------
Date: 12-10-97
Project No.: 95042.10
Project: LEA COUNTY LANDFILL
==============================================================================

------------------------------------------------------------------------------
                              Sample Data
------------------------------------------------------------------------------
Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SILTY CLAY, TR SAND
USCS Class: CL                       Liquid limit: NA
AASHTO Class:                        Plasticity index: NA
------------------------------------------------------------------------------
                                 Notes
------------------------------------------------------------------------------
Remarks: BORING: 110  DEPTH: 230.0'

Fig. No.:
------------------------------------------------------------------------------
                        Mechanical Analysis Data
------------------------------------------------------------------------------
                     Initial
Dry sample and tare=   335.30
Tare               =     0.00
Dry sample weight  =   335.30
Sample split on number 10 sieve
Split sample data:
  Sample and tare = 50  Tare =  0  Sample weight = 50
 -Cumulative weight retained tare= 0
   e for cumulative weight retained= 0
  Sieve            Cumul. Wt.   Percent
                   retained     finer
  # 10                0.00       100.0
  # 20                0.00       100.0
  # 40                0.10        99.8
  # 60                0.30        99.4
  # 100               0.80        98.4
  # 200               4.70        90.6
------------------------------------------------------------------------------
                        Hydrometer Analysis Data
------------------------------------------------------------------------------
Separation sieve is number 10
Percent -# 10 based on complete sample= 100.0
Weight of hydrometer sample: 50
Calculated biased weight=  50.00
Automatic temperature correction
  Composite correction at 20 deg C =-4

Meniscus correction only= 1
Specific gravity of solids= 2.68
Specific gravity correction factor= 0.993
```

```
Hydrometer type: 152H   Effective depth L= 16.294964 - 0.164 x Rm

 Elapsed     Temp, Actual   Corrected K          Rm     Eff.   Diameter  Percent
 time, min   deg C reading  reading                     depth  mm        finer
    1.0      23.0  37.5     34.2       0.0130   38.5   10.0   0.0412    67.9
    2.0      23.0  34.5     31.2       0.0130   35.5   10.5   0.0298    61.9
    3.0      23.0  33.0     29.7       0.0130   34.0   10.7   0.0246    58.9
    4.0      23.0  32.0     28.7       0.0130   33.0   10.9   0.0215    56.9
    8.0      23.0  29.5     26.2       0.0130   30.5   11.3   0.0155    52.0
   16.0      23.0  26.0     22.7       0.0130   27.0   11.9   0.0112    45.0
   30.0      23.0  24.0     20.7       0.0130   25.0   12.2   0.0083    41.1
   60.0      23.0  21.0     17.7       0.0130   22.0   12.7   0.0060    35.1
  125.0      23.0  17.5     14.2       0.0130   18.5   13.3   0.0042    28.1
  330.0      23.0  14.0     10.7       0.0130   15.0   13.8   0.0027    21.2
 1410.0      23.5  10.0      6.8       0.0130   11.0   14.5   0.0013    13.5
 2850.0      23.5   8.0      4.8       0.0130    9.0   14.8   0.0009     9.5
-----------------------------------------------------------------------------
                             Fractional Components
-----------------------------------------------------------------------------
Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. =  0.0    % GRAVEL =  0.0   % SAND =  9.4
% SILT = 72.7    % CLAY = 17.9    (% CLAY COLLOIDS = 10.4)

D85=   0.06  D60=   0.026  D50=   0.014
D30=   0.0047  D15=   0.00150  D10=  0.00097
Cc =   0.8610  Cu =  27.2270
```

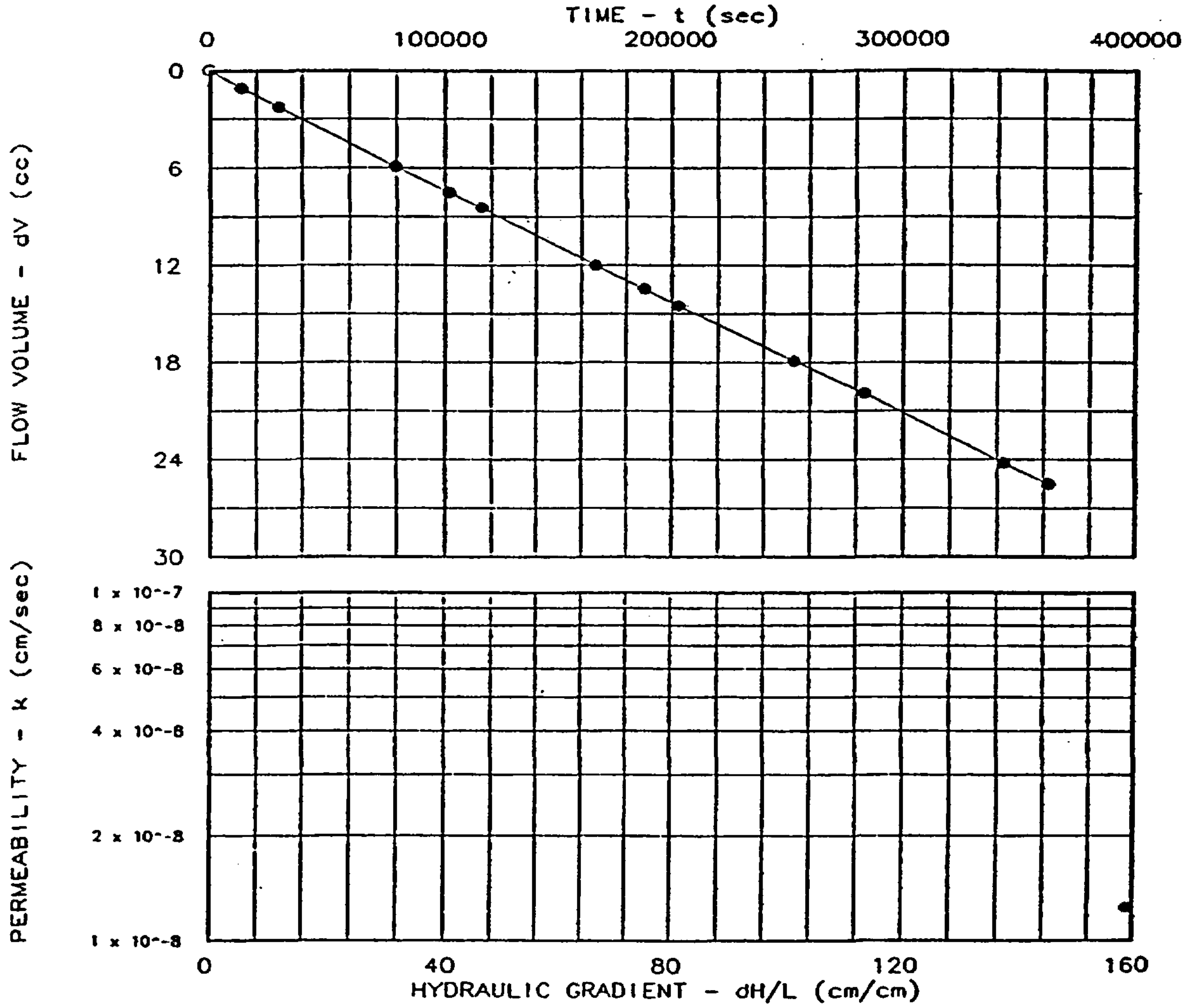
PERMEABILITY TEST REPORT

TEST DATA:
Specimen Height (cm): 4.82
Specimen Diameter (cm): 6.17
Dry Unit Weight (pcf): 118.6
Moisture Before Test (%): 9.6
Moisture After Test (%): 15.3
Run Number: 1 ● 2 ▲
Cell Pressure (psi): 30.0
Test Pressure(psi): 27.0
Back Pressure(psi): 16.1
Diff. Head (psi): 10.9
Flow Rate (cc/sec): 6.97 x 10^-5
Perm. (cm/sec): 1.25 x 10^-8

SAMPLE DATA:
Sample Identification: BORING: 110
DEPTH: 230.0'
Visual Description: RED SILTY CLAY, TR SAND
Remarks:

Maximum Dry Density (pcf):
Optimum Moisture Content (%):

Percent Compaction:
Permeameter type: FLEXIBLE WALL
Sample type: CORE



Project: LEA COUNTY LANDFILL
Location: HOBBS, NEW MEXICO
Date: 12-12-97

PERMEABILITY TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Project No.: 95042.10
File No.: 95042.10
Lab No.: 5
Tested by: JWM
Checked by: WSG
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name: LEA COUNTY LANDFILL
e No.: 95042.10
Project Location: HOBBS, NEW MEXICO
Project No.: 95042.10
Sample Identification: BORING: 110
DEPTH: 230.0'
Lab No.: 5
Description: RED SILTY CLAY,
TR SAND
Sample Type: CORE
Max. Dry Dens.:
Method (D1557/D698):
Opt. Water Content:
Date: 12-12-97
Remarks:

Permeameter Type: FLEXIBLE WALL
Tested by: JWM
Checked by: WSG
Test type: CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
Diameter:	1	2		1	2	
Top:	in	in		in	in	
Middle:	2.431 in	in		2.456 in	in	
Bottom:	in	in		in	in	
Average:	2.43 in	6.17 cm		2.46 in	6.24 cm	
Length:	1	2	3	1	2	3
	1.899 in	in	in	1.873 in	in	in
Average:	1.90 in	4.82 cm		1.87 in	4.76 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.68	
Wet Wt. & Tare:	300.50	316.30
Dry Wt. & Tare:	274.30	274.30
Tare Wt.:	0.00	0.00
Moisture Content:	9.6 %	15.3 %
Dry Unit Weight:	118.6 pcf	117.8 pcf
Porosity:	0.2914	0.2961
Saturation:	62.2 %	97.5 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 5 Panel No.: Positions:

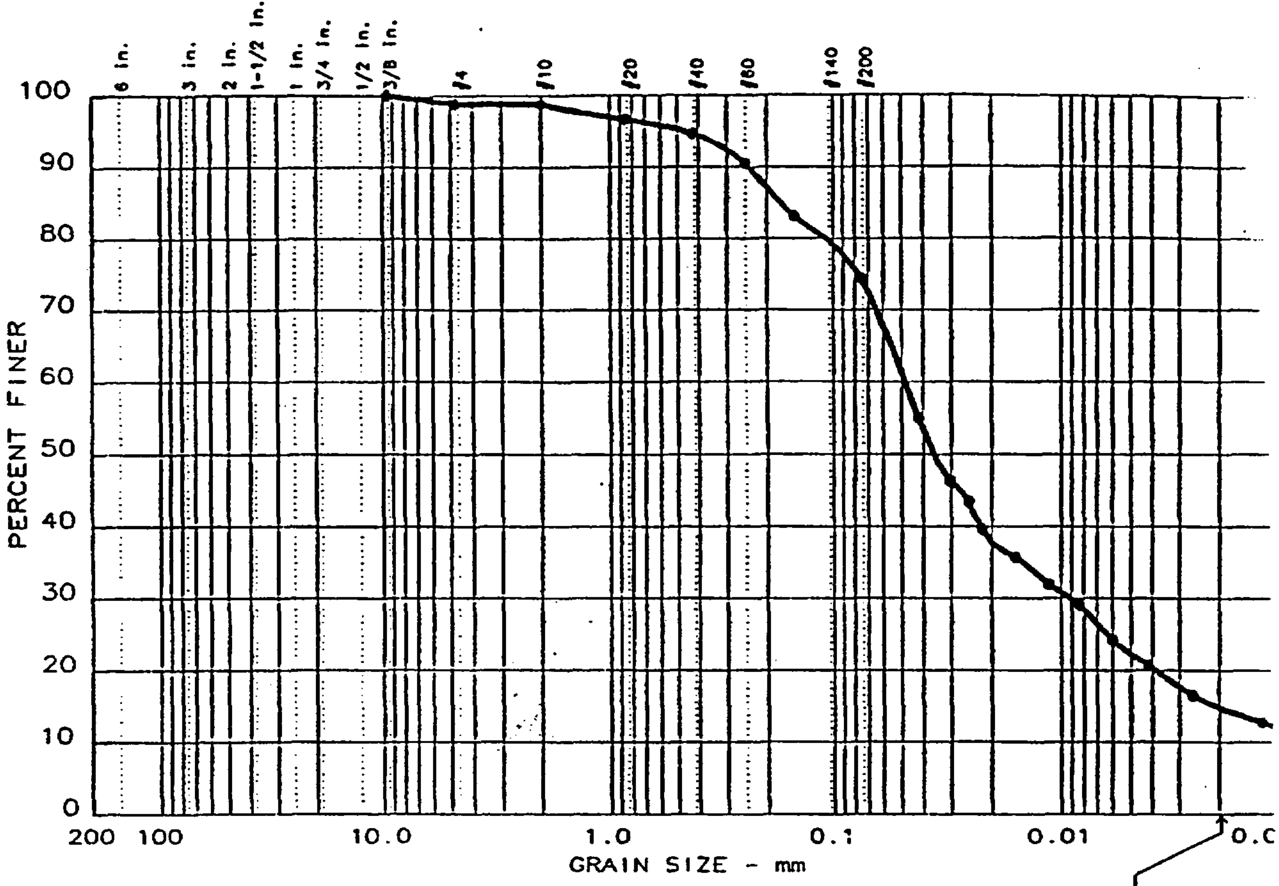
Run Number:	1	2
Cell Pressure:	30.0 psi	0.0 psi
Saturation Pressure:	30.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	27.0 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi		BURET READING-cc		FLOW VOLUME-cc AVERAGE
				IN	OUT	IN	OUT	
S X	12/15/97	8:26:00	0	27.0	17.0	4.10	84.70	0.00
	12/15/97	12:13:00	13,620	27.0	17.0	5.30	83.70	1.10
	12/15/97	16:37:00	29,460	27.0	17.0	6.50	82.60	2.25
	12/16/97	6:30:00	79,440	27.0	17.0	10.30	79.10	5.90
	12/16/97	12:45:00	101,940	27.0	17.0	12.00	77.60	7.50
	12/16/97	16:27:00	115,260	27.0	17.0	13.00	76.70	8.45
	12/17/97	6:39:00	166,380	27.0	17.0	16.60	73.20	12.00
	12/17/97	12:34:00	187,680	27.0	17.0	18.10	71.80	13.45
	12/17/97	16:47:00	202,860	27.0	17.0	19.20	70.80	14.50
	12/18/97	6:43:00	253,020	27.0	17.0	22.60	67.40	17.90
	12/18/97	15:09:00	283,380	27.0	17.0	24.60	65.40	19.9
	12/19/97	7:41:00	342,900	27.0	17.0	29.00	61.20	24.20
	12/19/97	12:54:00	361,680	27.0	17.0	30.30	59.90	25.50

Test Pressure = 27.0 psi Differential Head = 10.9 psi, 765.7 cm H2O
Gradient = 1.588E 02 Flow rate = 6.970E-05 cc/sec R squared = 0.99986
Permeability, K27.0° = 1.466E-08 cm/sec, K20° = 1.247E-08 cm/sec

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	6	0.0	1.1	24.4	59.6	14.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA	0.170		0.0357	0.0090	0.0020			

MATERIAL DESCRIPTION	USCS	AASHTO
● RED SILTY CLAY, SOME SAND, TR FINE GRAVEL	CL	

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 12-15-97

Remarks:
BORING: 110
DEPTH: 350.0'

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

```
                         GRAIN SIZE DISTRIBUTION TEST DATA          Test No.: 6
-------------------------------------------------------------------------------
Date: 12-15-97
Project No.: 95042.10
Project: LEA COUNTY LANDFILL
===============================================================================

-------------------------------------------------------------------------------
                                  Sample Data
-------------------------------------------------------------------------------
Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SILTY CLAY, SOME SAND, TR FINE GRAVEL
USCS Class: CL                          Liquid limit: NA
AASHTO Class:                           Plasticity index: NA
-------------------------------------------------------------------------------
                                     Notes
-------------------------------------------------------------------------------
Remarks: BORING: 110  DEPTH: 350.0'

Fig. No.:
-------------------------------------------------------------------------------
                            Mechanical Analysis Data
-------------------------------------------------------------------------------
                         Initial
Dry sample and tare=   444.50
Tare               =     0.00
Dry sample weight  =   444.50
Sample split on number 10 sieve
Split sample data:
  Sample and tare = 50  Tare =  0  Sample weight = 50
  Cumulative weight retained tare= 0
   e for cumulative weight retained= 0
 Sieve              Cumul. Wt.   Percent
                    retained     finer
  0.375 inches         0.00       100.0
  # 4                  5.00        98.9
  # 10                 5.20        98.8
  # 20                 1.10        96.7
  # 40                 2.10        94.7
  # 60                 4.20        90.5
  # 100                7.90        83.2
  # 200               12.30        74.5
-------------------------------------------------------------------------------
                            Hydrometer Analysis Data
-------------------------------------------------------------------------------
Separation sieve is number 10
Percent -# 10 based on complete sample=  98.8
Weight of hydrometer sample: 50
Calculated biased weight=  50.59
Automatic temperature correction
  Composite correction at 20 deg C =-4

Meniscus correction only= 1
```

Specific gravity correction factor= 0.970
Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
1.0	23.0	32.0	28.7	0.0126	33.0	10.9	0.0417	55.0
2.0	23.0	27.5	24.2	0.0126	28.5	11.6	0.0304	46.4
3.0	23.0	26.0	22.7	0.0126	27.0	11.9	0.0251	43.5
4.0	23.0	24.0	20.7	0.0126	25.0	12.2	0.0221	39.6
8.0	23.0	22.0	18.7	0.0126	23.0	12.5	0.0158	35.8
16.0	23.0	20.0	16.7	0.0126	21.0	12.9	0.0113	32.0
30.0	23.0	18.5	15.2	0.0126	19.5	13.1	0.0083	29.1
60.0	23.0	16.0	12.7	0.0126	17.0	13.5	0.0060	24.3
125.0	23.5	14.0	10.8	0.0126	15.0	13.8	0.0042	20.7
330.0	23.0	12.0	8.7	0.0126	13.0	14.2	0.0026	16.6
1410.0	23.0	10.0	6.7	0.0126	11.0	14.5	0.0013	12.8
2850.0	23.5	9.0	5.8	0.0126	10.0	14.7	0.0009	11.1

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0   % GRAVEL = 1.1   % SAND = 24.4
% SILT = 59.6   % CLAY = 14.9   (% CLAY COLLOIDS = 11.6)

D85= 0.17 D60= 0.048 D50= 0.036
D30= 0.0090 D15= 0.00203

PERMEABILITY TEST REPORT

TEST DATA:

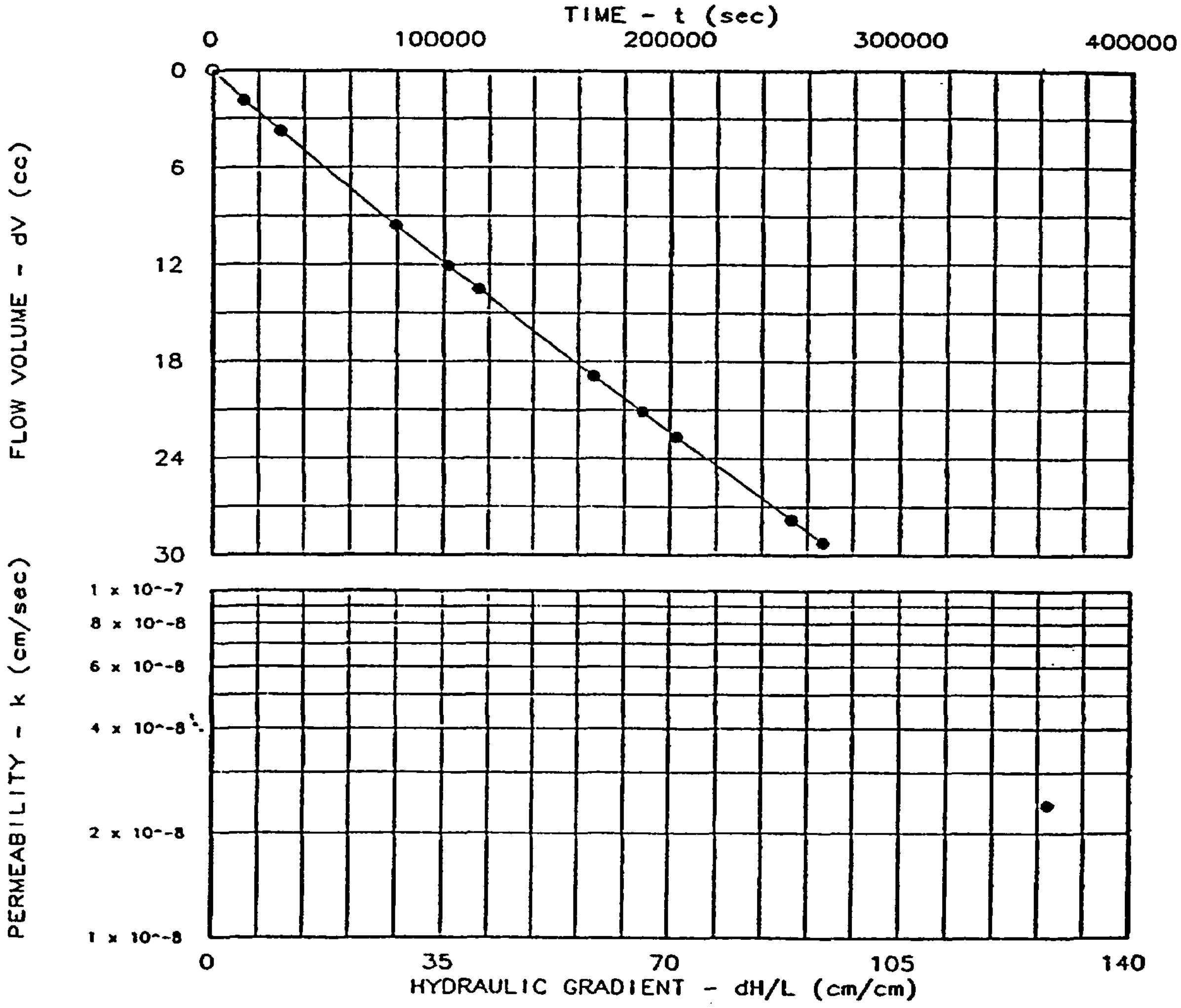
Specimen Height (cm): 5.93
Specimen Diameter (cm): 6.15
Dry Unit Weight (pcf): 106.8
Moisture Before Test (%): 13.4
Moisture After Test (%): 21.9
Run Number: 1 ● 2 ▲
Cell Pressure (psi): 30.0
Test Pressure(psi): 27.0
Back Pressure(psi): 16.3
Diff. Head (psi): 10.7
Flow Rate (cc/sec): 1.07 x 10^-4
Perm. (cm/sec): 2.41 x 10^-8

SAMPLE DATA:

Sample Identification: BORING: 110
DEPTH: 350.0'
Visual Description: RED SILTY CLAY, SOM-
SAND, TR FINE GRAVEL
Remarks:

Maximum Dry Density (pcf):
Optimum Moisture Content (%):

Percent Compaction:
Permeameter type: FLEXIBLE WALL
Sample type: CORE



Project: LEA COUNTY LANDFILL
Location: HOBBS, NEW MEXICO
Date: 12-11-97

PERMEABILITY TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Project No.: 95042.10
File No.: 95042.10
Lab No.: 1
Tested by: JWM
Checked by: WSG
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name:	LEA COUNTY LANDFILL
e No.:	95042.10
Project Location:	HOBBS, NEW MEXICO
Project No.:	95042.10
Sample Identification:	BORING: 110 DEPTH: 350.0'
Lab No.:	1
Description:	RED SILTY CLAY, SOME SAND, TR FINE GRAVEL
Sample Type:	CORE
Max. Dry Dens.:	
Method (D1557/D698):	
Opt. Water Content:	
Date:	12-11-97
Remarks:	

Permeameter Type:	FLEXIBLE WALL
Tested by:	JWM
Checked by:	WSG
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
iameter:	1	2		1	2	
Top:	in	in		in	in	
Middle:	2.423 in	in		2.408 in	in	
Bottom:	in	in		in	in	
Average:	2.42 in	6.15 cm		2.41 in	6.12 cm	
Length:	1	2	3	1	2	3
	2.334 in	in	in	2.350 in	in	i
Average:	2.33 in	5.93 cm		2.35 in	5.97 cm	

Moisture, Density and Sample Parameters:	Before test	After test
Specific Gravity:	2.79	
Wet Wt. & Tare:	342.00	367.50
Dry Wt. & Tare:	301.60	301.60
Tare Wt.:	0.00	0.00
Moisture Content:	13.4 %	21.9 %
Dry Unit Weight:	106.8 pcf	107.4 pcf
Porosity:	0.3870	0.3836
Saturation:	59.2 %	98.0 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 1　　Panel No.:　　Positions:

Run Number:	1	2
Cell Pressure:	30.0 psi	0.0 psi
Saturation Pressure:	30.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	27.0 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

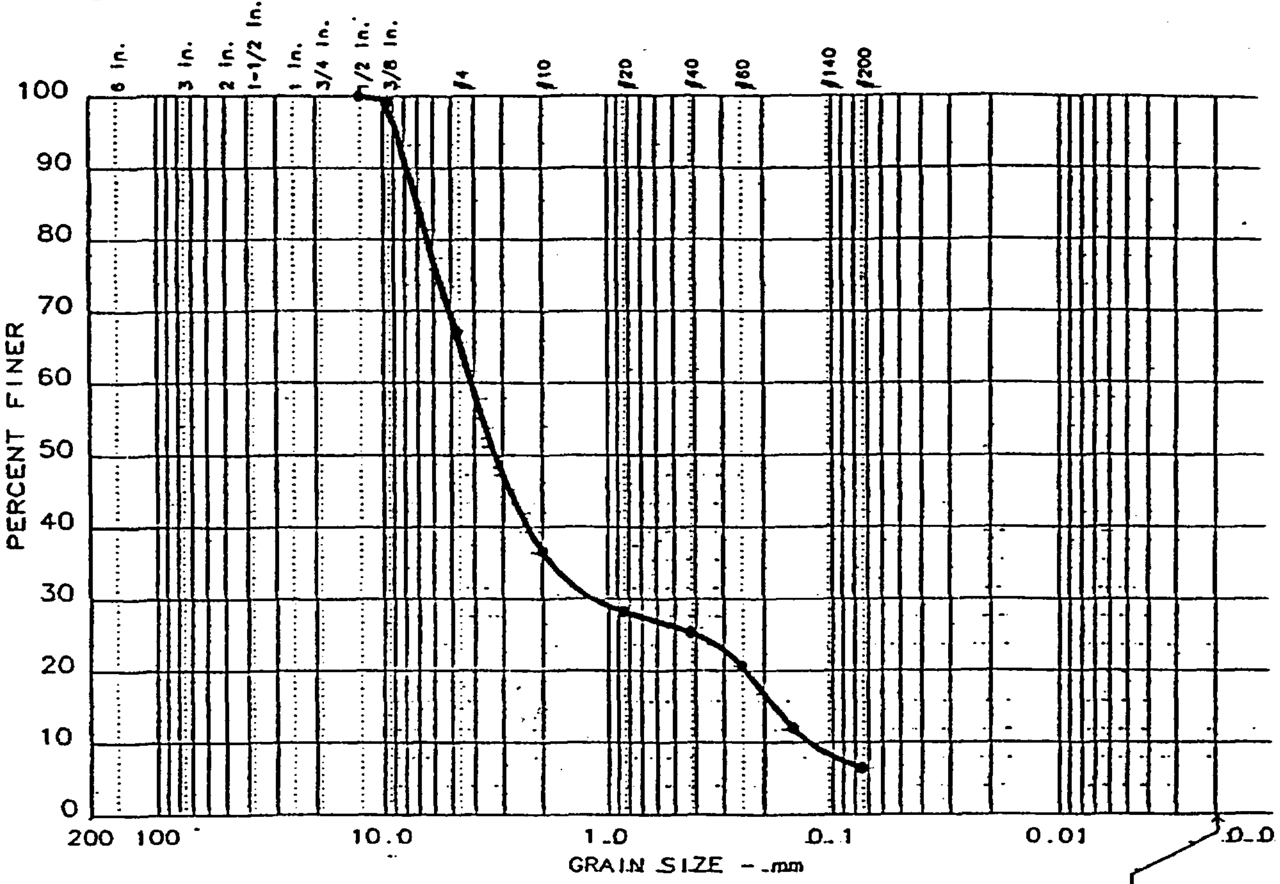
CASE D S	X R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	GAUGE PRESSURE-psi OUT	BURET READING-cc IN	BURET READING-cc OUT	FLOW VOLUME-cc AVERAGE
S	X	12/15/97	8:25:00	0	27.0	17.0	5.50	83.60	0.00
		12/15/97	12:11:00	13,560	27.0	17.0	7.50	81.90	1.85
		12/15/97	16:35:00	29,400	27.0	17.0	9.50	80.10	3.75
		12/16/97	6:28:00	79,380	27.0	17.0	15.40	74.40	9.55
		12/16/97	12:43:00	101,880	27.0	17.0	18.00	72.00	12.05
		12/16/97	16:25:00	115,200	27.0	17.0	19.50	70.60	13.50
		12/17/97	6:37:00	166,320	27.0	17.0	25.00	65.30	18.90
		12/17/97	12:32:00	187,620	27.0	17.0	27.20	63.10	21.10
		12/17/97	16:45:00	202,800	27.0	17.0	28.80	61.60	22.65
		12/18/97	6:41:00	252,960	27.0	17.0	34.00	56.50	27.80
		12/18/97	10:32:00	266,820	27.0	17.0	35.40	55.10	29.2

Test Pressure = 27.0 psi　Differential Head = 10.7 psi, 755.4 cm H2O

Gradient = 1.274E 02　Flow rate = 1.075E-04 cc/sec　R squared = 0.99922

Permeability, K27.0° = 2.836E-08 cm/sec,　K20° = 2.411E-08 cm/sec

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	3	0.0	32.9	60.6	6.5	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA	7.00	4.12	3.23	1.16	0.178	0.126	2.60	32.7

MATERIAL DESCRIPTION	USCS	AASHTO
● LIGHT PINK COARSE SAND, SOME FINE GRAVEL, TR SILT	SW-SM-	A-1-a

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 1-30-98

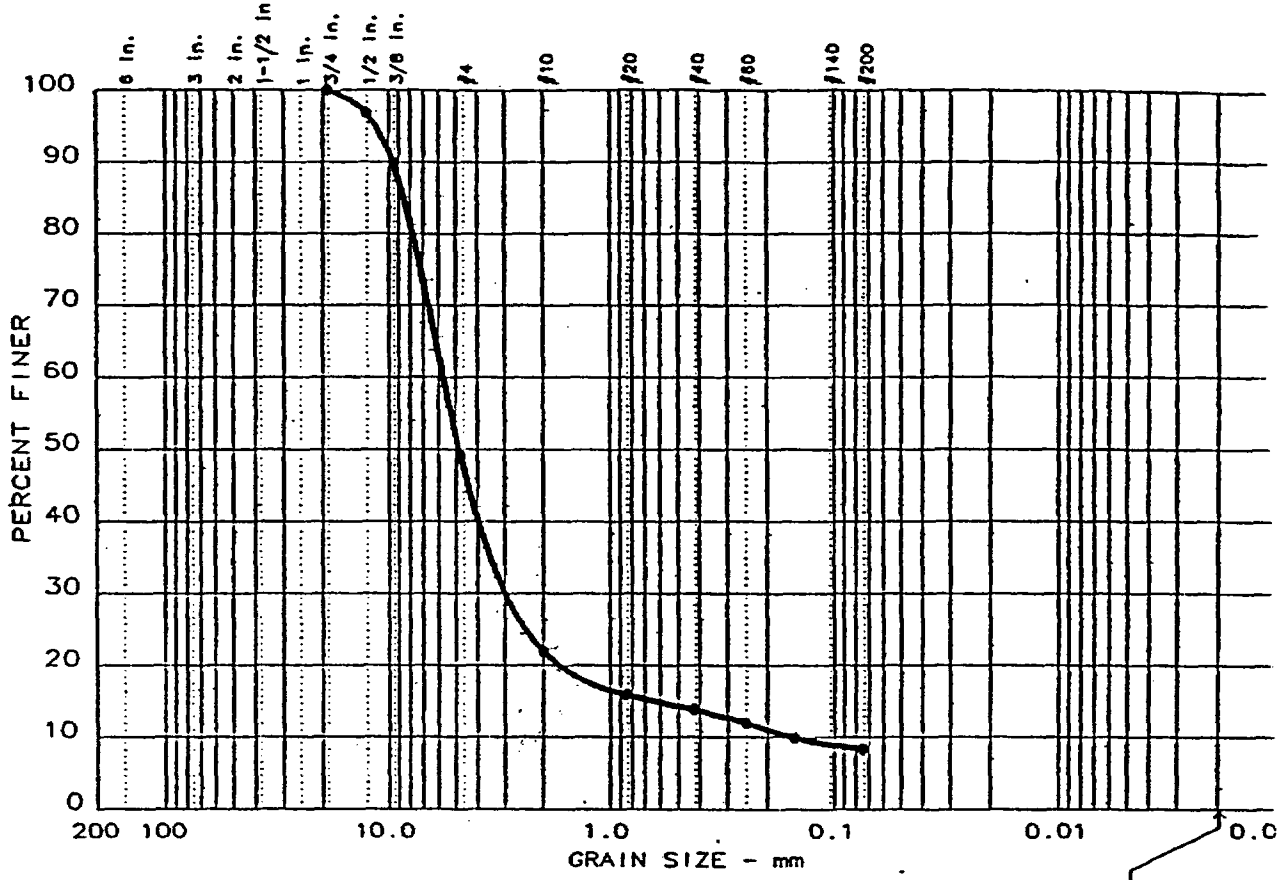
Remarks:
BORING: B-111
S-35

GRAIN SIZE DISTRIBUTION TEST REPORT
WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

```
                       GRAIN SIZE DISTRIBUTION TEST DATA          Test No.: 3
-------------------------------------------------------------------------------
Date: 1-30-98
Project No.: 95042.10
Project: LEA COUNTY LANDFILL
===============================================================================


-----------------------------------------------------------------------------
                                 Sample Data
-------------------------------------------------------------------------------
Location of Sample: HOBBS, NEW MEXICO
Sample Description: LIGHT PINK COARSE SAND,SOME FINE GRAVEL,TR SILT
USCS Class: SW-SM                      Liquid limit: NA
AASHTO Class: A-1-a                    Plasticity index: NA
-------------------------------------------------------------------------------
                                    Notes
-------------------------------------------------------------------------------
Remarks: BORING: B-111  S-35

Fig. No.:
-------------------------------------------------------------------------------
                           Mechanical Analysis Data
-------------------------------------------------------------------------------
                    Initial
Dry sample and tare=   192.90
Tare               =     0.00
Dry sample weight  =   192.90
Tare for cumulative weight retained= 0
  Sieve           Cumul. Wt.   Percent
                  retained     finer
  0.5   inches       0.00       100.0
  0.375 inches       1.40        99.3
  # 4               63.50        67.1
  # 10             122.20        36.7
  # 20             138.40        28.3
  # 40             144.00        25.3
  # 60             153.00        20.7
  # 100            169.60        12.1
  # 200            180.40         6.5
-------------------------------------------------------------------------------
                            Fractional Components
-------------------------------------------------------------------------------
Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. =  0.0     % GRAVEL = 32.9    % SAND = 60.6
% FINES =  6.5

D85=   7.00  D60=   4.116  D50=   3.232
D30=   1.1601  D15=   0.17762  D10=  0.12575
Cc =   2.6002  Cu =  32.7341
```

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	2	0.0	51.0	40.6	8.4	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA	8.51	5.68	4.83	2.98	0.601	0.153	10.22	37.

MATERIAL DESCRIPTION	USCS	AASHTO
● ROSE & WHITE F/M GRAVEL & SAND, TR SILT	GP-GM	A-1-a

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 1-30-98

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Remarks:

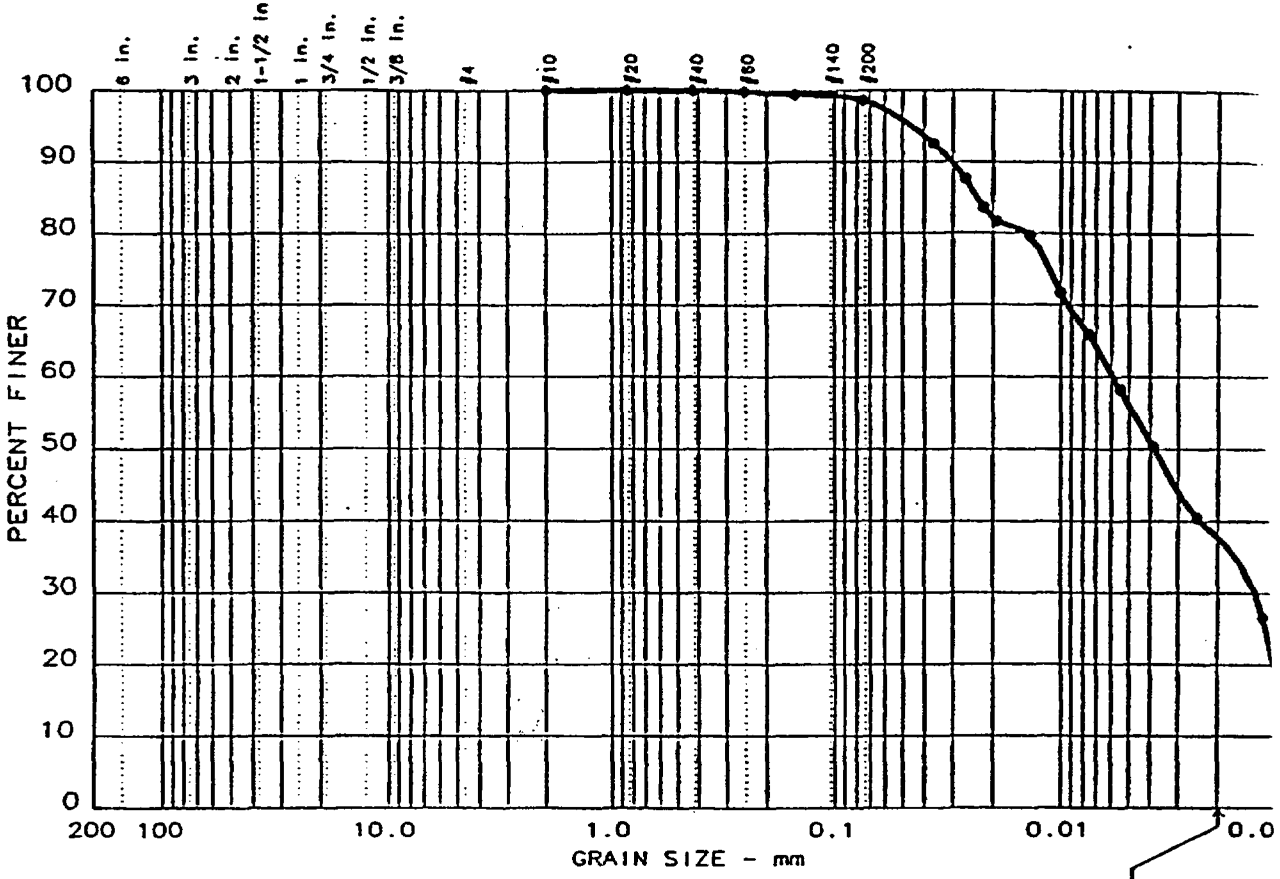
BORING: B-111

S-39

Figure No. ______

```
                    GRAIN SIZE DISTRIBUTION TEST DATA           Test No.: 2
------------------------------------------------------------------------
Date: 1-30-98
Project No.: 95042.10
Project: LEA COUNTY LANDFILL
========================================================================

------------------------------------------------------------------------
                              Sample Data
------------------------------------------------------------------------
Location of Sample: HOBBS, NEW MEXICO
Sample Description: ROSE & WHITE F/M GRAVEL & SAND, TR SILT
USCS Class: GP-GM                      Liquid limit: NA
AASHTO Class: A-1-a                    Plasticity index: NA
------------------------------------------------------------------------
                                 Notes
------------------------------------------------------------------------
Remarks: BORING: B-111  S-39

Fig. No.:
------------------------------------------------------------------------
                        Mechanical Analysis Data
------------------------------------------------------------------------
                       Initial
Dry sample and tare=    212.70
Tare               =      0.00
Dry sample weight  =    212.70
Tare for cumulative weight retained= 0
  Sieve            Cumul. Wt.   Percent
                   retained     finer
  0.75  inches        0.00       100.0
   .5   inches        6.80        96.8
  0.375 inches       21.30        90.0
  # 4               108.50        49.0
  # 10              165.90        22.0
  # 20              178.80        15.9
  # 40              183.20        13.9
  # 60              187.10        12.0
  # 100             191.60         9.9
  # 200             194.90         8.4
------------------------------------------------------------------------
                         Fractional Components
------------------------------------------------------------------------
Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. =  0.0     % GRAVEL = 51.0    % SAND = 40.6
% FINES =   8.4

D85=    8.51  D60=    5.682  D50=    4.831
D30=    2.9785  D15=    0.60117  D10=  0.15276
Cc =  10.2212  Cu =   37.1963
```

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	12	0.0	0.0	1.4	60.9	37.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA			0.0038	0.0014	0.0010	0.0009	0.34	6.2

MATERIAL DESCRIPTION	USCS	AASHTO
● RED SILTY CLAY, TR SAND	CL	

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 12-18-97

Remarks:

BORING: 111

DEPTH: 80.0'

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 12

Date: 12-18-97
Project No.: 95042.10
Project: LEA COUNTY LANDFILL

Sample Data

Location of Sample: HOBBS, NEW MEXICO
Sample Description: RED SILTY CLAY, TR SAND
USCS Class: CL   Liquid limit: NA
AASHTO Class: Plasticity index: NA

Notes

Remarks: BORING: 111 DEPTH: 80.0'

Fig. No.:

Mechanical Analysis Data

Initial
Dry sample and tare= 396.10
Tare = 0.00
Dry sample weight = 396.10
Sample split on number 10 sieve
Split sample data:
Sample and tare = 50 Tare = 0 Sample weight = 50
Cumulative weight retained tare= 0
e for cumulative weight retained= 0

Sieve	Cumul. Wt. retained	Percent finer
# 10	0.00	100.0
# 20	0.00	100.0
# 40	0.00	100.0
# 60	0.10	99.8
# 100	0.30	99.4
# 200	0.70	98.6

Hydrometer Analysis Data

Separation sieve is number 10
Percent -# 10 based on complete sample= 100.0
Weight of hydrometer sample: 50
Calculated biased weight= 50.00
Automatic temperature correction
Composite correction at 20 deg C =-3.5

Meniscus correction only= 1
Specific gravity of solids= 2.7
Specific gravity correction factor= 0.989

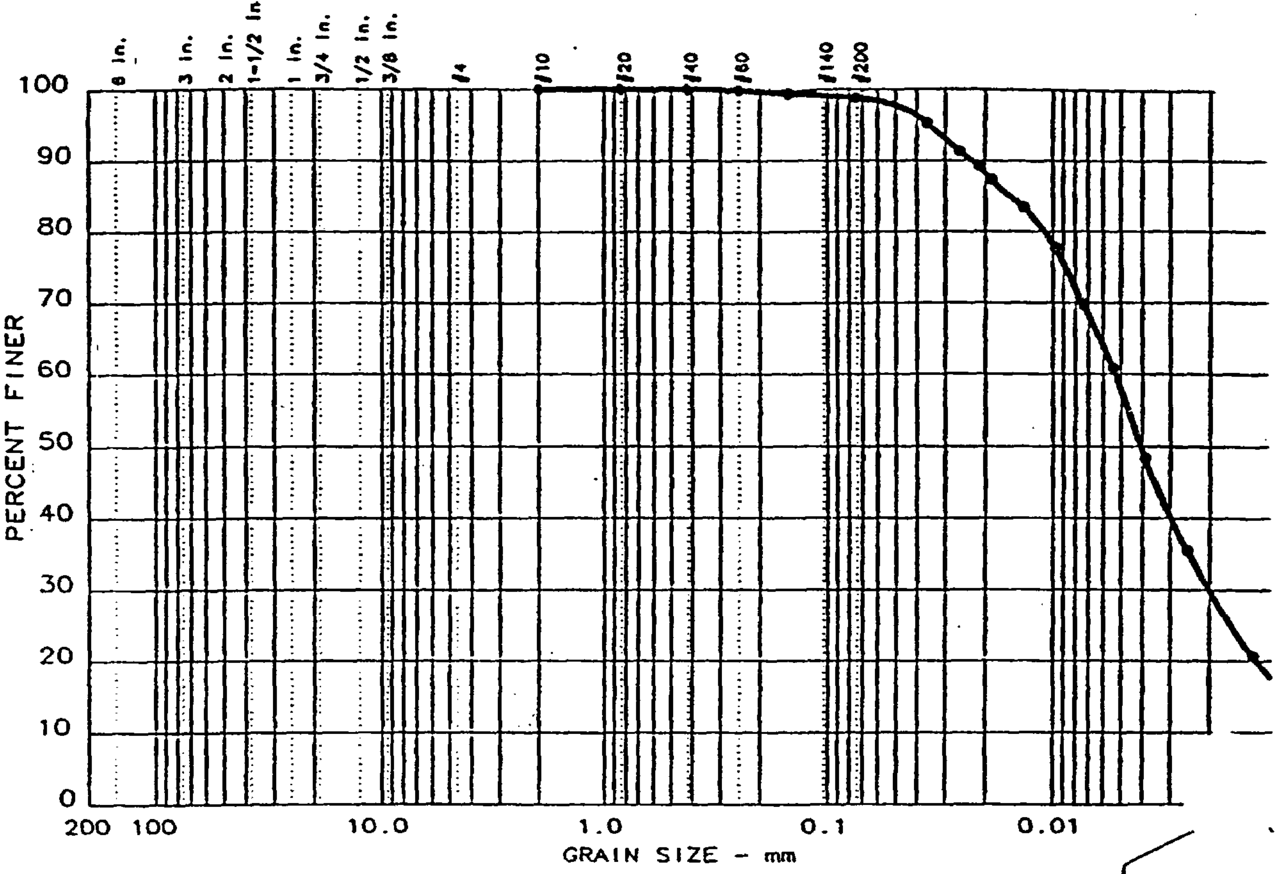
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
1.0	23.5	49.5	46.8	0.0129	50.5	8.0	0.0365	92.6
2.0	23.5	47.0	44.3	0.0129	48.0	8.4	0.0264	87.6
3.0	23.5	45.0	42.3	0.0129	46.0	8.8	0.0220	83.7
4.0	23.5	44.0	41.3	0.0129	45.0	8.9	0.0192	81.7
8.0	23.5	43.0	40.3	0.0129	44.0	9.1	0.0137	79.7
16.0	23.5	39.0	36.3	0.0129	40.0	9.7	0.0100	71.8
30.0	23.5	36.0	33.3	0.0129	37.0	10.2	0.0075	65.9
60.0	24.0	32.0	29.5	0.0128	33.0	10.9	0.0055	58.2
125.0	24.0	28.0	25.5	0.0128	29.0	11.5	0.0039	50.3
330.0	24.0	23.0	20.5	0.0128	24.0	12.4	0.0025	40.4
1410.0	24.0	16.0	13.5	0.0128	17.0	13.5	0.0013	26.6
2850.0	24.0	7.0	4.5	0.0128	8.0	15.0	0.0009	8.8

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0 % GRAVEL = 0.0 % SAND = 1.4
% SILT = 60.9 % CLAY = 37.7 (% CLAY COLLOIDS = 13.7)

D85= 0.02 D60= 0.006 D50= 0.004
D30= 0.0014 D15= 0.00102 D10= 0.00095
Cc = 0.3361 Cu = 6.1589

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	13	0.0	0.0	1.2	68.9	29.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NA	NA			0.0041	0.0020				

MATERIAL DESCRIPTION	USCS	AASHTO
● RED SILTY CLAY, TR SAND	CL	

Project No.: 95042.10
Project: LEA COUNTY LANDFILL
● Location: HOBBS, NEW MEXICO

Date: 12-18-97

Remarks:
BORING: 111
DEPTH: 140.0'

GRAIN SIZE DISTRIBUTION TEST REPORT
WEAVER BOOS CONSULTANTS, INC.

Figure No. ______

K

SEVERN TRENT STL

STL Denver
4955 Yarrow Street
Arvada, CO 80002

Tel: 303 736 0100 Fax: 303 431 7171
www.stl-inc.com

ANALYTICAL REPORT

URENCO Project

Lot #: D3J160213

Purchase Order 018511-0403003

John Shaw

Lockwood Greene
1500 International Drive
Spartanburg, SC 29304

STL DENVER

Gail DeRuzzo
Project Manager

November 19, 2003

Table Of Contents

Standard Deliverables

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Standard Deliverables *The Cover Letter and the Report Cover page are considered integral parts of this Standard Deliverable package. This report is incomplete unless all pages indicated in this Table of Contents are included.*	☐

- **Table of Contents**
- **Case Narrative**
- **Executive Summary – Detection Highlights**
- **Methods Summary**
- **Method/Analyst Summary**
- **Lot Sample Summary**
- **Analytical Results**
- **QC Data Association Summary**
- **Chain-of-Custody**

Case Narrative

Enclosed is the report for two samples received at STL's Denver laboratory on October 16, 2003. The results included in this report have been reviewed for compliance with STL Denver's Laboratory Quality Manual. The test results shown in this report meet all requirements of NELAC and any exceptions are noted below.

Dilution factors and footnotes have been provided to assist in the interpretation of the results. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interferences or analytes present at concentrations above the linear calibration curve, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

STL utilizes USEPA approved methods in all analytical work. The samples presented in this report were analyzed for the parameters listed on the analytical methods summary page in accordance with the methods indicated. A summary of quality control parameters is provided below.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Quality Control Summary for Lot D3J160213

Sample Receiving

- The cooler temperatures upon receipt at the Denver laboratory were 2.7, 3.4, and 2.8° C.
- The Trip Blank was received but not listed on the chain of custody. It was logged for volatile organic analysis.
- Triplicate volume was received for sample LES MW2. After discussion with the client, matrix QC was selected for the sample for all parameters that apply.
- Total and Fecal Coliform were collected a day later than all other parameters in order to allow sufficient time to meet the holding time for these tests.
- All sample bottles were received in acceptable condition.

Holding Times

- All holding times were met.

Method Blanks

- The analytes Methylene chloride Method 8260B and Aluminum and Copper Method 6010B were detected in the Method Blanks below the established reporting limits. No corrective action is taken for any values in Method Blanks that are below the requested reporting limits. In addition the sample result for Aluminum is greater than ten times the method blank value.
- All other Method Blanks were within established control limits.

Laboratory Control Samples

- The Laboratory Control Sample recovery for Aroclor 1260 by Method 8082 was above the upper control limit. The associated sample result is still considered valid because no target analytes were detected by Method 8082.

- The Laboratory Control Sample (LCS) recoveries were below the lower control limits for Diazinon, Ethyl parathion, Malathion, Methyl parathion, and Phorate by Method 8141A. The relative percent differences for these analytes were also outside control limits. The surrogate recovery for Chlormefos in the LCS was also outside control limits. The LCSD recoveries were in control and the MS/MSD recoveries for sample LES MW2 and another sample in the QC batch were all in control. This suggests that the method was in control and that there may have been problems with the preparation of the LCS only.

- All other Laboratory Control Samples were within established control limits.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

- The Matrix Spike and Matrix Spike Duplicate recoveries were outside control limits for Fluoride Method 300.0A on sample LES MW2. Because the corresponding Laboratory Control Sample and the Method Blank sample were within control limits, these anomalies may be due to matrix interference.

- Due to the result concentration exceeding the calibration range the MS/MSD results for Sulfate on sample LES MW2 are estimated.

- All other MS and MSD samples were within established control limits.

Organics

- The Continuing Calibration Verification (CCV) standards for 4,4'-DDD, Endosulfan II, Hepatchlor, Endrin aldehyde, and Endrin by Method 8081A exceeded the percent difference limits. However, the overall mean percent difference is within control limits, therefore, the CCV is also in control and no corrective action was necessary.

- The Continuing Calibration Verification (CCV) standards for TEPT, Demeton-S, Dimethoate, Merphos, and Naled by Method 8141A exceeded the percent difference limits. However, the overall mean percent difference is within control limits, therefore, the CCV is also in control and no corrective action was necessary. Additionally, the associated sample was non-detect.

EXECUTIVE SUMMARY - Detection Highlights

D3J160213

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
L.E.S. MW2 10/14/03 16:20 001				
4,4'-DDD	0.22	0.050	ug/L	SW846 8081A
Aluminum	480 J	100	ug/L	SW846 6010B
Barium	21	10	ug/L	SW846 6010B
Boron	1600	100	ug/L	SW846 6010B
Chromium	43	10	ug/L	SW846 6010B
Copper	8.6 B,J	10	ug/L	SW846 6010B
Iron	510	100	ug/L	SW846 6010B
Manganese	1000	10	ug/L	SW846 6010B
Molybdenum	40	20	ug/L	SW846 6010B
Nickel	34 B	40	ug/L	SW846 6010B
Zinc	16 B	20	ug/L	SW846 6010B
Acetone	2.8 J	10	ug/L	SW846 8260B
Methylene chloride	0.39 J,B	5.0	ug/L	SW846 8260B
Specific Conductance	6800	2.0	umhos/cm	MCAWW 120.1
Total Dissolved Solids	2500 Q	20	mg/L	MCAWW 160.1
Total Suspended Solids	6.2	4.0	mg/L	MCAWW 160.2
Chloride	1600 Q	300	mg/L	MCAWW 300.0A
Sulfate	2200 Q	500	mg/L	MCAWW 300.0A
Chemical Oxygen Demand (COD)	12 B	20	mg/L	MCAWW 410.4
TRIP BLANK 10/15/03 003				
Acetone	4.1 J	10	ug/L	SW846 8260B
Methylene chloride	0.61 J,B	5.0	ug/L	SW846 8260B

METHODS SUMMARY

D3J160213

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Chemical Oxygen Demand	MCAWW 410.4	MCAWW 410.4
Chloride	MCAWW 300.0A	MCAWW 300.0A
F. Coliform (Enumeration)	SM18 9222D Feca	SM18 9222D
Filterable Residue (TDS)	MCAWW 160.1	MCAWW 160.1
Fluoride	MCAWW 300.0A	MCAWW 300.0A
Inductively Coupled Plasma (ICP) Metals	SW846 6010B	SW846 3010A
Mercury in Liquid Waste (Manual Cold-Vapor)	SW846 7470A	SW846 7470A
Nitrate as N	MCAWW 300.0A	MCAWW 300.0A
Nitrite as N	MCAWW 300.0A	MCAWW 300.0A
Non-Filterable Residue (TSS)	MCAWW 160.2	MCAWW 160.2
Organochlorine Pesticides	SW846 8081A	SW846 3510C
Organophosphorous Compounds by GC	SW846 8141A	SW846 3510
PCBs by SW-846 8082	SW846 8082	SW846 3510C
Semivolatile Organic Compounds by GC/MS	SW846 8270C	SW846 3520C
Specific Conductance	MCAWW 120.1	MCAWW 120.1
Sulfate	MCAWW 300.0A	MCAWW 300.0A
T. Coliform (Enemeration)	SM18 9222B	SM18 9222B
Total Cyanide	MCAWW 335.3	MCAWW 335.3
Volatile Organics by GC/MS	SW846 8260B	SW846 5030B/826

References:

MCAWW	"Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.
SM18	"Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992.
SW846	"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

METHOD / ANALYST SUMMARY

D3J160213

ANALYTICAL METHOD	ANALYST	ANALYST ID
MCAWW 120.1	Nicole Dean	008504
MCAWW 160.1	Mark Angerhofer	005823
MCAWW 160.2	Claire Likar	004382
MCAWW 300.0A	Andrita Scofield	004409
MCAWW 335.3	Ewa Kudla	001167
MCAWW 410.4	Nicole Dean	008504
SM18 9222B	Claire Likar	004382
SM18 9222D Fecal	Claire Likar	004382
SW846 6010B	Kristen Roda	005692
SW846 6010B	Lynn-Anne Trudell	6645
SW846 7470A	Kacey Ono	003371
SW846 8081A	Sonya Dacar	011595
SW846 8082	Sonya Dacar	011595
SW846 8141A	Steve Szocik	002410
SW846 8260B	Greg Meier	006004
SW846 8270C	David Kidd	007536

References:

MCAWW	"Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.
SM18	"Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992.
SW846	"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

D3J160213

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
F2NR9	001	L.E.S. MW2	10/14/03	16:20
F2NT3	002	L.E.S. MW2	10/15/03	17:40
F2NT6	003	TRIP BLANK	10/15/03	

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW2

GC/MS Volatiles

Lot-Sample #...:	D3J160213-001	Work Order #...:	F2NR91A9	Matrix.........:	WATER
Date Sampled...:	10/14/03 16:20	Date Received..:	10/16/03		
Prep Date......:	10/27/03	Analysis Date..:	10/27/03		
Prep Batch #...:	3302592	Analysis Time..:	13:08		
Dilution Factor:	1				
		Method.........:	SW846 8260B		

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Acetone	**2.8 J**	**10**	**ug/L**	**2.5**
Benzene	ND	1.0	ug/L	0.17
Bromodichloromethane	ND	1.0	ug/L	0.20
Bromoform	ND	1.0	ug/L	0.23
Bromomethane	ND	2.0	ug/L	0.22
2-Butanone (MEK)	ND	5.0	ug/L	2.0
Carbon tetrachloride	ND	1.0	ug/L	0.20
Chlorobenzene	ND	1.0	ug/L	0.13
Chloroethane	ND	2.0	ug/L	0.18
Chloroform	ND	1.0	ug/L	0.17
Chloromethane	ND	2.0	ug/L	0.91
Dibromomethane	ND	1.0	ug/L	0.31
1,2-Dibromoethane (EDB)	ND	1.0	ug/L	0.18
1,2-Dichlorobenzene	ND	1.0	ug/L	0.15
1,3-Dichlorobenzene	ND	1.0	ug/L	0.13
1,4-Dichlorobenzene	ND	1.0	ug/L	0.16
Dichlorodifluoromethane	ND	2.0	ug/L	0.22
1,1-Dichloroethane	ND	1.0	ug/L	0.22
1,2-Dichloroethane	ND	1.0	ug/L	0.26
1,1-Dichloroethene	ND	1.0	ug/L	0.23
1,2-Dichloroethene (total)	ND	1.0	ug/L	0.24
cis-1,2-Dichloroethene	ND	1.0	ug/L	0.14
trans-1,2-Dichloroethene	ND	1.0	ug/L	0.15
1,2-Dichloropropane	ND	1.0	ug/L	0.18
cis-1,3-Dichloropropene	ND	1.0	ug/L	0.19
trans-1,3-Dichloropropene	ND	1.0	ug/L	0.20
Ethylbenzene	ND	1.0	ug/L	0.12
2-Hexanone	ND	5.0	ug/L	1.7
Methylene chloride	**0.39 J,B**	**5.0**	**ug/L**	**0.21**
4-Methyl-2-pentanone	ND	5.0	ug/L	0.98
Styrene	ND	1.0	ug/L	0.14
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	0.21
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	0.21
Tetrachloroethene	ND	1.0	ug/L	0.26
Toluene	ND	1.0	ug/L	0.15
1,2,4-Trichlorobenzene	ND	1.0	ug/L	0.21

(Continued on next page)

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW2

GC/MS Volatiles

Lot-Sample #...: D3J160213-001 Work Order #...: F2NR91A9 Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
1,1,1-Trichloroethane	ND	1.0	ug/L	0.16
1,1,2-Trichloroethane	ND	1.0	ug/L	0.27
Trichloroethene	ND	1.0	ug/L	0.16
Trichlorofluoromethane	ND	2.0	ug/L	0.24
1,2,3-Trichloropropane	ND	1.0	ug/L	0.33
Vinyl chloride	ND	1.0	ug/L	0.19
Xylenes (total)	ND	2.0	ug/L	0.41
n-Butylbenzene	ND	1.0	ug/L	0.21
sec-Butylbenzene	ND	1.0	ug/L	0.23
Isopropylbenzene	ND	1.0	ug/L	0.17
1,2,4-Trimethylbenzene	ND	1.0	ug/L	0.15
1,3,5-Trimethylbenzene	ND	1.0	ug/L	0.16
n-Propylbenzene	ND	1.0	ug/L	0.17
tert-Butylbenzene	ND	1.0	ug/L	0.17
Dibromochloromethane	ND	1.0	ug/L	0.19
2-Chlorotoluene	ND	1.0	ug/L	0.17
4-Chlorotoluene	ND	1.0	ug/L	0.21
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0	ug/L	0.47
1,3-Dichloropropane	ND	1.0	ug/L	0.22
2,2-Dichloropropane	ND	5.0	ug/L	0.18
1,1-Dichloropropene	ND	1.0	ug/L	0.19
Hexachlorobutadiene	ND	1.0	ug/L	0.18
4-Isopropyltoluene	ND	1.0	ug/L	0.20
Methyl tert-butyl ether	ND	5.0	ug/L	0.38
1,2,3-Trichlorobenzene	ND	1.0	ug/L	0.21
m-Xylene & p-Xylene	ND	2.0	ug/L	0.27
o-Xylene	ND	1.0	ug/L	0.15
Bromobenzene	ND	1.0	ug/L	0.17
Bromochloromethane	ND	1.0	ug/L	0.27
Naphthalene	ND	1.0	ug/L	0.50

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	78	(76 - 116)
1,2-Dichloroethane-d4	78	(59 - 129)
4-Bromofluorobenzene	96	(74 - 114)
Toluene-d8	94	(76 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

LOCKWOOD GREENE

Client Sample ID: TRIP BLANK

GC/MS Volatiles

Lot-Sample #...: D3J160213-003 Work Order #...: F2NT61AA Matrix.........: WATER
Date Sampled...: 10/15/03 Date Received..: 10/16/03
Prep Date......: 10/27/03 Analysis Date..: 10/27/03
Prep Batch #...: 3302592 Analysis Time..: 14:23
Dilution Factor: 1

Method.........: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Acetone	4.1 J	10	ug/L	2.5
Benzene	ND	1.0	ug/L	0.17
Bromodichloromethane	ND	1.0	ug/L	0.20
Bromoform	ND	1.0	ug/L	0.23
Bromomethane	ND	2.0	ug/L	0.22
2-Butanone (MEK)	ND	5.0	ug/L	2.0
Carbon tetrachloride	ND	1.0	ug/L	0.20
Chlorobenzene	ND	1.0	ug/L	0.13
Chloroethane	ND	2.0	ug/L	0.18
Chloroform	ND	1.0	ug/L	0.17
Chloromethane	ND	2.0	ug/L	0.91
Dibromomethane	ND	1.0	ug/L	0.31
1,2-Dibromoethane (EDB)	ND	1.0	ug/L	0.18
1,2-Dichlorobenzene	ND	1.0	ug/L	0.15
1,3-Dichlorobenzene	ND	1.0	ug/L	0.13
1,4-Dichlorobenzene	ND	1.0	ug/L	0.16
Dichlorodifluoromethane	ND	2.0	ug/L	0.22
1,1-Dichloroethane	ND	1.0	ug/L	0.22
1,2-Dichloroethane	ND	1.0	ug/L	0.26
1,1-Dichloroethene	ND	1.0	ug/L	0.23
1,2-Dichloroethene (total)	ND	1.0	ug/L	0.24
cis-1,2-Dichloroethene	ND	1.0	ug/L	0.14
trans-1,2-Dichloroethene	ND	1.0	ug/L	0.15
1,2-Dichloropropane	ND	1.0	ug/L	0.18
cis-1,3-Dichloropropene	ND	1.0	ug/L	0.19
trans-1,3-Dichloropropene	ND	1.0	ug/L	0.20
Ethylbenzene	ND	1.0	ug/L	0.12
2-Hexanone	ND	5.0	ug/L	1.7
Methylene chloride	0.61 J,B	5.0	ug/L	0.21
4-Methyl-2-pentanone	ND	5.0	ug/L	0.98
Styrene	ND	1.0	ug/L	0.14
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	0.21
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	0.21
Tetrachloroethene	ND	1.0	ug/L	0.26
Toluene	ND	1.0	ug/L	0.15
1,2,4-Trichloro-benzene	ND	1.0	ug/L	0.21

(Continued on next page)

LOCKWOOD GREENE

Client Sample ID: TRIP BLANK

GC/MS Volatiles

Lot-Sample #...: D3J160213-003 Work Order #...: F2NT61AA Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
1,1,1-Trichloroethane	ND	1.0	ug/L	0.16
1,1,2-Trichloroethane	ND	1.0	ug/L	0.27
Trichloroethene	ND	1.0	ug/L	0.16
Trichlorofluoromethane	ND	2.0	ug/L	0.24
1,2,3-Trichloropropane	ND	1.0	ug/L	0.33
Vinyl chloride	ND	1.0	ug/L	0.19
Xylenes (total)	ND	2.0	ug/L	0.41
n-Butylbenzene	ND	1.0	ug/L	0.21
sec-Butylbenzene	ND	1.0	ug/L	0.23
Isopropylbenzene	ND	1.0	ug/L	0.17
1,2,4-Trimethylbenzene	ND	1.0	ug/L	0.15
1,3,5-Trimethylbenzene	ND	1.0	ug/L	0.16
n-Propylbenzene	ND	1.0	ug/L	0.17
tert-Butylbenzene	ND	1.0	ug/L	0.17
Dibromochloromethane	ND	1.0	ug/L	0.19
2-Chlorotoluene	ND	1.0	ug/L	0.17
4-Chlorotoluene	ND	1.0	ug/L	0.21
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0	ug/L	0.47
1,3-Dichloropropane	ND	1.0	ug/L	0.22
2,2-Dichloropropane	ND	5.0	ug/L	0.18
1,1-Dichloropropene	ND	1.0	ug/L	0.19
Hexachlorobutadiene	ND	1.0	ug/L	0.18
4-Isopropyltoluene	ND	1.0	ug/L	0.20
Methyl tert-butyl ether	ND	5.0	ug/L	0.38
1,2,3-Trichlorobenzene	ND	1.0	ug/L	0.21
m-Xylene & p-Xylene	ND	2.0	ug/L	0.27
o-Xylene	ND	1.0	ug/L	0.15
Bromobenzene	ND	1.0	ug/L	0.17
Bromochloromethane	ND	1.0	ug/L	0.27
Naphthalene	ND	1.0	ug/L	0.50

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	93	(76 - 116)
1,2-Dichloroethane-d4	103	(59 - 129)
4-Bromofluorobenzene	97	(74 - 114)
Toluene-d8	90	(76 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW2

GC/MS Semivolatiles

Lot-Sample #...: D3J160213-001 Work Order #...: F2NR91CA Matrix.........: WATER
Date Sampled...: 10/14/03 16:20 Date Received..: 10/16/03
Prep Date......: 10/20/03 Analysis Date..: 11/15/03
Prep Batch #...: 3293438 Analysis Time..: 19:41
Dilution Factor: 1
Method.........: SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Acenaphthene	ND	10	ug/L	0.60
Acenaphthylene	ND	10	ug/L	0.60
Acetophenone	ND	10	ug/L	2.0
2-Acetylaminofluorene	ND	100	ug/L	1.0
4-Aminobiphenyl	ND	50	ug/L	1.0
Aniline	ND	10	ug/L	4.0
Anthracene	ND	10	ug/L	3.0
Aramite	ND	20	ug/L	2.0
Benzo(a)anthracene	ND	10	ug/L	0.80
Benzo(b)fluoranthene	ND	10	ug/L	0.90
Benzo(k)fluoranthene	ND	10	ug/L	2.0
Benzo(ghi)perylene	ND	10	ug/L	1.0
Benzo(a)pyrene	ND	10	ug/L	0.80
Benzyl alcohol	ND	10	ug/L	1.0
bis(2-Chloroethoxy) methane	ND	10	ug/L	0.90
bis(2-Chloroethyl)-ether	ND	10	ug/L	3.0
bis(2-Ethylhexyl) phthalate	ND	10	ug/L	0.90
4-Bromophenyl phenyl ether	ND	10	ug/L	0.70
Butyl benzyl phthalate	ND	10	ug/L	1.0
4-Chloroaniline	ND	10	ug/L	3.0
Chlorobenzilate	ND	10	ug/L	1.0
4-Chloro-3-methylphenol	ND	10	ug/L	0.80
2-Chloronaphthalene	ND	10	ug/L	0.70
2-Chlorophenol	ND	10	ug/L	0.80
4-Chlorophenyl phenyl ether	ND	10	ug/L	0.60
Chrysene	ND	10	ug/L	0.80
Diallate	ND	20	ug/L	2.0
Dibenz(a,h)anthracene	ND	10	ug/L	0.90
Dibenzofuran	ND	10	ug/L	0.60
Di-n-butyl phthalate	ND	10	ug/L	0.80
1,2-Dichlorobenzene	ND	10	ug/L	0.80
1,3-Dichlorobenzene	ND	10	ug/L	0.80
1,4-Dichlorobenzene	ND	10	ug/L	1.0

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LOCKWOOD GREENE

Client Sample ID: L.E.S. MW2

GC/MS Semivolatiles

Lot-Sample #...: D3J160213-001 Work Order #...: F2NR91CA Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
3,3'-Dichlorobenzidine	ND	50	ug/L	8.0
2,4-Dichlorophenol	ND	10	ug/L	0.70
2,6-Dichlorophenol	ND	10	ug/L	1.0
Diethyl phthalate	ND	10	ug/L	0.70
Dimethoate	ND	20	ug/L	2.0
7,12-Dimethylbenz(a)-anthracene	ND	20	ug/L	2.0
3,3'-Dimethylbenzidine	ND	20	ug/L	10
2,4-Dimethylphenol	ND	10	ug/L	4.0
Dimethyl phthalate	ND	10	ug/L	0.80
1,3-Dinitrobenzene	ND	10	ug/L	2.0
4,6-Dinitro-2-methylphenol	ND	50	ug/L	6.0
2,4-Dinitrophenol	ND	50	ug/L	6.0
2,4-Dinitrotoluene	ND	10	ug/L	1.0
2,6-Dinitrotoluene	ND	10	ug/L	0.80
Di-n-octyl phthalate	ND	10	ug/L	1.0
Diphenylamine	ND	10	ug/L	1.0
Disulfoton	ND	50	ug/L	6.0
Ethyl methanesulfonate	ND	10	ug/L	2.0
Fluoranthene	ND	10	ug/L	0.70
Fluorene	ND	10	ug/L	0.60
Hexachlorobenzene	ND	10	ug/L	0.80
Hexachlorobutadiene	ND	10	ug/L	1.0
Hexachlorocyclopenta-diene	ND	50	ug/L	5.0
Hexachloroethane	ND	10	ug/L	0.80
Hexachloropropene	ND	100	ug/L	1.0
Indeno(1,2,3-cd)pyrene	ND	10	ug/L	0.80
Isodrin	ND	10	ug/L	3.0
Isophorone	ND	10	ug/L	0.90
Isosafrole	ND	20	ug/L	2.0
Methapyrilene	ND	50	ug/L	30
3-Methylcholanthrene	ND	20	ug/L	3.0
Methyl methanesulfonate	ND	10	ug/L	2.0
2-Methylnaphthalene	ND	10	ug/L	0.80
Methyl parathion	ND	50	ug/L	2.0
2-Methylphenol	ND	10	ug/L	0.90
3-Methylphenol & 4-Methylphenol	ND	10	ug/L	0.80
Naphthalene	ND	10	ug/L	0.80
1,4-Naphthoquinone	ND	50	ug/L	2.0
1-Naphthylamine	ND	10	ug/L	2.0

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LOCKWOOD GREENE

Client Sample ID: L.E.S. MW2

GC/MS Semivolatiles

Lot-Sample #...: D3J160213-001 Work Order #...: F2NR91CA Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
2-Naphthylamine	ND	10	ug/L	1.0
2-Nitroaniline	ND	50	ug/L	0.90
3-Nitroaniline	ND	50	ug/L	0.90
4-Nitroaniline	ND	50	ug/L	6.0
Nitrobenzene	ND	10	ug/L	2.0
2-Nitrophenol	ND	10	ug/L	0.80
4-Nitrophenol	ND	50	ug/L	7.0
4-Nitroquinoline-1-oxide	ND	100	ug/L	50
N-Nitrosodi-n-butylamine	ND	10	ug/L	2.0
N-Nitrosodiethylamine	ND	10	ug/L	2.0
N-Nitrosodimethylamine	ND	10	ug/L	0.80
N-Nitrosodiphenylamine	ND	10	ug/L	1.0
N-Nitrosodi-n-propylamine	ND	10	ug/L	0.70
N-Nitrosomethylethylamine	ND	10	ug/L	2.0
N-Nitrosomorpholine	ND	10	ug/L	2.0
N-Nitrosopiperidine	ND	10	ug/L	2.0
N-Nitrosopyrrolidine	ND	10	ug/L	2.0
5-Nitro-o-toluidine	ND	20	ug/L	1.0
Parathion	ND	50	ug/L	2.0
Pentachlorobenzene	ND	10	ug/L	2.0
Pentachloroethane	ND	50	ug/L	2.0
Pentachloronitrobenzene	ND	50	ug/L	2.0
Pentachlorophenol	ND	50	ug/L	5.0
Phenacetin	ND	20	ug/L	1.0
Phenanthrene	ND	10	ug/L	0.70
Phenol	ND	10	ug/L	0.90
Phorate	ND	50	ug/L	1.0
2-Picoline	ND	20	ug/L	1.0
Pronamide	ND	20	ug/L	1.0
Pyrene	ND	10	ug/L	0.80
Pyridine	ND	20	ug/L	10
1,2,4,5-Tetrachlorobenzene	ND	10	ug/L	2.0
2,3,4,6-Tetrachlorophenol	ND	50	ug/L	5.0
Thionazin	ND	10	ug/L	2.0
o-Toluidine	ND	10	ug/L	2.0
1,2,4-Trichlorobenzene	ND	10	ug/L	0.90
2,4,5-Trichlorophenol	ND	10	ug/L	1.0
2,4,6-Trichlorophenol	ND	10	ug/L	0.80

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LOCKWOOD GREENE

Client Sample ID: L.E.S. MW2

GC/MS Semivolatiles

Lot-Sample #...: D3J160213-001 **Work Order #...:** F2NR91CA **Matrix.........:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
O,O,O-Triethylphosphorothioate	ND	50	ug/L	2.0
1,3,5-Trinitrobenzene	ND	50	ug/L	2.0

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	66	(32 - 116)
Phenol-d5	75	(40 - 111)
Nitrobenzene-d5	84	(53 - 107)
2-Fluorobiphenyl	64	(31 - 105)
2,4,6-Tribromophenol	97	(42 - 122)
Terphenyl-d14	86	(21 - 125)

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW2

GC Semivolatiles

Lot-Sample #...: D3J160213-001 **Work Order #...:** F2NR91CD **Matrix.........:** WATER
Date Sampled...: 10/14/03 16:20 **Date Received..:** 10/16/03
Prep Date......: 10/20/03 **Analysis Date..:** 10/28/03
Prep Batch #...: 3293260 **Analysis Time..:** 16:54
Dilution Factor: 1
Method.........: SW846 8081A

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Aldrin	ND	0.050	ug/L	0.0070
alpha-BHC	ND	0.050	ug/L	0.010
beta-BHC	ND	0.050	ug/L	0.010
delta-BHC	ND	0.050	ug/L	0.010
gamma-BHC (Lindane)	ND	0.050	ug/L	0.0080
Chlordane (technical)	ND	0.50	ug/L	0.060
4,4'-DDD	0.22	0.050	ug/L	0.010
4,4'-DDE	ND	0.050	ug/L	0.010
4,4'-DDT	ND	0.050	ug/L	0.010
Dieldrin	ND	0.050	ug/L	0.0090
Endrin	ND	0.050	ug/L	0.020
Endrin aldehyde	ND	0.050	ug/L	0.010
Endosulfan I	ND	0.050	ug/L	0.020
Endosulfan II	ND	0.050	ug/L	0.010
Endosulfan sulfate	ND	0.050	ug/L	0.010
Heptachlor	ND	0.050	ug/L	0.010
Heptachlor epoxide	ND	0.050	ug/L	0.010
Methoxychlor	ND	0.10	ug/L	0.020
Toxaphene	ND	5.0	ug/L	0.50

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Decachlorobiphenyl	100	(29 - 125)
Tetrachloro-m-xylene	97	(40 - 115)

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW2

GC Semivolatiles

Lot-Sample #...: D3J160213-001 Work Order #...: F2NR91CC Matrix.........: WATER
Date Sampled...: 10/14/03 16:20 Date Received..: 10/16/03
Prep Date......: 10/20/03 Analysis Date..: 10/28/03
Prep Batch #...: 3293236 Analysis Time..: 22:13
Dilution Factor: 1
Method.........: SW846 8082

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Aroclor 1016	ND	1.0	ug/L	0.15
Aroclor 1221	ND	1.0	ug/L	0.25
Aroclor 1232	ND	1.0	ug/L	0.14
Aroclor 1242	ND	1.0	ug/L	0.14
Aroclor 1248	ND	1.0	ug/L	0.15
Aroclor 1254	ND	1.0	ug/L	0.22
Aroclor 1260	ND	1.0	ug/L	0.16

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	98	(52 - 160)
Decachlorobiphenyl	114	(37 - 144)

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW2

GC Semivolatiles

Lot-Sample #...: D3J160213-001 Work Order #...: F2NR91CE Matrix.........: WATER
Date Sampled...: 10/14/03 16:20 Date Received..: 10/16/03
Prep Date......: 10/21/03 Analysis Date..: 11/05/03
Prep Batch #...: 3294207 Analysis Time..: 13:36
Dilution Factor: 1
Method.........: SW846 8141A

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Azinphos-methyl	ND	2.5	ug/L	0.14
Bolstar	ND	0.50	ug/L	0.14
Chlorpyrifos	ND	0.50	ug/L	0.054
Coumaphos	ND	0.50	ug/L	0.079
Demeton (total)	ND	1.0	ug/L	0.19
Diazinon	ND	0.50	ug/L	0.039
Dichlorvos	ND	0.50	ug/L	0.13
Dimethoate	ND	0.50	ug/L	0.18
Disulfoton	ND	0.50	ug/L	0.057
Ethoprop	ND	0.50	ug/L	0.056
Ethyl parathion	ND	0.50	ug/L	0.040
Famphur	ND	1.0	ug/L	0.054
Fensulfothion	ND	2.5	ug/L	0.22
Fenthion	ND	0.50	ug/L	0.061
Malathion	ND	1.2	ug/L	0.050
Merphos	ND	5.0	ug/L	0.063
Methyl parathion	ND	0.50	ug/L	0.061
Mevinphos	ND	6.2	ug/L	0.16
Naled	ND	10	ug/L	0.22
O,O,O-Triethylphosphorothioate	ND	0.50	ug/L	0.15
Phorate	ND	0.50	ug/L	0.075
Ronnel	ND	10	ug/L	0.11
Sulfotepp	ND	0.50	ug/L	0.030
Thionazin	ND	0.50	ug/L	0.059
Tokuthion	ND	0.50	ug/L	0.071
Trichloronate	ND	0.50	ug/L	0.057
EPN	ND	0.50	ug/L	0.050
Demeton-O	ND	1.0	ug/L	0.19
Demeton-S	ND	1.0	ug/L	0.19
Tetrachlorvinphos (Stirophos)	ND	2.5	ug/L	0.056

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	77	(49 - 105)
Ethyl Pirimifos	68	(20 - 121)

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW2

TOTAL Metals

Lot-Sample #...: D3J160213-001　　Matrix.......: WATER
Date Sampled...: 10/14/03 16:20　Date Received..: 10/16/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3290479						
Mercury	ND	0.20	ug/L	SW846 7470A	10/22-10/23/03	F2NR91A8
		Dilution Factor: 1		Analysis Time..: 13:27	MDL............: 0.054	
Prep Batch #...: 3291152						
Silver	ND	10	ug/L	SW846 6010B	10/23-10/25/03	F2NR91AL
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 0.70	
Aluminum	480 J	100	ug/L	SW846 6010B	10/23-10/24/03	F2NR91AM
		Dilution Factor: 1		Analysis Time..: 18:20	MDL............: 20	
Arsenic	ND	15	ug/L	SW846 6010B	10/23-10/25/03	F2NR91AN
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 4.9	
Barium	21	10	ug/L	SW846 6010B	10/23-10/25/03	F2NR91AP
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 0.37	
Beryllium	ND	5.0	ug/L	SW846 6010B	10/23-10/25/03	F2NR91AQ
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 0.41	
Boron	1600	100	ug/L	SW846 6010B	10/23-10/24/03	F2NR91AR
		Dilution Factor: 1		Analysis Time..: 18:20	MDL............: 8.3	
Cadmium	ND	5.0	ug/L	SW846 6010B	10/23-10/25/03	F2NR91AT
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 0.27	
Cobalt	ND	10	ug/L	SW846 6010B	10/23-10/25/03	F2NR91AU
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 0.67	
Chromium	43	10	ug/L	SW846 6010B	10/23-10/25/03	F2NR91AV
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 2.1	
Copper	8.6 B,J	10	ug/L	SW846 6010B	10/23-10/25/03	F2NR91AW
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 0.97	
Iron	510	100	ug/L	SW846 6010B	10/23-10/24/03	F2NR91AX
		Dilution Factor: 1		Analysis Time..: 18:20	MDL..... ......: 19	
Manganese	1000	10	ug/L	SW846 6010B	10/23-10/25/03	F2NR91A0
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 0.54	

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LOCKWOOD GREENE

Client Sample ID: L.E.S. MW2

TOTAL Metals

Lot-Sample #...: D3J160213-001 **Matrix.........:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Molybdenum	40	20	ug/L	SW846 6010B	10/23-10/25/03	F2NR91A1
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 2.3	
Nickel	34 B	40	ug/L	SW846 6010B	10/23-10/25/03	F2NR91A2
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 4.2	
Lead	ND	3.0	ug/L	SW846 6010B	10/23-10/25/03	F2NR91A3
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 2.1	
Antimony	ND	10	ug/L	SW846 6010B	10/23-10/25/03	F2NR91A4
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 3.6	
Selenium	ND	15	ug/L	SW846 6010B	10/23-10/25/03	F2NR91A5
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 4.6	
Thallium	ND	10	ug/L	SW846 6010B	10/23-10/25/03	F2NR91A6
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 8.1	
Zinc	16 B	20	ug/L	SW846 6010B	10/23-10/25/03	F2NR91A7
		Dilution Factor: 1		Analysis Time..: 18:21	MDL............: 7.1	

NOTE(S):

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

B Estimated result. Result is less than RL

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW2

General Chemistry

Lot-Sample #...: D3J160213-001 Work Order #...: F2NR9 Matrix.........: WATER
Date Sampled...: 10/14/03 16:20 Date Received..: 10/16/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION- ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)	12 B	20	mg/L	MCAWW 410.4	10/21/03	3296361
		Dilution Factor: 1		Analysis Time..: 16:45	MDL............: 2.9	
Chloride	1600 Q	300	mg/L	MCAWW 300.0A	10/16/03	3290566
		Dilution Factor: 100		Analysis Time..: 17:55	MDL............: 20	
Fluoride	ND G	5.0	mg/L	MCAWW 300.0A	10/16/03	3290569
		Dilution Factor: 5		Analysis Time..: 16:29	MDL............: 0.50	
Nitrate	ND G	2.5	mg/L	MCAWW 300.0A	10/16/03	3290567
		Dilution Factor: 5		Analysis Time..: 16:29	MDL............: 0.25	
Nitrite	ND G	10	mg/L	MCAWW 300.0A	10/16/03	3290570
		Dilution Factor: 20		Analysis Time..: 17:01	MDL............: 1.0	
Specific Conductance	6800	2.0	umhos/cm	MCAWW 120.1	10/17/03	3293257
		Dilution Factor: 1		Analysis Time..: 16:00	MDL............:	
Sulfate	2200 Q	500	mg/L	MCAWW 300.0A	10/16/03	3290568
		Dilution Factor: 100		Analysis Time..: 17:55	MDL............: 20	
Total Cyanide	ND	0.010	mg/L	MCAWW 335.3	10/22-10/23/03	3296416
		Dilution Factor: 1		Analysis Time..: 13:00	MDL............: 0.0039	
Total Dissolved Solids	2500 Q	20	mg/L	MCAWW 160.1	10/20/03	3303251
		Dilution Factor: 2		Analysis Time..: 17:00	MDL............: 6.0	
Total Suspended Solids	6.2	4.0	mg/L	MCAWW 160.2	10/20/03	3294676
		Dilution Factor: 1		Analysis Time..: 20:45	MDL............: 0.87	

NOTE(S):

RL Reporting Limit

B Estimated result. Result is less than RL.

Q Elevated reporting limit. The reporting limit is elevated due to high analyte levels

G Elevated reporting limit. The reporting limit is elevated due to matrix interference.

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW2

General Chemistry

Lot-Sample #...: D3J160213-002 Work Order #...: F2NT3 Matrix.........: WATER
Date Sampled...: 10/15/03 17:40 Date Received..: 10/16/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION- ANALYSIS DATE	PREP BATCH #
Fecal Coliform	ND	1.0	CFU/100m	SM18 9222D Fecal	10/16/03	3301603
	Dilution Factor: 1			Analysis Time..: 14:30	MDL............:	
Total Coliform	ND	1.0	CFU/100m	SM18 9222B	10/16/03	3301601
	Dilution Factor: 1			Analysis Time..: 15:00	MDL............:	

QC DATA ASSOCIATION SUMMARY

D3J160213

Sample Preparation and Analysis Control Numbers

SAMPLE#	MATRIX	ANALYTICAL METHOD	LEACH BATCH #	PREP BATCH #	MS RUN#
001	WATER	MCAWW 120.1		3293257	3293166
	WATER	MCAWW 160.1		3303251	3304079
	WATER	MCAWW 160.2		3294676	3294343
	WATER	MCAWW 300.0A		3290566	3300278
	WATER	MCAWW 300.0A		3290568	3300288
	WATER	MCAWW 300.0A		3290569	3300275
	WATER	MCAWW 300.0A		3290567	3300283
	WATER	MCAWW 300.0A		3290570	3300282
	WATER	SW846 7470A		3290479	3290257
	WATER	SW846 8141A		3294207	3294054
	WATER	SW846 8082		3293236	3293106
	WATER	SW846 8081A		3293260	3293130
	WATER	SW846 8260B		3302592	3304292
	WATER	SW846 8270C		3293438	3293249
	WATER	SW846 6010B		3291152	3291050
	WATER	MCAWW 335.3		3296416	3296234
	WATER	MCAWW 410.4		3296361	3296259
002	WATER	SM18 9222D Fecal		3301603	3301311
	WATER	SM18 9222B		3301601	3301310
003	WATER	SW846 8260B		3302592	3304292

METHOD BLANK REPORT

GC/MS Volatiles

Client Lot #...: D3J160213 **Work Order #...:** F3PE71AA **Matrix.........:** WATER
MB Lot-Sample #: D3J290000-592
Prep Date......: 10/27/03 **Analysis Time..:** 12:43
Analysis Date..: 10/27/03 **Prep Batch #...:** 3302592
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Acetone	ND	10	ug/L	SW846 8260B
Benzene	ND	1.0	ug/L	SW846 8260B
Bromodichloromethane	ND	1.0	ug/L	SW846 8260B
Bromoform	ND	1.0	ug/L	SW846 8260B
Bromomethane	ND	2.0	ug/L	SW846 8260B
2-Butanone (MEK)	ND	5.0	ug/L	SW846 8260B
Carbon tetrachloride	ND	1.0	ug/L	SW846 8260B
Chlorobenzene	ND	1.0	ug/L	SW846 8260B
Chloroethane	ND	2.0	ug/L	SW846 8260B
Chloroform	ND	1.0	ug/L	SW846 8260B
Chloromethane	ND	2.0	ug/L	SW846 8260B
Dibromomethane	ND	1.0	ug/L	SW846 8260B
1,2-Dibromoethane (EDB)	ND	1.0	ug/L	SW846 8260B
1,2-Dichlorobenzene	ND	1.0	ug/L	SW846 8260B
1,3-Dichlorobenzene	ND	1.0	ug/L	SW846 8260B
1,4-Dichlorobenzene	ND	1.0	ug/L	SW846 8260B
Dichlorodifluoromethane	ND	2.0	ug/L	SW846 8260B
1,1-Dichloroethane	ND	1.0	ug/L	SW846 8260B
1,2-Dichloroethane	ND	1.0	ug/L	SW846 8260B
1,1-Dichloroethene	ND	1.0	ug/L	SW846 8260B
1,2-Dichloroethene (total)	ND	1.0	ug/L	SW846 8260B
cis-1,2-Dichloroethene	ND	1.0	ug/L	SW846 8260B
trans-1,2-Dichloroethene	ND	1.0	ug/L	SW846 8260B
1,2-Dichloropropane	ND	1.0	ug/L	SW846 8260B
cis-1,3-Dichloropropene	ND	1.0	ug/L	SW846 8260B
trans-1,3-Dichloropropene	ND	1.0	ug/L	SW846 8260B
Ethylbenzene	ND	1.0	ug/L	SW846 8260B
2-Hexanone	ND	5.0	ug/L	SW846 8260B
Methylene chloride	**0.65 J**	**5.0**	**ug/L**	**SW846 8260B**
4-Methyl-2-pentanone	ND	5.0	ug/L	SW846 8260B
Styrene	ND	1.0	ug/L	SW846 8260B
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	SW846 8260B
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	SW846 8260B
Tetrachloroethene	ND	1.0	ug/L	SW846 8260B
Toluene	ND	1.0	ug/L	SW846 8260B
1,2,4-Trichlorobenzene	ND	1.0	ug/L	SW846 8260B
1,1,1-Trichloroethane	ND	1.0	ug/L	SW846 8260B
1,1,2-Trichloroethane	ND	1.0	ug/L	SW846 8260B
Trichloroethene	ND	1.0	ug/L	SW846 8260B

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METHOD BLANK REPORT

GC/MS Volatiles

Client Lot #...: D3J160213 Work Order #...: F3PE71AA Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Trichlorofluoromethane	ND	2.0	ug/L	SW846 8260B
1,2,3-Trichloropropane	ND	1.0	ug/L	SW846 8260B
Vinyl chloride	ND	1.0	ug/L	SW846 8260B
Xylenes (total)	ND	2.0	ug/L	SW846 8260B
n-Butylbenzene	ND	1.0	ug/L	SW846 8260B
sec-Butylbenzene	ND	1.0	ug/L	SW846 8260B
Isopropylbenzene	ND	1.0	ug/L	SW846 8260B
1,2,4-Trimethylbenzene	ND	1.0	ug/L	SW846 8260B
1,3,5-Trimethylbenzene	ND	1.0	ug/L	SW846 8260B
n-Propylbenzene	ND	1.0	ug/L	SW846 8260B
tert-Butylbenzene	ND	1.0	ug/L	SW846 8260B
Dibromochloromethane	ND	1.0	ug/L	SW846 8260B
2-Chlorotoluene	ND	1.0	ug/L	SW846 8260B
4-Chlorotoluene	ND	1.0	ug/L	SW846 8260B
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0	ug/L	SW846 8260B
1,3-Dichloropropane	ND	1.0	ug/L	SW846 8260B
2,2-Dichloropropane	ND	5.0	ug/L	SW846 8260B
1,1-Dichloropropene	ND	1.0	ug/L	SW846 8260B
Hexachlorobutadiene	ND	1.0	ug/L	SW846 8260B
4-Isopropyltoluene	ND	1.0	ug/L	SW846 8260B
Methyl tert-butyl ether	ND	5.0	ug/L	SW846 8260B
1,2,3-Trichlorobenzene	ND	1.0	ug/L	SW846 8260B
m-Xylene & p-Xylene	ND	2.0	ug/L	SW846 8260B
o-Xylene	ND	1.0	ug/L	SW846 8260B
Bromobenzene	ND	1.0	ug/L	SW846 8260B
Bromochloromethane	ND	1.0	ug/L	SW846 8260B
Naphthalene	ND	1.0	ug/L	SW846 8260B

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	90	(76 - 116)
1,2-Dichloroethane-d4	99	(59 - 129)
4-Bromofluorobenzene	98	(74 - 114)
Toluene-d8	88	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

J Estimated result. Result is less than RL.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC/MS Volatiles

Client Lot #...: D3J160213 **Work Order #...:** F3PE71AC **Matrix.........:** WATER
LCS Lot-Sample#: D3J290000-592
Prep Date......: 10/27/03 **Analysis Date..:** 10/27/03
Prep Batch #...: 3302592 **Analysis Time..:** 12:18
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD
Benzene	**85**	**(75 - 116)**	**SW846 8260B**
Chlorobenzene	**88**	**(77 - 117)**	**SW846 8260B**
1,1-Dichloroethene	**90**	**(67 - 125)**	**SW846 8260B**
Toluene	**85**	**(74 - 115)**	**SW846 8260B**
Trichloroethene	**92**	**(80 - 123)**	**SW846 8260B**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	90	(76 - 116)
1,2-Dichloroethane-d4	98	(59 - 129)
4-Bromofluorobenzene	101	(74 - 114)
Toluene-d8	92	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC/MS Volatiles

Client Lot #...: D3J160213 **Work Order #...:** F3PE71AC **Matrix.........:** WATER
LCS Lot-Sample#: D3J290000-592
Prep Date......: 10/27/03 **Analysis Date..:** 10/27/03
Prep Batch #...: 3302592 **Analysis Time..:** 12:18
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	METHOD
Benzene	**10.0**	**8.53**	**ug/L**	**85**	**SW846 8260B**
Chlorobenzene	**10.0**	**8.77**	**ug/L**	**88**	**SW846 8260B**
1,1-Dichloroethene	**10.0**	**8.96**	**ug/L**	**90**	**SW846 8260B**
Toluene	**10.0**	**8.46**	**ug/L**	**85**	**SW846 8260B**
Trichloroethene	**10.0**	**9.20**	**ug/L**	**92**	**SW846 8260B**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	90	(76 - 116)
1,2-Dichloroethane-d4	98	(59 - 129)
4-Bromofluorobenzene	101	(74 - 114)
Toluene-d8	92	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC/MS Volatiles

Client Lot #...: D3J160213 **Work Order #...:** F2NR91C4-MS **Matrix.........:** WATER
MS Lot-Sample #: D3J160213-001 F2NR91C5-MSD
Date Sampled...: 10/14/03 16:20 **Date Received..:** 10/16/03
Prep Date......: 10/27/03 **Analysis Date..:** 10/27/03
Prep Batch #...: 3302592 **Analysis Time..:** 13:33
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Benzene	**85**	**(75 - 116)**			**SW846 8260B**
	87	**(75 - 116)**	**2.5**	**(0-20)**	**SW846 8260B**
Chlorobenzene	**87**	**(77 - 117)**			**SW846 8260B**
	89	**(77 - 117)**	**3.0**	**(0-20)**	**SW846 8260B**
1,1-Dichloroethene	**93**	**(67 - 125)**			**SW846 8260B**
	94	**(67 - 125)**	**1.0**	**(0-20)**	**SW846 8260B**
Toluene	**83**	**(74 - 115)**			**SW846 8260B**
	86	**(74 - 115)**	**4.2**	**(0-20)**	**SW846 8260B**
Trichloroethene	**93**	**(80 - 123)**			**SW846 8260B**
	97	**(80 - 123)**	**4.0**	**(0-20)**	**SW846 8260B**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	90	(76 - 116)
	91	(76 - 116)
1,2-Dichloroethane-d4	94	(59 - 129)
	103	(59 - 129)
4-Bromofluorobenzene	99	(74 - 114)
	102	(74 - 114)
Toluene-d8	92	(76 - 116)
	89	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE DATA REPORT

GC/MS Volatiles

Client Lot #...: D3J160213 **Work Order #...:** F2NR91C4-MS **Matrix.........:** WATER
MS Lot-Sample #: D3J160213-001 F2NR91C5-MSD
Date Sampled...: 10/14/03 16:20 **Date Received..:** 10/16/03
Prep Date......: 10/27/03 **Analysis Date..:** 10/27/03
Prep Batch #...: 3302592 **Analysis Time..:** 13:33
Dilution Factor: 1

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD
Benzene	**ND**	**10.0**	**8.51**	**ug/L**	**85**		**SW846 8260B**
	ND	**10.0**	**8.73**	**ug/L**	**87**	**2.5**	**SW846 8260B**
Chlorobenzene	**ND**	**10.0**	**8.68**	**ug/L**	**87**		**SW846 8260B**
	ND	**10.0**	**8.94**	**ug/L**	**89**	**3.0**	**SW846 8260B**
1,1-Dichloroethene	**ND**	**10.0**	**9.28**	**ug/L**	**93**		**SW846 8260B**
	ND	**10.0**	**9.38**	**ug/L**	**94**	**1.0**	**SW846 8260B**
Toluene	**ND**	**10.0**	**8.26**	**ug/L**	**83**		**SW846 8260B**
	ND	**10.0**	**8.61**	**ug/L**	**86**	**4.2**	**SW846 8260B**
Trichloroethene	**ND**	**10.0**	**9.29**	**ug/L**	**93**		**SW846 8260B**
	ND	**10.0**	**9.67**	**ug/L**	**97**	**4.0**	**SW846 8260B**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	90	(76 - 116)
	91	(76 - 116)
1,2-Dichloroethane-d4	94	(59 - 129)
	103	(59 - 129)
4-Bromofluorobenzene	99	(74 - 114)
	102	(74 - 114)
Toluene-d8	92	(76 - 116)
	89	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: D3J160213 Work Order #...: F201F1AA Matrix.........: WATER
MB Lot-Sample #: D3J200000-438
Prep Date......: 10/20/03 Analysis Time..: 11:24
Analysis Date..: 11/15/03 Prep Batch #...: 3293438
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Acenaphthene	ND	10	ug/L	SW846 8270C
Acenaphthylene	ND	10	ug/L	SW846 8270C
Acetophenone	ND	10	ug/L	SW846 8270C
2-Acetylaminofluorene	ND	100	ug/L	SW846 8270C
4-Aminobiphenyl	ND	50	ug/L	SW846 8270C
Aniline	ND	10	ug/L	SW846 8270C
Anthracene	ND	10	ug/L	SW846 8270C
Aramite	ND	20	ug/L	SW846 8270C
Benzo(a)anthracene	ND	10	ug/L	SW846 8270C
Benzo(b)fluoranthene	ND	10	ug/L	SW846 8270C
Benzo(k)fluoranthene	ND	10	ug/L	SW846 8270C
Benzo(ghi)perylene	ND	10	ug/L	SW846 8270C
Benzo(a)pyrene	ND	10	ug/L	SW846 8270C
Benzyl alcohol	ND	10	ug/L	SW846 8270C
is(2-Chloroethoxy) methane	ND	10	ug/L	SW846 8270C
bis(2-Chloroethyl)-ether	ND	10	ug/L	SW846 8270C
bis(2-Ethylhexyl) phthalate	ND	10	ug/L	SW846 8270C
4-Bromophenyl phenyl ether	ND	10	ug/L	SW846 8270C
Butyl benzyl phthalate	ND	10	ug/L	SW846 8270C
4-Chloroaniline	ND	10	ug/L	SW846 8270C
Chlorobenzilate	ND	10	ug/L	SW846 8270C
4-Chloro-3-methylphenol	ND	10	ug/L	SW846 8270C
2-Chloronaphthalene	ND	10	ug/L	SW846 8270C
2-Chlorophenol	ND	10	ug/L	SW846 8270C
4-Chlorophenyl phenyl ether	ND	10	ug/L	SW846 8270C
Chrysene	ND	10	ug/L	SW846 8270C
Diallate	ND	20	ug/L	SW846 8270C
Dibenz(a,h)anthracene	ND	10	ug/L	SW846 8270C
Dibenzofuran	ND	10	ug/L	SW846 8270C
Di-n-butyl phthalate	ND	10	ug/L	SW846 8270C
1,2-Dichlorobenzene	ND	10	ug/L	SW846 8270C
1,3-Dichlorobenzene	ND	10	ug/L	SW846 8270C
1,4-Dichlorobenzene	ND	10	ug/L	SW846 8270C
3,3'-Dichlorobenzidine	ND	50	ug/L	SW846 8270C
2,4-Dichlorophenol	ND	10	ug/L	SW846 8270C
2,6-Dichlorophenol	ND	10	ug/L	SW846 8270C

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METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: D3J160213 **Work Order #...: F201F1AA** **Matrix.........: WATER**

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Diethyl phthalate	ND	10	ug/L	SW846 8270C
Dimethoate	ND	20	ug/L	SW846 8270C
7,12-Dimethylbenz(a)-anthracene	ND	20	ug/L	SW846 8270C
3,3'-Dimethylbenzidine	ND	20	ug/L	SW846 8270C
2,4-Dimethylphenol	ND	10	ug/L	SW846 8270C
Dimethyl phthalate	ND	10	ug/L	SW846 8270C
1,3-Dinitrobenzene	ND	10	ug/L	SW846 8270C
4,6-Dinitro-2-methylphenol	ND	50	ug/L	SW846 8270C
2,4-Dinitrophenol	ND	50	ug/L	SW846 8270C
2,4-Dinitrotoluene	ND	10	ug/L	SW846 8270C
2,6-Dinitrotoluene	ND	10	ug/L	SW846 8270C
Di-n-octyl phthalate	ND	10	ug/L	SW846 8270C
Diphenylamine	ND	10	ug/L	SW846 8270C
Disulfoton	ND	50	ug/L	SW846 8270C
Ethyl methanesulfonate	ND	10	ug/L	SW846 8270C
Fluoranthene	ND	10	ug/L	SW846 8270C
Fluorene	ND	10	ug/L	SW846 8270C
Hexachlorobenzene	ND	10	ug/L	SW846 8270C
Hexachlorobutadiene	ND	10	ug/L	SW846 8270C
Hexachlorocyclopenta-diene	ND	50	ug/L	SW846 8270C
Hexachloroethane	ND	10	ug/L	SW846 8270C
Hexachloropropene	ND	100	ug/L	SW846 8270C
Indeno(1,2,3-cd)pyrene	ND	10	ug/L	SW846 8270C
Isodrin	ND	10	ug/L	SW846 8270C
Isophorone	ND	10	ug/L	SW846 8270C
Isosafrole	ND	20	ug/L	SW846 8270C
Methapyrilene	ND	50	ug/L	SW846 8270C
3-Methylcholanthrene	ND	20	ug/L	SW846 8270C
Methyl methanesulfonate	ND	10	ug/L	SW846 8270C
2-Methylnaphthalene	ND	10	ug/L	SW846 8270C
Methyl parathion	ND	50	ug/L	SW846 8270C
2-Methylphenol	ND	10	ug/L	SW846 8270C
3-Methylphenol & 4-Methylphenol	ND	10	ug/L	SW846 8270C
Naphthalene	ND	10	ug/L	SW846 8270C
1,4-Naphthoquinone	ND	50	ug/L	SW846 8270C
1-Naphthylamine	ND	10	ug/L	SW846 8270C
2-Naphthylamine	ND	10	ug/L	SW846 8270C
2-Nitroaniline	ND	50	ug/L	SW846 8270C
3-Nitroaniline	ND	50	ug/L	SW846 8270C
4-Nitroaniline	ND	50	ug/L	SW846 8270C
Nitrobenzene	ND	10	ug/L	SW846 8270C

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METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: D3J160213 Work Order #...: F201F1AA Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
2-Nitrophenol	ND	10	ug/L	SW846 8270C
4-Nitrophenol	ND	50	ug/L	SW846 8270C
4-Nitroquinoline-1-oxide	ND	100	ug/L	SW846 8270C
N-Nitrosodi-n-butylamine	ND	10	ug/L	SW846 8270C
N-Nitrosodiethylamine	ND	10	ug/L	SW846 8270C
N-Nitrosodimethylamine	ND	10	ug/L	SW846 8270C
N-Nitrosodiphenylamine	ND	10	ug/L	SW846 8270C
N-Nitrosodi-n-propylamine	ND	10	ug/L	SW846 8270C
N-Nitrosomethylethylamine	ND	10	ug/L	SW846 8270C
N-Nitrosomorpholine	ND	10	ug/L	SW846 8270C
N-Nitrosopiperidine	ND	10	ug/L	SW846 8270C
N-Nitrosopyrrolidine	ND	10	ug/L	SW846 8270C
5-Nitro-o-toluidine	ND	20	ug/L	SW846 8270C
Parathion	ND	50	ug/L	SW846 8270C
Pentachlorobenzene	ND	10	ug/L	SW846 8270C
Pentachloroethane	ND	50	ug/L	SW846 8270C
Pentachloronitrobenzene	ND	50	ug/L	SW846 8270C
Pentachlorophenol	ND	50	ug/L	SW846 8270C
Phenacetin	ND	20	ug/L	SW846 8270C
Phenanthrene	ND	10	ug/L	SW846 8270C
Phenol	ND	10	ug/L	SW846 8270C
Phorate	ND	50	ug/L	SW846 8270C
2-Picoline	ND	20	ug/L	SW846 8270C
Pronamide	ND	20	ug/L	SW846 8270C
Pyrene	ND	10	ug/L	SW846 8270C
Pyridine	ND	20	ug/L	SW846 8270C
1,2,4,5-Tetrachlorobenzene	ND	10	ug/L	SW846 8270C
2,3,4,6-Tetrachlorophenol	ND	50	ug/L	SW846 8270C
Thionazin	ND	10	ug/L	SW846 8270C
o-Toluidine	ND	10	ug/L	SW846 8270C
1,2,4-Trichlorobenzene	ND	10	ug/L	SW846 8270C
2,4,5-Trichlorophenol	ND	10	ug/L	SW846 8270C
2,4,6-Trichlorophenol	ND	10	ug/L	SW846 8270C
O,O,O-Triethylphosphorothioate	ND	50	ug/L	SW846 8270C
1,3,5-Trinitrobenzene	ND	50	ug/L	SW846 8270C

(Continued on next page)

METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F201F1AA **Matrix.........:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	73	(32 - 116)
Phenol-d5	75	(40 - 111)
Nitrobenzene-d5	76	(53 - 107)
2-Fluorobiphenyl	69	(31 - 105)
2,4,6-Tribromophenol	87	(42 - 122)
Terphenyl-d14	85	(21 - 125)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F201F1AC **Matrix.........:** WATER
LCS Lot-Sample#: D3J200000-438
Prep Date......: 10/20/03 **Analysis Date..:** 11/15/03
Prep Batch #...: 3293438 **Analysis Time..:** 11:49
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD
Acenaphthene	**74**	**(55 - 97)**	**SW846 8270C**
4-Chloro-3-methylphenol	**84**	**(59 - 106)**	**SW846 8270C**
2-Chlorophenol	**71**	**(59 - 105)**	**SW846 8270C**
1,4-Dichlorobenzene	**54**	**(31 - 98)**	**SW846 8270C**
2,4-Dinitrotoluene	**83**	**(57 - 113)**	**SW846 8270C**
4-Nitrophenol	**92**	**(43 - 118)**	**SW846 8270C**
N-Nitrosodi-n-propylamine	**81**	**(51 - 99)**	**SW846 8270C**
Pentachlorophenol	**84**	**(48 - 114)**	**SW846 8270C**
Phenol	**71**	**(56 - 106)**	**SW846 8270C**
Pyrene	**82**	**(51 - 103)**	**SW846 8270C**
1,2,4-Trichlorobenzene	**58**	**(36 - 99)**	**SW846 8270C**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	72	(54 - 105)
Phenol-d5	75	(55 - 106)
Nitrobenzene-d5	80	(58 - 108)
2-Fluorobiphenyl	73	(53 - 97)
2,4,6-Tribromophenol	97	(62 - 113)
Terphenyl-d14	87	(55 - 109)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F201F1AC **Matrix.........:** WATER
LCS Lot-Sample#: D3J200000-438
Prep Date......: 10/20/03 **Analysis Date..:** 11/15/03
Prep Batch #...: 3293438 **Analysis Time..:** 11:49
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	METHOD
Acenaphthene	**100**	**73.9**	**ug/L**	**74**	**SW846 8270C**
4-Chloro-3-methylphenol	**150**	**127**	**ug/L**	**84**	**SW846 8270C**
2-Chlorophenol	**150**	**106**	**ug/L**	**71**	**SW846 8270C**
1,4-Dichlorobenzene	**100**	**54.2**	**ug/L**	**54**	**SW846 8270C**
2,4-Dinitrotoluene	**100**	**82.8**	**ug/L**	**83**	**SW846 8270C**
4-Nitrophenol	**150**	**138**	**ug/L**	**92**	**SW846 8270C**
N-Nitrosodi-n-propyl-amine	**100**	**80.8**	**ug/L**	**81**	**SW846 8270C**
Pentachlorophenol	**150**	**126**	**ug/L**	**84**	**SW846 8270C**
Phenol	**150**	**106**	**ug/L**	**71**	**SW846 8270C**
Pyrene	**100**	**82.3**	**ug/L**	**82**	**SW846 8270C**
1,2,4-Trichloro-benzene	**100**	**57.8**	**ug/L**	**58**	**SW846 8270C**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	72	(54 - 105)
Phenol-d5	75	(55 - 106)
Nitrobenzene-d5	80	(58 - 108)
2-Fluorobiphenyl	73	(53 - 97)
2,4,6-Tribromophenol	97	(62 - 113)
Terphenyl-d14	87	(55 - 109)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: D3J160213 Work Order #...: F2NR91D8-MS Matrix.........: WATER
MS Lot-Sample #: D3J160213-001 F2NR91D9-MSD
Date Sampled...: 10/14/03 16:20 Date Received..: 10/16/03
Prep Date......: 10/20/03 Analysis Date..: 11/15/03
Prep Batch #...: 3293438 Analysis Time..: 20:06
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Acenaphthene	72	(50 - 96)			SW846 8270C
	70	(50 - 96)	2.8	(0-40)	SW846 8270C
4-Chloro-3-methylphenol	82	(49 - 102)			SW846 8270C
	83	(49 - 102)	6.3	(0-40)	SW846 8270C
2-Chlorophenol	70	(49 - 98)			SW846 8270C
	71	(49 - 98)	6.5	(0-40)	SW846 8270C
1,4-Dichlorobenzene	57	(41 - 92)			SW846 8270C
	56	(41 - 92)	2.9	(0-30)	SW846 8270C
2,4-Dinitrotoluene	87	(51 - 106)			SW846 8270C
	86	(51 - 106)	3.1	(0-40)	SW846 8270C
4-Nitrophenol	100	(34 - 116)			SW846 8270C
	103	(34 - 116)	7.9	(0-40)	SW846 8270C
N-Nitrosodi-n-propyl-amine	81	(46 - 101)			SW846 8270C
	83	(46 - 101)	7.4	(0-40)	SW846 8270C
Pentachlorophenol	85	(34 - 116)			SW846 8270C
	85	(34 - 116)	5.4	(0-40)	SW846 8270C
Phenol	69	(46 - 98)			SW846 8270C
	69	(46 - 98)	6.0	(0-40)	SW846 8270C
Pyrene	78	(39 - 103)			SW846 8270C
	78	(39 - 103)	5.3	(0-40)	SW846 8270C
1,2,4-Trichloro benzene	61	(46 - 92)			SW846 8270C
	63	(46 - 92)	7.0	(0-40)	SW846 8270C

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	70	(32 - 116)
	68	(32 - 116)
Phenol-d5	73	(40 - 111)
	73	(40 - 111)
Nitrobenzene-d5	80	(53 - 107)
	83	(53 - 107)
2-Fluorobiphenyl	67	(31 - 105)
	70	(31 - 105)
2,4,6-Tribromophenol	95	(42 - 122)
	92	(42 - 122)

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MATRIX SPIKE SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: D3J160213 Work Order #...: F2NR91D8-MS Matrix.........: WATER
MS Lot-Sample #: D3J160213-001 F2NR91D9-MSD

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Terphenyl-d14	81	(21 - 125)
	81	(21 - 125)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F2NR91D8-MS **Matrix.........:** WATER
MS Lot-Sample #: D3J160213-001 F2NR91D9-MSD
Date Sampled...: 10/14/03 16:20 **Date Received..:** 10/16/03
Prep Date......: 10/20/03 **Analysis Date..:** 11/15/03
Prep Batch #...: 3293438 **Analysis Time..:** 20:06
Dilution Factor: 1

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD
Acenaphthene	ND	101	72.8	ug/L	72		SW846 8270C
	ND	106	74.9	ug/L	70	2.8	SW846 8270C
4-Chloro-3-methylphenol	ND	152	125	ug/L	82		SW846 8270C
	ND	159	133	ug/L	83	6.3	SW846 8270C
2-Chlorophenol	ND	152	106	ug/L	70		SW846 8270C
	ND	159	113	ug/L	71	6.5	SW846 8270C
1,4-Dichlorobenzene	ND	101	57.8	ug/L	57		SW846 8270C
	ND	106	59.4	ug/L	56	2.9	SW846 8270C
2,4-Dinitrotoluene	ND	101	88.2	ug/L	87		SW846 8270C
	ND	106	91.0	ug/L	86	3.1	SW846 8270C
4-Nitrophenol	ND	152	152	ug/L	100		SW846 8270C
	ND	159	164	ug/L	103	7.9	SW846 8270C
N-Nitrosodi-n-propyl-amine	ND	101	81.5	ug/L	81		SW846 8270C
	ND	106	87.8	ug/L	83	7.4	SW846 8270C
Pentachlorophenol	ND	152	128	ug/L	85		SW846 8270C
	ND	159	135	ug/L	85	5.4	SW846 8270C
Phenol	ND	152	104	ug/L	69		SW846 8270C
	ND	159	111	ug/L	69	6.0	SW846 8270C
Pyrene	ND	101	78.5	ug/L	78		SW846 8270C
	ND	106	82.8	ug/L	78	5.3	SW846 8270C
1,2,4-Trichloro-benzene	ND	101	62.1	ug/L	61		SW846 8270C
	ND	106	66.6	ug/L	63	7.0	SW846 8270C

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	70	(32 - 116)
	68	(32 - 116)
Phenol-d5	73	(40 - 111)
	73	(40 - 111)
Nitrobenzene-d5	80	(53 - 107)
	83	(53 - 107)
2-Fluorobiphenyl	67	(31 - 105)
	70	(31 - 105)
2,4,6-Tribromophenol	95	(42 - 122)
	92	(42 - 122)

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MATRIX SPIKE SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: D3J160213   **Work Order #...:** F2NR91D8-MS   **Matrix.........:** WATER
MS Lot-Sample #: D3J160213-001   F2NR91D9-MSD

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Terphenyl-d14	81	(21 - 125)
	81	(21 - 125)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

METHOD BLANK REPORT

GC Semivolatiles

Client Lot #...: D3J160213
MB Lot-Sample #: D3J200000-260
Analysis Date..: 10/28/03
Dilution Factor: 1

Work Order #...: F2X701AA
Prep Date......: 10/20/03
Prep Batch #...: 3293260

Matrix.........: WATER
Analysis Time..: 17:38

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Aldrin	ND	0.050	ug/L	SW846 8081A
alpha-BHC	ND	0.050	ug/L	SW846 8081A
beta-BHC	ND	0.050	ug/L	SW846 8081A
delta-BHC	ND	0.050	ug/L	SW846 8081A
gamma-BHC (Lindane)	ND	0.050	ug/L	SW846 8081A
Chlordane (technical)	ND	0.50	ug/L	SW846 8081A
4,4'-DDD	ND	0.050	ug/L	SW846 8081A
4,4'-DDE	ND	0.050	ug/L	SW846 8081A
4,4'-DDT	ND	0.050	ug/L	SW846 8081A
Dieldrin	ND	0.050	ug/L	SW846 8081A
Endrin	ND	0.050	ug/L	SW846 8081A
Endrin aldehyde	ND	0.050	ug/L	SW846 8081A
Endosulfan I	ND	0.050	ug/L	SW846 8081A
Endosulfan II	ND	0.050	ug/L	SW846 8081A
dosulfan sulfate	ND	0.050	ug/L	SW846 8081A
eptachlor	ND	0.050	ug/L	SW846 8081A
Heptachlor epoxide	ND	0.050	ug/L	SW846 8081A
Methoxychlor	ND	0.10	ug/L	SW846 8081A
Toxaphene	ND	5.0	ug/L	SW846 8081A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Decachlorobiphenyl	101	(29 - 125)
Tetrachloro-m-xylene	92	(40 - 115)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F2X701AC **Matrix.........:** WATER
LCS Lot-Sample#: D3J200000-260
Prep Date......: 10/20/03 **Analysis Date..:** 10/28/03
Prep Batch #...: 3293260 **Analysis Time..:** 16:40
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD
Aldrin	**91**	**(53 - 122)**	**SW846 8081A**
gamma-BHC (Lindane)	**99**	**(72 - 122)**	**SW846 8081A**
4,4'-DDT	**94**	**(66 - 138)**	**SW846 8081A**
Dieldrin	**104**	**(75 - 128)**	**SW846 8081A**
Endrin	**85**	**(64 - 138)**	**SW846 8081A**
Heptachlor	**92**	**(60 - 126)**	**SW846 8081A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Decachlorobiphenyl	106	(65 - 137)
Tetrachloro-m-xylene	80	(40 - 115)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F2X701AC **Matrix.........:** WATER
LCS Lot-Sample#: D3J200000-260
Prep Date......: 10/20/03 **Analysis Date..:** 10/28/03
Prep Batch #...: 3293260 **Analysis Time..:** 16:40
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	METHOD
Aldrin	**0.500**	**0.456**	**ug/L**	**91**	**SW846 8081A**
gamma-BHC (Lindane)	**0.500**	**0.493**	**ug/L**	**99**	**SW846 8081A**
4,4'-DDT	**0.500**	**0.470**	**ug/L**	**94**	**SW846 8081A**
Dieldrin	**0.500**	**0.520**	**ug/L**	**104**	**SW846 8081A**
Endrin	**0.500**	**0.426**	**ug/L**	**85**	**SW846 8081A**
Heptachlor	**0.500**	**0.460**	**ug/L**	**92**	**SW846 8081A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Decachlorobiphenyl	106	(65 - 137)
Tetrachloro-m-xylene	80	(40 - 115)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

ld print denotes control parameters

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F2NR91ED-MS **Matrix.........:** WATER
MS Lot-Sample #: D3J160213-001 F2NR91EE-MSD
Date Sampled...: 10/14/03 16:20 **Date Received..:** 10/16/03
Prep Date......: 10/20/03 **Analysis Date..:** 10/28/03
Prep Batch #...: 3293260 **Analysis Time..:** 17:09
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Aldrin	**98**	**(53 - 125)**			**SW846 8081A**
	90	**(53 - 125)**	**8.9**	**(0-30)**	**SW846 8081A**
gamma-BHC (Lindane)	**103**	**(63 - 128)**			**SW846 8081A**
	93	**(63 - 128)**	**10**	**(0-30)**	**SW846 8081A**
4,4'-DDT	**120**	**(58 - 147)**			**SW846 8081A**
	113	**(58 - 147)**	**7.4**	**(0-30)**	**SW846 8081A**
Dieldrin	**105**	**(75 - 128)**			**SW846 8081A**
	99	**(75 - 128)**	**7.1**	**(0-30)**	**SW846 8081A**
Endrin	**96**	**(64 - 138)**			**SW846 8081A**
	90	**(64 - 138)**	**7.6**	**(0-30)**	**SW846 8081A**
Heptachlor	**101**	**(53 - 133)**			**SW846 8081A**
	90	**(53 - 133)**	**12**	**(0-30)**	**SW846 8081A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Decachlorobiphenyl	98	(29 - 125)
	89	(29 - 125)
Tetrachloro-m-xylene	81	(40 - 115)
	100	(40 - 115)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE DATA REPORT

GC Semivolatiles

Client Lot #...: D3J160213 Work Order #...: F2NR91ED-MS Matrix.........: WATER
MS Lot-Sample #: D3J160213-001 F2NR91EE-MSD
Date Sampled...: 10/14/03 16:20 Date Received..: 10/16/03
Prep Date......: 10/20/03 Analysis Date..: 10/28/03
Prep Batch #...: 3293260 Analysis Time..: 17:09
Dilution Factor: 1

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD
Aldrin	ND	**0.476**	**0.464**	**ug/L**	**98**		**SW846 8081A**
	ND	**0.473**	**0.425**	**ug/L**	**90**	**8.9**	**SW846 8081A**
gamma-BHC (Lindane)	ND	**0.476**	**0.490**	**ug/L**	**103**		**SW846 8081A**
	ND	**0.473**	**0.442**	**ug/L**	**93**	**10**	**SW846 8081A**
4,4'-DDT	ND	**0.476**	**0.573**	**ug/L**	**120**		**SW846 8081A**
	ND	**0.473**	**0.532**	**ug/L**	**113**	**7.4**	**SW846 8081A**
Dieldrin	ND	**0.476**	**0.502**	**ug/L**	**105**		**SW846 8081A**
	ND	**0.473**	**0.467**	**ug/L**	**99**	**7.1**	**SW846 8081A**
Endrin	ND	**0.476**	**0.457**	**ug/L**	**96**		**SW846 8081A**
	ND	**0.473**	**0.424**	**ug/L**	**90**	**7.6**	**SW846 8081A**
Heptachlor	ND	**0.476**	**0.480**	**ug/L**	**101**		**SW846 8081A**
	ND	**0.473**	**0.428**	**ug/L**	**90**	**12**	**SW846 8081A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Decachlorobiphenyl	98	(29 - 125)
	89	(29 - 125)
Tetrachloro-m-xylene	81	(40 - 115)
	100	(40 - 115)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

METHOD BLANK REPORT

GC Semivolatiles

Client Lot #...: D3J160213 Work Order #...: F2X6D1AA Matrix.........: WATER
MB Lot-Sample #: D3J200000-236
Prep Date......: 10/20/03 Analysis Time..: 21:29
Analysis Date..: 10/28/03 Prep Batch #...: 3293236
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Aroclor 1016	ND	1.0	ug/L	SW846 8082
Aroclor 1221	ND	1.0	ug/L	SW846 8082
Aroclor 1232	ND	1.0	ug/L	SW846 8082
Aroclor 1242	ND	1.0	ug/L	SW846 8082
Aroclor 1248	ND	1.0	ug/L	SW846 8082
Aroclor 1254	ND	1.0	ug/L	SW846 8082
Aroclor 1260	ND	1.0	ug/L	SW846 8082

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	106	(52 - 160)
Decachlorobiphenyl	114	(37 - 144)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F2X6D1AC **Matrix.........:** WATER
LCS Lot-Sample#: D3J200000-236
Prep Date......: 10/20/03 **Analysis Date..:** 10/28/03
Prep Batch #...: 3293236 **Analysis Time..:** 21:51
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD
Aroclor 1016	**113**	**(56 - 124)**	**SW846 8082**
Aroclor 1260	**126 a**	**(64 - 120)**	**SW846 8082**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	96	(52 - 127)
Decachlorobiphenyl	119	(61 - 128)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

a Spiked analyte recovery is outside stated control limits.

LABORATORY CONTROL SAMPLE DATA REPORT

GC Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F2X6D1AC **Matrix.........:** WATER
LCS Lot-Sample#: D3J200000-236
Prep Date......: 10/20/03 **Analysis Date..:** 10/28/03
Prep Batch #...: 3293236 **Analysis Time..:** 21:51
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	METHOD
Aroclor 1016	**2.00**	**2.26**	**ug/L**	**113**	**SW846 8082**
Aroclor 1260	**2.00**	**2.52 a**	**ug/L**	**126**	**SW846 8082**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	96	(52 - 127)
Decachlorobiphenyl	119	(61 - 128)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

a Spiked analyte recovery is outside stated control limits.

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F2NR91EA-MS **Matrix.........:** WATER
MS Lot-Sample #: D3J160213-001 F2NR91EC-MSD
Date Sampled...: 10/14/03 16:20 **Date Received..:** 10/16/03
Prep Date......: 10/20/03 **Analysis Date..:** 10/28/03
Prep Batch #...: 3293236 **Analysis Time..:** 22:35
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Aroclor 1016	**109**	**(57 - 135)**			**SW846 8082**
	108	**(57 - 135)**	**0.28**	**(0-30)**	**SW846 8082**
Aroclor 1260	**108**	**(55 - 130)**			**SW846 8082**
	105	**(55 - 130)**	**3.3**	**(0-30)**	**SW846 8082**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	102	(52 - 160)
	99	(52 - 160)
Decachlorobiphenyl	115	(37 - 144)
	107	(37 - 144)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

old print denotes control parameters

MATRIX SPIKE SAMPLE DATA REPORT

GC Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F2NR91EA-MS **Matrix.........:** WATER
MS Lot-Sample #: D3J160213-001 F2NR91EC-MSD
Date Sampled...: 10/14/03 16:20 **Date Received..:** 10/16/03
Prep Date......: 10/20/03 **Analysis Date..:** 10/28/03
Prep Batch #...: 3293236 **Analysis Time..:** 22:35
Dilution Factor: 1

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD
Aroclor 1016	ND	1.89	2.06	ug/L	109		SW846 8082
	ND	1.90	2.05	ug/L	108	0.28	SW846 8082
Aroclor 1260	ND	1.89	2.05	ug/L	108		SW846 8082
	ND	1.90	1.99	ug/L	105	3.3	SW846 8082

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	102	(52 - 160)
	99	(52 - 160)
Decachlorobiphenyl	115	(37 - 144)
	107	(37 - 144)

NOTE(S):

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ulations are performed before rounding to avoid round-off errors in calculated results.

prim denotes control parameters

METHOD BLANK REPORT

GC Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F22GQ1AA **Matrix.........:** WATER
MB Lot-Sample #: D3J210000-207
Prep Date......: 10/21/03 **Analysis Time..:** 11:57
Analysis Date..: 11/05/03 **Prep Batch #...:** 3294207
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Azinphos-methyl	ND	2.5	ug/L	SW846 8141A
Bolstar	ND	0.50	ug/L	SW846 8141A
Chlorpyrifos	ND	0.50	ug/L	SW846 8141A
Coumaphos	ND	0.50	ug/L	SW846 8141A
Demeton (total)	ND	1.0	ug/L	SW846 8141A
Diazinon	ND	0.50	ug/L	SW846 8141A
Dichlorvos	ND	0.50	ug/L	SW846 8141A
Dimethoate	ND	0.50	ug/L	SW846 8141A
Disulfoton	ND	0.50	ug/L	SW846 8141A
Ethoprop	ND	0.50	ug/L	SW846 8141A
Ethyl parathion	ND	0.50	ug/L	SW846 8141A
Famphur	ND	1.0	ug/L	SW846 8141A
Fensulfothion	ND	2.5	ug/L	SW846 8141A
Fenthion	ND	0.50	ug/L	SW846 8141A
Malathion	ND	1.2	ug/L	SW846 8141A
phos	ND	5.0	ug/L	SW846 8141A
Methyl parathion	ND	0.50	ug/L	SW846 8141A
Mevinphos	ND	6.2	ug/L	SW846 8141A
Naled	ND	10	ug/L	SW846 8141A
O,O,O-Triethylphosphorothioate	ND	0.50	ug/L	SW846 8141A
Phorate	ND	0.50	ug/L	SW846 8141A
Ronnel	ND	10	ug/L	SW846 8141A
Sulfotepp	ND	0.50	ug/L	SW846 8141A
Thionazin	ND	0.50	ug/L	SW846 8141A
Tokuthion	ND	0.50	ug/L	SW846 8141A
Trichloronate	ND	0.50	ug/L	SW846 8141A
EPN	ND	0.50	ug/L	SW846 8141A
Demeton-O	ND	1.0	ug/L	SW846 8141A
Demeton-S	ND	1.0	ug/L	SW846 8141A
Tetrachlorvinphos (Stirop	ND	2.5	ug/L	SW846 8141A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	76	(49 - 105)
Ethyl Pirimifos	30	(20 - 121)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F22GQ1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D3J210000-207 F22GQ1AD-LCSD
Prep Date......: 10/21/03 **Analysis Date..:** 11/05/03
Prep Batch #...: 3294207 **Analysis Time..:** 12:30
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Demeton (total)	**32**	**(20 - 107)**			**SW846 8141A**
	88 p	**(20 - 107)**	**94**	**(0-40)**	**SW846 8141A**
Diazinon	**42 a**	**(58 - 108)**			**SW846 8141A**
	82 p	**(58 - 108)**	**65**	**(0-40)**	**SW846 8141A**
Ethyl parathion	**36 a**	**(62 - 118)**			**SW846 8141A**
	73 p	**(62 - 118)**	**68**	**(0-40)**	**SW846 8141A**
Malathion	**30 a**	**(33 - 109)**			**SW846 8141A**
	63 p	**(33 - 109)**	**71**	**(0-40)**	**SW846 8141A**
Methyl parathion	**40 a**	**(50 - 127)**			**SW846 8141A**
	80 p	**(50 - 127)**	**65**	**(0-40)**	**SW846 8141A**
Phorate	**42 a**	**(54 - 101)**			**SW846 8141A**
	85 p	**(54 - 101)**	**67**	**(0-40)**	**SW846 8141A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	44 *	(49 - 105)
	81	(49 - 105)
Ethyl Pirimifos	30	(20 - 121)
	90	(20 - 121)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

p Relative percent difference (RPD) is outside stated control limits

* Surrogate recovery is outside stated control limits.

a Spiked analyte recovery is outside stated control limits.

LABORATORY CONTROL SAMPLE DATA REPORT

GC Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F22GQ1AC-LCS **Matrix.........:** WATER

LCS Lot-Sample#: D3J210000-207 F22GQ1AD-LCSD

Prep Date......: 10/21/03 **Analysis Date..:** 11/05/03

Prep Batch #...: 3294207 **Analysis Time..:** 12:30

Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Demeton (total)	**2.00**	**0.636**	**ug/L**	**32**		**SW846 8141A**
	2.00	**1.76 p**	**ug/L**	**88**	**94**	**SW846 8141A**
Diazinon	**2.00**	**0.844 a**	**ug/L**	**42**		**SW846 8141A**
	2.00	**1.65 p**	**ug/L**	**82**	**65**	**SW846 8141A**
Ethyl parathion	**2.00**	**0.718 a**	**ug/L**	**36**		**SW846 8141A**
	2.00	**1.46 p**	**ug/L**	**73**	**68**	**SW846 8141A**
Malathion	**2.00**	**0.600 a**	**ug/L**	**30**		**SW846 8141A**
	2.00	**1.26 p**	**ug/L**	**63**	**71**	**SW846 8141A**
Methyl parathion	**2.00**	**0.806 a**	**ug/L**	**40**		**SW846 8141A**
	2.00	**1.59 p**	**ug/L**	**80**	**65**	**SW846 8141A**
Phorate	**2.00**	**0.848 a**	**ug/L**	**42**		**SW846 8141A**
	2.00	**1.70 p**	**ug/L**	**85**	**67**	**SW846 8141A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	44 *	(49 - 105)
	81	(49 - 105)
Ethyl Pirimifos	30	(20 - 121)
	90	(20 - 121)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

p Relative percent difference (RPD) is outside stated control limits

* Surrogate recovery is outside stated control limits.

a Spiked analyte recovery is outside stated control limits.

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F2LGF1A5-MS **Matrix.........:** WATER
MS Lot-Sample #: D3J150262-001 F2LGF1A6-MSD
Date Sampled...: 10/14/03 08:00 **Date Received..:** 10/15/03
Prep Date......: 10/21/03 **Analysis Date..:** 11/05/03
Prep Batch #...: 3294207 **Analysis Time..:** 17:51
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Demeton (total)	**69**	**(20 - 107)**			**SW846 8141A**
	78	**(20 - 107)**	**14**	**(0-40)**	**SW846 8141A**
Diazinon	**71**	**(58 - 108)**			**SW846 8141A**
	74	**(58 - 108)**	**5.8**	**(0-40)**	**SW846 8141A**
Ethyl parathion	**76**	**(62 - 118)**			**SW846 8141A**
	79	**(62 - 118)**	**4.2**	**(0-40)**	**SW846 8141A**
Malathion	**76**	**(33 - 109)**			**SW846 8141A**
	79	**(33 - 109)**	**4.4**	**(0-40)**	**SW846 8141A**
Methyl parathion	**84**	**(50 - 127)**			**SW846 8141A**
	87	**(50 - 127)**	**2.8**	**(0-40)**	**SW846 8141A**
Phorate	**79**	**(54 - 101)**			**SW846 8141A**
	78	**(54 - 101)**	**1.0**	**(0-40)**	**SW846 8141A**

RROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	81	(49 - 105)
	85	(49 - 105)
Ethyl Pirimifos	69	(20 - 121)
	74	(20 - 121)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE DATA REPORT

GC Semivolatiles

Client Lot #...: D3J160213 Work Order #...: F2LGF1A5-MS Matrix.........: WATER
MS Lot-Sample #: D3J150262-001 F2LGF1A6-MSD
Date Sampled...: 10/14/03 08:00 Date Received..: 10/15/03
Prep Date......: 10/21/03 Analysis Date..: 11/05/03
Prep Batch #...: 3294207 Analysis Time..: 17:51
Dilution Factor: 1

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD
Demeton (total)	ND	1.88	1.29	ug/L	69		SW846 8141A
	ND	1.89	1.48	ug/L	78	14	SW846 8141A
Diazinon	ND	1.88	1.33	ug/L	71		SW846 8141A
	ND	1.89	1.41	ug/L	74	5.8	SW846 8141A
Ethyl parathion	ND	1.88	1.43	ug/L	76		SW846 8141A
	ND	1.89	1.49	ug/L	79	4.2	SW846 8141A
Malathion	ND	1.88	1.44	ug/L	76		SW846 8141A
	ND	1.89	1.50	ug/L	79	4.4	SW846 8141A
Methyl parathion	ND	1.88	1.59	ug/L	84		SW846 8141A
	ND	1.89	1.63	ug/L	87	2.8	SW846 8141A
Phorate	ND	1.88	1.48	ug/L	79		SW846 8141A
	ND	1.89	1.46	ug/L	78	1.0	SW846 8141A

ROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	81	(49 - 105)
	85	(49 - 105)
Ethyl Pirimifos	69	(20 - 121)
	74	(20 - 121)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC Semivolatiles

Client Lot #...: D3J160213 **Work Order #...:** F2NR91EF-MS **Matrix.........:** WATER
MS Lot-Sample #: D3J160213-001 F2NR91EG-MSD
Date Sampled...: 10/14/03 16:20 **Date Received..:** 10/16/03
Prep Date.......: 10/21/03 **Analysis Date..:** 11/05/03
Prep Batch #...: 3294207 **Analysis Time..:** 14:09
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Demeton (total)	**40**	**(20 - 107)**			**SW846 8141A**
	27	**(20 - 107)**	**38**	**(0-40)**	**SW846 8141A**
Diazinon	**64**	**(58 - 108)**			**SW846 8141A**
	73	**(58 - 108)**	**13**	**(0-40)**	**SW846 8141A**
Ethyl parathion	**62**	**(62 - 118)**			**SW846 8141A**
	69	**(62 - 118)**	**10**	**(0-40)**	**SW846 8141A**
Malathion	**45**	**(33 - 109)**			**SW846 8141A**
	54	**(33 - 109)**	**16**	**(0-40)**	**SW846 8141A**
Methyl parathion	**61**	**(50 - 127)**			**SW846 8141A**
	68	**(50 - 127)**	**12**	**(0-40)**	**SW846 8141A**
Phorate	**58**	**(54 - 101)**			**SW846 8141A**
	57	**(54 - 101)**	**0.82**	**(0-40)**	**SW846 8141A**

RROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	60	(49 - 105)
	69	(49 - 105)
Ethyl Pirimifos	64	(20 - 121)
	73	(20 - 121)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE DATA REPORT

GC Semivolatiles

Client Lot #...: D3J160213 Work Order #...: F2NR91EF-MS Matrix.........: WATER
MS Lot-Sample #: D3J160213-001 F2NR91EG-MSD
Date Sampled...: 10/14/03 16:20 Date Received..: 10/16/03
Prep Date......: 10/21/03 Analysis Date..: 11/05/03
Prep Batch #...: 3294207 Analysis Time..: 14:09
Dilution Factor: 1

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD
Demeton (total)	**ND**	**1.89**	**0.764**	**ug/L**	**40**		**SW846 8141A**
	ND	**1.90**	**0.518**	**ug/L**	**27**	**38**	**SW846 8141A**
Diazinon	**ND**	**1.89**	**1.22**	**ug/L**	**64**		**SW846 8141A**
	ND	**1.90**	**1.39**	**ug/L**	**73**	**13**	**SW846 8141A**
Ethyl parathion	**ND**	**1.89**	**1.18**	**ug/L**	**62**		**SW846 8141A**
	ND	**1.90**	**1.31**	**ug/L**	**69**	**10**	**SW846 8141A**
Malathion	**ND**	**1.89**	**0.862**	**ug/L**	**45**		**SW846 8141A**
	ND	**1.90**	**1.02**	**ug/L**	**54**	**16**	**SW846 8141A**
Methyl parathion	**ND**	**1.89**	**1.15**	**ug/L**	**61**		**SW846 8141A**
	ND	**1.90**	**1.29**	**ug/L**	**68**	**12**	**SW846 8141A**
Phorate	**ND**	**1.89**	**1.09**	**ug/L**	**58**		**SW846 8141A**
	ND	**1.90**	**1.08**	**ug/L**	**57**	**0.82**	**SW846 8141A**

ROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	60	(49 - 105)
	69	(49 - 105)
Ethyl Pirimifos	64	(20 - 121)
	73	(20 - 121)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

METHOD BLANK REPORT

TOTAL Metals

Client Lot #...: D3J160213 **Matrix.........:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MB Lot-Sample #: D3J170000-479 **Prep Batch #...:** 3290479						
Mercury	ND	0.20 Dilution Factor: 1 Analysis Time..: 12:56	ug/L	SW846 7470A	10/22-10/23/03	F2TWN1AA
MB Lot-Sample #: D3J180000-152 **Prep Batch #...:** 3291152						
Aluminum	**30 B**	**100** Dilution Factor: 1 Analysis Time..: 17:15	**ug/L**	**SW846 6010B**	**10/23-10/24/03**	**F2XEF1AC**
Antimony	ND	10 Dilution Factor: 1 Analysis Time..: 20:06	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AT
Arsenic	ND	15 Dilution Factor: 1 Analysis Time..: 20:06	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AD
arium	ND	10 Dilution Factor: 1 Analysis Time..: 20:06	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AE
Beryllium	ND	5.0 Dilution Factor: 1 Analysis Time..: 20:06	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AF
Boron	ND	100 Dilution Factor: 1 Analysis Time..: 17:15	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AG
Cadmium	ND	5.0 Dilution Factor: 1 Analysis Time..: 20:06	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AH
Chromium	ND	10 Dilution Factor: 1 Analysis Time..: 20:06	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AK
Cobalt	ND	10 Dilution Factor: 1 Analysis Time..: 20:06	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AJ

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METHOD BLANK REPORT

TOTAL Metals

Client Lot #...: D3J160213　　　　Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Copper	1.3 B	10	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AL
		Dilution Factor: 1				
		Analysis Time..: 20:06				
Iron	ND	100	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AM
		Dilution Factor: 1				
		Analysis Time..: 17:15				
Lead	ND	3.0	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AR
		Dilution Factor: 1				
		Analysis Time..: 20:06				
Manganese	ND	10	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AN
		Dilution Factor: 1				
		Analysis Time..: 20:06				
Molybdenum	ND	20	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AP
		Dilution Factor: 1				
		Analysis Time..: 20:06				
Nickel	ND	40	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AQ
		Dilution Factor: 1				
		Analysis Time..: 20:06				
Selenium	ND	15	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AU
		Dilution Factor: 1				
		Analysis Time..: 20:06				
Silver	ND	10	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AA
		Dilution Factor: 1				
		Analysis Time..: 20:06				
Thallium	ND	10	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AV
		Dilution Factor: 1				
		Analysis Time..: 20:06				
Zinc	ND	20	ug/L	SW846 6010B	10/23-10/24/03	F2XEF1AW
		Dilution Factor: 1				
		Analysis Time..: 20:06				

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

B Estimated result. Result is less than RL.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

TOTAL Metals

Lot-Sample #...: D3J160213 **Matrix.........:** WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP-BATCH #
Aluminum	97	(86 - 108)			SW846 6010B	10/23-10/24/03	3291152
	100	(86 - 108)	3.0	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 17:20		
Antimony	99	(88 - 108)			SW846 6010B	10/23-10/24/03	3291152
	101	(88 - 108)	2.5	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		
Arsenic	100	(89 - 109)			SW846 6010B	10/23-10/24/03	3291152
	103	(89 - 109)	2.4	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		
Barium	104	(93 - 113)			SW846 6010B	10/23-10/24/03	3291152
	107	(93 - 113)	2.5	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		
Beryllium	99	(88 - 112)			SW846 6010B	10/23-10/24/03	3291152
	102	(88 - 112)	3.1	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		
Boron	96	(89 - 110)			SW846 6010B	10/23-10/24/03	3291152
	97	(89 - 110)	1.1	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 17:20		
Cadmium	101	(89 - 110)			SW846 6010B	10/23-10/24/03	3291152
	104	(89 - 110)	3.3	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		
Chromium	103	(89 - 112)			SW846 6010B	10/23-10/24/03	3291152
	106	(89 - 112)	3.1	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		
Cobalt	100	(86 - 107)			SW846 6010B	10/23-10/24/03	3291152
	103	(86 - 107)	2.8	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		
Copper	101	(86 - 110)			SW846 6010B	10/23-10/24/03	3291152
	104	(86 - 110)	2.7	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		

(Continued on next page)

LABORATORY CONTROL SAMPLE EVALUATION REPORT

TOTAL Metals

Lot-Sample #...: D3J160213 **Matrix.........:** WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP-BATCH #
Iron	96	(88 - 110)			SW846 6010B	10/23-10/24/03	3291152
	97	(88 - 110)	1.5	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 17:20		
Lead	101	(91 - 111)			SW846 6010B	10/23-10/24/03	3291152
	104	(91 - 111)	3.1	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		
Manganese	102	(90 - 110)			SW846 6010B	10/23-10/24/03	3291152
	105	(90 - 110)	2.7	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		
Molybdenum	99	(83 - 109)			SW846 6010B	10/23-10/24/03	3291152
	102	(83 - 109)	2.8	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		
Nickel	100	(90 - 110)			SW846 6010B	10/23-10/24/03	3291152
	103	(90 - 110)	2.6	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		
Selenium	98	(88 - 110)			SW846 6010B	10/23-10/24/03	3291152
	101	(88 - 110)	2.8	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		
Silver	100	(85 - 114)			SW846 6010B	10/23-10/24/03	3291152
	103	(85 - 114)	2.8	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		
Thallium	99	(88 - 108)			SW846 6010B	10/23-10/24/03	3291152
	101	(88 - 108)	2.5	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		
Zinc	96	(85 - 110)			SW846 6010B	10/23-10/24/03	3291152
	99	(85 - 110)	3.0	(0-20)	SW846 6010B	10/23-10/24/03	3291152
		Dilution Factor: 1			Analysis Time..: 20:11		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE DATA REPORT

TOTAL Metals

Lot-Sample #...: D3J160213 Matrix.........: WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION- ANALYSIS DATE	PREP BATCH #
Aluminum	2000	1940	ug/L	97		SW846 6010B	10/23-10/24/03	3291152
	2000	1990	ug/L	100	3.0	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 17:20		
Antimony	500	495	ug/L	99		SW846 6010B	10/23-10/24/03	3291152
	500	507	ug/L	101	2.5	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		
Arsenic	2000	2000	ug/L	100		SW846 6010B	10/23-10/24/03	3291152
	2000	2050	ug/L	103	2.4	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		
Barium	2000	2090	ug/L	104		SW846 6010B	10/23-10/24/03	3291152
	2000	2140	ug/L	107	2.5	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		
Beryllium	50.0	49.6	ug/L	99		SW846 6010B	10/23-10/24/03	3291152
	50.0	51.2	ug/L	102	3.1	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		
Boron	1000	956	ug/L	96		SW846 6010B	10/23-10/24/03	3291152
	1000	966	ug/L	97	1.1	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 17:20		
Cadmium	50.0	50.4	ug/L	101		SW846 6010B	10/23-10/24/03	3291152
	50.0	52.1	ug/L	104	3.3	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		
Chromium	200	205	ug/L	103		SW846 6010B	10/23-10/24/03	3291152
	200	212	ug/L	106	3.1	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		
Cobalt	500	500	ug/L	100		SW846 6010B	10/23-10/24/03	3291152
	500	514	ug/L	103	2.8	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		
Copper	250	254	ug/L	101		SW846 6010B	10/23-10/24/03	3291152
	250	261	ug/L	104	2.7	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		

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LABORATORY CONTROL SAMPLE DATA REPORT

TOTAL Metals

Lot-Sample #...: D3J160213 Matrix.........: WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Iron	1000	955	ug/L	96		SW846 6010B	10/23-10/24/03	3291152
	1000	970	ug/L	97	1.5	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 17:20		
Lead	500	504	ug/L	101		SW846 6010B	10/23-10/24/03	3291152
	500	521	ug/L	104	3.1	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		
Manganese	500	510	ug/L	102		SW846 6010B	10/23-10/24/03	3291152
	500	525	ug/L	105	2.7	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		
Molybdenum	1000	993	ug/L	99		SW846 6010B	10/23-10/24/03	3291152
	1000	1020	ug/L	102	2.8	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		
Nickel	500	500	ug/L	100		SW846 6010B	10/23-10/24/03	3291152
	500	513	ug/L	103	2.6	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		
Selenium	2000	1970	ug/L	98		SW846 6010B	10/23-10/24/03	3291152
	2000	2020	ug/L	101	2.8	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		
Silver	50.0	49.9	ug/L	100		SW846 6010B	10/23-10/24/03	3291152
	50.0	51.3	ug/L	103	2.8	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		
Thallium	2000	1980	ug/L	99		SW846 6010B	10/23-10/24/03	3291152
	2000	2030	ug/L	101	2.5	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		
Zinc	500	479	ug/L	96		SW846 6010B	10/23-10/24/03	3291152
	500	494	ug/L	99	3.0	SW846 6010B	10/23-10/24/03	3291152
			Dilution Factor: 1			Analysis Time..: 20:11		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

LABORATORY CONTROL SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D3J160213 **Matrix.........:** WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
LCS Lot-Sample#: D3J170000-479 **Prep Batch #...:** 3290479					
Mercury	101	(84 - 114)	SW846 7470A	10/22-10/23/03	F2TWN1AC
		Dilution Factor: 1		Analysis Time..: 12:58	

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: D3J160213 **Matrix..........:** WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
LCS Lot-Sample#: D3J170000-479 Prep Batch #...: 3290479							
Mercury	5.00	5.04	ug/L	101	SW846 7470A	10/22-10/23/03	F2TWN1AC
			Dilution Factor: 1		Analysis Time..: 12:58		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D3J160213 **Matrix.........:** WATER
Date Sampled...: 10/07/03 12:00 **Date Received..:** 10/08/03

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MS Lot-Sample #: D3J080173-004 **Prep Batch #...:** 3291152							
Barium	102	(85 - 120)			SW846 6010B	10/23-10/25/03	F13CM1CN
	101	(85 - 120)	0.46	(0-25)	SW846 6010B	10/23-10/25/03	F13CM1CP
		Dilution Factor: 1					
		Analysis Time..: 18:07					
Beryllium	94	(79 - 121)			SW846 6010B	10/23-10/25/03	F13CM1CQ
	92	(79 - 121)	2.3	(0-25)	SW846 6010B	10/23-10/25/03	F13CM1CR
		Dilution Factor: 1					
		Analysis Time..: 18:07					

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE DATA REPORT

TOTAL Metals

ient Lot #...: D3J160213 **Matrix..........:** WATER
Date Sampled...: 10/07/03 12:00 **Date Received..:** 10/08/03

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MS Lot-Sample #: D3J080173-004 **Prep Batch #...:** 3291152									
Barium									
	12	2000	2050	ug/L	102		SW846 6010B	10/23-10/25/03	F13CM1CN
	12	2000	2040	ug/L	101	0.46	SW846 6010B	10/23-10/25/03	F13CM1CP
			Dilution Factor: 1 Analysis Time..: 18:07						
Beryllium									
	ND	50.0	46.9	ug/L	94		SW846 6010B	10/23-10/25/03	F13CM1CQ
	ND	50.0	45.8	ug/L	92	2.3	SW846 6010B	10/23-10/25/03	F13CM1CR
			Dilution Factor: 1 Analysis Time..: 18:07						

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D3J160213 **Matrix.........:** WATER
Date Sampled...: 10/14/03 16:20 **Date Received..:** 10/16/03

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MS Lot-Sample #: D3J160213-001 Prep Batch #...: 3290479							
Mercury	99	(84 - 114)			SW846 7470A	10/22-10/23/03	F2NR91C2
	101	(84 - 114)	2.0	(0-10)	SW846 7470A	10/22-10/23/03	F2NR91C3
		Dilution Factor: 1 Analysis Time..: 13:29					
MS Lot-Sample #: D3J160213-001 Prep Batch #...: 3291152							
Aluminum	117	(83 - 119)			SW846 6010B	10/23-10/24/03	F2NR91DK
	114	(83 - 119)	2.0	(0-25)	SW846 6010B	10/23-10/24/03	F2NR91DL
		Dilution Factor: 1 Analysis Time..: 18:24					
Antimony	106	(81 - 124)			SW846 6010B	10/23-10/25/03	F2NR91CR
	102	(81 - 124)	3.4	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91CT
		Dilution Factor: 1 Analysis Time..: 18:25					
Arsenic	111	(84 - 124)			SW846 6010B	10/23-10/25/03	F2NR91DM
	107	(84 - 124)	4.0	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91DN
		Dilution Factor: 1 Analysis Time..: 18:25					
Barium	104	(85 - 120)			SW846 6010B	10/23-10/25/03	F2NR91DP
	101	(85 - 120)	3.5	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91DQ
		Dilution Factor: 1 Analysis Time..: 18:25					
Beryllium	96	(79 - 121)			SW846 6010B	10/23-10/25/03	F2NR91DR
	94	(79 - 121)	1.4	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91DT
		Dilution Factor: 1 Analysis Time..: 18:25					
Boron	101	(87 - 113)			SW846 6010B	10/23-10/24/03	F2NR91DU
	98	(87 - 113)	1.3	(0-25)	SW846 6010B	10/23-10/24/03	F2NR91DV
		Dilution Factor: 1 Analysis Time..: 18:24					
Cadmium	99	(82 - 119)			SW846 6010B	10/23-10/25/03	F2NR91DW
	96	(82 - 119)	3.1	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91DX
		Dilution Factor: 1 Analysis Time..: 18:25					

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MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D3J160213 **Matrix.........:** WATER
Date Sampled...: 10/14/03 16:20 **Date Received..:** 10/16/03

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Chromium	101	(73 - 135)			SW846 6010B	10/23-10/25/03	F2NR91D2
	91	(73 - 135)	8.4	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91D3
		Dilution Factor: 1 Analysis Time..: 18:25					
Cobalt	102	(82 - 119)			SW846 6010B	10/23-10/25/03	F2NR91D0
	98	(82 - 119)	3.8	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91D1
		Dilution Factor: 1 Analysis Time..: 18:25					
Copper	116	(82 - 129)			SW846 6010B	10/23-10/25/03	F2NR91D4
	111	(82 - 129)	3.9	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91D5
		Dilution Factor: 1 Analysis Time..: 18:25					
Iron	97	(52 - 155)			SW846 6010B	10/23-10/24/03	F2NR91D6
	90	(52 - 155)	4.8	(0-25)	SW846 6010B	10/23-10/24/03	F2NR91D7
		Dilution Factor: 1 Analysis Time..: 18:24					
ad	106	(89 - 121)			SW846 6010B	10/23-10/25/03	F2NR91CP
	101	(89 - 121)	4.4	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91CQ
		Dilution Factor: 1 Analysis Time..: 18:25					
Manganese	105	(79 - 121)			SW846 6010B	10/23-10/25/03	F2NR91CH
	95	(79 - 121)	3.2	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91CJ
		Dilution Factor: 1 Analysis Time..: 18:25					
Molybdenum	102	(83 - 109)			SW846 6010B	10/23-10/25/03	F2NR91CK
	99	(83 - 109)	2.7	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91CL
		Dilution Factor: 1 Analysis Time..: 18:25					
Nickel	97	(84 - 120)			SW846 6010B	10/23-10/25/03	F2NR91CM
	93	(84 - 120)	4.3	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91CN
		Dilution Factor: 1 Analysis Time..: 18:25					
Selenium	118	(71 - 140)			SW846 6010B	10/23-10/25/03	F2NR91CU
	113	(71 - 140)	4.6	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91CV
		Dilution Factor: 1 Analysis Time..: 18:25					

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MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D3J160213 Matrix.........: WATER

Date Sampled...: 10/14/03 16:20 Date Received..: 10/16/03

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Silver	119	(75 - 141)			SW846 6010B	10/23-10/25/03	F2NR91DH
	114	(75 - 141)	4.7	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91DJ
		Dilution Factor: 1 Analysis Time..: 18:25					
Thallium	105	(90 - 116)			SW846 6010B	10/23-10/25/03	F2NR91CW
	102	(90 - 116)	3.8	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91CX
		Dilution Factor: 1 Analysis Time..: 18:25					
Zinc	106	(60 - 137)			SW846 6010B	10/23-10/25/03	F2NR91C0
	102	(60 - 137)	4.1	(0-25)	SW846 6010B	10/23-10/25/03	F2NR91C1
		Dilution Factor: 1 Analysis Time..: 18:25					

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: D3J160213 **Matrix.........:** WATER
Date Sampled...: 10/14/03 16:20 **Date Received..:** 10/16/03

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MS Lot-Sample #: D3J160213-001 Prep Batch #...: 3290479									
Mercury									
	ND	5.00	4.93	ug/L	99		SW846 7470A	10/22-10/23/03	F2NR91C2
	ND	5.00	5.03	ug/L	101	2.0	SW846 7470A	10/22-10/23/03	F2NR91C3
			Dilution Factor: 1 Analysis Time..: 13:29						
MS Lot-Sample #: D3J160213-001 Prep Batch #...: 3291152									
Aluminum									
	480	2000	2810	ug/L	117		SW846 6010B	10/23-10/24/03	F2NR91DK
	480	2000	2760	ug/L	114	2.0	SW846 6010B	10/23-10/24/03	F2NR91DL
			Dilution Factor: 1 Analysis Time..: 18:24						
Antimony									
	ND	500	528	ug/L	106		SW846 6010B	10/23-10/25/03	F2NR91CR
	ND	500	510	ug/L	102	3.4	SW846 6010B	10/23-10/25/03	F2NR91CT
			Dilution Factor: 1 Analysis Time..: 18:25						
Arsenic									
	ND	2000	2230	ug/L	111		SW846 6010B	10/23-10/25/03	F2NR91DM
	ND	2000	2150	ug/L	107	4.0	SW846 6010B	10/23-10/25/03	F2NR91DN
			Dilution Factor: 1 Analysis Time..: 18:25						
Barium									
	21	2000	2110	ug/L	104		SW846 6010B	10/23-10/25/03	F2NR91DP
	21	2000	2040	ug/L	101	3.5	SW846 6010B	10/23-10/25/03	F2NR91DQ
			Dilution Factor: 1 Analysis Time..: 18:25						
Beryllium									
	ND	50.0	47.8	ug/L	96		SW846 6010B	10/23-10/25/03	F2NR91DR
	ND	50.0	47.2	ug/L	94	1.4	SW846 6010B	10/23-10/25/03	F2NR91DT
			Dilution Factor: 1 Analysis Time..: 18:25						
Boron									
	1600	1000	2650	ug/L	101		SW846 6010B	10/23-10/24/03	F2NR91DU
	1600	1000	2620	ug/L	98	1.3	SW846 6010B	10/23-10/24/03	F2NR91DV
			Dilution Factor: 1 Analysis Time..: 18:24						

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MATRIX SPIKE SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: D3J160213 **Matrix.........:** WATER
Date Sampled...: 10/14/03 16:20 **Date Received..:** 10/16/03

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Cadmium									
	ND	50.0	49.6	ug/L	99		SW846 6010B	10/23-10/25/03	F2NR91DW
	ND	50.0	48.1	ug/L	96	3.1	SW846 6010B	10/23-10/25/03	F2NR91DX
			Dilution Factor: 1						
			Analysis Time..: 18:25						
Chromium									
	43	200	245	ug/L	101		SW846 6010B	10/23-10/25/03	F2NR91D2
	43	200	225	ug/L	91	8.4	SW846 6010B	10/23-10/25/03	F2NR91D3
			Dilution Factor: 1						
			Analysis Time..: 18:25						
Cobalt									
	ND	500	509	ug/L	102		SW846 6010B	10/23-10/25/03	F2NR91D0
	ND	500	490	ug/L	98	3.8	SW846 6010B	10/23-10/25/03	F2NR91D1
			Dilution Factor: 1						
			Analysis Time..: 18:25						
Copper									
	8.6	250	298	ug/L	116		SW846 6010B	10/23-10/25/03	F2NR91D4
	8.6	250	286	ug/L	111	3.9	SW846 6010B	10/23-10/25/03	F2NR91D5
			Dilution Factor: 1						
			Analysis Time..: 18:25						
Iron									
	510	1000	1490	ug/L	97		SW846 6010B	10/23-10/24/03	F2NR91D6
	510	1000	1420	ug/L	90	4.8	SW846 6010B	10/23-10/24/03	F2NR91D7
			Dilution Factor: 1						
			Analysis Time..: 18:24						
Lead									
	ND	500	529	ug/L	106		SW846 6010B	10/23-10/25/03	F2NR91CP
	ND	500	506	ug/L	101	4.4	SW846 6010B	10/23-10/25/03	F2NR91CQ
			Dilution Factor: 1						
			Analysis Time..: 18:25						
Manganese									
	1000	500	1530	ug/L	105		SW846 6010B	10/23-10/25/03	F2NR91CH
	1000	500	1490	ug/L	95	3.2	SW846 6010B	10/23-10/25/03	F2NR91CJ
			Dilution Factor: 1						
			Analysis Time..: 18:25						

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MATRIX SPIKE SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: D3J160213 **Matrix.........:** WATER
Date Sampled...: 10/14/03 16:20 **Date Received..:** 10/16/03

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Molybdenum									
	40	1000	1060	ug/L	102		SW846 6010B	10/23-10/25/03	F2NR91CK
	40	1000	1030	ug/L	99	2.7	SW846 6010B	10/23-10/25/03	F2NR91CL
			Dilution Factor: 1 Analysis Time..: 18:25						
Nickel									
	34	500	520	ug/L	97		SW846 6010B	10/23-10/25/03	F2NR91CM
	34	500	498	ug/L	93	4.3	SW846 6010B	10/23-10/25/03	F2NR91CN
			Dilution Factor: 1 Analysis Time..: 18:25						
Selenium									
	ND	2000	2370	ug/L	118		SW846 6010B	10/23-10/25/03	F2NR91CU
	ND	2000	2260	ug/L	113	4.6	SW846 6010B	10/23-10/25/03	F2NR91CV
			Dilution Factor: 1 Analysis Time..: 18:25						
Silver									
	ND	50.0	59.7	ug/L	119		SW846 6010B	10/23-10/25/03	F2NR91DH
	ND	50.0	57.0	ug/L	114	4.7	SW846 6010B	10/23-10/25/03	F2NR91DJ
			Dilution Factor: 1 Analysis Time..: 18:25						
Thallium									
	ND	2000	2110	ug/L	105		SW846 6010B	10/23-10/25/03	F2NR91CW
	ND	2000	2030	ug/L	102	3.8	SW846 6010B	10/23-10/25/03	F2NR91CX
			Dilution Factor: 1 Analysis Time..: 18:25						
Zinc									
	16	500	546	ug/L	106		SW846 6010B	10/23-10/25/03	F2NR91C0
	16	500	524	ug/L	102	4.1	SW846 6010B	10/23-10/25/03	F2NR91C1
			Dilution Factor: 1 Analysis Time..: 18:25						

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

METHOD BLANK REPORT

General Chemistry

Client Lot #...: D3J160213 Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)		Work Order #: F29L11AA		MB Lot-Sample #:	D3J230000-361	
	ND	20	mg/L	MCAWW 410.4	10/21/03	3296361
		Dilution Factor: 1				
		Analysis Time..: 16:45				
Chloride		Work Order #: F3HM01AA		MB Lot-Sample #:	D3J170000-566	
	ND	3.0	mg/L	MCAWW 300.0A	10/16/03	3290566
		Dilution Factor: 1				
		Analysis Time..: 13:37				
Fecal Coliform		Work Order #: F3LPV1AA		MB Lot-Sample #:	D3J280000-603	
	ND	1.0	CFU/100m	SM18 9222D Fecal	10/16/03	3301603
		Dilution Factor: 1				
		Analysis Time..: 14:30				
Fluoride		Work Order #: F3HMF1AA		MB Lot-Sample #:	D3J170000-569	
	ND	1.0	mg/L	MCAWW 300.0A	10/16/03	3290569
		Dilution Factor: 1				
		Analysis Time..: 13:37				
itrate		Work Order #: F3HNK1AA		MB Lot-Sample #:	D3J170000-567	
	ND	0.50	mg/L	MCAWW 300.0A	10/16/03	3290567
		Dilution Factor: 1				
		Analysis Time..: 13:37				
Nitrite		Work Order #: F3HNG1AA		MB Lot-Sample #:	D3J170000-570	
	ND	0.50	mg/L	MCAWW 300.0A	10/16/03	3290570
		Dilution Factor: 1				
		Analysis Time. : 13:37				
Specific Conductance		Work Order #: F20C11AA		MB Lot-Sample #:	D3J200000-257	
	ND	2.0	umhos/cm	MCAWW 120.1	10/17/03	3293257
		Dilution Factor: 1				
		Analysis Time..: 16:00				
Sulfate		Work Order #: F3HPF1AA		MB Lot-Sample #:	D3J170000-568	
	ND	5.0	mg/L	MCAWW 300.0A	10/16/03	3290568
		Dilution Factor: 1				
		Analysis Time..: 13:37				
Total Coliform		Work Order #: F3LPR1AA		MB Lot-Sample #:	D3J280000-601	
	ND	1.0	CFU/100m	SM18 9222B	10/16/03	3301601
		Dilution Factor: 1				
		Analysis Time..: 15:00				

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METHOD BLANK REPORT

General Chemistry

ient Lot #...: D3J160213 Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Cyanide		Work Order #: F288Q1AA		MB Lot-Sample #:	D3J230000-416	
	ND	0.010	mg/L	MCAWW 335.3	10/22-10/23/03	3296416
		Dilution Factor: 1				
		Analysis Time..: 13:00				
Total Dissolved Solids		Work Order #: F3T8A1AA		MB Lot-Sample #:	D3J300000-251	
	ND	10	mg/L	MCAWW 160.1	10/20/03	3303251
		Dilution Factor: 1				
		Analysis Time..: 17:00				
Total Suspended Solids		Work Order #: F24V01AA		MB Lot-Sample #:	D3J210000-676	
	ND	4.0	mg/L	MCAWW 160.2	10/20/03	3294676
		Dilution Factor: 1				
		Analysis Time..: 20:45				

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

General Chemistry

Lot-Sample #...: D3J160213 Matrix.........: WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)		WO#:F29L11AC-LCS/F29L11AD-LCSD LCS Lot-Sample#: D3J230000-361					
	94	(86 - 114)			MCAWW 410.4	10/21/03	3296361
	94	(86 - 114)	0.0	(0-11)	MCAWW 410.4	10/21/03	3296361
		Dilution Factor: 1			Analysis Time..: 16:45		
Chloride		WO#:F3HM01AC-LCS/F3HM01AD-LCSD LCS Lot-Sample#: D3J170000-566					
	96	(90 - 110)			MCAWW 300.0A	10/16/03	3290566
	96	(90 - 110)	0.88	(0-10)	MCAWW 300.0A	10/16/03	3290566
		Dilution Factor: 1			Analysis Time..: 13:15		
Fluoride		WO#:F3HMF1AC-LCS/F3HMF1AD-LCSD LCS Lot-Sample#: D3J170000-569					
	98	(90 - 110)			MCAWW 300.0A	10/16/03	3290569
	100	(90 - 110)	1.3	(0-10)	MCAWW 300.0A	10/16/03	3290569
		Dilution Factor: 1			Analysis Time..: 13:15		
Nitrate		WO#:F3HNK1AC-LCS/F3HNK1AD-LCSD LCS Lot-Sample#: D3J170000-567					
	95	(90 - 110)			MCAWW 300.0A	10/16/03	3290567
	94	(90 - 110)	0.26	(0-10)	MCAWW 300.0A	10/16/03	3290567
		Dilution Factor: 1			Analysis Time..: 13:15		
Nitrite		WO#:F3HNG1AC-LCS/F3HNG1AD-LCSD LCS Lot-Sample#: D3J170000-570					
	102	(90 - 110)			MCAWW 300.0A	10/16/03	3290570
	99	(90 - 110)	3.2	(0-10)	MCAWW 300.0A	10/16/03	3290570
		Dilution Factor: 1			Analysis Time..: 13:15		
Specific Conductance		WO#:F20C11AC-LCS/F20C11AD-LCSD LCS Lot-Sample#: D3J200000-257					
	101	(89 - 109)			MCAWW 120.1	10/17/03	3293257
	102	(89 - 109)	1.1	(0-7.0)	MCAWW 120.1	10/17/03	3293257
		Dilution Factor: 1			Analysis Time..: 16:00		
Sulfate		WO#:F3HPF1AC-LCS/F3HPF1AD-LCSD LCS Lot-Sample#: D3J170000-568					
	92	(90 - 110)			MCAWW 300.0A	10/16/03	3290568
	92	(90 - 110)	0.43	(0-10)	MCAWW 300.0A	10/16/03	3290568
		Dilution Factor: 1			Analysis Time..: 13:15		
Total Dissolved Solids		WO#:F3T8A1AC-LCS/F3T8A1AD-LCSD LCS Lot-Sample#: D3J300000-251					
	99	(86 - 106)			MCAWW 160.1	10/20/03	3303251
	104	(86 - 106)	4.9	(0-20)	MCAWW 160.1	10/20/03	3303251
		Dilution Factor: 1			Analysis Time..: 00:00		

(Continued on next page)

LABORATORY CONTROL SAMPLE EVALUATION REPORT

General Chemistry

Lot-Sample #...: D3J160213 Matrix.........: WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Suspended Solids		WO#:F24V01AC-LCS/F24V01AD-LCSD LCS Lot-Sample#: D3J210000-676					
	96	(86 - 114)			MCAWW 160.2	10/20/03	3294676
	92	(86 - 114)	3.8	(0-20)	MCAWW 160.2	10/20/03	3294676

Dilution Factor: 1 Analysis Time..: 20:45

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE DATA REPORT

General Chemistry

Lot-Sample #...: D3J160213 Matrix.........: WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)			WO#:F29L11AC-LCS/F29L11AD-LCSD			LCS Lot-Sample#: D3J230000-361		
	100	94.1	mg/L	94		MCAWW 410.4	10/21/03	3296361
	100	94.1	mg/L	94	0.0	MCAWW 410.4	10/21/03	3296361
			Dilution Factor: 1			Analysis Time..: 16:45		
Chloride			WO#:F3HM01AC-LCS/F3HM01AD-LCSD			LCS Lot-Sample#: D3J170000-566		
	20.0	19.3	mg/L	96		MCAWW 300.0A	10/16/03	3290566
	20.0	19.1	mg/L	96	0.88	MCAWW 300.0A	10/16/03	3290566
			Dilution Factor: 1			Analysis Time..: 13:15		
Fluoride			WO#:F3HMF1AC-LCS/F3HMF1AD-LCSD			LCS Lot-Sample#: D3J170000-569		
	4.00	3.93	mg/L	98		MCAWW 300.0A	10/16/03	3290569
	4.00	3.98	mg/L	100	1.3	MCAWW 300.0A	10/16/03	3290569
			Dilution Factor: 1			Analysis Time..: 13:15		
Nitrate			WO#:F3HNK1AC-LCS/F3HNK1AD-LCSD			LCS Lot-Sample#: D3J170000-567		
	4.00	3.79	mg/L	95		MCAWW 300.0A	10/16/03	3290567
	4.00	3.78	mg/L	94	0.26	MCAWW 300.0A	10/16/03	3290567
			Dilution Factor: 1			Analysis Time..: 13:15		
Nitrite			WO#:F3HNG1AC-LCS/F3HNG1AD-LCSD			LCS Lot-Sample#: D3J170000-570		
	4.00	4.08	mg/L	102		MCAWW 300.0A	10/16/03	3290570
	4.00	3.95	mg/L	99	3.2	MCAWW 300.0A	10/16/03	3290570
			Dilution Factor: 1			Analysis Time..: 13:15		
Specific Conductance			WO#:F20C11AC-LCS/F20C11AD-LCSD			LCS Lot-Sample#: D3J200000-257		
	1010	1020	umhos/cm	101		MCAWW 120.1	10/17/03	3293257
	1010	1030	umhos/cm	102	1.1	MCAWW 120.1	10/17/03	3293257
			Dilution Factor: 1			Analysis Time..: 16:00		
Sulfate			WO#:F3HPF1AC-LCS/F3HPF1AD-LCSD			LCS Lot-Sample#: D3J170000-568		
	20.0	18.4	mg/L	92		MCAWW 300.0A	10/16/03	3290568
	20.0	18.3	mg/L	92	0.43	MCAWW 300.0A	10/16/03	3290568
			Dilution Factor: 1			Analysis Time..: 13:15		
Total Dissolved Solids			WO#:F3T8A1AC-LCS/F3T8A1AD-LCSD			LCS Lot-Sample#: D3J300000-251		
	500	494	mg/L	99		MCAWW 160.1	10/20/03	3303251
	500	519	mg/L	104	4.9	MCAWW 160.1	10/20/03	3303251
			Dilution Factor: 1			Analysis Time..: 00:00		

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LABORATORY CONTROL SAMPLE DATA REPORT

General Chemistry

Lot-Sample #...: D3J160213 Matrix.........: WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Suspended Solids		WO#:F24V01AC-LCS/F24V01AD-LCSD				LCS Lot-Sample#: D3J210000-676		
	250	239	mg/L	96		MCAWW 160.2	10/20/03	3294676
	250	230	mg/L	92	3.8	MCAWW 160.2	10/20/03	3294676

Dilution Factor: 1 Analysis Time..: 20:45

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

General Chemistry

Client Lot #...: D3J160213 **Matrix.........:** WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Cyanide		Work Order #: F288Q1AC LCS Lot-Sample#: D3J230000-416			
	99	(89 - 109)	MCAWW 335.3	10/22-10/23/03	3296416
		Dilution Factor: 1	Analysis Time..: 13:00		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE DATA REPORT

General Chemistry

Client Lot #...: D3J160213 **Matrix.........:** WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Cyanide			Work Order #: F288Q1AC LCS Lot-Sample#: D3J230000-416				
	0.100	0.0987	mg/L	99	MCAWW 335.3	10/22-10/23/03	3296416
			Dilution Factor: 1		Analysis Time..: 13:0C		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE EVALUATION REPORT

General Chemistry

Client Lot #...: D3J160213 **Matrix.........:** WATER
Date Sampled...: 10/14/03 16:55 **Date Received..:** 10/16/03

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)			WO#: F2NR91EK-MS/F2NR91EL-MSD MS Lot-Sample #: D3J160213-001				
	86	(74 - 109)			MCAWW 410.4	10/21/03	3296361
	77	(74 - 109)	8.2	(0-11)	MCAWW 410.4	10/21/03	3296361
			Dilution Factor: 1 Analysis Time..: 16:45				
Chloride			WO#: F2NHE1CD-MS/F2NHE1CE-MSD MS Lot-Sample #: D3J160175-001				
	109	(80 - 120)			MCAWW 300.0A	10/16/03	3290566
	111	(80 - 120)	0.91	(0-10)	MCAWW 300.0A	10/16/03	3290566
			Dilution Factor: 1 Analysis Time..: 15:35				
Chloride			WO#: F2NR91C6-MS/F2NR91C7-MSD MS Lot-Sample #: D3J160213-001				
	108	(80 - 120)			MCAWW 300.0A	10/16/03	3290566
	108	(80 - 120)	0.52	(0-10)	MCAWW 300.0A	10/16/03	3290566
			Dilution Factor: 1 Analysis Time..: 18:06				
Fluoride			WO#: F2NR91C8-MS/F2NR91C9-MSD MS Lot-Sample #: D3J160213-001				
	131 N	(80 - 120)			MCAWW 300.0A	10/16/03	3290569
	130 N	(80 - 120)	0.27	(0-10)	MCAWW 300.0A	10/16/03	3290569
			Dilution Factor: 1 Analysis Time..: 16:40				
Nitrate			WO#: F2NHE1CF-MS/F2NHE1CG-MSD MS Lot-Sample #: D3J160175-001				
	111	(80 - 120)			MCAWW 300.0A	10/16/03	3290567
	113	(80 - 120)	1.5	(0-10)	MCAWW 300.0A	10/16/03	3290567
			Dilution Factor: 1 Analysis Time..: 15:35				
Nitrate			WO#: F2NR91DA-MS/F2NR91DC-MSD MS Lot-Sample #: D3J160213-001				
	107	(80 - 120)			MCAWW 300.0A	10/16/03	3290567
	107	(80 - 120)	0.48	(0-10)	MCAWW 300.0A	10/16/03	3290567
			Dilution Factor: 1 Analysis Time..: 16:40				
Nitrite			WO#: F2NR91DD-MS/F2NR91DE-MSD MS Lot-Sample #: D3J160213-001				
	112	(80 - 120)			MCAWW 300.0A	10/16/03	3290570
	115	(80 - 120)	2.5	(0-10)	MCAWW 300.0A	10/16/03	3290570
			Dilution Factor: 1 Analysis Time..: 17:33				

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MATRIX SPIKE SAMPLE EVALUATION REPORT

General Chemistry

Client Lot #...: D3J160213 **Matrix.........:** WATER
Date Sampled...: 10/14/03 16:55 **Date Received..:** 10/16/03

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Sulfate			WO#: F2NHE1CH-MS/F2NHE1CJ-MSD			MS Lot-Sample #: D3J160175-001	
	112	(80 - 120)			MCAWW 300.0A	10/16/03	3290568
	113	(80 - 120)	0.69	(0-10)	MCAWW 300.0A	10/16/03	3290568
			Dilution Factor: 1				
			Analysis Time..: 15:35				
Sulfate			WO#: F2NR91DF-MS/F2NR91DG-MSD			MS Lot-Sample #: D3J160213-001	
	114 I	(80 - 120)			MCAWW 300.0A	10/16/03	3290568
	115 I	(80 - 120)	0.47	(0-10)	MCAWW 300.0A	10/16/03	3290568
			Dilution Factor: 1				
			Analysis Time..: 18:06				
Total Cyanide			WO#: F2NR91EH-MS/F2NR91EJ-MSD			MS Lot-Sample #: D3J160213-001	
	95	(78 - 120)			MCAWW 335.3	10/22-10/23/03	3296416
	96	(78 - 120)	0.62	(0-20)	MCAWW 335.3	10/22-10/23/03	3296416
			Dilution Factor: 1				
			Analysis Time..: 13:00				

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Estimated result. Result concentration exceeds the calibration range.

N Spiked analyte recovery is outside stated control limits

MATRIX SPIKE SAMPLE DATA REPORT

General Chemistry

Client Lot #...: D3J160213 Matrix.........: WATER
Date Sampled...: 10/14/03 16:55 Date Received..: 10/16/03

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)			WO#: F2NR91EK-MS/F2NR91EL-MSD MS Lot-Sample #: D3J160213-001						
	12	50.0	55.1	mg/L	86		MCAWW 410.4	10/21/03	3296361
	12	50.0	50.7	mg/L	77	8.2	MCAWW 410.4	10/21/03	3296361
			Dilution Factor: 1 Analysis Time..: 16:45						
Chloride			WO#: F2NHE1CD-MS/F2NHE1CE-MSD MS Lot-Sample #: D3J160175-001						
	11	25.0	38.1	mg/L	109		MCAWW 300.0A	10/16/03	3290566
	11	25.0	38.5	mg/L	111	0.91	MCAWW 300.0A	10/16/03	3290566
			Dilution Factor: 1 Analysis Time..: 15:35						
Chloride			WO#: F2NR91C6-MS/F2NR91C7-MSD MS Lot-Sample #: D3J160213-001						
	1600	2500	4300	mg/L	108		MCAWW 300.0A	10/16/03	3290566
	1600	2500	4320	mg/L	108	0.52	MCAWW 300.0A	10/16/03	3290566
			Dilution Factor: 1 Analysis Time..: 18:06						
Fluoride			WO#: F2NR91C8-MS/F2NR91C9-MSD MS Lot-Sample #: D3J160213-001						
	ND	25.0	32.7 N	mg/L	131		MCAWW 300.0A	10/16/03	3290569
	ND	25.0	32.6 N	mg/L	130	0.27	MCAWW 300.0A	10/16/03	3290569
			Dilution Factor: 1 Analysis Time..: 16:40						
Nitrate			WO#: F2NHE1CF-MS/F2NHE1CG-MSD MS Lot-Sample #: D3J160175-001						
	2.5	5.00	8.01	mg/L	111		MCAWW 300.0A	10/16/03	3290567
	2.5	5.00	8.13	mg/L	113	1.5	MCAWW 300.0A	10/16/03	3290567
			Dilution Factor: 1 Analysis Time..: 15:35						
Nitrate			WO#: F2NR91DA-MS/F2NR91DC-MSD MS Lot-Sample #: D3J160213-001						
	ND	25.0	26.8	mg/L	107		MCAWW 300.0A	10/16/03	3290567
	ND	25.0	26.7	mg/L	107	0.48	MCAWW 300.0A	10/16/03	3290567
			Dilution Factor: 1 Analysis Time..: 16:40						
Nitrite			WO#: F2NR91DD-MS/F2NR91DE-MSD MS Lot-Sample #: D3J160213-001						
	ND	100	112	mg/L	112		MCAWW 300.0A	10/16/03	3290570
	ND	100	115	mg/L	115	2.5	MCAWW 300.0A	10/16/03	3290570
			Dilution Factor: 1 Analysis Time..: 17:33						

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MATRIX SPIKE SAMPLE DATA REPORT

General Chemistry

Client Lot #...: D3J160213 Matrix.........: WATER
Date Sampled...: 10/14/03 16:55 Date Received..: 10/16/03

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Sulfate			WO#: F2NHE1CH-MS/F2NHE1CJ-MSD MS Lot-Sample #: D3J160175-001						
	11	25.0	38.8	mg/L	112		MCAWW 300.0A	10/16/03	3290568
	11	25.0	39.1	mg/L	113	0.69	MCAWW 300.0A	10/16/03	3290568
			Dilution Factor: 1 Analysis Time..: 15:35						
Sulfate			WO#: F2NR91DF-MS/F2NR91DG-MSD MS Lot-Sample #: D3J160213-001						
	2200	2500	5050 I	mg/L	114		MCAWW 300.0A	10/16/03	3290568
	2200	2500	5070 I	mg/L	115	0.47	MCAWW 300.0A	10/16/03	3290568
			Dilution Factor: 1 Analysis Time..: 18:06						
Total Cyanide			WO#: F2NR91EH-MS/F2NR91EJ-MSD MS Lot-Sample #: D3J160213-001						
	ND	0.100	0.0951	mg/L	95		MCAWW 335.3	10/22-10/23/03	3296416
	ND	0.100	0.0957	mg/L	96	0.62	MCAWW 335.3	10/22-10/23/03	3296416
			Dilution Factor: 1 Analysis Time..: 13:00						

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Estimated result Result concentration exceeds the calibration range.

N Spiked analyte recovery is outside stated control limits.

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: D3J160213 Work Order #...: F2NR9-SMP Matrix.......: WATER
F2NR9-DUP
Date Sampled...: 10/14/03 16:20 Date Received..: 10/16/03

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Specific Conductance						SD Lot-Sample #: D3J160213-001		
	6800	6800	umhos/cm	0.15	(0-7.0)	MCAWW 120.1	10/17/03	3293257

Dilution Factor: 1 Analysis Time..: 16:00

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: D3J160213 Work Order #...: F2RJM-SMP
F2RJM-DUP
Matrix.......: WATER

Date Sampled...: 10/14/03 16:10 Date Received..: 10/16/03

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Suspended Solids						SD Lot-Sample #:	D3J170113-002	
	73 Q	78 Q	mg/L	7.4	(0-20)	MCAWW 160.2	10/20/03	3294676
			Dilution Factor: 2			Analysis Time..: 20:45		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Q Elevated reporting limit. The reporting limit is elevated due to high analyte levels.

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: D3J160213 Work Order #...: F2NT3-SMP
F2NT3-DUP Matrix.......: WATER

Date Sampled...: 10/15/03 17:40 Date Received..: 10/16/03

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Coliform						SD Lot-Sample #:	D3J160213-002	
	ND	ND	CFU/100m	0	(0-20)	SM18 9222B	10/16/03	3301601
			Dilution Factor: 1			Analysis Time..: 15:00		
Fecal Coliform						SD Lot-Sample #:	D3J160213-002	
	ND	ND	CFU/100m	0	(0-20)	SM18 9222D Fecal	10/16/03	3301603
			Dilution Factor: 1			Analysis Time..: 14:30		

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: D3J160213 **Work Order #...:** F2KGH-SMP
F2KGH-DUP **Matrix.......:** WATER

Date Sampled...: 10/14/03 08:12 **Date Received..:** 10/15/03

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Dissolved Solids						SD Lot-Sample #: D3J150159-007		
	450	470	mg/L	3.9	(0-20)	MCAWW 160.1	10/20/03	3303251
			Dilution Factor: 1			Analysis Time..: 17:00		

Severn Trent Laboratories, Inc.

4955 rrow Street
Arvac 0 80002

Client: COOK-JOYCE INC. / L.E.S.

Project Manager: Doug Gr. ger (CJI)

Date: 10-14-03

Chain of Custody Number: 281514

Address: 8 - W. 11th

Telephone Number (Area Code)/Fax Number: 512-474-9097

Lab Number:

Page ____ of ____

City: AUSTIN

State: TX

Zip Code: 78701

Site Contact: Doug Granger

Lab Contact:

Project Name and Location (State): LES MW2

Carrier/Waybill Number:

Contract/Purchase Order/Quote No.: 03070

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	[illegible]	Volatiles	Semivolatiles	Metals	OC Pesticides	OP Pesticides	PCB	Cyanide	COD	TSS	Fecal Coliform	Total Coliform	General Chemistry	Trip Blank	Special Instructions/ Conditions of Receipt
L.E.S. MW2	10/14/03	1620		✓				✓	✓	✓	✓	✓		X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	
L.E.S. MW2	10/15/03	1740		✓										✓										✓	✓			

ossible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☒ Archive For 3 Months (A fee may be assessed if samples are retained longer than 1 month)

rn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☒ 21 Days ☐ Other ________

QC Requirements (Specify)

Relinquished By | Date 10/15/03 | Time 1800 | 1. Received By | Date 10/16/03 | Time 0915

elinquished By | Date | Time | 2. Received By | Date | Time

elinquished By | Date | Time | 3. Received By | Date | Time

nents

BUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

SEVERN TRENT STL

STL Denver
4955 Yarrow Street
Arvada, CO 80002

Tel: 303 736 0100 Fax: 303 431 7171
www.stl-inc.com

ANALYTICAL REPORT

URENCO Project

Lot #: D3K120128

Purchase Order 018511-0403003

John Shaw

Lockwood Greene
1500 International Drive
Spartanburg, SC 29304

STL DENVER

Gail DeRuzzo
Project Manager

December 22, 2003

Table Of Contents

Standard Deliverables

Report Contents

Total Number of Pages

Standard Deliverables

The Cover Letter and the Report Cover page are considered integral parts of this Standard Deliverable package. This report is incomplete unless all pages indicated in this Table of Contents are included.

Lot #: D3K120128

Case Narrative

Enclosed is the report for two samples received at STL's Denver laboratory on November 12, 2003. The results included in this report have been reviewed for compliance with STL Denver's Laboratory Quality Manual. The test results shown in this report meet all requirements of NELAC and any exceptions are noted below.

Dilution factors and footnotes have been provided to assist in the interpretation of the results. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interferences or analytes present at concentrations above the linear calibration curve, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

STL utilizes USEPA approved methods in all analytical work. The samples presented in this report were analyzed for the parameters listed on the analytical methods summary page in accordance with the methods indicated. A summary of quality control parameters is provided below.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Quality Control Summary for Lot D3K120128

Sample Receiving

- The cooler temperature upon receipt at the Denver laboratory was 3.1° C.
- All sample bottles were received in acceptable condition.

Holding Times

- All holding times were met.

Trip Blank

- Methylene chloride was detected in the Trip Blank below the reporting limit. The detection in the associated sample may be due to laboratory or field contamintation.

Method Blanks

- The analytes Barium, Boron, and Silver Method 6010B were detected in the Method Blanks below the established reporting limits. No corrective action is taken for any values in Method Blanks that are below the requested reporting limits. In addition the sample results for Barium and Boron were greater than ten times the method blank values.
- All other Method Blanks were within established control limits.

Laboratory Control Samples

- All Laboratory Control Samples were within established control limits.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

- The Matrix Spike and/or Matrix Spike Duplicate recoveries were outside control limits for Antimony and Molybdenum Method 6010B in QC batch 3317761. Because the corresponding Laboratory

Control Sample and the Method Blank sample were within control limits, these anomalies may be due to matrix interference.

- Due to the result concentration exceeding the calibration range the MS/MSD results for Sulfate are estimated.
- The percent recoveries of the MS/MSD and/or the relative percent difference were not calculated for Aluminum, Iron, and Manganese in Method 6010B because the sample concentrations were greater than four times the spike amounts.
- The method required MS/MSD could not be performed for Methods 8270C, 8081, and 8082 due to insufficient sample volume, however, LCS/LCSD pairs were analyzed to demonstrate method precision.
- All other MS and MSD samples were within established control limits.

Organics

- The surrogate recovery for Tetrachloro-m-xylene was above the upper control limit for sample LES MW2 by Method 8081A. The other surrogate, Decachlorobiphenyl, was in control. The sample results are still considered valid because no target analytes were detected. Matrix interference was evident.
- The second source Initial Calibration Verification (ICV) standard for Methyl methanesulfonate by Method 8270C exceeded the percent difference (%D) limits. However, the overall mean percent difference for all compounds is within control limits, therefore, the ICV is also in control and no corrective action was necessary.
- The Continuing Calibration Verification (CCV) standards for Demeton-S, EPN, and Naled by Method 8141A exceeded the percent difference limits. However, the overall mean percent difference is within control limits, therefore, the CCV is also in control and no corrective action was necessary. Additionally, the associated sample was non-detect.

Inorganics

- The method required sample duplicate could not be performed for Fecal Coliform due to insufficient sample volume.
- The serial dilution of a digestate in the analytical batch for Barium and Zinc were outside control limits indicating physical and chemical interferences. The associated sample results are flagged "L".

EXECUTIVE SUMMARY - Detection Highlights

D3K120128

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
LES MW2 11/11/03 12:00 001				
Silver	0.89 B,J	10	ug/L	SW846 6010B
Aluminum	58 B	100	ug/L	SW846 6010B
Barium	16 J,L	10	ug/L	SW846 6010B
Boron	1700 J	100	ug/L	SW846 6010B
Cobalt	0.84 B	10	ug/L	SW846 6010B
Chromium	3.6 B	10	ug/L	SW846 6010B
Copper	4.0 B	10	ug/L	SW846 6010B
Iron	35 B	100	ug/L	SW846 6010B
Manganese	670	10	ug/L	SW846 6010B
Molybdenum	39	20	ug/L	SW846 6010B
Zinc	7.8 B,L	20	ug/L	SW846 6010B
Methylene chloride	0.28 J	5.0	ug/L	SW846 8260B
Specific Conductance	7200	2.0	umhos/cm	MCAWW 120.1
Total Dissolved Solids	6000 Q	40	mg/L	MCAWW 160.1
Total Suspended Solids	2.8 B	4.0	mg/L	MCAWW 160.2
Chloride	1800 Q	300	mg/L	MCAWW 300.0A
Sulfate	2400 Q	500	mg/L	MCAWW 300.0A
Chemical Oxygen Demand (COD)	14 B	20	mg/L	MCAWW 410.4
TRIP BLANK 11/11/03 002				
Methylene chloride	0.48 J	5.0	ug/L	SW846 8260B

METHODS SUMMARY

D3K120128

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Chemical Oxygen Demand	MCAWW 410.4	MCAWW 410.4
Chloride	MCAWW 300.0A	MCAWW 300.0A
F. Coliform (Enumeration)	SM18 9222D Feca	SM18 9222D
Filterable Residue (TDS)	MCAWW 160.1	MCAWW 160.1
Fluoride	MCAWW 300.0A	MCAWW 300.0A
Inductively Coupled Plasma (ICP) Metals	SW846 6010B	SW846 3010A
Mercury in Liquid Waste (Manual Cold-Vapor)	SW846 7470A	SW846 7470A
Nitrate as N	MCAWW 300.0A	MCAWW 300.0A
Nitrite as N	MCAWW 300.0A	MCAWW 300.0A
Non-Filterable Residue (TSS)	MCAWW 160.2	MCAWW 160.2
Organochlorine Pesticides	SW846 8081A	SW846 3510C
Organophosphorous Compounds by GC	SW846 8141A	SW846 3510
PCBs by SW-846 8082	SW846 8082	SW846 3510C
Semivolatile Organic Compounds by GC/MS	SW846 8270C	SW846 3520C
Specific Conductance	MCAWW 120.1	MCAWW 120.1
Sulfate	MCAWW 300.0A	MCAWW 300.0A
T. Coliform (Enemeration)	SM18 9222B	SM18 9222B
Total Cyanide	MCAWW 335.3	MCAWW 335.3
Volatile Organics by GC/MS	SW846 8260B	SW846 5030B/826

References:

MCAWW	"Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.
SM18	"Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992.
SW846	"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

METHOD / ANALYST SUMMARY

D3K120128

ANALYTICAL METHOD	ANALYST	ANALYST ID
MCAWW 120.1	Nicole Dean	008504
MCAWW 160.1	Mark Angerhofer	005823
MCAWW 160.2	Claire Likar	004382
MCAWW 300.0A	Andrita Scofield	004409
MCAWW 335.3	Ewa Kudla	001167
MCAWW 410.4	Nicole Dean	008504
SM18 9222B	Maria Fayard	002596
SM18 9222D Fecal	Maria Fayard	002596
SW846 6010B	Kristen Roda	005692
SW846 6010B	Lynn-Anne Trudell	006645
SW846 7470A	Kacey Ono	003371
SW846 8081A	Steve Szocik	002410
SW846 8082	Sonya Dacar	011595
SW846 8141A	Steve Szocik	002410
SW846 8260B	Greg Meier	006004
SW846 8270C	David Kidd	007536

References:

MCAWW	"Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.
SM18	"Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992.
SW846	"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

D3K120128

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
F4L7C	001	LES MW2	11/11/03	12:00
F4L7W	002	TRIP BLANK	11/11/03	

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

LOCKWOOD GREENE

Client Sample ID: LES MW2

GC/MS Volatiles

Lot-Sample #...: D3K120128-001 Work Order #...: F4L7C1A8 Matrix.........: WATER
Date Sampled...: 11/11/03 12:00 Date Received..: 11/12/03
Prep Date......: 11/21/03 Analysis Date..: 11/21/03
Prep Batch #...: 3327096 Analysis Time..: 15:39
Dilution Factor: 1
Method.........: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Acetone	ND	10	ug/L	2.5
Benzene	ND	1.0	ug/L	0.17
Bromodichloromethane	ND	1.0	ug/L	0.20
Bromoform	ND	1.0	ug/L	0.23
Bromomethane	ND	2.0	ug/L	0.22
2-Butanone (MEK)	ND	5.0	ug/L	2.0
Carbon tetrachloride	ND	1.0	ug/L	0.20
Chlorobenzene	ND	1.0	ug/L	0.13
Chloroethane	ND	2.0	ug/L	0.18
Chloroform	ND	1.0	ug/L	0.17
Chloromethane	ND	2.0	ug/L	0.91
Dibromomethane	ND	1.0	ug/L	0.31
1,2-Dibromoethane (EDB)	ND	1.0	ug/L	0.18
1,2-Dichlorobenzene	ND	1.0	ug/L	0.15
1,3-Dichlorobenzene	ND	1.0	ug/L	0.13
1,4-Dichlorobenzene	ND	1.0	ug/L	0.16
Dichlorodifluoromethane	ND	2.0	ug/L	0.22
1,1-Dichloroethane	ND	1.0	ug/L	0.22
1,2-Dichloroethane	ND	1.0	ug/L	0.26
1,1-Dichloroethene	ND	1.0	ug/L	0.23
1,2-Dichloroethene (total)	ND	1.0	ug/L	0.24
cis-1,2-Dichloroethene	ND	1.0	ug/L	0.14
trans-1,2-Dichloroethene	ND	1.0	ug/L	0.15
1,2-Dichloropropane	ND	1.0	ug/L	0.18
cis-1,3-Dichloropropene	ND	1.0	ug/L	0.19
trans-1,3-Dichloropropene	ND	1.0	ug/L	0.20
Ethylbenzene	ND	1.0	ug/L	0.12
2-Hexanone	ND	5.0	ug/L	1.7
Methylene chloride	0.28 J	5.0	ug/L	0.21
4-Methyl-2-pentanone	ND	5.0	ug/L	0.98
Styrene	ND	1.0	ug/L	0.14
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	0.21
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	0.21
Tetrachloroethene	ND	1.0	ug/L	0.26
Toluene	ND	1.0	ug/L	0.15
1,2,4-Trichlorobenzene	ND	1.0	ug/L	0.21

(Continued on next page)

LOCKWOOD GREENE

Client Sample ID: LES MW2

GC/MS Volatiles

Lot-Sample #...: D3K120128-001 Work Order #...: F4L7C1A8 Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
1,1,1-Trichloroethane	ND	1.0	ug/L	0.16
1,1,2-Trichloroethane	ND	1.0	ug/L	0.27
Trichloroethene	ND	1.0	ug/L	0.16
Trichlorofluoromethane	ND	2.0	ug/L	0.24
1,2,3-Trichloropropane	ND	1.0	ug/L	0.33
Vinyl chloride	ND	1.0	ug/L	0.19
Xylenes (total)	ND	2.0	ug/L	0.41
n-Butylbenzene	ND	1.0	ug/L	0.21
sec-Butylbenzene	ND	1.0	ug/L	0.23
Isopropylbenzene	ND	1.0	ug/L	0.17
1,2,4-Trimethylbenzene	ND	1.0	ug/L	0.15
1,3,5-Trimethylbenzene	ND	1.0	ug/L	0.16
n-Propylbenzene	ND	1.0	ug/L	0.17
tert-Butylbenzene	ND	1.0	ug/L	0.17
Dibromochloromethane	ND	1.0	ug/L	0.19
2-Chlorotoluene	ND	1.0	ug/L	0.17
4-Chlorotoluene	ND	1.0	ug/L	0.21
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0	ug/L	0.47
1,3-Dichloropropane	ND	1.0	ug/L	0.22
2,2-Dichloropropane	ND	5.0	ug/L	0.18
1,1-Dichloropropene	ND	1.0	ug/L	0.19
Hexachlorobutadiene	ND	1.0	ug/L	0.18
4-Isopropyltoluene	ND	1.0	ug/L	0.20
Methyl tert-butyl ether	ND	5.0	ug/L	0.38
1,2,3-Trichlorobenzene	ND	1.0	ug/L	0.21
m-Xylene & p-Xylene	ND	2.0	ug/L	0.27
o-Xylene	ND	1.0	ug/L	0.15
Bromobenzene	ND	1.0	ug/L	0.17
Bromochloromethane	ND	1.0	ug/L	0.27
Naphthalene	ND	1.0	ug/L	0.50

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	96	(76 - 116)
1,2-Dichloroethane-d4	107	(59 - 129)
4-Bromofluorobenzene	91	(74 - 114)
Toluene-d8	98	(76 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

LOCKWOOD GREENE

Client Sample ID: TRIP BLANK

GC/MS Volatiles

Lot-Sample #...:	D3K120128-002	Work Order #...:	F4L7W1AA	Matrix.........:	WATER
Date Sampled...:	11/11/03	Date Received..:	11/12/03		
Prep Date......:	11/21/03	Analysis Date..:	11/21/03		
Prep Batch #...:	3327096	Analysis Time..:	16:03		
Dilution Factor:	1				
		Method.........:	SW846 8260B		

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Acetone	ND	10	ug/L	2.5
Benzene	ND	1.0	ug/L	0.17
Bromodichloromethane	ND	1.0	ug/L	0.20
Bromoform	ND	1.0	ug/L	0.23
Bromomethane	ND	2.0	ug/L	0.22
2-Butanone (MEK)	ND	5.0	ug/L	2.0
Carbon tetrachloride	ND	1.0	ug/L	0.20
Chlorobenzene	ND	1.0	ug/L	0.13
Chloroethane	ND	2.0	ug/L	0.18
Chloroform	ND	1.0	ug/L	0.17
Chloromethane	ND	2.0	ug/L	0.91
Dibromomethane	ND	1.0	ug/L	0.31
1,2-Dibromoethane (EDB)	ND	1.0	ug/L	0.18
1,2-Dichlorobenzene	ND	1.0	ug/L	0.15
1,3-Dichlorobenzene	ND	1.0	ug/L	0.13
1,4-Dichlorobenzene	ND	1.0	ug/L	0.16
Dichlorodifluoromethane	ND	2.0	ug/L	0.22
1,1-Dichloroethane	ND	1.0	ug/L	0.22
1,2-Dichloroethane	ND	1.0	ug/L	0.26
1,1-Dichloroethene	ND	1.0	ug/L	0.23
1,2-Dichloroethene (total)	ND	1.0	ug/L	0.24
cis-1,2-Dichloroethene	ND	1.0	ug/L	0.14
trans-1,2-Dichloroethene	ND	1.0	ug/L	0.15
1,2-Dichloropropane	ND	1.0	ug/L	0.18
cis-1,3-Dichloropropene	ND	1.0	ug/L	0.19
trans-1,3-Dichloropropene	ND	1.0	ug/L	0.20
Ethylbenzene	ND	1.0	ug/L	0.12
2-Hexanone	ND	5.0	ug/L	1.7
Methylene chloride	0.48 J	5.0	ug/L	0.21
4-Methyl-2-pentanone	ND	5.0	ug/L	0.98
Styrene	ND	1.0	ug/L	0.14
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	0.21
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	0.21
Tetrachloroethene	ND	1.0	ug/L	0.26
Toluene	ND	1.0	ug/L	0.15
1,2,4-Trichlorobenzene	ND	1.0	ug/L	0.21

(Continued on next page)

LOCKWOOD GREENE

Client Sample ID: TRIP BLANK

GC/MS Volatiles

Lot-Sample #...: D3K120128-002 Work Order #...: F4L7W1AA Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
1,1,1-Trichloroethane	ND	1.0	ug/L	0.16
1,1,2-Trichloroethane	ND	1.0	ug/L	0.27
Trichloroethene	ND	1.0	ug/L	0.16
Trichlorofluoromethane	ND	2.0	ug/L	0.24
1,2,3-Trichloropropane	ND	1.0	ug/L	0.33
Vinyl chloride	ND	1.0	ug/L	0.19
Xylenes (total)	ND	2.0	ug/L	0.41
n-Butylbenzene	ND	1.0	ug/L	0.21
sec-Butylbenzene	ND	1.0	ug/L	0.23
Isopropylbenzene	ND	1.0	ug/L	0.17
1,2,4-Trimethylbenzene	ND	1.0	ug/L	0.15
1,3,5-Trimethylbenzene	ND	1.0	ug/L	0.16
n-Propylbenzene	ND	1.0	ug/L	0.17
tert-Butylbenzene	ND	1.0	ug/L	0.17
Dibromochloromethane	ND	1.0	ug/L	0.19
2-Chlorotoluene	ND	1.0	ug/L	0.17
4-Chlorotoluene	ND	1.0	ug/L	0.21
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0	ug/L	0.47
1,3-Dichloropropane	ND	1.0	ug/L	0.22
2,2-Dichloropropane	ND	5.0	ug/L	0.18
1,1-Dichloropropene	ND	1.0	ug/L	0.19
Hexachlorobutadiene	ND	1.0	ug/L	0.18
4-Isopropyltoluene	ND	1.0	ug/L	0.20
Methyl tert-butyl ether	ND	5.0	ug/L	0.38
1,2,3-Trichlorobenzene	ND	1.0	ug/L	0.21
m-Xylene & p-Xylene	ND	2.0	ug/L	0.27
o-Xylene	ND	1.0	ug/L	0.15
Bromobenzene	ND	1.0	ug/L	0.17
Bromochloromethane	ND	1.0	ug/L	0.27
Naphthalene	ND	1.0	ug/L	0.50

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	95	(76 - 116)
1,2-Dichloroethane-d4	100	(59 - 129)
4-Bromofluorobenzene	93	(74 - 114)
Toluene-d8	102	(76 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

LOCKWOOD GREENE

Client Sample ID: LES MW2

GC/MS Semivolatiles

Lot-Sample #...: D3K120128-001 Work Order #...: F4L7C1A9 Matrix.........: WATER
Date Sampled...: 11/11/03 12:00 Date Received..: 11/12/03
Prep Date......: 11/14/03 Analysis Date..: 12/11/03
Prep Batch #...: 3318453 Analysis Time..: 02:25
Dilution Factor: 1
Method.........: SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Acenaphthene	ND	10	ug/L	0.60
Acenaphthylene	ND	10	ug/L	0.60
Acetophenone	ND	10	ug/L	2.0
2-Acetylaminofluorene	ND	100	ug/L	1.0
4-Aminobiphenyl	ND	50	ug/L	1.0
Aniline	ND	10	ug/L	4.0
Anthracene	ND	10	ug/L	3.0
Aramite	ND	20	ug/L	2.0
Benzo(a)anthracene	ND	10	ug/L	0.80
Benzo(b)fluoranthene	ND	10	ug/L	0.90
Benzo(k)fluoranthene	ND	10	ug/L	2.0
Benzo(ghi)perylene	ND	10	ug/L	1.0
Benzo(a)pyrene	ND	10	ug/L	0.80
Benzyl alcohol	ND	10	ug/L	1.0
bis(2-Chloroethoxy) methane	ND	10	ug/L	0.90
bis(2-Chloroethyl)-ether	ND	10	ug/L	3.0
bis(2-Ethylhexyl) phthalate	ND	10	ug/L	0.90
4-Bromophenyl phenyl ether	ND	10	ug/L	0.70
Butyl benzyl phthalate	ND	10	ug/L	1.0
4-Chloroaniline	ND	10	ug/L	3.0
Chlorobenzilate	ND	10	ug/L	1.0
4-Chloro-3-methylphenol	ND	10	ug/L	0.80
2-Chloronaphthalene	ND	10	ug/L	0.70
2-Chlorophenol	ND	10	ug/L	0.80
4-Chlorophenyl phenyl ether	ND	10	ug/L	0.60
Chrysene	ND	10	ug/L	0.80
Diallate	ND	20	ug/L	2.0
Dibenz(a,h)anthracene	ND	10	ug/L	0.90
Dibenzofuran	ND	10	ug/L	0.60
Di-n-butyl phthalate	ND	10	ug/L	0.80
1,2-Dichlorobenzene	ND	10	ug/L	0.80
1,3-Dichlorobenzene	ND	10	ug/L	0.80
1,4-Dichlorobenzene	ND	10	ug/L	1.0

(Continued on next page)

LOCKWOOD GREENE

Client Sample ID: LES MW2

GC/MS Semivolatiles

Lot-Sample #...: D3K120128-001 Work Order #...: F4L7C1A9 Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
3,3'-Dichlorobenzidine	ND	50	ug/L	8.0
2,4-Dichlorophenol	ND	10	ug/L	0.70
2,6-Dichlorophenol	ND	10	ug/L	1.0
Diethyl phthalate	ND	10	ug/L	0.70
Dimethoate	ND	20	ug/L	2.0
7,12-Dimethylbenz(a)-anthracene	ND	20	ug/L	2.0
3,3'-Dimethylbenzidine	ND	20	ug/L	10
2,4-Dimethylphenol	ND	10	ug/L	4.0
Dimethyl phthalate	ND	10	ug/L	0.80
1,3-Dinitrobenzene	ND	10	ug/L	2.0
4,6-Dinitro-2-methylphenol	ND	50	ug/L	6.0
2,4-Dinitrophenol	ND	50	ug/L	6.0
2,4-Dinitrotoluene	ND	10	ug/L	1.0
2,6-Dinitrotoluene	ND	10	ug/L	0.80
Di-n-octyl phthalate	ND	10	ug/L	1.0
Diphenylamine	ND	10	ug/L	1.0
Disulfoton	ND	50	ug/L	6.0
Ethyl methanesulfonate	ND	10	ug/L	2.0
Fluoranthene	ND	10	ug/L	0.70
Fluorene	ND	10	ug/L	0.60
Hexachlorobenzene	ND	10	ug/L	0.80
Hexachlorobutadiene	ND	10	ug/L	1.0
Hexachlorocyclopenta-diene	ND	50	ug/L	5.0
Hexachloroethane	ND	10	ug/L	0.80
Hexachloropropene	ND	100	ug/L	1.0
Indeno(1,2,3-cd)pyrene	ND	10	ug/L	0.80
Isodrin	ND	10	ug/L	3.0
Isophorone	ND	10	ug/L	0.90
Isosafrole	ND	20	ug/L	2.0
Methapyrilene	ND	50	ug/L	30
3-Methylcholanthrene	ND	20	ug/L	3.0
Methyl methanesulfonate	ND	10	ug/L	2.0
2-Methylnaphthalene	ND	10	ug/L	0.80
Methyl parathion	ND	50	ug/L	2.0
2-Methylphenol	ND	10	ug/L	0.90
3-Methylphenol & 4-Methylphenol	ND	10	ug/L	0.80
Naphthalene	ND	10	ug/L	0.80
1,4-Naphthoquinone	ND	50	ug/L	2.0
1-Naphthylamine	ND	10	ug/L	2.0

(Continued on next page)

LOCKWOOD GREENE

Client Sample ID: LES MW2

GC/MS Semivolatiles

Lot-Sample #...: D3K120128-001 Work Order #...: F4L7C1A9 Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
2-Naphthylamine	ND	10	ug/L	1.0
2-Nitroaniline	ND	50	ug/L	0.90
3-Nitroaniline	ND	50	ug/L	0.90
4-Nitroaniline	ND	50	ug/L	6.0
Nitrobenzene	ND	10	ug/L	2.0
2-Nitrophenol	ND	10	ug/L	0.80
4-Nitrophenol	ND	50	ug/L	7.0
4-Nitroquinoline-1-oxide	ND	100	ug/L	50
N-Nitrosodi-n-butylamine	ND	10	ug/L	2.0
N-Nitrosodiethylamine	ND	10	ug/L	2.0
N-Nitrosodimethylamine	ND	10	ug/L	0.80
N-Nitrosodiphenylamine	ND	10	ug/L	1.0
N-Nitrosodi-n-propylamine	ND	10	ug/L	0.70
N-Nitrosomethylethylamine	ND	10	ug/L	2.0
N-Nitrosomorpholine	ND	10	ug/L	2.0
N-Nitrosopiperidine	ND	10	ug/L	2.0
N-Nitrosopyrrolidine	ND	10	ug/L	2.0
5-Nitro-o-toluidine	ND	20	ug/L	1.0
Parathion	ND	50	ug/L	2.0
Pentachlorobenzene	ND	10	ug/L	2.0
Pentachloroethane	ND	50	ug/L	2.0
Pentachloronitrobenzene	ND	50	ug/L	2.0
Pentachlorophenol	ND	50	ug/L	5.0
Phenacetin	ND	20	ug/L	1.0
Phenanthrene	ND	10	ug/L	0.70
Phenol	ND	10	ug/L	0.90
Phorate	ND	50	ug/L	1.0
2-Picoline	ND	20	ug/L	1.0
Pronamide	ND	20	ug/L	1.0
Pyrene	ND	10	ug/L	0.80
Pyridine	ND	20	ug/L	10
1,2,4,5-Tetrachlorobenzene	ND	10	ug/L	2.0
2,3,4,6-Tetrachlorophenol	ND	50	ug/L	5.0
Thionazin	ND	10	ug/L	2.0
o-Toluidine	ND	10	ug/L	2.0
1,2,4-Trichlorobenzene	ND	10	ug/L	0.90
2,4,5-Trichlorophenol	ND	10	ug/L	1.0
2,4,6-Trichlorophenol	ND	10	ug/L	0.80

(Continued on next page)

LOCKWOOD GREENE

Client Sample ID: LES MW2

GC/MS Semivolatiles

Lot-Sample #...: D3K120128-001 Work Order #...: F4L7C1A9 Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
O,O,O-Triethylphosphorothioate	ND	50	ug/L	2.0
1,3,5-Trinitrobenzene	ND	50	ug/L	2.0

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	66	(32 - 116)
Phenol-d5	73	(40 - 111)
Nitrobenzene-d5	79	(53 - 107)
2-Fluorobiphenyl	70	(31 - 105)
2,4,6-Tribromophenol	74	(42 - 122)
Terphenyl-d14	84	(21 - 125)

LOCKWOOD GREENE

Client Sample ID: LES MW2

GC Semivolatiles

Lot-Sample #...:	D3K120128-001	Work Order #...:	F4L7C1CC	Matrix.........:	WATER
Date Sampled...:	11/11/03 12:00	Date Received..:	11/12/03		
Prep Date......:	11/17/03	Analysis Date..:	12/12/03		
Prep Batch #...:	3321203	Analysis Time..:	23:49		
Dilution Factor:	1				
		Method.........:	SW846 8081A		

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Aldrin	ND	0.050	ug/L	0.0070
alpha-BHC	ND	0.050	ug/L	0.010
beta-BHC	ND	0.050	ug/L	0.010
delta-BHC	ND	0.050	ug/L	0.010
gamma-BHC (Lindane)	ND	0.050	ug/L	0.0080
Chlordane (technical)	ND	0.50	ug/L	0.060
4,4'-DDD	ND	0.050	ug/L	0.010
4,4'-DDE	ND	0.050	ug/L	0.010
4,4'-DDT	ND	0.050	ug/L	0.010
Dieldrin	ND	0.050	ug/L	0.0090
Endrin	ND	0.050	ug/L	0.020
Endrin aldehyde	ND	0.050	ug/L	0.010
Endosulfan I	ND	0.050	ug/L	0.020
Endosulfan II	ND	0.050	ug/L	0.010
Endosulfan sulfate	ND	0.050	ug/L	0.010
Heptachlor	ND	0.050	ug/L	0.010
Heptachlor epoxide	ND	0.050	ug/L	0.010
Methoxychlor	ND	0.10	ug/L	0.020
Toxaphene	ND	5.0	ug/L	0.50

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Decachlorobiphenyl	93	(29 - 125)
Tetrachloro-m-xylene	117 *	(40 - 115)

NOTE(S):

* Surrogate recovery is outside stated control limits.

LOCKWOOD GREENE

Client Sample ID: LES MW2

GC Semivolatiles

Lot-Sample #...:	D3K120128-001	Work Order #...:	F4L7C1CA	Matrix.........:	WATER
Date Sampled...:	11/11/03 12:00	Date Received..:	11/12/03		
Prep Date......:	11/17/03	Analysis Date..:	12/07/03		
Prep Batch #...:	3321215	Analysis Time..:	19:55		
Dilution Factor:	1				
		Method.........:	SW846 8082		

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Aroclor 1016	ND	1.0	ug/L	0.15
Aroclor 1221	ND	1.0	ug/L	0.25
Aroclor 1232	ND	1.0	ug/L	0.14
Aroclor 1242	ND	1.0	ug/L	0.14
Aroclor 1248	ND	1.0	ug/L	0.15
Aroclor 1254	ND	1.0	ug/L	0.22
Aroclor 1260	ND	1.0	ug/L	0.16

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	95	(52 - 160)
Decachlorobiphenyl	89	(37 - 144)

LOCKWOOD GREENE

Client Sample ID: LES MW2

GC Semivolatiles

Lot-Sample #...: D3K120128-001	Work Order #...: F4L7C1CD	Matrix.........: WATER
Date Sampled...: 11/11/03 12:00	Date Received..: 11/12/03	
Prep Date......: 11/18/03	Analysis Date..: 12/02/03	
Prep Batch #...: 3322194	Analysis Time..: 15:15	
Dilution Factor: 1		
	Method.........: SW846 8141A	

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Azinphos-methyl	ND	2.5	ug/L	0.14
Bolstar	ND	0.50	ug/L	0.14
Chlorpyrifos	ND	0.50	ug/L	0.054
Coumaphos	ND	0.50	ug/L	0.079
Demeton (total)	ND	1.0	ug/L	0.19
Diazinon	ND	0.50	ug/L	0.039
Dichlorvos	ND	0.50	ug/L	0.13
Dimethoate	ND	0.50	ug/L	0.18
Disulfoton	ND	0.50	ug/L	0.057
Ethoprop	ND	0.50	ug/L	0.056
Ethyl parathion	ND	0.50	ug/L	0.040
Famphur	ND	1.0	ug/L	0.054
Fensulfothion	ND	2.5	ug/L	0.22
Fenthion	ND	0.50	ug/L	0.061
Malathion	ND	1.2	ug/L	0.050
Merphos	ND	5.0	ug/L	0.063
Methyl parathion	ND	0.50	ug/L	0.061
Mevinphos	ND	6.2	ug/L	0.16
Naled	ND	10	ug/L	0.22
O,O,O-Triethylphosphorothioate	ND	0.50	ug/L	0.15
Phorate	ND	0.50	ug/L	0.075
Ronnel	ND	10	ug/L	0.11
Sulfotepp	ND	0.50	ug/L	0.030
Thionazin	ND	0.50	ug/L	0.059
Tokuthion	ND	0.50	ug/L	0.071
Trichloronate	ND	0.50	ug/L	0.057
EPN	ND	0.50	ug/L	0.050
Demeton-O	ND	1.0	ug/L	0.19
Demeton-S	ND	1.0	ug/L	0.19
Tetrachlorvinphos (Stirophos)	ND	2.5	ug/L	0.056

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	89	(49 - 105)
Ethyl Pirimifos	80	(20 - 121)

LOCKWOOD GREENE

Client Sample ID: LES MW2

TOTAL Metals

Lot-Sample #...: D3K120128-001 Matrix.......: WATER
Date Sampled...: 11/11/03 12:00 Date Received..: 11/12/03

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 3317398						
Mercury	ND	0.20	ug/L	SW846 7470A	11/18/03	F4L7C1A7
		Dilution Factor: 1		Analysis Time..: 18:13	MDL............: 0.054	
Prep Batch #...: 3317761						
Silver	0.89 B,J	10	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1AK
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 0.70	
Aluminum	58 B	100	ug/L	SW846 6010B	11/19-11/21/03	F4L7C1AL
		Dilution Factor: 1		Analysis Time..: 23:05	MDL............: 20	
Arsenic	ND	15	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1AM
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 4.9	
Barium	16 J,L	10	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1AN
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 0.37	
Beryllium	ND	5.0	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1AP
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 0.41	
Boron	1700 J	100	ug/L	SW846 6010B	11/19-11/21/03	F4L7C1AQ
		Dilution Factor: 1		Analysis Time..: 23:05	MDL............: 8.3	
Cadmium	ND	5.0	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1AR
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 0.27	
Cobalt	0.84 B	10	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1AT
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 0.67	
Chromium	3.6 B	10	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1AU
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 2.1	
Copper	4.0 B	10	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1AV
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 0.97	
Iron	35 B	100	ug/L	SW846 6010B	11/19-11/21/03	F4L7C1AW
		Dilution Factor: 1		Analysis Time..: 23:05	MDL............: 19	
Manganese	670	10	ug/L	SW846 6010B	11/19-11/21/03	F4L7C1AX
		Dilution Factor: 1		Analysis Time..: 23:05	MDL............: 0.54	

(Continued on next page)

LOCKWOOD GREENE

Client Sample ID: LES MW2

TOTAL Metals

Lot-Sample #...: D3K120128-001 Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Molybdenum	39	20	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1A0
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 2.3	
Nickel	ND	40	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1A1
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 4.2	
Lead	ND L	3.0	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1A2
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 2.1	
Antimony	ND	10	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1A3
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 3.6	
Selenium	ND	15	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1A4
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 4.6	
Thallium	ND	10	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1A5
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 8.1	
inc	7.8 B,L	20	ug/L	SW846 6010B	11/19-11/20/03	F4L7C1A6
		Dilution Factor: 1		Analysis Time..: 18:07	MDL............: 7.1	

NOTE(S):

B Estimated result. Result is less than RL.

J Method blank contamination. The associated method blank contains the target analyte at a reportable level.

L Serial dilution of a digestate in the analytical batch indicates that physical and chemical interferences are present

LOCKWOOD GREENE

Client Sample ID: LES MW2

General Chemistry

Lot-Sample #...: D3K120128-001 Work Order #...: F4L7C Matrix.........: WATER
Date Sampled...: 11/11/03 12:00 Date Received..: 11/12/03

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)	14 B	20	mg/L	MCAWW 410.4	11/23/03	3327118
		Dilution Factor: 1		Analysis Time..: 13:40	MDL............: 2.9	
Chloride	1800 Q	300	mg/L	MCAWW 300.0A	11/12/03	3317591
		Dilution Factor: 100		Analysis Time..: 18:20	MDL............: 20	
Fecal Coliform	ND	1.0	CFU/100m	SM18 9222D Fecal	11/12/03	3321262
		Dilution Factor: 1		Analysis Time..: 11:00	MDL............:	
Fluoride	ND G	5.0	mg/L	MCAWW 300.0A	11/12/03	3317590
		Dilution Factor: 5		Analysis Time..: 17:58	MDL............: 0.50	
Nitrate	ND G	2.5	mg/L	MCAWW 300.0A	11/12/03	3317593
		Dilution Factor: 5		Analysis Time..: 17:58	MDL............: 0.25	
Nitrite	ND G	2.5	mg/L	MCAWW 300.0A	11/12/03	3317594
		Dilution Factor: 5		Analysis Time..: 17:58	MDL............: 0.25	
Specific Conductance	7200	2.0	umhos/cm	MCAWW 120.1	11/17/03	3321475
		Dilution Factor: 1		Analysis Time..: 12:00	MDL............:	
Sulfate	2400 Q	500	mg/L	MCAWW 300.0A	11/12/03	3317592
		Dilution Factor: 100		Analysis Time..: 18:20	MDL............: 20	
Total Coliform	ND	1.0	CFU/100m	SM18 9222B	11/12/03	3321264
		Dilution Factor: 1		Analysis Time..: 11:00	MDL............:	
Total Cyanide	ND	0.010	mg/L	MCAWW 335.3	11/19/03	3324356
		Dilution Factor: 1		Analysis Time..: 13:00	MDL............: 0.0039	
Total Dissolved Solids	6000 Q	40	mg/L	MCAWW 160.1	11/17/03	3329641
		Dilution Factor: 4		Analysis Time..: 18:00	MDL............: 12	
Total Suspended Solids	2.8 B	4.0	mg/L	MCAWW 160.2	11/17/03	3324539
		Dilution Factor: 1		Analysis Time..: 20:00	MDL............: 0.87	

NOTE(S):

RL Reporting Limit

B Estimated result. Result is less than RL.

Q Elevated reporting limit. The reporting limit is elevated due to high analyte levels.

Elevated reporting limit. The reporting limit is elevated due to matrix interference.

QC DATA ASSOCIATION SUMMARY

D3K120128

Sample Preparation and Analysis Control Numbers

SAMPLE#	MATRIX	ANALYTICAL METHOD	LEACH BATCH #	PREP BATCH #	MS RUN#
001	WATER	MCAWW 120.1		3321475	3322095
	WATER	MCAWW 160.1		3329641	3330150
	WATER	MCAWW 160.2		3324539	3324286
	WATER	MCAWW 300.0A		3317591	3317295
	WATER	MCAWW 300.0A		3317592	3317302
	WATER	MCAWW 300.0A		3317590	3317291
	WATER	MCAWW 300.0A		3317593	3317301
	WATER	MCAWW 300.0A		3317594	3317297
	WATER	SM18 9222D Fecal		3321262	
	WATER	SW846 7470A		3317398	3317175
	WATER	SM18 9222B		3321264	
	WATER	SW846 8141A		3322194	3322082
	WATER	SW846 8082		3321215	
	WATER	SW846 8081A		3321203	
	WATER	SW846 8260B		3327096	3327009
	WATER	SW846 8270C		3318453	
	WATER	SW846 6010B		3317761	3317382
	WATER	MCAWW 335.3		3324356	3324184
	WATER	MCAWW 410.4		3327118	3327030
002	WATER	SW846 8260B		3327096	3327009

METHOD BLANK REPORT

GC/MS Volatiles

Client Lot #...: D3K120128 Work Order #...: F5G461AA Matrix.........: WATER
MB Lot-Sample #: D3K230000-096
Prep Date......: 11/21/03 Analysis Time..: 09:08
Analysis Date..: 11/21/03 Prep Batch #...: 3327096
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Acetone	ND	10	ug/L	SW846 8260B
Benzene	ND	1.0	ug/L	SW846 8260B
Bromodichloromethane	ND	1.0	ug/L	SW846 8260B
Bromoform	ND	1.0	ug/L	SW846 8260B
Bromomethane	ND	2.0	ug/L	SW846 8260B
2-Butanone (MEK)	ND	5.0	ug/L	SW846 8260B
Carbon tetrachloride	ND	1.0	ug/L	SW846 8260B
Chlorobenzene	ND	1.0	ug/L	SW846 8260B
Chloroethane	ND	2.0	ug/L	SW846 8260B
Chloroform	ND	1.0	ug/L	SW846 8260B
Chloromethane	ND	2.0	ug/L	SW846 8260B
Dibromomethane	ND	1.0	ug/L	SW846 8260B
1,2-Dibromoethane (EDB)	ND	1.0	ug/L	SW846 8260B
1,2-Dichlorobenzene	ND	1.0	ug/L	SW846 8260B
,3-Dichlorobenzene	ND	1.0	ug/L	SW846 8260B
1,4-Dichlorobenzene	ND	1.0	ug/L	SW846 8260B
Dichlorodifluoromethane	ND	2.0	ug/L	SW846 8260B
1,1-Dichloroethane	ND	1.0	ug/L	SW846 8260B
1,2-Dichloroethane	ND	1.0	ug/L	SW846 8260B
1,1-Dichloroethene	ND	1.0	ug/L	SW846 8260B
1,2-Dichloroethene (total)	ND	1.0	ug/L	SW846 8260B
cis-1,2-Dichloroethene	ND	1.0	ug/L	SW846 8260B
trans-1,2-Dichloroethene	ND	1.0	ug/L	SW846 8260B
1,2-Dichloropropane	ND	1.0	ug/L	SW846 8260B
cis-1,3-Dichloropropene	ND	1.0	ug/L	SW846 8260B
trans-1,3-Dichloropropene	ND	1.0	ug/L	SW846 8260B
Ethylbenzene	ND	1.0	ug/L	SW846 8260B
2-Hexanone	ND	5.0	ug/L	SW846 8260B
Methylene chloride	ND	5.0	ug/L	SW846 8260B
4-Methyl-2-pentanone	ND	5.0	ug/L	SW846 8260B
Styrene	ND	1.0	ug/L	SW846 8260B
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	SW846 8260B
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	SW846 8260B
Tetrachloroethene	ND	1.0	ug/L	SW846 8260B
Toluene	ND	1.0	ug/L	SW846 8260B
1,2,4-Trichlorobenzene	ND	1.0	ug/L	SW846 8260B
1,1,1-Trichloroethane	ND	1.0	ug/L	SW846 8260B
1,1,2-Trichloroethane	ND	1.0	ug/L	SW846 8260B
ichloroethene	ND	1.0	ug/L	SW846 8260B

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METHOD BLANK REPORT

GC/MS Volatiles

Client Lot #...: D3K120128 Work Order #...: F5G461AA Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Trichlorofluoromethane	ND	2.0	ug/L	SW846 8260B
1,2,3-Trichloropropane	ND	1.0	ug/L	SW846 8260B
Vinyl chloride	ND	1.0	ug/L	SW846 8260B
Xylenes (total)	ND	2.0	ug/L	SW846 8260B
n-Butylbenzene	ND	1.0	ug/L	SW846 8260B
sec-Butylbenzene	ND	1.0	ug/L	SW846 8260B
Isopropylbenzene	ND	1.0	ug/L	SW846 8260B
1,2,4-Trimethylbenzene	ND	1.0	ug/L	SW846 8260B
1,3,5-Trimethylbenzene	ND	1.0	ug/L	SW846 8260B
n-Propylbenzene	ND	1.0	ug/L	SW846 8260B
tert-Butylbenzene	ND	1.0	ug/L	SW846 8260B
Dibromochloromethane	ND	1.0	ug/L	SW846 8260B
2-Chlorotoluene	ND	1.0	ug/L	SW846 8260B
4-Chlorotoluene	ND	1.0	ug/L	SW846 8260B
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0	ug/L	SW846 8260B
1,3-Dichloropropane	ND	1.0	ug/L	SW846 8260B
2,2-Dichloropropane	ND	5.0	ug/L	SW846 8260B
,1-Dichloropropene	ND	1.0	ug/L	SW846 8260B
Hexachlorobutadiene	ND	1.0	ug/L	SW846 8260B
4-Isopropyltoluene	ND	1.0	ug/L	SW846 8260B
Methyl tert-butyl ether	ND	5.0	ug/L	SW846 8260B
1,2,3-Trichlorobenzene	ND	1.0	ug/L	SW846 8260B
m-Xylene & p-Xylene	ND	2.0	ug/L	SW846 8260B
o-Xylene	ND	1.0	ug/L	SW846 8260B
Bromobenzene	ND	1.0	ug/L	SW846 8260B
Bromochloromethane	ND	1.0	ug/L	SW846 8260B
Naphthalene	ND	1.0	ug/L	SW846 8260B

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	90	(76 - 116)
1,2-Dichloroethane-d4	86	(59 - 129)
4-Bromofluorobenzene	85	(74 - 114)
Toluene-d8	102	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC/MS Volatiles

Client Lot #...: D3K120128 Work Order #...: F5G461AC Matrix.........: WATER
LCS Lot-Sample#: D3K230000-096
Prep Date......: 11/21/03 Analysis Date..: 11/21/03
Prep Batch #...: 3327096 Analysis Time..: 08:43
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD
Benzene	**91**	**(75 - 116)**	**SW846 8260B**
Chlorobenzene	**87**	**(77 - 117)**	**SW846 8260B**
1,1-Dichloroethene	**92**	**(67 - 125)**	**SW846 8260B**
Toluene	**93**	**(74 - 115)**	**SW846 8260B**
Trichloroethene	**95**	**(80 - 123)**	**SW846 8260B**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	90	(76 - 116)
1,2-Dichloroethane-d4	86	(59 - 129)
4-Bromofluorobenzene	88	(74 - 114)
Toluene-d8	104	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC/MS Volatiles

Client Lot #...: D3K120128 **Work Order #...:** F5G461AC **Matrix.........:** WATER
LCS Lot-Sample#: D3K230000-096
Prep Date......: 11/21/03 **Analysis Date..:** 11/21/03
Prep Batch #...: 3327096 **Analysis Time..:** 08:43
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	METHOD
Benzene	**10.0**	**9.09**	**ug/L**	**91**	**SW846 8260B**
Chlorobenzene	**10.0**	**8.72**	**ug/L**	**87**	**SW846 8260B**
1,1-Dichloroethene	**10.0**	**9.16**	**ug/L**	**92**	**SW846 8260B**
Toluene	**10.0**	**9.29**	**ug/L**	**93**	**SW846 8260B**
Trichloroethene	**10.0**	**9.51**	**ug/L**	**95**	**SW846 8260B**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	90	(76 - 116)
1,2-Dichloroethane-d4	86	(59 - 129)
4-Bromofluorobenzene	88	(74 - 114)
Toluene-d8	104	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC/MS Volatiles

Client Lot #...: D3K120128 **Work Order #...:** F41HD1AC-MS **Matrix.........:** WATER
MS Lot-Sample #: D3K170149-001 F41HD1AD-MSD
Date Sampled...: 11/14/03 15:18 **Date Received..:** 11/14/03
Prep Date......: 11/21/03 **Analysis Date..:** 11/21/03
Prep Batch #...: 3327096 **Analysis Time..:** 09:56
Dilution Factor: 133.3

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Benzene	**94**	**(75 - 116)**			**SW846 8260B**
	99	**(75 - 116)**	**4.2**	**(0-20)**	**SW846 8260B**
Chlorobenzene	**96**	**(77 - 117)**			**SW846 8260B**
	93	**(77 - 117)**	**3.2**	**(0-20)**	**SW846 8260B**
1,1-Dichloroethene	**82**	**(67 - 125)**			**SW846 8260B**
	84	**(67 - 125)**	**2.4**	**(0-20)**	**SW846 8260B**
Toluene	**99**	**(74 - 115)**			**SW846 8260B**
	99	**(74 - 115)**	**0.42**	**(0-20)**	**SW846 8260B**
Trichloroethene	**98**	**(80 - 123)**			**SW846 8260B**
	100	**(80 - 123)**	**1.9**	**(0-20)**	**SW846 8260B**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
ibromofluoromethane	88	(76 - 116)
	93	(76 - 116)
1,2-Dichloroethane-d4	88	(59 - 129)
	88	(59 - 129)
4-Bromofluorobenzene	92	(74 - 114)
	89	(74 - 114)
Toluene-d8	109	(76 - 116)
	96	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE DATA REPORT

GC/MS Volatiles

Client Lot #...: D3K120128 **Work Order #...:** F41HD1AC-MS **Matrix.........:** WATER
MS Lot-Sample #: D3K170149-001 F41HD1AD-MSD
Date Sampled...: 11/14/03 15:18 **Date Received..:** 11/14/03
Prep Date......: 11/21/03 **Analysis Date..:** 11/21/03
Prep Batch #...: 3327096 **Analysis Time..:** 09:56
Dilution Factor: 133.3

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD
Benzene	**ND**	**1330**	**1260**	**ug/L**	**94**		**SW846 8260B**
	ND	**1330**	**1310**	**ug/L**	**99**	**4.2**	**SW846 8260B**
Chlorobenzene	**ND**	**1330**	**1280**	**ug/L**	**96**		**SW846 8260B**
	ND	**1330**	**1240**	**ug/L**	**93**	**3.2**	**SW846 8260B**
1,1-Dichloroethene	**ND**	**1330**	**1100**	**ug/L**	**82**		**SW846 8260B**
	ND	**1330**	**1120**	**ug/L**	**84**	**2.4**	**SW846 8260B**
Toluene	**ND**	**1330**	**1320**	**ug/L**	**99**		**SW846 8260B**
	ND	**1330**	**1330**	**ug/L**	**99**	**0.42**	**SW846 8260B**
Trichloroethene	**30**	**1330**	**1340**	**ug/L**	**98**		**SW846 8260B**
	30	**1330**	**1360**	**ug/L**	**100**	**1.9**	**SW846 8260B**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	88	(76 - 116)
	93	(76 - 116)
1,2-Dichloroethane-d4	88	(59 - 129)
	88	(59 - 129)
4-Bromofluorobenzene	92	(74 - 114)
	89	(74 - 114)
Toluene-d8	109	(76 - 116)
	96	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: D3K120128 Work Order #...: F4V7P1AA Matrix.........: WATER
MB Lot-Sample #: D3K140000-453
Prep Date......: 11/14/03 Analysis Time..: 23:07
Analysis Date..: 12/10/03 Prep Batch #...: 3318453
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Acenaphthene	ND	10	ug/L	SW846 8270C
Acenaphthylene	ND	10	ug/L	SW846 8270C
Acetophenone	ND	10	ug/L	SW846 8270C
2-Acetylaminofluorene	ND	100	ug/L	SW846 8270C
4-Aminobiphenyl	ND	50	ug/L	SW846 8270C
Aniline	ND	10	ug/L	SW846 8270C
Anthracene	ND	10	ug/L	SW846 8270C
Aramite	ND	20	ug/L	SW846 8270C
Benzo(a)anthracene	ND	10	ug/L	SW846 8270C
Benzo(b)fluoranthene	ND	10	ug/L	SW846 8270C
Benzo(k)fluoranthene	ND	10	ug/L	SW846 8270C
Benzo(ghi)perylene	ND	10	ug/L	SW846 8270C
Benzo(a)pyrene	ND	10	ug/L	SW846 8270C
Benzyl alcohol	ND	10	ug/L	SW846 8270C
is(2-Chloroethoxy) methane	ND	10	ug/L	SW846 8270C
bis(2-Chloroethyl)-ether	ND	10	ug/L	SW846 8270C
bis(2-Ethylhexyl) phthalate	ND	10	ug/L	SW846 8270C
4-Bromophenyl phenyl ether	ND	10	ug/L	SW846 8270C
Butyl benzyl phthalate	ND	10	ug/L	SW846 8270C
4-Chloroaniline	ND	10	ug/L	SW846 8270C
Chlorobenzilate	ND	10	ug/L	SW846 8270C
4-Chloro-3-methylphenol	ND	10	ug/L	SW846 8270C
2-Chloronaphthalene	ND	10	ug/L	SW846 8270C
2-Chlorophenol	ND	10	ug/L	SW846 8270C
4-Chlorophenyl phenyl ether	ND	10	ug/L	SW846 8270C
Chrysene	ND	10	ug/L	SW846 8270C
Diallate	ND	20	ug/L	SW846 8270C
Dibenz(a,h)anthracene	ND	10	ug/L	SW846 8270C
Dibenzofuran	ND	10	ug/L	SW846 8270C
Di-n-butyl phthalate	ND	10	ug/L	SW846 8270C
1,2-Dichlorobenzene	ND	10	ug/L	SW846 8270C
1,3-Dichlorobenzene	ND	10	ug/L	SW846 8270C
1,4-Dichlorobenzene	ND	10	ug/L	SW846 8270C
3,3'-Dichlorobenzidine	ND	50	ug/L	SW846 8270C
2,4-Dichlorophenol	ND	10	ug/L	SW846 8270C
6-Dichlorophenol	ND	10	ug/L	SW846 8270C

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METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: D3K120128 **Work Order #...: F4V7P1AA** **Matrix.........: WATER**

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Diethyl phthalate	ND	10	ug/L	SW846 8270C
Dimethoate	ND	20	ug/L	SW846 8270C
7,12-Dimethylbenz(a)-anthracene	ND	20	ug/L	SW846 8270C
3,3'-Dimethylbenzidine	ND	20	ug/L	SW846 8270C
2,4-Dimethylphenol	ND	10	ug/L	SW846 8270C
Dimethyl phthalate	ND	10	ug/L	SW846 8270C
1,3-Dinitrobenzene	ND	10	ug/L	SW846 8270C
4,6-Dinitro-2-methylphenol	ND	50	ug/L	SW846 8270C
2,4-Dinitrophenol	ND	50	ug/L	SW846 8270C
2,4-Dinitrotoluene	ND	10	ug/L	SW846 8270C
2,6-Dinitrotoluene	ND	10	ug/L	SW846 8270C
Di-n-octyl phthalate	ND	10	ug/L	SW846 8270C
Diphenylamine	ND	10	ug/L	SW846 8270C
Disulfoton	ND	50	ug/L	SW846 8270C
Ethyl methanesulfonate	ND	10	ug/L	SW846 8270C
Fluoranthene	ND	10	ug/L	SW846 8270C
Fluorene	ND	10	ug/L	SW846 8270C
Hexachlorobenzene	ND	10	ug/L	SW846 8270C
Hexachlorobutadiene	ND	10	ug/L	SW846 8270C
Hexachlorocyclopentadiene	ND	50	ug/L	SW846 8270C
Hexachloroethane	ND	10	ug/L	SW846 8270C
Hexachloropropene	ND	100	ug/L	SW846 8270C
Indeno(1,2,3-cd)pyrene	ND	10	ug/L	SW846 8270C
Isodrin	ND	10	ug/L	SW846 8270C
Isophorone	ND	10	ug/L	SW846 8270C
Isosafrole	ND	20	ug/L	SW846 8270C
Methapyrilene	ND	50	ug/L	SW846 8270C
3-Methylcholanthrene	ND	20	ug/L	SW846 8270C
Methyl methanesulfonate	ND	10	ug/L	SW846 8270C
2-Methylnaphthalene	ND	10	ug/L	SW846 8270C
Methyl parathion	ND	50	ug/L	SW846 8270C
2-Methylphenol	ND	10	ug/L	SW846 8270C
3-Methylphenol & 4-Methylphenol	ND	10	ug/L	SW846 8270C
Naphthalene	ND	10	ug/L	SW846 8270C
1,4-Naphthoquinone	ND	50	ug/L	SW846 8270C
1-Naphthylamine	ND	10	ug/L	SW846 8270C
2-Naphthylamine	ND	10	ug/L	SW846 8270C
2-Nitroaniline	ND	50	ug/L	SW846 8270C
3-Nitroaniline	ND	50	ug/L	SW846 8270C
4-Nitroaniline	ND	50	ug/L	SW846 8270C
trobenzene	ND	10	ug/L	SW846 8270C

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METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: D3K120128 **Work Order #...: F4V7P1AA** **Matrix.........: WATER**

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
2-Nitrophenol	ND	10	ug/L	SW846 8270C
4-Nitrophenol	ND	50	ug/L	SW846 8270C
4-Nitroquinoline-1-oxide	ND	100	ug/L	SW846 8270C
N-Nitrosodi-n-butylamine	ND	10	ug/L	SW846 8270C
N-Nitrosodiethylamine	ND	10	ug/L	SW846 8270C
N-Nitrosodimethylamine	ND	10	ug/L	SW846 8270C
N-Nitrosodiphenylamine	ND	10	ug/L	SW846 8270C
N-Nitrosodi-n-propylamine	ND	10	ug/L	SW846 8270C
N-Nitrosomethylethylamine	ND	10	ug/L	SW846 8270C
N-Nitrosomorpholine	ND	10	ug/L	SW846 8270C
N-Nitrosopiperidine	ND	10	ug/L	SW846 8270C
N-Nitrosopyrrolidine	ND	10	ug/L	SW846 8270C
5-Nitro-o-toluidine	ND	20	ug/L	SW846 8270C
Parathion	ND	50	ug/L	SW846 8270C
Pentachlorobenzene	ND	10	ug/L	SW846 8270C
Pentachloroethane	ND	50	ug/L	SW846 8270C
entachloronitrobenzene	ND	50	ug/L	SW846 8270C
Pentachlorophenol	ND	50	ug/L	SW846 8270C
Phenacetin	ND	20	ug/L	SW846 8270C
Phenanthrene	ND	10	ug/L	SW846 8270C
Phenol	ND	10	ug/L	SW846 8270C
Phorate	ND	50	ug/L	SW846 8270C
2-Picoline	ND	20	ug/L	SW846 8270C
Pronamide	ND	20	ug/L	SW846 8270C
Pyrene	ND	10	ug/L	SW846 8270C
Pyridine	ND	20	ug/L	SW846 8270C
1,2,4,5-Tetrachlorobenzene	ND	10	ug/L	SW846 8270C
2,3,4,6-Tetrachlorophenol	ND	50	ug/L	SW846 8270C
Thionazin	ND	10	ug/L	SW846 8270C
o-Toluidine	ND	10	ug/L	SW846 8270C
1,2,4-Trichlorobenzene	ND	10	ug/L	SW846 8270C
2,4,5-Trichlorophenol	ND	10	ug/L	SW846 8270C
2,4,6-Trichlorophenol	ND	10	ug/L	SW846 8270C
O,O,O-Triethylphosphorothioate	ND	50	ug/L	SW846 8270C
1,3,5-Trinitrobenzene	ND	50	ug/L	SW846 8270C

(Continued on next page)

METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: D3K120128   Work Order #...: F4V7P1AA   Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	70	(32 - 116)
Phenol-d5	72	(40 - 111)
Nitrobenzene-d5	70	(53 - 107)
2-Fluorobiphenyl	62	(31 - 105)
2,4,6-Tribromophenol	69	(42 - 122)
Terphenyl-d14	77	(21 - 125)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: D3K120128 **Work Order #...:** F4V7P1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D3K140000-453 F4V7P1AD-LCSD
Prep Date......: 11/14/03 **Analysis Date..:** 12/10/03
Prep Batch #...: 3318453 **Analysis Time..:** 23:32
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Acenaphthene	73	(55 - 97)			SW846 8270C
	68	(55 - 97)	7.0	(0-30)	SW846 8270C
4-Chloro-3-methylphenol	77	(59 - 106)			SW846 8270C
	77	(59 - 106)	0.26	(0-40)	SW846 8270C
2-Chlorophenol	80	(59 - 105)			SW846 8270C
	78	(59 - 105)	3.1	(0-40)	SW846 8270C
1,4-Dichlorobenzene	63	(31 - 98)			SW846 8270C
	53	(31 - 98)	17	(0-40)	SW846 8270C
2,4-Dinitrotoluene	71	(57 - 113)			SW846 8270C
	68	(57 - 113)	4.3	(0-40)	SW846 8270C
4-Nitrophenol	67	(43 - 118)			SW846 8270C
	62	(43 - 118)	7.2	(0-40)	SW846 8270C
N-Nitrosodi-n-propylamine	73	(51 - 99)			SW846 8270C
	71	(51 - 99)	3.4	(0-40)	SW846 8270C
Pentachlorophenol	73	(48 - 114)			SW846 8270C
	70	(48 - 114)	4.0	(0-40)	SW846 8270C
Phenol	81	(56 - 106)			SW846 8270C
	80	(56 - 106)	2.1	(0-40)	SW846 8270C
Pyrene	73	(51 - 103)			SW846 8270C
	72	(51 - 103)	1.2	(0-40)	SW846 8270C
1,2,4-Trichlorobenzene	62	(36 - 99)			SW846 8270C
	54	(36 - 99)	14	(0-40)	SW846 8270C

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	75	(54 - 105)
	72	(54 - 105)
Phenol-d5	79	(55 - 106)
	76	(55 - 106)
Nitrobenzene-d5	78	(58 - 108)
	76	(58 - 108)
2-Fluorobiphenyl	66	(53 - 97)
	54	(53 - 97)
2,4,6-Tribromophenol	76	(62 - 113)
	73	(62 - 113)
Terphenyl-d14	78	(55 - 109)

(Continued on next page)

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: D3K120128 Work Order #...: F4V7P1AC-LCS Matrix.........: WATER
LCS Lot-Sample#: D3K140000-453 F4V7P1AD-LCSD

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
	77	(55 - 109)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: D3K120128   Work Order #...: F4V7P1AC-LCS   Matrix.........: WATER
LCS Lot-Sample#: D3K140000-453   F4V7P1AD-LCSD
Prep Date......: 11/14/03   Analysis Date..: 12/10/03
Prep Batch #...: 3318453   Analysis Time..: 23:32
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Acenaphthene	100	72.7	ug/L	73		SW846 8270C
	100	67.8	ug/L	68	7.0	SW846 8270C
4-Chloro-3-methylphenol	150	115	ug/L	77		SW846 8270C
	150	115	ug/L	77	0.26	SW846 8270C
2-Chlorophenol	150	120	ug/L	80		SW846 8270C
	150	117	ug/L	78	3.1	SW846 8270C
1,4-Dichlorobenzene	100	63.3	ug/L	63		SW846 8270C
	100	53.2	ug/L	53	17	SW846 8270C
2,4-Dinitrotoluene	100	70.5	ug/L	71		SW846 8270C
	100	67.6	ug/L	68	4.3	SW846 8270C
4-Nitrophenol	150	101	ug/L	67		SW846 8270C
	150	93.6	ug/L	62	7.2	SW846 8270C
N-Nitrosodi-n-propylamine	100	73.2	ug/L	73		SW846 8270C
	100	70.7	ug/L	71	3.4	SW846 8270C
Pentachlorophenol	150	109	ug/L	73		SW846 8270C
	150	105	ug/L	70	4.0	SW846 8270C
Phenol	150	122	ug/L	81		SW846 8270C
	150	120	ug/L	80	2.1	SW846 8270C
Pyrene	100	72.5	ug/L	73		SW846 8270C
	100	71.7	ug/L	72	1.2	SW846 8270C
1,2,4-Trichlorobenzene	100	62.2	ug/L	62		SW846 8270C
	100	54.3	ug/L	54	14	SW846 8270C

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	75	(54 - 105)
	72	(54 - 105)
Phenol-d5	79	(55 - 106)
	76	(55 - 106)
Nitrobenzene-d5	78	(58 - 108)
	76	(58 - 108)
2-Fluorobiphenyl	66	(53 - 97)
	54	(53 - 97)
2,4,6-Tribromophenol	76	(62 - 113)
	73	(62 - 113)
Terphenyl-d14	78	(55 - 109)

(Continued on next page)

LABORATORY CONTROL SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: D3K120128 Work Order #...: F4V7P1AC-LCS Matrix.........: WATER
LCS Lot-Sample#: D3K140000-453 F4V7P1AD-LCSD

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
	77	(55 - 109)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

METHOD BLANK REPORT

GC Semivolatiles

Client Lot #...: D3K120128
MB Lot-Sample #: D3K170000-203
Work Order #...: F40V71AA
Matrix.........: WATER
Prep Date......: 11/17/03
Analysis Time..: 06:57
Analysis Date..: 12/13/03
Prep Batch #...: 3321203
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Aldrin	ND	0.050	ug/L	SW846 8081A
alpha-BHC	ND	0.050	ug/L	SW846 8081A
beta-BHC	ND	0.050	ug/L	SW846 8081A
delta-BHC	ND	0.050	ug/L	SW846 8081A
gamma-BHC (Lindane)	ND	0.050	ug/L	SW846 8081A
Chlordane (technical)	ND	0.50	ug/L	SW846 8081A
4,4'-DDD	ND	0.050	ug/L	SW846 8081A
4,4'-DDE	ND	0.050	ug/L	SW846 8081A
4,4'-DDT	ND	0.050	ug/L	SW846 8081A
Dieldrin	ND	0.050	ug/L	SW846 8081A
Endrin	ND	0.050	ug/L	SW846 8081A
Endrin aldehyde	ND	0.050	ug/L	SW846 8081A
Endosulfan I	ND	0.050	ug/L	SW846 8081A
Endosulfan II	ND	0.050	ug/L	SW846 8081A
Endosulfan sulfate	ND	0.050	ug/L	SW846 8081A
Heptachlor	ND	0.050	ug/L	SW846 8081A
Heptachlor epoxide	ND	0.050	ug/L	SW846 8081A
Methoxychlor	ND	0.10	ug/L	SW846 8081A
Toxaphene	ND	5.0	ug/L	SW846 8081A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Decachlorobiphenyl	83	(29 - 125)
Tetrachloro-m-xylene	84	(40 - 115)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC Semivolatiles

Client Lot #...: D3K120128 **Work Order #...:** F40V71AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D3K170000-203 F40V71AD-LCSD
Prep Date......: 11/17/03 **Analysis Date..:** 12/12/03
Prep Batch #...: 3321203 **Analysis Time..:** 22:52
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Aldrin	**104**	**(53 - 122)**			**SW846 8081A**
	102	**(53 - 122)**	**1.8**	**(0-30)**	**SW846 8081A**
gamma-BHC (Lindane)	**105**	**(72 - 122)**			**SW846 8081A**
	107	**(72 - 122)**	**1.8**	**(0-30)**	**SW846 8081A**
4,4'-DDT	**107**	**(66 - 138)**			**SW846 8081A**
	108	**(66 - 138)**	**1.2**	**(0-30)**	**SW846 8081A**
Dieldrin	**112**	**(75 - 128)**			**SW846 8081A**
	113	**(75 - 128)**	**0.78**	**(0-30)**	**SW846 8081A**
Endrin	**109**	**(64 - 138)**			**SW846 8081A**
	110	**(64 - 138)**	**1.5**	**(0-30)**	**SW846 8081A**
Heptachlor	**101**	**(60 - 126)**			**SW846 8081A**
	101	**(60 - 126)**	**0.46**	**(0-30)**	**SW846 8081A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Decachlorobiphenyl	77	(65 - 137)
	91	(65 - 137)
Tetrachloro-m-xylene	89	(40 - 115)
	85	(40 - 115)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC Semivolatiles

Client Lot #...: D3K120128 Work Order #...: F40V71AC-LCS Matrix.........: WATER
LCS Lot-Sample#: D3K170000-203 F40V71AD-LCSD
Prep Date......: 11/17/03 Analysis Date..: 12/12/03
Prep Batch #...: 3321203 Analysis Time..: 22:52
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Aldrin	**0.500**	**0.520**	**ug/L**	**104**		**SW846 8081A**
	0.500	**0.511**	**ug/L**	**102**	**1.8**	**SW846 8081A**
gamma-BHC (Lindane)	**0.500**	**0.525**	**ug/L**	**105**		**SW846 8081A**
	0.500	**0.535**	**ug/L**	**107**	**1.8**	**SW846 8081A**
4,4'-DDT	**0.500**	**0.534**	**ug/L**	**107**		**SW846 8081A**
	0.500	**0.540**	**ug/L**	**108**	**1.2**	**SW846 8081A**
Dieldrin	**0.500**	**0.559**	**ug/L**	**112**		**SW846 8081A**
	0.500	**0.564**	**ug/L**	**113**	**0.78**	**SW846 8081A**
Endrin	**0.500**	**0.543**	**ug/L**	**109**		**SW846 8081A**
	0.500	**0.551**	**ug/L**	**110**	**1.5**	**SW846 8081A**
Heptachlor	**0.500**	**0.507**	**ug/L**	**101**		**SW846 8081A**
	0.500	**0.505**	**ug/L**	**101**	**0.46**	**SW846 8081A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Decachlorobiphenyl	77	(65 - 137)
	91	(65 - 137)
Tetrachloro-m-xylene	89	(40 - 115)
	85	(40 - 115)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

METHOD BLANK REPORT

GC Semivolatiles

Client Lot #...: D3K120128 **Work Order #...:** F40WT1AA **Matrix.........:** WATER
MB Lot-Sample #: D3K170000-215
Prep Date......: 11/17/03 **Analysis Time..:** 18:49
Analysis Date..: 12/07/03 **Prep Batch #...:** 3321215
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Aroclor 1016	ND	1.0	ug/L	SW846 8082
Aroclor 1221	ND	1.0	ug/L	SW846 8082
Aroclor 1232	ND	1.0	ug/L	SW846 8082
Aroclor 1242	ND	1.0	ug/L	SW846 8082
Aroclor 1248	ND	1.0	ug/L	SW846 8082
Aroclor 1254	ND	1.0	ug/L	SW846 8082
Aroclor 1260	ND	1.0	ug/L	SW846 8082

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	103	(52 - 160)
Decachlorobiphenyl	103	(37 - 144)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC Semivolatiles

Client Lot #...: D3K120128 **Work Order #...:** F40WT1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D3K170000-215 F40WT1AD-LCSD
Prep Date......: 11/17/03 **Analysis Date..:** 12/07/03
Prep Batch #...: 3321215 **Analysis Time..:** 19:11
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Aroclor 1016	**104**	**(56 - 124)**			**SW846 8082**
	109	**(56 - 124)**	**4.7**	**(0-30)**	**SW846 8082**
Aroclor 1260	**115**	**(64 - 120)**			**SW846 8082**
	118	**(64 - 120)**	**2.9**	**(0-30)**	**SW846 8082**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	89	(52 - 127)
	96	(52 - 127)
Decachlorobiphenyl	78	(61 - 128)
	81	(61 - 128)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC Semivolatiles

Client Lot #...: D3K120128 **Work Order #...:** F40WT1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D3K170000-215 F40WT1AD-LCSD
Prep Date......: 11/17/03 **Analysis Date..:** 12/07/03
Prep Batch #...: 3321215 **Analysis Time..:** 19:11
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Aroclor 1016	**2.00**	**2.09**	**ug/L**	**104**		**SW846 8082**
	2.00	**2.19**	**ug/L**	**109**	**4.7**	**SW846 8082**
Aroclor 1260	**2.00**	**2.29**	**ug/L**	**115**		**SW846 8082**
	2.00	**2.36**	**ug/L**	**118**	**2.9**	**SW846 8082**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	89	(52 - 127)
	96	(52 - 127)
Decachlorobiphenyl	78	(61 - 128)
	81	(61 - 128)

NOTE(S):

alculations are performed before rounding to avoid round-off errors in calculated results.

old print denotes control parameters

METHOD BLANK REPORT

GC Semivolatiles

Client Lot #...: D3K120128 **Work Order #...:** F42M71AA **Matrix.........:** WATER
MB Lot-Sample #: D3K180000-194
Prep Date.......: 11/18/03 **Analysis Time..:** 14:08
Analysis Date..: 12/02/03 **Prep Batch #...:** 3322194
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Azinphos-methyl	ND	2.5	ug/L	SW846 8141A
Bolstar	ND	0.50	ug/L	SW846 8141A
Chlorpyrifos	ND	0.50	ug/L	SW846 8141A
Coumaphos	ND	0.50	ug/L	SW846 8141A
Demeton (total)	ND	1.0	ug/L	SW846 8141A
Diazinon	ND	0.50	ug/L	SW846 8141A
Dichlorvos	ND	0.50	ug/L	SW846 8141A
Dimethoate	ND	0.50	ug/L	SW846 8141A
Disulfoton	ND	0.50	ug/L	SW846 8141A
Ethoprop	ND	0.50	ug/L	SW846 8141A
Ethyl parathion	ND	0.50	ug/L	SW846 8141A
Famphur	ND	1.0	ug/L	SW846 8141A
Fensulfothion	ND	2.5	ug/L	SW846 8141A
Fenthion	ND	0.50	ug/L	SW846 8141A
Malathion	ND	1.2	ug/L	SW846 8141A
Merphos	ND	5.0	ug/L	SW846 8141A
Methyl parathion	ND	0.50	ug/L	SW846 8141A
Mevinphos	ND	6.2	ug/L	SW846 8141A
Naled	ND	10	ug/L	SW846 8141A
O,O,O-Triethylphosphorothioate	ND	0.50	ug/L	SW846 8141A
Phorate	ND	0.50	ug/L	SW846 8141A
Ronnel	ND	10	ug/L	SW846 8141A
Sulfotepp	ND	0.50	ug/L	SW846 8141A
Thionazin	ND	0.50	ug/L	SW846 8141A
Tokuthion	ND	0.50	ug/L	SW846 8141A
Trichloronate	ND	0.50	ug/L	SW846 8141A
EPN	ND	0.50	ug/L	SW846 8141A
Demeton-O	ND	1.0	ug/L	SW846 8141A
Demeton-S	ND	1.0	ug/L	SW846 8141A
Tetrachlorvinphos (Stirop	ND	2.5	ug/L	SW846 8141A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	90	(49 - 105)
Ethyl Pirimifos	89	(20 - 121)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC Semivolatiles

Client Lot #...: D3K120128 **Work Order #...:** F42M71AC **Matrix.........:** WATER
LCS Lot-Sample#: D3K180000-194
Prep Date......: 11/18/03 **Analysis Date..:** 12/02/03
Prep Batch #...: 3322194 **Analysis Time..:** 14:41
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD
Demeton (total)	**74**	**(20 - 107)**	**SW846 8141A**
Diazinon	**82**	**(58 - 108)**	**SW846 8141A**
Ethyl parathion	**90**	**(62 - 118)**	**SW846 8141A**
Malathion	**72**	**(33 - 109)**	**SW846 8141A**
Methyl parathion	**85**	**(50 - 127)**	**SW846 8141A**
Phorate	**82**	**(54 - 101)**	**SW846 8141A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	82	(49 - 105)
Ethyl Pirimifos	86	(20 - 121)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC Semivolatiles

Client Lot #...: D3K120128 **Work Order #...:** F42M71AC **Matrix.........:** WATER
LCS Lot-Sample#: D3K180000-194
Prep Date......: 11/18/03 **Analysis Date..:** 12/02/03
Prep Batch #...: 3322194 **Analysis Time..:** 14:41
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	METHOD
Demeton (total)	**4.00**	**2.96**	**ug/L**	**74**	**SW846 8141A**
Diazinon	**4.00**	**3.30**	**ug/L**	**82**	**SW846 8141A**
Ethyl parathion	**4.00**	**3.60**	**ug/L**	**90**	**SW846 8141A**
Malathion	**4.00**	**2.90**	**ug/L**	**72**	**SW846 8141A**
Methyl parathion	**4.00**	**3.39**	**ug/L**	**85**	**SW846 8141A**
Phorate	**4.00**	**3.29**	**ug/L**	**82**	**SW846 8141A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	82	(49 - 105)
Ethyl Pirimifos	86	(20 - 121)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC Semivolatiles

Lot-Sample #...: D3K120128 **Work Order #...:** F4REN1AJ **Matrix.........:** WATER
MS Lot-Sample #: D3K130311-004
Date Sampled...: 11/12/03 01:00 **Date Received..:** 11/13/03
Prep Date......: 11/18/03 **Analysis Date..:** 12/02/03
Prep Batch #...: 3322194
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD
Demeton (total)	**75**	**(20 - 107)**	**SW846 8141A**
Diazinon	**84**	**(58 - 108)**	**SW846 8141A**
Ethyl parathion	**94**	**(62 - 118)**	**SW846 8141A**
Malathion	**83**	**(33 - 109)**	**SW846 8141A**
Methyl parathion	**89**	**(50 - 127)**	**SW846 8141A**
Phorate	**85**	**(54 - 101)**	**SW846 8141A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	75	(49 - 105)
Ethyl Pirimifos	83	(20 - 121)

OTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE DATA REPORT

GC Semivolatiles

Lot-Sample #...: D3K120128 Work Order #...: F4REN1AJ Matrix.........: WATER
MS Lot-Sample #: D3K130311-004
Date Sampled...: 11/12/03 01:00 Date Received..: 11/13/03
Prep Date.......: 11/18/03 Analysis Date..: 12/02/03
Prep Batch #...: 3322194
Dilution Factor: 1

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCENT RECOVERY	METHOD
Demeton (total)	**ND**	**4.22**	**3.16**	**ug/L**	**75**	**SW846 8141A**
Diazinon	**ND**	**4.22**	**3.56**	**ug/L**	**84**	**SW846 8141A**
Ethyl parathion	**ND**	**4.22**	**3.97**	**ug/L**	**94**	**SW846 8141A**
Malathion	**ND**	**4.22**	**3.50**	**ug/L**	**83**	**SW846 8141A**
Methyl parathion	**ND**	**4.22**	**3.74**	**ug/L**	**89**	**SW846 8141A**
Phorate	**ND**	**4.22**	**3.60**	**ug/L**	**85**	**SW846 8141A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	75	(49 - 105)
Ethyl Pirimifos	83	(20 - 121)

NTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

METHOD BLANK REPORT

TOTAL Metals

Client Lot #...: D3K120128 **Matrix.........:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MB Lot-Sample #: D3K130000-398 Prep Batch #...: 3317398						
Mercury	ND	0.20	ug/L	SW846 7470A	11/18/03	F4QF21AA
		Dilution Factor: 1				
		Analysis Time..: 18:09				
MB Lot-Sample #: D3K130000-761 Prep Batch #...: 3317761						
Aluminum	ND	100	ug/L	SW846 6010B	11/19-11/21/03	F4R8N1AA
		Dilution Factor: 1				
		Analysis Time..: 22:52				
Antimony	ND	10	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1AC
		Dilution Factor: 1				
		Analysis Time..: 17:53				
Arsenic	ND	15	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1AD
		Dilution Factor: 1				
		Analysis Time..: 17:53				
Barium	1.3 B	10	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1AE
		Dilution Factor: 1				
		Analysis Time..: 17:53				
Beryllium	ND	5.0	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1AF
		Dilution Factor: 1				
		Analysis Time..: 17:53				
Boron	9.6 B	100	ug/L	SW846 6010B	11/19-11/21/03	F4R8N1DH
		Dilution Factor: 1				
		Analysis Time..: 22:52				
Cadmium	ND	5.0	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1AG
		Dilution Factor: 1				
		Analysis Time..: 17:53				
Chromium	ND	10	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1A1
		Dilution Factor: 1				
		Analysis Time..: 17:53				
Cobalt	ND	10	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1AJ
		Dilution Factor: 1				
		Analysis Time..: 17:53				

(Continued on next page)

METHOD BLANK REPORT

TOTAL Metals

Client Lot #...: D3K120128 **Matrix.........:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Copper	ND	10 Dilution Factor: 1 Analysis Time..: 17:53	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1AK
Iron	ND	100 Dilution Factor: 1 Analysis Time..: 22:52	ug/L	SW846 6010B	11/19-11/21/03	F4R8N1AL
Lead	ND	3.0 Dilution Factor: 1 Analysis Time..: 17:53	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1AM
Manganese	ND	10 Dilution Factor: 1 Analysis Time..: 22:52	ug/L	SW846 6010B	11/19-11/21/03	F4R8N1AP
Molybdenum	ND	20 Dilution Factor: 1 Analysis Time..: 17:53	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1DJ
ickel	ND	40 Dilution Factor: 1 Analysis Time..: 17:53	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1AQ
Selenium	ND	15 Dilution Factor: 1 Analysis Time..: 17:53	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1AT
Silver	1.4 B	10 Dilution Factor: 1 Analysis Time..: 17:53	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1AU
Thallium	ND	10 Dilution Factor: 1 Analysis Time..: 17:53	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1AW
Zinc	ND	20 Dilution Factor: 1 Analysis Time..: 17:53	ug/L	SW846 6010B	11/19-11/20/03	F4R8N1A0

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

B Estimated result. Result is less than RL.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

TOTAL Metals

Lot-Sample #...: D3K120128 Matrix.........: WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP-BATCH #
Aluminum	97	(86 - 108)			SW846 6010B	11/19-11/21/03	3317761
	100	(86 - 108)	2.8	(0-20)	SW846 6010B	11/19-11/21/03	3317761
		Dilution Factor: 1			Analysis Time..: 22:57		
Antimony	94	(88 - 108)			SW846 6010B	11/19-11/20/03	3317761
	99	(88 - 108)	5.4	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		
Arsenic	96	(89 - 109)			SW846 6010B	11/19-11/20/03	3317761
	98	(89 - 109)	2.5	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		
Barium	105	(93 - 113)			SW846 6010B	11/19-11/20/03	3317761
	107	(93 - 113)	2.4	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		
Beryllium	94	(88 - 112)			SW846 6010B	11/19-11/20/03	3317761
	97	(88 - 112)	3.4	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		
Boron	96	(89 - 110)			SW846 6010B	11/19-11/21/03	3317761
	100	(89 - 110)	4.3	(0-20)	SW846 6010B	11/19-11/21/03	3317761
		Dilution Factor: 1			Analysis Time..: 22:57		
Cadmium	96	(89 - 110)			SW846 6010B	11/19-11/20/03	3317761
	100	(89 - 110)	3.1	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		
Chromium	95	(89 - 112)			SW846 6010B	11/19-11/20/03	3317761
	98	(89 - 112)	2.9	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		
Cobalt	95	(86 - 107)			SW846 6010B	11/19-11/20/03	3317761
	97	(86 - 107)	2.7	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		
Copper	97	(86 - 110)			SW846 6010B	11/19-11/20/03	3317761
	100	(86 - 110)	2.4	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		

(Continued on next page)

LABORATORY CONTROL SAMPLE EVALUATION REPORT

TOTAL Metals

Lot-Sample #...: D3K120128 Matrix.........: WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION- ANALYSIS DATE	PREP- BATCH #
Iron	97	(88 - 110)			SW846 6010B	11/19-11/21/03	3317761
	99	(88 - 110)	2.5	(0-20)	SW846 6010B	11/19-11/21/03	3317761
		Dilution Factor: 1			Analysis Time..: 22:57		
Lead	98	(91 - 111)			SW846 6010B	11/19-11/20/03	3317761
	100	(91 - 111)	1.9	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		
Manganese	98	(90 - 110)			SW846 6010B	11/19-11/21/03	3317761
	100	(90 - 110)	2.5	(0-20)	SW846 6010B	11/19-11/21/03	3317761
		Dilution Factor: 1			Analysis Time..: 22:57		
Molybdenum	91	(83 - 109)			SW846 6010B	11/19-11/20/03	3317761
	96	(83 - 109)	6.1	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		
Nickel	99	(90 - 110)			SW846 6010B	11/19-11/20/03	3317761
	101	(90 - 110)	2.3	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		
Selenium	97	(88 - 110)			SW846 6010B	11/19-11/20/03	3317761
	99	(88 - 110)	2.1	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		
Silver	102	(85 - 114)			SW846 6010B	11/19-11/20/03	3317761
	104	(85 - 114)	2.1	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		
Thallium	97	(88 - 108)			SW846 6010B	11/19-11/20/03	3317761
	99	(88 - 108)	2.6	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		
Zinc	94	(85 - 110)			SW846 6010B	11/19-11/20/03	3317761
	96	(85 - 110)	2.0	(0-20)	SW846 6010B	11/19-11/20/03	3317761
		Dilution Factor: 1			Analysis Time..: 17:57		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE DATA REPORT

TOTAL Metals

Lot-Sample #...: D3K120128

Matrix.........: WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION- ANALYSIS DATE	PREP BATCH #
Aluminum	2000	1950	ug/L	97		SW846 6010B	11/19-11/21/03	3317761
	2000	2000	ug/L	100	2.8	SW846 6010B	11/19-11/21/03	3317761
			Dilution Factor: 1			Analysis Time..: 22:57		
Antimony	500	468	ug/L	94		SW846 6010B	11/19-11/20/03	3317761
	500	494	ug/L	99	5.4	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		
Arsenic	2000	1920	ug/L	96		SW846 6010B	11/19-11/20/03	3317761
	2000	1970	ug/L	98	2.5	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		
Barium	2000	2090	ug/L	105		SW846 6010B	11/19-11/20/03	3317761
	2000	2140	ug/L	107	2.4	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		
Beryllium	50.0	47.0	ug/L	94		SW846 6010B	11/19-11/20/03	3317761
	50.0	48.7	ug/L	97	3.4	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		
Boron	1000	956	ug/L	96		SW846 6010B	11/19-11/21/03	3317761
	1000	998	ug/L	100	4.3	SW846 6010B	11/19-11/21/03	3317761
			Dilution Factor: 1			Analysis Time..: 22:57		
Cadmium	50.0	48.2	ug/L	96		SW846 6010B	11/19-11/20/03	3317761
	50.0	49.8	ug/L	100	3.1	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		
Chromium	200	189	ug/L	95		SW846 6010B	11/19-11/20/03	3317761
	200	195	ug/L	98	2.9	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		
Cobalt	500	474	ug/L	95		SW846 6010B	11/19-11/20/03	3317761
	500	487	ug/L	97	2.7	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		
Copper	250	243	ug/L	97		SW846 6010B	11/19-11/20/03	3317761
	250	249	ug/L	100	2.4	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		

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LABORATORY CONTROL SAMPLE DATA REPORT

TOTAL Metals

Lot-Sample #...: D3K120128 Matrix.........: WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Iron	1000	968	ug/L	97		SW846 6010B	11/19-11/21/03	3317761
	1000	992	ug/L	99	2.5	SW846 6010B	11/19-11/21/03	3317761
			Dilution Factor: 1			Analysis Time..: 22:57		
Lead	500	492	ug/L	98		SW846 6010B	11/19-11/20/03	3317761
	500	501	ug/L	100	1.9	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		
Manganese	500	488	ug/L	98		SW846 6010B	11/19-11/21/03	3317761
	500	501	ug/L	100	2.5	SW846 6010B	11/19-11/21/03	3317761
			Dilution Factor: 1			Analysis Time..: 22:57		
Molybdenum	1000	907	ug/L	91		SW846 6010B	11/19-11/20/03	3317761
	1000	964	ug/L	96	6.1	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		
Nickel	500	493	ug/L	99		SW846 6010B	11/19-11/20/03	3317761
	500	504	ug/L	101	2.3	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		
Selenium	2000	1950	ug/L	97		SW846 6010B	11/19-11/20/03	3317761
	2000	1990	ug/L	99	2.1	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		
Silver	50.0	50.8	ug/L	102		SW846 6010B	11/19-11/20/03	3317761
	50.0	51.9	ug/L	104	2.1	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		
Thallium	2000	1930	ug/L	97		SW846 6010B	11/19-11/20/03	3317761
	2000	1980	ug/L	99	2.6	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		
Zinc	500	468	ug/L	94		SW846 6010B	11/19-11/20/03	3317761
	500	478	ug/L	96	2.0	SW846 6010B	11/19-11/20/03	3317761
			Dilution Factor: 1			Analysis Time..: 17:57		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D3K120128 **Matrix.........:** WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
LCS Lot-Sample#: D3K130000-398 **Prep Batch #...:** 3317398					
Mercury	95	(84 - 114)	SW846 7470A	11/18/03	F4QF21AC
		Dilution Factor: 1		Analysis Time..: 18:11	

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: D3K120128 **Matrix.........:** WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
LCS Lot-Sample#: D3K130000-398 Prep Batch #...: 3317398							
Mercury	5.00	4.76	ug/L	95	SW846 7470A	11/18/03	F4QF21AC
			Dilution Factor: 1		Analysis Time..: 18:11		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D3K120128 **Matrix..........:** WATER
Date Sampled...: 11/11/03 12:00 **Date Received..:** 11/12/03

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MS Lot-Sample #: D3K120128-001 **Prep Batch #...:** 3317398							
Mercury	98	(84 - 114)			SW846 7470A	11/18/03	F4L7C1CJ
	99	(84 - 114)	1.6	(0-10)	SW846 7470A	11/18/03	F4L7C1CK
		Dilution Factor: 1					
		Analysis Time..: 18:15					

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: D3K120128 **Matrix.........:** WATER
Date Sampled...: 11/11/03 12:00 **Date Received..:** 11/12/03

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MS Lot-Sample #: D3K120128-001 **Prep Batch #...:** 3317398									
Mercury									
	ND	5.00	4.88	ug/L	98		SW846 7470A	11/18/03	F4L7C1CJ
	ND	5.00	4.96	ug/L	99	1.6	SW846 7470A	11/18/03	F4L7C1CK

Dilution Factor: 1
Analysis Time..: 18:15

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D3K120128 **Matrix.........:** WATER
Date Sampled...: 11/07/03 14:00 **Date Received..:** 11/07/03

MS Lot-Sample #: D3K070365-001 **Prep Batch #...:** 3317761

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Aluminum	NC,MSB	(83 - 119)			SW846 6010B	11/19-11/21/03	F4E321C1
	NC,MSB	(83 - 119)		(0-25)	SW846 6010B	11/19-11/21/03	F4E321C2
		Dilution Factor: 1 Analysis Time..: 23:41					
Antimony	38 N	(81 - 124)			SW846 6010B	11/19-11/20/03	F4E321C3
	44 N	(81 - 124)	13	(0-25)	SW846 6010B	11/19-11/20/03	F4E321C4
		Dilution Factor: 1 Analysis Time..: 18:49					
Arsenic	95	(84 - 124)			SW846 6010B	11/19-11/20/03	F4E321C5
	95	(84 - 124)	0.51	(0-25)	SW846 6010B	11/19-11/20/03	F4E321C6
		Dilution Factor: 1 Analysis Time..: 18:49					
Barium	92	(85 - 120)			SW846 6010B	11/19-11/20/03	F4E321C7
	95	(85 - 120)	2.4	(0-25)	SW846 6010B	11/19-11/20/03	F4E321C8
		Dilution Factor: 1 Analysis Time..: 18:49					
Beryllium	84	(79 - 121)			SW846 6010B	11/19-11/20/03	F4E321C9
	84	(79 - 121)	0.06	(0-25)	SW846 6010B	11/19-11/20/03	F4E321DA
		Dilution Factor: 1 Analysis Time..: 18:49					
Boron	93	(87 - 113)			SW846 6010B	11/19-11/21/03	F4E321EH
	101	(87 - 113)	6.1	(0-25)	SW846 6010B	11/19-11/21/03	F4E321EJ
		Dilution Factor: 1 Analysis Time..: 23:41					
Cadmium	85	(82 - 119)			SW846 6010B	11/19-11/20/03	F4E321DC
	85	(82 - 119)	0.09	(0-25)	SW846 6010B	11/19-11/20/03	F4E321DD
		Dilution Factor: 1 Analysis Time..: 18:49					
Chromium	84	(73 - 135)			SW846 6010B	11/19-11/20/03	F4E321EE
	83	(73 - 135)	1.2	(0-25)	SW846 6010B	11/19-11/20/03	F4E321EF
		Dilution Factor: 1 Analysis Time..: 18:49					

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MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D3K120128 **Matrix.........:** WATER
Date Sampled...: 11/07/03 14:00 **Date Received..:** 11/07/03

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION- ANALYSIS DATE	WORK ORDER #
Cobalt	86	(82 - 119)			SW846 6010B	11/19-11/20/03	F4E321DG
	87	(82 - 119)	0.12	(0-25)	SW846 6010B	11/19-11/20/03	F4E321DH
		Dilution Factor: 1					
		Analysis Time..: 18:49					
Copper	103	(82 - 129)			SW846 6010B	11/19-11/20/03	F4E321DJ
	104	(82 - 129)	0.55	(0-25)	SW846 6010B	11/19-11/20/03	F4E321DK
		Dilution Factor: 1					
		Analysis Time..: 18:49					
Iron	NC,MSB	(52 - 155)			SW846 6010B	11/19-11/21/03	F4E321DL
	NC,MSB	(52 - 155)		(0-25)	SW846 6010B	11/19-11/21/03	F4E321DM
		Dilution Factor: 1					
		Analysis Time..: 23:41					
Lead	90	(89 - 121)			SW846 6010B	11/19-11/20/03	F4E321DN
	91	(89 - 121)	0.69	(0-25)	SW846 6010B	11/19-11/20/03	F4E321DP
		Dilution Factor: 1					
		Analysis Time..: 18:49					
Manganese	NC,MSB	(79 - 121)			SW846 6010B	11/19-11/21/03	F4E321DT
	NC,MSB	(79 - 121)		(0-25)	SW846 6010B	11/19-11/21/03	F4E321DU
		Dilution Factor: 1					
		Analysis Time..: 23:41					
Molybdenum	81 N	(83 - 109)			SW846 6010B	11/19-11/20/03	F4E321EL
	83	(83 - 109)	2.7	(0-25)	SW846 6010B	11/19-11/20/03	F4E321EM
		Dilution Factor: 1					
		Analysis Time..: 18:49					
Nickel	86	(84 - 120)			SW846 6010B	11/19-11/20/03	F4E321DV
	86	(84 - 120)	0.54	(0-25)	SW846 6010B	11/19-11/20/03	F4E321DW
		Dilution Factor: 1					
		Analysis Time..: 18:49					
Selenium	105	(71 - 140)			SW846 6010B	11/19-11/20/03	F4E321D1
	106	(71 - 140)	0.74	(0-25)	SW846 6010B	11/19-11/20/03	F4E321D2
		Dilution Factor: 1					
		Analysis Time..: 18:49					
Silver	103	(75 - 141)			SW846 6010B	11/19-11/20/03	F4E321D3
	102	(75 - 141)	0.65	(0-25)	SW846 6010B	11/19-11/20/03	F4E321D4
		Dilution Factor: 1					
		Analysis Time..: 18:49					

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MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D3K120128 **Matrix.........:** WATER
Date Sampled...: 11/07/03 14:00 **Date Received..:** 11/07/03

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Thallium	93	(90 - 116)			SW846 6010B	11/19-11/20/03	F4E321D7
	93	(90 - 116)	0.42	(0-25)	SW846 6010B	11/19-11/20/03	F4E321D8
		Dilution Factor: 1 Analysis Time..: 18:49					
Zinc	90	(60 - 137)			SW846 6010B	11/19-11/20/03	F4E321EC
	90	(60 - 137)	0.11	(0-25)	SW846 6010B	11/19-11/20/03	F4E321ED
		Dilution Factor: 1 Analysis Time..: 18:49					

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

NC The recovery and/or RPD were not calculated.

MSB The recovery and RPD were not calculated because the sample amount was greater than four times the spike amount.

N Spiked analyte recovery is outside stated control limits.

MATRIX SPIKE SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: D3K120128 **Matrix.........:** WATER
Date Sampled...: 11/07/03 14:00 **Date Received..:** 11/07/03

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MS Lot-Sample #: D3K070365-001 **Prep Batch #...:** 3317761									
Aluminum									
	100000	2000	209000	ug/L			SW846 6010B	11/19-11/21/03	F4E321C1
			Qualifiers: NC,MSB						
	100000	2000	201000	ug/L			SW846 6010B	11/19-11/21/03	F4E321C2
			Qualifiers: NC,MSB						
			Dilution Factor: 1						
			Analysis Time..: 23:41						
Antimony									
	ND	500	193 N	ug/L	38		SW846 6010B	11/19-11/20/03	F4E321C3
	ND	500	220 N	ug/L	44	13	SW846 6010B	11/19-11/20/03	F4E321C4
			Dilution Factor: 1						
			Analysis Time..: 18:49						
Arsenic									
	14	2000	1910	ug/L	95		SW846 6010B	11/19-11/20/03	F4E321C5
	14	2000	1920	ug/L	95	0.51	SW846 6010B	11/19-11/20/03	F4E321C6
			Dilution Factor: 1						
			Analysis Time..: 18:49						
Barium									
	970	2000	2800	ug/L	92		SW846 6010B	11/19-11/20/03	F4E321C7
	970	2000	2870	ug/L	95	2.4	SW846 6010B	11/19-11/20/03	F4E321C8
			Dilution Factor: 1						
			Analysis Time..: 18:49						
Beryllium									
	20	50.0	62.0	ug/L	84		SW846 6010B	11/19-11/20/03	F4E321C9
	20	50.0	61.9	ug/L	84	0.06	SW846 6010B	11/19-11/20/03	F4E321DA
			Dilution Factor: 1						
			Analysis Time..: 18:49						
Boron									
	290	1000	1220	ug/L	93		SW846 6010B	11/19-11/21/03	F4E321EH
	290	1000	1300	ug/L	101	6.1	SW846 6010B	11/19-11/21/03	F4E321EJ
			Dilution Factor: 1						
			Analysis Time..: 23:41						
Cadmium									
	10	50.0	52.9	ug/L	85		SW846 6010B	11/19-11/20/03	F4E321DC
	10	50.0	52.9	ug/L	85	0.09	SW846 6010B	11/19-11/20/03	F4E321DD
			Dilution Factor: 1						
			Analysis Time..: 18:49						

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MATRIX SPIKE SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: D3K120128 **Matrix.........:** WATER
Date Sampled...: 11/07/03 14:00 **Date Received..:** 11/07/03

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Chromium									
	45	200	213	ug/L	84		SW846 6010B	11/19-11/20/03	F4E321EE
	45	200	211	ug/L	83	1.2	SW846 6010B	11/19-11/20/03	F4E321EF
			Dilution Factor: 1						
			Analysis Time..: 18:49						
Cobalt									
	190	500	624	ug/L	86		SW846 6010B	11/19-11/20/03	F4E321DG
	190	500	625	ug/L	87	0.12	SW846 6010B	11/19-11/20/03	F4E321DH
			Dilution Factor: 1						
			Analysis Time..: 18:49						
Copper									
	140	250	399	ug/L	103		SW846 6010B	11/19-11/20/03	F4E321DJ
	140	250	401	ug/L	104	0.55	SW846 6010B	11/19-11/20/03	F4E321DK
			Dilution Factor: 1						
			Analysis Time..: 18:49						
Iron									
	52000	1000	62400	ug/L			SW846 6010B	11/19-11/21/03	F4E321DL
			Qualifiers: NC,MSB						
	52000	1000	61900	ug/L			SW846 6010B	11/19-11/21/03	F4E321DM
			Qualifiers: NC,MSB						
			Dilution Factor: 1						
			Analysis Time..: 23:41						
Lead									
	130	500	577	ug/L	90		SW846 6010B	11/19-11/20/03	F4E321DN
	130	500	581	ug/L	91	0.69	SW846 6010B	11/19-11/20/03	F4E321DP
			Dilution Factor: 1						
			Analysis Time..: 18:49						
Manganese									
	17000	500	18800	ug/L			SW846 6010B	11/19-11/21/03	F4E321DT
			Qualifiers: NC,MSB						
	17000	500	19200	ug/L			SW846 6010B	11/19-11/21/03	F4E321DU
			Qualifiers: NC,MSB						
			Dilution Factor: 1						
			Analysis Time..: 23:41						
Molybdenum									
	10	1000	820 N	ug/L	81		SW846 6010B	11/19-11/20/03	F4E321EL
	10	1000	842	ug/L	83	2.7	SW846 6010B	11/19-11/20/03	F4E321EM
			Dilution Factor: 1						
			Analysis Time..: 18:49						

(Continued on next page)

MATRIX SPIKE SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: D3K120128 **Matrix.........:** WATER
Date Sampled...: 11/07/03 14:00 **Date Received..:** 11/07/03

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Nickel									
	210	500	636	ug/L	86		SW846 6010B	11/19-11/20/03	F4E321DV
	210	500	640	ug/L	86	0.54	SW846 6010B	11/19-11/20/03	F4E321DW
			Dilution Factor: 1						
			Analysis Time..: 18:49						
Selenium									
	34	2000	2140	ug/L	105		SW846 6010B	11/19-11/20/03	F4E321D1
	34	2000	2160	ug/L	106	0.74	SW846 6010B	11/19-11/20/03	F4E321D2
			Dilution Factor: 1						
			Analysis Time..: 18:49						
Silver									
	5.1	50.0	56.5	ug/L	103		SW846 6010B	11/19-11/20/03	F4E321D3
	5.1	50.0	56.2	ug/L	102	0.65	SW846 6010B	11/19-11/20/03	F4E321D4
			Dilution Factor: 1						
			Analysis Time..: 18:49						
Thallium									
	ND	2000	1850	ug/L	93		SW846 6010B	11/19-11/20/03	F4E321D7
	ND	2000	1860	ug/L	93	0.42	SW846 6010B	11/19-11/20/03	F4E321D8
			Dilution Factor: 1						
			Analysis Time..: 18:49						
Zinc									
	1000	500	1460	ug/L	90		SW846 6010B	11/19-11/20/03	F4E321EC
	1000	500	1450	ug/L	90	0.11	SW846 6010B	11/19-11/20/03	F4E321ED
			Dilution Factor: 1						
			Analysis Time..: 18:49						

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

NC The recovery and/or RPD were not calculated.

MSB The recovery and RPD were not calculated because the sample amount was greater than four times the spike amount.

N Spiked analyte recovery is outside stated control limits.

METHOD BLANK REPORT

General Chemistry

Client Lot #...: D3K120128 **Matrix.........:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)		Work Order #: F5G561AA		MB Lot-Sample #: D3K230000-118		
	ND	20	mg/L	MCAWW 410.4	11/23/03	3327118
		Dilution Factor: 1				
		Analysis Time..: 13:40				
Chloride		Work Order #: F4RKQ1AA		MB Lot-Sample #: D3K130000-591		
	ND	3.0	mg/L	MCAWW 300.0A	11/12/03	3317591
		Dilution Factor: 1				
		Analysis Time..: 12:54				
Fecal Coliform		Work Order #: F403L1AA		MB Lot-Sample #: D3K170000-262		
	ND	1.0	CFU/100m	SM18 9222D Fecal	11/12/03	3321262
		Dilution Factor: 1				
		Analysis Time..: 11:00				
Fluoride		Work Order #: F4RHV1AA		MB Lot-Sample #: D3K130000-590		
	ND	1.0	mg/L	MCAWW 300.0A	11/12/03	3317590
		Dilution Factor: 1				
		Analysis Time..: 12:54				
Nitrate		Work Order #: F4RNA1AA		MB Lot-Sample #: D3K130000-593		
	ND	0.50	mg/L	MCAWW 300.0A	11/12/03	3317593
		Dilution Factor: 1				
		Analysis Time..: 12:54				
Nitrite		Work Order #: F4RLP1AA		MB Lot-Sample #: D3K130000-594		
	ND	0.50	mg/L	MCAWW 300.0A	11/12/03	3317594
		Dilution Factor: 1				
		Analysis Time..: 12:54				
Specific Conductance		Work Order #: F42QA1AA		MB Lot-Sample #: D3K170000-475		
	ND	2.0	umhos/cm	MCAWW 120.1	11/17/03	3321475
		Dilution Factor: 1				
		Analysis Time..: 12:00				
Sulfate		Work Order #: F4RNG1AA		MB Lot-Sample #: D3K130000-592		
	ND	5.0	mg/L	MCAWW 300.0A	11/12/03	3317592
		Dilution Factor: 1				
		Analysis Time..: 12:54				
Total Coliform		Work Order #: F403R1AA		MB Lot-Sample #: D3K170000-264		
	ND	1.0	CFU/100m	SM18 9222B	11/12/03	3321264
		Dilution Factor: 1				
		Analysis Time..: 11:00				

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METHOD BLANK REPORT

General Chemistry

Client Lot #...: D3K120128 **Matrix.........:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Cyanide		Work Order #: F48JP1AA		MB Lot-Sample #:	D3K200000-356	
	ND	0.010	mg/L	MCAWW 335.3	11/19/03	3324356
		Dilution Factor: 1				
		Analysis Time..: 13:00				
Total Dissolved Solids		Work Order #: F5NND1AA		MB Lot-Sample #:	D3K250000-641	
	ND	10	mg/L	MCAWW 160.1	11/17/03	3329641
		Dilution Factor: 1				
		Analysis Time..: 18:00				
Total Suspended Solids		Work Order #: F49R21AA		MB Lot-Sample #:	D3K200000-539	
	ND	4.0	mg/L	MCAWW 160.2	11/17/03	3324539
		Dilution Factor: 1				
		Analysis Time..: 20:00				

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

General Chemistry

Lot-Sample #...: D3K120128 **Matrix.........:** WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)		WO#:F5G561AC-LCS/F5G561AD-LCSD				LCS Lot-Sample#: D3K230000-118	
	95	(86 - 114)			MCAWW 410.4	11/23/03	3327118
	94	(86 - 114)	0.34	(0-11)	MCAWW 410.4	11/23/03	3327118
		Dilution Factor: 1			Analysis Time..: 13:40		
Chloride		WO#:F4RKQ1AC-LCS/F4RKQ1AD-LCSD				LCS Lot-Sample#: D3K130000-591	
	102	(90 - 110)			MCAWW 300.0A	11/12/03	3317591
	103	(90 - 110)	0.68	(0-10)	MCAWW 300.0A	11/12/03	3317591
		Dilution Factor: 1			Analysis Time..: 12:31		
Fluoride		WO#:F4RHV1AC-LCS/F4RHV1AD-LCSD				LCS Lot-Sample#: D3K130000-590	
	105	(90 - 110)			MCAWW 300.0A	11/12/03	3317590
	106	(90 - 110)	0.95	(0-10)	MCAWW 300.0A	11/12/03	3317590
		Dilution Factor: 1			Analysis Time..: 12:31		
Nitrate		WO#:F4RNA1AC-LCS/F4RNA1AD-LCSD				LCS Lot-Sample#: D3K130000-593	
	100	(90 - 110)			MCAWW 300.0A	11/12/03	3317593
	100	(90 - 110)	0.25	(0-10)	MCAWW 300.0A	11/12/03	3317593
		Dilution Factor: 1			Analysis Time..: 12:31		
Nitrite		WO#:F4RLP1AC-LCS/F4RLP1AD-LCSD				LCS Lot-Sample#: D3K130000-594	
	110	(90 - 110)			MCAWW 300.0A	11/12/03	3317594
	108	(90 - 110)	1.1	(0-10)	MCAWW 300.0A	11/12/03	3317594
		Dilution Factor: 1			Analysis Time..: 12:31		
Specific Conductance		WO#:F42QA1AC-LCS/F42QA1AD-LCSD				LCS Lot-Sample#: D3K170000-475	
	103	(89 - 109)			MCAWW 120.1	11/17/03	3321475
	101	(89 - 109)	1.6	(0-7.0)	MCAWW 120.1	11/17/03	3321475
		Dilution Factor: 1			Analysis Time..: 12:00		
Sulfate		WO#:F4RNG1AC-LCS/F4RNG1AD-LCSD				LCS Lot-Sample#: D3K130000-592	
	100	(90 - 110)			MCAWW 300.0A	11/12/03	3317592
	100	(90 - 110)	0.35	(0-10)	MCAWW 300.0A	11/12/03	3317592
		Dilution Factor: 1			Analysis Time..: 12:31		
Total Dissolved Solids		WO#:F5NND1AC-LCS/F5NND1AD-LCSD				LCS Lot-Sample#: D3K250000-641	
	102	(86 - 106)			MCAWW 160.1	11/17/03	3329641
	104	(86 - 106)	1.4	(0-20)	MCAWW 160.1	11/17/03	3329641
		Dilution Factor: 1			Analysis Time..: 18:00		

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LABORATORY CONTROL SAMPLE EVALUATION REPORT

General Chemistry

Lot-Sample #...: D3K120128 **Matrix.........: WATER**

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Suspended Solids	WO#:F49R21AC-LCS/F49R21AD-LCSD LCS Lot-Sample#: D3K200000-539						
	102	(86 - 114)			MCAWW 160.2	11/17/03	3324539
	102	(86 - 114)	0.39	(0-20)	MCAWW 160.2	11/17/03	3324539
		Dilution Factor: 1			Analysis Time..: 20:00		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE DATA REPORT

General Chemistry

Lot-Sample #...: D3K120128 Matrix.........: WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)	WO#:F5G561AC-LCS/F5G561AD-LCSD LCS Lot-Sample#: D3K230000-118							
	100	94.6	mg/L	95		MCAWW 410.4	11/23/03	3327118
	100	94.3	mg/L	94	0.34	MCAWW 410.4	11/23/03	3327118
	Dilution Factor: 1 Analysis Time..: 13:40							
Chloride	WO#:F4RKQ1AC-LCS/F4RKQ1AD-LCSD LCS Lot-Sample#: D3K130000-591							
	20.0	20.5	mg/L	102		MCAWW 300.0A	11/12/03	3317591
	20.0	20.6	mg/L	103	0.68	MCAWW 300.0A	11/12/03	3317591
	Dilution Factor: 1 Analysis Time..: 12:31							
Fluoride	WO#:F4RHV1AC-LCS/F4RHV1AD-LCSD LCS Lot-Sample#: D3K130000-590							
	4.00	4.19	mg/L	105		MCAWW 300.0A	11/12/03	3317590
	4.00	4.23	mg/L	106	0.95	MCAWW 300.0A	11/12/03	3317590
	Dilution Factor: 1 Analysis Time..: 12:31							
Nitrate	WO#:F4RNA1AC-LCS/F4RNA1AD-LCSD LCS Lot-Sample#: D3K130000-593							
	4.00	3.99	mg/L	100		MCAWW 300.0A	11/12/03	3317593
	4.00	3.98	mg/L	100	0.25	MCAWW 300.0A	11/12/03	3317593
	Dilution Factor: 1 Analysis Time..: 12:31							
Nitrite	WO#:F4RLP1AC-LCS/F4RLP1AD-LCSD LCS Lot-Sample#: D3K130000-594							
	4.00	4.39	mg/L	110		MCAWW 300.0A	11/12/03	3317594
	4.00	4.34	mg/L	108	1.1	MCAWW 300.0A	11/12/03	3317594
	Dilution Factor: 1 Analysis Time..: 12:31							
Specific Conductance	WO#:F42QA1AC-LCS/F42QA1AD-LCSD LCS Lot-Sample#: D3K170000-475							
	1000	1030	umhos/cm	103		MCAWW 120.1	11/17/03	3321475
	1000	1010	umhos/cm	101	1.6	MCAWW 120.1	11/17/03	3321475
	Dilution Factor: 1 Analysis Time..: 12:00							
Sulfate	WO#:F4RNG1AC-LCS/F4RNG1AD-LCSD LCS Lot-Sample#: D3K130000-592							
	20.0	20.0	mg/L	100		MCAWW 300.0A	11/12/03	3317592
	20.0	19.9	mg/L	100	0.35	MCAWW 300.0A	11/12/03	3317592
	Dilution Factor: 1 Analysis Time..: 12:31							
Total Dissolved Solids	WO#:F5NND1AC-LCS/F5NND1AD-LCSD LCS Lot-Sample#: D3K250000-641							
	500	511	mg/L	102		MCAWW 160.1	11/17/03	3329641
	500	518	mg/L	104	1.4	MCAWW 160.1	11/17/03	3329641
	Dilution Factor: 1 Analysis Time..: 18:00							

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LABORATORY CONTROL SAMPLE DATA REPORT

General Chemistry

Lot-Sample #...: D3K120128 Matrix.........: WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Suspended Solids		WO#:F49R21AC-LCS/F49R21AD-LCSD LCS Lot-Sample#: D3K200000-539						
	250	254	mg/L	102		MCAWW 160.2	11/17/03	3324539
	250	255	mg/L	102	0.39	MCAWW 160.2	11/17/03	3324539

Dilution Factor: 1 Analysis Time..: 20:00

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

General Chemistry

Client Lot #...: D3K120128 **Matrix.........:** WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Cyanide		Work Order #: F48JP1AC	LCS Lot-Sample#: D3K200000-356		
	107	(89 - 109)	MCAWW 335.3	11/19/03	3324356
		Dilution Factor: 1	Analysis Time..: 13:00		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE DATA REPORT

General Chemistry

Client Lot #...: D3K120128 **Matrix.........:** WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Cyanide			Work Order #: F48JP1AC		LCS Lot-Sample#: D3K200000-356		
	0.100	0.107	mg/L	107	MCAWW 335.3	11/19/03	3324356
			Dilution Factor: 1		Analysis Time..: 13:00		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE EVALUATION REPORT

General Chemistry

Client Lot #...: D3K120128 **Matrix.........:** WATER
Date Sampled...: 11/13/03 12:40 **Date Received..:** 11/14/03

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)			WO#: F4V9C1AH-MS/F4V9C1AJ-MSD			MS Lot-Sample #:	D3K140280-007
	97	(86 - 114)			MCAWW 410.4	11/23/03	3327119
	101	(86 - 114)	2.2	(0-11)	MCAWW 410.4	11/23/03	3327119
			Dilution Factor: 1 Analysis Time..: 13:40				
Chloride			WO#: F4L8K1CK-MS/F4L8K1CL-MSD			MS Lot-Sample #:	D3K120125-007
	106	(80 - 120)			MCAWW 300.0A	11/12/03	3317591
	107	(80 - 120)	0.71	(0-10)	MCAWW 300.0A	11/12/03	3317591
			Dilution Factor: 1 Analysis Time..: 17:01				
Fluoride			WO#: F4L8K1CH-MS/F4L8K1CJ-MSD			MS Lot-Sample #:	D3K120125-007
	102	(80 - 120)			MCAWW 300.0A	11/12/03	3317590
	102	(80 - 120)	0.19	(0-10)	MCAWW 300.0A	11/12/03	3317590
			Dilution Factor: 1 Analysis Time..: 17:01				
itrate			WO#: F4L8K1CP-MS/F4L8K1CQ-MSD			MS Lot-Sample #:	D3K120125-007
	99	(80 - 120)			MCAWW 300.0A	11/12/03	3317593
	100	(80 - 120)	0.56	(0-10)	MCAWW 300.0A	11/12/03	3317593
			Dilution Factor: 1 Analysis Time..: 17:01				
Nitrite			WO#: F4L8K1CM-MS/F4L8K1CN-MSD			MS Lot-Sample #:	D3K120125-007
	109	(80 - 120)			MCAWW 300.0A	11/12/03	3317594
	109	(80 - 120)	0.18	(0-10)	MCAWW 300.0A	11/12/03	3317594
			Dilution Factor: 1 Analysis Time..: 17:01				
Sulfate			WO#: F4L8K1CR-MS/F4L8K1CT-MSD			MS Lot-Sample #:	D3K120125-007
	116 I	(80 - 120)			MCAWW 300.0A	11/12/03	3317592
	117 I	(80 - 120)	0.28	(0-10)	MCAWW 300.0A	11/12/03	3317592
			Dilution Factor: 1 Analysis Time..: 17:01				
Total Cyanide			WO#: F4MEW1AP-MS/F4MEW1AQ-MSD			MS Lot-Sample #:	D3K120149-001
	104	(78 - 120)			MCAWW 335.3	11/19/03	3324356
	105	(78 - 120)	0.94	(0-20)	MCAWW 335.3	11/19/03	3324356
			Dilution Factor: 1 Analysis Time..: 13:00				

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Estimated result. Result concentration exceeds the calibration range.

MATRIX SPIKE SAMPLE DATA REPORT

General Chemistry

Client Lot #...: D3K120128 **Matrix.........:** WATER
Date Sampled...: 11/13/03 12:40 **Date Received..:** 11/14/03

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)			WO#: F4V9C1AH-MS/F4V9C1AJ-MSD MS Lot-Sample #: D3K140280-007						
	40	50.0	88.8	mg/L	97		MCAWW 410.4	11/23/03	3327119
	40	50.0	90.8	mg/L	101	2.2	MCAWW 410.4	11/23/03	3327119
			Dilution Factor: 1 Analysis Time..: 13:40						
Chloride			WO#: F4L8K1CK-MS/F4L8K1CL-MSD MS Lot-Sample #: D3K120125-007						
	22	25.0	48.7	mg/L	106		MCAWW 300.0A	11/12/03	3317591
	22	25.0	49.1	mg/L	107	0.71	MCAWW 300.0A	11/12/03	3317591
			Dilution Factor: 1 Analysis Time..: 17:01						
Fluoride			WO#: F4L8K1CH-MS/F4L8K1CJ-MSD MS Lot-Sample #: D3K120125-007						
	ND	5.00	5.12	mg/L	102		MCAWW 300.0A	11/12/03	3317590
	ND	5.00	5.11	mg/L	102	0.19	MCAWW 300.0A	11/12/03	3317590
			Dilution Factor: 1 Analysis Time..: 17:01						
Nitrate			WO#: F4L8K1CP-MS/F4L8K1CQ-MSD MS Lot-Sample #: D3K120125-007						
	0.36	5.00	5.33	mg/L	99		MCAWW 300.0A	11/12/03	3317593
	0.36	5.00	5.36	mg/L	100	0.56	MCAWW 300.0A	11/12/03	3317593
			Dilution Factor: 1 Analysis Time..: 17:01						
Nitrite			WO#: F4L8K1CM-MS/F4L8K1CN-MSD MS Lot-Sample #: D3K120125-007						
	ND	5.00	5.46	mg/L	109		MCAWW 300.0A	11/12/03	3317594
	ND	5.00	5.47	mg/L	109	0.18	MCAWW 300.0A	11/12/03	3317594
			Dilution Factor: 1 Analysis Time..: 17:01						
Sulfate			WO#: F4L8K1CR-MS/F4L8K1CT-MSD MS Lot-Sample #: D3K120125-007						
	41	25.0	69.5 I	mg/L	116		MCAWW 300.0A	11/12/03	3317592
	41	25.0	69.7 I	mg/L	117	0.28	MCAWW 300.0A	11/12/03	3317592
			Dilution Factor: 1 Analysis Time..: 17:01						
Total Cyanide			WO#: F4MEW1AP-MS/F4MEW1AQ-MSD MS Lot-Sample #: D3K120149-001						
	ND	0.100	0.105	mg/L	104		MCAWW 335.3	11/19/03	3324356
	ND	0.100	0.106	mg/L	105	0.94	MCAWW 335.3	11/19/03	3324356
			Dilution Factor: 1 Analysis Time..: 13:00						

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Estimated result. Result concentration exceeds the calibration range.

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: D3K120128 Work Order #...: F4M33-SMP
F4M33-DUP Matrix.......: WATER

Date Sampled...: 11/12/03 06:05 Date Received..: 11/12/03

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Suspended Solids						SD Lot-Sample #:	D3K120185-002	
	80 Q	80 Q	mg/L	0.0	(0-20)	MCAWW 160.2	11/17/03	3324539
			Dilution Factor: 2.5			Analysis Time..: 20:00		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Q Elevated reporting limit. The reporting limit is elevated due to high analyte levels.

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: D3K120128 **Work Order #...:** F4MR6-SMP
F4MR6-DUP **Matrix.......:** WATER

Date Sampled...: 11/10/03 15:45 **Date Received..:** 11/12/03

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Dissolved Solids						SD Lot-Sample #: D3K120173-016		
	460	460	mg/L	1.1	(0-20)	MCAWW 160.1	11/17/03	3329641

Dilution Factor: 1 Analysis Time..: 18:00

Chair Custo..y Record

3.1° [illegible] 11.12

SEVERN TRENT **STL**
Severn Trent Laboratories, Inc.

STL Denver
4955 Yarrow Street
Arvada, CO 80002

STL-4124 (0901)

Client: Cook Joyce Inc	Project Manager: Doug Granger	Date: 11.11.03	Chain of Custody Number: 295419
Address: 812 W. 11th	Telephone Number (Area Code)/Fax Number: 512-474-9097	Lab Number:	Page ____ of ____
City: AUSTIN State: TX Zip Code: 78701	Site Contact:	Lab Contact: Gail DePuzzo	
Project Name and Location (State): Lockwood	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.: 54609			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix					Containers & Preservatives							Analysis (Attach list if more space is needed)												Special Instructions/ Conditions of Receipt
			Air	Aqueous	Sed.	Soil		Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	$Na_2S_2O_3$	VOA	SVOA	Pest/PCB	OP Pest	Cyanide	Metals	IC Cl, F, SO4	IC NO3, NO2	TDS, TSS	Sp. Cond	COD	Fecal/Total Coliform	
LES MW2	11.11.03	1200		X				8	1	1	3	1		2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☒ Archive For 3 Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☒ 21 Days ☐ Other________

QC Requirements (Specify)

1. Relinquished By	Date 11.11.03	Time 1330	1. Received By	Date 11/12/03	Time 0830
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

SEVERN TRENT STL

STL Denver
4955 Yarrow Street
Arvada, CO 80002

Tel: 303 736 0100 Fax. 303 431 7171
www.stl-inc.com

ANALYTICAL REPORT

2004X00404

URENCO Project

Lot #: D4C310153

Purchase Order 018511-0403003

Carl Jackson

Lockwood Greene
1500 International Drive
Spartanburg, SC 29304

STL DENVER

Gail DeRuzzo
Project Manager

May 6, 2004

Table Of Contents

Standard Deliverables

Report Contents

Total Number of Pages

76

Standard Deliverables

The Cover Letter and the Report Cover page are considered integral parts of this Standard Deliverable package. This report is incomplete unless all pages indicated in this Table of Contents are included.

Case Narrative

Enclosed is the report for three samples received at STL's Denver laboratory on March 31, 2004. The results included in this report have been reviewed for compliance with STL Denver's Laboratory Quality Manual. The test results shown in this report meet all requirements of NELAC and any exceptions are noted below.

Dilution factors and footnotes have been provided to assist in the interpretation of the results. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interferences or analytes present at concentrations above the linear calibration curve, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

STL utilizes USEPA approved methods in all analytical work. The samples presented in this report were analyzed for the parameters listed on the analytical methods summary page in accordance with the methods indicated. A summary of quality control parameters is provided below.

This report shall not be reproduced except in full, without the written approval of the laboratory.

Quality Control Summary for Lot D4C310153

Sample Receiving

- The cooler temperature upon receipt at the Denver laboratory was 3.6° C.
- All sample bottles were received in acceptable condition.

Holding Times

- All holding times were met.

Method Blanks

- The analytes Methylene chloride by Method 8260B, Aluminum by Method 6010B, and Chemical Oxygen Demand (COD) by Method 410.4 were detected in the Method Blanks below the established reporting limits. No corrective action is taken for any values in Method Blanks that are below the requested reporting limits.
- All other Method Blanks were within established control limits.

Laboratory Control Samples

- All Laboratory Control Samples were within established control limits.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

- The Matrix Spike and/or Matrix Spike Duplicate recoveries were outside control limits for 1,1-Dichloroethene by Method 8260B and COD by Method 410.4. Because the corresponding Laboratory Control Samples and the Method Blank samples were within control limits, these anomalies may be due to matrix interference.
- The method required MS/MSDs could not be performed for Methods 8270C, 8081A, 8082, and 8141A due to insufficient sample volume, however, LCS/LCSD pairs were analyzed to demonstrate method precision.

- All other MS and MSD samples were within established control limits.

Organics

- The second source Initial Calibration Verification (ICV) standard for 1,1-Dichloroethene and Hexachlorobutadiene by Method 8260B exceeded the control limits (65-135%). However, the overall mean percent RSD for all compounds is within control limits, therefore, the ICAL is also in control and no corrective action was necessary.

- The Continuing Calibration Verification (CCV) standards for Demeton-S, O,O,O-Triethylphosphorothioate, Dichlorvos, Azinphos-methyl, Mevinphos, Dimethoate, Malathion, Tetrachlorvinphos, and Naled by Method 8141A exceeded the percent difference limits in various runs and columns. However, the overall mean percent difference is within control limits, therefore, the CCV is also in control and no corrective action was necessary. Additionally, the associated sample was non-detect.

- The Continuing Calibration Verification (CCV) standards for Endrin and Endrin aldehyde by Method 8081A exceeded the percent difference limits in various runs and columns. However, the overall mean percent difference is within control limits, therefore, the CCV is also in control and no corrective action was necessary. Additionally, the associated sample was non-detect.

Inorganics

- The calibration blank result exceed's STL's reporting limit for Thallium. The sample result is non-detect, therefore, there is no impact on the data.

EXECUTIVE SUMMARY - Detection Highlights

D4C310153

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
L.E.S. MW-2 03/29/04 16:35 001				
Aluminum	120 J	100	ug/L	SW846 6010B
Barium	14	10	ug/L	SW846 6010B
Boron	1800	100	ug/L	SW846 6010B
Chromium	6.3 B	10	ug/L	SW846 6010B
Copper	3.5 B	10	ug/L	SW846 6010B
Iron	39 B	100	ug/L	SW846 6010B
Manganese	900	10	ug/L	SW846 6010B
Molybdenum	40	20	ug/L	SW846 6010B
Nickel	8.8 B	40	ug/L	SW846 6010B
Zinc	11 B	20	ug/L	SW846 6010B
Methylene chloride	0.59 J,B	5.0	ug/L	SW846 8260B
Specific Conductance	9700	2.0	umhos/cm	MCAWW 120.1
Total Dissolved Solids	6300 Q	20	mg/L	MCAWW 160.1
Total Suspended Solids	7.6	4.0	mg/L	MCAWW 160.2
Chloride	1700 Q	300	mg/L	MCAWW 300.0A
Sulfate	2400 Q	500	mg/L	MCAWW 300.0A
Fluoride	0.81 B,G	5.0	mg/L	MCAWW 300.0A
Nitrate	0.44 B,G	2.5	mg/L	MCAWW 300.0A
Nitrite	1.1 B,G	2.5	mg/L	MCAWW 300.0A
Chemical Oxygen Demand (COD)	20 J	20	mg/L	MCAWW 410.4
TRIP BLANK 03/30/04 003				
Methylene chloride	0.63 J,B	5.0	ug/L	SW846 8260B

METHODS SUMMARY

D4C310153

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Chemical Oxygen Demand	MCAWW 410.4	MCAWW 410.4
Chloride	MCAWW 300.0A	MCAWW 300.0A
F. Coliform (Enumeration)	SM18 9222D Feca	SM18 9222D
Filterable Residue (TDS)	MCAWW 160.1	MCAWW 160.1
Fluoride	MCAWW 300.0A	MCAWW 300.0A
Inductively Coupled Plasma (ICP) Metals	SW846 6010B	SW846 3010A
Mercury in Liquid Waste (Manual Cold-Vapor)	SW846 7470A	SW846 7470A
Nitrate as N	MCAWW 300.0A	MCAWW 300.0A
Nitrite as N	MCAWW 300.0A	MCAWW 300.0A
Non-Filterable Residue (TSS)	MCAWW 160.2	MCAWW 160.2
Organochlorine Pesticides	SW846 8081A	SW846 3510C
Organophosphorous Compounds by GC	SW846 8141A	SW846 3510
PCBs by SW-846 8082	SW846 8082	SW846 3510C
Semivolatile Organic Compounds by GC/MS	SW846 8270C	SW846 3520C
Specific Conductance	MCAWW 120.1	MCAWW 120.1
Sulfate	MCAWW 300.0A	MCAWW 300.0A
T. Coliform (Enemeration)	SM18 9222B	SM18 9222B
Total Cyanide	MCAWW 335.3	MCAWW 335.3
Volatile Organics by GC/MS	SW846 8260B	SW846 5030B/826

References:

MCAWW	"Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.
SM18	"Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992.
SW846	"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

METHOD / ANALYST SUMMARY

D4C310153

ANALYTICAL METHOD	ANALYST	ANALYST ID
MCAWW 120.1	Maria Fayard	002596
MCAWW 160.1	Jean Carrier	008763
MCAWW 160.2	Jean Carrier	008763
MCAWW 300.0A	Andrita Scofield	004409
MCAWW 335.3	Ewa Kudla	001167
MCAWW 410.4	Nicole Dean	008504
SM18 9222B	Maria Fayard	002596
SM18 9222D Fecal	Maria Fayard	002596
SW846 6010B	Lynn-Anne Trudell	6645
SW846 7470A	Kacey Ono	003371
SW846 8081A	Dennis Jonsrud	009226
SW846 8082	Steve Jetter	011748
SW846 8141A	Sonya Dacar	011595
SW846 8260B	Jason Reinhardt	013454
SW846 8270C	Rwanda Todea	005716

References:

MCAWW	"Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.
SM18	"Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992.
SW846	"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

D4C310153

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
GC8WL	001	L.E.S. MW-2	03/29/04	16:3
GC8WT	002	L.E.S. MW-2	03/30/04	12:4
GC8WX	003	TRIP BLANK	03/30/04	

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW-2

GC/MS Volatiles

Lot-Sample #...: D4C310153-001 Work Order #...: GC8WL1A8 Matrix.........: WATER
Date Sampled...: 03/29/04 16:35 Date Received..: 03/31/04
Prep Date......: 04/07/04 Analysis Date..: 04/08/04
Prep Batch #...: 4099587 Analysis Time..: 04:30
Dilution Factor: 1

Method.........: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Acetone	ND	10	ug/L	2.5
Benzene	ND	1.0	ug/L	0.17
Bromodichloromethane	ND	1.0	ug/L	0.20
Bromoform	ND	1.0	ug/L	0.23
Bromomethane	ND	2.0	ug/L	0.22
2-Butanone (MEK)	ND	5.0	ug/L	2.0
Carbon tetrachloride	ND	1.0	ug/L	0.20
Chlorobenzene	ND	1.0	ug/L	0.13
Chloroethane	ND	2.0	ug/L	0.18
Chloroform	ND	1.0	ug/L	0.17
Chloromethane	ND	2.0	ug/L	0.91
Dibromomethane	ND	1.0	ug/L	0.31
1,2-Dibromoethane (EDB)	ND	1.0	ug/L	0.18
1,2-Dichlorobenzene	ND	1.0	ug/L	0.15
1,3-Dichlorobenzene	ND	1.0	ug/L	0.13
1,4-Dichlorobenzene	ND	1.0	ug/L	0.16
Dichlorodifluoromethane	ND	2.0	ug/L	0.22
1,1-Dichloroethane	ND	1.0	ug/L	0.22
1,2-Dichloroethane	ND	1.0	ug/L	0.26
1,1-Dichloroethene	ND	1.0	ug/L	0.23
1,2-Dichloroethene (total)	ND	1.0	ug/L	0.24
cis-1,2-Dichloroethene	ND	1.0	ug/L	0.14
trans-1,2-Dichloroethene	ND	1.0	ug/L	0.15
1,2-Dichloropropane	ND	1.0	ug/L	0.18
cis-1,3-Dichloropropene	ND	1.0	ug/L	0.19
trans-1,3-Dichloropropene	ND	1.0	ug/L	0.20
Ethylbenzene	ND	1.0	ug/L	0.12
2-Hexanone	ND	5.0	ug/L	1.7
Methylene chloride	**0.59 J,B**	**5.0**	**ug/L**	**0.21**
4-Methyl-2-pentanone	ND	5.0	ug/L	0.98
Styrene	ND	1.0	ug/L	0.14
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	0.21
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	0.21
Tetrachloroethene	ND	1.0	ug/L	0.26
Toluene	ND	1.0	ug/L	0.15
1,2,4-Trichlorobenzene	ND	1.0	ug/L	0.21

(Continued on next page)

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW-2

GC/MS Volatiles

Lot-Sample #...: D4C310153-001 Work Order #...: GC8WL1A8 Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
1,1,1-Trichloroethane	ND	1.0	ug/L	0.16
1,1,2-Trichloroethane	ND	1.0	ug/L	0.27
Trichloroethene	ND	1.0	ug/L	0.16
Trichlorofluoromethane	ND	2.0	ug/L	0.24
1,2,3-Trichloropropane	ND	1.0	ug/L	0.33
Vinyl chloride	ND	1.0	ug/L	0.19
Xylenes (total)	ND	2.0	ug/L	0.41
n-Butylbenzene	ND	1.0	ug/L	0.21
sec-Butylbenzene	ND	1.0	ug/L	0.23
Isopropylbenzene	ND	1.0	ug/L	0.17
1,2,4-Trimethylbenzene	ND	1.0	ug/L	0.15
1,3,5-Trimethylbenzene	ND	1.0	ug/L	0.16
n-Propylbenzene	ND	1.0	ug/L	0.17
tert-Butylbenzene	ND	1.0	ug/L	0.17
Dibromochloromethane	ND	1.0	ug/L	0.19
2-Chlorotoluene	ND	1.0	ug/L	0.17
4-Chlorotoluene	ND	1.0	ug/L	0.21
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0	ug/L	0.47
1,3-Dichloropropane	ND	1.0	ug/L	0.22
2,2-Dichloropropane	ND	5.0	ug/L	0.18
1,1-Dichloropropene	ND	1.0	ug/L	0.19
Hexachlorobutadiene	ND	1.0	ug/L	0.18
4-Isopropyltoluene	ND	1.0	ug/L	0.20
Methyl tert-butyl ether	ND	5.0	ug/L	0.38
1,2,3-Trichlorobenzene	ND	1.0	ug/L	0.21
m-Xylene & p-Xylene	ND	2.0	ug/L	0.27
o-Xylene	ND	1.0	ug/L	0.15
Bromobenzene	ND	1.0	ug/L	0.17
Bromochloromethane	ND	1.0	ug/L	0.27
Naphthalene	ND	1.0	ug/L	0.50

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	93	(76 - 116)
1,2-Dichloroethane-d4	76	(59 - 129)
4-Bromofluorobenzene	84	(74 - 114)
Toluene-d8	83	(76 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level

LOCKWOOD GREENE

Client Sample ID: TRIP BLANK

GC/MS Volatiles

Lot-Sample #...: D4C310153-003
Work Order #...: GC8WX1AA
Matrix.........: WATER
Date Sampled...: 03/30/04
Date Received..: 03/31/04
Prep Date......: 04/07/04
Analysis Date..: 04/08/04
Prep Batch #...: 4099587
Analysis Time..: 00:52
Dilution Factor: 1
Method.........: SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Acetone	ND	10	ug/L	2.5
Benzene	ND	1.0	ug/L	0.17
Bromodichloromethane	ND	1.0	ug/L	0.20
Bromoform	ND	1.0	ug/L	0.23
Bromomethane	ND	2.0	ug/L	0.22
2-Butanone (MEK)	ND	5.0	ug/L	2.0
Carbon tetrachloride	ND	1.0	ug/L	0.20
Chlorobenzene	ND	1.0	ug/L	0.13
Chloroethane	ND	2.0	ug/L	0.18
Chloroform	ND	1.0	ug/L	0.17
Chloromethane	ND	2.0	ug/L	0.91
Dibromomethane	ND	1.0	ug/L	0.31
1,2-Dibromoethane (EDB)	ND	1.0	ug/L	0.18
,2-Dichlorobenzene	ND	1.0	ug/L	0.15
1,3-Dichlorobenzene	ND	1.0	ug/L	0.13
1,4-Dichlorobenzene	ND	1.0	ug/L	0.16
Dichlorodifluoromethane	ND	2.0	ug/L	0.22
1,1-Dichloroethane	ND	1.0	ug/L	0.22
1,2-Dichloroethane	ND	1.0	ug/L	0.26
1,1-Dichloroethene	ND	1.0	ug/L	0.23
1,2-Dichloroethene (total)	ND	1.0	ug/L	0.24
cis-1,2-Dichloroethene	ND	1.0	ug/L	0.14
trans-1,2-Dichloroethene	ND	1.0	ug/L	0.15
1,2-Dichloropropane	ND	1.0	ug/L	0.18
cis-1,3-Dichloropropene	ND	1.0	ug/L	0.19
trans-1,3-Dichloropropene	ND	1.0	ug/L	0.20
Ethylbenzene	ND	1.0	ug/L	0.12
2-Hexanone	ND	5.0	ug/L	1.7
Methylene chloride	**0.63 J,B**	**5.0**	**ug/L**	**0.21**
4-Methyl-2-pentanone	ND	5.0	ug/L	0.98
Styrene	ND	1.0	ug/L	0.14
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	0.21
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	0.21
Tetrachloroethene	ND	1.0	ug/L	0.26
Toluene	ND	1.0	ug/L	0.15
1,2,4-Trichlorobenzene	ND	1.0	ug/L	0.21

(Continued on next page)

LOCKWOOD GREENE

Client Sample ID: TRIP BLANK

GC/MS Volatiles

Lot-Sample #...: D4C310153-003   Work Order #...: GC8WX1AA   Matrix........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
1,1,1-Trichloroethane	ND	1.0	ug/L	0.16
1,1,2-Trichloroethane	ND	1.0	ug/L	0.27
Trichloroethene	ND	1.0	ug/L	0.16
Trichlorofluoromethane	ND	2.0	ug/L	0.24
1,2,3-Trichloropropane	ND	1.0	ug/L	0.33
Vinyl chloride	ND	1.0	ug/L	0.19
Xylenes (total)	ND	2.0	ug/L	0.41
n-Butylbenzene	ND	1.0	ug/L	0.21
sec-Butylbenzene	ND	1.0	ug/L	0.23
Isopropylbenzene	ND	1.0	ug/L	0.17
1,2,4-Trimethylbenzene	ND	1.0	ug/L	0.15
1,3,5-Trimethylbenzene	ND	1.0	ug/L	0.16
n-Propylbenzene	ND	1.0	ug/L	0.17
tert-Butylbenzene	ND	1.0	ug/L	0.17
Dibromochloromethane	ND	1.0	ug/L	0.19
2-Chlorotoluene	ND	1.0	ug/L	0.17
4-Chlorotoluene	ND	1.0	ug/L	0.21
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0	ug/L	0.47
1,3-Dichloropropane	ND	1.0	ug/L	0.22
2,2-Dichloropropane	ND	5.0	ug/L	0.18
1,1-Dichloropropene	ND	1.0	ug/L	0.19
Hexachlorobutadiene	ND	1.0	ug/L	0.18
4-Isopropyltoluene	ND	1.0	ug/L	0.20
Methyl tert-butyl ether	ND	5.0	ug/L	0.38
1,2,3-Trichlorobenzene	ND	1.0	ug/L	0.21
m-Xylene & p-Xylene	ND	2.0	ug/L	0.27
o-Xylene	ND	1.0	ug/L	0.15
Bromobenzene	ND	1.0	ug/L	0.17
Bromochloromethane	ND	1.0	ug/L	0.27
Naphthalene	ND	1.0	ug/L	0.50

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	90	(76 - 116)
1,2-Dichloroethane-d4	75	(59 - 129)
4-Bromofluorobenzene	85	(74 - 114)
Toluene-d8	85	(76 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW-2

GC/MS Semivolatiles

Lot-Sample #...:	D4C310153-001	Work Order #...:	GC8WL1A9	Matrix.........:	WATER
Date Sampled...:	03/29/04 16:35	Date Received..:	03/31/04		
Prep Date......:	04/02/04	Analysis Date..:	04/16/04		
Prep Batch #...:	4093267	Analysis Time..:	14:52		
Dilution Factor:	1				
		Method.........:	SW846 8270C		

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Acenaphthene	ND	10	ug/L	0.60
Acenaphthylene	ND	10	ug/L	0.60
Acetophenone	ND	10	ug/L	2.0
2-Acetylaminofluorene	ND	100	ug/L	2.0
4-Aminobiphenyl	ND	50	ug/L	2.0
Aniline	ND	10	ug/L	4.0
Anthracene	ND	10	ug/L	3.0
Aramite	ND	20	ug/L	2.0
Benzo(a)anthracene	ND	10	ug/L	0.80
Benzo(b)fluoranthene	ND	10	ug/L	0.90
Benzo(k)fluoranthene	ND	10	ug/L	2.0
Benzo(ghi)perylene	ND	10	ug/L	1.0
Benzo(a)pyrene	ND	10	ug/L	0.80
Benzyl alcohol	ND	10	ug/L	1.0
bis(2-Chloroethoxy) methane	ND	10	ug/L	0.90
bis(2-Chloroethyl)-ether	ND	10	ug/L	3.0
bis(2-Ethylhexyl) phthalate	ND	10	ug/L	0.90
4-Bromophenyl phenyl ether	ND	10	ug/L	0.70
Butyl benzyl phthalate	ND	10	ug/L	1.0
4-Chloroaniline	ND	10	ug/L	3.0
Chlorobenzilate	ND	10	ug/L	2.0
4-Chloro-3-methylphenol	ND	10	ug/L	0.80
2-Chloronaphthalene	ND	10	ug/L	0.70
2-Chlorophenol	ND	10	ug/L	0.80
4-Chlorophenyl phenyl ether	ND	10	ug/L	0.60
Chrysene	ND	10	ug/L	0.80
Diallate	ND	20	ug/L	2.0
Dibenz(a,h)anthracene	ND	10	ug/L	0.90
Dibenzofuran	ND	10	ug/L	0.60
Di-n-butyl phthalate	ND	10	ug/L	0.80
1,2-Dichlorobenzene	ND	10	ug/L	0.80
1,3-Dichlorobenzene	ND	10	ug/L	0.80
1,4-Dichlorobenzene	ND	10	ug/L	1.0

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LOCKWOOD GREENE

Client Sample ID: L.E.S. MW-2

GC/MS Semivolatiles

Lot-Sample #...: D4C310153-001 Work Order #...: GC8WL1A9 Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
3,3'-Dichlorobenzidine	ND	50	ug/L	8.0
2,4-Dichlorophenol	ND	10	ug/L	0.70
2,6-Dichlorophenol	ND	10	ug/L	2.0
Diethyl phthalate	ND	10	ug/L	0.70
Dimethoate	ND	20	ug/L	2.0
7,12-Dimethylbenz(a)-anthracene	ND	20	ug/L	3.0
3,3'-Dimethylbenzidine	ND	20	ug/L	4.0
2,4-Dimethylphenol	ND	10	ug/L	4.0
Dimethyl phthalate	ND	10	ug/L	0.80
1,3-Dinitrobenzene	ND	10	ug/L	2.0
4,6-Dinitro-2-methylphenol	ND	50	ug/L	6.0
2,4-Dinitrophenol	ND	50	ug/L	6.0
2,4-Dinitrotoluene	ND	10	ug/L	1.0
2,6-Dinitrotoluene	ND	10	ug/L	0.80
Di-n-octyl phthalate	ND	10	ug/L	1.0
Diphenylamine	ND	10	ug/L	2.0
Disulfoton	ND	50	ug/L	2.0
Ethyl methanesulfonate	ND	10	ug/L	2.0
Fluoranthene	ND	10	ug/L	0.70
Fluorene	ND	10	ug/L	0.60
Hexachlorobenzene	ND	10	ug/L	0.80
Hexachlorobutadiene	ND	10	ug/L	1.0
Hexachlorocyclopenta-diene	ND	50	ug/L	5.0
Hexachloroethane	ND	10	ug/L	0.80
Hexachloropropene	ND	100	ug/L	1.0
Indeno(1,2,3-cd)pyrene	ND	10	ug/L	0.80
Isodrin	ND	10	ug/L	5.0
Isophorone	ND	10	ug/L	0.90
Isosafrole	ND	20	ug/L	3.0
Methapyrilene	ND	50	ug/L	20
3-Methylcholanthrene	ND	20	ug/L	1.0
Methyl methanesulfonate	ND	10	ug/L	2.0
2-Methylnaphthalene	ND	10	ug/L	0.80
Methyl parathion	ND	50	ug/L	2.0
2-Methylphenol	ND	10	ug/L	0.90
3-Methylphenol & 4-Methylphenol	ND	10	ug/L	0.80
Naphthalene	ND	10	ug/L	0.80
1,4-Naphthoquinone	ND	50	ug/L	2.0
1-Naphthylamine	ND	10	ug/L	1.0

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LOCKWOOD GREENE

Client Sample ID: L.E.S. MW-2

GC/MS Semivolatiles

Lot-Sample #...: D4C310153-001 Work Order #...: GC8WL1A9 Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
2-Naphthylamine	ND	10	ug/L	1.0
2-Nitroaniline	ND	50	ug/L	0.90
3-Nitroaniline	ND	50	ug/L	0.90
4-Nitroaniline	ND	50	ug/L	6.0
Nitrobenzene	ND	10	ug/L	2.0
2-Nitrophenol	ND	10	ug/L	0.80
4-Nitrophenol	ND	50	ug/L	7.0
4-Nitroquinoline-1-oxide	ND	100	ug/L	5.0
N-Nitrosodi-n-butylamine	ND	10	ug/L	2.0
N-Nitrosodiethylamine	ND	10	ug/L	2.0
N-Nitrosodimethylamine	ND	10	ug/L	0.80
N-Nitrosodiphenylamine	ND	10	ug/L	1.0
N-Nitrosodi-n-propylamine	ND	10	ug/L	0.70
N-Nitrosomethylethylamine	ND	10	ug/L	2.0
N-Nitrosomorpholine	ND	10	ug/L	2.0
N-Nitrosopiperidine	ND	10	ug/L	2.0
N-Nitrosopyrrolidine	ND	10	ug/L	2.0
5-Nitro-o-toluidine	ND	20	ug/L	2.0
Parathion	ND	50	ug/L	2.0
Pentachlorobenzene	ND	10	ug/L	2.0
Pentachloroethane	ND	50	ug/L	2.0
Pentachloronitrobenzene	ND	50	ug/L	2.0
Pentachlorophenol	ND	50	ug/L	5.0
Phenacetin	ND	20	ug/L	2.0
Phenanthrene	ND	10	ug/L	0.70
Phenol	ND	10	ug/L	0.90
Phorate	ND	50	ug/L	2.0
2-Picoline	ND	20	ug/L	3.0
Pronamide	ND	20	ug/L	2.0
Pyrene	ND	10	ug/L	0.80
Pyridine	ND	20	ug/L	10
1,2,4,5-Tetrachlorobenzene	ND	10	ug/L	2.0
2,3,4,6-Tetrachlorophenol	ND	50	ug/L	2.0
Thionazin	ND	10	ug/L	2.0
o-Toluidine	ND	10	ug/L	2.0
1,2,4-Trichlorobenzene	ND	10	ug/L	0.90
2,4,5-Trichlorophenol	ND	10	ug/L	1.0
2,4,6-Trichlorophenol	ND	10	ug/L	0.80

(Continued on next page)

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW-2

GC/MS Semivolatiles

Lot-Sample #...: D4C310153-001 Work Order #...: GC8WL1A9 Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
O,O,O-Triethylphosphorothioate	ND	50	ug/L	2.0
1,3,5-Trinitrobenzene	ND	50	ug/L	2.0

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	74	(32 - 116)
Phenol-d5	77	(40 - 111)
Nitrobenzene-d5	76	(53 - 107)
2-Fluorobiphenyl	57	(31 - 105)
2,4,6-Tribromophenol	54	(42 - 122)
Terphenyl-d14	67	(21 - 125)

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW-2

GC Semivolatiles

Lot-Sample #...: D4C310153-001 **Work Order #...:** GC8WL1CC **Matrix.........:** WATER
Date Sampled...: 03/29/04 16:35 **Date Received..:** 03/31/04
Prep Date......: 03/31/04 **Analysis Date..:** 04/15/04
Prep Batch #...: 4091410 **Analysis Time..:** 17:06
Dilution Factor: 1
Method.........: SW846 8081A

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Aldrin	ND	0.050	ug/L	0.0070
alpha-BHC	ND	0.050	ug/L	0.010
beta-BHC	ND	0.050	ug/L	0.010
delta-BHC	ND	0.050	ug/L	0.010
gamma-BHC (Lindane)	ND	0.050	ug/L	0.0080
Chlordane (technical)	ND	0.50	ug/L	0.060
4,4'-DDD	ND	0.050	ug/L	0.010
4,4'-DDE	ND	0.050	ug/L	0.010
4,4'-DDT	ND	0.050	ug/L	0.010
Dieldrin	ND	0.050	ug/L	0.0090
Endrin	ND	0.050	ug/L	0.020
Endrin aldehyde	ND	0.050	ug/L	0.010
Endosulfan I	ND	0.050	ug/L	0.020
Endosulfan II	ND	0.050	ug/L	0.010
Endosulfan sulfate	ND	0.050	ug/L	0.010
Heptachlor	ND	0.050	ug/L	0.010
Heptachlor epoxide	ND	0.050	ug/L	0.010
Methoxychlor	ND	0.10	ug/L	0.020
Toxaphene	ND	5.0	ug/L	0.50

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Decachlorobiphenyl	84	(12 - 153)
Tetrachloro-m-xylene	91	(55 - 113)

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW-2

GC Semivolatiles

Lot-Sample #...:	D4C310153-001	Work Order #...:	GC8WL1CA	Matrix.........:	WATER
Date Sampled...:	03/29/04 16:35	Date Received..:	03/31/04		
Prep Date......:	03/31/04	Analysis Date..:	04/01/04		
Prep Batch #...:	4091394	Analysis Time..:	18:19		
Dilution Factor:	1				
		Method.........:	SW846 8082		

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Aroclor 1016	ND	1.0	ug/L	0.15
Aroclor 1221	ND	1.0	ug/L	0.25
Aroclor 1232	ND	1.0	ug/L	0.14
Aroclor 1242	ND	1.0	ug/L	0.14
Aroclor 1248	ND	1.0	ug/L	0.15
Aroclor 1254	ND	1.0	ug/L	0.22
Aroclor 1260	ND	1.0	ug/L	0.16

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	105	(51 - 122)
Decachlorobiphenyl	89	(41 - 138)

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW-2

GC Semivolatiles

Lot-Sample #...: D4C310153-001 Work Order #...: GC8WL1CD Matrix.........: WATER
Date Sampled...: 03/29/04 16:35 Date Received..: 03/31/04
Prep Date......: 04/05/04 Analysis Date..: 04/12/04
Prep Batch #...: 4096147 Analysis Time..: 20:18
Dilution Factor: 1
Method.........: SW846 8141A

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Azinphos-methyl	ND	2.5	ug/L	0.14
Bolstar	ND	0.50	ug/L	0.14
Chlorpyrifos	ND	0.50	ug/L	0.054
Coumaphos	ND	0.50	ug/L	0.079
Demeton (total)	ND	1.0	ug/L	0.19
Diazinon	ND	0.50	ug/L	0.039
Dichlorvos	ND	0.50	ug/L	0.13
Dimethoate	ND	0.50	ug/L	0.18
Disulfoton	ND	0.50	ug/L	0.057
Ethoprop	ND	0.50	ug/L	0.056
Ethyl parathion	ND	0.50	ug/L	0.040
Famphur	ND	1.0	ug/L	0.054
Fensulfothion	ND	2.5	ug/L	0.22
Fenthion	ND	0.50	ug/L	0.061
Malathion	ND	1.2	ug/L	0.050
Merphos	ND	5.0	ug/L	0.063
Methyl parathion	ND	0.50	ug/L	0.061
Mevinphos	ND	6.2	ug/L	0.16
Naled	ND	10	ug/L	0.22
O,O,O-Triethylphosphorothioate	ND	0.50	ug/L	0.15
Phorate	ND	0.50	ug/L	0.075
Ronnel	ND	10	ug/L	0.11
Sulfotepp	ND	0.50	ug/L	0.030
Thionazin	ND	0.50	ug/L	0.059
Tokuthion	ND	0.50	ug/L	0.071
Trichloronate	ND	0.50	ug/L	0.057
EPN	ND	0.50	ug/L	0.050
Demeton-O	ND	1.0	ug/L	0.19
Demeton-S	ND	1.0	ug/L	0.19
Tetrachlorvinphos (Stirophos)	ND	2.5	ug/L	0.056

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	92	(48 - 114)
Ethyl Pirimifos	72	(68 - 98)

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW-2

TOTAL Metals

Lot-Sample #...: D4C310153-001 Matrix.......: WATER
Date Sampled...: 03/29/04 16:35 Date Received..: 03/31/04

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 4092277						
Mercury	ND	0.20	ug/L	SW846 7470A	04/06/04	GC8WL1A7
		Dilution Factor: 1		Analysis Time..: 17:33	MDL............: 0.054	
Prep Batch #...: 4092620						
Silver	ND	10	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1AK
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 0.70	
Aluminum	120 J	100	ug/L	SW846 6010B	04/06-04/29/04	GC8WL1AL
		Dilution Factor: 1		Analysis Time..: 03:14	MDL............: 20	
Arsenic	ND	15	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1AM
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 4.9	
Barium	14	10	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1AN
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 0.37	
Beryllium	ND	5.0	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1AP
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 0.41	
Boron	1800	100	ug/L	SW846 6010B	04/06-04/29/04	GC8WL1AQ
		Dilution Factor: 1		Analysis Time..: 03:14	MDL............: 8.3	
Cadmium	ND	5.0	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1AR
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 0.27	
Cobalt	ND	10	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1AT
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 0.67	
Chromium	6.3 B	10	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1AU
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 2.1	
Copper	3.5 B	10	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1AV
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 0.97	
Iron	39 B	100	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1AW
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 19	
Manganese	900	10	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1AX
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 0.54	

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LOCKWOOD GREENE

Client Sample ID: L.E.S. MW-2

TOTAL Metals

Lot-Sample #...: D4C310153-001 Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION- ANALYSIS DATE	WORK ORDER #
Molybdenum	40	20	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1A0
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 2.3	
Nickel	8.8 B	40	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1A1
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 4.2	
Lead	ND	3.0	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1A2
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 2.1	
Antimony	ND	10	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1A3
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 3.6	
Selenium	ND	15	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1A4
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 4.6	
Thallium	ND	10	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1A5
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 8.1	
inc	11 B	20	ug/L	SW846 6010B	04/06-04/17/04	GC8WL1A6
		Dilution Factor: 1		Analysis Time..: 08:56	MDL............: 7.1	

NOTE(S):

J Method blank contamination The associated method blank contains the target analyte at a reportable level.

B Estimated result. Result is less than RL.

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW-2

General Chemistry

Lot-Sample #...: D4C310153-001 **Work Order #...:** GC8WL **Matrix.........:** WATER
Date Sampled...: 03/29/04 16:35 **Date Received..:** 03/31/04

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)	20 J	20	mg/L	MCAWW 410.4	04/08/04	4099309
		Dilution Factor: 1		Analysis Time..: 11:15	MDL............: 2.9	
Chloride	1700 Q	300	mg/L	MCAWW 300.0A	03/31/04	4092263
		Dilution Factor: 100		Analysis Time..: 16:21	MDL............: 20	
Fluoride	0.81 B,G	5.0	mg/L	MCAWW 300.0A	03/31/04	4092264
		Dilution Factor: 5		Analysis Time..: 15:34	MDL............: 0.50	
Nitrate	0.44 B,G	2.5	mg/L	MCAWW 300.0A	03/31/04	4092265
		Dilution Factor: 5		Analysis Time..: 15:34	MDL............: 0.25	
Nitrite	1.1 B,G	2.5	mg/L	MCAWW 300.0A	03/31/04	4092266
		Dilution Factor: 5		Analysis Time..: 15:34	MDL............: 0.25	
Specific Conductance	9700	2.0	umhos/cm	MCAWW 120.1	04/09/04	4103197
		Dilution Factor: 1		Analysis Time..: 16:00	MDL............:	
Sulfate	2400 Q	500	mg/L	MCAWW 300.0A	03/31/04	4092262
		Dilution Factor: 100		Analysis Time..: 16:21	MDL............: 20	
Total Cyanide	ND	0.010	mg/L	MCAWW 335.3	04/05/04	4096601
		Dilution Factor: 1		Analysis Time..: 14:00	MDL............: 0.0039	
Total Dissolved Solids	6300 Q	20	mg/L	MCAWW 160.1	04/02/04	4093379
		Dilution Factor: 2		Analysis Time..: 12:30	MDL............: 7.2	
Total Suspended Solids	7.6	4.0	mg/L	MCAWW 160.2	04/01/04	4092561
		Dilution Factor: 1		Analysis Time..: 18:00	MDL............: 0.87	

NOTE(S):

RL Reporting Limit

J Method blank contamination. The associated method blank contains the target analyte at a reportable level

Q Elevated reporting limit. The reporting limit is elevated due to high analyte levels

B Estimated result. Result is less than RL.

G Elevated reporting limit. The reporting limit is elevated due to matrix interference.

LOCKWOOD GREENE

Client Sample ID: L.E.S. MW-2

General Chemistry

Lot-Sample #...: D4C310153-002 Work Order #...: GC8WT Matrix.........: WATER
Date Sampled...: 03/30/04 12:46 Date Received..: 03/31/04

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Fecal Coliform	ND	1.0	CFU/100m	SM18 9222D Fecal	03/31/04	4096595
		Dilution Factor: 1		Analysis Time..: 11:00	MDL............:	
Total Coliform	ND	1.0	CFU/100m	SM18 9222B	03/31/04	4096596
		Dilution Factor: 1		Analysis Time..: 11:00	MDL............:	

QC DATA ASSOCIATION SUMMARY

D4C310153

Sample Preparation and Analysis Control Numbers

SAMPLE#	MATRIX	ANALYTICAL METHOD	LEACH BATCH #	PREP BATCH #	MS RUN#
001	WATER	MCAWW 120.1		4103197	4103088
	WATER	MCAWW 160.1		4093379	4096267
	WATER	MCAWW 160.2		4092561	4093173
	WATER	MCAWW 300.0A		4092263	4100224
	WATER	MCAWW 300.0A		4092262	4092120
	WATER	MCAWW 300.0A		4092264	4100208
	WATER	MCAWW 300.0A		4092265	4100231
	WATER	MCAWW 300.0A		4092266	4100226
	WATER	SW846 7470A		4092277	4092142
	WATER	SW846 8141A		4096147	
	WATER	SW846 8082		4091394	
	WATER	SW846 8081A		4091410	
	WATER	SW846 8260B		4099587	4099330
	WATER	SW846 8270C		4093267	
	WATER	SW846 6010B		4092620	4092293
	WATER	MCAWW 335.3		4096601	4096322
	WATER	MCAWW 410.4		4099309	4099149
002	WATER	SM18 9222D Fecal		4096595	
	WATER	SM18 9222B		4096596	
003	WATER	SW846 8260B		4099587	4099330

METHOD BLANK REPORT

GC/MS Volatiles

Client Lot #...: D4C310153 **Work Order #...:** GDT7J1AA **Matrix.........:** WATER
MB Lot-Sample #: D4D080000-587
Prep Date......: 04/07/04 **Analysis Time..:** 19:55
Analysis Date..: 04/07/04 **Prep Batch #...:** 4099587
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Acetone	ND	10	ug/L	SW846 8260B
Benzene	ND	1.0	ug/L	SW846 8260B
Bromodichloromethane	ND	1.0	ug/L	SW846 8260B
Bromoform	ND	1.0	ug/L	SW846 8260B
Bromomethane	ND	2.0	ug/L	SW846 8260B
2-Butanone (MEK)	ND	5.0	ug/L	SW846 8260B
Carbon tetrachloride	ND	1.0	ug/L	SW846 8260B
Chlorobenzene	ND	1.0	ug/L	SW846 8260B
Chloroethane	ND	2.0	ug/L	SW846 8260B
Chloroform	ND	1.0	ug/L	SW846 8260B
Chloromethane	ND	2.0	ug/L	SW846 8260B
Dibromomethane	ND	1.0	ug/L	SW846 8260B
1,2-Dibromoethane (EDB)	ND	1.0	ug/L	SW846 8260B
1,2-Dichlorobenzene	ND	1.0	ug/L	SW846 8260B
,3-Dichlorobenzene	ND	1.0	ug/L	SW846 8260B
1,4-Dichlorobenzene	ND	1.0	ug/L	SW846 8260B
Dichlorodifluoromethane	ND	2.0	ug/L	SW846 8260B
1,1-Dichloroethane	ND	1.0	ug/L	SW846 8260B
1,2-Dichloroethane	ND	1.0	ug/L	SW846 8260B
1,1-Dichloroethene	ND	1.0	ug/L	SW846 8260B
1,2-Dichloroethene (total)	ND	1.0	ug/L	SW846 8260B
cis-1,2-Dichloroethene	ND	1.0	ug/L	SW846 8260B
trans-1,2-Dichloroethene	ND	1.0	ug/L	SW846 8260B
1,2-Dichloropropane	ND	1.0	ug/L	SW846 8260B
cis-1,3-Dichloropropene	ND	1.0	ug/L	SW846 8260B
trans-1,3-Dichloropropene	ND	1.0	ug/L	SW846 8260B
Ethylbenzene	ND	1.0	ug/L	SW846 8260B
2-Hexanone	ND	5.0	ug/L	SW846 8260B
Methylene chloride	**0.48 J**	**5.0**	**ug/L**	**SW846 8260B**
4-Methyl-2-pentanone	ND	5.0	ug/L	SW846 8260B
Styrene	ND	1.0	ug/L	SW846 8260B
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L	SW846 8260B
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L	SW846 8260B
Tetrachloroethene	ND	1.0	ug/L	SW846 8260B
Toluene	ND	1.0	ug/L	SW846 8260B
1,2,4-Trichlorobenzene	ND	1.0	ug/L	SW846 8260B
1,1,1-Trichloroethane	ND	1.0	ug/L	SW846 8260B
1,2-Trichloroethane	ND	1.0	ug/L	SW846 8260B
ichloroethene	ND	1.0	ug/L	SW846 8260B

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METHOD BLANK REPORT

GC/MS Volatiles

Client Lot #...: D4C310153 **Work Order #...: GDT7J1AA** **Matrix.........: WATER**

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Trichlorofluoromethane	ND	2.0	ug/L	SW846 8260B
1,2,3-Trichloropropane	ND	1.0	ug/L	SW846 8260B
Vinyl chloride	ND	1.0	ug/L	SW846 8260B
Xylenes (total)	ND	2.0	ug/L	SW846 8260B
n-Butylbenzene	ND	1.0	ug/L	SW846 8260B
sec-Butylbenzene	ND	1.0	ug/L	SW846 8260B
Isopropylbenzene	ND	1.0	ug/L	SW846 8260B
1,2,4-Trimethylbenzene	ND	1.0	ug/L	SW846 8260B
1,3,5-Trimethylbenzene	ND	1.0	ug/L	SW846 8260B
n-Propylbenzene	ND	1.0	ug/L	SW846 8260B
tert-Butylbenzene	ND	1.0	ug/L	SW846 8260B
Dibromochloromethane	ND	1.0	ug/L	SW846 8260B
2-Chlorotoluene	ND	1.0	ug/L	SW846 8260B
4-Chlorotoluene	ND	1.0	ug/L	SW846 8260B
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0	ug/L	SW846 8260B
1,3-Dichloropropane	ND	1.0	ug/L	SW846 8260B
2,2-Dichloropropane	ND	5.0	ug/L	SW846 8260B
.,1-Dichloropropene	ND	1.0	ug/L	SW846 8260B
Hexachlorobutadiene	ND	1.0	ug/L	SW846 8260B
4-Isopropyltoluene	ND	1.0	ug/L	SW846 8260B
Methyl tert-butyl ether	ND	5.0	ug/L	SW846 8260B
1,2,3-Trichlorobenzene	ND	1.0	ug/L	SW846 8260B
m-Xylene & p-Xylene	ND	2.0	ug/L	SW846 8260B
o-Xylene	ND	1.0	ug/L	SW846 8260B
Bromobenzene	ND	1.0	ug/L	SW846 8260B
Bromochloromethane	ND	1.0	ug/L	SW846 8260B
Naphthalene	ND	1.0	ug/L	SW846 8260B

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	94	(76 - 116)
1,2-Dichloroethane-d4	76	(59 - 129)
4-Bromofluorobenzene	88	(74 - 114)
Toluene-d8	86	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

J Estimated result Result is less than RL.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC/MS Volatiles

Client Lot #...: D4C310153 **Work Order #...:** GDT7J1AC **Matrix.........:** WATER
LCS Lot-Sample#: D4D080000-587
Prep Date......: 04/07/04 **Analysis Date..:** 04/07/04
Prep Batch #...: 4099587 **Analysis Time..:** 19:35
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD
Benzene	**97**	**(75 - 116)**	**SW846 8260B**
Chlorobenzene	**92**	**(77 - 117)**	**SW846 8260B**
1,1-Dichloroethene	**102**	**(67 - 125)**	**SW846 8260B**
Toluene	**86**	**(74 - 115)**	**SW846 8260B**
Trichloroethene	**114**	**(80 - 123)**	**SW846 8260B**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	89	(76 - 116)
1,2-Dichloroethane-d4	72	(59 - 129)
4-Bromofluorobenzene	84	(74 - 114)
Toluene-d8	82	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC/MS Volatiles

Client Lot #...: D4C310153 **Work Order #...:** GDT7J1AC **Matrix.........:** WATER
LCS Lot-Sample#: D4D080000-587
Prep Date......: 04/07/04 **Analysis Date..:** 04/07/04
Prep Batch #...: 4099587 **Analysis Time..:** 19:35
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	METHOD
Benzene	**10.0**	**9.70**	**ug/L**	**97**	**SW846 8260B**
Chlorobenzene	**10.0**	**9.21**	**ug/L**	**92**	**SW846 8260B**
1,1-Dichloroethene	**10.0**	**10.2**	**ug/L**	**102**	**SW846 8260B**
Toluene	**10.0**	**8.64**	**ug/L**	**86**	**SW846 8260B**
Trichloroethene	**10.0**	**11.4**	**ug/L**	**114**	**SW846 8260B**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	89	(76 - 116)
1,2-Dichloroethane-d4	72	(59 - 129)
4-Bromofluorobenzene	84	(74 - 114)
Toluene-d8	82	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC/MS Volatiles

Client Lot #...: D4C310153 **Work Order #...:** GDCH91EW-MS **Matrix.........:** WATER
MS Lot-Sample #: D4D010203-001 GDCH91EX-MSD
Date Sampled...: 03/29/04 16:50 **Date Received..:** 04/01/04
Prep Date......: 04/07/04 **Analysis Date..:** 04/07/04
Prep Batch #...: 4099587 **Analysis Time..:** 21:56
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Benzene	**98**	**(75 - 116)**			**SW846 8260B**
	100	**(75 - 116)**	**1.2**	**(0-20)**	**SW846 8260B**
Chlorobenzene	**93**	**(77 - 117)**			**SW846 8260B**
	93	**(77 - 117)**	**0.23**	**(0-20)**	**SW846 8260B**
1,1-Dichloroethene	**156 a**	**(67 - 125)**			**SW846 8260B**
	159 a	**(67 - 125)**	**1.7**	**(0-20)**	**SW846 8260B**
Toluene	**88**	**(74 - 115)**			**SW846 8260B**
	88	**(74 - 115)**	**0.63**	**(0-20)**	**SW846 8260B**
Trichloroethene	**116**	**(80 - 123)**			**SW846 8260B**
	117	**(80 - 123)**	**0.89**	**(0-20)**	**SW846 8260B**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
ibromofluoromethane	91	(76 - 116)
	93	(76 - 116)
1,2-Dichloroethane-d4	74	(59 - 129)
	76	(59 - 129)
4-Bromofluorobenzene	84	(74 - 114)
	86	(74 - 114)
Toluene-d8	85	(76 - 116)
	85	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

a Spiked analyte recovery is outside stated control limits.

MATRIX SPIKE SAMPLE DATA REPORT

GC/MS Volatiles

Client Lot #...: D4C310153 **Work Order #...:** GDCH91EW-MS **Matrix.........:** WATER
MS Lot-Sample #: D4D010203-001 GDCH91EX-MSD
Date Sampled...: 03/29/04 16:50 **Date Received..:** 04/01/04
Prep Date......: 04/07/04 **Analysis Date..:** 04/07/04
Prep Batch #...: 4099587 **Analysis Time..:** 21:56
Dilution Factor: 1

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD
Benzene	**0.18**	**10.0**	**10.0**	**ug/L**	**98**		**SW846 8260B**
	0.18	**10.0**	**10.1**	**ug/L**	**100**	**1.2**	**SW846 8260B**
Chlorobenzene	**ND**	**10.0**	**9.32**	**ug/L**	**93**		**SW846 8260B**
	ND	**10.0**	**9.34**	**ug/L**	**93**	**0.23**	**SW846 8260B**
1,1-Dichloroethene	**ND**	**10.0**	**15.6**	**ug/L**	**156 a**		**SW846 8260B**
	ND	**10.0**	**15.9**	**ug/L**	**159 a**	**1.7**	**SW846 8260B**
Toluene	**ND**	**10.0**	**8.82**	**ug/L**	**88**		**SW846 8260B**
	ND	**10.0**	**8.76**	**ug/L**	**88**	**0.63**	**SW846 8260B**
Trichloroethene	**2.2**	**10.0**	**13.8**	**ug/L**	**116**		**SW846 8260B**
	2.2	**10.0**	**13.9**	**ug/L**	**117**	**0.89**	**SW846 8260B**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
ibromofluoromethane	91	(76 - 116)
	93	(76 - 116)
1,2-Dichloroethane-d4	74	(59 - 129)
	76	(59 - 129)
4-Bromofluorobenzene	84	(74 - 114)
	86	(74 - 114)
Toluene-d8	85	(76 - 116)
	85	(76 - 116)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

a Spiked analyte recovery is outside stated control limits.

METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: D4C310153   Work Order #...: GDEXW1AA   Matrix.........: WATER
MB Lot-Sample #: D4D020000-267
Prep Date......: 04/02/04   Analysis Time..: 17:41
Analysis Date..: 04/06/04   Prep Batch #...: 4093267
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Acenaphthene	ND	10	ug/L	SW846 8270C
Acenaphthylene	ND	10	ug/L	SW846 8270C
Acetophenone	ND	10	ug/L	SW846 8270C
2-Acetylaminofluorene	ND	100	ug/L	SW846 8270C
4-Aminobiphenyl	ND	50	ug/L	SW846 8270C
Aniline	ND	10	ug/L	SW846 8270C
Anthracene	ND	10	ug/L	SW846 8270C
Aramite	ND	20	ug/L	SW846 8270C
Benzo(a)anthracene	ND	10	ug/L	SW846 8270C
Benzo(b)fluoranthene	ND	10	ug/L	SW846 8270C
Benzo(k)fluoranthene	ND	10	ug/L	SW846 8270C
Benzo(ghi)perylene	ND	10	ug/L	SW846 8270C
Benzo(a)pyrene	ND	10	ug/L	SW846 8270C
Benzyl alcohol	ND	10	ug/L	SW846 8270C
is(2-Chloroethoxy) methane	ND	10	ug/L	SW846 8270C
bis(2-Chloroethyl)-ether	ND	10	ug/L	SW846 8270C
bis(2-Ethylhexyl) phthalate	ND	10	ug/L	SW846 8270C
4-Bromophenyl phenyl ether	ND	10	ug/L	SW846 8270C
Butyl benzyl phthalate	ND	10	ug/L	SW846 8270C
4-Chloroaniline	ND	10	ug/L	SW846 8270C
Chlorobenzilate	ND	10	ug/L	SW846 8270C
4-Chloro-3-methylphenol	ND	10	ug/L	SW846 8270C
2-Chloronaphthalene	ND	10	ug/L	SW846 8270C
2-Chlorophenol	ND	10	ug/L	SW846 8270C
4-Chlorophenyl phenyl ether	ND	10	ug/L	SW846 8270C
Chrysene	ND	10	ug/L	SW846 8270C
Diallate	ND	20	ug/L	SW846 8270C
Dibenz(a,h)anthracene	ND	10	ug/L	SW846 8270C
Dibenzofuran	ND	10	ug/L	SW846 8270C
Di-n-butyl phthalate	ND	10	ug/L	SW846 8270C
1,2-Dichlorobenzene	ND	10	ug/L	SW846 8270C
1,3-Dichlorobenzene	ND	10	ug/L	SW846 8270C
1,4-Dichlorobenzene	ND	10	ug/L	SW846 8270C
3,3'-Dichlorobenzidine	ND	50	ug/L	SW846 8270C
4-Dichlorophenol	ND	10	ug/L	SW846 8270C
,6-Dichlorophenol	ND	10	ug/L	SW846 8270C

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METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: D4C310153 Work Order #...: GDEXW1AA Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Diethyl phthalate	ND	10	ug/L	SW846 8270C
Dimethoate	ND	20	ug/L	SW846 8270C
7,12-Dimethylbenz(a)-anthracene	ND	20	ug/L	SW846 8270C
3,3'-Dimethylbenzidine	ND	20	ug/L	SW846 8270C
2,4-Dimethylphenol	ND	10	ug/L	SW846 8270C
Dimethyl phthalate	ND	10	ug/L	SW846 8270C
1,3-Dinitrobenzene	ND	10	ug/L	SW846 8270C
4,6-Dinitro-2-methylphenol	ND	50	ug/L	SW846 8270C
2,4-Dinitrophenol	ND	50	ug/L	SW846 8270C
2,4-Dinitrotoluene	ND	10	ug/L	SW846 8270C
2,6-Dinitrotoluene	ND	10	ug/L	SW846 8270C
Di-n-octyl phthalate	ND	10	ug/L	SW846 8270C
Diphenylamine	ND	10	ug/L	SW846 8270C
Disulfoton	ND	50	ug/L	SW846 8270C
Ethyl methanesulfonate	ND	10	ug/L	SW846 8270C
Fluoranthene	ND	10	ug/L	SW846 8270C
luorene	ND	10	ug/L	SW846 8270C
Hexachlorobenzene	ND	10	ug/L	SW846 8270C
Hexachlorobutadiene	ND	10	ug/L	SW846 8270C
Hexachlorocyclopenta-diene	ND	50	ug/L	SW846 8270C
Hexachloroethane	ND	10	ug/L	SW846 8270C
Hexachloropropene	ND	100	ug/L	SW846 8270C
Indeno(1,2,3-cd)pyrene	ND	10	ug/L	SW846 8270C
Isodrin	ND	10	ug/L	SW846 8270C
Isophorone	ND	10	ug/L	SW846 8270C
Isosafrole	ND	20	ug/L	SW846 8270C
Methapyrilene	ND	50	ug/L	SW846 8270C
3-Methylcholanthrene	ND	20	ug/L	SW846 8270C
Methyl methanesulfonate	ND	10	ug/L	SW846 8270C
2-Methylnaphthalene	ND	10	ug/L	SW846 8270C
Methyl parathion	ND	50	ug/L	SW846 8270C
2-Methylphenol	ND	10	ug/L	SW846 8270C
3-Methylphenol & 4-Methylphenol	ND	10	ug/L	SW846 8270C
Naphthalene	ND	10	ug/L	SW846 8270C
1,4-Naphthoquinone	ND	50	ug/L	SW846 8270C
1-Naphthylamine	ND	10	ug/L	SW846 8270C
2-Naphthylamine	ND	10	ug/L	SW846 8270C
2-Nitroaniline	ND	50	ug/L	SW846 8270C
3-Nitroaniline	ND	50	ug/L	SW846 8270C
-Nitroaniline	ND	50	ug/L	SW846 8270C
.itrobenzene	ND	10	ug/L	SW846 8270C

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METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: D4C310153 Work Order #...: GDEXW1AA Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
2-Nitrophenol	ND	10	ug/L	SW846 8270C
4-Nitrophenol	ND	50	ug/L	SW846 8270C
4-Nitroquinoline-1-oxide	ND	100	ug/L	SW846 8270C
N-Nitrosodi-n-butylamine	ND	10	ug/L	SW846 8270C
N-Nitrosodiethylamine	ND	10	ug/L	SW846 8270C
N-Nitrosodimethylamine	ND	10	ug/L	SW846 8270C
N-Nitrosodiphenylamine	ND	10	ug/L	SW846 8270C
N-Nitrosodi-n-propylamine	ND	10	ug/L	SW846 8270C
N-Nitrosomethylethylamine	ND	10	ug/L	SW846 8270C
N-Nitrosomorpholine	ND	10	ug/L	SW846 8270C
N-Nitrosopiperidine	ND	10	ug/L	SW846 8270C
N-Nitrosopyrrolidine	ND	10	ug/L	SW846 8270C
5-Nitro-o-toluidine	ND	20	ug/L	SW846 8270C
Parathion	ND	50	ug/L	SW846 8270C
Pentachlorobenzene	ND	10	ug/L	SW846 8270C
Pentachloroethane	ND	50	ug/L	SW846 8270C
entachloronitrobenzene	ND	50	ug/L	SW846 8270C
Pentachlorophenol	ND	50	ug/L	SW846 8270C
Phenacetin	ND	20	ug/L	SW846 8270C
Phenanthrene	ND	10	ug/L	SW846 8270C
Phenol	ND	10	ug/L	SW846 8270C
Phorate	ND	50	ug/L	SW846 8270C
2-Picoline	ND	20	ug/L	SW846 8270C
Pronamide	ND	20	ug/L	SW846 8270C
Pyrene	ND	10	ug/L	SW846 8270C
Pyridine	ND	20	ug/L	SW846 8270C
1,2,4,5-Tetrachlorobenzene	ND	10	ug/L	SW846 8270C
2,3,4,6-Tetrachlorophenol	ND	50	ug/L	SW846 8270C
Thionazin	ND	10	ug/L	SW846 8270C
o-Toluidine	ND	10	ug/L	SW846 8270C
1,2,4-Trichlorobenzene	ND	10	ug/L	SW846 8270C
2,4,5-Trichlorophenol	ND	10	ug/L	SW846 8270C
2,4,6-Trichlorophenol	ND	10	ug/L	SW846 8270C
O,O,O-Triethylphosphorothioate	ND	50	ug/L	SW846 8270C
1,3,5-Trinitrobenzene	ND	50	ug/L	SW846 8270C

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METHOD BLANK REPORT

GC/MS Semivolatiles

Client Lot #...: D4C310153 **Work Order #...:** GDEXW1AA **Matrix.........:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	74	(32 - 116)
Phenol-d5	74	(40 - 111)
Nitrobenzene-d5	69	(53 - 107)
2-Fluorobiphenyl	68	(31 - 105)
2,4,6-Tribromophenol	81	(42 - 122)
Terphenyl-d14	71	(21 - 125)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: D4C310153 **Work Order #...:** GDEXW1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D4D020000-267 GDEXW1AD-LCSD
Prep Date......: 04/02/04 **Analysis Date..:** 04/06/04
Prep Batch #...: 4093267 **Analysis Time..:** 18:09
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Acenaphthene	63	(55 - 97)			SW846 8270C
	65	(55 - 97)	3.1	(0-30)	SW846 8270C
4-Chloro-3-methylphenol	68	(59 - 106)			SW846 8270C
	70	(59 - 106)	3.2	(0-40)	SW846 8270C
2-Chlorophenol	71	(59 - 105)			SW846 8270C
	72	(59 - 105)	0.40	(0-40)	SW846 8270C
1,4-Dichlorobenzene	63	(31 - 98)			SW846 8270C
	63	(31 - 98)	0.35	(0-40)	SW846 8270C
2,4-Dinitrotoluene	65	(57 - 113)			SW846 8270C
	69	(57 - 113)	5.0	(0-40)	SW846 8270C
4-Nitrophenol	56	(43 - 118)			SW846 8270C
	59	(43 - 118)	5.9	(0-40)	SW846 8270C
N-Nitrosodi-n-propylamine	58	(51 - 99)			SW846 8270C
	58	(51 - 99)	0.91	(0-40)	SW846 8270C
Pentachlorophenol	78	(48 - 114)			SW846 8270C
	82	(48 - 114)	4.8	(0-40)	SW846 8270C
Phenol	66	(56 - 106)			SW846 8270C
	66	(56 - 106)	0.74	(0-40)	SW846 8270C
Pyrene	55	(51 - 103)			SW846 8270C
	59	(51 - 103)	6.1	(0-40)	SW846 8270C
1,2,4-Trichlorobenzene	67	(36 - 99)			SW846 8270C
	69	(36 - 99)	2.2	(0-40)	SW846 8270C

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	62	(54 - 105)
	64	(54 - 105)
Phenol-d5	64	(55 - 106)
	65	(55 - 106)
Nitrobenzene-d5	61	(58 - 108)
	61	(58 - 108)
2-Fluorobiphenyl	59	(53 - 97)
	59	(53 - 97)
2,4,6-Tribromophenol	72	(62 - 113)
	74	(62 - 113)
'erphenyl-d14	59	(55 - 109)

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LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC/MS Semivolatiles

Client Lot #...: D4C310153 **Work Order #...:** GDEXW1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D4D020000-267 GDEXW1AD-LCSD

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
	62	(55 - 109)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: D4C310153 **Work Order #...:** GDEXW1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D4D020000-267 GDEXW1AD-LCSD
Prep Date......: 04/02/04 **Analysis Date..:** 04/06/04
Prep Batch #...: 4093267 **Analysis Time..:** 18:09
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Acenaphthene	100	63.3	ug/L	63		SW846 8270C
	100	65.3	ug/L	65	3.1	SW846 8270C
4-Chloro-3-methylphenol	150	102	ug/L	68		SW846 8270C
	150	105	ug/L	70	3.2	SW846 8270C
2-Chlorophenol	150	107	ug/L	71		SW846 8270C
	150	107	ug/L	72	0.40	SW846 8270C
1,4-Dichlorobenzene	100	63.2	ug/L	63		SW846 8270C
	100	63.0	ug/L	63	0.35	SW846 8270C
2,4-Dinitrotoluene	100	65.4	ug/L	65		SW846 8270C
	100	68.8	ug/L	69	5.0	SW846 8270C
4-Nitrophenol	150	84.1	ug/L	56		SW846 8270C
	150	89.2	ug/L	59	5.9	SW846 8270C
N-Nitrosodi-n-propylamine	100	57.8	ug/L	58		SW846 8270C
	100	58.3	ug/L	58	0.91	SW846 8270C
Pentachlorophenol	150	117	ug/L	78		SW846 8270C
	150	123	ug/L	82	4.8	SW846 8270C
Phenol	150	98.9	ug/L	66		SW846 8270C
	150	99.6	ug/L	66	0.74	SW846 8270C
Pyrene	100	55.1	ug/L	55		SW846 8270C
	100	58.5	ug/L	59	6.1	SW846 8270C
1,2,4-Trichlorobenzene	100	67.1	ug/L	67		SW846 8270C
	100	68.5	ug/L	69	2.2	SW846 8270C

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2-Fluorophenol	62	(54 - 105)
	64	(54 - 105)
Phenol-d5	64	(55 - 106)
	65	(55 - 106)
Nitrobenzene-d5	61	(58 - 108)
	61	(58 - 108)
2-Fluorobiphenyl	59	(53 - 97)
	59	(53 - 97)
2,4,6-Tribromophenol	72	(62 - 113)
	74	(62 - 113)
Terphenyl-d14	59	(55 - 109)

(Continued on next page)

LABORATORY CONTROL SAMPLE DATA REPORT

GC/MS Semivolatiles

Client Lot #...: D4C310153 **Work Order #...:** GDEXW1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D4D020000-267 GDEXW1AD-LCSD

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
	62	(55 - 109)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

METHOD BLANK REPORT

GC Semivolatiles

Client Lot #...:	D4C310153	**Work Order #...:**	GC9FX1AA	**Matrix.........:**	WATER
MB Lot-Sample #:	D4C310000-410				
		Prep Date......:	03/31/04	**Analysis Time..:**	17:35
Analysis Date..:	04/15/04	**Prep Batch #...:**	4091410		
Dilution Factor:	1				

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Aldrin	ND	0.050	ug/L	SW846 8081A
alpha-BHC	ND	0.050	ug/L	SW846 8081A
beta-BHC	ND	0.050	ug/L	SW846 8081A
delta-BHC	ND	0.050	ug/L	SW846 8081A
gamma-BHC (Lindane)	ND	0.050	ug/L	SW846 8081A
Chlordane (technical)	ND	0.50	ug/L	SW846 8081A
4,4'-DDD	ND	0.050	ug/L	SW846 8081A
4,4'-DDE	ND	0.050	ug/L	SW846 8081A
4,4'-DDT	ND	0.050	ug/L	SW846 8081A
Dieldrin	ND	0.050	ug/L	SW846 8081A
Endrin	ND	0.050	ug/L	SW846 8081A
Endrin aldehyde	ND	0.050	ug/L	SW846 8081A
Endosulfan I	ND	0.050	ug/L	SW846 8081A
Endosulfan II	ND	0.050	ug/L	SW846 8081A
Endosulfan sulfate	ND	0.050	ug/L	SW846 8081A
Heptachlor	ND	0.050	ug/L	SW846 8081A
Heptachlor epoxide	ND	0.050	ug/L	SW846 8081A
Methoxychlor	ND	0.10	ug/L	SW846 8081A
Toxaphene	ND	5.0	ug/L	SW846 8081A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Decachlorobiphenyl	88	(12 - 153)
Tetrachloro-m-xylene	87	(55 - 113)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC Semivolatiles

Client Lot #...: D4C310153 **Work Order #...:** GC9FX1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D4C310000-410 GC9FX1AD-LCSD
Prep Date......: 03/31/04 **Analysis Date..:** 04/15/04
Prep Batch #...: 4091410 **Analysis Time..:** 16:09
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Aldrin	**97**	**(56 - 126)**			**SW846 8081A**
	96	**(56 - 126)**	**0.49**	**(0-30)**	**SW846 8081A**
gamma-BHC (Lindane)	**100**	**(72 - 126)**			**SW846 8081A**
	100	**(72 - 126)**	**0.54**	**(0-30)**	**SW846 8081A**
4,4'-DDT	**93**	**(76 - 135)**			**SW846 8081A**
	94	**(76 - 135)**	**0.88**	**(0-30)**	**SW846 8081A**
Dieldrin	**99**	**(80 - 132)**			**SW846 8081A**
	100	**(80 - 132)**	**0.77**	**(0-30)**	**SW846 8081A**
Endrin	**84**	**(63 - 144)**			**SW846 8081A**
	83	**(63 - 144)**	**1.3**	**(0-30)**	**SW846 8081A**
Heptachlor	**94**	**(63 - 124)**			**SW846 8081A**
	95	**(63 - 124)**	**0.78**	**(0-30)**	**SW846 8081A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Decachlorobiphenyl	83	(56 - 136)
	89	(56 - 136)
Tetrachloro-m-xylene	83	(49 - 111)
	84	(49 - 111)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC Semivolatiles

Client Lot #...: D4C310153 **Work Order #...:** GC9FX1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D4C310000-410 GC9FX1AD-LCSD
Prep Date......: 03/31/04 **Analysis Date..:** 04/15/04
Prep Batch #...: 4091410 **Analysis Time..:** 16:09
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Aldrin	**0.500**	**0.485**	**ug/L**	**97**		**SW846 8081A**
	0.500	**0.482**	**ug/L**	**96**	**0.49**	**SW846 8081A**
gamma-BHC (Lindane)	**0.500**	**0.498**	**ug/L**	**100**		**SW846 8081A**
	0.500	**0.500**	**ug/L**	**100**	**0.54**	**SW846 8081A**
4,4'-DDT	**0.500**	**0.464**	**ug/L**	**93**		**SW846 8081A**
	0.500	**0.468**	**ug/L**	**94**	**0.88**	**SW846 8081A**
Dieldrin	**0.500**	**0.496**	**ug/L**	**99**		**SW846 8081A**
	0.500	**0.499**	**ug/L**	**100**	**0.77**	**SW846 8081A**
Endrin	**0.500**	**0.420**	**ug/L**	**84**		**SW846 8081A**
	0.500	**0.414**	**ug/L**	**83**	**1.3**	**SW846 8081A**
Heptachlor	**0.500**	**0.469**	**ug/L**	**94**		**SW846 8081A**
	0.500	**0.473**	**ug/L**	**95**	**0.78**	**SW846 8081A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Decachlorobiphenyl	83	(56 - 136)
	89	(56 - 136)
Tetrachloro-m-xylene	83	(49 - 111)
	84	(49 - 111)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

METHOD BLANK REPORT

GC Semivolatiles

Client Lot #...: D4C310153 **Work Order #...:** GC9D31AA **Matrix.........:** WATER
MB Lot-Sample #: D4C310000-394
Prep Date......: 03/31/04 **Analysis Time..:** 16:36
Analysis Date..: 04/01/04 **Prep Batch #...:** 4091394
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Aroclor 1016	ND	1.0	ug/L	SW846 8082
Aroclor 1221	ND	1.0	ug/L	SW846 8082
Aroclor 1232	ND	1.0	ug/L	SW846 8082
Aroclor 1242	ND	1.0	ug/L	SW846 8082
Aroclor 1248	ND	1.0	ug/L	SW846 8082
Aroclor 1254	ND	1.0	ug/L	SW846 8082
Aroclor 1260	ND	1.0	ug/L	SW846 8082

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	93	(51 - 122)
Decachlorobiphenyl	94	(41 - 138)

NOTE(S):

·lculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC Semivolatiles

Client Lot #...: D4C310153 **Work Order #...:** GC9D31AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D4C310000-394 GC9D31AD-LCSD
Prep Date......: 03/31/04 **Analysis Date..:** 04/01/04
Prep Batch #...: 4091394 **Analysis Time..:** 17:02
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Aroclor 1016	**118**	**(58 - 128)**			**SW846 8082**
	122	**(58 - 128)**	**3.0**	**(0-30)**	**SW846 8082**
Aroclor 1260	**106**	**(69 - 140)**			**SW846 8082**
	108	**(69 - 140)**	**1.9**	**(0-30)**	**SW846 8082**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	92	(42 - 120)
	98	(42 - 120)
Decachlorobiphenyl	96	(56 - 136)
	92	(56 - 136)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC Semivolatiles

Client Lot #...: D4C310153 **Work Order #...:** GC9D31AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D4C310000-394 GC9D31AD-LCSD
Prep Date......: 03/31/04 **Analysis Date..:** 04/01/04
Prep Batch #...: 4091394 **Analysis Time..:** 17:02
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Aroclor 1016	**2.00**	**2.36**	**ug/L**	**118**		**SW846 8082**
	2.00	**2.44**	**ug/L**	**122**	**3.0**	**SW846 8082**
Aroclor 1260	**2.00**	**2.13**	**ug/L**	**106**		**SW846 8082**
	2.00	**2.17**	**ug/L**	**108**	**1.9**	**SW846 8082**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	92	(42 - 120)
	98	(42 - 120)
Decachlorobiphenyl	96	(56 - 136)
	92	(56 - 136)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

METHOD BLANK REPORT

GC Semivolatiles

Client Lot #...: D4C310153 **Work Order #...:** GDH0G1AA **Matrix.........:** WATER
MB Lot-Sample #: D4D050000-147
Prep Date.......: 04/05/04 **Analysis Time..:** 18:38
Analysis Date..: 04/12/04 **Prep Batch #...:** 4096147
Dilution Factor: 1

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Azinphos-methyl	ND	2.5	ug/L	SW846 8141A
Bolstar	ND	0.50	ug/L	SW846 8141A
Chlorpyrifos	ND	0.50	ug/L	SW846 8141A
Coumaphos	ND	0.50	ug/L	SW846 8141A
Demeton (total)	ND	1.0	ug/L	SW846 8141A
Diazinon	ND	0.50	ug/L	SW846 8141A
Dichlorvos	ND	0.50	ug/L	SW846 8141A
Dimethoate	ND	0.50	ug/L	SW846 8141A
Disulfoton	ND	0.50	ug/L	SW846 8141A
Ethoprop	ND	0.50	ug/L	SW846 8141A
Ethyl parathion	ND	0.50	ug/L	SW846 8141A
Famphur	ND	1.0	ug/L	SW846 8141A
Fensulfothion	ND	2.5	ug/L	SW846 8141A
Fenthion	ND	0.50	ug/L	SW846 8141A
Malathion	ND	1.2	ug/L	SW846 8141A
Merphos	ND	5.0	ug/L	SW846 8141A
Methyl parathion	ND	0.50	ug/L	SW846 8141A
Mevinphos	ND	6.2	ug/L	SW846 8141A
Naled	ND	10	ug/L	SW846 8141A
O,O,O-Triethylphosphorothioate	ND	0.50	ug/L	SW846 8141A
Phorate	ND	0.50	ug/L	SW846 8141A
Ronnel	ND	10	ug/L	SW846 8141A
Sulfotepp	ND	0.50	ug/L	SW846 8141A
Thionazin	ND	0.50	ug/L	SW846 8141A
Tokuthion	ND	0.50	ug/L	SW846 8141A
Trichloronate	ND	0.50	ug/L	SW846 8141A
EPN	ND	0.50	ug/L	SW846 8141A
Demeton-O	ND	1.0	ug/L	SW846 8141A
Demeton-S	ND	1.0	ug/L	SW846 8141A
Tetrachlorvinphos (Stirop	ND	2.5	ug/L	SW846 8141A

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	109	(48 - 114)
Ethyl Pirimifos	82	(68 - 98)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC Semivolatiles

Client Lot #...: D4C310153 **Work Order #...:** GDH0G1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D4D050000-147 GDH0G1AD-LCSD
Prep Date......: 04/05/04 **Analysis Date..:** 04/12/04
Prep Batch #...: 4096147 **Analysis Time..:** 19:11
Dilution Factor: 1

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Demeton (total)	**77**	**(47 - 100)**			**SW846 8141A**
	73	**(47 - 100)**	**4.7**	**(0-40)**	**SW846 8141A**
Diazinon	**103**	**(70 - 103)**			**SW846 8141A**
	96	**(70 - 103)**	**6.7**	**(0-40)**	**SW846 8141A**
Ethyl parathion	**79**	**(49 - 122)**			**SW846 8141A**
	86	**(49 - 122)**	**8.5**	**(0-40)**	**SW846 8141A**
Malathion	**69**	**(56 - 106)**			**SW846 8141A**
	73	**(56 - 106)**	**6.4**	**(0-40)**	**SW846 8141A**
Methyl parathion	**80**	**(68 - 105)**			**SW846 8141A**
	85	**(68 - 105)**	**5.7**	**(0-40)**	**SW846 8141A**
Phorate	**99**	**(62 - 104)**			**SW846 8141A**
	92	**(62 - 104)**	**6.9**	**(0-40)**	**SW846 8141A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	104	(48 - 114)
	95	(48 - 114)
Ethyl Pirimifos	83	(68 - 98)
	82	(68 - 98)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC Semivolatiles

Client Lot #...: D4C310153 **Work Order #...:** GDH0G1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: D4D050000-147 GDH0G1AD-LCSD
Prep Date......: 04/05/04 **Analysis Date..:** 04/12/04
Prep Batch #...: 4096147 **Analysis Time..:** 19:11
Dilution Factor: 1

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Demeton (total)	**4.00**	3.06	**ug/L**	**77**		**SW846 8141A**
	4.00	2.92	**ug/L**	**73**	**4.7**	**SW846 8141A**
Diazinon	**4.00**	4.10	**ug/L**	**103**		**SW846 8141A**
	4.00	3.84	**ug/L**	**96**	**6.7**	**SW846 8141A**
Ethyl parathion	**4.00**	3.15	**ug/L**	**79**		**SW846 8141A**
	4.00	3.43	**ug/L**	**86**	**8.5**	**SW846 8141A**
Malathion	**4.00**	2.75	**ug/L**	**69**		**SW846 8141A**
	4.00	2.93	**ug/L**	**73**	**6.4**	**SW846 8141A**
Methyl parathion	**4.00**	3.22	**ug/L**	**80**		**SW846 8141A**
	4.00	3.41	**ug/L**	**85**	**5.7**	**SW846 8141A**
Phorate	**4.00**	3.96	**ug/L**	**99**		**SW846 8141A**
	4.00	3.69	**ug/L**	**92**	**6.9**	**SW846 8141A**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chlormefos	104	(48 - 114)
	95	(48 - 114)
Ethyl Pirimifos	83	(68 - 98)
	82	(68 - 98)

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

METHOD BLANK REPORT

TOTAL Metals

Client Lot #...: D4C310153 **Matrix..........:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MB Lot-Sample #: D4D010000-277 Prep Batch #...: 4092277						
Mercury	ND	0.20	ug/L	SW846 7470A	04/06/04	GDA841AA
		Dilution Factor: 1 Analysis Time..: 17:15				
MB Lot-Sample #: D4D010000-620 Prep Batch #...: 4092620						
Aluminum	**42 B**	**100**	**ug/L**	**SW846 6010B**	**04/06-04/29/04**	**GDD581AA**
		Dilution Factor: 1 Analysis Time..: 03:00				
Antimony	ND	10	ug/L	SW846 6010B	04/06-04/17/04	GDD581C9
		Dilution Factor: 1 Analysis Time..: 08:42				
Arsenic	ND	15	ug/L	SW846 6010B	04/06-04/17/04	GDD581C2
		Dilution Factor: 1 Analysis Time..: 08:42				
Barium	ND	10	ug/L	SW846 6010B	04/06-04/17/04	GDD581AC
		Dilution Factor: 1 Analysis Time..: 08:42				
Beryllium	ND	5.0	ug/L	SW846 6010B	04/06-04/17/04	GDD581AD
		Dilution Factor: 1 Analysis Time..: 08:42				
Boron	ND	100	ug/L	SW846 6010B	04/06-04/29/04	GDD581C3
		Dilution Factor: 1 Analysis Time..: 03:00				
Cadmium	ND	5.0	ug/L	SW846 6010B	04/06-04/17/04	GDD581C4
		Dilution Factor: 1 Analysis Time..: 08:42				
Chromium	ND	10	ug/L	SW846 6010B	04/06-04/17/04	GDD581C6
		Dilution Factor: 1 Analysis Time..: 08:42				
Cobalt	ND	10	ug/L	SW846 6010B	04/06-04/17/04	GDD581C5
		Dilution Factor: 1 Analysis Time..: 08:42				

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METHOD BLANK REPORT

TOTAL Metals

Client Lot #...: D4C310153

Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Copper	ND	10 Dilution Factor: 1 Analysis Time..: 08:42	ug/L	SW846 6010B	04/06-04/17/04	GDD581AF
Iron	ND	100 Dilution Factor: 1 Analysis Time..: 08:42	ug/L	SW846 6010B	04/06-04/17/04	GDD581AG
Lead	ND	3.0 Dilution Factor: 1 Analysis Time..: 03:00	ug/L	SW846 6010B	04/06-04/29/04	GDD581C8
Manganese	ND	10 Dilution Factor: 1 Analysis Time..: 08:42	ug/L	SW846 6010B	04/06-04/17/04	GDD581AJ
Molybdenum	ND	20 Dilution Factor: 1 Analysis Time..: 08:42	ug/L	SW846 6010B	04/06-04/17/04	GDD581C7
ickel	ND	40 Dilution Factor: 1 Analysis Time..: 08:42	ug/L	SW846 6010B	04/06-04/17/04	GDD581AK
Selenium	ND	15 Dilution Factor: 1 Analysis Time..: 08:42	ug/L	SW846 6010B	04/06-04/17/04	GDD581DA
Silver	ND	10 Dilution Factor: 1 Analysis Time..: 08:42	ug/L	SW846 6010B	04/06-04/17/04	GDD581C1
Thallium	ND	10 Dilution Factor: 1 Analysis Time..: 08:42	ug/L	SW846 6010B	04/06-04/17/04	GDD581DC
Zinc	ND	20 Dilution Factor: 1 Analysis Time..: 08:42	ug/L	SW846 6010B	04/06-04/17/04	GDD581AN

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

B Estimated result. Result is less than RL.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

TOTAL Metals

Lot-Sample #...: D4C310153 Matrix.........: WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION- ANALYSIS DATE	PREP- BATCH #
Aluminum	91	(86 - 108)			SW846 6010B	04/06-04/29/04	4092620
	93	(86 - 108)	1.6	(0-20)	SW846 6010B	04/06-04/29/04	4092620
		Dilution Factor: 1			Analysis Time..: 03:04		
Antimony	95	(88 - 108)			SW846 6010B	04/06-04/17/04	4092620
	98	(88 - 108)	3.6	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		
Arsenic	95	(89 - 109)			SW846 6010B	04/06-04/17/04	4092620
	98	(89 - 109)	3.2	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		
Barium	102	(93 - 113)			SW846 6010B	04/06-04/17/04	4092620
	104	(93 - 113)	2.3	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		
Beryllium	94	(88 - 112)			SW846 6010B	04/06-04/17/04	4092620
	97	(88 - 112)	3.5	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		
Boron	93	(89 - 110)			SW846 6010B	04/06-04/29/04	4092620
	96	(89 - 110)	3.1	(0-20)	SW846 6010B	04/06-04/29/04	4092620
		Dilution Factor: 1			Analysis Time..: 03:04		
Cadmium	92	(89 - 110)			SW846 6010B	04/06-04/17/04	4092620
	96	(89 - 110)	4.0	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		
Chromium	98	(89 - 112)			SW846 6010B	04/06-04/17/04	4092620
	102	(89 - 112)	3.2	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		
Cobalt	96	(86 - 107)			SW846 6010B	04/06-04/17/04	4092620
	99	(86 - 107)	3.0	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		
Copper	95	(86 - 110)			SW846 6010B	04/06-04/17/04	4092620
	97	(86 - 110)	2.5	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		

(Continued on next page)

LABORATORY CONTROL SAMPLE EVALUATION REPORT

TOTAL Metals

Lot-Sample #...: D4C310153 Matrix.........: WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP-BATCH #
Iron	98	(88 - 110)			SW846 6010B	04/06-04/17/04	4092620
	103	(88 - 110)	4.6	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		
Lead	93	(91 - 111)			SW846 6010B	04/06-04/29/04	4092620
	96	(91 - 111)	2.8	(0-20)	SW846 6010B	04/06-04/29/04	4092620
		Dilution Factor: 1			Analysis Time..: 03:04		
Manganese	98	(90 - 110)			SW846 6010B	04/06-04/17/04	4092620
	101	(90 - 110)	3.1	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		
Molybdenum	95	(83 - 109)			SW846 6010B	04/06-04/17/04	4092620
	99	(83 - 109)	4.0	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		
Nickel	96	(90 - 110)			SW846 6010B	04/06-04/17/04	4092620
	99	(90 - 110)	3.0	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		
Selenium	97	(88 - 110)			SW846 6010B	04/06-04/17/04	4092620
	100	(88 - 110)	2.8	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		
Silver	98	(85 - 114)			SW846 6010B	04/06-04/17/04	4092620
	101	(85 - 114)	3.2	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		
Thallium	98	(88 - 108)			SW846 6010B	04/06-04/17/04	4092620
	101	(88 - 108)	3.3	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		
Zinc	96	(85 - 110)			SW846 6010B	04/06-04/17/04	4092620
	99	(85 - 110)	3.0	(0-20)	SW846 6010B	04/06-04/17/04	4092620
		Dilution Factor: 1			Analysis Time..: 08:47		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

LABORATORY CONTROL SAMPLE DATA REPORT

TOTAL Metals

Lot-Sample #...: D4C310153 Matrix.........: WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION- ANALYSIS DATE	PREP BATCH #
Aluminum	2000	1820	ug/L	91		SW846 6010B	04/06-04/29/04	4092620
	2000	1850	ug/L	93	1.6	SW846 6010B	04/06-04/29/04	4092620
			Dilution Factor: 1			Analysis Time..: 03:04		
Antimony	500	475	ug/L	95		SW846 6010B	04/06-04/17/04	4092620
	500	492	ug/L	98	3.6	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		
Arsenic	2000	1900	ug/L	95		SW846 6010B	04/06-04/17/04	4092620
	2000	1970	ug/L	98	3.2	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		
Barium	2000	2030	ug/L	102		SW846 6010B	04/06-04/17/04	4092620
	2000	2080	ug/L	104	2.3	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		
Beryllium	50.0	46.9	ug/L	94		SW846 6010B	04/06-04/17/04	4092620
	50.0	48.5	ug/L	97	3.5	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		
Boron	1000	930	ug/L	93		SW846 6010B	04/06-04/29/04	4092620
	1000	959	ug/L	96	3.1	SW846 6010B	04/06-04/29/04	4092620
			Dilution Factor: 1			Analysis Time..: 03:04		
Cadmium	50.0	46.0	ug/L	92		SW846 6010B	04/06-04/17/04	4092620
	50.0	47.9	ug/L	96	4.0	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		
Chromium	200	197	ug/L	98		SW846 6010B	04/06-04/17/04	4092620
	200	203	ug/L	102	3.2	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		
Cobalt	500	478	ug/L	96		SW846 6010B	04/06-04/17/04	4092620
	500	493	ug/L	99	3.0	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		
Copper	250	236	ug/L	95		SW846 6010B	04/06-04/17/04	4092620
	250	242	ug/L	97	2.5	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		

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LABORATORY CONTROL SAMPLE DATA REPORT

TOTAL Metals

Lot-Sample #...: D4C310153 Matrix.........: WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Iron	1000	984	ug/L	98		SW846 6010B	04/06-04/17/04	4092620
	1000	1030	ug/L	103	4.6	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		
Lead	500	467	ug/L	93		SW846 6010B	04/06-04/29/04	4092620
	500	481	ug/L	96	2.8	SW846 6010B	04/06-04/29/04	4092620
			Dilution Factor: 1			Analysis Time..: 03:04		
Manganese	500	490	ug/L	98		SW846 6010B	04/06-04/17/04	4092620
	500	505	ug/L	101	3.1	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		
Molybdenum	1000	951	ug/L	95		SW846 6010B	04/06-04/17/04	4092620
	1000	990	ug/L	99	4.0	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		
Nickel	500	479	ug/L	96		SW846 6010B	04/06-04/17/04	4092620
	500	493	ug/L	99	3.0	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		
Selenium	2000	1940	ug/L	97		SW846 6010B	04/06-04/17/04	4092620
	2000	2000	ug/L	100	2.8	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		
Silver	50.0	49.0	ug/L	98		SW846 6010B	04/06-04/17/04	4092620
	50.0	50.6	ug/L	101	3.2	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		
Thallium	2000	1960	ug/L	98		SW846 6010B	04/06-04/17/04	4092620
	2000	2030	ug/L	101	3.3	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		
Zinc	500	478	ug/L	96		SW846 6010B	04/06-04/17/04	4092620
	500	493	ug/L	99	3.0	SW846 6010B	04/06-04/17/04	4092620
			Dilution Factor: 1			Analysis Time..: 08:47		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D4C310153

Matrix.........: WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
LCS Lot-Sample#:	D4D010000-277	**Prep Batch #...:** 4092277			
Mercury	99	(84 - 114)	SW846 7470A	04/06/04	GDA841AC
		Dilution Factor: 1		Analysis Time..: 17:17	

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: D4C310153 **Matrix.........:** WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
LCS Lot-Sample#: D4D010000-277	**Prep Batch #...:** 4092277						
Mercury	5.00	4.95	ug/L	99	SW846 7470A	04/06/04	GDA841AC
		Dilution Factor: 1			Analysis Time..: 17:17		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D4C310153 **Matrix..........:** WATER
Date Sampled...: 03/29/04 15:20 **Date Received..:** 03/30/04

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
MS Lot-Sample #: D4C300202-006 **Prep Batch #...:** 4092277							
Mercury	95	(84 - 114)			SW846 7470A	04/06/04	GC63M1AV
	95	(84 - 114)	0.63	(0-10)	SW846 7470A	04/06/04	GC63M1AW

Dilution Factor: 1
Analysis Time..: 17:29

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: D4C310153 **Matrix..........:** WATER
Date Sampled...: 03/29/04 15:20 **Date Received..:** 03/30/04

MS Lot-Sample #: D4C300202-006 **Prep Batch #...:** 4092277

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER
Mercury									
	ND	5.00	4.73	ug/L	95		SW846 7470A	04/06/04	GC63M1
	ND	5.00	4.76	ug/L	95	0.63	SW846 7470A	04/06/04	GC63M1

Dilution Factor: 1
Analysis Time..: 17:29

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results

MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D4C310153 **Matrix..........:** WATER
Date Sampled...: 03/29/04 10:40 **Date Received..:** 03/30/04

MS Lot-Sample #: D4C300171-001 **Prep Batch #...:** 4092620

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Aluminum	103	(83 - 119)			SW846 6010B	04/06-04/29/04	GC6T51A8
	113	(83 - 119)	6.7	(0-25)	SW846 6010B	04/06-04/29/04	GC6T51A9
		Dilution Factor: 1					
		Analysis Time..: 03:28					
Antimony	97	(81 - 124)			SW846 6010B	04/06-04/17/04	GC6T51D7
	97	(81 - 124)	0.06	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51D8
		Dilution Factor: 1					
		Analysis Time..: 09:10					
Arsenic	97	(84 - 124)			SW846 6010B	04/06-04/17/04	GC6T51DH
	97	(84 - 124)	0.56	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51DJ
		Dilution Factor: 1					
		Analysis Time..: 09:10					
Barium	104	(85 - 120)			SW846 6010B	04/06-04/17/04	GC6T51CA
	105	(85 - 120)	1.2	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51CC
		Dilution Factor: 1					
		Analysis Time..: 09:10					
Beryllium	94	(79 - 121)			SW846 6010B	04/06-04/17/04	GC6T51CD
	96	(79 - 121)	1.1	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51CE
		Dilution Factor: 1					
		Analysis Time..: 09:10					
Boron	96	(87 - 113)			SW846 6010B	04/06-04/29/04	GC6T51DL
	96	(87 - 113)	0.76	(0-25)	SW846 6010B	04/06-04/29/04	GC6T51DM
		Dilution Factor: 1					
		Analysis Time..: 03:28					
Cadmium	94	(82 - 119)			SW846 6010B	04/06-04/17/04	GC6T51DP
	94	(82 - 119)	0.51	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51DQ
		Dilution Factor: 1					
		Analysis Time..: 09:10					
Chromium	99	(73 - 135)			SW846 6010B	04/06-04/17/04	GC6T51DW
	100	(73 - 135)	1.2	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51DX
		Dilution Factor: 1					
		Analysis Time..: 09:10					

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MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D4C310153 **Matrix.........:** WATER
Date Sampled...: 03/29/04 10:40 **Date Received..:** 03/30/04

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Cobalt	96	(82 - 119)			SW846 6010B	04/06-04/17/04	GC6T51DT
	97	(82 - 119)	1.2	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51DU
		Dilution Factor: 1					
		Analysis Time..: 09:10					
Copper	98	(82 - 129)			SW846 6010B	04/06-04/17/04	GC6T51CH
	100	(82 - 129)	1.4	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51CJ
		Dilution Factor: 1					
		Analysis Time..: 09:10					
Iron	106	(52 - 155)			SW846 6010B	04/06-04/17/04	GC6T51CK
	121	(52 - 155)	6.7	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51CL
		Dilution Factor: 1					
		Analysis Time..: 09:10					
Lead	96	(89 - 121)			SW846 6010B	04/06-04/29/04	GC6T51D4
	95	(89 - 121)	0.69	(0-25)	SW846 6010B	04/06-04/29/04	GC6T51D5
		Dilution Factor: 1					
		Analysis Time..: 03:28					
Manganese	98	(79 - 121)			SW846 6010B	04/06-04/17/04	GC6T51CP
	100	(79 - 121)	1.2	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51CQ
		Dilution Factor: 1					
		Analysis Time..: 09:10					
Molybdenum	97	(83 - 109)			SW846 6010B	04/06-04/17/04	GC6T51D1
	98	(83 - 109)	1.3	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51D2
		Dilution Factor: 1					
		Analysis Time..: 09:10					
Nickel	97	(84 - 120)			SW846 6010B	04/06-04/17/04	GC6T51CR
	98	(84 - 120)	1.1	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51CT
		Dilution Factor: 1					
		Analysis Time..: 09:10					
Selenium	98	(71 - 140)			SW846 6010B	04/06-04/17/04	GC6T51EA
	98	(71 - 140)	0.20	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51EC
		Dilution Factor: 1					
		Analysis Time..: 09:10					
Silver	101	(75 - 141)			SW846 6010B	04/06-04/17/04	GC6T51DE
	100	(75 - 141)	1.3	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51DF
		Dilution Factor: 1					
		Analysis Time..: 09:10					

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MATRIX SPIKE SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: D4C310153 **Matrix.........:** WATER
Date Sampled...: 03/29/04 10:40 **Date Received..:** 03/30/04

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Thallium	100	(90 - 116)			SW846 6010B	04/06-04/17/04	GC6T51EE
	100	(90 - 116)	0.67	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51EF
		Dilution Factor: 1 Analysis Time..: 09:10					
Zinc	100	(60 - 137)			SW846 6010B	04/06-04/17/04	GC6T51C0
	97	(60 - 137)	2.3	(0-25)	SW846 6010B	04/06-04/17/04	GC6T51C1
		Dilution Factor: 1 Analysis Time..: 09:10					

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: D4C310153 **Matrix.........:** WATER
Date Sampled...: 03/29/04 10:40 **Date Received..:** 03/30/04

MS Lot-Sample #: D4C300171-001 **Prep Batch #...:** 4092620

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Aluminum									
	870	2000	2920	ug/L	103		SW846 6010B	04/06-04/29/04	GC6T51A
	870	2000	3120	ug/L	113	6.7	SW846 6010B	04/06-04/29/04	GC6T51A
			Dilution Factor: 1						
			Analysis Time..: 03:28						
Antimony									
	ND	500	485	ug/L	97		SW846 6010B	04/06-04/17/04	GC6T51D
	ND	500	486	ug/L	97	0.06	SW846 6010B	04/06-04/17/04	GC6T51D
			Dilution Factor: 1						
			Analysis Time..: 09:10						
Arsenic									
	ND	2000	1930	ug/L	97		SW846 6010B	04/06-04/17/04	GC6T51D
	ND	2000	1940	ug/L	97	0.56	SW846 6010B	04/06-04/17/04	GC6T51D
			Dilution Factor: 1						
			Analysis Time..: 09:10						
Barium									
	92	2000	2160	ug/L	104		SW846 6010B	04/06-04/17/04	GC6T51C
	92	2000	2190	ug/L	105	1.2	SW846 6010B	04/06-04/17/04	GC6T51C
			Dilution Factor: 1						
			Analysis Time..: 09:10						
Beryllium									
	ND	50.0	47.2	ug/L	94		SW846 6010B	04/06-04/17/04	GC6T51C
	ND	50.0	47.8	ug/L	96	1.1	SW846 6010B	04/06-04/17/04	GC6T51C
			Dilution Factor: 1						
			Analysis Time..: 09:10						
Boron									
	10	1000	974	ug/L	96		SW846 6010B	04/06-04/29/04	GC6T51D
	10	1000	966	ug/L	96	0.76	SW846 6010B	04/06-04/29/04	GC6T51D
			Dilution Factor: 1						
			Analysis Time..: 03:28						
Cadmium									
	ND	50.0	46.8	ug/L	94		SW846 6010B	04/06-04/17/04	GC6T51D
	ND	50.0	47.0	ug/L	94	0.51	SW846 6010B	04/06-04/17/04	GC6T51D
			Dilution Factor: 1						
			Analysis Time..: 09:10						

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MATRIX SPIKE SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: D4C310153 Matrix.........: WATER
Date Sampled...: 03/29/04 10:40 Date Received..: 03/30/04

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Chromium									
	15	200	213	ug/L	99		SW846 6010B	04/06-04/17/04	GC6T51DW
	15	200	216	ug/L	100	1.2	SW846 6010B	04/06-04/17/04	GC6T51DX
			Dilution Factor: 1						
			Analysis Time..: 09:10						
Cobalt									
	1.2	500	483	ug/L	96		SW846 6010B	04/06-04/17/04	GC6T51DT
	1.2	500	488	ug/L	97	1.2	SW846 6010B	04/06-04/17/04	GC6T51DU
			Dilution Factor: 1						
			Analysis Time..: 09:10						
Copper									
	1.7	250	247	ug/L	98		SW846 6010B	04/06-04/17/04	GC6T51CH
	1.7	250	251	ug/L	100	1.4	SW846 6010B	04/06-04/17/04	GC6T51CJ
			Dilution Factor: 1						
			Analysis Time..: 09:10						
Iron									
	1200	1000	2260	ug/L	106		SW846 6010B	04/06-04/17/04	GC6T51CK
	1200	1000	2410	ug/L	121	6.7	SW846 6010B	04/06-04/17/04	GC6T51CL
			Dilution Factor: 1						
			Analysis Time..: 09:10						
Lead									
	3.5	500	484	ug/L	96		SW846 6010B	04/06-04/29/04	GC6T51D4
	3.5	500	480	ug/L	95	0.69	SW846 6010B	04/06-04/29/04	GC6T51D5
			Dilution Factor: 1						
			Analysis Time..: 03:28						
Manganese									
	77	500	569	ug/L	98		SW846 6010B	04/06-04/17/04	GC6T51CP
	77	500	576	ug/L	100	1.2	SW846 6010B	04/06-04/17/04	GC6T51CQ
			Dilution Factor: 1						
			Analysis Time..: 09:10						
Molybdenum									
	3.4	1000	971	ug/L	97		SW846 6010B	04/06-04/17/04	GC6T51D1
	3.4	1000	983	ug/L	98	1.3	SW846 6010B	04/06-04/17/04	GC6T51D2
			Dilution Factor: 1						
			Analysis Time..: 09:10						

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MATRIX SPIKE SAMPLE DATA REPORT

TOTAL Metals

Client Lot #...: D4C310153 **Matrix.........:** WATER
Date Sampled...: 03/29/04 10:40 **Date Received..:** 03/30/04

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Nickel									
	17	500	502	ug/L	97		SW846 6010B	04/06-04/17/04	GC6T51C
	17	500	507	ug/L	98	1.1	SW846 6010B	04/06-04/17/04	GC6T51C
				Dilution Factor: 1 Analysis Time..: 09:10					
Selenium									
	5.6	2000	1960	ug/L	98		SW846 6010B	04/06-04/17/04	GC6T51E
	5.6	2000	1960	ug/L	98	0.20	SW846 6010B	04/06-04/17/04	GC6T51E
				Dilution Factor: 1 Analysis Time..: 09:10					
Silver									
	ND	50.0	51.1	ug/L	101		SW846 6010B	04/06-04/17/04	GC6T51D
	ND	50.0	50.4	ug/L	100	1.3	SW846 6010B	04/06-04/17/04	GC6T51D
				Dilution Factor: 1 Analysis Time..: 09:10					
Thallium									
	ND	2000	2000	ug/L	100		SW846 6010B	04/06-04/17/04	GC6T51E
	ND	2000	2010	ug/L	100	0.67	SW846 6010B	04/06-04/17/04	GC6T51E
				Dilution Factor: 1 Analysis Time..: 09:10					
Zinc									
	9.1	500	507	ug/L	100		SW846 6010B	04/06-04/17/04	GC6T51C
	9.1	500	495	ug/L	97	2.3	SW846 6010B	04/06-04/17/04	GC6T51C
				Dilution Factor: 1 Analysis Time..: 09:10					

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

METHOD BLANK REPORT

General Chemistry

Client Lot #...: D4C310153

Matrix.........: WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)		Work Order #: GDRJC1AA		MB Lot-Sample #:	D4D080000-309	
	4.2 B	20	mg/L	MCAWW 410.4	04/08/04	4099309
		Dilution Factor: 1				
		Analysis Time..: 11:15				
Chloride		Work Order #: GDW4V1AA		MB Lot-Sample #:	D4D010000-263	
	ND	3.0	mg/L	MCAWW 300.0A	03/31/04	4092263
		Dilution Factor: 1				
		Analysis Time..: 15:19				
Fecal Coliform		Work Order #: GDKA41AA		MB Lot-Sample #:	D4D050000-595	
	ND	1.0	CFU/100m	SM18 9222D Fecal	03/31/04	4096595
		Dilution Factor: 1				
		Analysis Time..: 11:00				
Fluoride		Work Order #: GDWTA1AA		MB Lot-Sample #:	D4D010000-264	
	ND	1.0	mg/L	MCAWW 300.0A	03/31/04	4092264
		Dilution Factor: 1				
		Analysis Time..: 15:19				
Nitrate		Work Order #:.GDW541AA		MB Lot-Sample #:	D4D010000-265	
	ND	0.50	mg/L	MCAWW 300.0A	03/31/04	4092265
		Dilution Factor: 1				
		Analysis Time..: 15:19				
Nitrite		Work Order #: GDW5L1AA		MB Lot-Sample #:	D4D010000-266	
	ND	0.50	mg/L	MCAWW 300.0A	03/31/04	4092266
		Dilution Factor: 1				
		Analysis Time..: 15:19				
Specific Conductance		Work Order #: GD0WC1AA		MB Lot-Sample #:	D4D120000-197	
	ND	2.0	umhos/cm	MCAWW 120.1	04/09/04	4103197
		Dilution Factor: 1				
		Analysis Time..: 16:00				
Sulfate		Work Order #: GDA3N1AA		MB Lot-Sample #:	D4D010000-262	
	ND	5.0	mg/L	MCAWW 300.0A	03/31/04	4092262
		Dilution Factor: 1				
		Analysis Time..: 15:19				
Total Coliform		Work Order #: GDKAQ1AA		MB Lot-Sample #:	D4D050000-596	
	ND	1.0	CFU/100m	SM18 9222B	03/31/04	4096596
		Dilution Factor: 1				
		Analysis Time..: 11:00				

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METHOD BLANK REPORT

General Chemistry

Client Lot #...: D4C310153 **Matrix.........:** WATER

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Cyanide		Work Order #: GDKDG1AA		MB Lot-Sample #: D4D050000-601		
	ND	0.010	mg/L	MCAWW 335.3	04/05/04	4096601
		Dilution Factor: 1 Analysis Time..: 14:00				
Total Dissolved Solids		Work Order #: GDJ5M1AA		MB Lot-Sample #: D4D020000-379		
	ND	10	mg/L	MCAWW 160.1	04/02/04	4093379
		Dilution Factor: 1 Analysis Time..: 12:30				
Total Suspended Solids		Work Order #: GDF141AA		MB Lot-Sample #: D4D010000-561		
	ND	4.0	mg/L	MCAWW 160.2	04/01/04	4092561
		Dilution Factor: 1 Analysis Time..: 18:00				

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Estimated result Result is less than RL

LABORATORY CONTROL SAMPLE EVALUATION REPORT

General Chemistry

Lot-Sample #...: D4C310153 Matrix.........: WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)		WO#:GDRJC1AC-LCS/GDRJC1AD-LCSD			LCS Lot-Sample#: D4D080000-309		
	102	(86 - 114)			MCAWW 410.4	04/08/04	4099309
	104	(86 - 114)	2.9	(0-11)	MCAWW 410.4	04/08/04	4099309
		Dilution Factor: 1			Analysis Time..: 11:15		
Chloride		WO#:GDW4V1AC-LCS/GDW4V1AD-LCSD			LCS Lot-Sample#: D4D010000-263		
	103	(90 - 110)			MCAWW 300.0A	03/31/04	4092263
	101	(90 - 110)	1.9	(0-10)	MCAWW 300.0A	03/31/04	4092263
		Dilution Factor: 1			Analysis Time..: 14:48		
Fluoride		WO#:GDWTA1AC-LCS/GDWTA1AD-LCSD			LCS Lot-Sample#: D4D010000-264		
	102	(90 - 110)			MCAWW 300.0A	03/31/04	4092264
	102	(90 - 110)	0.24	(0-10)	MCAWW 300.0A	03/31/04	4092264
		Dilution Factor: 1			Analysis Time..: 14:48		
Nitrate		WO#:GDW541AC-LCS/GDW541AD-LCSD			LCS Lot-Sample#: D4D010000-265		
	98	(90 - 110)			MCAWW 300.0A	03/31/04	4092265
	98	(90 - 110)	0.25	(0-10)	MCAWW 300.0A	03/31/04	4092265
		Dilution Factor: 1			Analysis Time..: 14:48		
Nitrite		WO#:GDW5L1AC-LCS/GDW5L1AD-LCSD			LCS Lot-Sample#: D4D010000-266		
	102	(90 - 110)			MCAWW 300.0A	03/31/04	4092266
	102	(90 - 110)	0.24	(0-10)	MCAWW 300.0A	03/31/04	4092266
		Dilution Factor: 1			Analysis Time..: 14:48		
Specific Conductance		WO#:GD0WC1AC-LCS/GD0WC1AD-LCSD			LCS Lot-Sample#: D4D120000-197		
	103	(89 - 109)			MCAWW 120.1	04/09/04	4103197
	104	(89 - 109)	1.4	(0-7.0)	MCAWW 120.1	04/09/04	4103197
		Dilution Factor: 1			Analysis Time..: 16:00		
Sulfate		WO#:GDA3N1AC-LCS/GDA3N1AD-LCSD			LCS Lot-Sample#: D4D010000-262		
	101	(90 - 110)			MCAWW 300.0A	03/31/04	4092262
	100	(90 - 110)	0.49	(0-10)	MCAWW 300.0A	03/31/04	4092262
		Dilution Factor: 1			Analysis Time..: 14:48		
Total Dissolved Solids		WO#:GDJ5M1AC-LCS/GDJ5M1AD-LCSD			LCS Lot-Sample#: D4D020000-379		
	97	(86 - 106)			MCAWW 160.1	04/02/04	4093379
	96	(86 - 106)	1.0	(0-20)	MCAWW 160.1	04/02/04	4093379
		Dilution Factor: 1			Analysis Time..: 12:30		

(Continued on next page)

LABORATORY CONTROL SAMPLE EVALUATION REPORT

General Chemistry

Lot-Sample #...: D4C310153

Matrix.........: WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Suspended Solids	WO#:GDF141AC-LCS/GDF141AD-LCSD LCS Lot-Sample#: D4D010000-561						
	103	(86 - 114)			MCAWW 160.2	04/01/04	4092561
	107	(86 - 114)	3.3	(0-20)	MCAWW 160.2	04/01/04	4092561

Dilution Factor: 1 Analysis Time..: 18:00

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE DATA REPORT

General Chemistry

Lot-Sample #...: D4C310153 Matrix.........: WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)			WO#:GDRJC1AC-LCS/GDRJC1AD-LCSD				LCS Lot-Sample#: D4D080000-309	
	100	102	mg/L	102		MCAWW 410.4	04/08/04	4099309
	100	104	mg/L	104	2.9	MCAWW 410.4	04/08/04	4099309
			Dilution Factor: 1			Analysis Time..: 11:15		
Chloride			WO#:GDW4V1AC-LCS/GDW4V1AD-LCSD				LCS Lot-Sample#: D4D010000-263	
	20.0	20.5	mg/L	103		MCAWW 300.0A	03/31/04	4092263
	20.0	20.1	mg/L	101	1.9	MCAWW 300.0A	03/31/04	4092263
			Dilution Factor: 1			Analysis Time..: 14:48		
Fluoride			WO#:GDWTA1AC-LCS/GDWTA1AD-LCSD				LCS Lot-Sample#: D4D010000-264	
	4.00	4.10	mg/L	102		MCAWW 300.0A	03/31/04	4092264
	4.00	4.09	mg/L	102	0.24	MCAWW 300.0A	03/31/04	4092264
			Dilution Factor: 1			Analysis Time..: 14:48		
Nitrate			WO#:GDW541AC-LCS/GDW541AD-LCSD				LCS Lot-Sample#: D4D010000-265	
	4.00	3.94	mg/L	98		MCAWW 300.0A	03/31/04	4092265
	4.00	3.93	mg/L	98	0.25	MCAWW 300.0A	03/31/04	4092265
			Dilution Factor: 1			Analysis Time..: 14:48		
Nitrite			WO#:GDW5L1AC-LCS/GDW5L1AD-LCSD				LCS Lot-Sample#: D4D010000-266	
	4.00	4.07	mg/L	102		MCAWW 300.0A	03/31/04	4092266
	4.00	4.06	mg/L	102	0.24	MCAWW 300.0A	03/31/04	4092266
			Dilution Factor: 1			Analysis Time..: 14:48		
Specific Conductance			WO#:GD0WC1AC-LCS/GD0WC1AD-LCSD				LCS Lot-Sample#: D4D120000-197	
	1410	1450	umhos/cm	103		MCAWW 120.1	04/09/04	4103197
	1410	1470	umhos/cm	104	1.4	MCAWW 120.1	04/09/04	4103197
			Dilution Factor: 1			Analysis Time..: 16:00		
Sulfate			WO#:GDA3N1AC-LCS/GDA3N1AD-LCSD				LCS Lot-Sample#: D4D010000-262	
	20.0	20.2	mg/L	101		MCAWW 300.0A	03/31/04	4092262
	20.0	20.0	mg/L	100	0.49	MCAWW 300.0A	03/31/04	4092262
			Dilution Factor: 1			Analysis Time..: 14:48		
Total Dissolved Solids			WO#:GDJ5M1AC-LCS/GDJ5M1AD-LCSD				LCS Lot-Sample#: D4D020000-379	
	500	485	mg/L	97		MCAWW 160.1	04/02/04	4093379
	500	480	mg/L	96	1.0	MCAWW 160.1	04/02/04	4093379
			Dilution Factor: 1			Analysis Time..: 12:30		

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LABORATORY CONTROL SAMPLE DATA REPORT

General Chemistry

Lot-Sample #...: D4C310153 Matrix.........: WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Suspended Solids			WO#:GDF141AC-LCS/GDF141AD-LCSD LCS Lot-Sample#: D4D010000-561					
	116	120	mg/L	103		MCAWW 160.2	04/01/04	4092561
	116	124	mg/L	107	3.3	MCAWW 160.2	04/01/04	4092561

Dilution Factor: 1 Analysis Time..: 18:00

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

General Chemistry

Client Lot #...: D4C310153 Matrix.........: WATER

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Cyanide		Work Order #: GDKDG1AC	LCS Lot-Sample#: D4D050000-601		
	96	(89 - 109)	MCAWW 335.3	04/05/04	4096601
		Dilution Factor: 1	Analysis Time..: 14:00		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE DATA REPORT

General Chemistry

Client Lot #...: D4C310153 Matrix.........: WATER

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCNT RECVRY	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Cyanide			Work Order #: GDKDG1AC		LCS Lot-Sample#: D4D050000-601		
	0.100	0.0965	mg/L	96	MCAWW 335.3	04/05/04	4096601
			Dilution Factor: 1		Analysis Time..: 14:00		

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

MATRIX SPIKE SAMPLE EVALUATION REPORT

General Chemistry

Client Lot #...: D4C310153 **Matrix.........:** WATER
Date Sampled...: 03/29/04 10:20 **Date Received..:** 03/30/04

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Chemical Oxygen Demand (COD)			WO#: GC6PG1A2-MS/GC6PG1A3-MSD			MS Lot-Sample #: D4C300158-001	
	107	(74 - 109)			MCAWW 410.4	04/08/04	4099309
	110 N	(74 - 109)	2.7	(0-11)	MCAWW 410.4	04/08/04	4099309
			Dilution Factor: 1				
			Analysis Time..: 11:15				
Chloride			WO#: GC8WL1CL-MS/GC8WL1CM-MSD			MS Lot-Sample #: D4C310153-001	
	104	(80 - 120)			MCAWW 300.0A	03/31/04	4092263
	104	(80 - 120)	0.04	(0-10)	MCAWW 300.0A	03/31/04	4092263
			Dilution Factor: 1				
			Analysis Time..: 16:37				
Fluoride			WO#: GC8WL1CJ-MS/GC8WL1CK-MSD			MS Lot-Sample #: D4C310153-001	
	103	(80 - 120)			MCAWW 300.0A	03/31/04	4092264
	103	(80 - 120)	0.0	(0-10)	MCAWW 300.0A	03/31/04	4092264
			Dilution Factor: 1				
			Analysis Time..: 15:50				
trate			WO#: GC8WL1CQ-MS/GC8WL1CR-MSD			MS Lot-Sample #: D4C310153-001	
	102	(80 - 120)			MCAWW 300.0A	03/31/04	4092265
	102	(80 - 120)	0.03	(0-10)	MCAWW 300.0A	03/31/04	4092265
			Dilution Factor: 1				
			Analysis Time..: 15:50				
Nitrite			WO#: GC8WL1CN-MS/GC8WL1CP-MSD			MS Lot-Sample #: D4C310153-001	
	101	(80 - 120)			MCAWW 300.0A	03/31/04	4092266
	101	(80 - 120)	0.03	(0-10)	MCAWW 300.0A	03/31/04	4092266
			Dilution Factor: 1				
			Analysis Time..: 15:50				
Sulfate			WO#: GC8WL1CG-MS/GC8WL1CH-MSD			MS Lot-Sample #: D4C310153-001	
	102	(80 - 120)			MCAWW 300.0A	03/31/04	4092262
	102	(80 - 120)	0.06	(0-10)	MCAWW 300.0A	03/31/04	4092262
			Dilution Factor: 1				
			Analysis Time..: 16:37				
Total Cyanide			WO#: GDAF11AH-MS/GDAF11AJ-MSD			MS Lot-Sample #: D4C310358-001	
	92	(78 - 120)			MCAWW 335.3	04/05/04	4096601
	92	(78 - 120)	0.21	(0-20)	MCAWW 335.3	04/05/04	4096601
			Dilution Factor: 1				
			Analysis Time..: 14:00				

NOTE(S):

culations are performed before rounding to avoid round-off errors in calculated results.

.. Spiked analyte recovery is outside stated control limits.

MATRIX SPIKE SAMPLE DATA REPORT

General Chemistry

Client Lot #...: D4C310153 **Matrix.........:** WATER
Date Sampled...: 03/29/04 10:20 **Date Received..:** 03/30/04

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH
Chemical Oxygen Demand (COD)			WO#: GC6PG1A2-MS/GC6PG1A3-MSD MS Lot-Sample #: D4C300158-001						
	5.9	50.0	59.3	mg/L	107		MCAWW 410.4	04/08/04	409930
	5.9	50.0	61.0 N	mg/L	110	2.7	MCAWW 410.4	04/08/04	409930
			Dilution Factor: 1						
			Analysis Time..: 11:15						
Chloride			WO#: GC8WL1CL-MS/GC8WL1CM-MSD MS Lot-Sample #: D4C310153-001						
	1700	2500	4320	mg/L	104		MCAWW 300.0A	03/31/04	409226
	1700	2500	4330	mg/L	104	0.04	MCAWW 300.0A	03/31/04	409226
			Dilution Factor: 1						
			Analysis Time..: 16:37						
Fluoride			WO#: GC8WL1CJ-MS/GC8WL1CK-MSD MS Lot-Sample #: D4C310153-001						
	0.81	25.0	26.6	mg/L	103		MCAWW 300.0A	03/31/04	409226
	0.81	25.0	26.6	mg/L	103	0.0	MCAWW 300.0A	03/31/04	409226
			Dilution Factor: 1						
			Analysis Time..: 15:50						
.trate			WO#: GC8WL1CQ-MS/GC8WL1CR-MSD MS Lot-Sample #: D4C310153-001						
	0.44	25.0	25.9	mg/L	102		MCAWW 300.0A	03/31/04	409226
	0.44	25.0	25.9	mg/L	102	0.03	MCAWW 300.0A	03/31/04	409226
			Dilution Factor: 1						
			Analysis Time..: 15:50						
Nitrite			WO#: GC8WL1CN-MS/GC8WL1CP-MSD MS Lot-Sample #: D4C310153-001						
	1.1	25.0	26.3	mg/L	101		MCAWW 300.0A	03/31/04	409226
	1.1	25.0	26.2	mg/L	101	0.03	MCAWW 300.0A	03/31/04	409226
			Dilution Factor: 1						
			Analysis Time..: 15:50						
Sulfate			WO#: GC8WL1CG-MS/GC8WL1CH-MSD MS Lot-Sample #: D4C310153-001						
	2400	2500	4960	mg/L	102		MCAWW 300.0A	03/31/04	409226
	2400	2500	4960	mg/L	102	0.06	MCAWW 300.0A	03/31/04	409226
			Dilution Factor: 1						
			Analysis Time..: 16:37						
Total Cyanide			WO#: GDAF11AH-MS/GDAF11AJ-MSD MS Lot-Sample #: D4C310358-001						
	ND	0.100	0.0942	mg/L	92		MCAWW 335.3	04/05/04	409660
	ND	0.100	0.0944	mg/L	92	0.21	MCAWW 335.3	04/05/04	409660
			Dilution Factor: 1						
			Analysis Time..: 14:00						

NOTE(S):

'culations are performed before rounding to avoid round-off errors in calculated results.

.. Spiked analyte recovery is outside stated control limits.

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: D4C310153 **Work Order #...:** GC7TQ-SMP GC7TQ-DUP **Matrix.......:** WATER

Date Sampled...: 03/29/04 09:30 **Date Received..:** 03/30/04

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Suspended Solids						SD Lot-Sample #: D4C300292-009		
	42	42	mg/L	0.0	(0-20)	MCAWW 160.2	04/01/04	409256

Dilution Factor: 1.25 Analysis Time..: 18:00

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: D4C310153 Work Order #...: GC46Q-SMP
GC46Q-DUP
Matrix.......: WATER

Date Sampled...: 03/28/04 11:40 Date Received..: 03/29/04

PARAM RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH :
Total Dissolved Solids					SD Lot-Sample #: D4C290157-001		
140	130	mg/L	2.9	(0-20)	MCAWW 160.1	04/02/04	409337
		Dilution Factor: 1			Analysis Time..: 12:30		

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #...: D4C310153 **Work Order #...:** GC8WL-SMP GC8WL-DUP **Matrix.......:** WATER

Date Sampled...: 03/29/04 16:35 **Date Received..:** 03/31/04

PARAM	RESULT	DUPLICATE RESULT	UNITS	RPD	RPD LIMIT	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Specific Conductance						SD Lot-Sample #:	D4C310153-001	
	9700	9800	umhos/cm	0.51	(0-7.0)	MCAWW 120.1	04/09/04	410319
			Dilution Factor: 1			Analysis Time..: 16:00		

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XB 3/31/04

Chain of Custody Record

SEVERN TRENT STL
Severn Trent Laboratories, Inc.

STL Denver
4955 Yarrow Street
Arvada, CO 80002

STL-4124 (0901)

Client: Cook-Joyce Inc //L.E.S.
Project Manager: Doug Granger (C.J.I)
Date:
Chain of Custody Number: 299654
Address: 812 W. 11th
Telephone Number (Area Code)/Fax Number: 512-474-9097
Lab Number:
Page ____ of ____
City: AUSTIN
State: TX
Zip Code: 78701
Site Contact: Doug granger
Lab Contact: Gail DeRuzzo
Project Name and Location (State): Lockwood URENCO
Carrier/Waybill Number:
Contract/Purchase Order/Quote No.: 54609-A

			Matrix					Containers & Preservatives							Analysis (Attach list if more space is needed)													
Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Air	Aqueous	Sed	Soil		Unpres	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	$Na_2S_2O_3$	VOA	SVOA	Pest/PCB	OP Pest	Total Metals	Cyanide	COD	Cl/SO4	IC NO_3/NO_2	TSS/TDS	Sp. Cond	Total Coliform	Fecal Coliform	Special Instructions/ Conditions of Receipt
L.E.S. MW-2	3-29-04	1635		X				8	1	1	3	1		~~2~~	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
L.E.S MW-2	3-30-04	1246		X										2												✓	✓	
N/A		N/A												N	A													N/A

Sampled by C. Book / J. Abney

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☒ Archive For 3 Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☒ 21 Days ☐ Other ____

QC Requirements (Specify)

1. Relinquished By — Date 3-30-04 — Time 1330
1. Received By — Date 3/31/04 — Time 0930
2. Relinquished By — Date — Time
2. Received By — Date — Time
3. Relinquished By — Date — Time
3. Received By — Date — Time

Comments

76

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

3.6

KB 3/31/04

Chain of Custody Record

SEVERN TRENT STL

Severn Trent Laboratories, Inc.

STL Denver
4955 Yarrow Street
Arvada, CO 80002

STL-4124 (0901)

Client: Cook-Joyce Inc / L.E.S

Project Manager: Doug Granger (C.J.I)

Date:

Chain of Custody Number: 299654

Address: 812 W. 11th

Telephone Number (Area Code)/Fax Number: 512-474-9097

Lab Number:

Page ____ of ____

City: AUSTIN

State: TX

Zip Code: 78701

Site Contact: Doug Granger

Lab Contact: Gail DePrizzo

Project Name and Location (State): Lockwood URENCO

Carrier/Waybill Number:

Contract/Purchase Order/Quote No.: 54609-A

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix				Containers & Preservatives							Analysis (Attach list if more space is needed)													Special Instructions/ Conditions of Receipt
			Air	Aqueous	Sed	Soil	Unpres	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	Na2S2O3	VOA	SVOA	Pest/PCB	OP Pest	Total Metals	Cyanide	COD	Cl/SO4	IC NO3/NO2	TSS/TDS	Sp. Cond	Total Coliform	Fecal Coliform	
L.E.S. MW-2	3-29-04	1635		X			8	1	1	3	1		~~2~~	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
L.E.S MW-2	3-30-04	1246		X									2												✓	✓	

N/A N/A N/A N/A

Sampled by C. Book / J. dabney

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☒ Archive For 3 Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☒ 21 Days ☐ Other________

QC Requirements (Specify)

1. Relinquished By: | Date: 3-30-04 | Time: 1330
1. Received By: | Date: 3/31/04 | Time: 0930
2. Relinquished By: | Date: | Time:
2. Received By: | Date: | Time:
3. Relinquished By: | Date: | Time:
3. Received By: | Date: | Time:

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH
AUSTIN, TEXAS 78701-2000
(512) 474-9097 FAX (512) 474-8463

HYDROGEOLOGIC INVESTIGATION
SECTION 32; TOWNSHIP 21 RANGE 38
Eunice, New Mexico

19 NOVEMBER 2003

Prepared for:

Lockwood Greene Engineering & Construction
1500 International Drive
Spartanburg, South Carolina 29304

L

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LOCKWOODGREENE\FINAL\03070
R031119_REPORT.DOC

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1.0 INTRODUCTION

In accordance with the Scope-of-Services outlined in a letter from Cook-Joyce, Inc. (CJI) dated 19 August 2003, CJI was contracted by Lockwood-Greene Engineering and Construction (LG) to conduct a hydrogeologic investigation of an undeveloped property in southeastern New Mexico. The hydrogeologic investigation was conducted on behalf of Louisiana Energy Services' efforts to license and operate a uranium enrichment facility at this site. The following sections detail CJI investigational activities at the site.

1.1 SITE DESCRIPTION

The approximate 560-acre site is located 2 miles east of Highway 18 in Eunice, Lea County, New Mexico, as shown on the Site Location Map (Figure 1). The property includes the portion of Section 32, Township 21, and Range 38 of the New Mexico State grid system that lies north of New Mexico State Highway 234, which runs east and west across the southern portion of Section 32. There are no permanent structures on-site. Currently the property is used for cattle grazing.

The site is characterized by sandy topsoil, sparse vegetation including mesquite trees, some rolling sand dunes, and about 30 feet of topographic relief from north to south. Although there are numerous operational oil wells within close proximity to the site, there are none on the subject property. There are three man-made features on-site. The first is a gravel road that trends north-south near the center of the site. The road is primarily used by haul trucks entering and exiting an adjacent surface mine facility that is located north of the site. The second man-made feature is a gravel pad approximately 200' x 300' that was constructed in early September during field activities. The third feature is an underground carbon dioxide gas pipeline that is operated by Trinity Pipeline and crosses the site from approximately the northwest corner to the southeast corner of the property.

1.2 ADJACENT PROPERTIES

There are several industrial developments within relatively close proximity to the site (see Figure 2). The site is bordered to the north by a railroad spur that operates between the town of

Eunice and Waste Control Specialists, LLC (WCS). WCS operates a permitted RCRA landfill and waste storage and processing facilities, and specializes in hazardous and low-level nuclear waste at their facility. The WCS facility, which is located just across the border in the State of Texas, is located within about one-half mile east/northeast of the eastern-most portion of the subject property. WCS also owns the adjacent undeveloped property to the east (Section 33), between Section 32 and the WCS facility.

The Lea County Municipal Landfill is located immediately south of State Highway 234 near the southeast corner of the subject property. With the exception of the Lea County Municipal Landfill and a few oil wells, adjacent property south of State Highway 234 is undeveloped. Although primarily undeveloped property borders the site to the west, there is a landfarm in operation within about one-half mile of the western boundary of the subject site. Though not thoroughly investigated as a part of this project, the D & D Landfarm appears to remediate soil from off-site sources that may have been affected by oil exploration processes.

There are two industrial facilities located about one-quarter mile north of the subject property. The two facilities are Wallach Gravel Quarry and Sundown. Wallach has operated a surface mining operation on their property since about the 1950's. Sundown operates an oil recovery/recycling facility which includes a sludge pond and an oil storage tank farm that is used to store oil and sludge recovered from oil exploration processes.

In addition to the active facilities located in the area of the site, an abandoned sand and gravel quarry is located to northeast of the site on WCS property and which is referred to on USGS maps as Baker Spring.

2.0 HYDROGEOLOGIC INVESTIGATION FIELD ACTIVITIES

On 25 August 2003, CJI personnel mobilized to the site to conduct field activities related to the hydrogeologic investigation. The field activities were conducted to collect data to identify and characterize the hydrogeologic conditions of the uppermost water-bearing zone beneath the site. The investigation consisted of the installation of nine borings to the top of the redbed to determine: a) the depth to the redbed, and b) if shallow groundwater is present in the overlying sand unit. Because groundwater was not located in the shallow sand unit, three additional monitor wells were installed into a silty sand unit in the redbeds at an approximate depth of 240 feet below ground level (bgl). These three monitor wells were gauged to evaluate if groundwater was present. Only one of the three wells produced groundwater. Groundwater samples were collected from this monitor well. Detailed field activities are described in Appendix B.

2.1 GENERAL GEOLOGIC CONDITIONS

Prior to initiation of the field investigation, the general hydrogeologic conditions were evaluated. The data reviewed were obtained from past investigations of the WCS property, the Lea County Landfill, and pedestrian surveys of the Wallach sand and gravel operation to the north. The area is underlain with approximately 25 to 50 feet of primarily unconsolidated sand with thin to medium lenses of gravel. Perched or localized pockets of groundwater in this unit were identified as being present to the north of the site in the Wallach mining excavation and to the east in some piezometers located on the WCS property.

The sand unit is underlain by the Triassic aged Dockum Group or redbeds. The redbed consist primarily of a clay mudstone that is interbedded with silt and sandstone zones. Laterally consistent silt and sandstone zones have been identified at depths of approximately 125 feet and 230 feet below ground level (bgl). In addition, a discontinuous silt zone at approximately 180 feet BGL has been identified in past investigations of the WCS property. Groundwater has not been identified in the 125-foot silty sandstone zone. Groundwater in the 180-foot zone is present at some locations but not continuously across the WCS property. Groundwater is present in a 230-foot zone across the entire portion of the WCS property that has been investigated.

2.2 SHALLOW SUBSURFACE INVESTIGATION

Prior to mobilizing to the site, nine proposed boring locations based on a 1,00-foot center grid pattern were overlain on an USGS-based site map (see Figure 3) and the associated coordinates for each of these boring locations was ascertained. On 25 August 2003, CJI personnel conducted a walking survey of the majority of the site while the predetermined boring locations were staked. Boring locations were located using a hand-held GPS unit. With the exception of B-1, each boring location was staked as close to the predetermined coordinates as possible. Due to the presence of sand dunes, it was necessary to field-locate B-1 about 75' northwest of its mapped location.

Nine borings, B-1 through B-9, were installed and geologically logged to the geological contact of the "redbeds". The borings were drilled using solid and hollow stem augers and the borings were geologically logged from the cuttings. The boring logs are presented in Appendix A. The borings ranged in depth from 35 feet to 60 feet. The depth and elevation of the redbed in each of the borings is shown in Table 1. Once the borings were advanced to the contact, the boreholes were then allowed to remain open for a minimum of 24 hours to determine if shallow groundwater was present.

The upper unit was typically described as a dry, red and gray, silty sand with some gravel and gravel layers present. The borings were gauged for a minimum period of 24 hours and groundwater was not identified in any of the nine borings. Following the gauging period, the borings were backfilled with cuttings from the drilling operations.

2.3 DEEP SUBSURFACE INVESTIGATION

Upon completion of the shallow subsurface investigation, an investigation of the underlying strata was conducted for the purpose of identifying the uppermost water-bearing zone at the expected depth of 230 feet bgl. This portion of the investigation consisted of the installation of three test borings to define the interval of the suspected 230-foot uppermost groundwater-bearing zone. Once the subsurface geologic data were obtained through geophysical logs, these data were used to design three monitor wells (MWs) near B-1, B-7, and B-9. A summary of the field activities is presented in Appendix B.

2.3.1 Geophysical Borings

Three test borings were drilled with air rotary method to a depth of 250 feet bgl without the collection of soil or core samples. The borings were filled with water from a supply well on the WCS property that is completed into the Santa Rosa formation of the Dockum Group. CJI personnel then geophysically logged the borings. The three test boreholes (B-3, B-7, and B-9) were logged for resistivity using a Mineral Logging Systems unit 1502-282. The geophysical logs of the three test boreholes can be found in Appendix C of this report.

The geophysical logs indicate that more resistive zones, which are indicative of zones of higher sand and silt content than the baseline clay zones, are located at approximate depths of 100 feet and 225 feet BGL in each of the three borings. A discontinuous resistive zone, at an approximate depth of 185 feet BGL, was also detected in Borings B-3 and B-9, but not in B-7.

2.3.2 Monitor Well Drilling and Installation Program

The three monitor wells were designed based on the results of the geophysical logs. The design consisted of the placement of the screened interval across the 230-foot zone that is approximately 15 feet in thickness. A sand filter pack was placed in the annular space around the screen and extended a minimum of 3 feet above the screen. Well centralizers were placed approximately every 50 feet along the well casing to prevent the well from contacting the borehole wall to ensure a proper filter pack and well seal. Above the sand filter pack, bentonite chips were placed to seal the screened interval from potential infiltration from above. The bentonite chips were placed to a depth of 75 feet bgl. A cement-bentonite grout was placed above the bentonite chip seal. Monitor Well Completion Diagrams for each of the wells are presented in Appendix D.

The wells were completed at the surface with 4-inch square steel box tubing with a lockable cap and a 4-foot square concrete pad. Cattle panels were placed around the wells to help prevent livestock from damaging the wells. A detailed summary of the monitor well drilling and construction activities is included in Appendix B.

2.4 SURVEY DATA

A survey of the locations and elevations of the 9 borings and 3 monitor wells was conducted by Pettigrew and Associates, a Registered Professional Surveyor. In addition, top-of-casing elevation and top of concrete pad elevation data were collected at each of the monitor wells. The results of these data are shown on the boring logs and the Monitor Well Construction Diagrams and a report of the survey results are presented in Appendix G. The boring and monitor well surveyed locations are shown on Figure 3.

2.5 GROUNDWATER LEVEL DATA COLLECTION

On 22 September, CJI began collecting groundwater elevation data from MW-1, MW-2, and MW-3 to evaluate groundwater recharge in the screened interval. Measurements were collected using an electric e-line that records to 0.01 foot. The results of the groundwater level data are presented on Table 2.

Groundwater was present in Monitor Well MW-2 but Monitor Wells MW-1 and MW-3 did not produce groundwater. Groundwater levels continued to recharge in MW-2 throughout the monitoring period.

Due to the lack of groundwater in Monitor Wells MW-1 and MW-3, deionized water was placed in the wells. The wells were surged in an attempt to remove any smearing of the borehole walls that might have been present and that could have prevented the well from producing groundwater. The wells were surged a total of five times over a five day period using a surge block that forced water to move back and forth through the borehole wall to remove any fines that may have caused smearing. Water levels were recorded for a three-week period after surging. The water level in MW-1 remained relatively constant and the water level in MW-3 fell during the monitoring period, which would indicate that the screened intervals in these two wells are dry.

2.6 GROUNDWATER SAMPLING

Groundwater samples were collected from Monitor Well MW-2. Lockwood Greene coordinated the delivery of the sample containers and determined the parameters to be analyzed for the sampling events. Severn Trent Laboratories (STL) and Framatome supplied the sample containers. Two groundwater sampling events were conducted. Due to the short holding times of some of the parameters, each of the sampling events was conducted over a two day period. Samples were collected on 14 October 2003 and 11 November 2003 for the containers supplied by STL. Samples were collected on 19 October 2003 and 12 November 2003 for the containers supplied by Framatome.

Because groundwater had not reached equilibrium in MW-2 prior to each sampling event, the available groundwater in the well had not stagnated and therefore purging was not conducted prior to sampling. The samples were collected using new dedicated disposable 2-inch diameter bailers. The samples were placed in the laboratory supplied containers and placed on ice for next day delivery to the laboratories. The samples were transported under standard chain-of-custody procedures. During the sampling activities, the sampling team donned latex gloves to prevent cross contamination.

3.0 DATA ANALYSIS

The data collected from the field investigation activities and from past investigations on the WCS property to the east have been used to develop a general model of the site characteristics. The model includes a top of redbed contour map, a hydraulic gradient map of groundwater in the 230-foot zone, and a hydraulic conductivity calculation of the 230-foot zone.

The top of redbed structure map is presented as Figure 4. The top of red bed represents the paleogeographic surface of this unit prior to being covered by the overburden sand and silt material that extends to the current land surface. Based on the structure map there is a northwest-southeast trending ridge in the redbed that is located to the northeast of the subject site. Along the southwest toe of this ridge appears to be a top of redbed drainage that slopes to the south. To the east of the subject site in Section 33, the redbeds generally slope towards this drainage feature. Beneath the site, the drainage feature generally slopes to the southwest corner of the property in an east to west drainage feature. This drainage feature has relief of approximately 40 feet.

A groundwater gradient map from wells completed in the 230-foot zone on the WCS site has been extended to include the groundwater elevation data from Monitor Well MW-2. The groundwater gradient map is presented as Figure 6. The gradient is shown to be in a south-southwesterly direction on the WCS site and appears to be in a south-southeasterly direction in the area of MW-2 on the LES property., The gradient in the area of MW-2 is approximately 0.011 feet per foot.

Based on recovery rates of groundwater in Monitor Well MW-2, the hydraulic conductivity of the 230-foot zone has been calculated at 3.7 x 10^{-6} cm/sec (3.8 feet/year). The hydraulic conductivity was calculated using Hvorslev's rising head slug test method. The hydraulic conductivity calculations are presented in Appendix E.

Using the calculated groundwater gradient and the hydraulic conductivity value, the groundwater velocity has been calculated to be 0.3 feet per year. The calculation of groundwater velocity is presented in Appendix F. It should be noted that the porosity value used in the calculation was developed from laboratory analysis of soil samples collected from this zone from the WCS site.

4.0 CONCLUSIONS

Based on the field activities and data collected to date, the following conclusions have been made:

- The surface soils at the site consist mainly of fine sand and silt. There are minimal amounts of gravel in certain zones but gravel is not consistently present throughout the site;

- The upper geologic contact of the redbeds, in boreholes B-1 through B-9, is found between 23' BGL and 46' BGL. The red bed surface is a paleogeographic surface that slopes towards the southwest corner of the property;

- Shallow groundwater was not detected above the redbeds in boreholes B-1 through B-9;

- The 230-zone, that is believed to correspond with the water-bearing zone that WCS is monitoring, is found to be approximately 15 feet thick and was encountered at depths ranging from 214 feet to 222 feet BGL;

- Based on interpretation of on-site and off-site data the groundwater gradient in the 230-foot zone is approximately 0.011 feet per foot to the south-southeast beneath the area of investigation;

- The hydraulic conductivity of the 230-foot zone has been calculated to be 3.7×10^{-6} cm/sec; and

- The velocity of the groundwater flow is approximately 0.3 feet per year.

TABLES

TABLE 1
SHALLOW BORHOLE SURVEY DATA
Lockwood Greene Engineering and Construction
Eunice, New Mexico

Boring	Surface Elevation (feet MSL)	Depth to Redbed (feet MSL)	Elevation at Top of Redbed (feet MSL)
B-1	3,396	55	3,341
B-2	3,402	34	3,368
B-3	3,403	23	3,380
B-4	3,401	45	3,356
B-5	3,409	43	3,366
B-6	3,415	45	3,370
B-7	3,415	26	3,389
B-8	3,423	38	3,385
B-9	3,421	46	3,375

TABLE 2
GROUNDWATER LEVEL DATA
Lockwood Greene Engineering and Construction
Eunice, New Mexico

Monitor Well MW-1	
DATE	DTW TOC
9/22/03	dry
9/23/03	dry
9/24/03	dry
9/25/03	dry
9/26/03	dry
9/29/03	dry
9/30/03	dry
10/1/03	dry
10/2/03	dry
10/3/03	dry
10/6/03	dry
10/7/03	dry
10/8/03	dry
10/9/03	dry
10/10/03	dry
10/13/03	dry
10/14/03	dry
10/15/03	dry
10/16/03	212.1
10/17/03	215.02
10/18/03	215.03
10/19/03	214.56
10/20/03	214.52
10/22/03	214.43
10/24/03	214.32
10/27/03	214.35
11/4/03	214.37
11/7/03	214.4
11/10/03	214.36
11/11/03	N/A
11/12/03	N/A

Monitor Well MW-2	
DATE	DTW TOC
9/22/03	190.78
9/23/03	165.04
9/24/03	153.85
9/25/03	149.68
9/26/03	148.67
9/29/03	138.71
9/30/03	135.11
10/1/03	164.07
10/2/03	149.14
10/3/03	142.58
10/6/03	145.03
10/7/03	138.11
10/8/03	140.64
10/9/03	136.9
10/10/03	133.68
10/13/03	N/A
10/14/03	140.53
10/15/03	165.48
10/16/03	148.52
10/17/03	141.86
10/18/03	N/A
10/19/03	133.55
10/20/03	147.56
10/22/03	130.79
10/24/03	125.54
10/27/03	120.33
11/4/03	115.84
11/7/03	115.02
11/10/03	114.91
11/11/03	114.24
11/12/03	121.82

Monitor Well MW-3	
DATE	DTW TOC
9/22/03	dry
9/23/03	dry
9/24/03	dry
9/25/03	dry
9/26/03	dry
9/29/03	dry
9/30/03	dry
10/1/03	dry
10/2/03	dry
10/3/03	dry
10/6/03	dry
10/7/03	dry
10/8/03	dry
10/9/03	dry
10/10/03	dry
10/13/03	dry
10/14/03	dry
10/15/03	dry
10/16/03	220.36
10/17/03	224.37
10/18/03	224.58
10/19/03	224.73
10/20/03	224.79
10/22/03	224.98
10/24/03	225.23
10/27/03	225.5
11/4/03	228.14
11/7/03	228.31
11/10/03	226.58
11/11/03	N/A
11/12/03	N/A

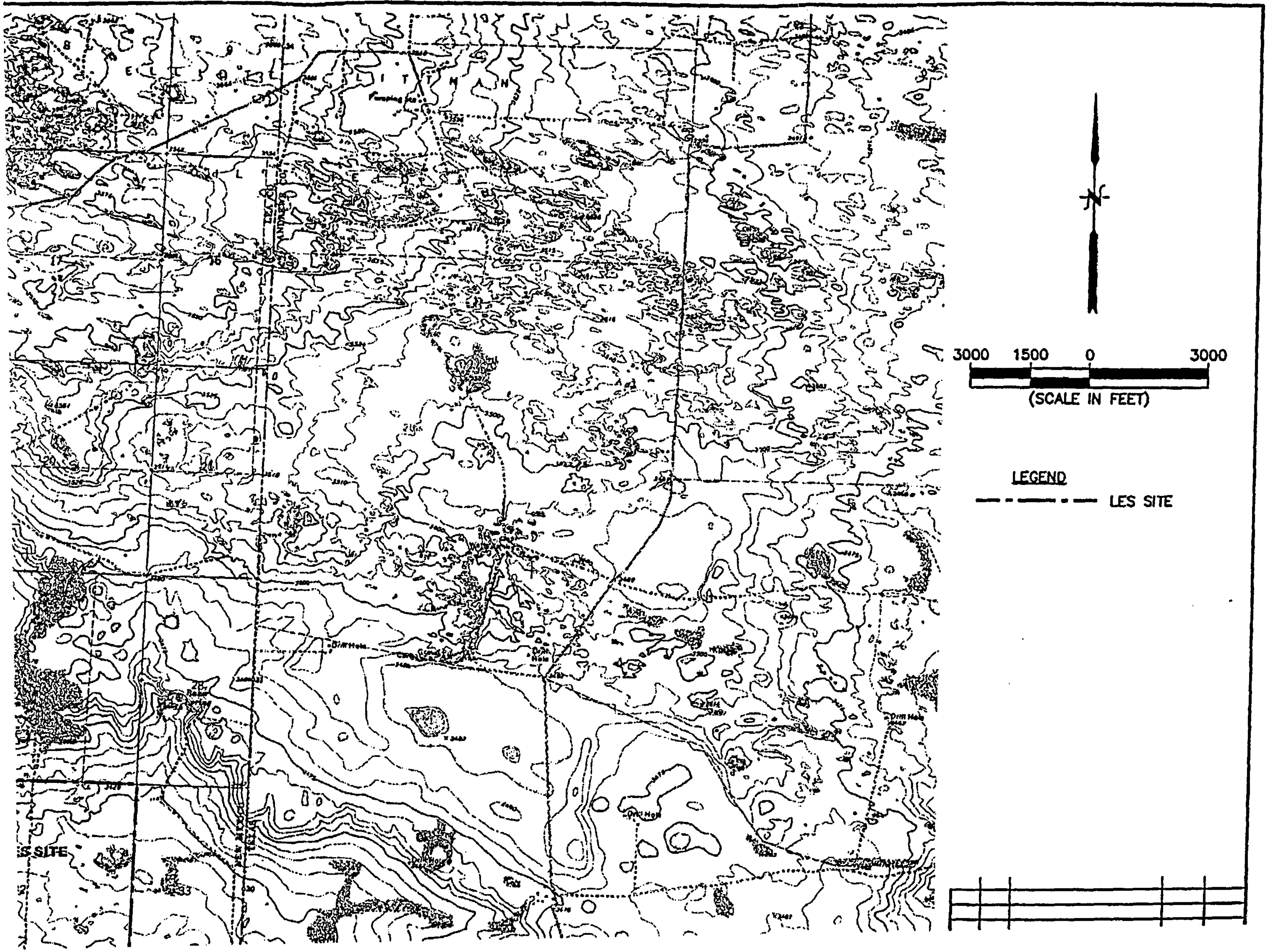
DTWTOC - Depth to water from top of casing.

Monitor Well MW-2 was developed on 9/30, 10/2, 10/7, 10/8, and 10/10.

Groundwater samples were collected from MW-2 on 10/14, 10/15, 10/19, 11/11, and 11/12.

Monitor Wells MW-1 and MW-3 were surged five times using 12 to 13 gallons of DI water from 10/16 - 10/20.

FIGURES

LITTMAN
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Drill Hole
TEXAS
NEW MEXICO
LES SITE
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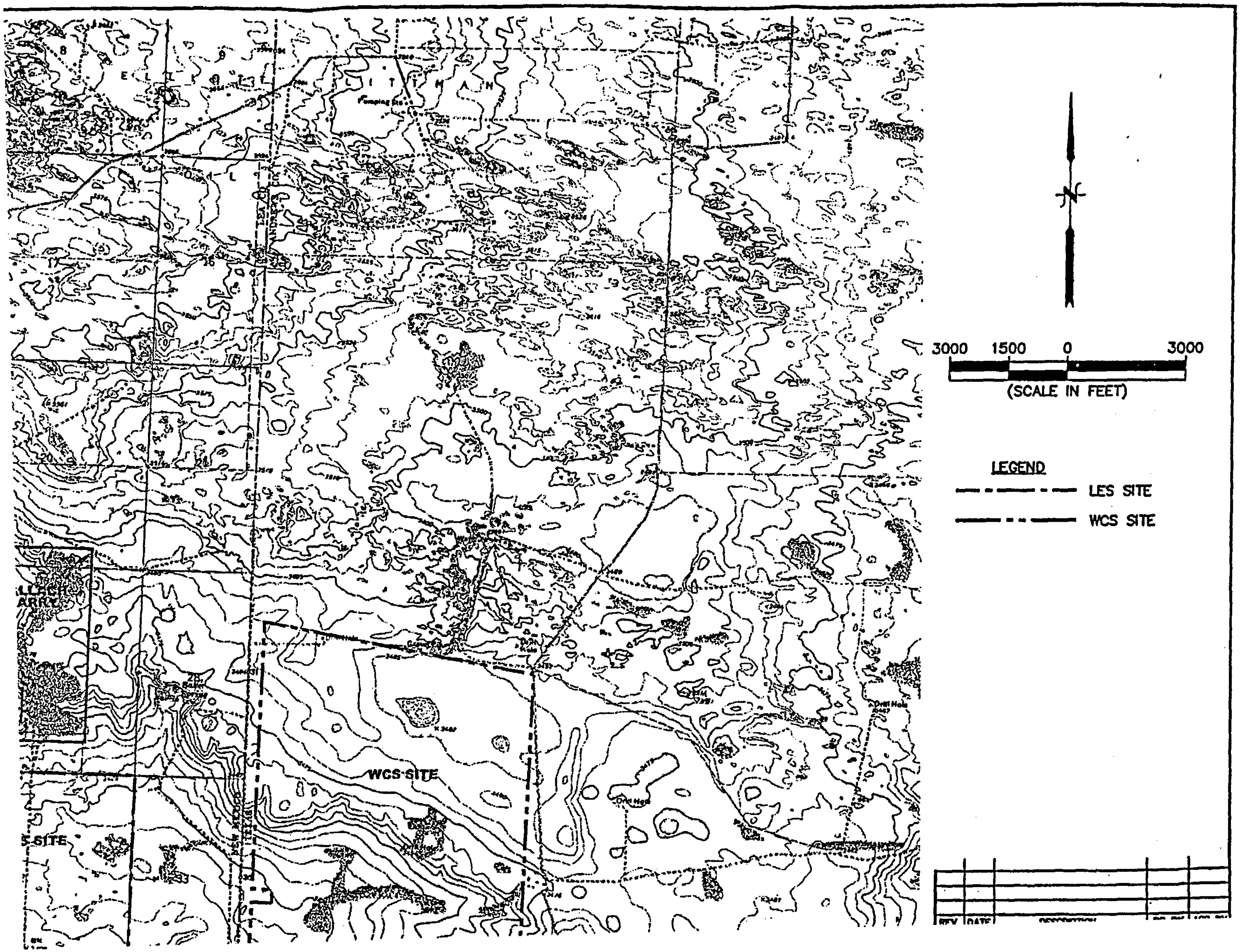
3000 1500 0 3000
(SCALE IN FEET)
LEGEND
— - — - — LES SITE



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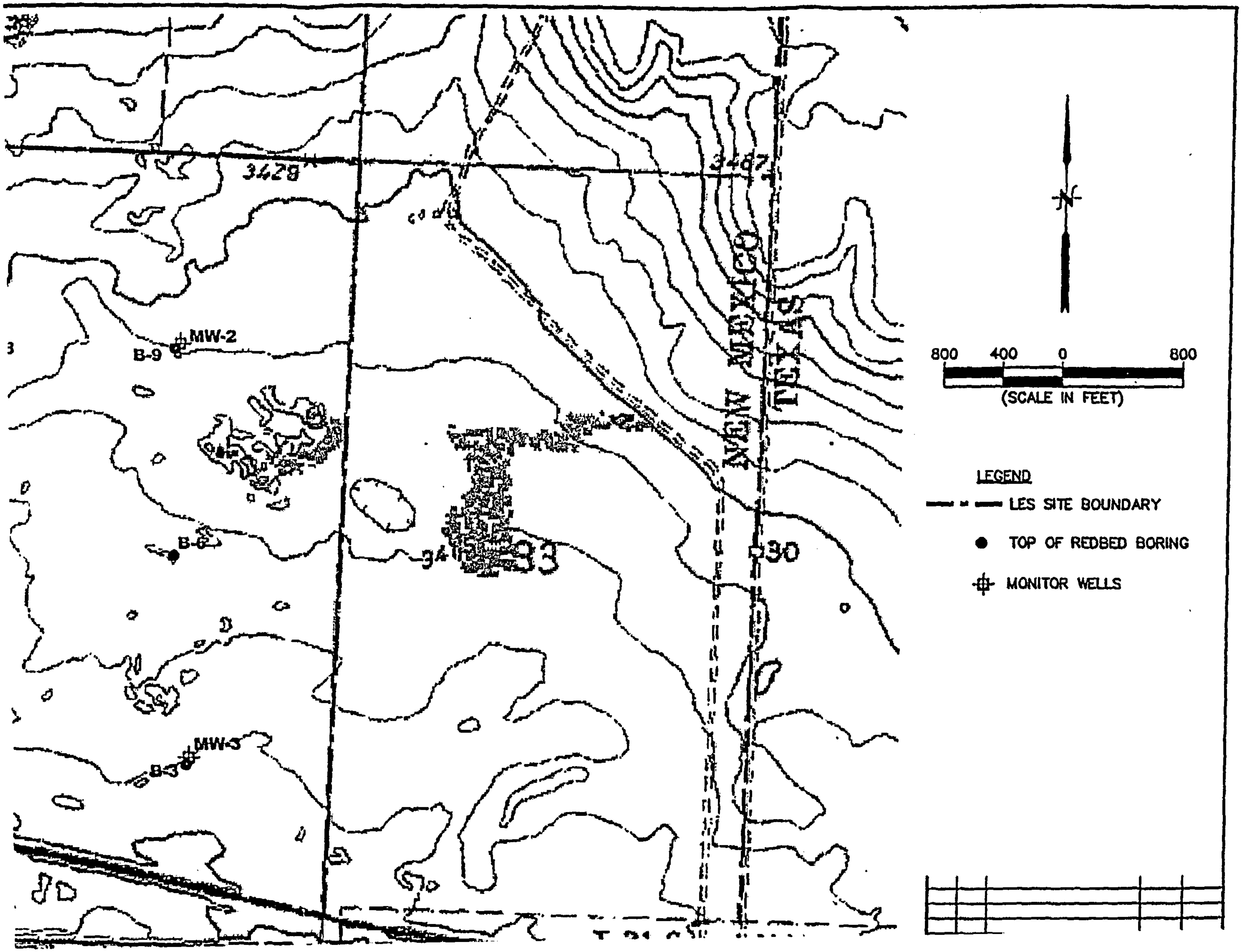
DATE
DESCRIPTION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MW-2
B-9
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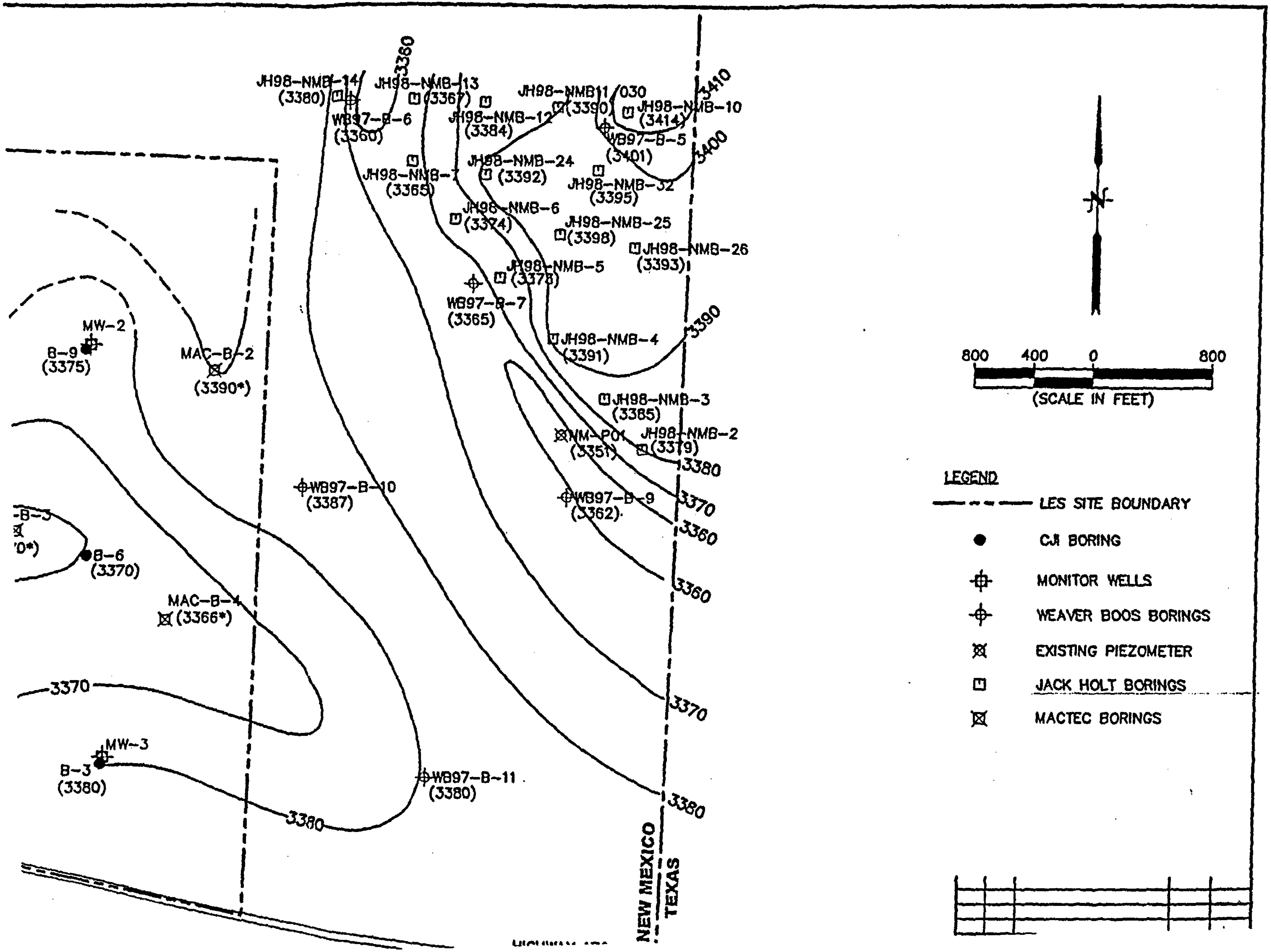
MONITOR WELLS
B-6
34
33
30
MW-3
B-3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(3393)
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(3378)
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(3365)
JH98-NMB-4
(3391)
3390
MW-2
B-9
(3375)
MAC-B-2
(3390*)
JH98-NMB-3
(3385)
NM-P01
(3351)
JH98-NMB-2
(3379)
3380
WB97-B-10
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WB97-B-9
(3362)
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MAC-B-4
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3370
3370
MW-3
B-3
(3380)
WB97-B-11
(3380)
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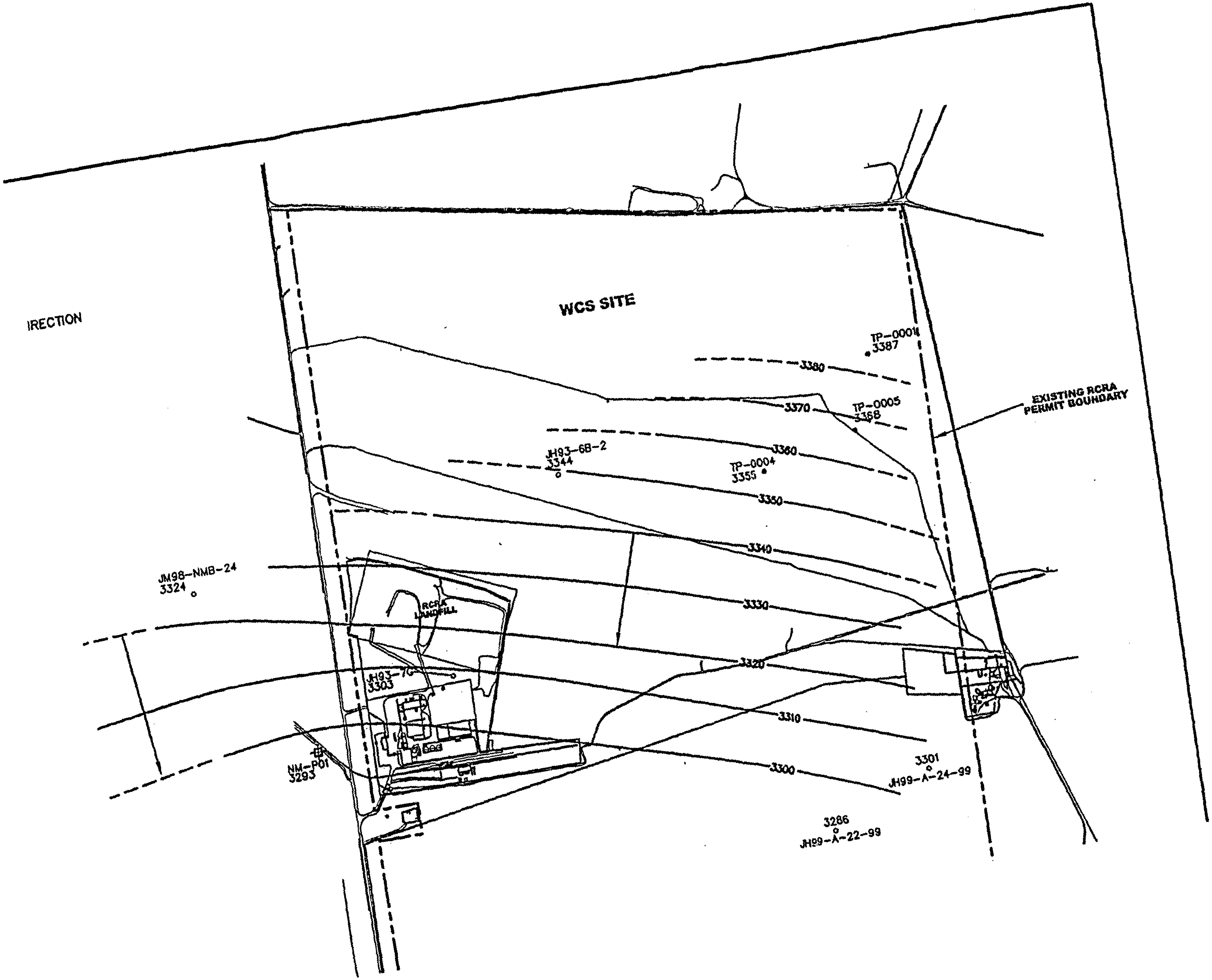
3380
NEW MEXICO
TEXAS
N
800
400
0
800
(SCALE IN FEET)
LEGEND
LES SITE BOUNDARY
CJI BORING
MONITOR WELLS
WEAVER BOOS BORINGS
EXISTING PIEZOMETER
JACK HOLT BORINGS
MACTEC BORINGS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TP-0004
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3350
3340
JM98-NMB-24
3324
RCRA LANDFILL
3330
3320
JH93-7C
3303
3310
NM-P01
3293
3300
3301
JH99-A-24-99
3286
JH99-A-22-99

APPENDIX A

LITHOLOGIC LOGS

LOG OF BORING NO. B-1

Lockwood Greene Engineering and Construction

TYPE: 6" Flight Augers

LOCATION: Eunice, N.M.

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH				
				N 522,969.2 E 925,623.0 El 3396.49					
				Fine sand with silt - very loose, very dry, red, (SM).					
5									
10									
15				Fine sand with silt and gravel (< 1/2" Dia.) - very dry, red and gray, (SW).	3381.5 15.0				
20									
25									
30				Fine sand with silt and gravel (< 1-1/2" Dia) - very dry, gray and red, (SW).					
35									
40				Fine sand with silt and abundant gravel (< 1-1/2" Dia.) - very dry, red, (SW).					
45									
50									
55				Top of red bed, silty clay - very dry, red, (CL).	3341.5 55.0				
60				TD-60'	3336.5 60.0				

COMPLETION DEPTH: 60.0'

DATE: 8-28-03 PROJECT NO.: 03070

GEOT2 03070 11-17-03

COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH
AUSTIN, TEXAS 78701-2000
(512)474-9097 FAX (512)474-8463

Sheet 1 of 1

LOG OF BORING NO. B-2

Lockwood Greene Engineering and Construction

TYPE: 8" Hollow-Stems

LOCATION: Eunice, N.M.

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION	LAYER ELEV./DEPTH
				N 522,906.4 E 927,284.7 El 3402.31	
0	░			Fine sand with silt and gravel (< 1/2" Dia.) - very loose, very dry, tan, (SW).	
5	░			Fine sand with silt and gravel (< 1/2" Dia.) - very loose, very dry, red, (SW).	
10	░				
15	░			Fine sand with silt and gravel (< 1/2" Dia.) - very dry, gray and red, (SW). Gravel layer from 15.5' - 16.5'	
20	░				
25	░				
30	░				3368.3 34.0
35	▨			Top of red bed, silty clay - very dry, red, some chert present, (CL).	3362.3 40.0
40				TD=40'	

GEOTR2 03070 11-17-03

COMPLETION DEPTH: 40.0'

DATE: 8-27-03

PROJECT NO.: 03070

Sheet 1 of 1

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LOG OF BORING NO. B-3

Lockwood Greene Engineering and Construction

TYPE: 6" Flight Augers

LOCATION: Eunice, N.M.

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION N 522,942.0 E 928,870.2 El 3403.38	LAYER ELEV./ DEPTH
5				Fine sand with silt - very loose, very dry, red, (SM).	3396.4 7.0
10 15 20				Fine sand with silt and gravel (< 1/4" Dia.) - very dry, gray, (SW). Fine sand with silt and gravel (< 1/2" Dia.) - very dry, gray and red, some chert present, (SW).	3380.4 23.0
25 30 35				Top of red bed, silty clay - very dry, red, (CL).	3368.4 35.0
				TD=35'	

COMPLETION DEPTH: 35.0'

DATE: 8-28-03

PROJECT NO.: 03070

GEOTT2 03070 11-17-03

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Sheet 1 of 1

LOG OF BORING NO. B-4

Lockwood Greene Engineering and Construction

TYPE: 6" Flight Augers

LOCATION: Eunice, N.M.

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION N 524,233.0 E 925,711.8 El 3400.66	LAYER ELEV./ DEPTH				
5 10 15 20	▥			Fine sand with silt - very loose, very dry, gray and red, (SM).	3379.7 21.0				
25 30 35 40 45	░			Fine sand with silt and gravel (<1" Dia.) - very dry, red and gray, (SW). Fine sand with silt and gravel (<1" Dia.) - very dry, gray and red, (SW).	3355.7 45.0				
50 55 60	▨			Top of red bed, silty clay - very dry, red, (CL).	3340.7 60.0				
				TD=60'					

COMPLETION DEPTH: 60.0'

DATE: 8-28-03 PROJECT NO.: 03070

GEOTZ 03070 11-19-03

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Sheet 1 of 1

LOG OF BORING NO. B-5

Lockwood Greene Engineering and Construction

TYPE: 0-40' Hollow-Stems 40-45' Air Rotary

LOCATION: Eunice, N.M.

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION N 524,274.0 E 927,281.5 El 3408.85	LAYER ELEV./ DEPTH				
				Fine sand with silt - very loose, very dry, red, (SM).					
5									
10				Fine sand with silt - very dry, red and gray, caliche present, (SM).					
15									
20									
25									
30				Fine sand with silt and gravel (< 1/2" Dia.) - very dry, gray and red, (SW). 6" gravel layer from 32'-32.5'.	3378.9 30.0				
35				3" gravel layer					
40									
				Top of red bed, silty clay - very dry, red, (CL).	3365.9 43.0				
45				TD=45'	3363.9 45.0				

COMPLETION DEPTH: 45.0'

DATE: 8-27-03

PROJECT NO.: 03070

GEOTZ 03070 11-17-03

Sheet 1 of 1

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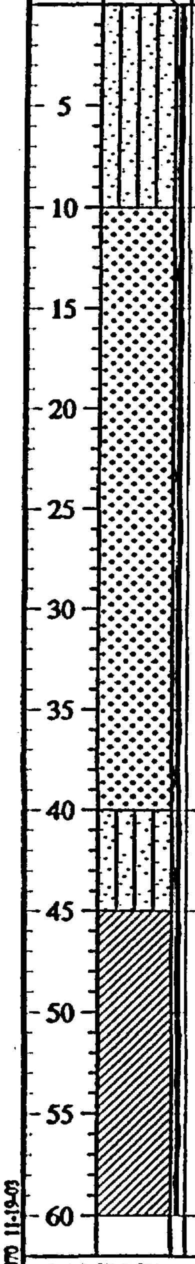
LOG OF BORING NO. B-6

Lockwood Greene Engineering and Construction

TYPE: 6" Flight Augers

LOCATION: Eunice, N.M.

N 524,346.4 E 928,685.6 El 3414.75



DEPTH, FT	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH
0		Fine sand with silt - very loose,very dry,red, (SM).	
		Fine sand with silt - very dry, red and gray, (SM).	3404.8 10.0
10		Fine sand with silt and gravel (<1/4" Dia.) - very dry, gray, (SW).	
		Fine sand with silt and gravel (<1/2" Dia.) - very dry, gray, (SW).	3374.8 40.0
40		Fine sand with silt - very dry, red and gray, (SM).	3369.8 45.0
45		Top of red bed, silty clay - very dry, red, (CL).	3354.8 60.0
60		TD=60'	

COMPLETION DEPTH: 60.0'

DATE: 8-28-03

PROJECT NO.: 03070

GEOTE2 03070 11-19-03

Sheet 1 of 1

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812 WEST ELEVENTH
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LOG OF BORING NO. B-7

Lockwood Greene Engineering and Construction

TYPE: 6" Flight Augers

LOCATION: Eunice, N.M.

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH
				N 525,545.0 E 925,661.4 El 3415.00	
				Fine sand with silt - very loose, very dry, red, (SM).	
5					
10				Fine sand with silt - very dry, red and gray, (SM).	
15					
20					
				Fine sand with silt and gravel (<1" Dia.) - very dry, gray and red, (SW).	3392.0 23.0
25					
				Top of red bed, silty clay - very dry, red, (CL).	3389.0 26.0
30					
35					
40				TD=40'	3375.0 40.0

COMPLETION DEPTH: 40.0'

DATE: 8-28-03

PROJECT NO.: 03070

GEOT2 03070 11-17-03

Sheet 1 of 1

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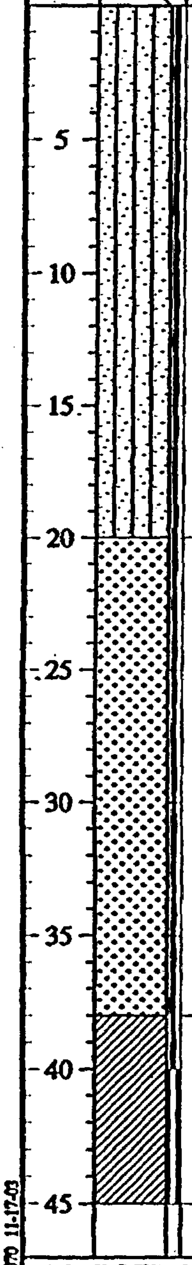
LOG OF BORING NO. B-8

Lockwood Greene Engineering and Construction

TYPE: Hollow-Stem Augers 0-40', 40-45' Air Rotary

LOCATION: Eunice, N.M.



BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH
	N 525,604.7 E 927,274.2 El 3423.29	
	Fine sand with silt - very loose, very dry, red, (SM).	3403.3 20.0
	Fine sand with silt and gravel (<1" Dia.) - very dry, caliche and chert present, red, gray, and tan, (SW).	3385.3 38.0
	Top of red bed, silty clay - very dry, red, (CL).	3378.3 45.0
	TD-45'	

COMPLETION DEPTH: 45.0'

DATE: 8-26-03

PROJECT NO.: 03070

GEOTE2 03070 11-17-03

Sheet 1 of 1

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LOG OF BORING NO. B-9

Lockwood Greene Engineering and Construction

TYPE: 6" Flight Augers

LOCATION: Eunice, N.M.

DEPTH, FT	SYMBOL	SAMPLES	BLOWS PER FOOT OR REC/(RQD), %	STRATUM DESCRIPTION N 525,735.9 E 928,595.5 El 3421.33	LAYER ELEV./ DEPTH
0–6				Fine sand with silt - very loose, very dry, red, (SM).	3415.3 6.0
6–14				Fine sand with silt and gravel (<1/2" Dia.) - very loose, slightly moist, (SW).	3407.3 14.0
14–46				Fine sand with silt - very dry, red and gray, (SM). Fine sand with silt - very dry, gray, (SM). Fine sand with silt - very dry, red and gray, (SM).	3375.3 46.0
46–60				Top of red bed, silty clay - very dry, red, (CL).	3361.3 60.0
				TD=60'	

COMPLETION DEPTH: 60.0'

DATE: 8-28-03

PROJECT NO.: 03070

GEOT2 03070 11-17-03

Sheet 1 of 1

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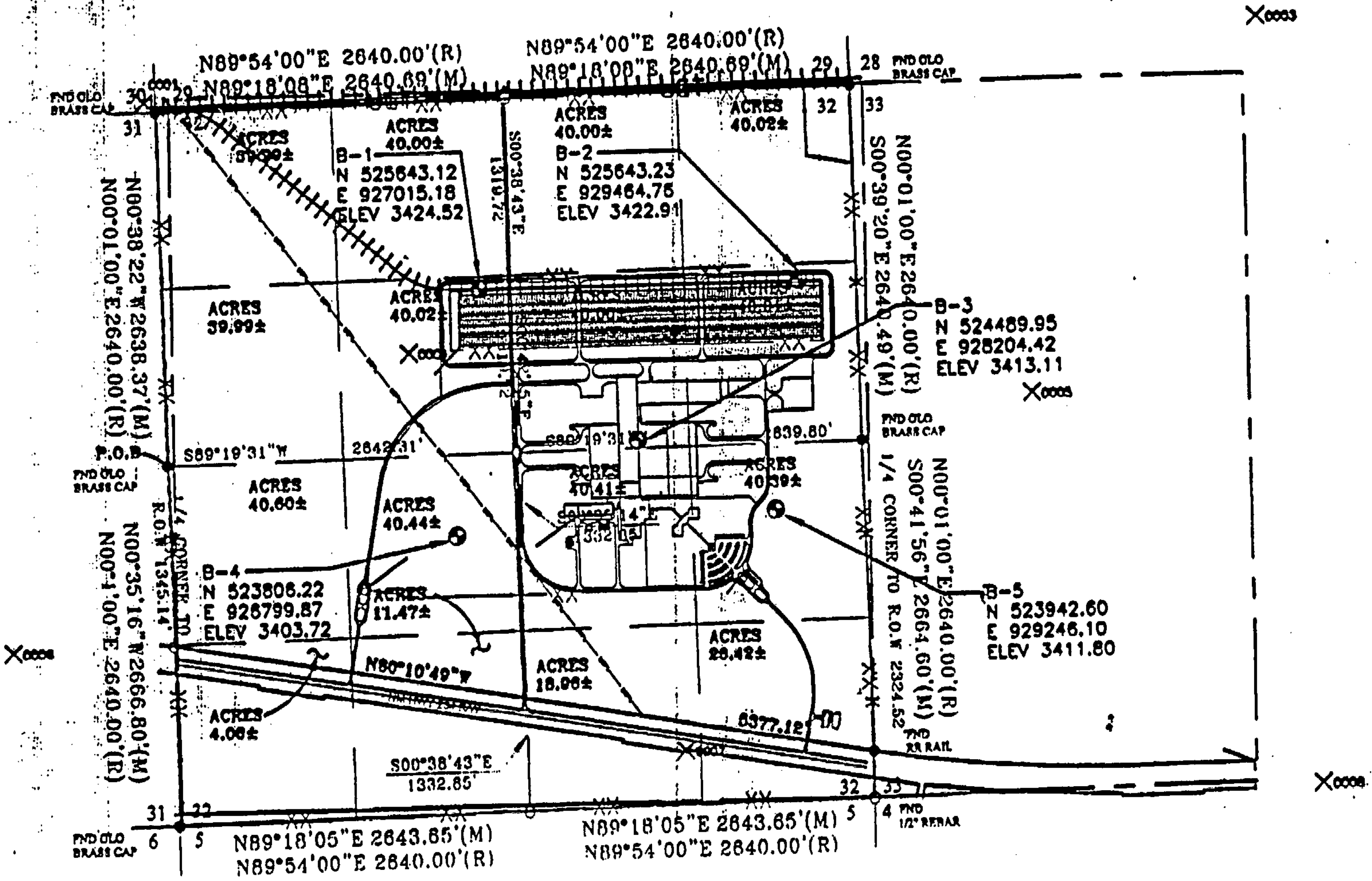

SOURCE: THIS DRAWING WAS ADAPTED FROM A CONCEPTUAL SITE PLAN SOIL BORING LAYOUT DATED SEPTEMBER 2, 2003 AND PROVIDED BY LOCKWOOD GREENE

LEGEND

B-1 ● BORING LOCATION AND IDENTIFICATION

MACTEC

MACTEC Engineering and Consulting, Inc.
1725 Louisville Drive
Knoxville, Tennessee 37921-5904
865-588-8544 • Fax: 865-588-8026

FIGURE 2: BORING LOCATION PLAN NATIONAL ENRICHMENT FACILITY LEA COUNTY, NEW MEXICO

DRAFTING BY:	PREPARED BY: MBH	CHECKED BY: JWS
JOB NUMBER: 3043031049/0001	DATE: OCTOBER 2, 2003	SCALE: 0 1000'

KEY TO SYMBOLS AND DESCRIPTIONS

GROUP SYMBOLS	TYPICAL NAMES	GROUP SYMBOLS	TYPICAL NAMES
▩	**TOPSOIL**	░	**CONCRETE**
■	**ASPHALT**	▤	**DOLOMITE**
▬	**GRAVEL**	▦	**LIMESTONE**
▧	**FILL**	▤	**SHALE**
▦	**SUBSOIL**	▤	**LIMESTONE/SHALE** - Limestone with shale interbeds
▤	**ALLUVIUM**	▒	**SANDSTONE**
▤	**COLLUVIUM**	▥	**SILTSTONE**
░	**RESIDUUM** - Soft to firm	▯	**AUGER BORING**
▨	**RESIDUUM** - Stiff to very hard	▮▮	**UNDISTURBED SAMPLE ATTEMPT**

■	Undisturbed Sample 1.5-2.0 = Recovered (ft) / Pushed (ft)		
▒	Split Spoon Sample	■	Auger Cuttings
▯	Rock Core 60-100 = RQD / Recovery	▩	Dilatometer
	No Sample	▧	Crandall Sampler
│	Rotary Drill	▒	Pressure Meter
▽	Water Table at time of drilling	○	No Recovery
		▼	Water Table after 24 hours

Correlation of Penetration Resistance with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 20	Firm	5 - 8	Firm
21 - 30	Very Firm	9 - 15	Stiff
31 - 50	Dense	16 - 30	Very Stiff
Over 50	Very Dense	31 - 50	Hard
		Over 50	Very Hard

<u>BOUNDARY CLASSIFICATIONS:</u> Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

<u>Reference:</u> The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vol. 1, March, 1953 (Revised April, 1960)

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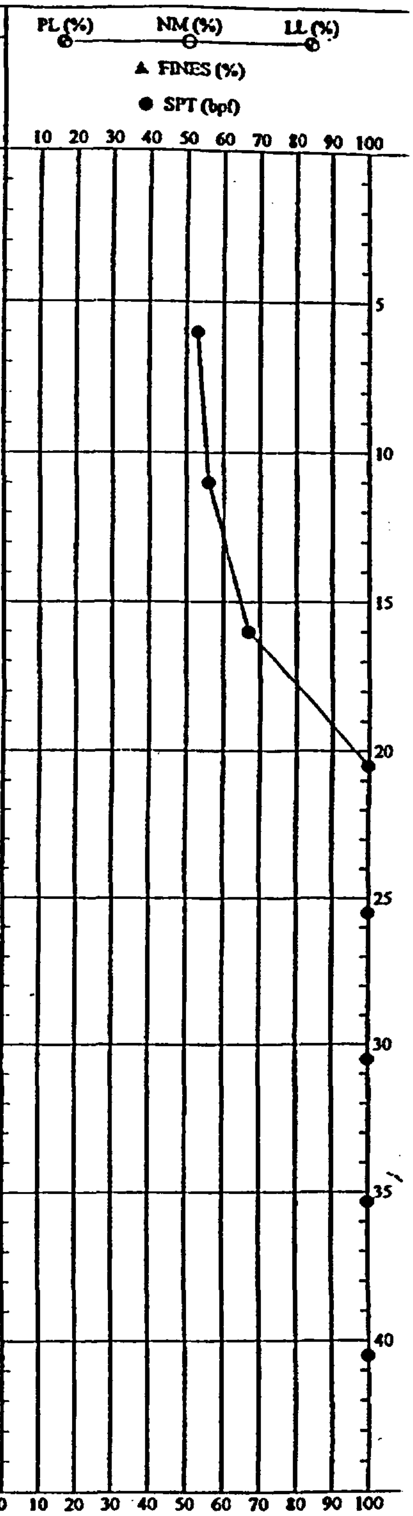
1725 Louisville Drive
Knoxville, Tennessee 37921-5904
865-588-8544 • Fax: 865-588-8026

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)	SAMPLES IDENT	SAMPLES N-COUNT 1st 6" 2nd 6" 3rd 6"
0	REDDISH BROWN, DRY, SILTY FINE SAND WITH SOME FINE ROOTS - EOLIAN	3423.4		
	VERY DENSE, REDDISH BROWN, DRY, SILTY FINE TO MEDIUM SAND			
5		3418.4	SPT-1	15-25-28
10		3413.4	SPT-2	21-30-26
15	VERY DENSE, DARK RED, DRY, FINE TO MEDIUM SILTY FINE TO MEDIUM SAND WITH CLASTS OF CEMENTED SAND	3408.4	SPT-3	15-30-37
20	VERY DENSE, LIGHT REDDISH YELLOW, DRY, SILTY FINE TO MEDIUM SAND WITH CLASTS OF CEMENTED SAND	3403.4	SPT-4	50/6"
			UD-1	1.0-2.0
25		3398.4	SPT-5	50/6"
30		3393.4	SPT-6	50/6"
35	VERY DENSE, LIGHT REDDISH YELLOW, SILTY FINE TO COARSE SAND WITH SOME SUBANGULAR TO ROUNDED FINE GRAVEL	3388.4	SPT-7	50/4"
40	VERY HARD, DARK RED, DRY, HIGH PLASTICITY CLAY BORING TERMINATED 40.5'	3383.4	SPT-8	50/6"
45		3378.4		



SOIL 3043031049 01.GPJ LAW GTBB.GDT 10/3/03

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/9/2003.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

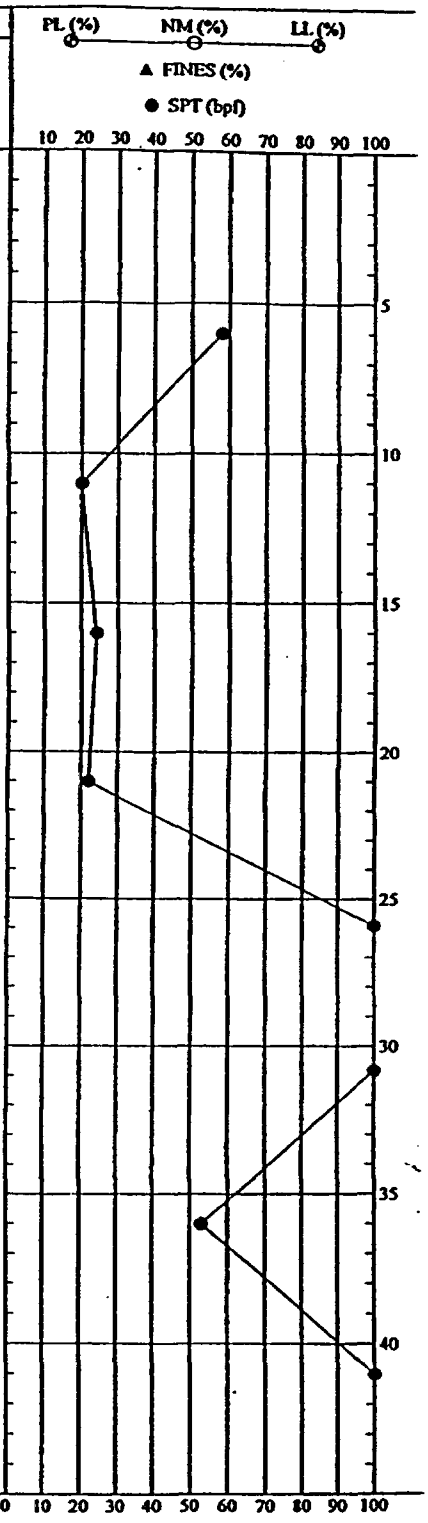
PROJECT: NEF - Lea County, New Mexico

DRILLED: September 9, 2003 **BORING NO.:** B-

PROJ. NO.: 3043031049/0001 **PAGE** 1 OF

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
0	REDDISH BROWN, DRY, SILTY, FINE SAND WITH SOME FINE ROOTS - EOLIAN		3422.2			
	VERY DENSE, LIGHT YELLOW, DRY, FINE SILTY SAND WITH CLASTS OF CEMENTED SAND - CALICHE FROM 6.0' - 7.5'					
5			3417.2			
				SPT-1		13-29-29
10	FIRM TO VERY FIRM, LIGHT YELLOW, DRY, SILTY FINE TO MEDIUM SAND		3412.2			
				SPT-3		11-10-10
15			3407.2			
				SPT-4		9-12-12
20	VERY FIRM TO VERY DENSE, LIGHT YELLOW, SILTY FINE TO MEDIUM SAND WITH CLASTS OF CEMENTED SAND FROM 25.0' TO 35.0'		3402.2			
				SPT-5		13-10-12
25			3397.2			
				SPT-6		15-50/5"
30			3392.2			
				SPT-7		50/1"
35	VERY HARD, DARK RED AND PURPLE, MOIST, HIGH PLASTICITY CLAY		3387.2			
				SPT-8		14-23-30
40			3382.2			
				SPT-9		12-33-50/5"
	BORING TERMINATED AT 41.4'					
45			3377.2			



SOIL 3043031049_01.GPJ LAW_GIBB.GDT 10/3/03

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SOIL TEST BORING RECORD

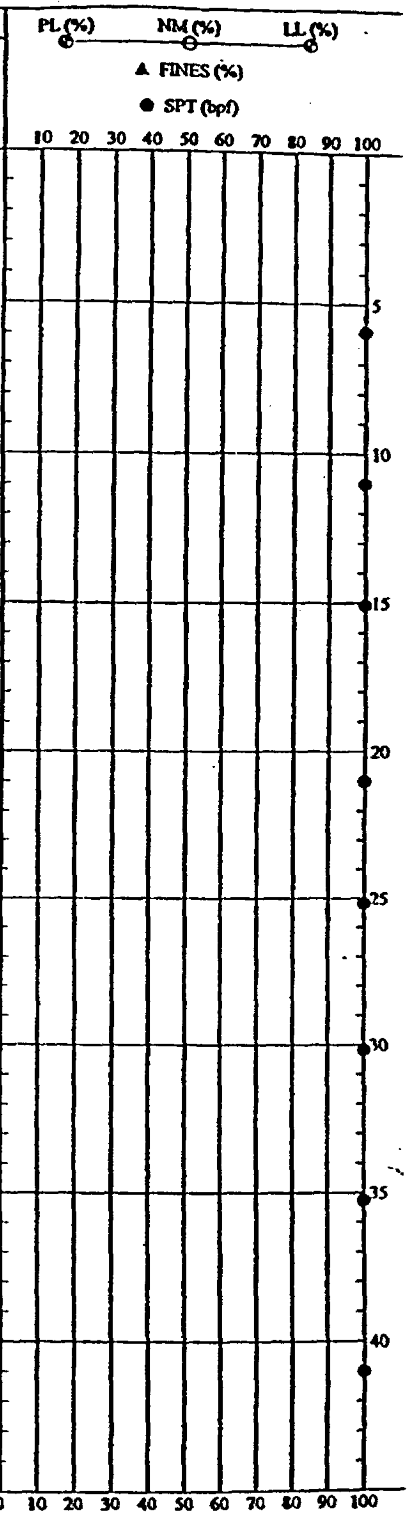
PROJECT: NEF - Lea County, New Mexico

DRILLED: September 9, 2003 **BORING NO.:** B-2

PROJ. NO.: 3043031049/0001 **PAGE** 1 **OF** 1

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	ELEV (ft)	SAMPLES IDENT	SAMPLES N-COUNT (1st 6" 2nd 6" 3rd 6")
0	REDDISH BROWN, DRY, SILTY FINE SANDY WITH SOME ROOTS - EOLIAN	3412.5		
	VERY DENSE, REDDISH BROWN, DRY, SILTY FINE TO MEDIUM SAND WITH CLASTS OF CEMENTED SAND			
5		3407.5	SPT-1	30-50/5"
10		3402.5	SPT-2	33-50/6"
15	VERY DENSE, LIGHT YELLOW, DRY SILTY FINE TO MEDIUM SAND - CALICHE	3397.5	SPT-3	50/1"
20	VERY DENSE, REDDISH YELLOW, DRY SILTY FINE TO MEDIUM SAND WITH CLASTS OF CEMENTED SAND AND SOME FINE SUBANGULAR TO ROUNDED GRAVEL	3392.5	SPT-4	22-40-50/3"
25	VERY DENSE, LIGHT YELLOW, DRY SILTY FINE TO MEDIUM CEMENTED SAND - CALICHE	3387.5	SPT-5	50/2"
30		3382.5	SPT-6	50/2"
35	VERY DENSE, REDDISH BROWN, DRY, SILTY FINE TO MEDIUM SAND	3377.5	SPT-7	50/3"
40	VERY HARD, DARK RED, DRY, HIGH PLASTICITY CLAY	3372.5	SPT-8	23-50/6"
45		3367.5		



SOIL 3043031049 01.GPJ LAW_GIBB.GDT 10/3/03

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/10/2003.

SOIL TEST BORING RECORD

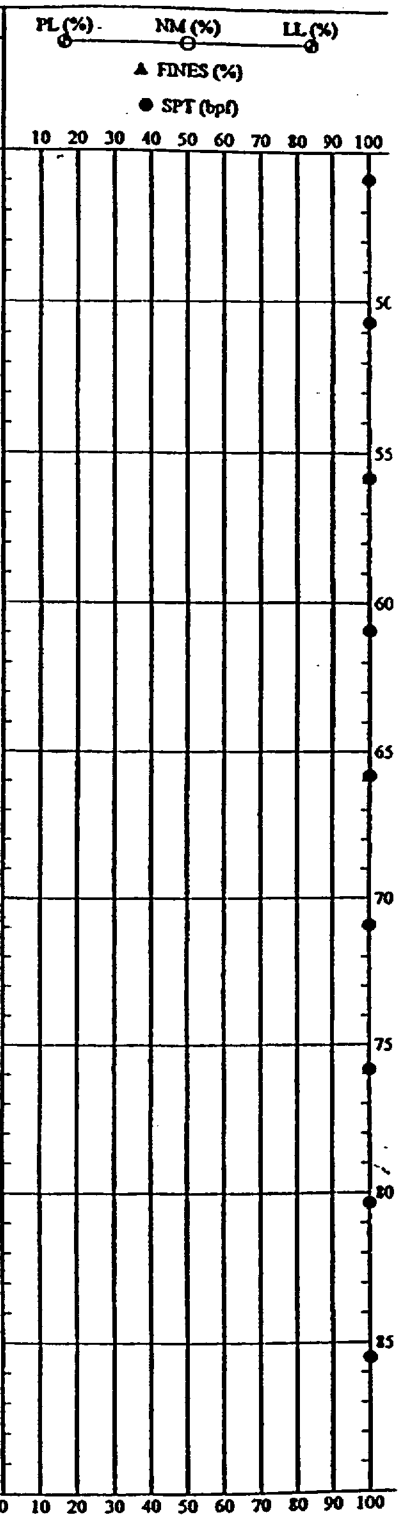
PROJECT: NEF - Lea County, New Mexico

DRILLED: September 10, 2003 **BORING NO.:** B-

PROJ. NO.: 3043031049/0001 **PAGE** 1 **OF**

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
45	VERY HARD, DARK RED, DRY, HIGH PLASTICITY CLAY	▨	3367.5	SPT-9		27-50/5"
50			3362.5	SPT-10		39-50/2"
55	VERY HARD, DARK RED AND PURPLE, DRY, HIGH PLASTICITY CLAY	▨	3357.5	SPT-11		35-50/4"
60			3352.5	SPT-12		31-50/5"
65			3347.5	SPT-13		32-50/4"
70			3342.5	SPT-14		22-50/5"
75			3337.5	SPT-15		39-50/4"
80	VERY HARD, DARK RED AND PURPLE, DRY, HIGH PLASTICITY CLAY WITH OCCASIONAL THIN CEMENTED LAYERS OF GREENISH GRAY	▨	3332.5	SPT-16		50/4"
85	VERY HARD, REDDISH PURPLE WITH GRAY MOTTLING, DRY HIGH PLASTICITY CLAY	▨	3327.5	SPT-17		50/6"
90			3322.5			



REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/10/2003.

SOIL TEST BORING RECORD

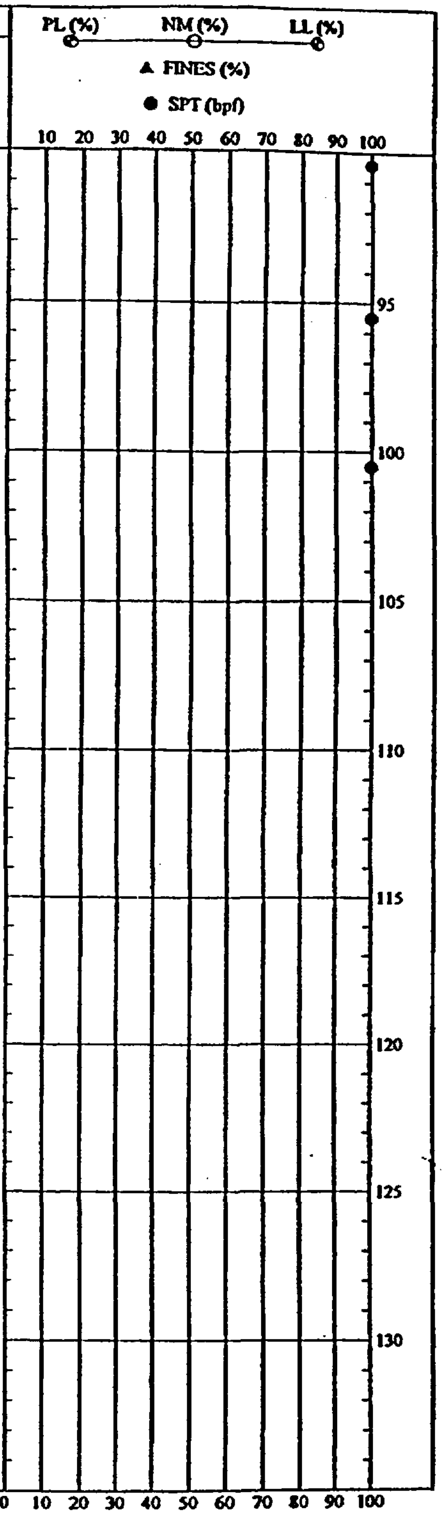
PROJECT: NEF - Lea County, New Mexico

DRILLED: September 10, 2003 **BORING NO.:** B

PROJ. NO.: 3043031049/0001 **PAGE** 2 **OF**

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
90	VERY HARD, RED AND PURPLE, DRY, HIGH PLASTICITY CLAY	▨	3322.5	SPT-18	▤	50/5"
95		▨	3317.5	SPT-19	▤	50/6"
100		▨	3312.5	SPT-20	▤	50/6"
	BORING TERMINATED AT 100.5'					
105			3307.5			
110			3302.5			
115			3297.5			
120			3292.5			
125			3287.5			
130			3282.5			
135			3277.5			



REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/10/2003.

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SOIL TEST BORING RECORD

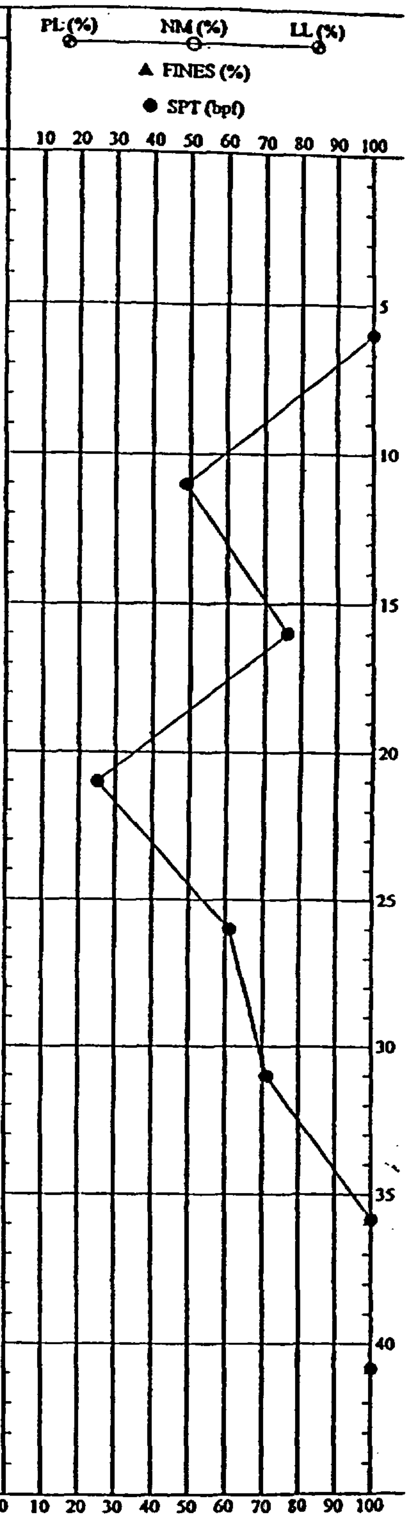
PROJECT: NEF - Lea County, New Mexico

DRILLED: September 10, 2003 **BORING NO.:** B-3

PROJ. NO.: 3043031049/0001 **PAGE 3 OF 3**

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
0	REDDISH BROWN, DRY, SILTY FINE SAND WITH SOME ROOTS - EOLIAN VERY DENSE, REDDISH BROWN, DRY, SILTY FINE SAND	3403.5			
5		3398.5	SPT-1	▨	26-50/6"
10	DENSE TO VERY DENSE, LIGHT RED, DRY, SILTY FINE TO MEDIUM SAND WITH CLASTS OF CEMENTED SAND	3393.5	SPT-2	▨	17-26-23
15		3388.5	SPT-3	▨	20-39-37
20	VERY FIRM TO VERY DENSE, LIGHT RED, DRY, SILTY FINE SAND WITH CEMENTED ZONES FROM 25.0' TO 30.0'	3383.5	SPT-4	▨	7-13-12
			UD-2	■	1.0-2.0
25		3378.5	SPT-5	▨	16-34-27
30	VERY DENSE, LIGHT REDDISH BROWN, DRY FINE SILTY FINE TO MEDIUM SAND	3373.5	SPT-6	▨	16-30-41
35		3368.5	SPT-7	▨	39-50/4"
40	VERY HARD, DARK RED, DRY, HIGH PLASTICITY CLAY BORING TERMINATED AT 40.8'	3363.5	SPT-8	▨	35-50/4"
45		3358.5			



SOIL 3043031049 01.GPJ LAW GIBB.GDT 10/3/03

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/9/2003.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

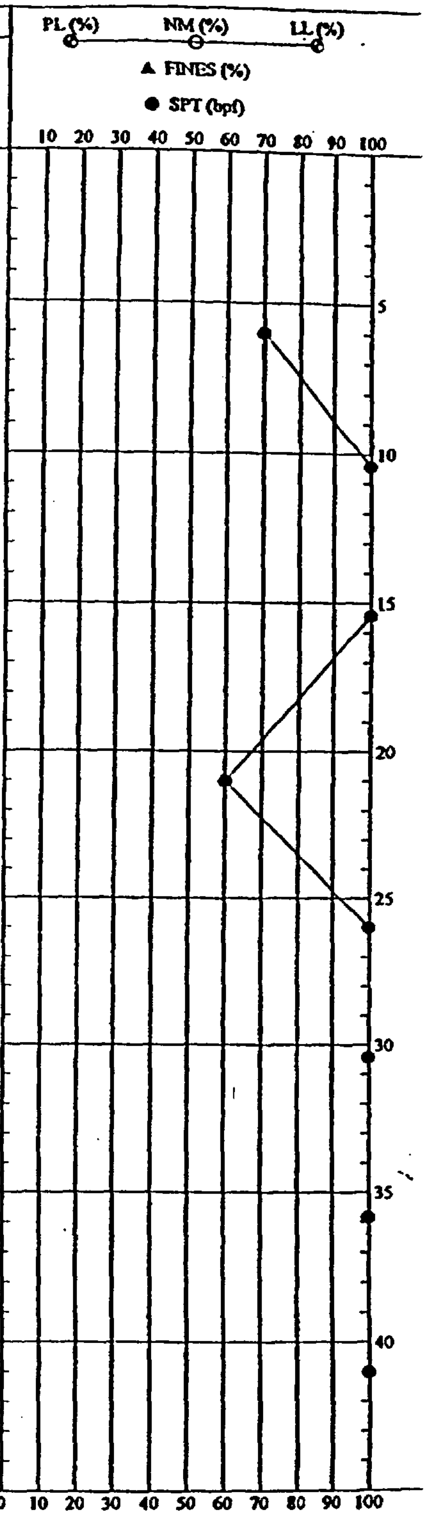
PROJECT: NEF - Lea County, New Mexico

DRILLED: September 9, 2003 **BORING NO.:** B-

PROJ. NO.: 3043031049/0001 **PAGE** 1 **OF**

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	ELEV (ft)	SAMPLES IDENT	SAMPLES N-COUNT (1st 6" 2nd 6" 3rd 6")
0	REDDISH BROWN, DRY, SILTY FINE SAND WITH SOME FINE ROOTS - EOLIAN VERY DENSE, REDDISH YELLOW, DRY SILTY FINE TO MEDIUM SAND	3411.2		
5		3406.2	SPT-1	25-35-35
10	VERY DENSE, LIGHT YELLOW, DRY, SILTY FINE TO MEDIUM CEMENTED SAND - CALICHE	3401.2	SPT-2	50/5"
15		3396.2	SPT-3	50/5"
20	VERY DENSE, LIGHT YELLOW, DRY SILTY FINE TO MEDIUM SAND WITH CLASTS OF CEMENTED SAND	3391.2	SPT-4	15-24-36
25		3386.2	SPT-5	9-38-50/4"
30	VERY DENSE, REDDISH YELLOW, DRY, SILTY FINE TO MEDIUM SAND WITH SOME FINE SUBANGULAR TO ROUNDED GRAVEL	3381.2	SPT-6	50/5"
35		3376.2	SPT-7	30-50/4"
40	VERY HARD, REDDISH PURPLE, DRY, HIGH PLASTICITY CLAY BORING TERMINATED AT 41.0'	3371.2	SPT-8	18-50/6"
45		3366.2		



REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/10/2003

SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 10, 2003 **BORING NO.:** B-5

PROJ. NO.: 3043031049/0001 **PAGE 1 OF 1**

MACTEC

APPENDIX B

SUMMARY OF FIELD ACTIVITIES

SUMMARY OF FIELD ACTIVITIES

Shallow Boring Program

On 26 August 2003, Total Support Services, Inc. (TSS), LG, and CJI personnel were on-site with a Mobil B-59 drill rig to install the nine shallow subsurface soil borings. Initially, CJI proposed to air rotary drill each of the borings to the redbeds. However, due to the looseness and subsequent continuous cave-ins of the sandy soil near the surface, hollow-stem augers were used to keep the boreholes open. After attempts to air rotary drill B-8 and B-5 through hollow-stem augers proved difficult, solid-stem augers were determined to be the preferred method of installing the shallow boreholes. Although hollow-stem augers were used to advance B-2, solid-stem augers were utilized to advance the remaining six shallow boreholes.

In each of the nine shallow boreholes, a CJI geologist lithologically logged the soil using the USCS classification system from borehole cuttings. Particular attention was paid to the upper contact of the redbeds (see Figure 4). The lithologic logs of each of these borings can be found in Appendix A of this report. Upon reaching the upper contact of the redbeds, each borehole was over-drilled several feet so that the borehole might remain open below the contact. On 28 August 2003, the last of the shallow boreholes were completed. On 29 August, each borehole was gauged using an electric water level indicator to determine whether any groundwater had collected in the boring. The top of redbed depths and elevations are shown on Table 1.

Deep Boring Program

The deep subsurface investigation was originally proposed to be conducted using mud rotary drilling techniques which would allow the collection of soil core samples in B-1, B-7, and B-9 from the top of the redbeds to the bottom of the uppermost water-bearing zone. The lower contact of the shallowest water-bearing zone was anticipated to be between 220' and 250' BGS.

On 3 September, TSS personnel mobilized to the site with a Mobil B-53 drill rig to conduct the deep subsurface investigation. TSS set up on B-1 and attempted to set hollow-stem augers to the top of the redbeds. However, due to geologic conditions (the presence of large gravel), the hollow-stem augers became lodged in the borehole at a depth of about 50' BGL. Numerous unsuccessful attempts were made to dislodge the augers. Eventually another borehole was advanced near the first borehole location. The result was the same and the augers were lodged at about 45' BGL. After unsuccessfully attempting to retrieve the drilling equipment from the two boreholes, the equipment was abandoned. A total of 40' of hollow-stem augers was lost in B-1. At that time, due to geologic conditions, a decision to abandon B-1 and replace that monitor well location with B-3 was made.

Following the abandonment of B-1, TSS moved to B-7. Prior to mud rotary drilling B-7, hollow-stem augers were advanced to the top of the redbeds to keep the upper sand from collapsing into the borehole. Once the hollow-stems were in place, mud rotary drilling was to be used to advance the borehole to total depth (TD). However, due to prior drilling difficulties and time constraints, the decision to utilize air rotary drilling methods to advance B-7 to 180' BGS prior to converting to mud rotary drilling techniques was made. On 7 September, TSS began core sampling B-7 starting at 180' BGS. Due to mud rotary drilling difficulties there was essentially no recovery of core soil samples from 180'-205' BGS. After numerous unsuccessful attempts to collect core soil samples from B-7, a decision was made to air core each of the three test boreholes to 250' BGS and then geophysically log the boreholes to determine monitor well design information.

At that time, TSS began advancing B-9 to 250' using air rotary drilling techniques. After casing the upper 45' of soil using 8-1/4" outer diameter (OD) hollow-stem augers, test borehole B-9 was advanced to a TD of 250' BGS. After tripping the drilling equipment out of the borehole, an electric water level indicator was used to check for the presence of groundwater. It was determined that there was no groundwater in the test borehole immediately upon completion of drilling activities. The borehole was allowed to remain open overnight and was checked the following day. On 10 September, CJI personnel determined groundwater in B-9 was at about 232.22' BGS. Using the same drilling methods, the test borehole at B-7 and the first test borehole at B-3 were completed to about 250' BGS on 11 September and 12 September, respectively. The test boreholes were dry to TD immediately upon completion of drilling activities. Groundwater was not present in B-7 even after allowing it to remain open overnight.

The test borehole at B-3 was geophysically logged immediately after drilling and was not allowed to remain open overnight for subsequent groundwater level data collection.

Before geophysical logging activities could be completed in the test borehole at B-3, the borehole collapsed to 25' BGS. Therefore, a second test borehole was drilled at B-3 to about 250' BGS on 13 September. The second test borehole was also dry upon completion of drilling activities and was geophysically logged immediately thereafter.

Monitor Well Drilling and Installation Program

After the test boreholes at B-3, B-7, and B-9 were geophysically logged, TSS began to make preparations to advance a borehole at each of these locations in which a monitor well would be installed. The boreholes would be cased to the top of the redbeds using 10" OD hollow-stem augers and then air drilled to TD using air rotary drilling methods with a 6"-diameter bit. After setting up to begin this process at B-3, the B-59 drill rig broke down and was not able to be repaired. For this reason, TSS and CJI demobilized from the site on 14 September.

On 18 September, TSS and CJI mobilized to the site. In addition, due to additional time constraints, a second drill rig (CME 75) supplied by Enviro-Drill, Inc. (EDI) was on-site to facilitate monitor well drilling and installation processes.

TSS set up on B-7 (MW-1) and advanced 10" OD hollow-stem augers to 30' BGS. After completing this task, TSS moved to B-3 and began drilling MW-3 by also installing 30' of 10" OD augers. EDI began drilling at B-9 (MW-2) by installing 50' of 10" OD hollow-stem augers. TSS and EDI advanced each monitor well boring to TD using air rotary drilling techniques and 6"-diameter bits. Both crews were using Sullair 900 air compressors. However, EDI drilled using 125 pounds per square inch (PSI) air pressure while TSS drilled using 150 PSI air pressure. On 19 September, TSS reached TD of 240' BGS in MW-3 borehole and EDI reached TD of 235.5' BGS in MW-2 borehole. After completing the installation of MW-3, TSS set up over the augers previously set in the MW-1 borehole. On 20 September, TSS reached TD of 231' BGS in MW-1 borehole.

Upon reaching TD, each crew installed the monitor well material, as witnessed by CJI and LG personnel. Monitor well construction diagrams detailing the installations can be found in Appendix D of this report. Each monitor well was constructed using 2-inch diameter Schedule 40 PVC sealed in its factory packaging. Personnel who handled the unpackaged screen or casing donned latex gloves prior to handling the material. Each monitor well was constructed using 15' of 0.010-inch slotted screen and enough riser to bring the monitor well to the surface. Stainless steel centralizers were attached to the riser about every 50' to hold the monitor well in place. After inserting the screen and riser into the monitor well borehole, a sand filter pack was poured from the surface to bring the sand filter at least three feet above the top of the screened interval. Following placement of the sand filter, bentonite chips were poured from the surface to a level of 75' BGS. The bentonite chips were then hydrated using 10 gallons of distilled water. After pouring in the distilled water, the chips were allowed to hydrate. A cement/bentonite slurry was then placed into the monitor well borehole to fill the annulus to about ground level. Then grout was placed into the annulus by pressure grouting from the bottom up using tremie pipe. After the grout was placed to this level, the hollow-stem augers were removed. The monitor wells were then allowed to set up overnight. The following day, bentonite chips were added to bring the plug to about surface level. After pouring in the appropriate amount of bentonite chips, they were hydrated with five gallons of distilled water. The drop in the level of the cement/bentonite slurry was between 7' and 17' BGS in the three monitor wells.

A variance from the general construction process in Monitor Well MW-1 is noted. While removing the hollow-stem augers from Monitor Well MW-1, TSS experienced some difficulties. About 15' of augers became lodged in the hole and, due to darkness, had to remain in the borehole overnight. The augers were eventually removed the following day. However, in the process of removing them, some loose soil caved in on top of the cement/bentonite slurry.

Each of the monitor wells was surface-completed with a 4'x4'x6" concrete pad and a protective steel upright casing. Prior to pouring concrete for the pads, plastic was laid down within the form to help keep the moisture from being drawn out to the underlying sandy soil. In addition, 6"x6" wire mesh was cut and laid in the forms to help strengthen the concrete. A three-sided, pre-fabricated metal fence was then placed around each pad to protect the monitor well from cows and other potential harm. In addition, each of the protective casings was locked with a padlock to help prevent tampering.

APPENDIX C

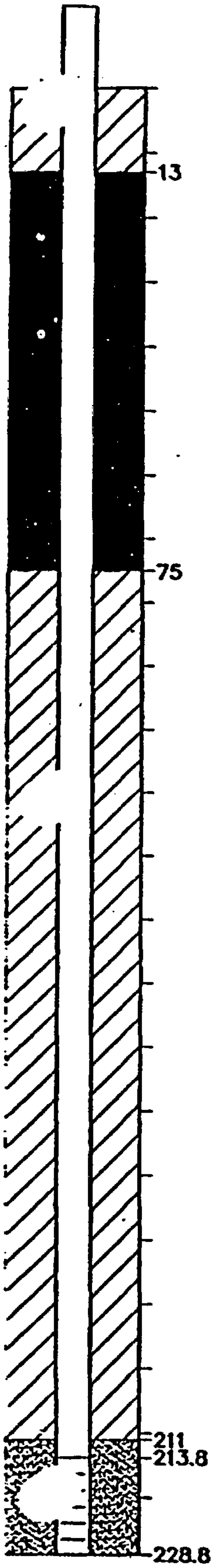
GEOPHYSICAL LOGS

APPENDIX D

MONITOR WELL CONSTRUCTION DIAGRAM

Well No.: MW-1
Boring No.: B-7

MONITOR WELL CONSTRUCTION SUMMARY



Survey Coordinates:	525569.741 N	Elevation Ground Level:	3415.44'
	925710.071 E	Top of Casing:	3418.37'
	New Mexico State Plane Zone 3001 (NAD83)	Screened Interval:	3186.7' – 3201.7'

DRILLING SUMMARY

Total Depth: 231'
Borehole Diameter: 10" Augers 0 – 30' BGS
6" Air 30' – 231' BGS
Casing Stick-up Height: 2.93'
Driller: Total Support Services
Rig: B-59
Bit(s): 6" Rotary Bit, 10" Hollow Stem Augers
Drilling Fluid: Air
Protective Casing: 4" x 4" Steel

CONSTRUCTION TIME LOG[1]

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling:				
Augers	9/18	17:25	9/18	17:55
Air Drill	9/20	10:30	9/20	14:20
Geophys Log:	9/12	10:45	9/12	11:30
Casing:	9/20	16:05	9/20	16:35
Filter Placement:	9/20	16:40	9/20	16:47
Cementing:	9/20	17:42	9/20	18:02
Bentonite Seal:	9/20	16:47	9/20	17:42
	9/21	11:03	9/21	11:15

WELL DESIGN AND SPECIFICATIONS

Basis: Geologic Log ___ Geophysical Log X
Casing String(s): C = Casing S - Screen

Depth	String(s)	Elevation
0' – 213. 8'	C	3201.7' – 3415. 4'
213. 8' – 228. 8'	S	3186.7' – 3201.7'

Casing: C1 2" Flush Threaded Schedule 40 PVC
C2
Screen: S1 2" Flush Threaded Schedule 40 PVC, 0.01" Slot
S2

WELL DEVELOPMENT

WELL COMPLETION

Filter Pack: 211' – 229' BGS (7-50 lb. bags of 20-40 filtered Unimin silica sand)

Bentonite Seal: 75' – 211' BGS (40½-50 lb. Bags)

Grout Seal: 2 pours: 1st pour; 100 gallons water, 6-92.5 bags Portland cement, and ½-50 lb. bag CETCO Super Gel; 2nd pour 75-gallons water, 4-92.5 lb. bags Portland cement and 1/3-50 lb. bag CETCO Super Gel.

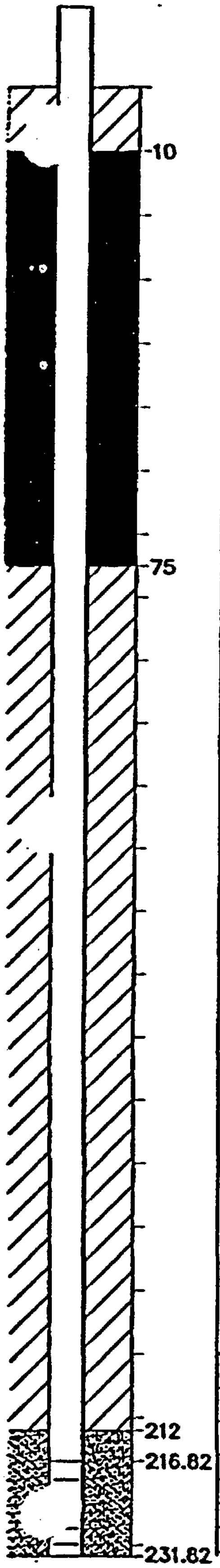
COMMENTS: [1]All dates 2003. Hydrated chips from 75' – 211' BGS with 10 gallons distilled water. On 9/21, added 13 bags of Bentonite from 1' – 13' BGS and hydrated with 5 gallons of distilled water. Centralizers at 51', 101', 151', and 201' BGS.

Site Name: LES Eunice, N.M.
Supervised by: Edward E. Hyde
Date: 11/19/03

Well No.: MW-2
Boring No.: B-9

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coordinates:	525770.200 N	Elevation Ground Level:	3422.14'
	928625.728 E	Top of Casing:	3425.25'
	New Mexico State Plane Zone 3001 (NAD83)	Screened Interval:	3180.32' – 3205.32'



DRILLING SUMMARY

Total Depth: 235.5'
Borehole Diameter: 10"Augers 0 – 50' BGS
6" Air 50' – 235.5' BGS
Casing Stick-up Height: 3.11'
Driller: Enviro-Drill, Inc.
Rig: CME-75
Bit(s): 6" Cutter Bit, 10" Hollow Stem Augers
Drilling Fluid: Air
Protective Casing: 4" x 4" Steel

CONSTRUCTION TIME LOG[1]

	Start		Finish	
Task	Date	Time	Date	Time
Drilling:				
Augers	9/18	17:49	9/18	19:35
Air Drill	9/19	08:25	9/19	12:45
Geophys Log:	9/10	12:00	9/10	19:00
Casing:	9/19	15:40	9/19	16:20
Filter Placement:	9/19	16:25	9/19	16:35
Cementing:	9/19	19:05	9/19	20:32
Bentonite Seal:	9/19	16:36	9/19	17:02
	9/20	11:15	9/20	11:25

WELL DESIGN AND SPECIFICATIONS

Basis: Geologic Log ___ Geophysical Log X
Casing String(s): C = Casing S - Screen

Depth	String(s)	Elevation
0' – 216.82'	C1	3200.32' – 3422.14'
216.82' – 231.82'	S1	3180.32' – 3205.32'

Casing: C1 2" Flush Threaded Schedule 40 PVC
C2
Screen: S1 2" Flush Threaded Schedule 40 PVC, 0.010" Slot
S2

WELL DEVELOPMENT

Filter Pack: 212' – 232' BGS (8-50 lb. bags of 20-40 filtered Unimin silica sand)

Bentonite Seal: 75' – 212' BGS (41 1/3-50 lb. Bags)

Grout Seal: 3 pours: 1st pour; 160 gallons of water, 6-92.5 lb. Bags Portland cement, and 1-50 lb. bag CETCO Super Gel. 2nd pour; 60 gallons of water, 2-92.5 lb bags of Portland, and 1/3-50 lb bag of CETCO Supergel. 3rd pour; 25 gallons of water, 1-92.5 lb bags of Portland, and 1/8-50 lb bag of CETCO Supergel.

COMMENTS: [1]All dates 2003. Hydrated chips with 10 gallons distilled water from 75' – 212'. Centralizers at 47', 97', 147', and 197' BGS. On 9/20 added 7 bags of Bentonite chips from 1' – 10' BGS and hydrated with 5 gallons of distilled water.

Site Name: LES EUNICE, N.M.

Supervised by: Edward E.

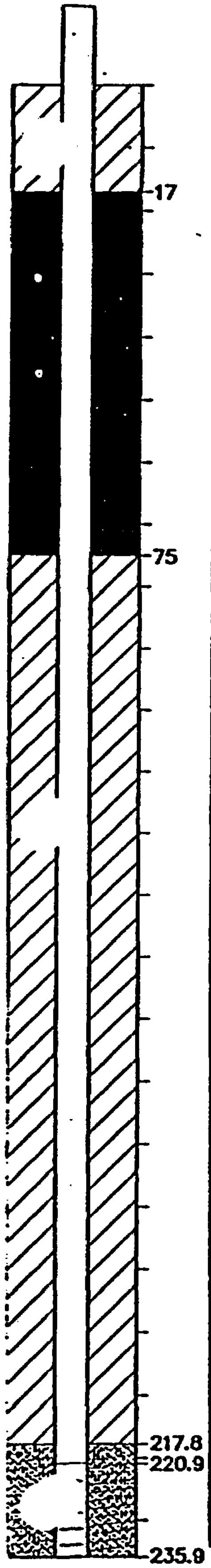
Date: 11/19/03

LOCKWOOD GREENE\FINAL\03070\
F031119_WELL NO. MW-2.DOC

Well No.: MW-3
Boring No.: B-3

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coordinates:	522989.922 N	Elevation Ground Level:	3403.98'
	928883.152 E	Top of Casing:	3406.98'
	New Mexico State Plane Zone 3001 (NAD83)	Screened Interval:	3168.08' – 3183.08'



DRILLING SUMMARY

Total Depth: 240'
Borehole Diameter: 10"Augers 0 – 30' BGS
6" Air 30' – 240' BGS
Casing Stick-up Height: 3.0'
Driller: Total Support Services, Inc..
Rig: B-59
Bit(s): 6" Rotary Bit, 10" Hollow Stem Augers
Drilling Fluid: Air
Protective Casing: 4" x 4" Steel

CONSTRUCTION TIME LOG[1]

	Start		Finish	
Task	Date	Time	Date	Time
Drilling:				
Augers	9/18	19.14	9/18	19:48
Air Drill	9/19	10:45	9/19	14:45
Geophys Log:	9/13	16:00	9/13	17:50
Casing:	9/19	17:15	9/19	17:55
Filter Placement	9/19	18:00	9/19	18:08
Cementing:	9/19	19:15	9/19	19:33
Bentonite Seal:	9/19	18:10	9/19	18:42
	9/20	08:18	9/20	08:30

WELL DESIGN AND SPECIFICATIONS

Basis: Geologic Log ___ Geophysical Log X
Casing String(s): C = Casing S - Screen

Depth	String(s)	Elevation
0' – 220.9'	C	3183.08' – 3403.98'
220.9' – 235.9'	S	3168.08' – 3183.08'

Casing: C1 2" Flush Threaded
Schedule 40 PVC
C2

Screen: S1 2" Flush Threaded
Schedule 40 PVC, 0.010" Slot
S2

WELL DEVELOPMENT

WELL COMPLETION

Filter Pack: 217.8' – 235.8' BGS (7-1/2 50 lb. bags of 20-40 filtered Unimin silica sand)

Bentonite Seal: 75' – 217.8' BGS (44 ½-50 lb. Bags)

Grout Seal: 2 pours: 1st pour; 17' – 75' BGS, 150 gallons water, 8-50 lb. bags Portland cement, and 2/3 50-lb. bag CETCO Super Gel. 2nd pour, 95 gallons of water, 4-50 lb. bags Portland cement, and 1/3-bag of CETCO Supergel.

COMMENTS: [1]All dates 2003. Hydrated chips with 10 gallons distilled water (75' – 217.8' BGS). On 9/20, added 17 bags of Bentonite chips from 1' – 17' BGS and hydrated with 5 gallons of distilled water. Centralizers at 51', 101', 151', and 201' BGS.

Site Name: LES Eunice, N.M.

Supervised by: Edward E. Kyle

Date: 11/19/03

APPENDIX E

HYDRAULIC CONDUCTIVITY CALCULATIONS

SHEET NO.____OF__________

PROJECT LOCKWOOD GREENE JOB NO. 03070 PREP. BY DG DATE 11/17/03

SUBJECT HVORSLEU SLUG TEST CALC. CHKD. BY______ DATE______

PHASE/TASK______ APP. BY______ DATE______

$TD = 235.5$ FT

$H = 120.5$ FT

$H_o = 44.72$ FT

$H - H_o = 75.78$ FT

TIME (HRS)	DTW (FT)	h (FT)	$\frac{H-h}{H-H_o}$
0	190.78	44.72	1
24	165.04	70.46	0.66
48	153.85	81.65	0.51
72	149.68	85.82	0.46
96	148.67	86.83	0.44
168	138.71	96.79	0.31
192	135.11	106.39	0.27

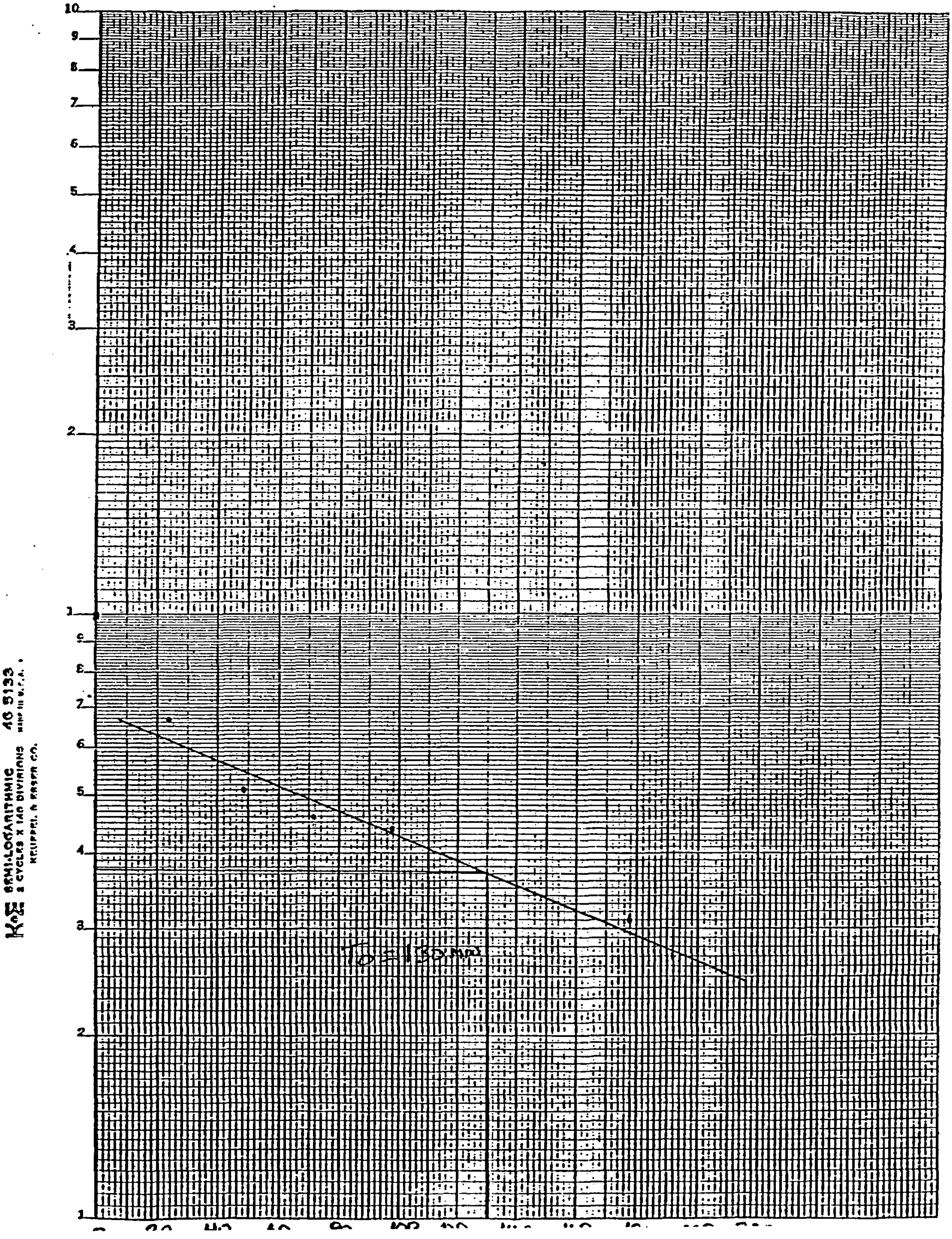
$$K = \frac{r^2 \ln (L/R)}{2 L T_o}$$

$$= \frac{(0.083\,\text{FT})^2 \ln (15\,\text{FT} / 0.25\,\text{FT})}{2\ 15\,\text{FT}\ 130\,\text{MIN}}$$

$$= 7.2 \times 10^{-6}\ \text{FT/MIN}$$

$$= 3.7 \times 10^{-6}\ \text{cm/sec}$$

$$= 3.8\ \text{FT/YR}$$


10
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K&E SEMI-LOGARITHMIC 46 5133
2 CYCLES X 140 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.

APPENDIX F

GROUNDWATER VELOCITY CALCULATIONS

COOK-JOYCE INC.

SHEET NO.____OF__________

PROJECT LOCKWOOD GREENE JOB NO. 03070 PREP. BY DG DATE 11/17/03
SUBJECT GROUNDWATER VELOCITY CALC. CHKD. BY________ DATE________
PHASE/TASK________ APP. BY________ DATE________

$$V = \frac{K\, i}{n}$$

K = HYDRAULIC CONDUCTIVITY
i = HYDRAULIC GRADIENT
n = POROSITY
V = VELOCITY

K = 3.8 FT/YR
i = 0.011
n = 0.14

$$V = \frac{3.8 \text{ FT/YR } 0.011}{0.14}$$

V = 0.3 FT/YR

APPENDIX G

SURVEY RESULTS

DEBRA P. HICKS, P.E./L.S.I.
WILLIAM M. HICKS, III, P.E./P.S.

PETTIGREW and ASSOCIATES
1110 N. GRIMES
HOBBS, NEW MEXICO 88240
(505) 393-9827

23 September, 2003

Cook-Joyce Inc.
812 West Elevneth
Austin, Texas 78701-2000
Facsimile Number: 512-474-8463

ATTN: Ed Hughes / Doug Granger
RE: Location of monitoring wells and borehole locations within the LES site east of Eunice New Mexico.

Dear Mr. Granger:

Below I have tabulated the data you have requested for the borehole locations:

Borehole locations			
Northing	Easting	Elevation	Description
522969.203	925622.959	3396.49	BH-1
522906.403	927284.708	3402.31	BH-2
522941.969	928870.232	3403.38	BH-3
524232.996	925711.777	3400.66	BH-4
524273.953	927281.455	3408.85	BH-5
524346.448	928685.553	3414.75	BH-6
525545.025	925661.407	3415.00	BH-7
525604.689	927274.151	3423.29	BH-8
525735.902	928595.512	3421.33	BH-9

Additionally here is the data you requested for the three monitoring wells:

Monitoring Wells			
Northing	Easting	Elevation	Description
525569.741	925710.071	3418.31	MW-1 VAULT
		3418.37	MW-1 CASING
		3416.00	MW-1 CONC
		3415.44	MW-1 GRND
525770.200	928625.728	3425.11	MW-2 VAULT
		3425.25	MW-2 CASING
		3422.60	MW-2 CONC
		3422.14	MW-2 GRND
522989.922	928883.152	3406.97	MW-3 VAULT
		3406.98	MW-3 CASING
		3404.33	MW-3 CONC
		3403.98	MW-3 GRND

RE: Location of monitoring wells and borehole locations within the LES site east of Eunice New Mexico.

All observations were made from USC&GS Benchmark 12DD. We used real-time differentially corrected global positioning system observations at each location. Horizontal and vertical control values (X,Y,Z) at benchmark 12DD were derived from 3 continuously operating reference stations in the area. The above listed coordinates are referenced to New Mexico State Plane Coordinates Zone 3001 (NAD83), with the vertical referenced to NAVD(88). The X&Y values have been scaled to ground values.

Sincerely,
PETTIGREW and ASSOCIATES, P.A.

Daniel R. Muth, PS

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RCRA
PERMIT APPLICATION
FOR A HAZARDOUS WASTE
STORAGE, TREATMENT AND DISPOSAL FACILITY
ANDREWS COUNTY, TEXAS

SECTION VI. GEOLOGY REPORT

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VI. Introduction

Waste Control Specialists, Inc. (WCS) proposes to permit a Class I hazardous waste landfill pursuant to 40 CFR Part 270, 31 TAC Chapter 305 (C) and (D) and 31 TAC Chapter 335. This report, which addresses the geologic aspects of the Resource Conservation and Recovery Act (RCRA) Part B Permit Application, has two companion reports which focus on the various engineering and geotechnical considerations of the Part B Permit Application. These two companion reports, provided under separate cover, were prepared by AM Environmental, Inc. (AME) of Austin, Texas (engineering design) and Jack H. Holt and Associates, Inc. (JHA) also of Austin, Texas (geotechnical evaluation). Where engineering design and/or geotechnical aspects of the geologic report are addressed by one of the other two reports, this fact is noted in the geologic report table of contents as well as noted within the geologic report text.

The proposed WCS landfill site is located in northwest Andrews County, Texas, approximately 30 miles northwest of the City of Andrews (Figure VI.A.1). This site rests on a gently sloping plain with a natural slope of approximately 0.5 degrees. The site is underlain by Quaternary windblown sands, the Tertiary Ogallala Formation, and the Triassic Dockum Group.

Portions of the Ogallala Formation serve as the regional aquifer for the Southern High Plains. However, the proposed WCS landfill site is located on the western edge of the Caprock Escarpment where the Ogallala Formation has been mostly eroded away and appears to be locally dry.

Regionally, the erosional remnants of the Ogallala Formation are typically cemented with caliche and produce water only in relatively low topographic areas, following wet weather periods. However, the vertical downward migration of groundwater from the Ogallala Formation appears to be locally impeded by many feet of low hydraulic conductivity claystones, siltstones, and interbedded silty sandstones which comprise the upper portion of the Dockum Group.

A summary of the regional and local topography, physiography and geology is presented in Section VI.A. of this report. Section A.1. contains a discussion regarding the active geologic processes, including: fault identification; seismicity; surface lineations; and land surface subsidence. The potential for erosion is discussed in a separate report provided by AME.

A regional and local physiographic and topographic discussion is provided in Section A.2. A discussion regarding the regional geology, including surface geology and stratigraphy, is contained in Section A.3. The regional discussion addresses the conditions that exist in the area of West Texas and Southeast New Mexico.

Results of the site subsurface soils investigation are presented in Section A.4. The subsurface structure, stratigraphic complexity, and the general hydrogeologic framework of the proposed WCS landfill site are discussed in this section. The subsurface investigation procedures and geotechnical properties of the subsurface soils are discussed in a separate report provided by JHA.

Section VI.B. of this report provides a detailed discussion of the regional and local groundwater conditions. This discussion includes a review of regional aquifers (Section B.1.) as well as a presentation of local groundwater conditions and the underground sources of drinking water (USDW) (Section B.2.). The detection monitoring system is discussed in a separate report provided by AME.

Section VI.C. of this report pertains to groundwater monitoring exemption, while Section VI.D. focuses on unsaturated zone monitoring. Records regarding local oil and gas wells are provided in Appendix A. Soil boring and well completion logs are provided in Appendix B. Shallow geophysical logs are provided in Appendix C.

VI.A. Geology and Topography

A.1. Active Geologic Processes

Active geologic processes consist of faulting, seismicity, surface lineations, land surface subsidence and the potential for surface erosion. These processes are discussed in the following section, except the potential for surface erosion. This is discussed in the companion engineering design report prepared by AME.

A.1.1. Identification of Faults

Regional Tectonic Processes

The proposed WCS landfill site is located within the Permian Basin region of West Texas. The Permian Basin derives its name from the fact that it is underlain by extensive deposits of Permian sediments.

The proposed landfill site is situated over the north central portion of a prominent structural feature known as the Central Basin Platform (Figure VI.A.2). The Central Basin Platform is a deep-seated horst-like structure that extends northwest to southeast from Southeast New Mexico to eastern Pecos County, Texas. The Central Basin Platform is flanked by two prominent structural depressions known as the Delaware Basin and the Midland Basin.

From the Cambrian to late Mississippian, West Texas and Southeast New Mexico experienced only mild structural deformation that produced broad regional arches and shallow depressions (Wright, 1979). The Central Basin Platform served intermittently as a slightly positive feature during the early Paleozoic (Galley, 1958). During the Mississippian and Pennsylvanian, the Central Basin Platform uplifted along ancient lines of weakness (Hills, 1985). The Delaware, Midland, and Val Verde Basins began to form out of the previously existing broad limestone shelf and shale basin.

Late Mississippian tectonic events uplifted and folded the platform and were followed by more intense late Pennsylvanian and early Permian deformation that compressed and faulted the area (Hills, 1963). Highly deformed local structures formed ranges of mountains oriented generally parallel to the main axis of the platform (Wright, 1979). The overall structural configuration of the Permian Basin was essentially completed by the end of Wolfcampian time (early Permian) (Stone and Webster, 1983).

This period of intense, late Paleozoic deformation was followed by a long period of gradual subsidence and erosion that stripped the Central Basin Platform and other structures to near base-level (Wright, 1979). The expanding sea gradually encroached over broad eroded surfaces and truncated edges of previously deposited sedimentary strata. These strata included new layers of arkose, sand, chert pebble conglomerate and shale deposits, which accumulated as erosional products along the edges and on the flanks of both regional and local structures. Throughout the remainder of Permian, the Permian Basin slowly filled with several thousand feet of evaporites, carbonates, and shales (Stone and Webster, 1983).

From the end of the Permian until late Cretaceous, there was relatively little tectonic activity except for periods of slight regional uplifting and downwarping (Stone and Webster, 1983). During the early Triassic, the region was slowly uplifted and slightly eroded. These conditions continued until the late Triassic, when gentle downwarping formed a large land-locked basin in which the terrigenous deposits of the Dockum Group accumulated in alluvial flood plains and as deltaic and lacustrine deposits (McGowen, et. al., 1979).

The late Cretaceous to early Tertiary marked the beginning of the Laramide Orogeny, which formed the Cordilleran Range to the west of the Permian Basin. This orogeny uplifted the region to essentially its present position, supplying sediments for the Pliocene Ogallala Formation and initiating the present hydrologic regime (Stone and Webster, 1983). There have been no major tectonic events within the Permian Basin since that time, except for a period of minor volcanism during the late Tertiary in northeastern New Mexico (Stone and Webster, 1983). Slight Tertiary movement along Precambrian lines of weakness may have opened joint channels which allowed the circulation of groundwater into Permian evaporite layers (Hills, 1985). The near-surface regional structure may be locally modified by differential subsidence related to groundwater dissolution of Permian salt deposits (Gustavson et. al., 1980).

Regional Faulting

Two types of faulting were associated with early Permian deformation. Most of the faults were long, high-angle reverse faults with several hundred feet of vertical displacement that often involved the Precambrian basement rocks (Hills, 1985). The traces of these faults are shown on the Precambrian structure map provided in Figure VI.A.3. The second type of faulting is found along the western margin of the platform where long strike-slip faults, with displacements of tens of miles, are found (Harrington, 1963) (Figure VI.A.4).

The large structural features of the Permian basin are reflected only indirectly in the Mesozoic and Cenozoic rocks, as there has been virtually no tectonic movement within the basin since the Permian (Nicholson and Clebsch, 1961). The east-west and north-south regional cross-sections provided in Figures VI.A.5 and VI.A.6 illustrate this relationship. Figure VI.A.5 reveals the draping of the Permian and Triassic sediments over the Central Basin Platform structure, located approximately 7,000 feet beneath the present land surface. The faults that uplifted the platform do not appear to displace the younger Permian sediments. The northernmost fault on Figure VI.A.6, located at the Matador Uplift, terminates in lower Wolfcamp sediments.

A further comparison of the structure of the Devonian Woodford Formation (Figure VI.A.7) to the structure of the younger Upper Guadalupe Whitehorse Group (Permian) (Figure VI.A.8) indicates that the structure of the younger strata is intimately related to the older structure. However, structural mapping of the younger strata does not indicate the upward continuation of this faulting into the overlying, shallow section. Therefore, the regional information does not indicate the presence of post-Permian faulting within the regional study area. In addition, the local information does not indicate Holocene displacement of faults within 3,000 feet of the proposed WCS landfill site. This local information is discussed fully in Section A.4.2.

Seismicity

The Central Basin Platform is an area of moderate, low intensity seismic activity, based on observational data obtained from the National Geophysical Data Center of the National Oceanic and Atmospheric Administration (NOAA, 1992). A computer search for all recorded seismic activity within a 250 km (155 mile) radius of the proposed WCS landfill site (32.433N, 103.05W) provided a list of 84 seismic events (152 total, 68 suspected duplicates) during the period from 1931 to 1992 (Table VI.A.1, Figure VI.A.9). Seismic activity within the regional area has been reported as recently as 1992 (Table VI.A.1). However, all documented seismic events are located at distances which exceed the required search distance of 3,000 feet from the proposed WCS landfill site.

The proposed WCS landfill site is located within an earthquake risk area zone of (1), which represents an area where only minor damage is expected as a result of earthquake activity (Algermissen, 1969) (Figure VI.A.10). This is due, in part, to the relatively low level of tectonic activity occurring within the regional study area. While data are insufficient to equate any seismic activity with specific tectonic structures or to indicate the tectonic stress levels and direction, the seismic activity that has occurred within the region is postulated to be associated with salt dissolution or movement along faults near oil and gas secondary recovery operations (Davis et. al., 1989). A search of Texas Railroad Commission (TRC) and New Mexico Oil Conservation Commission (OCC) records conducted by Geosource, Inc., Austin, Texas, revealed no secondary recovery operations within a three-mile radius of the proposed WCS landfill site.

Surface Lineations

Surface lineations are straight physiographic features. Surface lineations are typically identified based on a review of surface geologic maps, surface topography maps, LANDSAT images and/or high altitude aerial photographs (Finley and Gustavson, 1981). In the Southern High Plains, surface lineations typically fall into a combination of six categories: 1) linear stream segments; 2) drainage lines along linear valleys; 3) prominent topographic breaks (scarps); 4) alignment of playa lakes; 5) geologic contacts; and 6) anomalous ground surface color tones based on aerial photographic data. More than 4,600 surface lineations have been identified in the area of the Southern High Plains, ranging in length from 1.2 miles up to 40 miles (Finley and Gustavson, 1981).

Surface lineations are often associated with subsurface joint patterns and faults (Finley and Gustavson, 1981). Fractures form in geologic material along planes of weakness where cohesion has been lost (Dennis, 1972). Joints, unlike faults, are defined as fractures along which movement has been negligible or absent (Dennis, 1972). The development of joints is an indication of the brittle behavior of rock, and is most evident in the Triassic and Permian sandstones within the area of the Southern High Plains (Finley and Gustavson, 1981). The poorly consolidated sediments of the Ogallala Formation do not exhibit well-developed jointing patterns. The caliche caprock material often exhibits an irregular, nearly orthogonal jointing pattern. Since few surface faults have been recognized and mapped in the Southern High Plains, it is the jointing of the geologic material that exerts the greatest control over regional surface lineation patterns (Finley and Gustavson, 1981).

Several mechanisms can account for the relationship between surface lineations and subsurface jointing. Joints form preferential planes that can be exploited by surficial and subsurface weathering processes. Consequently, drainage systems in the Southern High Plains are often classified as surface lineations, since their linear orientation is controlled by the joint systems that they exploit (Finley and Gustavson, 1981). In addition, joints can be propagated upward into geologically younger sediments, by the differential compaction and dissolution of underlying materials (Stone and Webster, 1983; Finley and Gustavson, 1981).

In the Southern High Plains, the orientation of subsurface joints and their associated surface lineations is controlled primarily by historical tectonic and structural trends (Finley and Gustavson, 1981). As shown in Figure VI.A.11, the dominant direction of orientation for surface lineations in the Southern High Plains is northwest to southeast, with a secondary orientation direction of northeast to southwest. Figure VI.A.11 shows a surface lineation with a northwest-southeast alignment in the approximate vicinity of Monument Draw. This feature is located in northern Andrews County about 14 miles from the proposed WCS landfill site. This is the closest lineament to the proposed landfill site observed by Finley and Gustavson (1981). Their data do not indicate the presence of surface lineations at the site.

Surface lineations were identified in the vicinity of the proposed WCS landfill site, based on an analysis of NASA color-infrared aerial photographs (Figure VI.A.12).

These lineations, including one that is inferred through the proposed WCS landfill site, correspond to linear drainage features and ground surface color tone anomalies.

The lineation inferred through the proposed WCS landfill site appears as an anomaly in the ground surface color tone on a NASA color-infrared aerial photograph (Figure VI.A.12). This anomaly may be caused by shadows, changes in soil moisture and vegetation etc. (Finley and Gustavson, 1981) and appears to be linked to relatively abrupt topographic variations.

A.1.2. Land Surface Subsidence

Land surface subsidence can be induced by fluid withdrawal or can be naturally occurring. Most commonly, fluid withdrawal is associated with groundwater pumpage and oil and gas production activities.

Subsidence Associated with Fluid Withdrawal

The water-bearing zones of the Ogallala Aquifer consist of poorly consolidated to unconsolidated sands and gravels at a depth greater than 300 feet below the ground surface (Knowles et. al., 1984). The aquifer is typically under water table conditions. Despite the potential withdrawal of groundwater in the general vicinity of the proposed WCS landfill site, pressure declines associated with groundwater pumpage are probably insufficient to induce significant subsidence.

Oil production is occurring in the area from consolidated sediments at depths greater than 3,000 feet. Therefore, no subsidence is expected to occur from the withdrawal of brine or oil and gas. No evidence of subsidence related to fluid withdrawal was found in the reviewed literature (Section VI.E.).

Naturally Occurring Subsidence

Subsidence can also be naturally occurring and result from sediment compaction and/or subsurface dissolution of soluble strata. As discussed previously, joint/lineament systems can be associated with sediment compaction and dissolution (Finley and Gustavson, 1981).

A zone of active salt dissolution and subsidence has been noted by Gustavson et. al. (1980, 1981) in Permian strata of the Northern Texas Panhandle. Collapse features are evidence of such subsidence. However, no salt dissolution collapse features are noted within the study area based on a search of the available literature. Shallow depressions are noted in the study area. However, these depressions can be attributed to eolian deflation, caliche caprock solution and compaction, animal activity, and differential compaction (Collins, 1990).

A.1.3. Potential for Erosion

The potential for erosion is discussed in the companion engineering design report provided by AME.

A.2. Physiography and Topography

A.2.1. Physiographic Setting and Climate

Physiographic Setting

The proposed WCS landfill site is located in West Texas, which lies within the southern portion of the North American Great Plains Physiographic Province (Stone and Webster, 1983). The site is situated in northwest Andrews County, Texas on the southwestern edge of the Southern High Plains (Llano Estacado) (Figure VI.A.13).

The Llano Estacado is an elevated area of low relief undulating plains encompassing a large area of West Texas and Eastern New Mexico. It is bounded by the Western Caprock Escarpment along the Pecos River Valley to the west and the Eastern Caprock Escarpment developed by the headward tributaries of the Colorado, Brazos, and Red Rivers to the east (Stone and Webster, 1983) (Figure VI.A.13). The Basin and Range Physiographic Province lies to the west of the Southern High Plains. The Rolling Plains Physiographic Province lies to the east and the Edwards Plateau lies to the south of the Southern High Plains. Cities on the approximate boundary of the Llano Estacado include Amarillo, Texas to the north, Big Spring, Texas to the east, Midland/Odessa, Texas to the south, and Roswell, New Mexico to the west.

Climate

The proposed WCS landfill site lies within an area of temperate, arid climate. The average annual precipitation is approximately 14.5 inches (Figure VI.A.14), with more than 70 percent of the precipitation occurring between early May and late October (TNRIS, 1992). The mean annual maximum temperature is 77.4°F and the mean annual minimum temperature is 49.4°F. The maximum average daily temperature of 95.5°F occurs in July and the minimum average daily temperature of 29.5°F occurs in January. The average annual wind speed is 10.4 miles per hour with the prevailing direction being southwesterly in the winter and south to southeasterly in the summer. The average free water evaporation exceeds precipitation by about 58 inches per year (Conner et. al., 1974).

A.2.2. Topographic Features, Soil and Land Use

Regional Topography

The proposed WCS landfill site is located on a gently sloping plain. The regional slope is toward the southeast at 8 to 10 feet per mile (Reeves, 1966), with the local slope oriented toward the southwest at 25 feet per mile (Plate VI.A.1). Regional topographic features include the Pecos River Plain to the south and west, the Mescalero Ridge to the northwest, Monument Draw and Rattlesnake Ridge to the west, and the Llano Estacado to the north and east (Nicholson and Clebsch, 1961) (Figure VI.A.13 and Plate VI.A.2).

The Southern High Plains can be characterized by relatively flat topography, cut by regional surface drainage features and punctuated by playa lakes (Stone and Webster, 1983). Drainage is not well defined and consists of ephemeral streams that channel runoff into the playas.

The Mescalero Ridge defines the western edge of the Llano Estacado. It is a nearly perpendicular cliff, facing west to southwest. The ridge has a relief of nearly 150 feet in western Lea County, New Mexico, but displays very little relief in eastern Lea County or western Andrews County due to a heavy cover of dune sand. The south to southeast sloping Pecos River Plain, to the west, is covered with dune sand resulting in a low-relief undulating topography.

The only major regional drainage feature is Monument Draw, which is located to the southwest of the site, in Lea County, New Mexico (Plate VI.A.2). Monument Draw runs between the proposed WCS landfill site and Eunice, New Mexico. The draw begins with a southeasterly course to a point north of Eunice where it turns south and becomes a well defined cut approximately 30 feet in depth and 1,800 to 2,000 feet in width. The draw does not have through-going drainage and is partially filled with dune sand and alluvium (note: a second Monument Draw is shown on Plate VI.A.2 in northern Andrews County; this draw is a separate feature not to be confused with the draw in Lea County, New Mexico). East of Monument Draw is a north-south trending topographic high known locally as Rattlesnake Ridge. This poorly defined ridge parallels the Texas - New Mexico State line and crests about 125 feet higher than Monument Draw (Nicholson and Clebsch, 1961).

Large-Scale Local Topography Within the Boundary of the Proposed Landfill Site

The ground surface elevation within the boundary of the proposed WCS landfill site ranges from a high of 3,487.56 feet relative to mean sea level (MSL) in the extreme north central section to a low of 3,422.74 feet MSL in the southwest corner over a linear distance of approximately 4,600 feet (Plate VI.A.3). A relatively abrupt topographic slope break occurs along the central portion of the proposed WCS landfill site, south of a line from surveyed grid locations 10-F, 8-F, 6-D, 4-D and 2-D.

Small-Scale Local Topography Within the Boundary of the Proposed Landfill Site

Small-scale topographic features within the boundary of the proposed WCS landfill site include two highs, five closed depressions (locally referred to as "buffalo wallows") and a subtle surface water drainage feature (Plate VI.A.3).

A total of three of the local topographic depressions are located in close proximity to each along the southwestern margin of the proposed WCS landfill cell (Plate VI.A.3). The largest of these depressions (located at grid location 8-E) is about 400 feet by 300 feet with approximately one to two feet of vertical relief. The next largest of the three depressions (located near grid location 8-F) is nearly circular with a diameter of 300 feet and approximately three to four feet of vertical relief. The smallest of the three depressions (located between grid location 7-D and 7-E) is about 300 feet by 200 feet in size with approximately one to two feet of vertical relief.

A subtle surface water drainage feature is headed in the area immediately to the west of the three topographic depressions discussed above. This drainage feature accounts for approximately 12 feet of topographic incising over a run of approximately 500 feet. Field observations of this surface water feature indicate channel flow in the upper reach, with a rapid transition to sheet flow at its terminal end to the south.

A fourth topographic depression is located near grid location 2-D, along the eastern boundary of the proposed WCS landfill cell. This depression has dimensions of 200 feet by 100 feet and approximately four feet of topographic relief.

A fifth topographic depression is located near grid location 10-A, along the northwest corner of the proposed WCS landfill site. This depression has dimensions of around 125 feet by 200 feet and approximately one to two feet of topographic relief.

Local topographic highs are located along the southwest margin of the proposed WCS landfill cell. The largest high (located between grid 10-E and 10-F) is crescent-shaped with the long axis measuring approximately 600 feet and the short axis measuring about 300 feet. This topographic high has a vertical relief of one to two feet. The other topographic high (located between grid 8-E and 9-E) measures about 100 feet by 200 feet with less than two feet of vertical relief.

Local Topography Outside the Boundary of the Proposed Landfill Site

Local topographic features outside the boundary of the proposed WCS landfill site include three depressions to the west, a spring to the west and three highs to the north (Plate VI.A.3). Baker Spring is located 1,925 feet west and 360 feet south of the northwest corner of the proposed WCS landfill site, in Lea County, New Mexico. The water surface elevation at Baker Spring was surveyed at 3,440.82 feet MSL on February 2, 1993. Reports by local residents indicate that this spring is no longer active, and that the loss of spring activity may be linked to blasting activities at a nearby rock quarry (Vance, 1993). Site observations suggest that the historical source of Baker Spring may be attributed to seasonal seepage from the base of a surface outcropping of Ogallala Formation sediments. Field observations regarding the topography surrounding Baker Spring indicate evidence of historical quarrying activity.

Area Soils

The soils at the proposed WCS landfill site consist of dune sand mixed with organic material overlying weakly to strongly cemented caliche (Conner et. al., 1974; Turner et. al., 1974). The top soil depth ranges from 2 to 24 inches. The shallow caliche consists primarily of cemented dune sand and cemented Ogallala Formation sediments.

Area Land Use

The proposed WCS landfill site is located on land owned by the Flying "W" Diamond Ranch. This property, and the property immediately surrounding the proposed WCS landfill site is presently used as rangeland for cattle, requiring approximately 60 acres to sustain each head (Vance, 1993)

Other uses of land within the vicinity of the proposed WCS landfill site include: drill sites for oil and gas wells (a producing oil well is located near the southwest corner of the property); quarrying operations; and the surface recovery of oil field wastes. Surface quarrying of sand and gravel is conducted approximately one mile to the west of the proposed WCS landfill site, in New Mexico. The oil field waste recovery facility is adjacent to this rock quarry.

A.3. Regional Geology

A.3.1 Regional Surface Sediments

The geologic formations that outcrop within the region range from Quaternary through Triassic in age and include: Quaternary Alluvium (Holocene), Windblown cover sand (Pleistocene), and the Tahoka Formation (Pleistocene); the Tertiary Ogallala Formation (Pliocene); the Cretaceous Fort Terrett Formation; and the Triassic Dockum Group (Chinle Formation). The Hobbs Sheet of the Geologic Atlas of Texas showing the area surrounding the proposed WCS landfill site is provided on Plate VI.A.2.

Alluvium, Windblown Cover Sand, and Tahoka Formation

Floodplain deposits of fluvial origin outcrop at the surface to the west and southwest of the proposed WCS landfill site. These sediments are Holocene and possibly Pleistocene in age and were deposited along the course of Monument Draw in New Mexico (Plate VI.A.2).

Windblown cover sand of Pleistocene age is found immediately north of the proposed WCS landfill site, to the east along Highway 176, and at numerous other locations in Andrews, Gaines and other counties in Texas shown on Plate VI.A.2. This windblown cover sand ranges up to 10 feet in thickness and is calcareous, grayish red, fine to medium-grained quartz with silt and caliche nodules common (Barnes, 1976).

The Tahoka Formation is of Pleistocene age and consists of lacustrine clay, silt, sand, and gravel (Barnes, 1976). The clay and silt is sandy, indistinctly bedded to massive, and consists of various shades of light gray and bluish gray. The sand is gray, fine to coarse-grained quartz, friable, and grades to gravel at the margins of the deposits. These sediments occur approximately four miles east of the proposed WCS landfill site, near a topographic depression located north of Highway 176. The Tahoka Formation also outcrops at Whalen Lake and Shafter Lake in Andrews County, at San Simon Sink in New Mexico, and at a few other locations as shown on the Plate VI.A.2.

Ogallala Formation

The Pliocene Ogallala Formation consists of fluviatile sand, silt, clay, and gravel capped by caliche (Barnes, 1976). The sand deposits of the Ogallala Formation consist of fine to medium-grained quartz grains, which are silty and calcareous. Bed forms range from indistinctly bedded to massive, crossbedded, unconsolidated to weakly cohesive with local quartzite lenses. The sand intervals of the Ogallala Formation occur in various shades of gray and red.

Ogallala Formation silt and clay deposits are reddish brown, dusky red, and pink and contain caliche nodules. Gravels occur as basal conglomerates in intra-formational channel deposits, and consist primarily of quartz, quartzite, sandstone, limestone, chert, igneous rock, and metamorphic rock. The capping caliche is hard, sandy, pisolitic at the top, and produces caprock along Mescalero Ridge. Development of the local caliche horizon probably occurred relatively recently, after the deposition of the Pliocene Ogallala Formation.

Within the southern region of the Llano Estacado, the Ogallala Formation lies unconformably above either Triassic or Cretaceous rocks, and occurs as an apron of coalescing alluvial fan lobes which extend eastward from the Rocky Mountains. This alluvial outwash plain was dominated by braided streams and extends from South Dakota to the Texas Panhandle (Seni, 1980).

The headward erosion of the major rivers, such as the Pecos River in New Mexico and the Canadian, Colorado, and Brazos Rivers in Texas, and their various tributaries has regionally modified the surface expression of the Ogallala Formation (Figure VI.A.13). Consequently, portions of the Ogallala Formation have been erosionally removed, exposing deeper, older stratigraphic units. In addition, winds and streams have locally eroded the Ogallala Formation, exposing Cretaceous rocks around some saline lakes in the southern part of the Southern High Plains (Plate VI.A.2). The Ogallala Formation, in the regional area shown on Plate VI.A.2, ranges from 0 to 100 feet in thickness (Barnes, 1976).

Fort Terrett Formation

A very isolated occurrence of the Fort Terrett Formation is exposed in a rock quarry approximately one mile west of the proposed WCS landfill site (Plate VI.A.2). This formation consists of limestone and shale deposited in a marine environment. Fort Terrett limestones are light gray to grayish yellow in color and are mostly fine grained, argillaceous, thin to thick bedded and massive. The shales are calcareous and thinly laminated and occur in shades of dusky yellow, yellowish gray, light olive-gray, and dark gray (Barnes, 1976).

The possibility exists that the Fort Terrett Formation sediments mapped at the rock quarry east of the proposed WCS landfill site (Plate VI.A.2) may actually be caliche. This is based on the fact that no Fort Terrett Formation sediments were observed (during on-site field activities) at an outcrop at Baker Spring, which is immediately east of the quarry. An exposure of highly cemented, concretionary and pisolitic caliche was observed at Baker Spring, which could be confused as a Cretaceous marine limestone.

However, the silt, sand and gravel content of the limestone material at Baker Spring indicates that it is caliche, and it is suggested that this caliche material may be the same material that was mapped by Barnes (1976) as the Fort Terrett Formation at the adjacent rock quarry.

Dockum Group - Chinle Formation

The Chinle Formation is the uppermost unit of the Triassic Dockum Group in eastern New Mexico and western Texas (Nicholson and Clebsch, 1961). The Chinle Formation consists of red and greenish micaceous claystone, thinly interbedded with fine-grained sandstone (Barnes, 1976). The Chinle Formation is exposed in a rock quarry in New Mexico approximately one mile west of the site (Plate VI.A.2).

In Texas, the Dockum Group consists of shale, sandstone, siltstone, limestone, and gravel. These shale sediments are typically micaceous, thinly bedded, and variegated. The Dockum Group lies immediately beneath the Ogallala Formation at the proposed WCS landfill site and ranges up to 1,400 feet in thickness within the region.

A.3.2 Regional Stratigraphy

Groundwater resources are commonly referred to as underground sources of drinking water (USDWs). The base of the Dockum Group (Santa Rosa Formation) is considered to be the base of the lowermost aquifer capable of providing usable groundwater to the land surface in the regional study area (Nicholson and Clebsch, 1961). This formation lies unconformably on top of the Permian Dewey Lake Formation, with the base of the Dockum Group at a depth of approximately 1,400 feet beneath the proposed WCS landfill site.

The deeper formations of Permian age were deposited in a restricted-marine environment and thus contain salt deposits which make the groundwater produced from them too brackish for use. The stratigraphic column for the Central Basin Platform area is shown in Figure VI.A.15. Included on the column are all stratigraphic units from the Precambrian to Recent time. However, for the purpose of this regional discussion, only the Permian Ochoan units through the Recent units will be reviewed.

To better understand how the local geology relates to the regional stratigraphy, information was obtained from oil and gas operations in Andrews County, Texas and Lea County, New Mexico. A search of the oil and gas well records within a one-mile radius of the proposed WCS landfill site was conducted by Geosource, Inc., Austin, Texas, in November 1992.

Geosource, Inc. utilized public and private sources of data to identify producing and abandoned oil and gas wells or well tests located in the area. Table VI.A.2 lists the sources of information reviewed and briefly describes the information which can be obtained from each source. There are 12 operating or plugged wells located within a one-mile radius of the site. A map showing the location of oil and gas artificial penetrations within the area is included as Figure VI.A.16. A tabulation of the oil and gas wells is included as Table VI.A.3. Records of these wells are provided in Appendix A.

A detailed analysis of the regional and local subsurface stratigraphy was conducted based on a review of the drilling records and/or electric, nuclear, and lithologic logs from 17 individual locations. The data set consists of all available log data for the area on file with Petroleum Information (PI) within the boundaries of Figure VI.A.17. A total of two regional stratigraphic cross-sections were constructed using these data and are shown as Plates' VI.A.4 and VI.A.5. These cross-sections depict the major stratigraphic units that occur within 2,000 feet below ground level (BGL) in the vicinity of the site. Review of these cross-sections does not indicate the presence of local faulting. The locations of the cross-sections are shown in Figure VI.A.17. The individual well logs used to prepare the cross-sections have been named and numbered for cross-referencing purposes.

Permian Units

The Permian sediments consist of the Wolfcamp, Leonard, Guadalupe, and Ochoa Series (Figure VI.A.15). The Ochoan sediments are important to this discussion because they are immediately below the USDW. In addition, the Ochoan stratigraphy provides information pertaining to the deeper structure beneath the site.

The Ochoa Series section represents the top of the Permian strata, and in the Central Basin Platform area consists primarily of the: Salado Formation; the Rustler Formation; and the Dewey Lake Formation (WTGS, 1976). The Salado Formation, which rests unconformably on the Tansill Formation, consists of a thick, regionally extensive evaporite unit composed dominantly of salt and lesser amounts of anhydrite and minor amounts of mudstone (McGillis and Presley, 1981). The Salado Formation ranges in thickness from approximately 750 feet in the area of the Central Basin Platform to over 2,000 feet in the Delaware Basin.

The Rustler Formation consists of a maximum of 375 feet of dolomite and anhydrite with an irregular basal zone of red sand, conglomerate, and variegated shale (Jones, 1953). The Rustler Formation represents the youngest anhydrite in the Permian Basin.

The Dewey Lake Formation lies conformably on the Rustler Formation and consists mainly of fine-grained red sandstone and siltstone with some anhydrite, but no salt. It ranges in thickness from 250 to 300 feet in Andrews County (WTGS, 1961). Although there is an unconformity found at the top of the Dewey Lake Formation, which separates it from Triassic deposits, in many places the nature of this contact is not clear (Stone and Webster, 1983). The Ochoan units have a combined thickness of over 3,000 feet and indicate a similar structural trend as the lower Permian units.

A portion of the Ochoan stratigraphic sequence (i.e., Salado Formation, Rustler Formation, and Dewey Lake Formation) is shown on Cross-sections A-A' and B-B' (Plates VI.A.4 and VI.A.5). The upper contact of the Salado Formation, in the area of the proposed WCS landfill site, is at a depth of approximately 1,595 feet BGL at location #13 and 1,828 feet BGL at location #15.

The Rustler Formation top occurs at a depth of approximately 1,356 feet BGL at location #13 and 1,615 feet BGL at location #15. The total thickness of the Rustler Formation ranges from 210 feet at location #4 to 237 feet thick at location #12.

The erosional surface of the Dewey Lake Formation slopes regionally to the southeast (Nativ, 1988). The upper contact of the Dewey Lake Formation in the area of the proposed WCS landfill site is at a depth of approximately 1,217 feet BGL at location #13 and 1,382 feet BGL at location #9.

Triassic Units

The Triassic Dockum Group disconformably overlies the Permian stratigraphic sequence within the regional study area (Figure VI.A.15). The Dockum Group is comprised of a series of fluvial and lacustrine mudstone, siltstone, sandstone, and silty dolomite deposits (McGowen et. al., 1979) which range up to approximately 1,400 feet thick in the area of the Central Basin Platform. These sediments accumulated in a variety of continental depositional settings, including braided and meandering streams, alluvial fan deltas, lacustrine deltas, lacustrine systems, and mud flats (McGowen et. al., 1979).

Figure VI.A.18 shows the inferred paleogeographic setting that existed during the deposition of the Dockum Group. The terrigenous clastics deposited in the Permian Basin area were mainly derived from older sedimentary rocks that accumulated in Texas and New Mexico. The maximum preserved thickness of Triassic rocks (2,000 feet) occurs in the Midland Basin (Nativ, 1988).

The Tecovas Formation represents the lowermost lithologic cycle of the Triassic System. It consists primarily of claystone and siltstone. However, the Tecovas Formation is absent throughout portions of the Central Basin Platform.

The Trujillo Formation (i.e., Santa Rosa Formation of New Mexico) represents the middle lithologic cycle of Dockum Group deposition. The Trujillo (Santa Rosa) Formation is characterized by a sandy lower interval that becomes increasingly muddy in the upper section. The upper lithologic cycle of the Triassic System, or Chinle Formation, exhibits similar overall upward fining, except in the area of the northwestern Midland Basin, where sand from an eastern source was deposited during the upper Triassic cycle (McGowen et. al., 1979). Figure VI.A.19 presents an isopach (i.e., thickness) map of the upper Dockum Group.

The stratigraphic sequence of the Triassic Dockum Group (i.e., Santa Rosa Formation and Chinle Formation) is shown on Cross-sections A-A' and B-B' (Plates VI.A.4 and

VI.A.5). The upper contact of the Santa Rosa Formation in the area of the proposed WCS landfill site is at a depth of approximately 965 feet BGL at location #13 and 1,202 feet BGL at location #14. The geophysical log characteristic shows the Santa Rosa Formation to be a massive sandstone body. The total thickness of the Santa Rosa ranges from 230 feet at locations #15 and #17 to 305 feet thick at location #12.

The upper Dockum Group (Chinle Formation) top occurs at a depth of approximately 48 feet BGL at location #9 (immediately south of the proposed landfill site) and 93 feet BGL at location #14. The total thickness of the upper Dockum Group ranges from 955 feet at location #13 to 1,125 feet thick at location #4. The cross-sections show the fluvial nature of the upper Dockum Group with interbedded sandstone, siltstone, and clay lenses. The erosional surface of the Triassic Dockum Group is also quite evident. The Dockum Group is overlain in some areas of the Southern High Plains by Cretaceous rocks and in other areas by the Ogallala Formation.

Cretaceous Units

The Jurassic stratigraphic sequence is not found in the Permian Basin (Figure VI.A.15). Therefore, the Cretaceous (Comanchean Series) sediments rest disconformably upon the Triassic Dockum Group. These sediments are found in southeast-dipping isolated erosional remnants (Figure VI.A.20) as much as 100 feet thick (Cronin and Wells, 1963). Note that the subcrop map shows that Cretaceous rocks have been eroded away beneath the proposed WCS landfill site. Therefore, while Cretaceous rocks are found in the region, no Cretaceous units are shown on the accompanying stratigraphic cross-sections (Plates VI.A.4 and VI.A.5).

Cretaceous rocks were deposited in an epineritic and littoral environment on a slowly subsiding shelf (Nativ, 1988). The base of the Cretaceous System in the Southern High Plains is composed of basal sands of the Trinity Group. These light gray to reddish gray sediments consist of nearly pure quartz sands with scattered lenses of gravel (Stone and Webster, 1983). They are poorly consolidated and form a blanket-like deposit that is 10 to 25 feet thick in the southeastern High Plains area.

The sediments of the Fredericksburg Group rest unconformably on top of the Trinity Group deposits and consist predominately of calcareous rocks. These strata consist of light-gray argillaceous limestone interbedded with shale at the base, becoming more massive marly limestone near the middle and grading into interbedded dolomite, shale, and sandstone at the top (Stone and Webster, 1983).

Tertiary Units

Within the regional study area, the Ogallala Formation (Pliocene) rests disconformably upon either the Triassic Dockum Group or the Cretaceous sediments. Figure VI.A.21 presents the structure of the base of the Ogallala Formation, which corresponds to the erosional surface of the underlying Cretaceous and Triassic units. The Ogallala Formation contains both coarse fluvial conglomerate and sandstone and fine-grained eolian siltstone and clay (Nativ, 1988).

Seni (1980) believed that the depositional environment of the Ogallala Formation and the overlying Quaternary deposits produced a series of overlapping, humid-type alluvial fans. Three fan lobes were identified (Figure VI.A.22) whose grain size varies as a function of the distance from the major channel system. After further investigation, it was noted that the grain size of the Ogallala Formation clastics is controlled by the topography of the underlying mid-Tertiary erosional surface (Gustavson and Winkler, 1988). Coarse fluvial clastics were deposited in paleovalleys, while finer eolian sediments covered upland areas (Nativ, 1988). Eolian clastics also overlie the fluvial sediments in the paleovalleys as sand and silt sheets. The Ogallala Formation typically ranges from 0 to 200 feet thick in the south portion of the Southern High Plains. The thickness of the Ogallala Formation reflects the underlying paleotopography.

A resistant calcite layer called the caprock caliche lies at or near the top of the Ogallala Formation (Nativ, 1988). Caliche develops as an authigenic accumulation of calcium carbonate that results from soil-forming processes, precipitation from groundwater, or some combination of both (Stone, 1985). The processes governing the development of caliche are discussed fully in Section A.4.3.

The Ogallala Formation and Dockum Group are easily discernible on electric logs from nearby oil and gas wells and are shown on Plates VI.A.4 and VI.A.5. Because the top of the Dockum Group is an erosional surface, the elevation of the contact between these two formations varies significantly over relatively short distances. The thickness of the

Ogallala Formation in the area shown by the cross-sections ranges from 48 feet at location #9 (immediately south of the proposed landfill site) to 93 feet at location #14 (approximately three miles north of the site). This thickness determination assumes that all material overlying the Dockum Group consists of Ogallala Formation sediments. This is based on geophysical log signature, and includes some amount of surficial deposits and caliche cemented surficial deposits.

A.4. Site Subsurface Soils Investigation

A.4.1. Investigation Procedures

Site operations were conducted from November, 1992 through February, 1993. These operations included: the drilling of continuous cores and soil borings; geophysical logging; and the installation of piezometers and monitoring wells. All soil borings were described using the Unified Soil Classification System (USCS). A summary of soil boring, well completion and selected geologic data is provided in Table VI.A.4. Soil boring and well completion logs are provided in Appendix B. Geophysical logs are provided in Appendix C. A detailed discussion of the site subsurface investigation procedures is provided in the companion geotechnical report provided by JHA.

A.4.2. Subsurface Structure

A discussion of the regional subsurface structure is provided in Section A.1 and A.3. This analysis of faulting, seismicity and the overall regional subsurface structure is based on a review of the available published literature, and is based on the construction of two deep geologic cross-sections (Plate VI.A.4 and V.I.A.5). These two cross-sections were developed from available oil and gas industry data.

The site subsurface structural analysis is based on data resulting from the site investigation: 55 continuous cores; eight geophysical logs; and four shallow exploration borings (Table VI.A.4). The structural interpretation derived from this information is summarized in ten shallow geologic cross-sections A-A' through J-J'. A cross-section location map is provided as Figure VI.A.23. The 10 shallow cross-sections are provided as Figure VI.A.24 through VI.A.33. A structure map on top of the Dockum Group is provided as Figure VI.A.34. In addition, two orthographic projections of the Dockum Group surface are provided as Figure VI.A.35 and VI.A.36, and a depth to the top of the Dockum Group map is provided as Figure VI.A.37.

The regional subsurface structural data indicates no evidence of post-Permian faulting or warping within the local study area. The site subsurface data supports this regional analysis. The local geologic cross-sections (Figure VI.A.24 through VI.A.33) indicate horizontally configured intervals of primarily silty claystone, siltstone and sandstone within the shallow Dockum Group (Chinle Formation) sediments. While individual lithologic intervals range from isolated to laterally extensive, the local depositional framework within the Dockum Group indicates no evidence of faulting or warping.

Paleotopographic Surface of the Dockum Group

The buried surface of the local Dockum Group indicates a paleotopographic expression, which is consistent with published information (Reeves, 1966; McGowen et. al., 1979; Dutton and Simpkins, 1986). As shown in Figures VI.A.34, VI.A.35 and VI.A.36, an apparent ridge runs in a roughly northwest/southeast direction through the middle of the local study area. The "D" survey line, or local cross-section G-G' (Figure VI.A.30) runs along the approximate axis of this structural feature.

This ridge has the general appearance of a east/southeast plunging anticline when viewed from above (Figure VI.A.34). However, local cross-sections A-A', B-B', C-C' and D-D' (Figure VI.A.24, VI.A.25, VI.A.26 and VI.A.27, respectively), which cut profile views across this apparent structural ridge, do not indicate a similar anticlinal warping of the underlying stratigraphic intervals. Rather, these cross-sections indicate a generally horizontal configuration of shallow Dockum Group sediments.

The Dockum Group sediments are locally overlain by nine to 54 feet of top soil, windblown silt and sand, caliche, and the gravel, sand, silt and clay deposits of the Pliocene Ogallala Formation. A disconformable contact exists between the underlying Dockum Group and the overlying Ogallala Formation (Gawloski, 1983). The depositional record of most of the Tertiary System (Miocene through Paleocene), as well as the entire Cretaceous and Jurassic Systems, is not present in the local study area. This represents a missing time-rock interval of approximately 169 million years. Erosion of this time-rock interval, including a portion of the Triassic Dockum Group, occurred prior to the deposition of Ogallala Formation sediments (Gawloski, 1983; McGowen et. al., 1979; Dutton and Simpkins, 1986). It is this erosional activity, combined with some amount of scouring associated with the transportation of Ogallala Formation sediments which has locally shaped the surface of the Dockum Group, giving it the paleotopographic appearance indicated in Figures VI.A.34, VI.A.35 and VI.A.36.

General Relationship Between Local Surface Topography and Dockum Structure

The local surface topography is partially dependant on the structure of the underlying Dockum Group. The surface of the Dockum Group slopes rapidly to the south and north, off of the axis of the Dockum Group ridge (Figure VI.A.34). The local ground surface topography slopes rapidly to the south off of the axis of the underlying Dockum Group ridge and flattens along the southern margin of the study area (Plate VI.A.3). This is in strong similarity to the underlying Dockum Group structure. However, the ground surface topography continues to gently climb toward the north of the underlying Dockum Group ridge, despite the fact that the Dockum Group structure drops off toward the north.

The thickness of sediment overlying the Dockum Group is related to Dockum Group structure and ground surface topography. The difference between ground surface elevation and underlying Dockum Group structure elevation can be expressed in the form of the depth (below ground level) to the top of the Dockum Group, which is referred to here as overburden thickness. As shown in Figure VI.A.37, the overburden sequence within the local study area is thinnest along an arcuate band extending approximately from location 9-H to location 1-E. A comparison of the overburden thickness trend (Figure VI.A.37) to the Dockum Group structure (Figure VI.A.34) and local topography (Plate VI.A.3) shows that this band of thinnest overburden corresponds to the area where the local topography rapidly drops-off, in effect coming closest to reaching the surface of the underlying Dockum Group. However, south of this band of thinnest overburden, the ground surface topography flattens-out to a slope of approximately 0.5 degrees, while the underlying Dockum Group structure continues to drop-off toward the south at a slope of approximately three degrees (six times greater than topography). As a result, the overburden thickness increases along the southern portion of the study area.

To the north of the band of thinnest overburden, the topography rises at a gentle rate while the structure of the underlying Dockum Group begins to drop-off on the northern flank of the local Dockum Group ridge. Consequently, the overburden thickness increases in the northern portion of the local study area.

Small-Scale Dockum Group Structural Features and Buffalo Wallow Development

Localized drainage depressions such as playa lakes and buffalo wallows characterize much of the topographic surface of the High Plains, and are attributed to a variety of causes, including: differential compaction; eolian deflation; the transportation of sediment by animal activity (thus the name buffalo wallow); the dissolution and subsidence of the underlying caliche cap; as well as the dissolution and subsidence of underlying Cretaceous limestone and Permian evaporite sediments (Nicholson and Clebsch, 1961; Reeves, 1966; Gustavson and Finley, 1985; Collins, 1990). Within the local study area, a relationship may exist between the formation of buffalo wallows and the existence of underlying structural depressions in the surface of the Dockum Group.

Small-scale features are apparent on the surface of the local Dockum Group. Figures VI.A.34, VI.A.35 and VI.A.36 show that the Dockum Group ridge, which extends through the center of the local study area, is pock-marked with low-relief (i.e., approximately four to nine feet deep) structural depressions. One such depression was explored by a series of four shallow borings (less than 31 feet deep) and one deeper continuous core (depth of 100 feet) near location 2-D. At this location, a bowl shaped structural depression in the surface of the Dockum Group corresponds to an overlying topographic depression, locally referred to as a buffalo wallow.

Both the depression in the surface of the Dockum Group, and the overlying buffalo wallow, have a relief of approximately four feet. However, cross-section D-D' (Figure VI.A.27), which passes beneath this topographic depression, does not indicate a similar down-warping of sedimentary intervals beneath the depression. Instead, cross-section D-D' indicates horizontally configured stratigraphic intervals beneath location 2-D. Therefore, it is unlikely that the structural depression beneath 2-D is due to the dissolution and slumping of underlying Dockum Group or deeper Permian evaporite layers. The structural depression in the surface of the Dockum Group is probably a reflection of a small-scale paleotopographic depression scoured into the surface of the Dockum Group prior to the local deposition of Ogallala Formation sediments.

The results of the coring and soil boring activity at location 2-D suggest that partial dissolution of the shallow caliche cap may have contributed to the development of the buffalo wallow. The continuous core drilled within the buffalo wallow (location 2-D) encountered only six feet of caliche cap, consisting primarily of calcium carbonate cemented silt and sand. However, four exploration soil borings drilled along the outer rim of the buffalo wallow (location 2-D(A), 2-D(B), 2-D(C) and 2-D(D)) encountered a thickness of caliche cap ranging from 5.7 feet to 15.6 feet, with an average thickness of approximately 10.2 feet. This suggests that a portion of the caliche cap material may have been dissolved at the surface or beneath the buffalo wallow at 2-D. Surficial dissolution of caliche cementation and subsequent removal by deflation may explain the development of buffalo wallows (Nicholson and Clebesch, 1961). In addition, dissolution of the deeper portion of the caliche, and subsequent slumping of the overlying caliche cap, may have initiated the topographic expression of the buffalo wallow or simply propagated a pre-existing topographic surface depression.

The drilling results at location 2-D indicate sediment depletion within the buffalo wallow. The depth from ground surface to the top of the Dockum Group is given in Figure VI.A.37. The thickness of material overlying the Dockum Group locally thins in the vicinity of 2-D. This can be explained by the removal of surficial material near location 2-D by eolian deflation or by the transportation of soil from the depression by animal activity. The buffalo wallow is presently covered with a thick carpet of vegetation, which would be expected to greatly diminish the effect of eolian deflation. However, this buffalo wallow presently appears to be frequented by livestock, resulting in possible sediment removal on their hooves and fur. This pattern of current livestock activity at the buffalo wallow may be indicative of the historic use of the site by North American Bison (i.e., buffalo).

The topographic and structural depression at location 2-D may establish a surface water and ground water relationship which has been integral in the development of the buffalo wallow. The buffalo wallow probably serves as a seasonal collection point for surface water. The coring and soil boring process at location 2-D indicated that the buffalo wallow contains approximately two feet of organic-rich soil, compared to less than 0.4 feet of soil along the rim of the buffalo wallow. In addition, the significantly increased density and length of grass and shrub growth within the buffalo wallow suggests increased available moisture.

This potential surface water and groundwater relationship is supported by the fact that the coring activity within the buffalo wallow encountered saturated conditions within the shallow sand and gravel immediately overlying the Dockum Group. However, cores and soil borings surrounding location 2-D did not produce water. This suggests that ponded surface water within the buffalo wallow is able to infiltrate into the subsurface, but is forced to pond beneath the buffalo wallow, possibly due to the structural depression in the underlying Dockum Group. This infiltrating surface water may increase the rate of caliche dissolution beneath the buffalo wallow and, therefore, may help to propagate the growth of the 2-D buffalo wallow. A complete discussion of the site groundwater conditions is provided in Section B.2.

If a local relationship exists between buffalo wallow formation and Dockum Group structure, then it is likely that buffalo wallows would be more abundant overlying Dockum Group structural highs. It is here where structural depressions are most likely to be closed (i.e., bowl-shaped) and, therefore, capable of ponding shallow groundwater. Such a relationship may be suggested by the abundance of buffalo wallows within the local area roughly bounded by survey locations 7-D and 7-E through 11-D and 10-F (Plate VI.A.3). This area directly overlies a broad structural high in the surface of the Dockum Group (Figure VI.A.34).

A.4.3. Subsurface Stratigraphic Complexity

The local subsurface stratigraphic framework is presented in ten shallow geologic cross-sections (Figures VI.A.24 through VI.A.33). These cross-sections are based on the results of the site coring, soil boring and geophysical logging program. A total of 59 soil boring logs are presented in Appendix B. A total of eight geophysical logs are provided in Appendix C. A percent siltstone and sandstone isopach map, which delineates the local sediment distribution pattern in the shallow Dockum Group, is provided as Figure VI.A.38. A stratigraphic column is provided as Figure VI.A.15.

Surficial Materials

The site is overlain by a thin veneer of two feet or less of organic-rich top soil. The top soil consists of moist, brown silty sand which contains abundant vegetation debris and roots. The top soil commonly contains well rounded, white, black, red, pink and opaque quartzitic gravel and gravel fragments, as well as caliche fragments. These gravel and caliche fragments appear to have weathered out of underlying caliche-cemented Ogallala Formation sediments.

Caliche

Within the local study area, the top soil horizon is underlain by a variable sequence of calcium carbonate cemented, calcrete duracrust capping material (i.e., caliche). Caliche is common throughout the Southern High Plains or Llano Estacado, and forms the resistant beds of the Caprock Escarpment along the western and eastern margins of the Southern High Plains (Gustavson and Finley, 1985). Caliche typically forms in arid to semi-arid climates, where seasonal precipitation dissolves and vertically transports low magnesium calcite from the surface soils into the deeper soil, where it is precipitated in the vadose zone of the C soil horizon (Leeder, 1982), or at the vadose zone/phreatic zone interface (Braithwaite, 1983).

Thick sequences of caliche such as those encountered within the local study area, are probably remnants from the Pleistocene, and may record episodic accumulations of carbonate in response to Pliocene-Pleistocene climatic fluctuations (Leeder, 1982). Common sources of calcium in the shallow subsurface include weathered rock products and organic sources such as lichen, fungi, algae and bacteria (James and Choquette, 1984). The primary factors controlling caliche formation include: meteoric precipitation rate; carbon dioxide content of meteoric water and carbon dioxide donation by organic material (increased carbon dioxide concentrations increase the rate of calcium carbonate dissolution); and temperature (increased temperature promotes calcium carbonate precipitation) (James and Choquette, 1984).

A local surface exposure of caliche, Ogallala Formation and Dockum Group sediments was observed at Baker Spring (Plate VI.A.3). At this location, the caliche cap consists of: approximately six feet of white, highly fractured calcium carbonate cemented feldspathic and quartzitic silt and very fine grained sand; overlying approximately 12 feet of white and pinkish white, massive caliche with extensive concretionary nodule growths (i.e., pisolites) and feldspathic and quartzitic silt and very fine grained sand; resting on top of approximately six feet of pinkish white, calcium carbonate cemented feldspathic and quartzitic silt, sand and gravel which becomes less cemented with depth. This lower six feet of caliche material appears to be calcium carbonate cemented Ogallala Formation sediments. This caliche altered Ogallala Formation material has an irregular basal contact and indicates a gradational transition into primarily uncemented Ogallala Formation sands and gravels below.

Caliche was encountered during the drilling program and was observed to be laterally extensive throughout the local study area, ranging up to 47 feet thick at location 7-A (Figure VI.A.24 through VI.A.33). As seen in the cross-sections, the local caliche cap thickens toward the north and south margins of the study area, similar to the overall thickness trend of the combined overburden sequence (Figure VI.A.37).

The caliche encountered during the drilling program is similar to the caliche exposed at Baker Spring. Matrix color ranges from white to pinkish white, with varying degrees of cementation, hardness, fracturing and pisolitic concretions. The caliche horizon contained varying amounts of feldspathic and quartzitic silt, sand and gravel fragments with a general trend of decreased cementation and increased silt, sand and gravel content with depth. In many areas, the caliche cap material included altered eolian silts and sands, as well as cemented Ogallala Formation sediments. Open fractures and vugs were observed within the caliche horizon.

Ogallala Formation

As discussed in Section A.3.2, the Ogallala Formation records a period of fluvial deposition during the Pliocene (3 to 11 million years ago). The Ogallala Formation had a source area in the Rocky Mountains, and was deposited as an eastern-thinning apron of coalescing alluvial fans (Seni, 1980).

A local surface exposure of caliche, Ogallala Formation and Dockum Group sediments was observed at Baker Spring (Plate VI.A.3). The Ogallala Formation sediments consist of approximately six feet of caliche cemented feldspathic and quartzitic silt, sand and gravel, resting on top of approximately 15 feet of planar crossbedded and trough crossbedded sand and gravel, which is indicative of a high energy fluvial system (Seni, 1980). Sediment color ranges from pinkish tan to dark brown with red, pink, white, black and opaque quartzitic gravel clasts and granitic cobbles. The base of the Ogallala Formation has a sharp and irregular contact with the underlying dusky red siltstone and claystone of the Dockum Group.

Ogallala Formation sediments were encountered in numerous soil borings throughout the local study area (Figure VI.A.24 through VI.A.33). These sediments consist of feldspathic and quartzitic sand and gravel with silt and clay, and appeared consistent with the surface exposure at Baker Spring. For the purpose of general classification and cross-section preparation, that portion of the Ogallala Formation that has been cemented as part of the overlying caliche cap, is represented in the cross-sections as caliche. However, it should be noted that a significant portion of the caliche cap within the local study area consists of altered Ogallala Formation sediments. The following discussion focuses on the uncemented portion of the Ogallala Formation, below the base of the caliche cap.

Caliche alteration of the Ogallala Formation, combined with incomplete recovery of caliche-cemented and uncemented Ogallala Formation samples during the coring program, hampered the accurate recognition and classification of the Ogallala Formation sediments. Therefore, an accurate thickness (i.e., isopach) map of the Ogallala Formation could not be prepared as part of the geologic investigation. However, the geologic cross-sections (Figure VI.A.24 through VI.A.33) provide a general means for determining the local thickness trend of Ogallala Formation.

The local thickness trend of the Ogallala Formation is partially related to the structure of the underlying Dockum Group. As shown in the local cross-sections A-A', B-B', C-C', D-D' and J-J' (Figure VI.A.24, VI.A.25, VI.A.26, VI.A.27 and VI.A.33, respectively), the thickness of the Ogallala Formation generally increases off of the northern and southern flanks of the underlying Dockum Group ridge (Figure VI.A.34).

In addition, small-scale structural lows in the surface of the Dockum Group generally contain an increased thickness of Ogallala Formation. This is particularly evident on cross-sections G-G' (Figure VI.A.30), where Ogallala Formation sediments appear thickest in structural lows between locations 9-D and 7-D, and between locations 5-D and 2-D. This general thickness trend is due to the fact that the Ogallala Formation occurs as an erosional remnant throughout much of the Southern High Plains area (Seni, 1980). As a result, thicker sequences of Ogallala Formation sediments often correspond to structural lows in the underlying formations. It is in these structural lows where the Ogallala Formation is partially protected from erosional activity. In addition, it is within these structural lows where a portion of the Ogallala Formation rests below the base of caliche cementation and is, therefore, clearly recognizable as the Ogallala Formation.

Ground surface topography also determines the local thickness trend of the Ogallala Formation. As discussed in Section VI.A.4.2, the overburden is thinnest where the ground surface has been eroded closest to the surface of the underlying Dockum Group. Since much of the local Ogallala Formation is tied up as cemented caliche, the thickness of the Ogallala Formation has a similar thickness trend as the entire overburden sequence. This general relationship is illustrated in Figure VI.A.37.

Dockum Group

As discussed in Section VI.A.3.2, the Dockum Group records a period of fluvial-deltaic and lacustrine deposition within a restricted continental basin during the Triassic (180 to 260 million years ago). The source areas for the Dockum Group included: the Llano Uplift area to the east; the Amarillo Uplift, Wichita Mountain Uplift and Arbuckle Mountain Uplift to the north and northeast; the Sierra Grande Arch and Sangre De Cristo Uplift to the northwest; the Sacramento Uplift to the west; and the Diablo Platform to the south (Figure VI.A.18) (McGowen et. al., 1979).

In Texas, the Dockum Group is stratigraphically divided into three formations: the basal Tecovas Formation (siltstone and claystone); the middle Trujillo Formation (sandstone and siltstone); and the upper Chinle Formation (claystone and siltstone) (Gawloski, 1983). The Trujillo Formation of West Texas is analogous to the Santa

Rosa Formation of New Mexico. The portion of the Dockum Group encountered at the site is classified as part of the Chinle Formation.

A thin surface outcrop of Dockum Group sediments exists at Baker Spring (Plate VI.A.3). At this location, approximately five feet of dusky red colored siltstone and claystone is exposed at the base of a highwall of caliche and Ogallala Formation sediments. The upper surface of the Dockum Group is irregular and indicates an eroded, disconformable contact with the overlying Ogallala Formation.

The Dockum Group was penetrated to a maximum depth of 300 feet below ground level (location 9-G) during the on-site soil boring program. Continuous cores, drill cuttings and geophysical logs were used to characterize this shallow portion of the Dockum Group at the site. This information is presented in 10 hydrogeologic cross-sections (Figure VI.A.24 through VI.A.33). In addition, the general distribution of Dockum Group silt and sand is presented in Figure VI.A.38.

Based on the results of the on-site drilling program, the Dockum Group consists primarily of reddish brown, maroon and purple siltstone and claystone with intervals of reddish tan and greenish gray siltstone and sandstone. However, as shown in the cross-sections, a number of cycles of predominantly mudstone and siltstone/sandstone deposition indicate the variable depositional history and complexity of the local Dockum Group.

The portion of the Dockum Group encountered during the on-site drilling program can be divided into three major depositional cycles: 1) a lower interval consisting of siltstone with some claystone, below an approximate elevation of 3,250 feet MSL; 2) an intermediate interval of primarily claystone with some siltstone and sandstone, within an approximate elevation range from 3,250 to 3,325 feet MSL; and 3) an upper interval consisting of siltstone and sandstone with some claystone above an approximate elevation of 3,325 feet MSL. These three depositional cycles are particularly well defined in cross-sections A-A' and J-J' (Figure VI.A.24 and VI.A.33, respectively).

The upper and lower depositional cycles represent periods of increased depositional activity. Reddish brown, massive to parallel-laminated claystones typically indicate lacustrine or prodelta sedimentation, while greenish gray and reddish brown, parallel-laminated and cross-laminated siltstones and very fine grained sandstones indicate delta-front deposition (McGowen et. al., 1979). A predominant greenish gray coloration of the siltstones and sandstones indicates deposition during periods of high lake levels (i.e., high stand), which corresponds to periods of relatively high rainfall rates. During these periods, the fluvial system is actively transporting material to the basin from distant source areas. This sediment is rich in lighter colored granitic minerals and often contains flakes of mica and biotite. A predominant reddish brown coloration of the siltstones and sandstones indicates deposition during periods of low lake level (i.e., low stand). This is when rainfall rates are relatively low, and the fluvial system is no longer transporting sediment into the basin from distant source areas. The primary sediment source consists of pre-existing Triassic strata located along the margin of the lacustrine basin.

The middle depositional cycle represents a period of relatively quite lacustrine deposition. This interval consists primarily of reddish brown, maroon and purple claystone with some siltstone and sandstone. The claystone intervals record periods of both high stand and low stand lacustrine deposition. However, a predominance of maroon and purple, worm-burrowed claystone is indicative of high stand lacustrine deposition. A dominantly reddish brown and purple claystone, mottled with greenish gray, is indicative of high stand mud flat deposition. Mud flat sediments also exhibit clay and mineral infilling of fractures (i.e., mud cracks) and contain disseminated calcium carbonate cementation and caliche nodules. Siltstone and sandstone intervals that do not exhibit observable grain size sorting trends are typically the result of fan delta deposition associated with low stand braided stream systems. Massive, reddish brown claystones which exhibit abundant worm burrows and slickensides are associated with low stand lacustrine and mud flat deposition (McGowen et. al., 1979).

The local distribution pattern of Dockum Group sandstone and siltstone indicates a sediment transportation network which is oriented in a general west to east direction. A percent sandstone and siltstone map was generated for the uppermost depositional cycle (Figure VI.A.38). The sandstone and siltstone within the upper depositional cycle exhibits a sinuous to dendritic distribution pattern, with a distribution axis running through the middle portion of the local study area. This configuration is consistent with the regional distribution pattern which indicates an east to northeast progradation of Dockum Group sands extending from a source area in the Diablo Platform to the west/southwest (Figure VI.A.39).

A sandstone and siltstone distribution map for the lower depositional cycle was not generated due the minimal number of borings which penetrate this interval. However, a geophysical logging program was conducted at eight deep locations at the proposed WCS landfill site, which provides information regarding the lateral continuity of the lower depositional cycle. These logs, combined with the results from the continuous coring/soil boring program, indicate a laterally continuous sandy silt interval within the lower depositional cycle, at an approximate subsurface elevation of 3,225 feet to 3,250 feet MSL (Figure VI.A.24 and VI.A.33).

The geophysical log signature observed in Figure VI.A.24 and VI.A.33 can also be seen on the two deep cross-sections (Plate VI.A.4 and VI.A.5) within the same approximate subsurface elevation range. As shown on the two deep cross-sections, the long axis of this sandy silt interval is oriented in a generally southwest to northeast direction. This interval is shown on Plate VI.A.5 extending over four miles from location #12 to location #15. As shown on Plate VI.A.4, the short axis of this sandy silt unit extends a minimum distance of 1.3 miles from location #4 to location #9. The southwest to northeast distribution pattern of this lower cycle sandy silt interval is consistent with the distribution pattern of the upper cycle (Figure VI.A.38) and is consistent with the regional Dockum Group sand distribution pattern (Figure VI.A.39).

A.4.4. Hydrogeologic Framework

The local hydrogeologic framework consists of unsaturated caliche and Ogallala Formation deposits overlying Dockum Group sediments which appear to be under both confined and water table conditions. Saturated conditions were encountered in the Ogallala Formation beneath the buffalo wallow at location 2-D. However, the Ogallala Formation did not yield water from any of the borings surrounding the buffalo wallow, or at any of the other locations at the proposed WCS landfill site.

This isolated occurrence of shallow groundwater in the Ogallala Formation is attributed to the localized perching of groundwater within a shallow depression in the paleotopographic surface of the Dockum Group immediately beneath the buffalo wallow. Based on the results of the site-wide drilling program, this isolated occurrence of shallow Ogallala Formation groundwater does not constitute an aquifer. See Section VI.A.4.2 for a complete discussion of local Dockum Group structure and its relationship to the 2-D buffalo wallow. A complete discussion of the local hydrogeologic system is provided in Section B.2.

A.4.5. Geotechnical Properties of the Subsurface Soils

A discussion of the subsurface soil geotechnical properties is provided in the companion report provided by JHA. Selected data based on laboratory permeameter testing are used in the discussion of local groundwater conditions contained in Section VI.B.2.

VI.B. Facility Groundwater

B.1. Regional Aquifers

The High Plains Aquifer of West Texas consists of water bearing units within: Quaternary alluvial deposits; the Pliocene Ogallala Formation; and Createceous rocks (Nativ and Gutierrez, 1988). Regionally, the Ogallala Formation is the primary component of the High Plains Aquifer (Dutton and Simpkins, 1986). The High Plains Aquifer is viewed as one, hydraulically connected aquifer system, and groundwater typically exists under both unconfined and confined conditions.

B.1.1. Ogallala Aquifer

The Ogallala Aquifer is the primary freshwater aquifer within the regional study area and serves as the principal source of groundwater in the Southern High Plains (Cronin, 1969). The general characteristics of the Ogallala Formation, which have been discussed previously in Sections A.3.1, A.3.2 and A.4.3 indicate the fluvial origin of the Ogallala Formation. There is complex vertical and lateral variability found within the Ogallala Formation.

Regionally, the Ogallala Formation thickens to the north and west. The saturated thickness of the Ogallala Aquifer ranges from a few feet to approximately 300 feet in the Southern High Plains (Nativ, 1988). Groundwater within the Ogallala Aquifer is typically under water table conditions, with a regional hydraulic gradient toward the southeast (Figure VI.B.1) ranging from approximately 10 feet/mile (Stone and Webster, 1983) to 15 feet/mile (Knowles et. al., 1984). The average hydraulic conductivity of the Ogallala Aquifer ranges from 1 foot/day (Knowles et. al., 1984) to 27 feet/day (Stone and Webster, 1983).

The Ogallala Aquifer is recharged primarily through the infiltration of precipitation. The rate of recharge is believed to be less than 1 inch/year (Stone and Webster, 1983). Groundwater discharge from the Ogallala Aquifer occurs naturally through springs, underflow, evaporation and transpiration, but is also removed artificially through pumpage and catchment. Currently, the rate of withdrawal exceeds the rate of recharge for much of the Ogallala Aquifer (Stone and Webster, 1983).

Water quality data for three Ogallala Aquifer wells, located within two miles of the site, resulted from a review of Texas and New Mexico state records for western Andrews County, Texas and eastern Lea County, New Mexico. These water well locations are tabulated in Table VI.B.1.a, and water quality data for these wells are presented in Table VI.B.1.b. The well locations are spotted on Plate VI.A.1.

Review of the water quality data indicates that the local Ogallala Aquifer contains fresh to slightly saline water (TDS $\leq$ 3,000 mg/L). The TDS value for well 26-40-201 (1,070 mg/L) is slightly above the Recommended Secondary Constituent Level of 1,000 mg/L (25 TAC Chapter 337). However, the Ogallala Formation does not appear to be water bearing at the proposed WCS landfill site.

Tertiary-Quaternary Aquifer

The Tertiary-Quaternary Aquifer is a minor regional aquifer and is not present at the proposed WCS landfill site. Quaternary-age alluvium occurs as channel deposits composed of alternating thickly bedded calcareous silt, fine sand, and clay that overlie Ogallala Formation and Chinle Formation sediments along Monument Draw (Nicholson and Clebsch, 1961). From the north end of Monument Draw southward, groundwater moves through both the Quaternary alluvium and through the large outliers of the Ogallala Formation underlying the Eunice Plain area. The sediments along Monument Draw and under the Eunice Plain to the west of the draw have an average saturated thickness of about 30 feet (Nicholson and Clebsch, 1961). The bulk of the water in the Tertiary-Quaternary Aquifer is derived by underground flow from the Laguna Valley area to the north-northwest, as local recharge by precipitation is probably negligible. East of Monument Draw, the buried Triassic strata form a north-trending barrier which is reflected topographically by Rattlesnake Ridge (Nicholson and Clebsch, 1961). Groundwater flow is diverted southward by this barrier. In the Rattlesnake Ridge area, the base of the Ogallala Formation is generally above the water table.

B.1.2. Cretaceous Aquifer

The Cretaceous Aquifer of the Southern High Plains is typically considered as part of the High Plains Aquifer (Nativ and Gutierrez, 1988). Recharge to the Cretaceous Aquifer is provided by overlying Quaternary and Ogallala Formation sediments in Texas, and by upward leakage from the underlying Dockum Group in eastern New Mexico. The regional hydraulic gradient of the Cretaceous Aquifer is toward the southeast (Figure VI.B.2).

The Cretaceous Aquifer in the Southern High Plains consists of: a basal unit - Trinity Formation sandstone; an intermediate unit - Edwards Formation limestone; and an upper unit - Kiamichi/Duck Creek Formation sandstone and limestone. Where present in the subsurface, the Cretaceous Aquifer is used in the Southern High Plains as a primary source of groundwater (Nativ and Gutierrez, 1988). However, within Andrews County, the Cretaceous Aquifer is only present in the extreme southeastern portion of the county. Therefore, the Cretaceous Aquifer is not considered to be of importance to this report and is not discussed further in this section.

B.1.3. Dockum Group Aquifer

The Dockum Group regionally consists of Triassic fluvial and lacustrine clay, shale, siltstone, sandstone and conglomerate. The Dockum Group is divided into three stratigraphic units (bottom section to top section): the Tecovas Formation; Trujillo Formation (analogous to the Santa Rosa Formation) and Chinle Formation. The Tecovas Formation is not present within the regional or local study area. Water from the Dockum Aquifer is used as a replacement for, or in combination with the Ogallala Aquifer as a regional source for irrigation, stock and municipal water (Dutton and Simpkins, 1986).

Lower Dockum Aquifer

Topographically controlled groundwater basin divides were developed during the Pleistocene, by the erosion of the Pecos and Canadian River valleys (Figure VI.B.3). Prior to the development of these groundwater basin divides, the lower Dockum Aquifer was recharged by precipitation on its outcrop area in eastern New Mexico (Figure VI.B.3, view a and b). However, since the development of the Pecos and

Canadian River valleys, the lower Dockum Aquifer in Texas has been cut-off from its recharge area. Without recharge, the lower Dockum Aquifer experiences a net loss of groundwater from withdrawal by wells and by seepage (Figure VI.B.3, view c and d) (Dutton and Simpkins, 1986).

Hydraulic head levels, hydrochemical facies analyses and groundwater oxygen isotope values for the Dockum Aquifer, compared to the High Plains Aquifer, indicate that the confined Dockum Aquifer is separated from the overlying High Plains Aquifer by the thick confining claystones of the upper Dockum Group (Dutton and Simpkins, 1986). Groundwater oxygen isotope values indicate that the confined Dockum Aquifer was recharged in eastern New Mexico during a cool climate, at elevations above approximately 5,900 feet MSL (Dutton and Simpkins, 1986). However, due to the Pleistocene cut-off of the lower Dockum recharge area, current recharge is negligible (Figure VI.B.3). Therefore, groundwater within the lower, confined Dockum Aquifer is "old" (up to 3 million years old) and storage is irrevocably depleted by pumpage.

The regional hydraulic gradient of the lower Dockum Aquifer, which is toward the southeast, is presented in Figure VI.B.4. It can be inferred from this map that the potentiometric surface of the water bearing zones within the lower Dockum Group is located at an approximate elevation of 3,100 feet MSL (350 feet BGL) in the area of the proposed WCS landfill site.

Upper Dockum Aquifer

The upper portion of the Dockum Group (Chinle Formation) serves as an aquitard in the regional and local study area (Nicholson and Clebsch, 1961; Dutton and Simpkins, 1986). This is supported by the fact that the hydraulic head of the lower Dockum Aquifer is significantly lower than that of the overlying Ogallala Aquifer throughout much of the regional study area (Figure VI.B.5). This relative head difference, approximately 200 to 300 feet in western Andrews County, suggests that the lower Dockum Aquifer is receiving essentially no recharge (Nativ, 1988). The primary limiting factors on recharge include: the aquitard characteristic of the upper Dockum Group; and the cut-off, by the Pecos River Valley, of historical recharge areas in eastern New Mexico (Figure VI.B.3).

Permeable zones do exist within the upper Dockum Group which produce low quantities of good to poor quality water. Recharge to the upper Dockum Aquifer is provided by vertical infiltration of precipitation from the overlying units of the Quaternary-Tertiary Aquifer and High Plains Aquifer. This occurs where relatively permeable zones within the Dockum Aquifer are in contact with the overlying aquifer units (Nicholson and Clebsch, 1961). Within the regional study area, the flow direction in the upper Dockum Aquifer system is toward the east, away from outcrop areas to the west (Dutton and Simpkins, 1986).

B.2. Local Groundwater Conditions

The local groundwater system consists of unsaturated caliche and Ogallala Formation deposits resting on top of Dockum Group sediments which appear to be under both confined and water table conditions. Saturated conditions were encountered in the Ogallala Formation beneath the buffalo wallow at location 2-D. However, the Ogallala Formation did not yield water from any of the borings surrounding the buffalo wallow, or at any other locations within the local study area, and therefore does not constitute an aquifer. This isolated occurrence of Ogallala Formation groundwater is attributed to the localized perching of groundwater within a shallow depression in the paleotopographic surface of the Dockum Group immediately beneath the buffalo wallow (see Section VI.A.4.2 for a complete discussion of local Dockum Group structure and its relationship to the 2-D buffalo wallow). Water bearing units within the shallow Dockum Group consist of isolated to laterally extensive prodelta and delta-front siltstones and sandstones.

B.2.1. Uppermost Aquifer

The uppermost aquifer at the site consists of the saturated portion of the Dockum Group. Insufficient data are currently available to conclusively determine the character of the uppermost aquifer. This is due to the fact that the water levels in many of the 12 groundwater monitoring wells and piezometers, which were installed as part of the field investigation, have not yet equilibrated. In some cases, this water level equilibration period currently exceeds 90 days (Table VI.B.2). However, four of the piezometers installed have approximately reached stabilization, and form the basis for the following discussion. Regardless of which portion of the local Dockum Group is ultimately defined as the uppermost aquifer, the results of the on-site drilling program and deep cross-section preparation indicate an interval of underlying clay that is in excess of 30 feet in thickness (Figure VI.A.24 through VI.A.33; Plate VI.A.4 and VI.A.5).

Hydraulic Gradient

Water level elevations at four on-site piezometers have approximately reached static conditions. The water elevations at these locations range from 3,322.11 feet MSL (150.23 feet BGL) at location 11-D, to 3,257.45 feet MSL (181.10 feet BGL) at location 2-G (Table VI.B.2). Based on this preliminary information, a east/southeast gradient of approximately 75 feet per mile (0.014 feet per foot) is inferred for the local Dockum Group (Figure VI.B.5). This information corresponds well with the regional potentiometric surface map (Figure VI.B.4), which indicates a southeast hydraulic gradient for lower Dockum Group. The regional potentiometric surface map (Figure VI.B.4) also indicates a potentiometric surface for the lower Dockum Group of approximately 3,100 feet MSL in western Andrews County.

Aquifer System

As shown in the cross-sections at locations 2-G, 7-G and 11-D (Figure VI.A.24 and VI.A.33), the present hydraulic head level in these piezometers extends well above the top of the completion interval. This suggests that the water bearing intervals at these locations are under confined conditions. However, the water levels in the supplemental wells installed in the claystone above these water bearing intervals have not yet equilibrated. Therefore, it can not be confirmed at this time whether the head levels in piezometers 2-G, 7-G and 11-D, indicate confined conditions or simply reflect the uppermost zone of saturation within the surrounding claystones (i.e., water table conditions).

The water level at piezometer 4-C has equilibrated, and is within the completion interval (Figure VI.A.29). This indicates that the Dockum Group sandstone in which piezometer 4-C is completed, is under water table conditions.

Nested wells have been installed at three locations at the site (4-G, 6-B and 9-G), to obtain data regarding vertical hydraulic gradients. Once water levels reach static conditions, a more complete understanding of the local hydrogeologic system will be gained.

Groundwater Seepage Velocity

As discussed above, the analysis of the preliminary water level data from four of the on-site piezometers, indicates a hydraulic gradient of approximately 75 feet per mile (0.014 feet per foot) towards the southeast (Figure VI.B.6). Since water levels at the site have not reached static conditions, no field testing (i.e., slug testing or aquifer pump testing) has been performed to this point to evaluate in-situ hydraulic conductivity values. The fact that most wells at the site require many weeks for their water levels to reach static conditions, provides a qualitative indication of relatively low hydraulic conductivities for the local Dockum Aquifer.

Since in-situ pumping or slug test data are not currently available, hydraulic conductivity values based on laboratory permeameter testing results were used. These hydraulic conductivity values were derived from the testing of subsurface soil samples obtained during the on-site drilling program. Porosity values are based on assumptions from Walton (1991). A discussion of the permeameter testing, and other geotechnical testing programs, is provided in the companion report prepared by JHA.

Groundwater seepage velocities were calculated for three types of lithologic material: claystone, siltstone and sandstone. The highest measured hydraulic conductivity values available, derived from laboratory permeameter testing, were used to calculate the seepage velocity for each of the three lithology types. In addition, the assumed porosity value for each lithology was selected from the low end of the published range (Walton, 1991), to maximize the calculated seepage velocity. Groundwater seepage velocities were calculated using Darcy's Law as follows:

$$v = (K/n)\,(dh/dl) \qquad \text{(Freeze and Cherry, 1979, p 71)}$$

where:

v = seepage velocity
K = hydraulic conductivity
n = porosity
dh/dl = hydraulic gradient

The results of these calculations are summarized as follows:

Lithology	K (cm/sec)	n (0.20 =20%)	(dh/dl)	V (ft/day)	V (ft/year)
claystone	1.76×10^{-8}	0.10	0.014	7.0×10^{-6}	0.003
siltstone	3.20×10^{-6}	0.25	0.014	5.2×10^{-4}	0.2
sandstone	2.58×10^{-6}	0.25	0.014	4.3×10^{-4}	0.2

Groundwater Quality Data

Water quality samples have not been obtained from wells at the site. This is due to the fact that the wells have not equilibrated and have not been developed. However, a search of available state water quality data for Texas and New Mexico provided a groundwater analysis of a Dockum Aquifer well within two miles of the proposed landfill site (Table VI.B.1.b and Plate VI.A.1). This well is used as a groundwater monitoring well (MW-79) at the nearby Parabo, Inc. facility. The chemical analysis indicates slightly saline water ($1,000 \leq$ TDS $\leq 3,000$ mg/L). The TDS (2,386 mg/L), sulfate (359 mg/L) and chloride (723 mg/L) values are above the Recommended Secondary Constituent Levels (25 TAC Chapter 337) of 1,000 mg/L, 300 mg/L and 300 mg/L, respectively.

B.2.2. Aquiclude

As discussed in Section VI.B.1.3, the Chinle Formation of the Dockum Group serves as a regional aquitard (Dutton and Simpkins, 1986). The portion of the Dockum Group encountered during the on-site drilling program consists of a complex assemblage of Chinle Formation claystone, siltstone and sandstone. As discussed in Section VI.B.2.1, laboratory-measured maximum hydraulic conductivities for site-specific Chinle Formation samples range from 1.76×10^{-8} cm/sec for claystone, to 3.20×10^{-6} cm/sec for siltstone and 2.58×10^{-6} for sandstone. These hydraulic conductivity values, combined with the massive to horizontally bedded character of local Chinle Formation, indicate that it will serve as an effective aquitard or aquiclude.

B.2.3. Underground Sources of Drinking Water (USDW)

An inventory of water wells within a 2-mile radius of the proposed landfill site was performed, based on existing state agency records. This information is summarized in

Table VI.B.1.a, and the well locations are posted on Plate VI.A.1. The 2-mile search area was initiated when no wells were found to be located within one mile of the site. A summary of groundwater quality analyses for these wells is provided in Table VI.B.1.b.

Based on geophysical log response and limited water chemistry data (Table VI.B.1.b), the Dockum Group appears to contain moderately saline water (TDS $\leq$ 10,000 mg/L). The underlying Permian units contain salt deposits and are not locally used as a water supply. Therefore, the base of the local USDW is determined to be at the base of the Dockum Group (i.e., approximately 1,400 feet BGL).

As discussed in Section B.1.1, the primary source of potable groundwater within the regional area is the Ogallala Aquifer. However, as discussed in this section, the base of the local USDW is considered to include water bearing zones within the lower Dockum Group. The local groundwater system will be insulated from proposed landfill activities at the WCS facility by the aquitard characteristics of the upper Dockum Group, and by the proposed landfill design and engineering controls. The proposed landfill design and engineering controls are discussed in the companion report provided by AME.

B.3. Detection Monitoring System

The detection monitoring system, including proposed well system (Section VI.B.3.1) and sampling parameters (Section VI.B.3.2), is discussed in the companion report provided by AME.

VI.C. Exemption from Groundwater Monitoring for an Entire Facility

WCS does not, at this time, wish to request an exemption from groundwater monitoring for the proposed landfill facility.

VI.D. Unsaturated Zone Monitoring

This section does not apply to this Part B Permit Application, because the proposed WCS facility is not a land treatment unit and is not associated with any Corrective Action.

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REPORT OF
PRELIMINARY SUBSURFACE EXPLORATION

PROPOSED NATIONAL ENRICHMENT FACILITY
LEA COUNTY, NEW MEXICO

Prepared for:

LOCKWOOD GREENE

Spartanburg, South Carolina

Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.

Knoxville, Tennessee

MACTEC Project 3043031049/0001

October 17, 2003

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Mr. Philip Clarkson
Lockwood Greene
1500 International Drive
Spartanburg, SC 29304

Subject: **Report of Preliminary Subsurface Exploration**
Proposed National Enrichment Facility
Lea County, New Mexico
MACTEC Project 3043031049/0001

Dear Mr. Clarkson:

We at MACTEC Engineering and Consulting, Inc., (MACTEC) are pleased to submit this Report of Preliminary Subsurface Exploration for your project. Our services, as authorized by you, were provided in general accordance with our proposal number Prop03Knox/404, Revision 2, dated September 2, 2002.

The purpose of this preliminary exploration was to develop information about the site and subsurface conditions that could be used for assistance in determining the feasibility of constructing the proposed facilities at the site. This report describes the work performed, and presents the results obtained and our preliminary geotechnical exploration.

The preliminary exploration does not provide the necessary information to complete the design of the facilities. When specific project details concerning building and pavement locations and the foundation loads and site grades are developed, subsequent and more detailed exploration and analysis will be necessary to provide the final geotechnical design parameters.

Thank you for the opportunity to provide our professional geotechnical services during this phase of your project. We will be pleased to discuss our recommendations with you and would welcome the opportunity to provide the geotechnical engineering services needed to successfully complete your project.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

Marshall Lew

Matthew B. Haston
Senior Professional

Marshall Lew, Ph.D., P.E.
Senior Principal

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EXECUTIVE SUMMARY

We were selected by Lockwood Greene to perform a preliminary geotechnical exploration for the proposed National Enrichment Facility. The proposed project site is located north of New Mexico Highway 234 in the western portion of Lea County, New Mexico. The objectives of our preliminary exploration were to develop information about the site and subsurface conditions that could be used for assistance in determining the feasibility of constructing the proposed facilities at the site.

The exploration consisted of drilling five test borings in the proposed building area to depths of 40 to 100 feet. The major findings and recommendations of our subsurface exploration are as follows:

- Underlying an approximately two-foot veneer of loose eolian sands, the soil test borings encountered Quaternary age firm to very dense silty sands. Zones of rocklike calcium carbonate cemented soils (caliche) were encountered at varying intervals within this zone. Underlying the upper sandy soils, Triassic age very hard clays were encountered at depths of 35 to 40 feet. Each of the borings terminated in the clay soils at their predetermined depths.

- Ground water was not encountered in the borings performed for this exploration at the time of drilling. Based upon information from other explorations at this site and adjacent sites, we do not expect ground water to present difficulty during construction considering the preliminary maximum excavation depths.

- Shallow spread foundations bearing in the firm and better sandy soils such as those encountered in the soil test borings may be preliminarily designed using the allowable bearing pressure of 7,000 pounds per square foot.

- The upper loose eolian sands are not likely suitable for direct shallow foundation support or for the subgrade support of new engineered fills, pavements, or grade slabs. Therefore, we recommend that where encountered within building areas, these upper loose sands be stripped from the site during mass grading.

This summary is only an overview and should not be used as a separate document or in place of reading the entire report, including the appendices. Further, this is a preliminary exploration and does not provide the information for the final design of the proposed facilities. Additional field exploration, engineering analysis, laboratory and field testing may be required to develop the final geotechnical design parameters. We recommend the owner retain MACTEC to provide these services based on our familiarity with the project, the subsurface conditions, the intent of the preliminary recommendations, and our experience in this area.

1.0 OBJECTIVES OF EXPLORATION

The objective of this preliminary exploration was to develop information about the site and subsurface conditions that could be used for assistance in determining the feasibility of constructing the proposed facilities at the site and to aid in the development of a construction cost estimate and design basis. The preliminary exploration does not provide the necessary information to complete the design of the facilities. When specific project details concerning building, pavement, and railroad spur locations and the foundation loads and site grades are developed, subsequent and more detailed exploration and analysis will be necessary provide the final geotechnical design parameters. An assessment of site environmental conditions or an assessment for the presence of pollutants in the soil, rock, surface water, or ground water of the site was beyond the proposed scope of this exploration.

2.0 SCOPE OF EXPLORATION

The scope of services for this preliminary exploration has included a site reconnaissance, drilling the five requested soil test borings at the locations selected by Lockwood Greene within the proposed project area, and visually classifying the soil samples obtained from the standard penetration testing.

We collected two undisturbed and six bulk samples in conjunction with the drilling for laboratory testing. California bearing ratio (CBR), compaction, Atterberg limits, grain size, and moisture content laboratory tests were conducted on selected bulk samples to evaluate their suitability for use as engineered fill and to determine a representative CBR value for preliminary design purposes. Resistivity, pH, Atterberg limits, grain size, and moisture content laboratory tests were conducted on selected samples obtained during the standard penetration testing to evaluate the index properties of the site soils, aid in the classification of the soil type, and to assist in the evaluation of the corrosion potential of the site soils.

3.0 PROJECT INFORMATION AND SITE CONDITIONS

Project information was provided in a "Request for Proposal" (RFP) from Mr. Philip Clarkson of Lockwood Greene, dated August 18, 2003. Also provided was a drawing entitled "Conceptual Site Plan" (Drawing SKC-006), by Lockwood Greene, dated September 2, 2003. The drawing shows the preliminary location of the proposed facilities in relation to existing site features and existing topography. Lockwood Greene also provided a copy of a geotechnical exploration performed by others at a nearby site for informational purposes.

The proposed project is to consist of the construction of a National Enrichment Facility (NEF) north of Highway 234 just west of the New Mexico-Texas state line, near Eunice, New Mexico. The NEF is to be comprised of several building modules which will cover a combined total area in excess of 1,000,000 square feet. The individual building modules are to be of reinforced concrete frame construction with precast concrete exterior wall panels. The walls will act as shear walls providing lateral support for the structure. Based upon the provided drawing, several individual concrete storage pads are to be constructed to the north of the building area. These concrete pads cover an area having plan dimensions of approximately 1,000 by 2,000 feet. Also proposed for construction as part of the NEF are various paved access drives and parking areas, above ground storage tanks, cooling towers, and ancillary security and visitor center structures.

Maximum individual total column foundation loads are reportedly in the range of 400 to 1,300 kips. We understand much of the total column load is dead load. The project is in the preliminary planning phases at this time and information regarding finished grade elevations of the proposed facility has not been provided. Based upon the provided information, the finished floor is to be at about Elev.3414 feet. Site grades within the proposed project grading area range from Elev. 3402 to 3424 feet. We understand the proposed construction will not include basements or subsurface pits of more than five feet in depth.

Based upon a review of the provided topographic drawing, site grades range from about Elev. 3455 feet in the northeast corner of Section 33 down to about Elev. 3380 feet in the southwest corner of Section 32. The site is covered by sparse vegetation consisting of grasses, brush, and cacti. Surficial soils are loose sands. An existing unimproved road crosses the central portion of the site in a north-south orientation. A subsurface pipeline crosses the site in a northwest-southeast orientation.

4.0 AREA AND SITE GEOLOGY

4.1 PHYSICAL SETTING

The topography in southeastern New Mexico generally consists of broad plains and gently rolling hills with locally some bluffs and shallow river valleys. The geologic structure is relatively simple, generally consisting of flat-lying to gently warped sedimentary rocks ranging in age from Permian to Pliocene.

The site is located in the Great Plains physiographic province. In the project area, the Great Plains province is divided into two sections, the Pecos Valley section and the Southern High Plains section (Doleman, 1997). Mescalero Ridge, an escarpment (steep cliff) located about ½ mile to the northeast of the project site, is considered the boundary between the two sections. The primary difference between the two sections is the topography: the topographically lower Pecos Valley section is characterized by an irregular erosional surface while the topographically higher Southern High Plains section is a large flat mesa that slopes very gently to the southeast (Doleman, 1997).

The site is located in the Pecos Valley section of the Great Plains. Topography in this area was formed by erosion of the Tertiary age fluvial deposits and localized exposure of the underlying Mesozoic and Paleozoic rocks (Doleman, 1997). In the project area, the topography slopes gently to the southwest (at a gradient of approximately 15 feet per mile) and the surface geology is characterized by Quaternary age eolian (wind blown) deposits that mantle the underlying Quaternary and Tertiary age sediments. Local variations in local topography are reflective of the thickness and distribution of the eolian deposits.

4.2 REGIONAL GEOLOGY

The southeastern portion of New Mexico (and adjacent West Texas) is located in a geologically stable area known as the Permian Basin. This large subsurface structural basin, named for the geologic period in which it was formed, is a broad, down-warped area filled in with thick sequences of sedimentary rocks. During the late Cretaceous to early Tertiary time, tectonic uplift (mountain-building processes) to the west of the Permian Basin resulted in a structural high in the area that is now the Rocky Mountains and the southern extension of the Rocky Mountains (including the mountain ranges to the west of the project area). Erosion of this structural high provided the source area for sediments that now make up the younger Tertiary and Quaternary age formations that are locally exposed in the site vicinity.

4.3 LOCAL GEOLOGIC CONDITIONS

4.3.1 General

In the project area, the bedrock is relatively shallow (within 40 feet of the ground surface) and consists of sedimentary rocks of the Triassic age Chinle Formation. The Chinle Formation bedrock consists of a thick sequence of massive, unsaturated red, reddish purple or green claystone and siltstone with some localized fine-grained sandstone interbeds. The bedrock is overlain by approximately 35 to 40 feet of Quaternary age alluvial sediments. Based on published geologic maps and geotechnical reports for other projects in the area, the Quaternary age materials are part of the Gatuna Formation and consist of moderately cemented sand and gravel. The Gatuna Formation materials are mantled with a thin veneer of eolian (wind blown sand).

4.3.2 Geologic Materials

The materials encountered in our geotechnical borings at the site consist of Quaternary age eolian sand (wind-blown dune deposits) that is predominantly dry reddish brown silty sand. The upper loose eolian deposits were generally encountered to depths of up to two feet below existing ground surface in the exploratory borings. However, in areas where sand dunes have formed, the actual depth of the eolian soils is likely more than 2 feet.

Quaternary age alluvial deposits of the Gatuna Formation underlie the eolian deposits. As encountered in our borings, these alluvial deposits consist of dry, light yellow to reddish yellow, dense to very dense sand and silty sand. The sand is fine- to medium-grained, slightly to moderately cemented, and locally contains subangular to rounded gravel and caliche.

Dark red and purple, very hard high plasticity clay (claystone) of the Triassic age Chinle Formation uncomformably underlies the dense Gatuna Formation materials. As encountered in our borings, the Chinle Formation bedrock is at a depth of about 35 feet at the location of Boring B-2 and at a depth of about 40 feet at the location of Borings B-1, B-3, B-4, and B-5. In Boring B-3, drilled to a depth of approximately 100 feet beneath the existing ground surface, the very hard high plasticity clay was encountered from a depth of 40 feet to the maximum depth drilled (100.5 feet).

4.3.3 Ground-Water Conditions

Ground water was not encountered in the borings drilled at the site as part of our investigation. Also, ground-water wells being drilled in the eastern portion of the site by others (at the same time of our field investigation at the site) did not encounter water to a depth of about 220 feet (maximum depth drilled at the time of our investigation).

Based on the information from geotechnical investigations for other projects in the immediate area, the depth to ground water is greater than 150 feet in the general site vicinity. Ground water was not encountered in exploratory borings drilled as part of an investigation east of the site (between the site and the Texas border) within the 250-foot total depth explored (Weaver Boos & Gordon, Inc., 1998). Also, piezometers installed for a project in Andrews County Texas (located approximately ½-mile east of the site) indicate that the depth to ground water ranged from approximately 150 feet to 188 feet beneath the existing ground surface in January 1993 (Jack H. Holt, Ph.D. & Associates Inc., 1993).

4.4 TECTONIC SETTING

4.4.1 General

The tectonic regions in the project area (and in the state of New Mexico) can be defined based on historic seismicity and tectonic (structural) history. The project site is located within the seismically stable Permian Basin. The Permian Basin is defined by a broad subsurface structural feature composed of a series of Paleozoic age (greater than 250 million years before present) sedimentary basins whose last episodes of large-scale subsidence occurred during late Permian time (about 250 million years before present). The structural relief of these basins now exists as subsurface features buried beneath a thick sequence of younger, relatively undeformed sediments. Relative structural stability has been maintained since Permian time within this region as indicated by a lack of deep-seated, active faults within the post-Permian strata.

A prominent subsurface structural feature within the Permian Basin is the Central Basin Platform (CBP). The project site is located in the CBP where the top of the Permian deposits are approximately 1,400 feet below the ground surface, where outside the limits of the CBP, the Permian deposits are much deeper (Weaver Boos Consultants, Inc., 1998). The Permian deposits are primarily limestone and constitute the main reservoir rocks for the oil and gas fields in the general area.

The Permian Basin is bounded on the west by a seismically active area known as the Rio Grande Rift. The Rio Grande Rift is a major continental rift extending north-south through the state of New Mexico from north of Taos to south of Las Cruces. The overwhelming majority of active faults in New Mexico are located within the boundaries of the Rio Grande Rift.

The seismically active Basin and Range province borders the western margin of the Rio Grande Rift. This province is characterized by fault block mountain ranges commonly bounded by range front normal faults separated by intervening valleys. The valleys are typically formed on structural grabens overlain by valley fill sediments derived from the adjacent mountain blocks. Major development of basin and range structures occurred from late Tertiary (5 million years before present) to Pleistocene time (11,000 years before present) and continue into the present time. A number of fault offsets of late Tertiary age along the western flanks of the Guadalupe, Delaware, Sacramento and San Andres Mountains are observed within the Basin and Range physiographic province in Trans-Pecos, Texas.

Leveling surveys between El Paso, Texas and Carlsbad, New Mexico and the historic seismic record for the New Mexico and West Texas regions support the interpretation that current tectonic activity is occurring in the Rio Grande Rift and the Basin and Range province while the Permian Basin (in which the site is located) remains stable and tectonically or seismically quiet.

4.4.2 Faults

The majority of Quaternary age faults within New Mexico are mapped along the north-south trending Rio Grande Rift located approximately 180 miles west of the site.

According to Machette et al. (1998), Quaternary age faults are not identified in New Mexico within 100 miles of the site. Quaternary age faults within 150 miles of the site include the Guadalupe fault, located approximately 115 miles west of the site in New Mexico, and in Texas, the West Delaware Mountains fault zone, East Sierra Diablo fault, East Flat Top Mountain fault, and the East Baylor Mountain-Carrizo Mountain fault located 110 miles southwest, 120 miles southwest, 120 miles west-southwest, and 120 miles southwest of the site, respectively.

4.4.3 Seismicity

Current research indicates that the Rio Grande Rift and the adjacent Basin and Range tectonic province are seismically active and the Permian Basin (in which the site is located) is considered to be seismically quiet or inactive. As previously indicated, the overwhelming majority of active faults in New Mexico are located within the boundaries of the Rio Grande Rift. The majority of seismic activity reported in New Mexico for the period 1869 to 1998 is concentrated along the rift (Sanford, Lin, Tsai, and Jaksha, 2002). However, even though the Permian Basin is considered seismically inactive, there is a documented cluster of seismic activity in the Central Basin Platform area since the mid-1960s (U. S. Department of Energy, 2003). In this area, the spatial distribution of epicenters correlate with known locations of oil and natural gas fields and is believed to be induced by production, secondary recovery, or waste injection activities within this natural gas and petroleum province, rather than seismic sources (Sanford, Lin, Tsai, and Jaksha, 2002; U. S. Department of Energy, 2003).

5.0 SUBSURFACE CONDITIONS

Subsurface conditions were explored with five widely spaced borings drilled in general accordance with the procedures presented in Appendix A. The boring locations were selected by Lockwood Greene and boring depths were selected by MACTEC. The borings locations and elevations shown on the Boring Location Plan (Figure 2) and the Soil Test Boring Records were surveyed by others prior to the field exploration.

Subsurface conditions encountered at the boring locations are shown on the Soil Test Boring Records in Appendix B. These Soil Test Boring Records represent our interpretation of the subsurface conditions, based on the field logs and visual examination of the field samples by one of our engineers. The lines designating the interfaces between various strata on the Soil Test Boring Records represent the approximate interface locations.

The soil test borings drilled at this site typically encountered Quaternary age eolian and alluvial silty sands underlain by Triassic age clays. A discussion of the origin of these materials is presented in Section 4.0 of this report.

The upper eolian silty sand soils were encountered to a maximum depth of about two feet at the soil test boring locations. These sandy soils were observed to be loose. It should be noted that in areas where these soils have accumulated and formed dunes, the thickness of the eolian sands will be more than two feet. Dunes having estimated heights of up to about eight feet were observed during the field exploration. The upper approximately one foot of the eolian sands were observed to have fine roots and various organic materials.

Silty sand soils of Quartenary age were encountered underlying the surficial eolian deposits. These soils were classified as firm to very dense based upon their Standard Penetration Test (SPT) resistance values which ranged from 20 to in excess of 100 blows per foot. Calcium carbonated cementation was noted within this zone to a varying degree, with zones of caliche encountered at irregular intervals. Fine gravel was observed in some of the split-spoon samples from the soils within this zone.

Triassic age high plasticity clays were encountered underlying the Quaternary age sands at depths of 35 to 40 feet. These materials were classified as very hard based upon SPT resistance values which ranged from 53 to in excess of 100 blows per foot. Each of the soil test borings drilled as part of this project were terminated in the Triassic age clays at the predetermined depths.

6.0 GROUND-WATER CONDITIONS

Ground water was not observed in the test borings at the time of drilling. Also, it was reported that ground water was not encountered in borings drilled at the site by others for water well development to depths of 220 feet. For safety reasons, the borings drilled as part of MACTEC's scope of work were backfilled promptly after drilling; consequently, long-term measurements for the presence or absence of ground water were not obtained.

Fluctuations in the ground-water level occur because of variations in rainfall, evaporation, construction activity, surface run-off, and other site-specific factors. Given the proposed preliminary excavation depths, we expect ground water will not present significant construction problems for this project. The selected contractor should, however, be prepared to promptly remove surface waters which could impact construction activities.

7.0 PRELIMINARY FOUNDATION RECOMMENDATIONS

As previously noted, this exploration was for assistance in preliminary planning and design for the proposed NEF facility. Five borings, with an average spacing of 1,700 feet, across the proposed site for a project of this size are not sufficient to adequately define subsurface conditions for final design purposes. While these borings do, in our professional opinion, provide a sound basis for assistance in judging the feasibility of developing the site, there is insufficient information for developing specific, final recommendations for site preparation and foundation type or types and design parameters. The following information, therefore, should be considered as preliminary recommendations, subject to refinement when additional project details are available so that a more detailed program of borings and field or laboratory testing can be performed.

Assuming subsurface conditions encountered at the boring locations are representative of subsurface conditions elsewhere on the site, subsurface conditions generally appear to be suitable for the proposed construction supported on a system of shallow foundations. Footings bearing in the firm and dense sandy soils below the upper loose eolian (wind deposited) soils may be preliminarily designed for an allowable bearing pressure of 7,000 pounds per square foot (psf).

The upper loose eolian deposits were generally encountered to depths of up to two feet below existing ground surface in the soil test borings. However, in areas where sand dunes have formed, the actual depth of the eolian soils is likely more than two feet. If the eolian deposits are not removed as a part of mass site grading, it will be necessary to extend the foundation excavations into the underlying firm or better sandy soils to achieve the recommended preliminary allowable bearing pressure and reduce the likelihood of excessive differential settlements; therefore, we recommend that the upper eolian soils be removed during mass grading in structural areas.

The preliminary geotechnical and structural data available at this stage precludes performing rigorous settlement analyses. However, based upon the available data, our preliminary analyses indicate that spread footings bearing in the firm or better sands below the upper eolian soils as described above may be preliminarily assumed to be subject to maximum total settlements of up to about one inch for column loads of up to 1,300 kips. Under these circumstances, differential settlements may range up to ½ of an inch between similarly loaded columns. Settlements between differentially loaded or closely spaced columns would likely be more than the aforementioned values.

The behavior of a shallow foundation with respect to settlement is dependent upon a variety of factors. The information provided herein is intended to demonstrate the feasibility of shallow foundation support. Excessive differential settlement between adjacent columns, while uncommon in the firm or better soils such as those encountered in the borings, can cause structural and architectural damage. A more thorough exploration and analysis will be required to accurately estimate the range of expected total and differential settlements which may be expected when project specifics have been developed.

8.0 PRELIMINARY SITE PREPARATION RECOMMENDATIONS

Existing vegetation, surficial organic containing soils and loose eolian sands should be stripped and removed from the construction area. Typically, the upper approximately one foot of the site soils were observed to contain fine roots and limited organic materials. The eolian sands were encountered to depths of about two feet at the soil test boring locations; however, sand dunes were observed across the proposed building locations during the field exploration. These sand dunes are likely composed of loose sands and should therefore be stripped from the site as part of mass grading. Based upon our observations, sand dunes of up to eight feet in height will likely be encountered during grading. We recommend that prior to the preparation of the final bid documents, additional geotechnical exploration be performed to evaluate the depth to which the upper loose eolian sands may be encountered, especially with regard to the dune areas.

Information regarding the use of the upper loose sands for use as new fill is presented in the Engineered Fill section of this report.

After stripping the site and before placing new fill, we recommend the exposed subgrade in the building and pavement areas be proofrolled to detect unsuitable soil conditions. Proofrolling should be done after a suitable period of dry weather to avoid degrading an otherwise acceptable subgrade. Proofrolling should be performed with a heavily-loaded dump truck or with similar approved construction equipment. The proofrolling equipment should make at least four passes over each section, with the last two passes perpendicular to the first two.

We recommend the exposed subgrade and proofrolling operation be observed and documented by our personnel. If unstable conditions are encountered at the subgrade level, our geotechnical engineer will make appropriate recommendations to the owner's representative for dealing with the conditions.

Earth moving, selective borrowing and soil compaction will be required to achieve the final grades proposed for this project. Contractors bidding on this work should be supplied with this preliminary geotechnical information as well as supplemental exploration results because bids based on such data are generally more competitive, time schedules are more accurate and potential cost overruns are smaller as a result. Typical information required for grading operations would require further refinement of the items listed below in relationship to the selected site surface elevations:

- Classification tests to identify soil type
- Existing soil moisture contents to plan moisture content control measures
- Additional compaction tests to determine the maximum dry density and optimum moisture content for verifying the adequacy of compaction operations
- Evaluation of the compaction test results and recommendations of proper compaction procedures such as lift thickness, proper equipment types, moisture content control measures, etc.
- Further delineation of the stratification of materials to be excavated

9.0 DIFFICULT EXCAVATION

Construction of the proposed NEF will require excavation of the existing site soils to get within the range of the preliminary finished floor at about Elev. 3,414 feet. Based upon the limited number of borings performed for the preliminary exploration, much of these materials may be removed using conventional earthmoving equipment. However, zones of very dense soils and caliche were encountered above the proposed finished floor elevation. Therefore, such materials will likely be encountered during site grading. Heavy excavating equipment with ripping tools could be required to remove much of these materials. Materials sufficiently hard to cause refusal to the power auger equipment used to drill the borings were not encountered during the preliminary exploration.

Typically, there is no sharp transition between uncemented and cemented soils in geologic settings such as this site. The caliche encountered during this exploration could be penetrated by the mechanical auger used to drill the borings and can likely be excavated without blasting. It is, however, often difficult to excavate these materials without the use of specialized equipment or blasting, especially if harder or more extensive zones of caliche are encountered during site grading. The excavation of very dense soils or caliche in confined excavations, such as for shallow foundations or utilities, is often extremely difficult. The ease of excavation depends on the quality of the grading equipment, skill of the equipment operators, and geologic structure of the material to be excavated. Materials that cannot be penetrated by the mechanical auger often require blasting prior to removal.

10.0 PRELIMINARY SEISMIC CONSIDERATIONS

10.1 SITE COEFFICIENT AND SEISMIC ZONATION

The site coefficient, S, for seismic design of the proposed buildings can be determined as established in the Earthquake Regulations under Section 1629 of the Uniform Building Code (UBC) 1997 edition. Based on Figure 16-2 of the 1997 UBC, the site is located within Seismic Zone 1. In addition, based on our review of the site soil conditions as encountered in our borings and local geology, the Soil Profile Type may be assumed to be Type S_C as defined in Table 16-J of the 1997 UBC.

10.2 LIQUEFACTION

Liquefaction potential is greatest where the ground-water level is shallow, and submerged loose, fine sands occur within a depth of about 50 feet or less. Liquefaction potential decreases as grain size and clay and gravel content increase. As ground acceleration and shaking duration increase during an earthquake, liquefaction potential increases.

Ground water was not encountered in our borings drilled to a maximum depth of 100 feet below the ground surface. In addition, it was reported that a boring on the site drilled for water well development did not encounter water at a depth of 220 feet. Also, the soils at the site were dense to very dense. The absence of ground water near the surface would make the potential for liquefaction remote.

11.0 COMPACTED FILL RECOMMENDATIONS

We recommend compacted fill be constructed by spreading acceptable soil in loose layers not more than 8 inches thick. The soils used within the proposed construction areas should be compacted in lifts to at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557). The upper 24 inches of fill beneath pavements and upper 12 inches beneath grade slabs should be compacted to at least 98 percent of the modified Proctor maximum dry density.

As a general rule, the moisture content of the fill soils compacted to 95 percent of the modified Proctor density should be maintained within +3 to -3 percentage points of the optimum moisture content as determined from the compaction test. This provision may require the contractor to dry soils during periods of wet weather or to wet soils during warm or dry periods. The fill soils should have a plasticity index (PI) of less than 15, and a maximum dry density of no less than 90 pounds per cubic foot (pcf).

A sample of potential borrow material was collected from Borings B-3 and B-4 and tested to determine the maximum dry density, optimum moisture content, natural moisture content, and PI. These tests are used to determine if the soil is suitable for use as engineered fill.

The laboratory test data indicate potential on-site borrow soils are typically dryer than the optimum moisture content. Since some of the natural moistures are substantially less than optimum moisture content, the contractor should anticipate wetting of the borrow soils will likely be required to achieve adequate compaction. Our laboratory test data also indicate the potential on-site borrow soils have maximum dry densities and PI values within the recommended ranges. In our opinion, the laboratory data indicate the potential on-site borrow soils are suitable for use as compacted fill. Additional testing should be performed to verify the suitability of the proposed borrow materials prior to final design or the initiation of site grading. The results of the laboratory tests along with a description of the test procedures are provided in Appendix C.

If calcium carbonate cemented soils (caliche) are to be used as engineered fill, it is imperative this material be reduced to particles having a maximum dimension of six inches by the excavation and compaction equipment. Sufficient quantities of soil should be mixed with these materials such that voids do not result between the pieces of caliche and so that the fill meets compaction requirements.

The upper eolian sands removed as part of site stripping are likely suitable for use as engineered fill provided the organic content of these materials is within an acceptable range. It is our preliminary recommendation that soils having an organic content of less than two percent, when subject to organic loss on ignition testing, are suitable for use as engineered fill. The upper approximately one foot of the eolian sands were observed to contain fine roots and organic materials. The upper eolian sands are likely to have in-situ moisture contents well below the materials optimum moisture content and the addition of water will be necessary to achieve the recommended degree of compaction.

12.0 CORROSION POTENTIAL

Corrosion is a major factor in reducing the service life of metal and concrete structures within the soil. Therefore, measuring the corrosion potential of soils is an important consideration when designing or selecting protective measures for buried structures or potions of structures.

There are several measurable soil properties which may be used to estimate the potential corrosiveness of a soil. These properties include resistivity, pH, chloride concentration, and sulfide content. Resistivity and pH are the two soil properties which have the greatest influence on underground corrosion and are relatively easily measured.

The electrical resistivity of a soil is measured in the laboratory by immersing the probe of a conductivity meter into a prepared slurry of soil sample and deionized water. Split-spoon samples from the depths of 5 and 10 feet were combined and tested from Borings B-2 and B-4. The measured resistivity of these samples was 7,400 and 2,100 ohm-centimeters for the samples from Borings B-2 and B-4, respectively.

The pH of a soil is a measure of the hydrogen-ion concentration and indicates the intensity of acidity or alkalinity of a soil. A pH value of 7 indicates neutrality; higher values, alkalinity; lower values, acidity. Soil pH values were determined by immersing the probe of a pH meter into a prepared slurry of soil sample and deionized water. The pH values were 7.99 and 7.93 for the samples from Borings B-2 and B-4, respectively.

Based upon published information, the measured pH and resistivity values place the site soils in the non-corrosive to questionable range for corrosion potential.

As the sample from Boring B-4 fell within the questionable range, we recommend further evaluation of the potential for corrosion. This evaluation will likely include additional pH and resistivity tests, as well as testing of the soil's sulfide and chloride concentration. Measures such as special coatings or cathodic protection for buried steel structures or the use of admixtures or chemically resistant cement for concrete protection may be required depending upon the results of such testing.

13.0 PRELIMINARY PERCOLATION RATE

Percolation testing was conducted at the proposed NEF site in general accordance with the procedures presented in Title 20, Chapter 7, Part 3 of the New Mexico Administrative Code (NMAC). Percolation testing was performed at locations approximately 25 and 75 feet east of soil test Boring B-4. The test holes were each drilled to depths of about 10 feet below existing ground surface in the silty sand soils such as those encountered in the upper portion of the subsurface profile across the site. Each hole was filled with water to a depth of about 1½ feet below existing ground surface; therefore, the upper loose eolian sands are not represented in the percolation test results.

The measured percolation rates for the two test locations were 6.7 and 10.0 minutes per inch. Averaging the two test results, as is suggested in the NMAC, the percolation rate of 8.4 minutes per inch is recommended for the preliminary design of systems leaching into materials similar to those tested. Additional percolation testing should be performed once information concerning specific drain field locations and elevations has been developed.

14.0 PRELIMINARY CALIFORNIA BEARING RATIO INFORMATION

Two remolded CBR tests were performed on bulk soil samples collected from auger cuttings. The samples were obtained from the depths of 5 to 10 feet in Boring B-3 and from ground surface to 15 feet in Boring B-4. Since the as-molded densities and moisture contents differed somewhat from the targeted values, interpolation and extrapolation of the CBR data were required to estimate the CBR values at 95 percent of the modified Proctor maximum dry density at optimum moisture content. The CBR test results are attached in Appendix C.

The CBR values corresponding to 95 percent of the modified Proctor maximum dry density at optimum moisture were estimated to be 34.4 and 10.5 for the samples from B-3 and B-4, respectively. We recommend the lower CBR value of 10.5 for use in preliminary design purposes.

Additional testing should be performed to evaluate the CBR values of proposed fill soils prior to the completion of the final design.

15.0 RECOMMENDED ADDITIONAL GEOTECHNICAL EXPLORATION

This exploration is preliminary in nature and should be used for general site planning and feasibility evaluation only. Due to the relatively limited information available at this preliminary stage of the project, preparation of a complete report of geotechnical study with specific recommendations for foundation design and site preparation will require significant supplemental exploration and analysis. Project details and performance criteria should, however, be initially further developed. As project details are developed, additional exploration, field and laboratory testing, and engineering analysis will be required. Additional field testing may include items such as more soil test borings, the collection of relatively undisturbed and disturbed samples, and possibly in-situ testing. Additional laboratory testing may include triaxial shear tests, consolidation tests, direct shear tests, grain size testing, unit weight, Atterberg limits, moisture content and compaction tests. Field resistivity testing may be used in conjunction with laboratory pH, chloride content, and sulfate tests to further evaluate the corrosion potential of the site soils. The geotechnical engineer should be retained to consult with the designer during design development, design and construction phases to be sure that the recommendations are properly interpreted and further developed as necessary.

16.0 BASIS OF RECOMMENDATIONS

The preliminary recommendations provided herein are based on the subsurface conditions and on project information provided to us; they apply only to the specific project and site discussed in this report. If the project information section in this report contains incorrect information or if additional information becomes available, you should convey the corrected or additional information to us and retain us to review our recommendations. We will then modify them if the new information has rendered them inappropriate for the proposed project. As mentioned previously, additional exploration and analysis along with interaction of the design team will be required to develop final recommendations for foundation design and site preparation.

Our exploration services include storing the collected samples and making them available for inspection for a period of 30 days. The samples are then discarded unless you request otherwise.

17.0 REFERENCES

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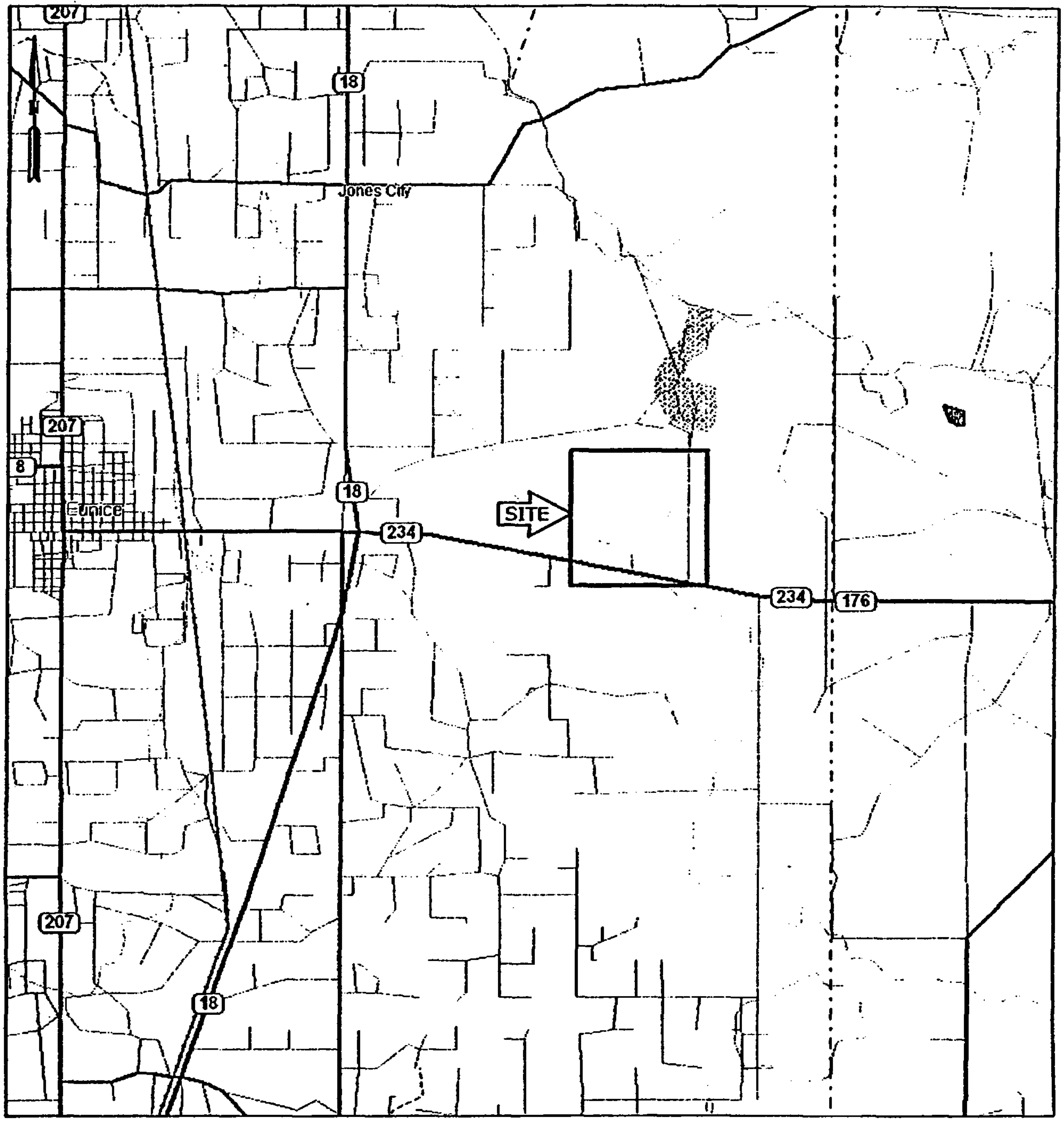
FIGURES



SOURCE: DELORME MAPPING AND OBSERVATIONS BY MACTEC PERSONNEL

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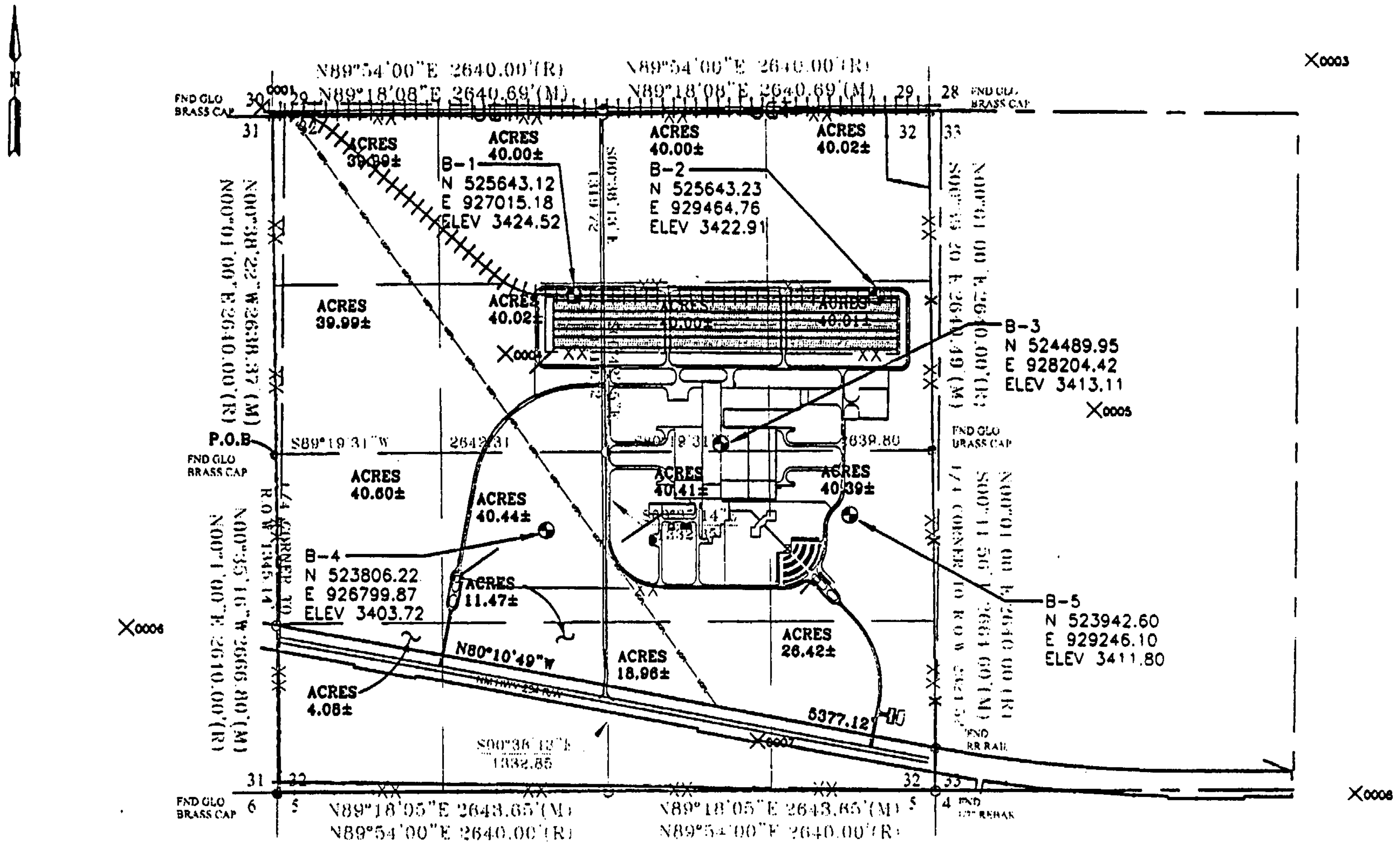
FIGURE 1: SITE LOCATION PLAN NATIONAL ENRICHMENT FACILITY LEA COUNTY, NEW MEXICO

COORDINATES: N XX°XX'XX"
W XX°XX'XX"

DRAFTING BY:	PREPARED BY: mBH	CHECKED BY: JMS
JOB NUMBER: 3043031049/0001	DATE: OCTOBER 2, 2003	SCALE: 0 6250'



SOURCE: THIS DRAWING WAS ADAPTED FROM A CONCEPTUAL SITE PLAN SOIL BORING LAYOUT DATED SEPTEMBER 2, 2003 AND PROVIDED BY LOCKWOOD GREENE.

LEGEND

B-1 ⊕ BORING LOCATION AND IDENTIFICATION

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FIGURE 2: BORING LOCATION PLAN
NATIONAL ENRICHMENT FACILITY
LEA COUNTY, NEW MEXICO

DRAFTING BY:	PREPARED BY: MBH	CHECKED BY: JMS
JOB NUMBER: 3043031049/0001	DATE: OCTOBER 2, 2003	SCALE: 0 1000'

COORDINATES: N XX°XX'XX", W XX°XX'XX"

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APPENDIX A

FIELD EXPLORATORY PROCEDURES

FIELD EXPLORATORY PROCEDURES

Soil Test Boring (Hollow Stem)

Soil test borings and sampling operations were conducted in general accordance with ASTM D 1586. The borings were advanced by mechanically turning continuous steel hollow-stem auger flights into the ground. At regular intervals, soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot of penetration was recorded and is designated the "standard penetration test (SPT) resistance." Proper evaluation of the penetration resistance provides an index to the soil's strength, density, and ability to support foundations.

Representative portions of the soil samples obtained from the split-tube sampler were examined by our engineer to assign manual soil classifications. Representative portions of the split-spoon samples were then placed in containers and shipped to our laboratory. Test Boring Records are attached, graphically showing the soil descriptions and penetration resistances.

Boring Backfill

The borings were backfilled shortly after drilling for safety purposes. We backfilled the borings with auger cuttings to the ground surface.

You are advised that, even with this backfill technique, there is the possibility of future borehole subsidence depending on actual subsurface conditions, surface drainage, etc. The property owner should monitor the boring locations over time to discover subsidence and make any necessary repairs.

Bulk Samples

Bulk samples of several soil types obtained at various elevations were collected for testing to determine the suitability of soil for reuse as engineered fill, its maximum dry density and CBR value.

Undisturbed Sampling

The relatively undisturbed samples were obtained by pushing a section of 3-inch O.D., 16-gauge steel tubing into the soil at the desired sampling level. The sampling procedure is described by ASTM D-1587. The tube, together with the encased soils, was carefully removed from the ground, made airtight, and transported to our laboratory.

APPENDIX B

KEY TO SYMBOLS AND DESCRIPTIONS

SOIL TEST BORING RECORDS

GROUP SYMBOLS	TYPICAL NAMES	GROUP SYMBOLS	TYPICAL NAMES
▩	**TOPSOIL**	▨	**CONCRETE**
■	**ASPHALT**	▤	**DOLOMITE**
▨	**GRAVEL**	▤	**LIMESTONE**
▧	**FILL**	▤	**SHALE**
▦	**SUBSOIL**	▤	**LIMESTONE/SHALE** - Limestone with shale interbeds
▤	**ALLUVIUM**	▩	**SANDSTONE**
▤	**COLLUVIUM**	▥	**SILTSTONE**
▩	**RESIDUUM** - Soft to firm	▯	**AUGER BORING**
▥	**RESIDUUM** - Stiff to very hard	▮▮	**UNDISTURBED SAMPLE ATTEMPT**

■	Undisturbed Sample 1.5-2.0 = Recovered (ft) / Pushed (ft)		
▤	Split Spoon Sample	▩	Auger Cuttings
▯	Rock Core 60-100 = RQD / Recovery	▩	Dilatometer
	No Sample	⧅	Crandall Sampler
¦	Rotary Drill	⁂	Pressure Meter
▽	Water Table at time of drilling	○	No Recovery
		▼	Water Table after 24 hours

Correlation of Penetration Resistance with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 20	Firm	5 - 8	Firm
21 - 30	Very Firm	9 - 15	Stiff
31 - 50	Dense	16 - 30	Very Stiff
Over 50	Very Dense	31 - 50	Hard
		Over 50	Very Hard

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vol. 1, March, 1953 (Revised April, 1960)

KEY TO SYMBOLS AND DESCRIPTIONS

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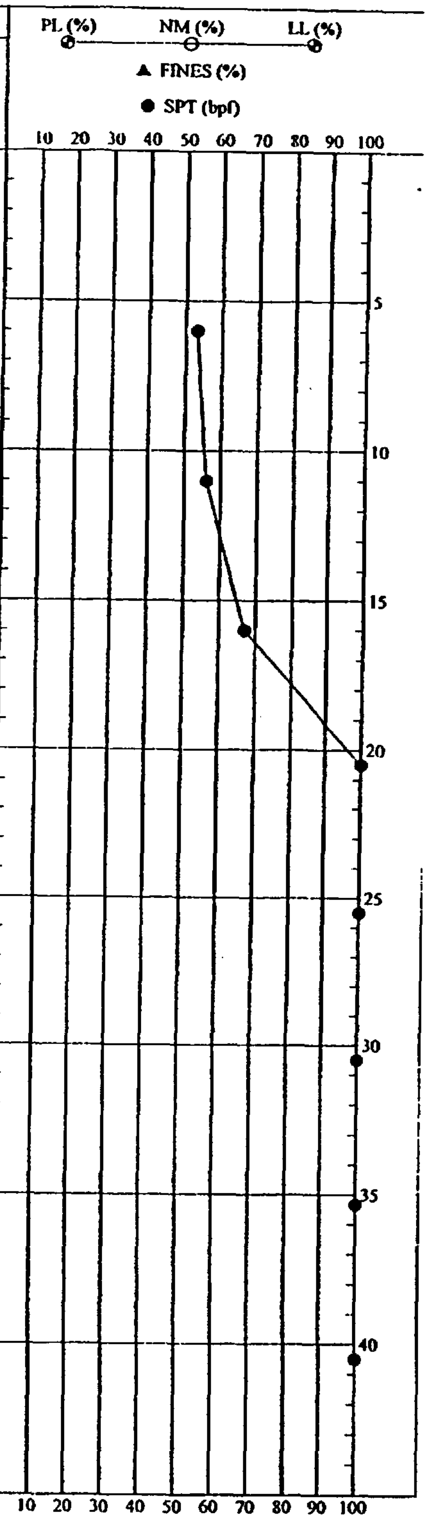
SOIL CLASSIFICATION AND REMARKS

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)	SAMPLES IDENT	N-COUNT 1st 6" 2nd 6" 3rd 6"
0	REDDISH BROWN, DRY, SILTY FINE SAND WITH SOME FINE ROOTS - EOLIAN	3423 4		
	VERY DENSE, REDDISH BROWN, DRY, SILTY FINE TO MEDIUM SAND			
5		3418.4	SPT-1	15-25-28
10		3413 4	SPT-2	21-30-26
15	VERY DENSE, DARK RED, DRY, FINE TO MEDIUM SILTY FINE TO MEDIUM SAND WITH CLASTS OF CEMENTED SAND	3408 4	SPT-3	15-30-37
20	VERY DENSE, LIGHT REDDISH YELLOW, DRY, SILTY FINE TO MEDIUM SAND WITH CLASTS OF CEMENTED SAND	3403 4	SPT-4	50/6"
			UD-1	1 0-2 0
25		3398.4	SPT-5	50/6"
30		3393.4	SPT-6	50/6"
35	VERY DENSE, LIGHT REDDISH YELLOW, SILTY FINE TO COARSE SAND WITH SOME SUBANGULAR TO ROUNDED FINE GRAVEL	3388 4	SPT-7	50/4"
40	VERY HARD, DARK RED, DRY, HIGH PLASTICITY CLAY BORING TERMINATED 40 5'	3383.4	SPT-8	50/6"
45		3378.4		



SOIL 3045031049 01.GPJ LAW GIBB.GDT 10/3/03

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION BACK FILLED ON 9/9/2003

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER INTERFACES BEWEEN STRATA ARE APPROXIMATE TRANSITIONS BETWEEN STRATA MAY BE GRADUAL

SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 9, 2003 **BORING NO.:** B-1

PROJ. NO.: 3043031049/0001 **PAGE 1 OF 1**

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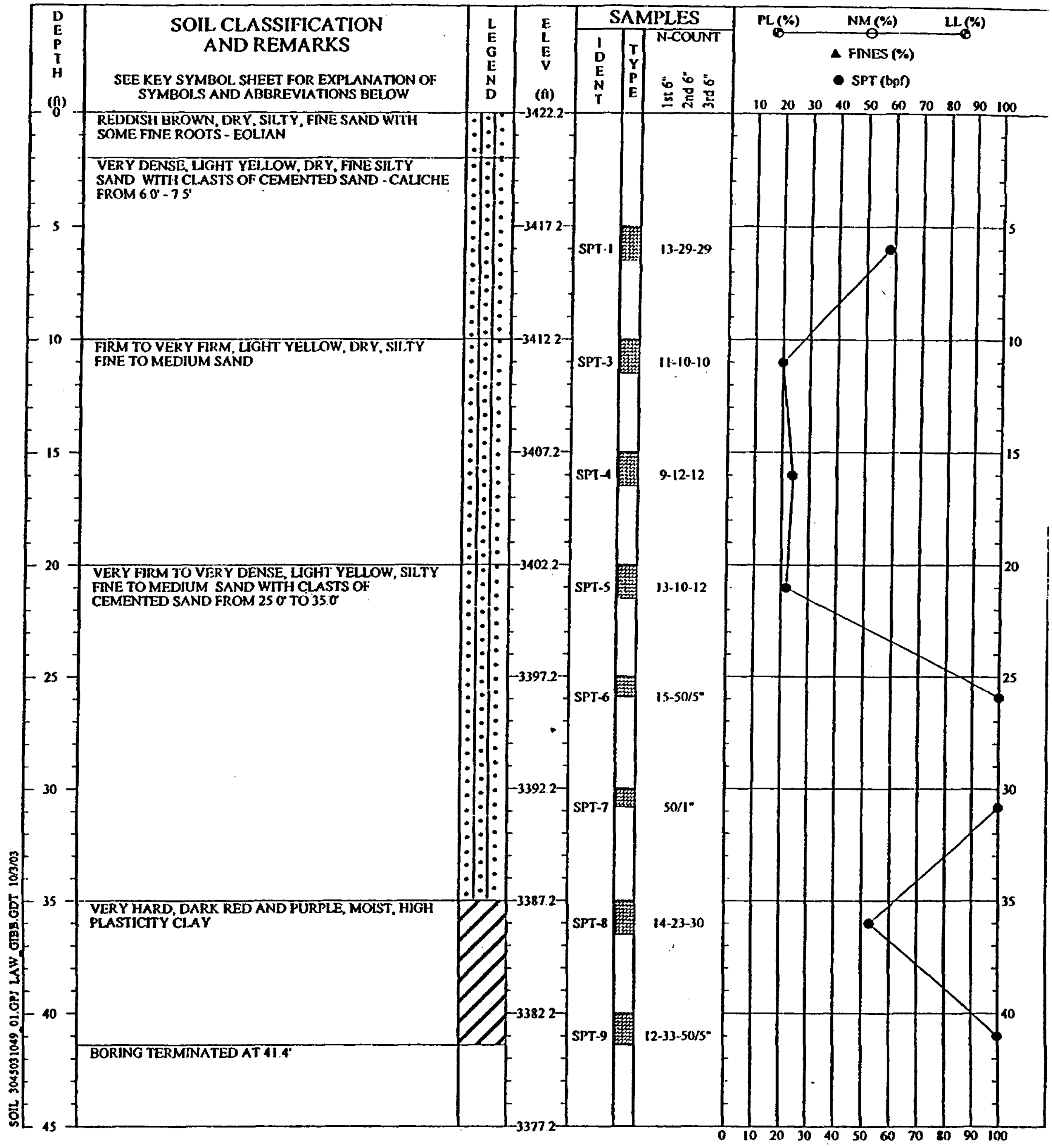

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)	IDENT	N-COUNT 1st 6" 2nd 6" 3rd 6"
0	REDDISH BROWN, DRY, SILTY, FINE SAND WITH SOME FINE ROOTS - EOLIAN	3422.2		
	VERY DENSE, LIGHT YELLOW, DRY, FINE SILTY SAND WITH CLASTS OF CEMENTED SAND - CALICHE FROM 6.0' - 7.5'			
5		3417 2	SPT-1	13-29-29
10	FIRM TO VERY FIRM, LIGHT YELLOW, DRY, SILTY FINE TO MEDIUM SAND	3412 2	SPT-3	11-10-10
15		3407.2	SPT-4	9-12-12
20	VERY FIRM TO VERY DENSE, LIGHT YELLOW, SILTY FINE TO MEDIUM SAND WITH CLASTS OF CEMENTED SAND FROM 25.0' TO 35.0'	3402.2	SPT-5	13-10-12
25		3397.2	SPT-6	15-50/5"
30		3392 2	SPT-7	50/1"
35	VERY HARD, DARK RED AND PURPLE, MOIST, HIGH PLASTICITY CLAY	3387.2	SPT-8	14-23-30
40		3382 2	SPT-9	12-33-50/5"
	BORING TERMINATED AT 41.4'			
45		3377 2		

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/9/2003.

SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 9, 2003 **BORING NO.:** B-2

PROJ. NO.: 3043031049/0001 **PAGE** 1 **OF** 1

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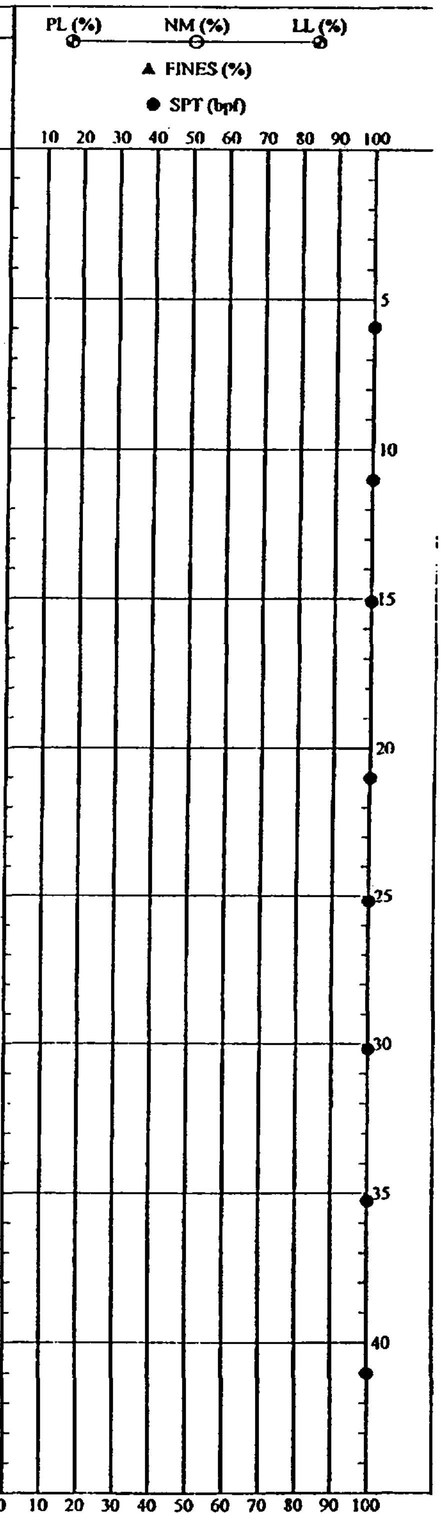
DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW	ELEV (ft)	SAMPLES IDENT	SAMPLES N-COUNT (1st 6" 2nd 6" 3rd 6")
0	REDDISH BROWN, DRY, SILTY FINE SANDY WITH SOME ROOTS - EOLIAN	3412 5		
	VERY DENSE, REDDISH BROWN, DRY, SILTY FINE TO MEDIUM SAND WITH CLASTS OF CEMENTED SAND			
5		3407 5	SPT-1	30-50/5"
10		3402 5	SPT-2	33-50/6"
15	VERY DENSE, LIGHT YELLOW, DRY SILTY FINE TO MEDIUM SAND - CALICHE	3397 5	SPT-3	50/1"
20	VERY DENSE, REDDISH YELLOW, DRY SILTY FINE TO MEDIUM SAND WITH CLASTS OF CEMENTED SAND AND SOME FINE SUBANGULAR TO ROUNDED GRAVEL	3392.5	SPT-4	22-40-50/3"
25	VERY DENSE, LIGHT YELLOW, DRY SILTY FINE TO MEDIUM CEMENTED SAND - CALICHE	3387 5	SPT-5	50/2"
30		3382 5	SPT-6	50/2"
35	VERY DENSE, REDDISH BROWN, DRY, SILTY FINE TO MEDIUM SAND	3377.5	SPT-7	50/3"
40	VERY HARD, DARK RED, DRY, HIGH PLASTICITY CLAY	3372 5	SPT-8	23-50/6"
45		3367 5		



SOIL 3045031049 01.GPJ LAW GIBB.GDT 10/3/03

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SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 10, 2003 **BORING NO.:** B-3

PROJ. NO.: 3043031049/0001 **PAGE 1 OF 3**

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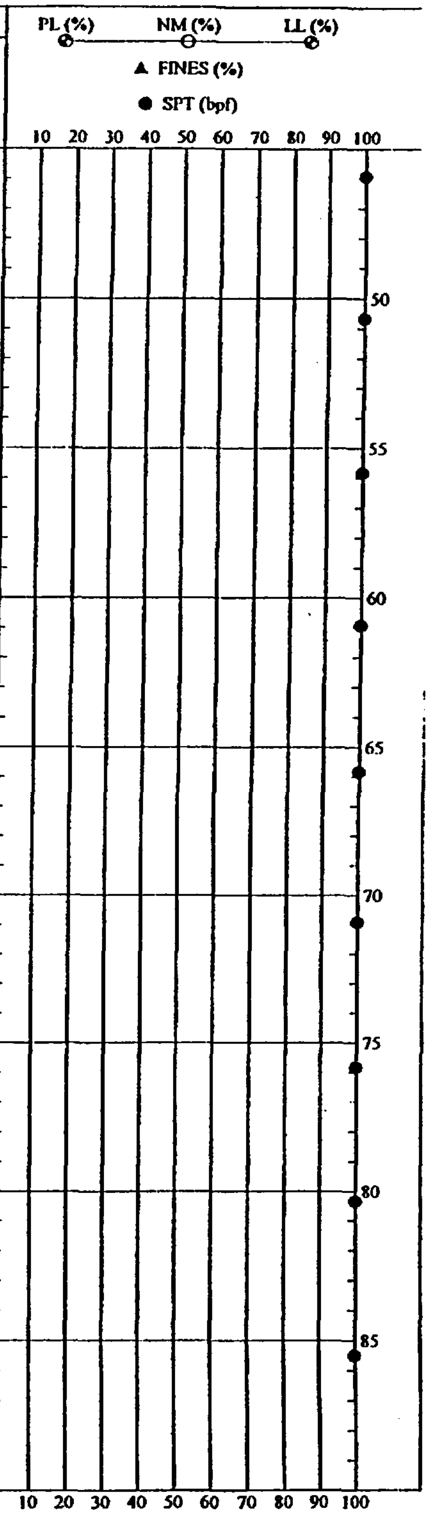
DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW	LEGEND	ELEV (ft)	SAMPLES IDENT	SAMPLES TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
45	VERY HARD, DARK RED, DRY, HIGH PLASTICITY CLAY	▨	3367.5	SPT-9	▨	27-50/5"
50		▨	3362.5	SPT-10	▨	39-50/2"
55	VERY HARD, DARK RED AND PURPLE, DRY, HIGH PLASTICITY CLAY	▨	3357.5	SPT-11	▨	35-50/4"
60		▨	3352.5	SPT-12	▨	31-50/5"
65		▨	3347.5	SPT-13	▨	32-50/4"
70		▨	3342.5	SPT-14	▨	22-50/5"
75		▨	3337.5	SPT-15	▨	39-50/4"
80	VERY HARD, DARK RED AND PURPLE, DRY, HIGH PLASTICITY CLAY WITH OCCASIONAL THIN CEMENTED LAYERS OF GREENISH GRAY	▨	3332.5	SPT-16	▨	50/4"
85	VERY HARD, REDDISH PURPLE WITH GRAY MOTTLING, DRY HIGH PLASTICITY CLAY	▨	3327.5	SPT-17	▨	50/6"
90			3322.5			



SOIL 3043031049 01.GPJ LAW GIBB.GDT 10/3/03

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION BACK FILLED ON 9/10/2003

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SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 10, 2003 **BORING NO.:** B-3

PROJ. NO.: 3043031049/0001 **PAGE 2 OF 3**

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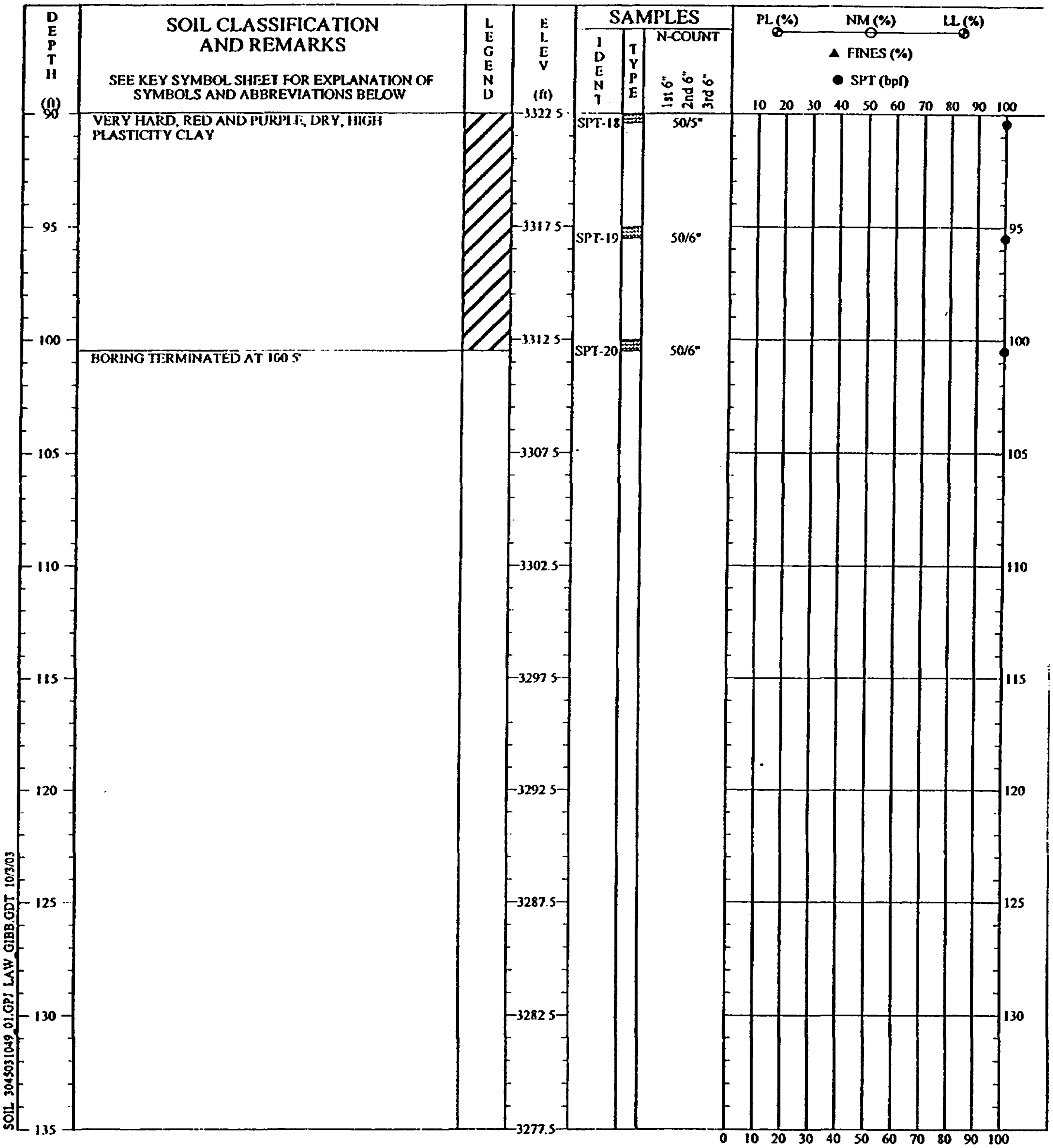

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/10/2003

SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 10, 2003 **BORING NO.:** B-3

PROJ. NO.: 3043031049/0001 **PAGE** 3 **OF** 3

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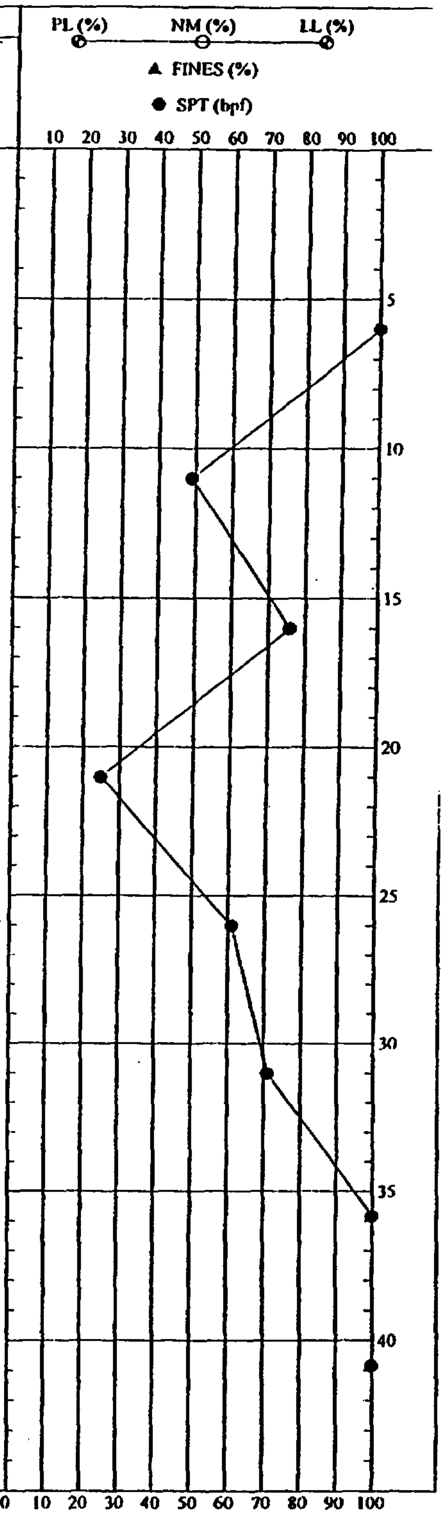
DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	ELEV (ft)	SAMPLES IDENT	SAMPLES N-COUNT 1st 6" 2nd 6" 3rd 6"
0	REDDISH BROWN, DRY, SILTY FINE SAND WITH SOME ROOTS - EOLIAN VERY DENSE, REDDISH BROWN, DRY, SILTY FINE SAND	3403 5		
5		3398 5	SPT-1	26-50/6"
10	DENSE TO VERY DENSE, LIGHT RED, DRY, SILTY FINE TO MEDIUM SAND WITH CLASTS OF CEMENTED SAND	3393 5	SPT-2	17-26-23
15		3388 5	SPT-3	20-39-37
20	VERY FIRM TO VERY DENSE, LIGHT RED, DRY, SILTY FINE SAND WITH CEMENTED ZONES FROM 25.0' TO 30.0'	3383.5	SPT-4	7-13-12
			UD-2	1.0-2 0
25		3378 5	SPT-5	16-34-27
30	VERY DENSE, LIGHT REDDISH BROWN, DRY FINE SILTY FINE TO MEDIUM SAND	3373 5	SPT-6	16-30-41
35		3368 5	SPT-7	39-50/4"
40	VERY HARD, DARK RED, DRY, HIGH PLASTICITY CLAY BORING TERMINATED AT 40 8'	3363 5	SPT-8	35-50/4"
45		3358 5		



REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION BACK FILLED ON 9/9/2003

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER INTERFACES BEWEEN STRATA ARE APPROXIMATE TRANSITIONS BETWEEN STRATA MAY BE GRADUAL

SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 9, 2003 **BORING NO.:** B-4

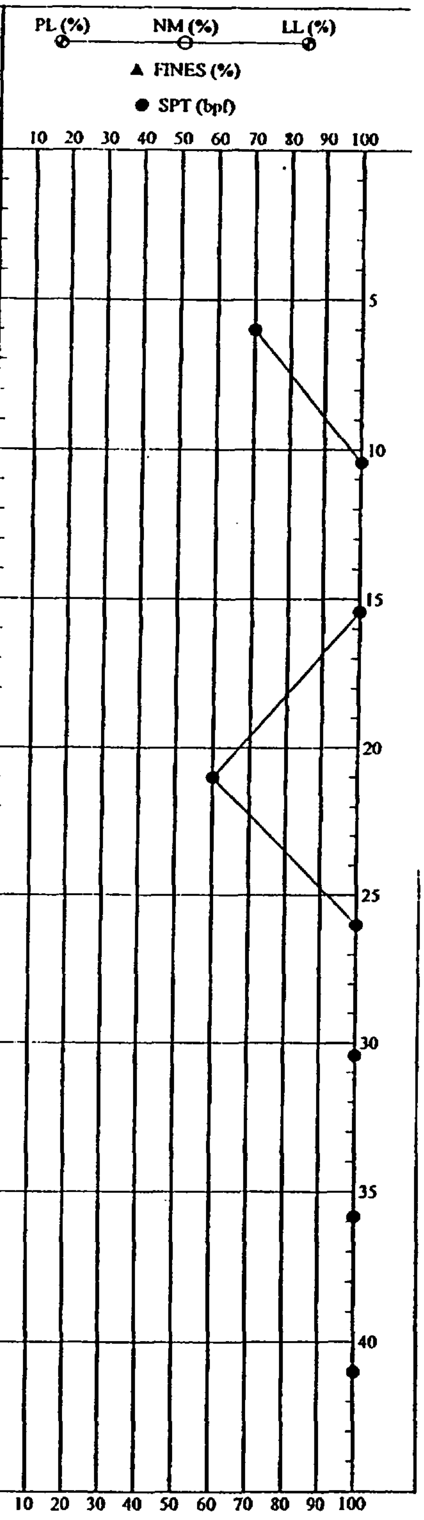
PROJ. NO.: 3043031049/0001 **PAGE** 1 **OF** 1

MACTEC

SOIL CLASSIFICATION AND REMARKS

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)	SAMPLES IDENT	N-COUNT (1st 6" - 2nd 6" - 3rd 6")
0	REDDISH BROWN, DRY, SILTY FINE SAND WITH SOME FINE ROOTS - EOLIAN	3411.2		
	VERY DENSE, REDDISH YELLOW, DRY SILTY FINE TO MEDIUM SAND			
5		3406.2	SPT-1	25-35-35
10	VERY DENSE, LIGHT YELLOW, DRY, SILTY FINE TO MEDIUM CEMENTED SAND - CALICHE	3401.2	SPT-2	50/5"
15		3396.2	SPT-3	50/5"
20	VERY DENSE, LIGHT YELLOW, DRY SILTY FINE TO MEDIUM SAND WITH CLASTS OF CEMENTED SAND	3391.2	SPT-4	15-24-36
25		3386.2	SPT-5	9-38-50/4"
30	VERY DENSE, REDDISH YELLOW, DRY, SILTY FINE TO MEDIUM SAND WITH SOME FINE SUBANGULAR TO ROUNDED GRAVEL	3381.2	SPT-6	50/5"
35		3376.2	SPT-7	30-50/4"
40	VERY HARD, REDDISH PURPLE, DRY, HIGH PLASTICITY CLAY	3371.2	SPT-8	18-50/6"
	BORING TERMINATED AT 41.0'			
45		3366.2		



REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING A SAFETY HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BACK FILLED ON 9/10/2003

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: NEF - Lea County, New Mexico

DRILLED: September 10, 2003 **BORING NO.:** B-5

PROJ. NO.: 3043031049/0001 **PAGE 1 OF 1**

MACTEC

APPENDIX C

LABORATORY TEST PROCEDURES

LABORATORY TEST RESULTS

LABORATORY TEST PROCEDURES

Atterberg Limits

Originally, the Atterberg Limits consisted of seven "limits of consistency" of fine-grained soils. In current engineering usage, the term usually refers only to the liquid limit (LL) and plastic limit (PL). The LL (between the liquid and plastic states) is the water content at which a trapezoidal groove of specified shape, cut in moist soil held in a special cup, is closed after 25 taps on a hard rubber plate. The PL (between plastic and semi-solid states) is the water content at which the soil crumbles when rolled into threads of 1/8 inch in diameter.

The LL has been found to be proportional to the compressibility of the normally consolidated soil. The PI is the calculated difference in water contents between the LL and the PL. Together the LL and PI are used to classify silts and clays according to the Unified Soil Classification System (ASTM D 2487). The PI is used to predict the potential for volume changes in confined soils beneath foundations or grade slabs. The LL, PL, and PI are determined in accordance with ASTM D 4318.

Moisture Content

The moisture content in a given mass of soil is the ratio, expressed as a percentage, of the weight of the water to the weight of the solid particles. This test was conducted in accordance with ASTM D 2216.

Grain Size Distribution

Grain Size Tests are performed to aid in determining the soil classification and the grain size distribution. The soil samples are prepared for testing according to ASTM D 421 (dry preparation) or ASTM D 2217 (wet preparation). If only the grain size distribution of soils coarser than a number 200 sieve (0.074-mm opening) is desired, the grain size distribution is determined by washing the sample over a number 200 sieve and, after drying, passing the samples through a standard set of nested sieves. If the grain size distribution of the soils finer than the number 200 sieve is also desired, the grain size distribution of the soils coarser than the number 10 sieve is determined by passing the sample through a set of nested sieves. Materials passing the number 10 sieve are dispersed with a dispersing agent and suspended in water, and the grain size distribution calculated from the measured settlement rate of the particles. These tests are conducted in accordance with ASTM D 422.

Compaction Tests (Moisture-Density Relationship)

Compaction tests are performed on representative soil samples to determine the maximum dry density and optimum moisture content. The results of the tests are used in conjunction with other tests to determine engineering properties relating to settlement, bearing capacity, shear strength, and permeability. The results may also be used as a standard to determine the percent compaction of any soil embankment.

The two most commonly used compaction tests are the standard Proctor test and the modified Proctor test. They are performed in accordance with ASTM D 698 and D 1557, respectively. Generally, the standard Proctor compaction test is run on samples from building areas and areas where moderate loads are anticipated. The modified Proctor compaction test is generally used for analyses of highways and other areas where large building loads are expected. Both tests have three procedures, depending upon soil particle size:

Test	Procedure	Hammer Weight	Hammer Fall	Mold Diameter	Screen Size (Material Finer Than)	Number of Layers	Number of Blows per Layer
Standard (D 698)	A	5.5 lb.	12"	4"	No. 4 sieve	3	25
	B	5.5 lb.	12"	4"	No. 3/8" sieve	3	25
	C	5.5 lb.	12"	6"	3/4" sieve	3	56
Modified (D 1557)	A	10 lb.	18"	4"	No. 4 sieve	5	25
	B	10 lb.	18"	4"	No. 3/8" sieve	5	25
	C	10 lb.	18"	6"	3/4" sieve	5	56

Test results are presented as a curve depicting dry unit weight versus moisture content. The compaction method used and any deviations from the recommended procedures are noted in the report.

Laboratory California Bearing Ratio Tests

The results of the compaction test are utilized in compacting the test sample to the desired density and moisture content for the laboratory California Bearing Ratio test. The California Bearing Ratio, generally abbreviated CBR, is a punching shear test and is a comparative measure of the shearing resistance of a soil. It provides data that is a semi-empirical index of the strength and deflection characteristics of a soil that has been correlated with pavement performance to establish design curves. The CBR is used with empirical curves to design pavement structures.

A laboratory CBR test is conducted according to ASTM D 1883. A representative sample is compacted to a specified density at a specified moisture content. The test is performed on a 6-inch diameter, 4.585-inch-thick disc of compacted soil that is confined in a steel cylindrical mold. The sample is compacted in accordance with Method B or D of ASTM D 698 or D 1557. These compaction procedures are outlined in this report in the section on compaction tests.

CBR tests may be run on the compacted samples in either soaked or unsoaked conditions. During testing, a piston approximately 2 inches in diameter is forced into the soil sample at the rate of 0.05 inches per minute to a depth of 0.5 inches to determine the resistance to penetration. The CBR is the percentage of the load it takes to penetrate the soil to a 0.1-inch depth compared to the load it takes to penetrate a standard crushed stone to the same depth.

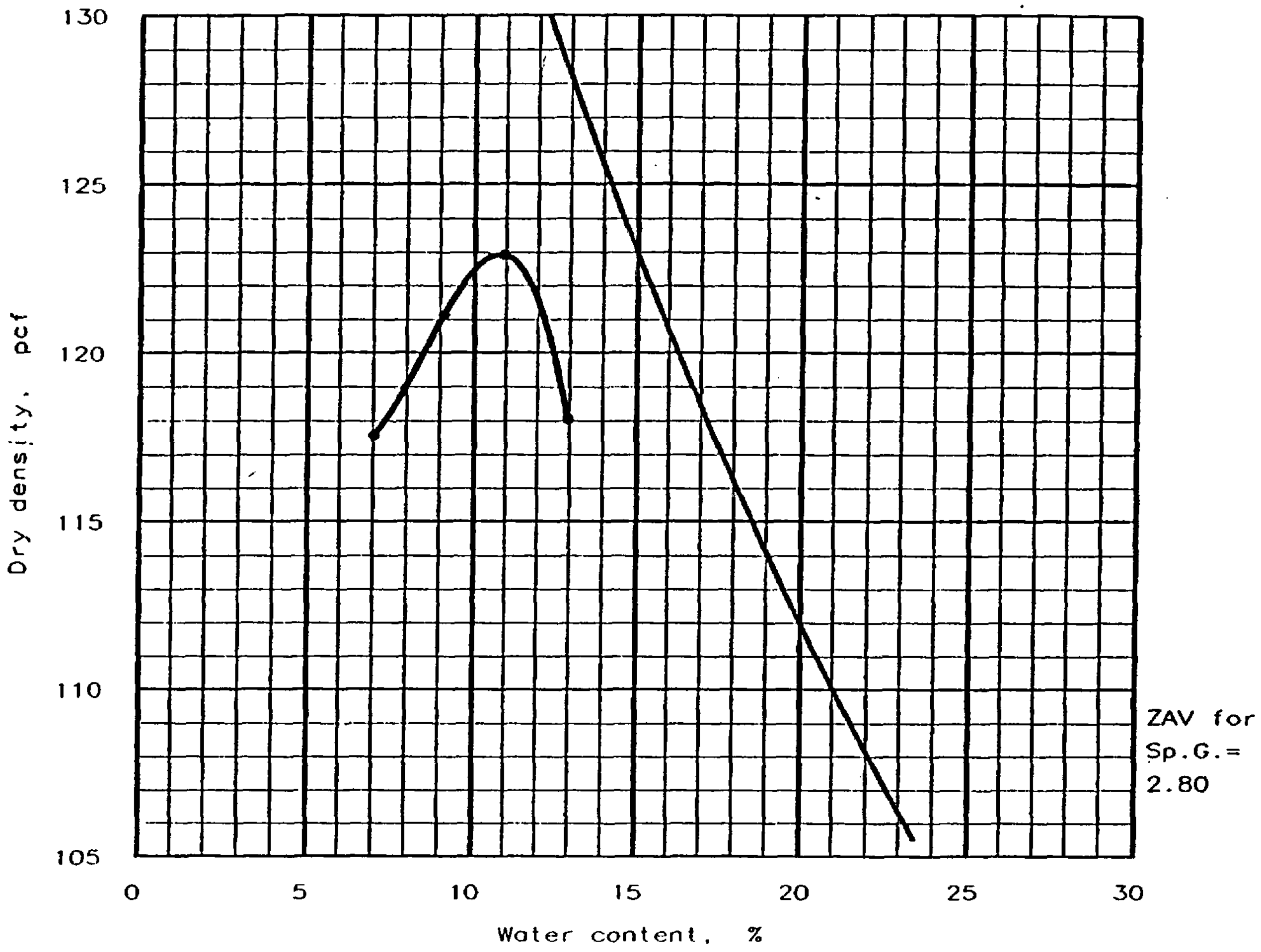
Table C.1
Soil Data Summary
Index and Compaction Properties

Boring Number	Sample Type	Sample Depth (Feet)	Maximum Dry Density, pcf (ASTM D 1557)	Optimum Moisture Content, % (ASTM D 1557)	Natural Moisture Content, %	Liquid Limit, %	Plastic Limit, %	Plasticity Index, %	Percent Finer Than #200 Sieve	pH	Resistivity (Ohm-cm)
B-2	SS	5			4.1			NP	16.7		
B-2	SS	25			3.9			NP	18.9		
B-2	SS	5								7.99	7,400
B-2	SS	10									
B-3	SS	5			7.5	26	17	9	31.0		
B-3	SS	10									
B-3	BULK	5 - 10	122.9	10.8	4.3			NP	24.8		
B-3	SS	45			11.4	60	23	37	91.9		
B-3	SS	50									
B-3	SS	70			13.7	50	18	32	96.1		
B-3	SS	75									
B-4	SS	5								7.93	2,100
B-4	SS	10									
B-4	BULK	0 - 15	122.8	9.6	3.2			NP	22.8		
B-5	SS	5			2.8			NP	21.6		
B-5	SS	10									

Bulk - Bulk Sample
SS - Standard Penetration Test Sample
NP - Non-Plastic

Prepared By MBH Date 10-15-03 Checked By Date 10-15-03

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 1557-02 Procedure B, Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in	% < No.200
	USCS	AASHTO						
5-10'	SM	A-2-4(0)	4.3 %	NT	NV	NP	0.0 %	31.2 %

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 122.9 pcf Optimum moisture = 10.8 %	Brown silty sand

Project No.: 3043031049.0001

Project: NEF Lea County, New Mexico

Location: Boring B-3 Bulk

Date: October 13, 2003

MOISTURE-DENSITY RELATIONSHIP TEST

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Remarks:

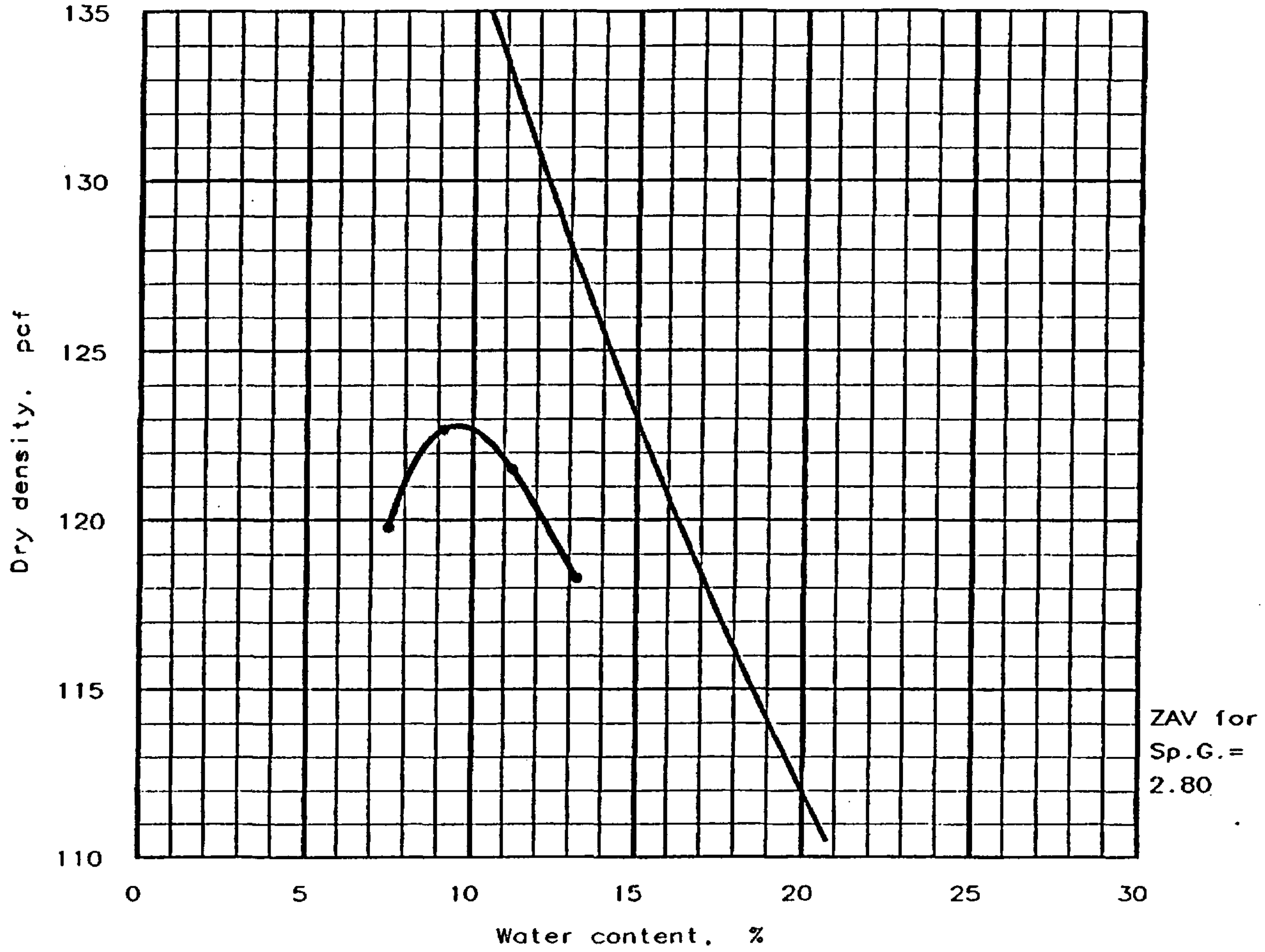
Sample Number 2837

NT- No Test

DNS- Data Not Submitted

Fig. No. 2837

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 1557-02 Procedure B, Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in	% < No.200
	USCS	AASHTO						
0-15'	SM	A-2-4(0)	3-8% %	NT	NP	NP	0.0 %	22.7 %

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 122.8 pcf Optimum moisture = 9.6 %	Tan silty sand

Project No.: 3043031049.0001

Project: NEF Lea County, New Mexico

Location: Boring B-4 , 0-7' and 7-15' combined
Bulk Sample

Date: October 13, 2003

MOISTURE-DENSITY RELATIONSHIP TEST

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Remarks:

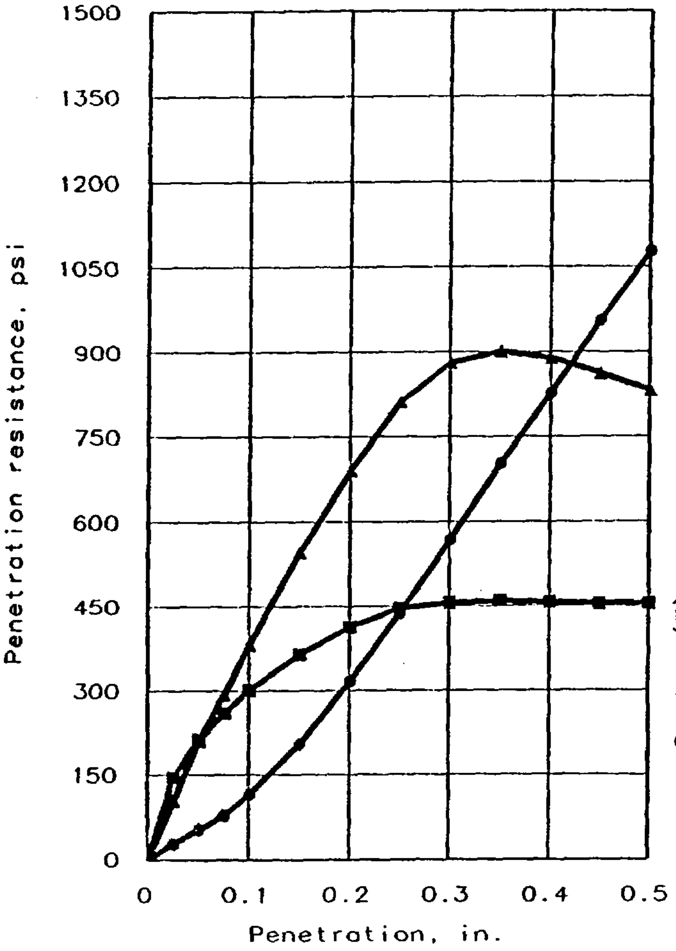
Sample Number 2836

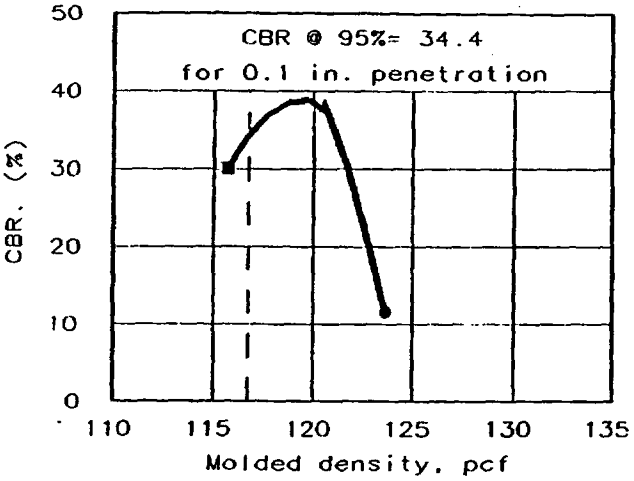
NT- No Test

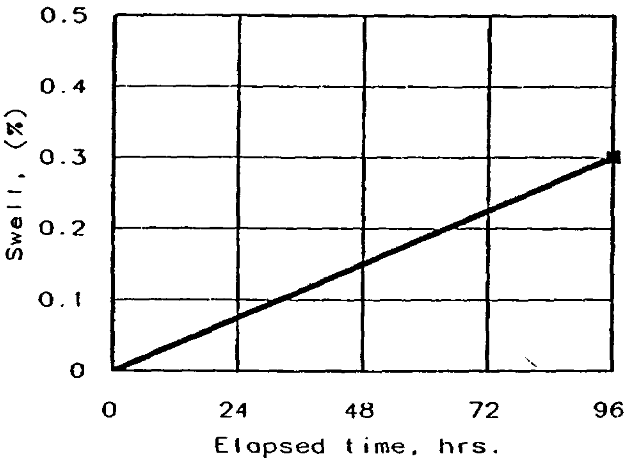
DNS- Data Not Submitted

Fig. No. 2836

BEARING RATIO TEST REPORT







	Molded			Soaked			CBR, (%)		Lin.	Pen.	Swell
	Dens.	% max	moist	Dens.	% max	moist	0.1"	0.2"	Cor.	Sur.	%
1 ●	123.6	100.6	11.2%	123.2	100.2	13.1%	11.6	21.1	0	10.0	0.3
2 ▲	120.5	98.0	11.2%	120.1	97.7	12.7%	38.1	46.0	0	10.0	0.3
3 ■	115.7	94.1	11.1%	115.4	93.9	13.9%	30.1	27.5	0	10.0	0.3

MATERIAL DESCRIPTION	USCS	Max. dens.	Opt. w.c.	LL	PI
Brown silty sand	SM	122.9	10.8	NV	NP

Project No: 3043031049.0001
Project: NEF - Lea County, New Mexico
Location: Boring B-3, 5-10' Bulk

Date: October 13,2003

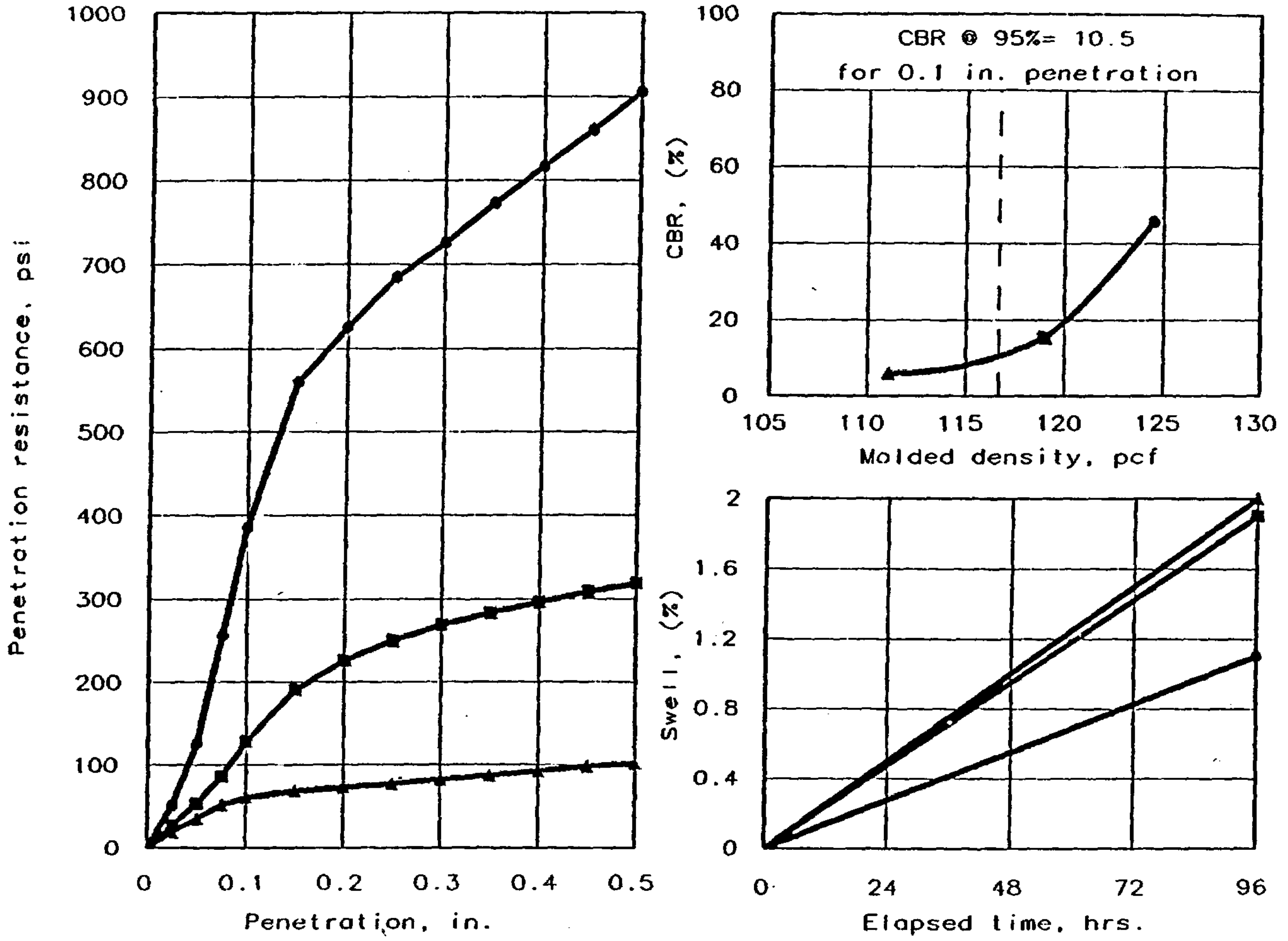
BEARING RATIO TEST REPORT

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Test Descr./Remarks:
ASTM D1883-99 C.B.R.
ASTM D 1557-02 B /
Sample Number 2837
Penetration on
soaked samples.

Fig. No.: 2837

BEARING RATIO TEST REPORT



	Molded			Soaked			CBR, (%)		Lin. Cor.	Pen. Sur.	Swell %
	Dens.	% max	moist	Dens.	% max	moist	0.1"	0.2"			
1 ●	124.5	101.4	9.5%	123.1	100.2	14.0%	45.5	43.3	0.020	10.0	1.1
2 ▲	111.1	90.5	9.7%	108.9	88.7	18.5%	6.0	4.8	0	10.0	2.0
3 ■	119.0	96.9	9.7%	116.8	95.1	16.3%	15.3	15.7	0.020	10.0	1.9

MATERIAL DESCRIPTION	USCS	Max. dens.	Opt. w.c.	LL	PI
Tan silty sand	SM	122.8	9.6	NV	NP

Project No: 3043031049.0001
Project: NEF - Lea County, New Mexico
Location: Boring B-4, 0-7' & 7-15' combined Bulk

Date: October 13,2003

BEARING RATIO TEST REPORT

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Test Descr./Remarks:
ASTM D1883-99 C.B.R.
ASTM D 1557-02 B /
Sample Number 2836
Penetration on
soaked samples.

Fig. No.: 2836

SECTION VI

GEOLOGY REPORT

FEBRUARY 2004

Prepared for:

WASTE CONTROL SPECIALISTS LLC
Andrews, Texas

Prepared by:

Cook-Joyce, Inc.
812 West Eleventh
Austin, Texas 78701

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Intera, Inc.
9111A Research Boulevard
Austin, Texas 78758

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SECTION VI

GEOLOGY REPORT

FEBRUARY 2004

Prepared for:

WASTE CONTROL SPECIALISTS LLC
Andrews, Texas

Prepared by:

Cook-Joyce, Inc.
812 West Eleventh
Austin, Texas 78701

&

Intera, Inc.
9111A Research Boulevard
Austin, Texas 78758

The copy of this report (CJI, 2004) was provided to AREVA by WCS.
It is missing copies of several figures, all appendices, and one plate, as follows:

- Figures 6.5-1 through 6.6-7
- Appendices 6.2-1 through 6.6-7
- Plate 6.2-1

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LIST OF FIGURES – continued

FIGURE

LIST OF FIGURES – continued

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GEOLOGY REPORT INTRODUCTION

The Waste Control Specialists LLC (WCS) facility in northwestern Andrews County was permitted in 1994 as a Class I hazardous waste landfill pursuant to 40 CFR Part 270, 30 TAC Chapter 305 (C) and (D) and 30 TAC Chapter 335.

The WCS site is located at the southwestern edge of the Southern High Plains, approximately 30 miles northwest of the City of Andrews (Figure 6.0-1). The WCS facility including the existing landfill, the RCRA permitted area, and the Flying W Ranch is shown on Figure 6.0-2. This part of Andrews County is a gently southeastward sloping plain with a natural slope of about 8 to 10 feet per mile. The immediate landfill vicinity is underlain primarily by the Late Tertiary/Quaternary-aged pedogenic Caprock caliche that overlies all pre-Quaternary strata in the High Plains. Quaternary Blackwater Draw eolian sands and younger windblown sands overlie the Caprock caliche in the northern and southern parts of the permitted area. Below the Caprock caliche are sands and sandstones that have been variously ascribed to the Tertiary Ogallala Formation, the Tertiary-aged sections of the Gatuna Formation, and the Cretaceous Antlers Formation. The sands and sandstones underlying the Caprock caliche are situated in the same stratigraphic interval and hydrogeologically they represent a single hydrostratigraphic unit overlying the Triassic red beds, the distinctive red and purple mudstones, siltstones and sandstones of the Triassic Dockum Group. The undifferentiated sands and sandstones of the Ogallala/Antlers/Gatuna Formations underlying the Caprock caliche and overlying the Dockum Group are herein referred to as the OAG hydrostratigraphic unit, or simply the OAG unit.

The WCS facility is located over a geologic feature referred to as the red bed ridge. The red bed ridge is a prominent buried ridge developed on the upper surface of the Triassic Dockum Group. The Dockum Group red beds are present beneath the entire WCS facility at depths ranging from about 8 feet over the crest of the red bed ridge to about 60 to 70 feet on the northern and southern boundaries of the permitted area. The lower part of the WCS landfill excavation lies within the upper 40 to 60 feet of the Dockum Group.

The OAG unit, which overlies the Dockum Group, is largely unsaturated over the crest of the red bed ridge beneath the WCS permitted area. The OAG unit is saturated to the northwest and east of the WCS permitted area including the extreme east central portion of the permitted area.

The Dockum Group is over 1,000 feet thick beneath the WCS facility. The first potential transmissive zones in the Dockum Group beneath the facility are discontinuous sandstones/siltstones at depths of up to 125 feet; however this zone has never yielded groundwater to monitor wells completed in the zone. Five monitor wells completed in the 125 foot zone have been dry since installation in 1996 and 1998. The next potential transmissive zone is a discontinuous sandstone/siltstone at a depth of about 180 feet. The uppermost continuous transmissive zone, which is the water bearing zone in which the facility's upgradient and downgradient monitor wells are screened, is a laterally continuous 10 to 30 foot thick sandstone/siltstone at a depth of about 225 feet. This unit is saturated and has very low permeability. The non-potable water supply for the WCS facility is obtained from the sandstone sections of the lower Dockum Group Santa Rosa Formation at a depth of about 1,140 to 1,400 feet below ground surface. A secondary supply is obtained from the lower Dockum Group Trujillo Formation sandstone at a depth of about 600 to 700 feet below ground surface. Potable water for the WCS facility is obtained by pipeline from Eunice, New Mexico.

1.0 REGIONAL PHYSIOGRAPHY AND TOPOGRAPHY

The WCS facility is located in west Texas, which lies within the southern portion of the North American Great Plains Physiographic Province. The site is situated in northwest Andrews County on the southwestern edge of the Southern High Plains, or the Llano Estacado (Figure 6.1-1). The Southern High Plains is an elevated area of undulating plains with low relief encompassing a large area of west Texas and eastern New Mexico. It is bounded on the north by the southern escarpment of the Canadian River and on the east by the Caprock escarpment developed by the headward erosion of the upper tributaries of the Colorado, Brazos and Red Rivers. The western boundary is the Mescalero Ridge escarpment of the Pecos River valley. The southern boundary, which is not distinctly defined, blends into the Edwards Plateau. The Basin and Range Physiographic Province lies to the west of the Southern High Plains, and the Rolling Plains Physiographic Province lies to the east. The regional topographic slope is toward the southeast at about 8 to 10 feet per mile.

Mescalero Ridge, which defines the western edge of the Southern High Plains, is topographically expressed about 15 miles to the northwest of the site in western Lea County, New Mexico. The ridge is a nearly perpendicular cliff facing southwest with a relief of 100 to 150 feet.

The nearest surface water drainage feature to the WCS facility is Monument Draw in Lea County, New Mexico, a reasonably well-defined, southward-draining draw about 3 miles west of the WCS site. The draw does not have through-going drainage and loses surface expression after it enters Winkler County, Texas. (Note: there are two surface drainage features named Monument Draw in the vicinity: Monument Draw, New Mexico, a south-flowing ephemeral stream in Lea County, New Mexico, and Monument Draw, Texas (same name), an east-flowing ephemeral stream in Andrews County, Texas). East of Monument Draw, New Mexico and south of the WCS facility is a local topographic high known as Rattlesnake Ridge. This poorly defined ridge parallels the Texas-New Mexico border and crests about 125 feet higher than Monument Draw, New Mexico (Nicholson and Clebsch, 1961).

The WCS permitted area is on the southwestern slope of the drainage divide between the Pecos River and the Colorado River. In the immediate vicinity of the WCS permitted area, the slope is southwest toward Monument Draw, New Mexico at about 50 feet per mile. The maximum and minimum elevations of the permitted area are about 3490 feet and 3415 feet msl, respectively.

Small surface depressions (buffalo wallows) and a few established playa basins are present within a 6.2-mile radius of the WCS facility. The largest of the surface depressions within the permitted area is a small playa about 15 acres in size approximately one-half mile northeast of the existing landfill. Remnant deposits of a filled and now partially covered playa or salt lake basin are found about 2.5 miles east of the permitted area. Surface drainage from the area north and east of the WCS facility flows eastward into this basin.

Local topographic features outside the permitted area include Baker Spring to the west, small depressions or solution pans between Baker Spring and the permitted area, and a spring about 3 miles to the east on the western side of the partially covered playa or salt lake basin.

Baker Spring is located in Lea County, New Mexico, about 1925 feet west of the permitted area. Two surface draws empty into the Baker Spring depression. As discussed in Section 5.0 (Site Subsurface Soils Investigation), Baker Spring is the site of a former quarry area.

Brune (1981) indicates a historical spring (Scratch Spring) about 3 miles east of the permitted area, on the western side of the partially covered playa or salt lake basin. According to Brune (1981), the spring was dry in 1923 although the depression was reported to have water. The three small depressions, or solution pans, west of the permitted area are included in the discussion of local depressions in Section 4.3.1.3.

Other land uses within a few miles of the WCS facility include agricultural farming and ranching, drill sites for oil and gas wells (Railroad Commission records for an oil well located near the southwest corner of the permitted area indicate the well was completed in 1991, with the last recorded production in 1993); quarrying operations; and the surface recovery and land farming of oil field wastes. Surface quarrying of caliche, sand and gravel is conducted in New Mexico, approximately one mile west of the WCS landfill site. The oil field waste recovery facility is adjacent to this quarry. The Lea County, New Mexico municipal solid waste landfill is located adjacent to the state line to the immediate south and west of the WCS facility.

2.0 REGIONAL GEOLOGY

This section discusses the regional geology from ground surface to a depth of approximately 1400 feet, which includes the lowermost underground source of drinking water (USDW). The geologic deposits in the vicinity of the WCS facility have been mapped and evaluated in detail by Dr. T. M. Lehman and Dr. K. Rainwater in a recent report to the Andrews Industrial Foundation (Appendix 6.2-1). The evaluation in Appendix 6.2-1 is utilized to some extent in the following discussion of the regional geology. The Hobbs Sheet of the Geologic Atlas of Texas showing the area surrounding the proposed WCS landfill site is provided as Plate 6.2-1. Two regional cross sections developed by Terra Dynamics (1993) using oil and gas well logs are provided as Plate 6.2-2 and Plate 6.2-3. The locations of the cross sections are shown on Figure 6.2-1.

The geologic formations in the vicinity of the WCS facility comprise, from oldest to youngest, the Triassic Dockum Group, the Cretaceous Trinity Group Antlers Formation, the Late Tertiary Ogallala Formation, the Late Tertiary/Quaternary Gatuna Formation or Cenozoic Basin Fill, the Pleistocene windblown sand of the Blackwater Draw Formation, and Holocene windblown sands and playa deposits. A regional hard caliche, termed the Caprock caliche, developed on all pre-Quaternary formations before the Blackwater Draw windblown sands were deposited.

A stratigraphic column for the above units is provided in Figure 6.2-2. This stratigraphic column adopts the nomenclature of Lehman (1994a, 1994b) for the Dockum Group and includes the entire stratigraphic sequence typical of the Central Basin Platform of the west Texas Permian Basin (Bebout and Meador, 1985).

2.1 TRIASSIC DOCKUM GROUP

The Triassic Dockum Group disconformably overlies the Permian stratigraphic sequence within the region. The Dockum Group consists of five formations; the lowermost is the Santa Rosa Formation, followed by the Tecovas, the Trujillo, the Cooper Canyon, and the Redonda Formations. Only the Santa Rosa, Tecovas, Trujillo and Cooper Canyon Formations are present in the vicinity of the WCS facility. The Dockum Group consists of a series of fluvial and lacustrine mudstone, siltstone, sandstone, and silty dolomite deposits (McGowen et al., 1979), which range up to approximately 1400 feet thick in the area of the Central Basin Platform. These sediments accumulated in a variety of continental depositional settings, including braided and meandering streams, alluvial fan deltas, lacustrine deltas, lacustrine systems, and mud flats (McGowen et al., 1979).

Figure 6.2-3 shows the inferred paleogeographic setting that existed during the deposition of the Dockum Group. McGowen et al. (1979) interpret that the Dockum Group accumulated in an inland fluvial-lacustrine basin. The terrigenous clastics of the Dockum Group deposited in the Permian Basin area were mainly derived from older sedimentary rocks that accumulated in Texas and New Mexico. In southeastern New Mexico and the Andrews County, Texas area, the sediments were derived from upland source areas to the south and west.

The lowermost part of the Dockum Group is the Santa Rosa Formation sandstone, which is about 200 to 250 feet thick. The Santa Rosa Formation comprises a lower sandstone member, a middle sandstone member, a middle shale member and an upper sandstone member (McGowen et al., 1979). The lower sandstone member, comprising 70 to 80 feet of medium- to fine-grained sandstone and some conglomerates, is characterized by overlapping thin, relatively broad, channel-fill sandstone bodies, which were deposited in an alluvial fan or a fan–delta system. The middle sandstone member is a coarse-grained meanderbelt sequence (McGowen and Garner, 1970; Levey, 1976, as referenced by McGowen et al., 1979) about 75 to 80 feet in thickness. The shale member overlying the middle sandstone is an olive-gray lacustrine claystone with plant material, and siltstone and sandstone lenses with a total thickness of about 75 feet. The upper sandstone is about 20 feet of very fine-grained sandstone overlain by about 10 feet of trough-fill, fine to medium-grained sandstone.

The Santa Rosa Formation sandstone is the lowermost formation used as a groundwater source in the area. The Santa Rosa sandstone yields brackish water from a depth of about 1,140 to 1,400 feet below ground surface from the central water supply well located between the ranch house immediately east of the WCS facility and the permitted landfill (Plate 6.2-2; the central well is named Great Western Drig. Scratch Royalty # 1-A).

The Tecovas Formation consists primarily of lacustrine claystone and siltstones between the Santa Rosa Formation sandstone and the Trujillo Formation sandstone. The Tecovas Formation is about 400 to 500 feet thick in the WCS area (Plates 6.2-2 and 6.2-3).

The middle sandstone of the Dockum Group is the Trujillo Formation sandstone. The Trujillo Formation is a fine-grained sandstone that is typically gray or greenish-gray in unweathered section. The Trujillo Formation Sandstone occurs at a depth of about 600 feet in the WCS area (see cross sections on Plates 6.2-2 and 6.2-3) and is about 100 feet thick.

Overlying the Trujillo Formation sandstone are the red or purple shales and siltstones of the Cooper Canyon Formation. The Cooper Canyon Formation has been historically referred to as the Chinle Formation in the Southern High Plains region (Appendix 6.2-1); however, the geologic evaluation by Texas Tech University provided in Appendix 6.2-1 indicates that the correct name for this unit is the Cooper Canyon Formation. There may be instances herein or elsewhere where Chinle is used instead of Cooper Canyon. For clarity, where this report uses the term Triassic red beds, red beds, or Chinle, the referenced formation is the Cooper Canyon Formation of the Dockum Group. The Cooper Canyon Formation has a thickness of the order of 500 feet in the WCS vicinity..

The Dockum Group is disconformably overlain in some areas of the Southern High Plains by Cretaceous rocks and in other areas by the Tertiary Ogallala Formation or the Tertiary/Quaternary Gatuna Formation. The Jurassic Period is not represented in the stratigraphic section of the area.

2.2 CRETACEOUS FORMATIONS

Cretaceous rocks were deposited in a shallow sea throughout the Texas Panhandle and eastern New Mexico (Nativ and Gutierrez, 1988). The entire Cretaceous stratigraphic section in this area comprises, from oldest to youngest, the Antlers, Walnut, Comanche Peak, Edwards, Kiamichi, and Duck Creek Formations (Appendix 6.2-1, Nativ and Gutierrez, 1988). The Walnut, Comanche Peak, Edwards, Kiamichi, and Duck Creek Formations are shown as the Fredricksburg Group on the Hobbs Geologic map sheet (Plate 6.2-1). The Comanche Peak

Formation is also mapped as the Fort Terrett Formation on the Hobbs sheet. The Cretaceous rocks dip southeastward at about 7 to 8 feet per mile (Nativ and Gutierrez, 1988).

The Cretaceous section thins and is absent in western Andrews County and southern Gaines County as shown on Figure 6.2-4 (Nativ and Gutierrez, 1988). However, Barnes (1976) indicates minor outcrops of the Cretaceous Fort Terrett (Comanche Peak) and Antlers Formations at Whalen Lake and Shafter Lake, 16 and 24 miles, respectively, east-southeast of the WCS facility, and in New Mexico about 1 mile west of the WCS facility (Plate 6.2-1). Lehman and Rainwater (Appendix 6.2-1) also indicate that a thick bed of limestone exposed in the floor of a gravel pit about one mile southeast of the permitted area is likely the Comanche Peak Formation. Lehman and Rainwater also determined that only the basal Cretaceous unit, the Antlers Formation, is present in the immediate vicinity of the WCS facility.

The Antlers Formation is the basal sand unit of the Cretaceous section in the Southern High Plains region. It is also referred to informally and in older literature as the Antlers Sand(stone), the Trinity Sand(stone), or the Paluxy Sand(stone). The Antlers Formation is a weakly cemented, fine- to medium-grained quartz sandstone and chert-pebble conglomerate. Regionally, the thickness of the Antlers Formation is considered to range from 0 to 60 feet (Fallin, 1989). The thickest areas occur in several linear belts trending southeastward, which represent filled channels that had been cut into the underlying Triassic red beds (Fallin, 1989). The Antlers Formation occurs as a buried erosional remnant along the crest of the red bed ridge underlying the WCS facility. Within 1 to 2 miles of the WCS facility, the Antlers Formation has a maximum thickness of 72 feet (Figure 6.2-5). Immediately below the permitted area, the Antlers Formation ranges in thickness from 0 feet in the southwest corner to about 20 feet in the area of the existing landfill.

2.3 TERTIARY OGALLALA FORMATION

The late Tertiary Ogallala Formation consists of fluviatile sand, silt, clay, and gravel capped by caliche (Barnes, 1976). The regional distribution of the Ogallala Formation and Ogallala aquifer has been the subject of considerable research and has been reviewed by numerous authors (e.g. Gustavson, 1996, Blandford et al., 2003). The sand deposits of the Ogallala Formation consist of fine- to medium-grained quartz grains that are unconsolidated to weakly cohesive with localized silica-cemented lenses. Bed forms range from indistinctly bedded to massive to crossbedded. The sand intervals of the Ogallala Formation occur in various shades of gray and red.

Ogallala Formation silt and clay deposits are reddish brown, dusky red, and pink and contain caliche nodules. Gravels occur as basal conglomerates in intra-formational channel deposits, and consist primarily of quartz, quartzite, sandstone, limestone, chert, igneous rock, and metamorphic rock.

Within the Southern High Plains, the Ogallala Formation lies unconformably above either Triassic or Cretaceous rocks and occurs as an apron of coalescing alluvial fan lobes that extend eastward from the Rocky Mountains. The Ogallala alluvial outwash plain was dominated by braided streams and extends from South Dakota to the Texas Panhandle (Seni, 1980).

A depositional facies map of the Ogallala Formation, shown on Figure 6.2-6, and a structure contour map of the base of the Ogallala, shown on Figure 6.2-7, indicate the braided nature of the Ogallala depositional environment. The headward erosion of major rivers, such as the Pecos River in New Mexico and the Canadian, Colorado, and Brazos Rivers in Texas, and their various tributaries, has regionally modified the surface expression of the Ogallala Formation. Consequently, portions of the Ogallala Formation have been erosionally removed, exposing deeper, older stratigraphic units. The Ogallala Formation typically ranges from 9 to 200 feet in thickness in the south portion of the Southern High Plains and reflects the underlying paleotopography. In the area shown on Plate 6.2-1, the Ogallala Formation ranges from 0 to 100 feet in thickness (Barnes, 1976).

2.4 LATE TERTIARY/QUATERNARY GATUNA FORMATION

The Late Tertiary or Quaternary Gatuna Formation, which is part of the Cenozoic Basin Fill of the Pecos River valley, exists in the equivalent stratigraphic interval as the Ogallala Formation southwest of the red bed ridge in the vicinity of the WCS facility (Appendix 6.2-1). Some of these deposits southwest of the red bed ridge have been mapped as the Ogallala Formation

(Nicholson and Clebsch, 1961; Barnes, 1976), but Lehman and Rainwater (Appendix 6.2-1) conclude that these sediments may more logically be included with the Gatuna Formation, as suggested by Hawley (1993).

The Gatuna Formation and the rest of the Cenozoic Basin Fill occur as alluvial deposits in Monument Draw, New Mexico and in the Pecos River valley in general. The Pecos River valley and Monument Draw, New Mexico developed in response to subsurface dissolution of evaporites in the Pecos Trough and Monument Draw Trough of the Delaware Basin (Ashworth, 1990).

The Gatuna formation is quite thin in the WCS area, although it is about 60 feet thick in Monument Draw, New Mexico a few miles to the west where it was mapped by Nicholson and Clebsch (1961) as the Ogallala Formation. In the WCS area, the Gatuna Formation consists of 15 to 20 feet of coarse, red, cross-bedded, gravelly sand, with large boulders of sandstone and limestone.

2.5 LATE TERTIARY/QUATERNARY CAPROCK CALICHE

The pedogenic Caprock caliche is a thick, hard caliche unit that has developed over all pre-Quaternary formations in the Southern High Plains. The Caprock caliche is not considered a formal stratigraphic unit, and it is frequently considered part of and mapped as the Ogallala Formation (Appendix 6.2-1). The Caprock caliche in the vicinity of the WCS facility is hard, laminated and pisolitic, with chert pebbles (Appendix 6.2-1). It is typically 5 to 10 feet thick but can be as thick as 20 feet or more. In thick areas, nodules and layers of opal have formed as replacement mineralization. Where exposed at surface, the Caprock caliche is weathered and broken into rubble. The Caprock caliche is distinguished from caliches in overlying sediments by its hard, laminated and pisolitic form, compared to the lighter, softer, sandier and less dense younger caliches. In the immediate vicinity of the WCS landfill, the Caprock caliche is exposed at surface or covered by a thin veneer of windblown sand.

2.6 QUATERNARY BLACKWATER DRAW FORMATION

The Quaternary Blackwater Draw Formation was formerly referred to as windblown cover sand and is mapped as Qcs on Plate 6.2-1. The Blackwater Draw Formation forms an extensive cover over virtually all of the Southern High Plains. The windblown sands, silts, and clays were derived from the alluvial sediments in the Pecos River valley to the west (Holliday, 1989). Grain size of the eolian Blackwater Draw Formation in the Southern High Plains decreases from sand in the southwest to clay-size particles in the northeast. Several soil horizons have developed in the Blackwater Draw Formation, with varying degrees of caliche development. Regionally, the Blackwater Draw Formation ranges from 0 to 100 feet thick (Holliday, 1990).

2.7 QUATERNARY HOLOCENE AND PLEISTOCENE PLAYA DEPOSITS

Playa deposits mapped on the Hobbs Sheet (Plate 6.2-1) are both Holocene and Pleistocene in age. The older Pleistocene deposits are mapped as the Tahoka Formation (Qta), and the younger playa deposits, which are either Holocene or late Pleistocene, are mapped simply as playa deposits (Qp). Playa deposits typically range from 3 to 30 feet in thickness (Holliday et al., 1996).

The Tahoka Formation comprises lacustrine clays, silts, sands and gravels that are locally calcareous and selenitic. The clays and silts are indistinctly bedded, sandy and weakly coherent, and various shades of light gray and bluish gray. The sands are fine- to coarse-grained quartz, indistinctly bedded to massive, friable, gray, and grading to gravel at the margins of the deposits (Barnes, 1976). The deposits may also contain late Pleistocene molluscan and vertebrate fossils.

The late Pleistocene/Holocene playa deposits, mapped on the Hobbs Sheet as Qp, comprise sandy clay and silt in shallow depressions and are colored light to dark gray. The late Pleistocene deposits are usually covered by a thin deposit of recent sediments. The mapped playa deposits in the immediate vicinity of the WCS facility are Holocene/late Pleistocene.

2.8 HOLOCENE WINDBLOWN SAND

Windblown Holocene sands, mapped on the Hobbs sheet as Qsu, occur to the north and south of the WCS facility. The sands are partially stabilized by vegetation but can be seen in time-series aerial photographs to be undergoing transport as active dunes. The Holocene sands overlie the Pleistocene Blackwater Draw Formation and are typically 5 to 10 feet thick.

2.9 OAG UNIT AT THE WCS FACILITY

At the WCS facility, the Tertiary Ogallala Formation and the Late Tertiary/Quaternary Gatuna Formation occur in the same stratigraphic interval as the Cretaceous Antlers Formation (Appendix 6.2-1). The Ogallala Formation occurs to the northeast of the red bed ridge, on the Southern High Plains proper, while the Gatuna Formation occurs to the southwest of the red bed ridge, and the Antlers Formation occurs as an erosional remnant on the crest of the red bed ridge. The undifferentiated sands and sandstones of the Ogallala, Antlers, and Gatuna Formations overlying the Dockum Group red beds are referred to as the OAG unit. A schematic cross section shown on Figure 6.2-8 shows the stratigraphic relationships of the OAG unit. The local geologic and hydrogeologic situation is presented in more detail in Section 5.0 (Site Subsurface Soils Investigation) and Section 6.0 (Groundwater).

3.0 REGIONAL AQUIFERS

The High Plains aquifer of west Texas, considered to be the principal aquifer in west Texas, consists of water-bearing units within the Tertiary Ogallala Formation and underlying Cretaceous rocks (Nativ and Gutierrez, 1988). The High Plains aquifer is typically viewed hydrogeologically as a single, hydraulically connected aquifer system, and groundwater typically exists under both unconfined and confined conditions. The term Ogallala aquifer is frequently used interchangeably with the High Plains aquifer, since regionally the Ogallala Formation is the primary component of the High Plains aquifer (Dutton and Simpkins, 1986). However, the Ogallala and Cretaceous aquifers have been independently evaluated in the literature and will be addressed individually in the following discussion.

The Cenozoic Basin Fill alluvium and the Triassic Dockum Group are considered minor aquifers in this part of west Texas (TWDB, 2001) and will also be addressed below.

3.1 OGALLALA AQUIFER

The Ogallala aquifer, which consists of the Ogallala Formation, is the primary freshwater aquifer within the regional study area and serves as the principal source of groundwater in the Southern High Plains (Cronin, 1969). The southern limit of the Ogallala aquifer is north of the red bed ridge at approximately the northern and eastern boundaries of the WCS permitted area.

Regionally, the Ogallala aquifer thickens to the north and west (Blandford et al. 2003) as shown on cross sections in Figures 6.3-1 and 6.3-2. The saturated thickness of the Ogallala aquifer ranges from a few feet to approximately 300 feet in the Southern High Plains (Nativ, 1988). Groundwater within the Ogallala aquifer is typically under water table conditions, with a regional hydraulic gradient toward the southeast ranging from approximately 10 feet/mile to 15 feet/mile, as illustrated on Figure 6.3-3. The average hydraulic conductivity of the Ogallala aquifer is about 10 feet/day, as illustrated in Figure 6.3-4, with higher values preferentially distributed in depositional channels (Figure 6.3-5). Assuming an average hydraulic gradient of 12.5 feet/mile and a porosity of 0.20, the average rate of flow in the Ogallala aquifer is 43 feet/year.

The primary sources of recharge to the Ogallala aquifer are playas, headwater creeks, and irrigation return flow (Blandford et al., 2003). Regionally, the recharge rate to the Ogallala aquifer is estimated to be of the order of 0.35 inches/year (Mullican et al., 1997). Blandford et al. (2003) estimated predevelopment recharge at less than 0.083 inches/year. In a recent numerical model of the Ogallala aquifer, prescribed recharge beneath irrigated lands was on the order of 1.25 to 2.25 inches/year, and recharge beneath non-irrigated agricultural lands ranged from 0.25 to 2.0 inches/year (Blandford et al., 2003). Groundwater discharge from the Ogallala aquifer occurs naturally through springs, underflow, evaporation and transpiration, but is also removed artificially through pumping. Throughout much of the Southern High Plains, groundwater discharge from the Ogallala aquifer exceeds recharge, and water levels have consistently declined. In some regions, however, water levels have remained reasonably stable over the last decades or even increased, indicating that recharge is the same or greater than discharge/pumping (Blandford et al., 2003). Water levels in three wells in Andrews County with a period of record of 40 to 50 years have remained stable over the entire period (Figure 6.3-6).

Water quality data for three Ogallala aquifer wells, located within two miles of the site, were obtained from a review of Texas and New Mexico state records for western Andrews County, Texas and eastern Lea County, New Mexico. These water well locations are provided in Table 6.3-1, and water quality data for these wells are provided in Table 6.3-2. The well locations are provided on Figure 6.0-2.

Review of the water quality data indicates that the local Ogallala aquifer contains fresh to slightly saline water (TDS = 3000 mg/L). The Ogallala Formation is not water bearing in the WCS permitted area (Figure 6.3-7).

3.2 CRETACEOUS AQUIFER (ANTLERS FORMATION)

The Cretaceous aquifer of the Southern High Plains is typically considered as part of the High Plains Aquifer (Nativ and Gutierrez, 1988). The regional hydraulic gradient of the Cretaceous aquifer is toward the southeast, similar to the overlying and often hydraulically interconnected Ogallala aquifer.

The Cretaceous aquifer of the Southern High Plains consists of a basal unit (Trinity or Antlers Formation sandstone), an intermediate unit (Edwards Formation limestone), and an upper unit (Kiamichi/Duck Creek Formation sandstone and limestone). Where present in the subsurface, the Cretaceous aquifer is used in the Southern High Plains as a source of groundwater (Nativ and Gutierrez, 1988). The Cretaceous Antlers Formation has been identified in the vicinity of the WCS facility and in the subsurface immediately below the facility (Appendix 6.2-1); however, it is unsaturated but for a few isolated pockets and at the extreme east central portion of the permitted area (see Section 6.0).

3.3 TRIASSIC DOCKUM GROUP AQUIFER

The Dockum Group regionally consists of Triassic fluvial and lacustrine clays, shales, siltstones, sandstones and conglomerates. The Dockum Group consists of five formations, the lowermost of which is the Santa Rosa Formation, followed by the Tecovas, the Trujillo, the Cooper Canyon, and the Redonda Formations. Only the Santa Rosa, Tecovas, Trujillo and Cooper Canyon Formations are present in the vicinity of the WCS facility. Water from the Dockum Group aquifer is used as a replacement for, or in combination with, the Ogallala aquifer as a regional source for irrigation, stock and municipal water (Dutton and Simpkins, 1986).

There are two water-bearing sandstone formations in the Dockum Group in the vicinity of the WCS facility. Both yield non-potable water with less than 5,000 mg/L total dissolved solids. The Santa Rosa Formation sandstone at the base of the Dockum Group is about 250 feet thick and is considered the best aquifer within the Dockum Group (Bradley and Kalaswad, 2003). The top of the Santa Rosa Formation sandstone is at 1,140 feet below ground surface at the WCS facility (Plate 6.2-2). The top of the 100-foot thick Trujillo Formation sandstone, the other Dockum Group water-bearing formation in the area, is at about 600 feet below ground surface (Plate 6.2-2).

The lower Dockum Group aquifer is recharged by precipitation where Dockum Group sediments are exposed at land surface (Bradley and Kalaswad, 2003). However, most of the recharge to the sandstones in the lower Dockum Group (comprising the Santa Rosa and Trujillo Formation sandstones) is considered to have occurred during the Pleistocene (Dutton, 1995; Dutton and

Simpkins, 1986) some 15,000 to 35,000 years before present. Topographically controlled groundwater basin divides were developed during the Pleistocene by the erosion of the Pecos and Canadian River valleys. Prior to the development of these groundwater basin divides, the lower Dockum aquifer was recharged by precipitation on its outcrop area in eastern New Mexico (Figure 6.3-8). However, since the development of the Pecos and Canadian River valleys, the lower Dockum aquifer in Texas has been cut-off from its recharge area. Without recharge, the lower Dockum aquifer experiences a net loss of groundwater from withdrawal by wells and by seepage (Dutton and Simpkins, 1986). The regional hydraulic gradient of the lower Dockum aquifer, which is toward the southeast at approximately 15 feet/mile, is provided in Figure 6.3-9. Based on water levels encountered during logging of the two WCS non-potable water wells, water levels in the lower Dockum aquifer range from 2,852 feet msl (Santa Rosa Formation) to 3,172 feet msl (Trujillo Formation). Transmissivity of the lower Dockum aquifer ranges from 860 ft^2/day to about 30 ft^2/day and storativity, based on two values, is 0.0001 and 0.002 (Dutton and Simpkins, 1986). Based on the transmissivity values noted above, an average thickness of 350 feet of combined Santa Rosa and Trujillo Formation sandstones, a porosity of 0.15, and a gradient of 15 feet/mile, the rate of groundwater flow is estimated to be between 17 feet/year and 0.6 feet/year.

The upper portion of the Dockum Group (Cooper Canyon Formation) serves as an aquitard in the regional and local study area (Nicholson and Clebsch, 1961; Dutton and Simpkins, 1986). This is supported by the fact that the hydraulic head of the lower Dockum aquifer is significantly lower than that of the overlying Ogallala aquifer throughout much of the regional study area (Figure 6.3-10). This relative head difference, approximately 200 to 300 feet in western Andrews County, suggests that the lower Dockum aquifer is receiving essentially no recharge from cross-formational flow (Nativ, 1988). The primary limiting factors on recharge to the Dockum Group aquifer include the low-permeability aquitard characteristics of the upper Dockum Group and cut-off by the Pecos River Valley of historical recharge areas in eastern New Mexico.

3.4 CENOZOIC BASIN FILL AQUIFER

The Cenozoic Basin Fill aquifer, also referred to as the Pecos Alluvium aquifer (Jones, 2001), is a minor regional aquifer and is not present in the vicinity of the WCS facility. The Cenozoic Basin Fill alluvial deposits (Gatuna Formation) have been identified on the southwest slope of the permitted area (Appendix 6.2-1); however, they are not water bearing and do not constitute an aquifer.

4.0 ACTIVE GEOLOGIC PROCESSES

This section addresses the requirement to provide a description of the active geologic processes in the vicinity of the facility. Active geologic processes include flooding and submergence, faulting, seismicity, land surface subsidence, and the potential for surface erosion. Flooding is addressed by locating the facility out of a 100-year floodplain and submergence applies only to coastal zones. Faults, seismicity, land surface subsidence, and surface erosion are discussed in the following sections.

4.1 FAULTS

This section provides an analysis of faults in the vicinity of the facility at the regional and local scales. The requirements of 30 TAC 305.50(4)(F) and 30 TAC 305.50(10)(E) require delineation of all faults within 3000 feet of the facility, together with a demonstration that:

(i) the fault has not experienced displacement within Holocene time, or if faults have experienced displacement within Holocene time, that no such faults pass within 200 feet of the portion of the surface facility where treatment, storage, or disposal of hazardous wastes will be conducted; and

(ii) the fault will not result in structural instability of the surface facility or provide for groundwater movement to the extent that there is endangerment to human health or the environment.

The WCS site is situated over the north central portion of a prominent Paleozoic structural feature known as the Central Basin Platform. Faults are only known in the deep subsurface as interpreted from petroleum exploration activities. The faults are expressed in Paleozoic rocks at depths of thousands of feet. The deep faults lose their expression as stratigraphic offsets after early Permian (Wolfcampian) time. All of the major faulting in the vicinity of the Central Basin Platform occurred in response to tectonic forces active before the global plate tectonic reorganization that created the North American continent. (Bally et al., 1989). The Paleozoic faults exhibit low natural microseismicity as a result of passive response to relatively low levels of tectonic stress in the trailing edge of the westward-drifting North American plate. The closest area of active regional tectonic stress and active faulting is the Rio Grande Rift that forms the eastern boundary of the Basin and Range Province. The Rio Grande Rift is over 200 miles west of the WCS area. There is no surface evidence of faulting within 3000 feet the WCS permitted area.

4.1.1 Regional Tectonic Setting and Faults

The WCS facility is located within the Permian Basin region of west Texas. The Permian Basin derives its name from the fact that it is underlain by extensive deposits of Permian sediments.

4.1.1.1 Tectonic Setting

The WCS site is situated over the north-central portion of a prominent structural feature known as the Central Basin Platform (Figure 6.4-1). The Central Basin Platform is a deep-seated horst-like structure that extends northwest to southeast from southeastern New Mexico to eastern Pecos County, Texas. The Central Basin Platform is flanked by two prominent structural depressions known as the Delaware Basin to the southwest and the Midland Basin to the northeast, and by the Val Verde Basin to the south.

From the Cambrian to late Mississippian, west Texas and southeast New Mexico experienced only mild structural deformation that produced broad regional arches and shallow depressions (Wright, 1979). The Central Basin Platform served intermittently as a slightly positive feature during the early Paleozoic (Galley, 1958). During the Mississippian and Pennsylvanian, the Central Basin Platform uplifted using ancient lines of weakness (Hills, 1985), and the Delaware, Midland, and Val Verde Basins began to form as separate basins.

Late Mississippian tectonic events uplifted and folded the platform and were followed by more intense late Pennsylvanian and early Permian deformation that compressed and faulted the area (Hills, 1963). Highly deformed local structures formed ranges of mountains oriented generally parallel to the main axis of the platform (Wright, 1979).

This period of intense, late Paleozoic deformation was followed by a long period of gradual subsidence and erosion that stripped the Central Basin Platform and other structures to near base-level (Wright, 1979). The expanding sea gradually encroached over broad eroded surfaces and truncated edges of previously deposited sedimentary strata. New layers of arkose, sand, chert pebble conglomerate and shale deposits accumulated as erosional products along the edges and on the flanks of both regional and local structures. Throughout the remainder of the Permian, the Permian Basin slowly filled with several thousand feet of evaporites, carbonates, and shales (Figure 6.4-2).

From the end of the Permian until late Cretaceous, there was relatively little tectonic activity except for periods of slight regional uplifting and downwarping. During the early Triassic, the region was slowly uplifted and slightly eroded. These conditions continued until the late Triassic, when gentle downwarping formed a large land-locked basin in which terrigenous deposits of the Dockum Group accumulated in alluvial flood plains and as deltaic and lacustrine deposits (McGowen, et al., 1979). In Jurassic time, the area was again subject to erosion.

During Cretaceous time, a large part of the western interior of North America was submerged, and the west Texas/southeastern New Mexico region was part of a large continental shelf sea in which a thick sequence of Cretaceous rocks was deposited. The Cretaceous sequence of sediments comprised a basal clastic unit (the Trinity, Antlers or Paluxy sands) and overlying shallow marine carbonates.

Uplift and southward– and eastward-retreating Cretaceous seas were coincident with the Laramide Orogeny, which formed the Cordilleran Range west of the Permian Basin. The Laramide Orogeny uplifted the region to essentially its present position, supplying sediments for the late Tertiary Ogallala Formation. The major episode of Laramide folding and faulting occurred in the late Paleocene. There have been no major tectonic events within the Permian Basin since the Laramide Orogeny, except for a period of minor volcanism during the late Tertiary in northeastern New Mexico and in the Trans-Pecos area. Hills (1985) suggests that slight Tertiary movement along Precambrian lines of weakness may have opened joint channels which allowed the circulation of groundwater into Permian evaporite layers. The near-surface regional structural controls may be locally modified by differential subsidence related to groundwater dissolution of Permian salt deposits (Gustavson, 1980).

4.1.1.2 Faults

Two types of faulting were associated with early Permian deformation. Most of the faults were long, high-angle reverse faults with several hundred feet of vertical displacement that often involved the Precambrian basement rocks (Hills, 1985). The traces of these faults are shown on the Precambrian structure map provided in Figure 6.4-3. The second type of faulting is found along the western margin of the Central Basin Platform where long strike-slip faults, with displacements of tens of miles, are found (Hills, 1985) (Figure 6.4-4).

The large structural features of the Permian Basin are reflected only indirectly in the Mesozoic and Cenozoic rocks, as there has been virtually no tectonic movement within the basin since the Permian (Nicholson and Clebsch, 1961). The east-west and north-south regional cross-sections provided in Figures 6.4-5 and 6.4-6 illustrate this relationship. Figure 6.4-5 shows the draping of the Permian and Triassic sediments over the Central Basin Platform structure, located approximately 7000 feet beneath the present land surface. The faults that uplifted the platform do not appear to displace the younger Permian sediments. The northernmost fault on Figure 6.4-6, located at the Matador Uplift, terminates in lower Wolfcampian sediments.

A further comparison of the structure of the Devonian Woodford Formation to the structure of the younger Upper Guadalupe Whitehorse Group (Permian) (Figures 6.4-7 and 6.4-8) indicates that the faults in the Devonian section do not continue upward into the overlying Permian Guadalupe Whitehorse Group. The regional geologic and tectonic information does not indicate the presence of post-Permian faulting within the regional study area. In addition, the local information does not indicate Holocene displacement of faults within 3000 feet of the proposed WCS landfill site. The site-specific structural setting is discussed below.

Two regional stratigraphic cross sections constructed in the vicinity of the WCS site using oil and gas well logs are shown as Plates 6.2-2 and 6.2-3. The locations of the cross sections are shown in Figure 6.2-1. These cross sections depict the major stratigraphic units that occur within about 2000 feet below ground surface in the vicinity of the site. The stratigraphic units depicted on Plates 6.2-2 and 6.2-3 include the upper OAG unit of a few tens of feet in thickness, the underlying Triassic red beds of the Dockum Group with a thickness of 1,000 to 1,500 feet, the underlying Permian Dewey Lake Formation red beds, and the Permian evaporites of the Rustler and Salado Formations. These cross sections do not indicate the presence of faulting in the upper 2,000 feet of sediments within 3 to 4 miles of the WCS site. The base of the underground source of drinking water (USDW) is the bottom of the Santa Rosa Formation at about 1,400 feet below ground surface in the vicinity of the WCS facility. The Santa Rosa Formation is the lowermost formation of the Triassic Dockum Group.

There is no evidence of displacement or offset of post-Permian sediments including Holocene sediments in the vicinity of the landfill. The WCS landfill excavation exposed the OAG unit, which includes the Caprock caliche, overlain by minor amounts of Blackwater Draw Formation and recent cover sand. The Blackwater Draw Formation typically has relatively well-developed soil horizons as well as calcic horizons. No offset or displacement was documented in the OAG unit, including the Caprock caliche, or the Blackwater Draw sediments, buried soil horizons, or the surface soil horizon.

4.1.2 Seismicity

The WCS facility lies in a region with crustal properties that indicate minimum risk due to faulting and seismicity. Crustal thickness is the most reliable predictor of seismic activity and faulting in intracratonic regions (EPRI, 1993). Crustal thickness in the vicinity of the WCS facility is approximately 30 miles (50 km), one of the three thickest crustal regions in North America (Mooney and Braile, 1989). In comparison, the crustal thickness of the Rio Grand Rift is as little as 7.5 miles (12 km) in places. Further, the seismic velocity of the crust in the Southern Great Plains implies that the crust is unusually intact and continuous in this region (EPRI, 1989).

The Central Basin Platform is an area of moderate, low intensity seismic activity based on observational data obtained from the National Geophysical Data Center of the National Oceanic and Atmospheric Administration (NOAA, 1992) and the U.S. Geological Survey (USGS) Earthquake Data Base available from the National Earthquake Information Center (http://neic.usgs.gov/). Table 6.4-1 provides the historical seismic activity within 250 kilometers of the WCS facility (32.433°N, 103.05°W). Table 6.4-1 includes the data through 1992 from the NOAA data base, which was submitted in the original RCRA permit application, updated with information through 2003 from the national seismic data base operated by the USGS. The computer search for all recorded seismic activity within a 250 km (155 mile) radius of the proposed WCS landfill site provided a list of 188 seismic events (188 total with 68 suspected duplicates by Terra Dynamics (1993)) during the period from 1931 to 2003. Seismic activity for New Mexico and bordering areas, which includes Andrews County, is shown on Figure 6.4-9. With respect to seismicity in the WCS area, Sanford et al. (2002) indicate that a large fraction of activity in southeastern New Mexico and adjacent areas of west Texas is induced by oil and gas production, secondary recovery, or waste injection.

Figure 6.4-10 illustrates the largest earthquakes (moment magnitudes >3) from the same data set used to develop Figure 6.4-9. The largest earthquake in the vicinity of the WCS facility, referred to as the Rattlesnake Canyon earthquake with a magnitude of 5, occurred in 1992. The Rattlesnake Canyon earthquake was located by the seismograph stations monitored by the New Mexico Institute of Mining and Technology at latitude 32°17.80N and longitude 103°10.33W (Sanford et al., 1993), which is approximately 11 miles southwest of the facility. The USGS located the Rattlesnake Canyon earthquake at latitude 32°20.16N and longitude 103°06.06W, about 7 miles southwest of the WCS facility; however, Sanford et al. (1993) indicate that due to the uncertainty in the location reported by the USGS, the location reported by Sanford et al. (1993) is more accurate. The location of the Rattlesnake Canyon earthquake was approximately three miles east of the Paleozoic west platform fault (Figure 6.4-4). The Rattlesnake Canyon earthquake was interpreted by Sanford et al. (1993) as a reverse fault, with movement consistent with the approximately east-west maximum horizontal stress orientation reported by Zoback and Zoback (1991).

The seismic hazard at a particular geographic position is due to ground motion or shaking. Seismic hazard is based on historical seismic activity and frequently presented as Peak Ground Acceleration (PGA) maps. The maps present the probability of the PGA due to earthquakes exceeding a particular value of acceleration (expressed as a fraction or percent of gravitational acceleration) over a particular time period. A PGA of greater than about 0.2 g is considered the acceleration level at which considerable damage can begin to occur to weakly built structures (Sanford et al., 2002). Figure 6.4-11 is a seismic hazard map of the western United States prepared by the USGS (http://geohazards.cr.usgs.gov/eq/, October 2002 revision). The map indicates that at the 90% probability level over a 50-year time period, the PGA of the southeastern New Mexico/Andrews County area would not exceed approximately 0.03 to 0.04 g (site specific search yields 0.0322 g). Figure 6.4-12 is a similar seismic hazard map of the western United States, which indicates that at the 98% probability level over a 50-year tme period, the PGA of the southeastern New Mexico/Andrews County area would not exceed approximately 0.14 to 0.16 g (site specific search yields 0.1535 g). Golder Associates (1998) calculated the PGA at the WCS site for the Rattlesnake Canyon earthquake in the range of 0.06 to 0.07 g, which is well below the PGA of 0.2 g where considerable damage can begin to occur to weakly built structures (Sanford et al., 2002). Golder Associates (1998) indicate that these low estimated accelerations are "generally considered to be insignificant to well designed and constructed engineered structures or facilities."

4.1.3 Lineaments

Lineaments are relatively straight physiographic features typically identified by a review of surficial geologic maps, surface topography maps, LANDSAT images, and aerial photographs, including high altitude aerial photographs. Based on Landsat imagery, Finley and Gustavson (1981) identified more than 4600 lineaments throughout the Texas Panhandle, ranging in length from 1.2 miles up to 25 miles (Figure 6.4-13). Finley and Gustavson (1981) noted that the Landsat-identified lineaments fell into six categories: 1) stream segments, or short stream reaches commonly connecting at sharp angular junctions, 2) drainage lines, or linear valley trends independent of the orientation of stream segments within the trend, 3) scarps, or prominent topographic breaks, 4) playa alignments, 5) geologic contacts, or contacts between surficial materials with different reflectivities, and 6) tonal anomalies, or linear features that are not clearly a member of any of the previous categories and may be composites of previous categories.

Finley and Gustavson (1981) conclude that the development of physiographically-expressed lineaments is controlled or at least influenced by geologic structure. They further interpret that since few surface faults are mapped in the study area (91,500 square miles of the Texas Panhandle, including the Southern High Plains and most of Andrews County), joints rather than widespread faults are the likely geologic structural control on lineament development. Joints are fractures or partings in rocks along which movement has been negligible or absent (Dennis, 1972). The development of joints is an indication of the brittle behavior of rock, and is most evident in the Triassic and Permian sandstones within the area of the Southern High Plains. The poorly consolidated sediments of the Ogallala Formation do not exhibit well-developed jointing patterns. The Caprock caliche often exhibits an irregular, nearly orthogonal jointing pattern (Finley and Gustavson, 1981).

Finley and Gustavson (1981) suggest that minor or poorly developed jointing in the Pleistocene and Holocene deposits overlying the Caprock caliche may have offered preferred infiltration focus that could foster playa development at the intersection of joint sets, and that an area of increased joint density may localize playa-lake depressions.

Several mechanisms can account for the relationship between physiographically-expressed surface lineaments and susbsurface jointing. Joints form preferential planes that can be exploited by surficial and subsurface weathering processes. Joints offer paths of weakness and less resistance to erosional processes, allowing the development of surface drainage systems and linear stream segments in preferred orientations. Consequently, drainage systems in the Southern High Plains are often classified as lineaments, since their linear orientation is controlled by the joint systems that they exploit (Finley and Gustavson, 1981). Joints can be propagated upward into geologically younger sediments by many processes, including residual tectonic stresses (Price, 1966), crustal extension due to post-glacial rebound (Grisak and Cherry, 1975), shrinkage and differential compaction related to wetting and drying of clay-rich sediments, and differential compaction and dissolution of underlying materials (Finley and Gustavson, 1981). In the Southern High Plains, the orientation of joints and their associated surface lineations is controlled primarily by historical tectonic and structural trends (Finley and Gustavson, 1981). As shown in Figure 6.4-13, the dominant orientation for surface lineations in the Southern High Plains is northwest to southeast, with a secondary orientation of northeast to southwest.

At the regional scale mapped by Finley and Gustavson (1981), Figure 6.4-13 shows a multicomponent northwest-southeast lineament approximately 3 to 4 miles in total length about 10 miles north of the WCS facility in Gaines County. The lineament is located in the approximate vicinity of Monument Draw, Texas (note: there are two Monument Draws in the WCS vicinity: one in Texas which starts between Hobbs and Eunice in New Mexico and heads eastward as a tributary to Mustang Creek in Texas; and one which starts west of Monument, New Mexico, continuing southeasterly and turning south around Eunice about 5 miles west of the Texas/New Mexico border). A second lineament at the regional scale identified by Finley and Gustavson (1981) lies in Andrews County, about 14 miles east of the WCS facility. This lineament appears to be the continuation of Monument Draw, Texas. The lineament map of Finley and Gustavson does not indicate the presence of Landsat-identified lineaments at the WCS facility.

Also at the regional scale, Bolden (1984) suggests that there are several regional-scale lineaments 200 to 330 miles in length in Trans-Pecos Texas and the Texas Panhandle oriented between 298° and 306°. The nearest of these to the WCS facility is a shorter offshoot line oriented approximately 345°, extending through Ward and Winkler counties in Texas into Lea County in New Mexico. The offshoot line appears to be defined by Monument Draw, New Mexico and its southern extension to the Pecos River through Winkler and Ward Counties, Texas.

At the local scale, lineaments were identified by Terra Dynamics in the vicinity of the WCS site based on an analysis of NASA color-infrared aerial photographs (Terra Dynamics, 1993). Terra Dynamics indicated the lineaments were related to linear drainage features and ground surface color tone anomalies. The lineaments were shown as straight lines on the color infrared imagery used by Terra Dynamics (Terra Dynamics, 1993, Figure VI.A.12). Terra Dynamics identified 5 northwest trending lineaments. The southernmost of these lineaments extended through the WCS facility. Terra Dynamics also identified two north trending lineaments between the WCS site and Eunice. The lineament through the WCS site was described as an anomaly in the ground surface color tone on the color-infrared

Figure 6.4-14 is a 1983 color infrared photograph of the WCS area from the National High Altitude Program (note: the 1982 photograph included in the Terra Dynamics Geology report is not available from the EROS data center) and Figure 6.4-15 is a 1986 color infrared photograph of the same area at a slightly different scale. Four of the five northwest and north trending lineaments near the WCS site identified by Terra Dynamics are shown on Figure 6.4-15. The northernmost northwest-trending lineament identified by Terra Dynamics is off the photo approximately 8 miles to the north of the WCS site.

Golder Associates also conducted an analysis of the lineaments in the vicinity of the WCS facility and provided a summary of their evaluation in a draft document to WCS dated January 4, 1999. Lineaments identified by Terra Dynamics and Golder Associates are discussed below.

The southernmost northwest-trending lineament through the WCS facility, identified by Terra Dynamics, is represented by aligned zones of enhanced vegetation, shallow depressions and darker ground tones trending about 300° to 310°. The aligned depressions are most evident where the Caprock caliche is at or very near the surface. The tonal contrast in the center of the photo is where the Caprock caliche is either at ground surface or covered by only a thin veneer of windblown sand. The largest of the depressions, which may be considered a small playa about 15 acres in size, is located about one-half mile northeast of the existing landfill. The alignment of the playas at the WCS site likely results from their development at the intersection of joints, with the primary jointing direction trending 300° to 310°.

Part of the surface expression of the 300° to 310° lineament is a bench in the topography between Windmill Hill and the existing landfill. The bench alignment is coincident with the regional 300° to 320° alignment of lineaments in the Southern High Plains (Finley and Gustavson, 1981) that likely represents one of the primary jointing directions in the Southern High Plains. The bench overlies and is aligned with the red bed ridge and is topographically expressed for about 6000 feet with a relief of about 20 feet. The bench is on the southwest slope of the drainage divide between the Pecos River and the Colorado River. The bench has developed as an erosional feature along the preferred jointing direction in the Southern High Plains. The bench projects to Baker Spring, to a notch in the topography about one-half mile northwest of Baker Spring, and parallels Mescalero Ridge, part of the Caprock escarpment to the northwest of Monument, New Mexico.

Two smaller lineaments oriented about 45° were identified by Golder Associates to the west and east of the permitted area. The westernmost 45° lineament, which is about 4000 feet in length, is a surface draw that empties into a depression at Baker Spring, New Mexico. The 45° lineament east of the permitted area is less developed. It extends through the ranch house area for a total length of about 4,500 to 5,000 feet, developing into a shallow draw southwest of the ranch house area. The north-trending lineaments identified by Terra Dynamics about 3 miles west of the WCS site in Lea County, New Mexico, may be related to tonal contrasts in the vicinity of Monument Draw, New Mexico.

The lineaments in the vicinity of the WCS facility do not have any geologic or geomorphic characteristics typical of active faults. There are no topographic shifts along the lineament, or any apparent offsets in local drainage, or any interruptions in the gradient of erosional terraces above Baker Spring (assuming Baker Spring comprises part of the lineament). The lineament in the vicinity of the WCS facility is considered to be an erosional feature.

4.2 LAND SURFACE SUBSIDENCE

This section addresses the potential for land surface subsidence due to ongoing geologic processes and human activities in the vicinity of the WCS facility. Subsidence can be defined as the sudden sinking or gradual downward settling of the earth's surface with little or no horizontal movement. Subsidence may be caused by natural geologic processes such as solution or compaction or by human activities such as subsurface mining or pumping of oil or groundwater.

4.2.1 Land Surface Subsidence due to Geologic Processes

No subsidence features related to geologic processes have been identified within the permitted area or the immediate vicinity of the site. The nearest active subsidence features to the WCS facility are the San Simon Swale, the San Simon Sink, the Wink Sink, and a sink northwest of Jal, New Mexico (Figure 6.4-16). The San Simon Swale and the San Simon Sink are located approximately 20 miles west-southwest of the WCS facility in Lea County, New Mexico. The San Simon Swale is a large (100 mi^2), northwest- to southeast-trending, elongate depression that overlies and is parallel to the inner margin of the Permian Capitan Reef (Figure 6.4-16). The San Simon Sink is located within the southern end of the San Simon Swale and covers an area of 0.5 mi^2. The sink is approximately 130 feet deep and is filled with 400 feet of alluvium deposited on top of Triassic red beds (Baumgardner et al., 1982). Subsidence was last recorded at the San Simon Sink approximately 50 years ago.

The Wink Sink, which formed in 1980, is located 2.5 miles northeast of Wink in southwestern Winkler County, Texas (Figure 6.4-16). The diameter of the Wink Sink is approximately 360 feet with an average depth of 80 feet (Baumgardner et al., 1982). In 1998, a sink developed 14 miles northwest of Jal, New Mexico. The sink was approximately 100 feet wide and 150 feet deep (Odessa American, 1998).

Like the San Simon Swale and the San Simon Sink, the Wink Sink and the sink northwest of Jal lie above the Capitan Reef. These surface subsidence features are believed to be caused by the collapse of solution cavities formed in the Permian Salado Formation that migrated upward over time in response to successive roof failures (Baumgardner et al., 1982). There appears to be a correlation between the location of the Capitan Reef, dissolution of salt in the Salado Formation, and the development of land surface subsidence features. Groundwater in the Capitan Reef is unsaturated with respect to sodium chloride, and the hydraulic head of groundwater in the reef is higher than the elevation of the Salado Formation. This allows relatively fresh water from the reef to move upward into the Salado Formation along fractures or other zones of permeability and dissolve salt. Denser brine then moves back down the same fracture system and a brine-density-flow cycle is set up that allows for development of solution cavities, successive roof collapses and eventual subsidence of the land surface (Baumgardner et al., 1982). Land subsidence features similar to those discussed above would not be expected to form at or in the immediate vicinity of the WCS facility. The WCS facility is not located above the Capitan Reef, the eastern edge of which is about 15 miles west of the facility, and the eastern edge of the Capitan reef defines the eastern extent of salt dissolution associated with the reef (Baumgardner et al., 1982).

At the regional scale and over geologic time periods of millions of years, subsidence features such as the Pecos Trough and the Monument Draw Trough have developed in the region (Ashworth, 1990). The surface drainage systems of the Pecos River and Monument Draw, New Mexico have developed in response to the deep-seated subsidence in the Delaware Basin. The Pecos Trough, in the central part of the Delaware Basin, and the Monument Draw Trough, along the eastern margin of the Delaware Basin, developed through dissolution and removal of Permian evaporites (Ashworth, 1990). The Pecos and Monument Draw Troughs were subsequently filled with a thick sequence of Cenozoic alluvial deposits. The Monument Draw Trough extends southeastward from southern Lea County, New Mexico through Winkler County, Texas and into northern Ward County (Figure 6.4-16). The northern end of the trough is approximately 20 miles southwest of the WCS facility.

4.2.2 Land Surface Subsidence due to Human Activities

Subsidence features related to human activities are normally related to withdrawal of subsurface fluids such as oil and groundwater and compaction of overlying unconsolidated deposits or collapse of overlying consolidated sediments. No subsidence features related to human activities have been identified within the permitted area or the immediate vicinity of the site.

Oil production occurs throughout west Texas and southeast New Mexico. Oil production in the vicinity of the WCS facility is from consolidated sediments at depths greater than 3,000 feet (Terra Dynamics, 1993). There is no evidence of land subsidence related to withdrawal of oil within the permitted area or the immediate area surrounding the WCS facility. Literature review identified examples of land surface subsidence related to oil production, but these examples are confined to the Gulf Coast region of southeast Texas (Davis et al., 1989).

Land surface subsidence in response to groundwater withdrawal usually occurs due to consolidation of a thick sequence of unconsolidated or poorly consolidated sediments that form an interbedded aquifer-aquitard system (Freeze and Cherry, 1979). Such a system of unconsolidated or poorly consolidated sediments does not exist beneath the WCS facility. Groundwater at the WCS facility is obtained from sandstones in the Dockum Group at depths in excess of 600 feet. Dockum sandstones, mudstones, and siltstones are consolidated and are not subject to compaction upon fluid withdrawal. As such, land surface subsidence due to groundwater withdrawal at the WCS facility is not an issue.

4.3 EROSION

This section addresses the potential for surface erosion due to ongoing geologic processes in the vicinity of the facility. Lehman (Appendix 6.2-2) evaluated erosion on the Southern High Plains and in the vicinity of the WCS facility. Much of the following discussion is taken from Lehman (Appendix 6.2-2).

Erosion can be defined as a physical and chemical removal or wearing away of the material comprising the earth's surface. This ongoing process is driven by a natural attempt to attain and maintain an equilibrium state between inputs and outputs. Stated simply, erosion seeks to level topographic highs and fill in topographic lows at rates largely controlled by local climate, geology, vegetation and topography. The rate of erosion fluctuates as climatic conditions change over short time spans, but the equilibrium between natural inputs and outputs can be described as more or less stable for relatively long periods of time (Dunne and Leopold, 1978).

Erosion can be caused by water, wind, ice and gravity. The objectives of this section are to characterize the dominant erosional agents present in the vicinity of the WCS facility and to estimate the rates at which these processes proceed. To accomplish these objectives, a literature review was performed and photographs from the area were reviewed. The aerial photographs include stereo coverage for 1938, 1939, 1981, 1983 and 1986, as well as single photographs from 1949 and 1954. The photographs were reviewed to identify any possible landform changes attributable to erosional processes.

Regional Context

Lehman (Appendix 6.2-2) also conducted an assessment of the long-term erosion potential at the WCS facility. As indicated above, much of the following discussion is extracted from Appendix 6.2-2.

The Southern High Plains is a very stable geomorphic surface that presents a nearly featureless landscape with only subtle topographic relief, crossed by widely spaced dry valleys or draws. Short-duration high-intensity rainfall events (thunderstorms), sparse vegetation on thin soils, and the generally unconsolidated nature of the surficial sediments and strata bordering the Southern High Plains could result in enhanced potential for erosion of the land surface. However, sediment removal is limited by the low annual rainfall, low surface slope gradients, absence of an integrated drainage system, presence of indurated Caprock caliche at shallow depth, and land surface alteration by man (Finley, 1979 *in* Dutton et al., 1979).

Potential for surface erosion at the WCS facility was considered in terms of two separate topics: 1) processes and rates of erosion on the Southern High Plains surface itself and 2) processes and rates of erosion along the escarpment bordering the Southern High Plains. Estimates of the long-term potential for surface erosion at the site are based on previous studies conducted for the Southern High Plains region in connection with the assessment of the Waste Isolation Pilot Plant (WIPP) site in Eddy County, New Mexico and nuclear isolation feasibility studies for Deaf Smith County in the Texas Panhandle. Information gathered in connection with these sites is quite extensive and applicable to assessment of the WCS facility, owing to their similar geologic, physiographic and climatic setting.

4.3.1 Erosion of the Southern High Plains Surface

On the surface of the Southern High Plains, the dominant mechanisms by which sediment erosion and deposition occurs include 1) incision and aggradation via overland flow within the draws, 2) wind erosion and local deposition of dune sand or regional dust fall, and 3) deposition and deflation in playa and saline lake basins. Each of these processes as they relate to the WCS facility is discussed in the following sections.

4.3.1.1 Overland Flow

The WCS facility is situated on the southwestern side of an expansive divide between two draws that cross the Southern High Plains surface – Monument Draw, New Mexico, a south-flowing ephemeral stream in Lea County, New Mexico, and Monument Draw, Texas (same name), an east-flowing ephemeral stream in Andrews County, Texas (Plate 6.2-1). Monument Draw, New Mexico flows intermittently southward from Lea County, New Mexico into Winkler County, Texas, but appears to terminate near the town of Wink and does not continue southward to the Pecos River. Flow in Monument Draw, Texas, however, continues eastward through Andrews County until it joins Mustang Draw, which is a tributary of the Colorado River.

The broad expanses between draws on the Southern High Plains do not exhibit an integrated drainage system. Topography in the immediate vicinity of the WCS landfill slopes to the southwest toward Monument Draw, New Mexico. However, because the immediate vicinity of the WCS facility, along with much of western and southern Andrews County, lacks an integrated drainage system due to low rainfall rates and an irregular hummocky surface mantle of permeable eolian sediment stabilized by sparse vegetation, most surface runoff collects in shallow surface depressions rather than contributing to Monument Draw, New Mexico. As such, local erosion by overland flow appears to be balanced with local deposition in internally-drained surface depressions, and local erosion would not be expected to affect the WCS facility.

Headward erosion of the draws was also evaluated. Monument Draw, New Mexico and Monument Draw, Texas are typical of the draws that cross the Southern High Plains surface. The most recent episode of incision and widening of these valleys began 20,000 years ago, and ended 12,000 years ago when sediment began aggrading in the valleys (Holliday, 1995). Filling of the valleys culminated about 3000 years ago, and little aggradation or downcutting has occurred in the past 3000 years. Estimated rates of recent incision (downcutting) in the modern draws range from 0.06 in/yr to 0.08 in/yr (Gustavson et al., 1980; Finley and Gustavson, 1980; Finley, 1981). The valleys average about 1542 feet in width, and the average maximum width is about 4000 feet (Holliday, 1995). If the valleys were initially incised and widened over a time span of 8000 years (20,000 to 12,000 years ago), then the flanks of the valleys retreated at an average rate of 1.18 in/yr to a maximum of 2.95 in/yr over that time span (assuming parallel slope retreat on either side of the valley axis). The WCS facility is about 3 miles east of

Monument Draw, New Mexico. If in the future this draw were to begin a renewed episode of incision and widening, it would take more than 160,000 years (at the average rate of 1.18 in/yr) for eastward retreat of the flank of Monument Draw, New Mexico to approach the WCS facility. These drainages have not widened their valleys for the past 12,000 years; hence, retreat of the valley flanks would require renewed downcutting in the lower reaches of Monument Draw, New Mexico, and would also likely require a return to climatic conditions that prevailed during the Late Pleistocene when the draws were incised (Lehman, Appendix 6.2-2).

4.3.1.2 Wind Erosion

Over the past 2 million years, most of the Southern High Plains surface experienced periods of wind erosion and deposition, alternating with periods of stabilization of the surface by vegetation, resulting in soil formation (Holliday, 1989). As a result, the Southern High Plains surface has experienced net aggradation (not erosion) resulting in deposition of the cover sands of the Blackwater Draw Formation that blankets most of the surface. Radiometric age determinations on ash beds and interbedded playa deposits demonstrate that deposition of the Blackwater Draw Formation began prior to 1.4 million years ago and continued until at least 100,000 to 50,000 years ago (Gustavson et al., 1991). Interbedding of the Quaternary Blackwater Draw Formation with radiocarbon-dated playa basin deposits suggests that deposition continued at least locally up to 3000 years ago (Gustavson et al., 1991; Holliday, et al., 1996). At least two recent episodes of regional eolian deposition younger than the Blackwater Draw Formation have also affected the southwestern part of the Southern High Plains in the vicinity of the WCS facility, and more localized episodes of eolian deposition have occurred on the down-wind side of lake basins and draws over the past 10,000 to 20,000 years. In local areas where wind has deflated the surficial sediments down to the resistant Caprock caliche, this has effectively halted further eolian deflation of the surface because the indurated Caprock caliche is relatively hard and deflation-resistant.

Surficial eolian deposits (including the Blackwater Draw Formation and younger windblown sediments) range from 0 to over 100 feet in thickness, and over much of the Southern High Plains surface average about 10 feet in thickness. As eolian deposition has taken place intermittently for at least the past 1.4 million years, this yields an average long-term net accumulation rate of 0.000079 in/yr. This rate is comparable to measured rates of eolian dust accumulation on the High Plains today (Machenberg, 1986).

The land surface in the immediate vicinity of the WCS facility is topographically high and capped by the indurated Caprock caliche, but the surrounding area is blanketed by at least three successive layers of eolian sediment deposited over the past 2 million years. These eolian deposits are today partially stabilized by vegetation. If future conditions allow for increased sand mobility (increased aridity), the vicinity of the WCS facility will likely receive additional input of eolian sediment. The source area for local eolian sediment lies to the south and west of the WCS facility (upwind), in the alluvium of the Pecos River Valley, and providing future prevailing winds remain as today, these would potentially supply fresh windblown sand and dust to the area. It is unlikely that wind erosion could impact the WCS facility, and it is more likely that deposition of eolian sediment would further encroach on the surrounding area (Lehman, Appendix 6.2-2).

4.3.1.3 Development of Playa Basins

Small surface depressions (buffalo wallows) and a few established playa basins are present within a 6.2-mile radius of the WCS facility (Figure 6.4-15). The largest of the surface depressions within the permitted area is a small playa about 15 acres in size approximately one-half mile northeast of the existing landfill. Remnant deposits of a filled and now partially covered playa or salt lake basin are found about 2.5 miles east of the permitted area. Surface drainage from the area north and east of the WCS facility flows eastward into this basin.

In general, the small surface depressions and established playa basins range in size from 33 feet to 1.5 miles in diameter, though most are less than 0.6 miles in diameter, and exhibit up to 33 feet of topographic relief. The basins originated 30,000 to 10,000 years ago, although some may be older, and have partially or completely filled with up to 3 to 65 feet of sediment since that time (Holliday et al., 1996). The basins formed within the eolian cover sands of the Southern High Plains (Blackwater Draw) and are considered to be formed primarily by wind erosion, and hence are larger and more numerous where the cover sands are thicker (Holliday et al., 1996). The basins typically hold water temporarily only after extended periods of rainfall, and focused infiltration of water through the floors of the playas is considered the primary recharge mechanism for the unconfined High Plains aquifers (Gustavson et al., 1995; Mullican et al., 1997). Buffalo (and more recently, cattle) may also have played a role in enlarging the original depressions by transporting mud or dust out of the basins on their hooves and hides. Recent studies suggest that some larger playas, such as several near Amarillo in the northern panhandle of Texas, may be influenced by subsurface dissolution or Permian salts.

Playas and playa development have been the subject of considerable research since they were identified as internally-drained ephemeral surface water sources (e.g. Dumble, 1888). Gustavson et al. (1995) provide a review of the processes that form playas, concluding that no single process accounts for their origin. Gustavson et al. (1995) indicate that playas result from a number of different and intermittently active processes, which include eolian deflation and deposition, fluvial erosion and lacustrine and deltaic deposition, ground water recharge, pedogenesis, salt dissolution and subsidence, dissolution of soil carbonate, and animal activities. The origin of the playas in the vicinity of the WCS permitted area facility is most likely a result of the development of 'solution pans', or localized dissolution of the Caprock caliche at or near the ground surface. Gustavson et al. (1995) indicate that some playa basins probably began as solution pans on the Caprock caliche as early as the late Tertiary.

Development of playa basins does not result in substantial erosion of the surrounding landscape because topographic relief is low, and relatively small amounts of sediment removed from the surrounding watershed are concentrated in the basin and subsequently removed in part only by wind erosion when the lake is dry. The basins do not expand beyond an optimum diameter of several kilometers after they form and remain approximately fixed in diameter throughout their history (Holliday et al., 1996).

A number of irregularly-shaped salt lake basins occur on the Southern High Plains. The basins are currently groundwater discharge areas where large quantities of soluble salts have accumulated in lake waters and sediments (Gustavson et al., 1995). The solutes in the salt lakes and the evaporite minerals are derived from evaporation of the local groundwater (Wood et al., 1992). The origin of these basins has been attributed to several processes (summarized in Gustavson and Finley, 1985), including subsidence (Baker, 1915), deflation (Evans and

Meade, 1945), blockage of previously existing valleys (Reeves, 1966; Reeves and Parry, 1969) and accelerated erosion at intersections of lineaments representing the earth's regmatic shear pattern (Reeves, 1970). Gustavson and Finley (1985) conclude that development of some of the larger lake basins has been influenced by both dissolution-induced subsidence and deflation. Wood et al. (1992) showed that the salt lake basins could result solely from deflation in areas where the water table in the Ogallala aquifer was high due to underlying bedrock highs. The nearest salt lake basins to the WCS facility are Whalen Lake and Shafter Lake located to the east-southeast approximately 16 miles and 24 miles, respectively. A local depression about 2.5 miles east of the WCS permitted area, which contains Quaternary playa deposits (Tahoka Formation) partially covered by recent windblown sand, may be either a larger playa or a basin with a similar origin to the salt lake basins. Under any of the hypotheses of the origin of the salt lake basins, their development occurred over geologic time scales of millions to hundreds of millions of years. The salt lake basins are not an active geologic process that could affect the WCS facility.

4.3.2 Erosion of the Southern High Plains Escarpment

The escarpment bordering the Southern High Plains (the Caprock escarpment) on the west, north and eastern sides has developed over geologic time and continues to retreat by erosion. The WCS facility is about 10 to 15 miles southeast of Mescalero Ridge, where the western Caprock escarpment is topographically well defined. In the WCS vicinity, the Southern High Plains has begun to physiographically lose definition as an escarpment and become more of a gently southeastward sloping topography that indistinctly blends into the Edwards Plateau further to the southeast. Mescalero Ridge is retreating eastward and northward, away from the WCS area. The northward head-cutting of Monument Draw into Mescalero Ridge defines the southernmost extent of active erosion of the Caprock escarpment in the area. Although the WCS site does not appear to be located in an area where the Caprock escarpment would develop or retreat under existing physiographic conditions, the potential rates of erosion for the escarpment are instructive should erosional directions alter in the future, perhaps in response to deep-seated salt dissolution in the Pecos or Monument Troughs. A detailed discussion of escarpment erosion is provided by Dr. T. M. Lehman (Appendix 6.2-2). Parts of the discussion below are taken from Appendix 6.2-2.

The rate of the erosional retreat of the escarpment has been estimated based on projecting the original aerial extent of the Ogallala Formation relative to its present outcrop limit over the time elapsed since the end of deposition of the Ogallala Formation from 3 to 5 million years ago (Gustavson et al., 1980) (Figure 6.4-17). The present limit of the Ogallala Formation along the southwestern margin of the Southern High Plains is approximately 43 to 93 miles east of its postulated maximum limit along the eastern flank of the Guadalupe and Sacramento Mountains (Gustavson et al., 1980) (Figure 6.4-17). Assuming parallel slope retreat on both sides of the Pecos River Valley, the western escarpment of the Southern High Plains has retreated to the east 22 to 47 miles (relative to the present position of the Pecos River) owing to incision and widening of the Pecos River Valley following the end of Ogallala deposition. This results in an annual retreat rate of 0.275 to 0.59 in/yr if Ogallala deposition ended 5 million years ago, or an annual retreat rate of 0.47 to 0.98 in/yr if Ogallala deposition ended 3 million years ago (Lehman, Appendix 6.2-2).

This estimate is complicated by recognition that the Pecos River Valley has subsided in response to subsurface salt dissolution, and that downcutting and widening of at least the lower part of the Pecos River Valley must have occurred before or during deposition of the Ogallala Formation, because the alluvial fill of the lower Pecos Valley (Cenozoic Alluvial Fill or Gatuna Formation) is at least 13 million years old (as old as the basal sediments of the Ogallala Formation (Powers and Holt, 1993; Hawley, 1993). The youngest part of the Gatuna Formation is no older than 600,000 years. Hence, some or most of the eastward retreat of the Caprock escarpment in this area must have occurred prior to 600,000 years ago. If the present eastern limit of the Gatuna Formation marks the former position of the Caprock escarpment 600,000 years ago, then retreat of the escarpment for the past 600,000 years has been a maximum of 12.5 to 18.6 miles, and as little as 1.9 to 3.85 miles in other areas (based on Gatuna distributions shown by Kelley, 1980). This yields minimum and maximum annual retreat rates of 1.2 to 2 in/yr (Lehman, Appendix 6.2-2). A comparable estimated retreat rate of 1.6 in/yr was determined for widening of the Canadian River Valley, which is also incised into the High Plains surface along a belt of dissolution-induced subsidence active before, during, and after Ogallala deposition (Gustavson et al., 1980). The Canadian and Pecos Rivers are thought to have been affected by the same processes, and hence retreat rates may have been similar in both valleys.

A number of authors have produced similar estimates for the rate of retreat of the eastern escarpment of the Southern High Plains based on geomorphic history (Table 6.4-2). These estimates range from 1.6 in/yr to a maximum of 7.5 in/yr. Given that the original extent of the Ogallala Formation east of the Southern High Plains was as much as 2 to 3 times greater than its original extent west of the present Southern High Plains escarpment (Figure 6.4-17) and assuming that both western and eastern escarpments of the Southern High Plains retreated simultaneously, then the eastern escarpment must have retreated at least 2 to 3 times faster than the western escarpment, and perhaps as much as 6 times faster (Osterkamp and Wood, 1984).

A number of authors have determined modern erosion rates for the eastern escarpment of the High Plains (Table 6.4-2). These estimates are based on 2 to 4 years monitoring of erosion pins emplaced on varied slopes and soil types bordering the Southern High Plains escarpment, suspended sediment loads of streams draining the escarpment, and reservoir sedimentation rates. The erosion rates measured in these studies range from a low of 0.004 in/yr to a maximum of 28.5 in/yr. The maximum short-term erosion rate found in these studies (28.5 in/yr) was for headcut erosion of a vertical scarp in completely unconsolidated modern alluvium. These data were summarized by Gustavson and Simpkins (1989), who regarded a range of 0.4 to 1.2 in/yr as reasonable for modern erosion rates. Annual rainfall in the region where these studies were conducted (northeastern border of the Southern High Plains) is 18 to 20 in/yr, rather than the 12 to 14 in/yr received in western Andrews County, therefore the erosion rate measurements are higher than would be expected in the vicinity of the WCS facility.

As indicated in the opening paragraph of this discussion, erosional retreat of the Caprock escarpment does not appear to be occurring in the direction of the WCS area. However, assuming that conditions could physiographically lead, at some future time, to escarpment retreat toward the WCS area, Lehman (Appendix 6.2-2) estimates the time for escarpment retreat to approach the WCS area. Assuming the present closest position of the Caprock escarpment is approximately 22 miles to the west-southwest of the WCS facility (near Jal, New Mexico), and further assuming an average rate for erosional retreat of the escarpment estimated above (about 2 in/yr), it would require about 700,000 years for eastward retreat of the escarpment to reach the WCS vicinity. Alternatively, assuming escarpment retreat were to occur along the eastern flank of Monument Draw, New Mexico, it would require 100,000 years at an average rate of about 2 in/yr for escarpment retreat to approach the WCS area. Escarpment retreat is, therefore, not considered to be an issue with respect to the WCS facility.

4.3.3 Erosional Features within the Permitted Area

Present-day erosional features within the WCS permitted area were identified using aerial photographs and topographic maps and field reconnaissance of the area. Physiographically, the WCS facility is located on a gently sloping plain with a regional slope toward the southeast at 8 to 10 feet per mile (Reeves, 1966). Local slope across the permitted area is to the southwest toward Monument Draw, New Mexico at approximately 50 feet per mile. Soils developed across the permitted area are typically shallow fine sandy loams with moderate to rapid permeability. The hazard of soil blowing is noted as moderate (Conner et al., 1974).

Erosional features developed within the permitted area include several subtle surface water drainage features located in the southeastern corner of the permitted area. These drainage features developed along the flanks of Windmill Hill and gather surface water runoff from Windmill Hill and the ranch house area. Drainage in these features is to the west-southwest.

Other erosional features identified within the permitted area include a topographic bench and several small depressions or playas. The bench runs through the center of the permitted area at an alignment of 300° to 320° and with a relief of approximately 20 feet. The bench developed as an erosional feature along the preferred jointing direction in the Southern High Plains. Four small depressions or playas are located on the northern half of the permitted area. The largest of these has a diameter of 1200 feet along its long axis, while the smallest is approximately 200 feet in diameter.

Terra Dynamics (1993) identified a subtle surface water drainage feature and five additional small depressions within the boundary of the landfill. These erosional features were removed during construction of the landfill and are no longer present within the permitted area.

The landforms within the WCS permitted area were evaluated using stereoscopically-paired aerial photographs from the 1938 and 1981 as well as NHAP color infrared aerial photographs from 1983 and 1986. The objective of this photo-geologic analysis was to determine where and how any possible changes in landforms had occurred due to erosion. The vertical exaggeration of the stereoscopic images was exploited to help detect any erosional changes in topography. Other characteristics compared between different sets of aerial photographs were shapes and sizes of drainageways and depressions or playas and observable changes in location or direction of these features.

Landforms on the WCS permitted area have remained virtually static for at least the last 70 years. No observable changes were detected in drainageway location, direction, shape or size or in the location, shape or size of the depressions or playas. The geologic interpretation is that active erosional processes have a relatively low impact in the permitted area, which is typical of this type of arid climate. This interpretation is consistent with Lehman (Appendix 6.2-2) who concludes that the present landscape of the Southern High Plains is in dynamic equilibrium. Local erosion by overland flow is balanced by local deposition when surface water runoff ponds in depressions and playas, and local wind erosion is balanced by local sediment deposition transported from upwind source areas. Lehman (Appendix 6.2-2) also concludes that the area is not subject to significant long-term erosion, but if anything, to slow aggradation due to addition of eolian sediment.

5.0 SITE SUBSURFACE SOILS INVESTIGATION

5.1 INVESTIGATION PROCEDURES

Site investigation activities were initiated in 1992 and have continued through 2003. During this period, seven (7) investigation events have been conducted for the purpose of characterizing the subsurface conditions. A total of 220 borings have been drilled and 109 monitor wells and piezometers installed. The site investigation activities included: the drilling of continuous cores and soil borings; geophysical logging; surface seismic surveys; and the installation of piezometers and monitoring wells. A summary of soil boring, well completion and selected geologic data is provided in Table 6.5-1. Soil boring locations, geologic logs and well completion logs are provided in Appendix 6.5-1. Geophysical logs are provided in Appendix 6.5-2. The locations of the borings in the area of the permitted boundary of the site are shown on Figure 6.5-1. The locations of the borings outside the permitted boundary of the site are shown on Figure 6.5-2.

5.1.1 1993 RCRA Site Investigation Activities

In 1993, Terra Dynamics, Inc. and Jack H. Holt and Associates, Inc. (JHA) conducted a hydrogeologic site investigation for the purpose of preparing the Geology Report of the initial Permit Application. A total of 59 borings was drilled in 1992 and 1993 to evaluate the hydrogeologic and geotechnical conditions at the site. Each of the borings was geologically logged from cores and grab samples. At nine boring locations, 14 monitor wells were completed. At each of the nine monitor well boring locations, the borings were geophysically logged. The results of the boring and monitor well installation were the basis for the evaluation of site hydrogeologic conditions presented by Terra Dynamics, Inc. in the original Permit Application.

JHA prepared a geotechnical and engineering analysis of the soil conditions in the area of the proposed landfill for the original Permit Application. The JHA report includes laboratory analyses from geotechnical testing, an analysis of foundation stability, and a slope stability evaluation.

5.1.2 1997 Weaver Boos Municipal Landfill Siting Investigation

In 1997 Weaver Boos Consultants, Inc. conducted a two phase investigation that included the drilling of 26 borings to the west and southwest of the RCRA landfill. With the exception of two borings that were located on adjacent property further west, the borings were located on WCS property in New Mexico. The purpose of the investigations was to evaluate subsurface conditions in the area of the proposed Lea County, New Mexico Sanitary Landfill. The first phase of the investigation was conducted for the purpose of locating the landfill. The second phase was conducted to evaluate the geologic conditions beneath the current area of the Lea County landfill that is currently in operation. The results of the geologic investigation were reported in a 1998 Solid Waste Landfill Application for a Permit in Lea County, New Mexico, which is presented in Appendix 6.5-3. This site has been permitted and is currently in operation.

5.1.3 1998 11(e)2 Siting Investigation

In 1998 numerous borings were drilled to evaluate a potential landfill location for the deposition of 11(e)2-defined materials. The field investigation activities were conducted by JHA in three phases and consisted of drilling 65 borings and constructing five monitor wells or piezometers. The first phase of the investigation is located to the west/southwest of the existing RCRA landfill and consisted of advancing 28 borings and installing monitor wells at three of the boring locations. These borings are identified with the nomenclature "A" series borings. The second phase borings are located to the north of the existing RCRA landfill and consisted of six borings. These borings are identified as the "B" series borings. To distinguish between the "B" series borings drilled in 1993, the year of the borings has been added to the nomenclature of the 1998 borings. The third phase borings are located to the west of the existing landfill in New Mexico and consisted of advancing 31 borings (NMB series) two of which were completed as monitor wells. The boreholes of the two monitor wells have also been geophysically logged. Two separate reports, dated 30 December 1998 and 11 February 2000 were prepared for these investigation activities. These reports are presented in Appendix 6.5-3.

5.1.4 RCRA Monitor Well Installation

Espey, Huston and Associates, Inc. (EHA) drilled nine borings and installed a total of 23 monitor wells in two phases around the existing RCRA Landfill. The first phase occurred in 1996 and included seven borings and the installation of 17 monitor wells. The second phase occurred in 1998 and included two borings and the installation of six monitor wells. The 23 monitor wells are nested and located at four upgradient and five downgradient locations. At each of the nine locations there are two wells screened into the upper and lower portion of the uppermost water-bearing "225 foot zone" siltstone unit. At each of the five downgradient locations an additional monitor well is screened in the dry 125-foot siltstone unit. EHA completed two separate reports for the well installation activities, these reports are presented in Appendix 6.5-3.

5.1.5 Texas Tech Piezometers

In 1999 Texas Tech University Water Resources Center drilled and installed 35 piezometers to investigate shallow subsurface conditions with particular interest in the location of groundwater occurrence on top of the red bed clay. The piezometers are located across the entire WCS property. A copy of this report is presented in Appendix 6.2-1.

5.1.6 2001 11(e)2 Siting Investigation

In 2001 Cook-Joyce, Inc. drilled and installed 12 monitor wells (PM series) and 13 piezometers (TP series) to evaluate the hydrogeologic conditions of an area in the eastern portion of the permitted boundary of the site. The purpose of the investigation was to further evaluate this area of the site for the potential location of an 11(e)2 landfill site. Seven of these borings were geophysically logged and the geophysical logs are presented in Appendix 6.5-2.

5.1.7 Additional Piezometers

In 2003 and 2004 two additional piezometers were installed on the WCS property and nine borings were drilled on adjacent property to the west in association with a geologic investigation conducted by Louisiana Energy Services (LES). Piezometer NMP-01 was installed in May of 2003 and is located on WCS property in New Mexico to the southwest of the RCRA landfill. The purpose of installing the piezometer was to further evaluate the groundwater gradient in the "225 foot zone" uppermost groundwater-bearing unit. Piezometer TP-14 was installed in 2004 and is located to the east-northeast of the RCRA landfill and was installed in a depression or playa where groundwater was encountered above the red beds of the Dockum Group.

Nine borings were drilled across Section 32 in New Mexico adjacent to the WCS property. Six of these borings were advanced to the top of the red beds and three were advanced to approximately 250 feet below ground surface. The three deep borings were used in this report to supplement the site borings in determining the structure of the "225 foot zone" that is considered the upper most aquifer beneath the WCS site.

5.1.8 Additional Geologic Data

In addition to the geologic boring data and the monitor wells/piezometers that have been drilled and installed, two geophysical surveys have been performed, and the two non-potable water supply wells have been geophysically logged. The two geophysical surveys were conducted by Advanced Geological Services and Geological Associates in 2001 and include a total of eight lines, four resistivity and four seismic lines, that are located to the north-northwest of the RCRA landfill and to west of the landfill location in the area of the 2001 11(e)2 siting investigation. The results of these surveys are presented in Appendix 6.5-4.

The geophysical borehole logging conducted by Computalog, has been conducted in the site's two non-potable water wells which produce from the lower sandstones of the Dockum Group to evaluate the deeper stratigraphic conditions in the area of the site. The geophysical boring logs are presented in Appendix 6.5-2.

5.1.9 Survey Control

Survey control of the borings and wells has been conducted through several events since 1993. As surveying technologies evolved, various surveying techniques have been utilized for the different surveying events. In addition, survey control of the benchmarks used for the various events has changed. Due to the variations in the survey techniques and benchmark controls, reported survey data on some of the boring logs and monitor well construction forms required adjustment. The adjusted elevations are presented in the tables in Appendix 6.5-1.

The survey of the initial 59 borings and wells that was conducted for the 1993 RCRA investigation used a benchmark elevation that has subsequently been adjusted. This survey data was collected using survey methodologies that do not possess the accuracy of subsequent surveys that utilized GPS surveying systems. Therefore, due to benchmark adjustments and comparisons to later surveys of the existing wells from this investigation, an adjustment to the elevations have been made. Based on these adjustments it is believed that the elevations presented in this report are within a reasonable degree of accuracy.

The survey data presented on the logs of the Weaver, Boos investigation for the Lea County Municipal Landfill project is limited. Of the two investigation activities conducted by Weaver, Boos, surveyed elevations are reported for the borings. However, horizontal control of the first phase was not presented but a boring location map was presented. The second phase borings were located with a local grid system with an undefined origin. To determine an approximate boring location, these borings were plotted on a U.S. Geological Survey (USGS) Topographic Map based on the submitted location maps and then compared to reported elevations to the elevations of the plotted locations on the topographic map. Based on the general concurrence of the two elevations, it is believed that the locations presented in this report are properly located within a reasonable degree of accuracy.

The six B-98 series borings conducted as part of the 1998 11(e)2 investigation were not surveyed. The locations of these boring are estimated in this report based on the boring location map prepared as part of the investigation. The elevations of these borings were estimated from elevations shown on the site topographic maps.

5.2 SUBSURFACE STRUCTURE

The site subsurface structural analysis is based on data compiled from all site investigation activities that includes 220 geologic borings (Table 6.5-1) and 17 geophysical logs. The structural interpretation derived from this information is summarized in five shallow geologic cross-sections, A-A' through E-E'. A cross-section location map is provided as Figure 6.5-3. The five shallow cross-sections are provided as Figures 6.5-4 through 6.5-8. An isopach map of the overburden material is provided as Figure 6.5-9. A contour map of the top of the Dockum Group is provided as Figure 6.5-10. Structure maps of the top and bottom of the "225 foot zone", which is the upper most water-bearing zone, are provided as Figure 6.5-11 and 6.5-12.

The site subsurface data supports the regional structural analysis of horizontally configured intervals in descending order of recent wind blown sand and the Blackwater Draw Formation, caliche overburden material and undifferentiated materials of the Ogallala, Antlers and Gatuna (OAG) Formations overlying primarily silty claystone, siltstone and sandstone of the Dockum Group sediments. The contact of the OAG units and the Dockum is an erosional unconformity. Lithologic intervals within the Dockum Group range from discontinuous to laterally extensive. Based on the structure of the laterally continuous "225 foot zone", which is a siltstone in the Dockum Group, the local depositional framework indicates no evidence of faulting in the study area.

5.2.1 Surface and Shallow Strata

The surface and the shallow soil strata of the study area generally consist of, in descending order, windblown sands, unconsolidated and indurated caliche, sand and gravel. This zone overlies the Triassic age Dockum Group and is generally referred to as the overburden material. The overburden generally ranges in thickness from 8 to 70 feet in the study area. An isopach map of the overburden thickness is presented as Figure 6.5-9. Overall thickness of the overburden thins from the flanks of the red bed ridge to the top of the ridge where the overburden is the thinnest in the study area.

5.2.2 Dockum Group

The buried surface of the local Dockum Group indicates a paleotopographic expression as a ridge. The overburden OAG sediments, which range in age from Cretaceous to Tertiary, disconformably overlie the Dockum Group. The Dockum Group sediments are locally overlain by 8 to 80 feet of overburden deposits in the study area.

As shown in a map of the top of the Dockum Group (Figure 6.5-10), a buried ridge runs in a roughly northwest/southeast direction through the middle of the local study area. Three cross-sections (C-C', D-D', and E-E') run generally perpendicular to the axis of this ridge.

In the study area, the highest measured elevation of the buried ridge is 3453 feet msl. The north side of the ridge has relatively gentle relief of approximately 25 feet over 4200 feet (0.6% relief) in the study area. The south side of the ridge has considerably more relief. In the west central portion of the study area, along the Texas-New Mexico border, the top of red beds grades from an approximate elevation of 3450 to 3365 feet msl over 1800 feet (6.2% relief). In the south central to southeastern portion of the study area, the red bed ridge grades from approximately 3450 to 3375 feet msl over 4200 feet (1.7% relief).

Structure maps (Figure 6.5-11 and 6.5-12) of the top and bottom of the "225 foot zone" indicate a gentle dip to the south-southwest. The top of the "225 foot zone" dips at rate of about 1.3% to the southwest in the central part of the study area.

The dip in the "225 foot zone" is in contrast to the regional dip of Dockum Group that is toward the center of the Dockum Basin located to the north-northeast of the site. The localized dip could be due to variations in localized depositional activities and differential compaction.

5.2.3 Surface Structure

The topography of the study area generally slopes to the south-southwest. In the study area there are three general areas of varying slope. In the northern and central portions of the study area, the land surface is relatively flat but gently slopes to the south-southwest at approximately 10 feet over 3,000 feet. From the south central portion of the study area, surface grades increase to a drainage feature that is located in the southern portion of the site. The slope of the land surface from the south central portion of the site to the drainage feature is approximately 25 feet over a distance of 500 feet. This drainage feature slopes from east to west, at approximately 50 feet over a distance of 7,000 feet, where the drainage feature discharges from the site towards Monument draw.

Localized drainage depressions, such as playas or buffalo wallows, are located in the northern and central portion of the study area. The origin of these depressions or playas is discussed in Section 4.3.1.3.

One of the local depressions or playa areas was investigated by a series of four borings around the location of boring B-41. At this location, a depression in the surface of the Dockum Group corresponds to the overlying topographic depression. Both the depression in the surface of the top of the red bed and the overlying playa have relief of approximately four feet. However, the structure map of the top of the "225 foot" siltstone does not indicate a similar depression beneath the surface depression. Therefore, it is unlikely that the playa is due to the dissolution and slumping of underlying Dockum Group or deeper evaporite layers. The structural depression in the surface of the Dockum Group is probably a reflection of a small-scale paleotopographic depression scoured into the surface of the Dockum Group prior to the deposition of Ogallala Formation sediments.

The playas appear to be aligned generally in a pattern that parallels the red bed ridge near where the overburden material is thinnest. As discussed in Section 4.3.1.3, the playas near the ridge are likely due to dissolution of the near-surface caliche material.

The results of the coring and soil boring activity at boring B-41 suggest that partial dissolution of the shallow caliche cap may have occurred. The continuous core boring encountered only six feet of caliche cap, consisting primarily of calcium carbonate-cemented silt and sand. However, four exploration soil borings drilled along the outer rim of the playa (borings 41-N, 41-S, 41-E and 41-W) encountered a thickness of caliche cap ranging from 5.7 feet to 15.6 feet, with an average thickness of approximately 10.2 feet. This suggests that a portion of the caliche cap material at B-41 may have been dissolved at or near the surface, which is consistent with the playa development process discussed by Gustavson, et. al (1995).

Potential surface water infiltration and localized groundwater in the area of playas is supported by the presence of saturated conditions within the shallow sand and gravel immediately overlying the red beds in borings (B-41 and TP-14), located in two different playas. These two playas are located in the center and the northern portion of the study area, respectively. However, cores and four soil borings surrounding location B-41 did not produce water.

The U.S. Geological Survey, NE Eunice sheet identifies the presence of a depression west of the study area as Baker Spring. However, there is also evidence that supports this feature is at least partially a result of past quarrying activities. As part of an investigation of the area, a pedestrian survey was conducted. A surface engineering control, or diversion berm, was identified above the quarry high wall. It appears that the berm had been constructed to divert surface water from the north and cause it to flow to the east of the former quarry area. Stockpiles of the overburdened silt and very fine sand material, which is typically not suitable for sand or gravel use, were identified in the area south of the quarry floor. In addition, the area of the quarry is littered with debris such as thick cable and other scrap metal components that appear to be parts of excavation equipment. It appears that the quarry floor has been excavated to the top of the redbed through the removal of the overlying sand and gravel reserves. The quarry floor is presently at a lower elevation than the natural drainage features that flow from the northwest and the northeast, and merge in the area of the quarry that formerly ran to the south. Both of these drainage features now allow surface water to flow into the old quarry floor, which causes ponding. The quarry floor is several feet below the outlet that would otherwise flow to the south. Therefore, the results of past quarrying activities allow surface water that formerly flowed through the natural drainage feature to be diverted and now pond in the quarry floor.

In an interview with the Plant Manager of the Wallach Quarry, which is located to the west of the Baker Spring/Quarry area, he stated that Baker Spring is not a naturally occurring feature but the result of past mining activities. He stated that Mr. Baker conducted mining operations of the sand and gravel materials above the red bed beginning in the 1940's and continued into the 1950's. He further stated that Baker did not have a crusher and at one time hauled the material to a crusher in the vicinity, which was owned by Wallach.

A search of historic aerial photographs identified a series photographs from 1939 that can be viewed in stereopair and a single aerial from 1949. These aerial photographs are presented in Appendix 6.5-5. The 1939 photos show a clean fresh face of the excavation and stockpiles of mine spoil. The quarry floor appears to have regularly shaped excavation patterns with stockpiles and what appear to be ponds. The 1949 aerial photograph shows a network of roads, including a main road that leads south towards State Highway 234, in the area of the excavation.

Based on the investigation of the Baker Spring area, it is concluded that the feature is principally man-made and results from the historical excavation of gravel and caprock materials that are present above the red bed clay. As a result of the excavation, the quarry floor is topographically lower than the surrounding area. Following rainfall events, ponding on the excavation floor occurs. Because the floor consists of the very low permeability clay of the red bed, limited seepage of the ponded water occurs. Shading from the high wall and trees that have flourished in the mine spoil retard the natural evaporation rates and water stands in the pond for some time. It is suspected that during periods of ponding, a limited volume of surface water may infiltrate into the sands at the base of the excavated wall and is retained as bank storage. As the surface water level declines, the bank storage is discharged back to the excavation floor.

5.3 SUBSURFACE STRATIGRAPHY

The local subsurface stratigraphic framework is presented in five shallow geologic cross-sections (Figures 6.5-4 through 6.5-8). These cross-sections are based on the results of the site coring, soil boring and geophysical logging programs. Two hundred and twenty soil boring logs are presented in Appendix 6.5-1. Seventeen geophysical logs are provided in Appendix 6.5-2. A stratigraphic column is provided as Figure 6.2-2.

5.3.1 Surficial Materials

Two types of surface material overlie the study area. In the area of the red bed ridge in the central portion of the study area, a thin veneer of two feet or less of topsoil and wind blown sand is present at the surface. The topsoil consists of brown silty sand that contains sparse vegetation debris and roots.

Off the flanks of the red bed ridge, generally to the north and south, the sand content in the surface material increases with depth. This sand is associated with the Blackwater Draw Formation of Pleistocene age. The Blackwater Draw consists of sand that is reddish brown, fine to very fine grained, with minor amounts of clay and nodules of soft sandy caliche.

5.3.2 Caliche

Within the local study area, the topsoil horizon is underlain by a variable sequence of calcium carbonate-cemented, calcrete duracrust capping material referred to as the Caprock caliche (or simply as caliche). The Caprock caliche forms the resistant beds of the Caprock escarpment along the western and eastern margins of the Southern High Plains (Gustavson and Finley, 1985).

A local surface exposure of the caliche was observed at Baker Spring. At this location, the caliche consists of: approximately six feet of white, highly fractured calcium carbonate-cemented feldspathic and quartzitic silt and very fine grained sand; overlying approximately 12 feet of white and pinkish white, massive caliche with extensive concretionary nodule growths (i.e., pisolites) and feldspathic and quartzitic silt and very fine grained sand; resting on top of approximately six feet of pinkish white, calcium carbonate-cemented feldspathic and quartzitic silt, sand and gravel which becomes less cemented with depth. The lower six feet of caliche appears to be well-to-poorly cemented calcium carbonate. The caliche has an irregular basal contact and indicates a gadational transition into primarily uncemented sands and gravels below.

With the exception of the western extent of the study area, the caliche was observed to be laterally extensive throughout the area. The caliche encountered during the drilling program is similar to the caliche exposed at Baker Spring. Matrix color ranges from white to pinkish white, with varying degrees of cementation, hardness, fracturing and pisolitic concretions. The caliche horizon contains varying amounts of feldspathic and quartzitic silt, sand and gravel fragments with a general trend of decreased cementation and increased silt, sand and gravel content with depth. Open fractures and vugs were periodically observed within the caliche horizon.

5.3.3 OAG Unit

The unconsolidated or semi-consolidated sand and gravel unit that is located between the Caprock caliche and the underling red beds of the Dockum Group has been identified in past studies as various geologic formations including the Ogallala, the Antlers, and the Gatuna. For the purposes of this report, this material is considered one single hydrogeologic unit of undifferentiated Ogallala, Antlers, and Gatuna that is referred to as the OAG Unit. With the exception of some areas on the top of the red bed ridge, where the caprock extends to the top of the red bed, lower sand units of the OAG Unit are present across the site.

In a local surface exposure of the OAG Unit observed at Baker Spring, the sediments consist of approximately six feet of caliche-cemented silt, sand, and gravel, resting on top of approximately 15 feet of planar crossbedded and trough crossbedded sand and gravel. Sediment color ranges from pinkish tan to dark brown with red, pink, white, black and opaque quartzitic gravel clasts and granite cobbles. The base of the OAG Unit has a sharp and irregular contact with the underlying dusky red siltstone and claystone of the Dockum Group.

OAG sediments were encountered in numerous soil borings throughout the local study area. These sediments consist of unconsolidated to poorly consolidated fledspathic and quartzitic very fine to coarse sand and gravel with minor silt and clay content. For the purpose of general classification and cross-section preparation, the portion of the OAG Unit that has been cemented as part of the overlying caliche cap, is represented in the cross-sections as caliche.

The local thickness of the OAG Unit is partially related to the structure of the underlying red bed. The thickness of the OAG Unit generally increases off of the northern and southern flanks of the underlying red bed ridge. In the area of the ridge, the thickness of the OAG ranges from 0 to 30 feet. Off the flanks of the ridge, within the RCRA permitted area, the OAG thickness increases to as much as 70 feet. In addition, small-scale structural lows in the surface of the red bed generally contain an increased thickness of OAG Unit and an increase in gravel and sandy gravel near the contact with the underlying Dockum redbeds.

5.3.4 Dockum Group

The Dockum Group records a period of fluvial-deltaic and lacustrine deposition within a restricted continental basin during the Triassic (208 to 245 million years ago). The source areas of the Dockum Group include: the Llano Uplift area to the east; the Amarillo Uplift, Wichita Mountain Uplift and Arbuckle Mountain Uplift to the north and northeast; the Sierra Grande Arch and Sangre De Cristo Uplift to the northwest; the Sacramento Uplift to the west; and the Diablo Platform to the south (Figure 6.2-3).

In this report, the Dockum Group stratigraphic system proposed by Lehman (1994a, 1994b) is adopted as discussed in the Regional Geology section (Section 2.0).

The upper surface of the Dockum Group is irregular and indicative of the erosional, disconformable contact with the overlying OAG Unit.

The Dockum Group was penetrated to a maximum depth of 600 feet below ground level (WB-B-110) as part of the Weaver Boos Consultants, Inc. soil boring program for the Lea County municipal landfill investigation. In addition, the site's non-potable water supply well was geophysically logged through the entire thickness of the Dockum to a depth of 2,470 feet below ground level and a second well that does not fully penetrate the Dockum, was logged to a depth of 800 feet. Continuous cores, drill cuttings and geophysical logs were used to characterize the upper 600 feet of the Dockum Group at the site, which is considered the Cooper Canyon Formation by Lehman (1994a, 1994b).

Based on the results of the on-site drilling program, the Dockum Group consists primarily of reddish brown, maroon and purple siltstone and claystone with intervals of reddish tan and greenish gray siltstone and sandstone. The portion of the Dockum Group encountered during the on-site drilling program can be divided into five zones. The upper zone consists of primarily dry claystone that is interbedded with relatively thin discontinuous silty sandstone layers. The second zone encountered is a dry, fine-grained sandstone with minor amounts of silt. The third zone is similar to the upper zone and is made up of claystone interbedded with discontinuous silty sandstone layers. The fourth zone is a saturated, silty sandstone. The fifth zone is similar to the first and third zones and consists of claystones and siltstones.

The upper zone of claystone is encountered at the contact of the OAG unit and extends to an approximate depth of 125 feet below ground level. The landfill is excavated approximately 40 feet into the upper zone. The thickness of this zone is approximately 85 feet and generally consists of a red to purple, dry, very firm to consolidated clay or claystone. Based on numerous geotechnical tests that have been conducted on this zone, the claystone has a moisture content ranging from approximately 1.5 to 30%, a plasticity index (PI) of 15 to 50, a dry density of 116 to 144 pounds per cubic foot, percent passing the #200 sieve of 90 to 100%, and permeability of 10^{-9} to 10^{-8} centimeters per second (Table 6.5-2). Discontinuous stringers of sandstone with silt have been identified in some of the site borings and a dry sand lense was exposed just below the OAG-Dockum contact in the landfill sidewall during excavation. Generally these sandstone lenses occur at depths of 50 and 80 feet below ground level and consist of dry, fine-grained, gray to red sand with silt and clay. The sandstone lenses have PI values as low as 13, percent passing the #200 sieve are in the 70% range, and permeability values are in the 10^{-6} to 10^{-7} cm/sec range.

The second zone in the Dockum red beds is encountered at an approximate depth of 125 feet below ground level. This "125 foot zone" consists of a dry, gray to white, sandstone with silt. This zone is laterally continuous within the study area with the exception of the far western portion of the New Mexico borings. There are five monitor wells screened in this zone along the southern boundary of the existing landfill. These monitor wells have been dry since they were installed in 1996 and 1998. The upper and lower contact with the red bed claystone is transitional making a determination of the contact arbitrary.

The third zone is similar to the uppermost zone and consists of a dry, red to purple claystone with varying silt content. The third zone is approximately 100 feet in thickness. This zone is interbedded with discontinuous, dry, fine-grained, sandstone lenses. A discontinuous silty sandstone zone is encountered at an approximate depth of 180 feet below ground level.

The fourth zone is encountered at an approximate depth of 225 feet below ground level and ranges in thickness from approximately 10 to 30 feet. The zone consists of a saturated, gray to pink, fine-grained, sandstone with varying amounts of silt. This zone is the uppermost water-bearing zone that is continuous across the site and the existing groundwater monitoring system for the landfill is completed into this zone. This zone has been tested in the field and the laboratory to determine the hydraulic conductivity and permeability. Hydraulic conductivity values range from 10^{-7} to 10^{-9} cm/sec. Laboratory porosity testing of the zone has been conducted with results that range from 8 to 18%.

Beneath the uppermost water-bearing zone is a claystone that is the lower confining unit. This claystone is similar to zone three. Few borings at the site have been advanced more than 10 feet into this zone. Two borings were advanced to a depth of approximately 600 feet in the area of the existing Lea County Landfill, located adjacent to the southwest corner of the study area. These borings indicate that the claystone is massively bedded to a depth of approximately 565 feet below ground surface where the claystone transitions into sandstone (likely the Trujillo Formation sandstone) that was reported to be saturated. Geophysical logging has been conducted on the site's two non-potable water supply wells. One of the supply wells, the central well, is located in the RCRA permitted area. The second supply well, the southeast well, is located approximately 3 miles to the southeast of the site just south of State Highway 176. The geophysical logs also suggest that this lower confining unit is massive, with possible silty or sandy claystone zones that are less than 10 feet in thickness. These zones occur between depths of 374 to 690 feet below ground surface in the southeast well and 400 to 600 feet below ground surface in the central well.

5.4 GEOTECHNICAL PROPERTIES OF THE SUBSURFACE SOILS

Geotechnical testing to evaluate the subsurface properties has been conducted as part of the numerous site investigation activities conducted since 1992. The results of the analyses are summarized in Table 6.5-2. The laboratory results of each of the geotechnical testing studies are provided in Appendix 6.5-6. The following is a list of the test methods used:

• Unified Soil Classification System	D-2487-90
• Sieve Analysis Including Minus No. 200 Hydrometer Analysis	D422-63
• Minus #200 Mesh	D1140
• Moisture Content	D2216-90
• Atterberg Limits including Liquid and Plastic Limits	D4318-84

Unconfined Compression Tests – rock specimens	D2938-68
Unconfined Compression Strength – clay soils	D2166-91
Triaxial Compression Tests	D4767-88
Unit Weight Tests	D2937-90
Permeability Tests	D5084-91
Moisture-Density Relationship – Standard Proctor	D698-91

Field hydraulic conductivity testing of the 225 foot uppermost water-bearing zone has been conducted at two locations: MW-1B and DW-36A. Rising head slug tests were conducted at each of these locations by removing a volume of water from the well and measuring the rate of recovery versus time. The resultant hydraulic conductivity values were calculated to be 6.0×10^{-8} cm/sec and 6.17×10^{-8} cm/sec for MW-1B and DW-36A, respectively. The slug test data and hydraulic conductivity calculations are presented in Appendix 6.5-7.

6.0 GROUNDWATER

6.1 LOCAL GROUNDWATER USAGE

An investigation to identify the locations of groundwater wells in the WCS vicinity was conducted by Banks Information Solutions, Inc. (Banks), and a pedestrian survey of the area was also conducted. In January 2004, Banks reviewed files at the TWDB and the TCEQ and the state of New Mexico files to identify well reports that had been submitted to the State within a 3-mile radius of the approximate location of the existing landfill. The results of the report identified a total of seven water wells within the search area. The nearest wells identified are located approximately 1.5 miles to the southeast and to the north of the landfill. Each of the wells identified was completed in the shallow overburden material of the OAG Unit.

In addition to the water well search, Banks also conducted a search of oil and gas wells within a 2-mile radius of the site. A total of 12 oil and gas wells were identified within the search area. Two of the locations were proposed locations but were not drilled; six locations have been plugged; two locations are described as shut-in oil wells; one is in production; and no information of one well was reported. However, the location of the well number 12, for which no information was presented, appears using a dry hole symbol and as a dry hole on the USGS topographic map of the area. The results of the Banks survey are presented in Appendix 6.6-1.

A pedestrian survey of the WCS property was conducted to inventory the locations of water wells. The results of the pedestrian survey identified an additional five wells (Figure 6.6-1) in the area of the uninhabited ranch house, located approximately one mile east of the landfill, that were not identified in the Banks search. Four of the wells are shallow wells completed into the overburden material. Two of the wells are located at the ranch house and two are located approximately 0.5 miles to the northeast of the ranch house. The fifth well is ~~T~~the site's central well, used as a non-potable water source, corresponds with the location of well number 8 of the oil and gas search. This well was reported to have been converted to a water supply well. Based on the geophysical log of this well, the accessible depth of the central well is 2,470 feet below ground level.

6.2 FACILITY GROUNDWATER

In the study area, 104 piezometers or monitor wells have been installed to evaluate the local groundwater conditions. The well completion diagrams for these wells and piezometers are presented in Appendix 6.5-1.

6.2.1 Groundwater Occurrence

Groundwater was encountered in four units in the study area. The three upper zones, the OAG unit and ~~a~~ two discontinuous sandstone seams in the Dockum Group at approximately 80 and 180 feet below ground level, contained localized discontinuous lenses of groundwater. The fourth is the uppermost water-bearing zone or "aquifer" that is continuous across the site ~~is~~ located in the "225 foot zone".

If groundwater was encountered in the boring, the depth is noted on the geologic logs. Historic depth to groundwater measurements of the site's monitor wells and piezometers are presented in Table 6.6-2. The maximum and minimum stabilized groundwater elevations of these wells and piezometers are presented in Table 6.6-3.

OAG Unit

Saturated conditions were encountered in the OAG unit at seven of the total of 172 borings located in both the RCRA permitted area and the NMB series borings located immediately to the west. These isolated locations (B-41, TP-14, NMB-37, A-28, A16, TP-05 and TM-09) are located in the area of the higher elevations of the red bed ridge. At each of these locations, the groundwater is unconfined. TP-14, A-16, TP-05 and TM-09 were completed as monitor wells.

Two of the locations with saturated conditions (B-41 and TP-14) are located in the area of localized depressions or playas. Boring B-41 was not completed as a piezometer but four additional borings were drilled around the edge of the depression to determine the extent of groundwater. All but one of these perimeter borings was dry, suggesting that the groundwater is an isolated occurrence.

Boring A-16, which was completed as a monitor well, indicates a thin lense of groundwater, that is approximately 1 foot thick, remains perched on top of the red bed. The geologic log of boring A-28, which is located topographically downgradient of A-16 based on the top of red bed elevation, also recorded saturated conditions in the OAG unit. Borings A-19 and B-20, that are located topographically side gradient of A-28, were not saturated.

Groundwater was also encountered in boring NMB-37. There are six borings that are generally located around NMB-37 that did not encounter groundwater. Therefore, the groundwater encountered in boring NMB-37 appears to be isolated and of limited lateral extent.

TP-05 and PM-09 are located near the eastern boundary of the permitted area. These two wells indicate the presence of groundwater and appear to be the edge of the zone of continuous saturation in the Ogallala aquifer to the east of the permitted area.

As part of Texas Tech 1999 investigation (Appendix 6.2-1), 35 borings were drilled of which 34 were completed as piezometers. The piezometers are located across the WCS property, which is approximately 23 sections (Figure 6.6-2). Groundwater was encountered in 17 of these piezometers. The location, thickness, and elevation of the groundwater at each of the locations are also shown in Figure 6.6-3. In addition, other boring and piezometer locations where groundwater was identified in the OAG Unit are shown on this ~~F~~figure. The occurrence of groundwater in the OAG Unit has been identified in three areas of the WCS property. The first, as previously discussed ~~are~~is the isolated occurrences of groundwater on the crest of the red bed ridge.

The second area is on the northwest portion of the WCS property outside the RCRA permitted boundary of the site. In this area, three piezometers (PZ-1, PZ-2, and PZ-16) indicated saturated conditions in the OAG Unit. The saturated thickness of the OAG unit in these piezometers ranges from 6 to 25 feet. To the southeast of these, ~~piezometers~~ piezometer PZ-5 is dry. Borings WB-4 and WB-8 are located to the south and also did not indicate the presence of groundwater. Based on the groundwater elevations of the three piezometers in this area, the groundwater flow direction is to the southeast.

The third occurrence of groundwater in the OAG Unit is generally to the east of the RCRA permitted boundary of the site. In this area, groundwater is present in the OAG at 14 piezometer~~s~~ locations with a saturated thickness ranging from 1 to 18 feet. Based on the groundwater elevations recorded from these 14 piezometers, the groundwater flow direction is to the east.

South of the permitted area the OAG Unit appears to be dry based on unsaturated conditions in 11 piezometers.

80 Foot Sandstone

The "80 foot" sandstone is a discontinuous saturated zone. Two wells are completed in this zone, PM-02 and PM-08. At these two locations groundwater is under confined conditions.

180 Foot Sandstone

The "180 foot" sandstone is a discontinuous saturated zone. ~~Of t~~The four wells completed in this zone, 4G, 5C, 6B1 and PM-09, indicate that the groundwater is under confined conditions.

Uppermost Aquifer

The uppermost aquifer at the site consists of the saturated "225 foot zone" in the Dockum Group. Currently there are nine sets of two nested monitor wells completed into the "225 foot zone". At each ~~monitor~~ location a monitor well is screened in the upper and lower portion of the "225 zone". The thickness of this zone at the existing monitor wells ranges from 26 to 30 feet. The two nested monitor wells at each location are completed with 15 feet of screen in the upper and lower portions of the water-bearing zone. The existing monitoring system of this zone consists of four upgradient monitor wells (MW-1A and B through MW-4A and B) and five downgradient monitor wells (DW-32A and B through DW-36A and B). In addition to the "225 foot" monitor wells, an additional supplemental monitor well (SW-32 through SW-36) has been completed in the unsaturated "125 foot zone" at each of the downgradient monitor well locations. The upgradient and downgradient wells are located on approximately 150-foot spacing.

Within the study area, there are currently 32 wells completed in the "225 foot zone" at 21 locations. The list of wells completed in the "225 foot zone" is shown on Table 6.6-1.

6.2.2 Monitor Well Groundwater Levels

Depth to groundwater measurements have been recorded in each of the site's monitor wells on a quarterly basis since the wells were installed. However, due to the low permeability of the "225 foot zone" and the withdrawal of groundwater for sampling purposes, static levels have not been achieved. Therefore, to determine the groundwater elevations needed to develop a gradient map of this zone, supplemental wells were used. The groundwater levels for the site monitor wells and the supplemental wells are presented in Table 6.5-1.

6.2.3 Limits of the Uppermost Aquifer

As previously discussed, the uppermost aquifer beneath the landfill ~~and~~ that is continuous across the site is the "225 foot zone". Structure maps of the top and the bottom of the uppermost aquifer are presented in Figures 6.5-11 and 6.5-12. This zone ranges in thickness from 11 to 30 feet in the study area.

6.2.4 Hydraulic Gradient

Based on the groundwater elevations from the wells and piezometers that were determined to be properly screened across only the "225 foot zone" and have stabilized groundwater levels, a table containing monthly gauging elevations was developed and is included as Table 6.6-2.

Horizontal Groundwater Gradient

Groundwater gradient maps have been constructed utilizing the semi-annual gauging events recorded in April 2003 and October 2003 (Figures 6.6-4 and 6.6-5). These two figures represent the groundwater elevation data collected during the spring and fall 2003 groundwater monitoring events. Included in the fall 2003 gradient map is the groundwater elevation for piezometer NMP-01, which was installed in May 2003.

The groundwater gradient maps for Spring and Fall 2003 are similar in both the direction and the magnitude of the gradient. The groundwater flow direction is to the south-southwest at an average gradient of 0.016 ft/ft across the site.

Groundwater Velocity

The velocity of the groundwater in the uppermost aquifer has been calculated based on the groundwater gradient, the hydraulic conductivity, and the porosity using the following expression:

$$\text{Groundwater velocity} = \frac{Ki}{\theta}$$

Two in-situ hydraulic conductivity tests have been conducted of the "225 foot zone" at monitor well locations MW-1B and DW-36A. The tests were conducted by lowering the water level in the wells and measuring the rate of recharge versus time. The resulting hydraulic conductivity values were calculated to be 6.0 x 10^{-8} cm/sec and 6.17 x 10^{-8} cm/sec for MW-1B and DW-36A, respectively. The geometric mean of the hydraulic conductivity as determined from the two field tests of the "225 foot zone" is 6.06 x 10^{-8} cm/sec. Five laboratory permeability tests were also conducted to evaluate the hydraulic conductivity of the "225 foot zone". The geometric mean of the hydraulic conductivity as determined from the five laboratory tests of core samples from the "225 foot zone" is 1.07 x 10^{-8} cm/sec. A geometric mean of the hydraulic conductivity in-situ and laboratory values (6.06 x 10^{-8} and 1.07 x 10^{-8} cm/sec) is 2.55 x 10^{-8} cm/sec.

The hydraulic gradient in the "225 foot zone" is approximately 0.016 ft/ft based on the 2003 groundwater gradient maps presented in Figures 6.6-4 and 6.6-5. A porosity value of 14% was used for calculation of velocity. This value is an average of four laboratory-determined porosity values. Porosity results for the core samples ranged from 8%-18%. These laboratory results are presented in Appendix 6.5-6.

The calculated groundwater velocity is:

$$\text{Groundwater velocity} = \frac{Ki}{\theta}$$

Hydraulic conductivity (K) = 2.55×10^{-8} cm/sec

Hydraulic gradient (i) = 0.016 ft/ft

Porosity (θ) = 0.14

$$= \frac{2.55E-08\text{cm/sec} \times 0.016\ \text{ft/ft} \times 86{,}400\text{sec/day} \times 365\text{day/yr} \times 1\text{ft}/30.48\text{cm}}{0.14}$$

Groundwater velocity = 0.003 ft/year

6.2.5 Gradient Variations

As previously discussed, the horizontal gradient of the "225 foot zone" is to the south-southwest at an average of 0.016 ft/ft based on two determinations in 2003. Over the past two years of monitoring groundwater levels, the groundwater gradient in the area of the landfill varies little between monitoring events from 0.015 to 0.017 ft/ft. The two in-situ hydraulic conductivity results at DW-36A and MW-1B are similar at 6.0 x10^{-8} and 6.13 x 10^{8} cm/sec. It should be noted that these in-situ hydraulic conductivity tests were able to be conducted on these wells because the groundwater recovered more rapidly following sampling events (i.e. over a period of 2 to 3 months) than in the remaining monitor wells. Therefore, if additional in-situ hydraulic conductivity tests were to be conducted on the remaining monitoring wells, these hydraulic conductivities would be expected to be less than the tests conducted. This would result in a decrease in the estimated groundwater velocity of the "225 foot zone".

~~The "225 foot zone" is under confined conditions with a hydraulic head of approximately 60 to 130 feet depending of the depth of the "225 foot zone" and location of the well point in relationship to the water level.~~

There does not appear to be communication between the "225 foot zone" and upper or lower water-bearing zones. Where present, the upper dscontinuous "180 foot" sandstone is mostly dry with only isolated lenses of groundwater. Where groundwater is present in the 180 foot ~~label~~ sandstone, the groundwater levels are significantly lower than the hydraulic head of the "225 foot zone". Therefore, it is unlikely that these two sandstone zones are in communication.

The first reported occurrence of groundwater beneath the "225 foot zone" is at an approximate depth of 600 feet below ground level. Although completion records of the site's southeast non-potable water supply well are not available, the total depth of the well has been measured at 850 feet below ground level. It is believed that this well is completed into the Trujillo Formation of the Dockum Group at about 600 feet below ground surface. The water level of the southeast supply well is at 290 feet below ground level. This water level is approximately 50 feet below the base of the "225 foot zone" and is approximately 150 feet below the hydraulic head of the "225 foot zone". The water level in the non-potable central supply well, which is believed to be completed in the Santa Rosa Formation between 1,140 and 1,400 feet below ground surface, is about 600 feet below ground surface. The very large hydraulic head differences between the "225 foot zone", the Trujillo Formation at 600 feet below ground surface, and the Santa Rosa Formation at 1,140 feet below ground surface indicates that there is virtually no vertical hydraulic communication in the Triassic Dockum Group in this area.

6.2.6 Conceptual Release Pathway

In the event of a breach of the landfill primary liner system, the following simplified conceptual model of the migration pathway is presented. If the leachate exits below the primary liner, the landfill's secondary landfill system would then prevent the leachate from migrating further.

In the event that the secondary liner system failed, the leachate collection system would collect leachate. The leachate collection system is designed to maintain a maximum leachate level of 1 foot in the base of the landfill.

The 1 foot of leachate would represent a minimal driving force for the downward migration of the leachate through the red bed claystone. With the approximate hydraulic conductivity of the claystone of 1 x 10^{-9} cm/sec, or 2.8 x 10^{-6} ft/day, and at a thickness of 40 feet below the base of the landfill and assuming a vertical downward gradient of 1 and a porosity of 0.14, it would require approximately 5,400 years at a velocity of 0.00739 ft/year (as calculated below), which does not include the time necessary to saturate the claystone, for leachate to reach the "125 foot" sandstone. The "125 foot" sandstone is currently being monitored with the SW series monitor wells that are located along the southern boundary of the site.

$$\text{Velocity} = \frac{1E-09\text{cm/sec x 1 ft/ft x 86,400sec/day x 365day/yr x 1ft/30.48cm}}{0.14}$$

=0.00739 ft/yr

The "125 foot" sandstone has an approximate permeability of 1 x 10^{-6} cm/sec, or 2.8 x 10^{-3} ft/day. Based on a thickness of 20 feet of this zone, it would require approximately 3 years for the leachate to migrate to the base of this zone and into the underlying claystone that has a permeability of approximately 1 x 10^{-9} cm/sec.

Assuming that the leachate would continue to move vertically through the underlying claystone, it would require approximately 13,500 years, at 0.00739 ft/yr, to reach the uppermost aquifer in the "225 foot zone" sandstone.

Totaling the estimated travel time through each of these three zones, it will require approximately 18,900 years for a release from the landfill to intersect the uppermost aquifer, at an approximate depth of 225 feet below ground level.

The groundwater velocity in the uppermost aquifer has been calculated to be 0.003 ft/year. Assuming that a water well was installed within 100 feet of the landfill into the uppermost aquifer and screened such that groundwater from this zone was harvested, it would require another ~~years~~30,000 years for the groundwater to intersect the well.

6.3 DETECTION MONITORING

As discussed in Section 6.2.6, it is estimated that it will require approximately 19,000 years for a release from the landfill to impact the groundwater and an additional 30,000 years for the affected groundwater to migrate to a well located within 100 feet of the landfill. However, a groundwater monitoring system is proposed. In the unlikely event that a release from the land disposal area were to occur and migrate to the uppermost water bearing zone or aquifer, the monitoring well system and the detection monitoring program are designed to provide a reliable indication of the presence of hazardous constituents in the ground water. The following sections describe the existing and proposed monitor well system, including well location, well design, and development; groundwater sampling procedures and frequency; detection monitoring parameters and analytical procedures; and data evaluation procedures.

6.3.1 Monitor Well Locations

Monitoring wells will be completed in the uppermost aquifer, which is located at an approximate depth of 225 feet below ground level at the downgradient limit of the waste disposal area. In addition, at each of the downgradient monitoring locations, supplemental observation wells will be completed in the upper dry sandstone/siltstone zone that occurs at an approximate depth of 125 feet below ground level.

Based on groundwater elevations measured in site piezometers completed in the uppermost aquifer, the groundwater gradient is to the south-southwest (Figure 6.6-4). The proposed detection monitoring system consists of 28 downgradient monitoring locations, including five locations at which monitoring wells have previously been installed (Figure 6.6-5). The location of the property boundary in relationship to the RCRA permitted boundary is shown on Figure 6.6-1. The location of borings in the area of the landfill are shown on Figure 6.5-1. The existing monitor wells are spaced on approximately 150-foot centers, and future monitor wells are proposed to be constructed at the same spacing. This spacing is appropriate for detection of a release, particularly in view of the extremely remote potential for a release to reach the uppermost aquifer. The point of compliance for the landfill monitoring system is also presented on Figure 6.6-6.

6.3.2 Monitor Well Design

Future monitor wells will be constructed in accordance with ASTM Method D5092, *Design and Installation of Groundwater Monitoring Wells in Aquifers*, and the requirements of the permit. The general specifications to which the existing monitor wells were constructed are presented in Table 6.6-4. Their construction provides for the collection of samples that are representative of ground-water quality at the point of compliance. The design and construction of future monitor wells are discussed below.

The monitor well boreholes will be drilled with air rotary techniques to a minimum depth of 1 foot into the confining redbed clay and claystone underlying the uppermost aquifer. The wells will be constructed with a minimum of 2-inch inside diameter (ID) flush threaded PVC casing, screen and end cap. The screen will be factory-slotted to 0.01 inches. The casing will be pre-cleaned and sealed for delivery on-site, or will be pressure washed prior to placement in the well. Casing centralizers will be placed in the borehole on approximately 50-foot centers to ensure proper placement of the filter pack and grout. A permanent mark or notch will be placed in the top of the casing at the surface for survey and groundwater gauging purposes. The top of the casing will be fitted with a seal cap.

At each location, the entire aquifer thickness will be screened with one or more wells having a screened interval no greater than 15 feet, resulting in a nest of wells at locations where the aquifer is greater than 15 feet in thickness. This manner of construction is consistent with the completion of the existing wells, and will be followed at future well locations. A properly sized, clean siliceous granular material (filter pack) will be placed in the annular space around the screen and will extend 2 to 3 feet above the top of the screen. A granular bentonite seal will be placed above the sand pack to a minimum thickness of 2 feet. Sufficient time will be allowed for the bentonite seal to be hydrated with native groundwater. In the event that the groundwater does not recharge to a thickness to hydrate the lower 2 feet of the bentonite seal within a reasonable time, deionized (DI) water may be used to hydrate the seal material. Samples of the DI water will be collected and analyzed for the parameters presented in Table 6.6-5. A cement bentonite grout will be placed above the bentonite seal to within 2 feet of the surface. Prior to construction of the surface completion, additional bentonite grout will be added if settlement occurs.

The well will be completed at the surface with a lockable steel protective casing, a concrete pad, and protective steel bollards. The concrete pad will extend into the annular space to the top of the cement bentonite grout and at the surface will be extend a minimum of 2 feet around the protective casing. The steel protective casing will be placed over the well casing and will extend a minimum of 2 feet below ground level. Protective steel bollards will be placed around the concrete pad and will extend to a minimum height of 4 feet.

Monitor well design and construction will be conducted under the supervision of a Texas Licensed Professional Geoscientist. A Texas Licensed Professional Geoscientist will submit a certification report within 60 days of installation of the proposed monitor wells. The certification report will include the following information:

- Name/number of the well;
- Intended use of the well;
- Date and time of the construction activities;
- A description of the drilling method;
- Surveyed location of the well and the ground surface and top of casing elevations;
- The diameter of the borehole and the casing diameter;
- The total well depth;
- A geologic boring log;
- The depth to the first saturated zone;
- Identification of well materials;
- The screen size and the screened interval;

- The volume of the sand filter pack, bentonite seal, and bentonite grout;
- Placement method of the filter pack, bentonite seal, and bentonite grout;
- Surface construction as built drawing, including a description of the protective casing, bollards, and the size of the concrete well pad; and
- Well development procedures.

The general design of the proposed monitor wells is shown on Figure 6.6-7.

6.3.3 Monitor Well Development

Newly installed monitor wells will be developed prior to the initial sampling event to repair borehole wall smearing that may have resulted from drilling and to remove fines from the well and filter pack. Well development will be conducted by a combination of surging, pumping, and bailing the groundwater in the well. Initially, the well will be surged using an inert surge plug of a diameter slightly less than the ID of the well casing. The surge plug will be moved up and down through the screened interval of the well to force groundwater across the filter pack and borehole wall. Groundwater will then be pumped from the bottom of the well to remove fines that have entered the casing. This procedure will be repeated until groundwater conditions stabilize based on visual observations of turbidity. Once the sample appears to be relatively free of sediment or the sediment content has stabilized, groundwater will be field-tested for pH and conductivity. Well development will be deemed complete after these field measurements have generally stabilized.

6.3.4 Groundwater Sampling Procedures

Prior to the collection of groundwater samples, the monitor well surface completion will be inspected to evaluate the integrity of the well. If the result of the inspection determines that general maintenance of the well is required, such action will be completed and noted in the Annual Groundwater Monitoring Report. (Note: if the integrity of the well has been compromised such that the collection of a representative sample can not be performed, the a proposal for replacement of the damaged well will be submitted to TCEQ within ninety days of the date of the inspection that identified the deterioration.)

Until April 2003, the wells were generally purged prior to sampling. However, historically slow recharge of the uppermost aquifer precluded the groundwater from fully recovering between semi-annual sampling events. Purging the wells prior to sampling was discontinued in April 2003, as authorized by a permit modification approved by the TCEQ on February 26, 2003. Because groundwater is so slow to recharge, purging of the groundwater prior to sampling is not required to insure that "fresh groundwater" is available for collection during sampling and wells will not be purged prior to sampling.

Prior to the collection of a groundwater sample, the water level in the detection monitoring and supplemental wells (if present) will be gauged using an electric line tape and recorded to the nearest 0.01 foot. Groundwater samples will be collected using new, clean, dedicated or disposable bailers fabricated of inert materials or dedicated pumps. Measurement of pH, conductivity and temperature will be conducted and recorded in the field.

The groundwater samples will be placed in laboratory supplied containers that will include preservatives as required. The samples will be placed in cooled ice chests for storage and shipment to the laboratory under standard chain-of custody procedures.

The supplemental wells will be gauged during each groundwater sampling event. In the event that liquid is identified in the supplemental wells, a sample will be collected in the same manner as described for the detection monitoring wells.

6.3.5 Groundwater Sampling Frequency

An evaluation of groundwater recharge rates and the groundwater gradient in the water bearing zone of interest at the WCS site has been performed. The purpose of the evaluation was to estimate the amount of time necessary for "new" groundwater to be available for sampling based on site-specific conditions. "New" groundwater is desired to be sampled at each monitoring event so that independent samples are collected for data evaluation purposes, as required by applicable regulations.

Assuming purging is not conducted before sample collection, the volume of groundwater removed to conduct the required laboratory analysis is approximately 3 gallons or 0.401 ft^3.

The radius of influence of this volume of removed water in the water-bearing zone of interest is estimated at 0.733 ft, as calculated below.

Volume (V) of water removed = 0.401 ft^3

Water-bearing zone of interest screen length (h) = 15 ft

Water-bearing zone of interest porosity (θ) = 14 percent

$$= \frac{\sqrt{V}}{\sqrt{p?h}}$$

$$= \frac{\sqrt{0.401 \text{ft}^3}}{\sqrt{p x 0.14 x 15 ft}}$$

radius = 0.246 ft

In order for "new" and "independent" groundwater for a sampling event to occupy a well after a sampling event, groundwater must flow under natural conditions from the upgradient end of the radius of influence to the downgradient end, i.e., a total distance of 2 x 0.246 ft, or 0.492 ft. Another way to say this is that although one would expect water to refill the well from 360 degrees, only the water from upgradient is new water, or water that has not been sampled previously. Therefore, it takes water that moves twice the distance of the radius of influence to be new water.

The minimum time taken for "new" groundwater to occupy the sampling volume and provide an "independent" sample is about 164 years (0.492 ft divided by 0.003 ft/year) for a porosity of 0.14.

These calculations approximating site-specific conditions of the water-bearing zone of interest demonstrate that the interval between sampling events must be much longer than a year in order to collect independent samples from the monitoring wells at each sampling event.

Although it is estimated that a period of ~~54~~164 years will be required for independent groundwater to be available for sampling, the current groundwater sampling frequency of staggered semi-annual monitoring will be continued. Samples will be collected in the first month of the second and fourth quarters of the calendar year (April and October). The monitor well pairs at each of the downgradient locations will be sampled every other 6month period. Therefore, as presently being conducted, the even numbered paired wells will be sampled in the first semi-annual sampling event and the odd numbered paired wells will be sampled in the second semi-annual sampling event.

As discussed in Section 6.3.7, data evaluation procedures do not involve comparison of downgradient monitoring data to background data. In addition, given the very slow rate of groundwater flow as previously discussed, any wells located upgradient of the waste management area are so far removed from the point of compliance in terms of time of travel that they are not likely to represent the same data population for the naturally-occurring parameters as that present along the point of compliance. Consequently, no sampling of the upgradient monitor wells is proposed.

6.3.6 Analytical Parameters

A list of the analytical parameters, analytical method, detection limit, and concentration limits is presented in Table 6.6-5. The parameters listed in Table 6.6-5 will provide a reliable and early indication of any groundwater contamination at the site. General water quality parameters of pH (field), conductivity (field), Total Organic Carbon (TOC), and total phenolics will provide useful information regarding the general quality of the groundwater and as general indicators of contamination. The list of analytical parameters was approved by the TCEQ in a permit modification authorization dated October 7, 2003.

The metal parameters that are currently being analyzed in the groundwater monitor wells include arsenic, cadmium, nickel, and selenium. These metals were selected based on an analysis of mobility of several metals that were identified in leachate samples collected from four landfill cells in March of 2002 (Table 6.6-6).

Of the eight RCRA metals, antimony, beryllium, chromium, and silver were not detected in any of the leachate samples and were therefore eliminated as reliable indicators of groundwater contamination. Each of the remaining metals was further evaluated in terms of mobility.

Mobility was evaluated in terms of the potential for transfer of the metal from the soil matrix to the groundwater matrix. The soil-leachate partition factor (Ksw), which represents the conventional three-phase equilibrium partitioning relationship among the soil, pore water, and pore vapor phases of the soil matrix, was used as the relative measure of mobility. Calculation of the soil-leachate partition factor is a function of a pH-dependent soil-water sorption coefficient (Kd). Soil-leachate partition factors were calculated for each metal using the Kd coefficients for pH levels of 5, 6, 7, and 8. The calculations are summarized on Table 6.6-7.

Concentration-weighted mobility factors were then calculated for soil pH values of 6, 7, and 8, since soils at the site were anticipated to fall within the neutral to alkaline range, using the maximum and average leachate concentrations as shown on Table 6.6-6. The calculations of concentration-weighted mobility factors are summarized on Table 6.6-8. The metals were then ranked, based on the concentration-weighted mobility factors. Table 6.6-9 provides the concentration/mobility rankings in descending order for the metals, based on maximum leachate concentrations, for soil pH values of 6, 7, and 8. The concentration/mobility rankings for the metals based on average leachate concentrations are provided in descending order in Table 6.6-10 for soil pH values of 6, 7, and 8.

Review of Tables 6.6-9 and 6.6-10 demonstrates that arsenic is the first or second-highest ranking constituent in both tables for all soil pH values. Therefore, arsenic was selected as a detection monitoring parameter. The top five highest ranking metals other than arsenic on Tables 6.6-9 and 6.6-10 for all three pH levels are identified below, together with the number of times the metal was in the top five.

Metal	Number of Top Five Occurrences
Nickel	6
Selenium	6
Barium	5
Cobalt	4
Cadmium	3

Of these five metals, WCS proposes to include nickel, selenium, and cadmium as detection monitoring parameters. Including arsenic, this yields a total of four metals proposed for the detection monitoring program. Cadmium was selected instead of cobalt and barium since these two metals have much higher acceptable levels in groundwater. The current maximum allowable concentrations of these constituents in groundwater are 1.5 mg/L for cobalt (TRRP Tier 1 Residential Groundwater PCL) and 2.0 mg/L for barium (EPA Maximum Contaminant Level), while the maximum allowable concentration of cadmium in groundwater is 0.005 mg/L.

The organic parameters for the groundwater monitoring program were selected based on a review of the waste characteristics, detected organic constituents in the landfill leachate, and the relative mobility of organic compounds. Table 6.6-11 identifies the organic constituents detected in the landfill leachate, their concentration, and data relative to environmental mobility for these parameters.

The specific organic parameters proposed for the detection monitoring program consist of the priority pollutant volatile organics, excluding methylene chloride, 2-chloroethylvinylether, acrolein, and acrylonitrile; plus acetone and carbon disulfide. In addition, WCS proposes to include phenol, which is a semi-volatile (acid-extractable) organic, and 1,4-dioxane, which can be analyzed as a volatile or as a semi-volatile (base/neutral) organic.

Priority pollutants were identified by EPA under the NPDES program as the most prevalent chemicals in industry. Due to their prevalence and mobility, this subset of organic constituents has been determined to be a reliable indicator of ground water contamination at numerous federal Superfund sites. As a class, the volatile organic constituents are more mobile in the environment than the semi-volatile organic constituents. Many of the organic constituents detected in the leachate from the WCS landfill are volatile organics. Further, the priority pollutant volatile organics include chlorinated organic compounds that were not detected in these particular leachate samples, but are prevalent in commerce and in many areas of impacted ground waters across the country.

Other organic constituents detected in the landfill leachate would generally be less mobile than the proposed volatile organics, and if a release from the landfill were to occur and impact groundwater quality, volatile organics would be expected to be present. As such, the volatile organics will provide a reliable indication of any organic constituents that may reach groundwater at the site. However, since phenol exhibits a similar mobility (based on the Kd for this compound), this semi-volatile organic will also be included as a detection monitoring parameter.

Methylene chloride will not be included as a monitoring parameter due to its common detection as a laboratory contaminant. In addition, 2-chloroethylvinylether is not included since it is a constituent listed in Appendix VIII of 40 CFR Part 261, but was not included as a constituent in Appendix IX of 40 CFR Part 264. Acrolein and acrylonitrile are not included because the laboratory reporting limit for each of these constituents is 20 µg/L and the Appendix IX PQL for each is 5 µg/L. Acetone and carbon disulfide, which are not priority pollutants, are included in the proposed volatile organic monitoring parameters since they were detected in the landfill leachate. WCS proposes to analyze for 1,4-dioxane using EPA Method 8270 for semi-volatile organics, since this method has a significantly lower reporting limit than Method 8260. Table 6.6-12 identifies the detection monitoring parameters and the methods for chemical analysis of the parameters.

6.3.7 Data Evaluation and Response

The results of the groundwater analyses obtained for each monitoring event will be evaluated to assess whether any indication of contamination is evident. The volatile organic priority pollutants, carbon disulfide, acetone, 1,4-dioxane, and phenol do not occur naturally in soils and/or groundwater. Consequently, these parameters will be evaluated for indication of a statistically significant increase by direct comparison to the PQL values listed in Appendix IX of 40 *CFR* Part 264. These PQLs represent the lowest concentrations of analytes in ground waters that can be reliably determined within specified limits of precision and accuracy under routine operating conditions.

Due to the large number of organic constituents being monitored and the part per billion concentration ranges of the PQLs, there is a significant probability over time that one or more of these constituents will be reported in one or more samples due to artifacts of the sampling and analytical process, rather than as a result of the actual presence of the constituent in the groundwater. To verify a reported organic constituent is actually present in the groundwater, a resample event will be included as part of the procedure for determination of a statistically significant increase.

In the event that an apparent statistically significant increase is identified for any well in a given monitoring event, the well(s) will be resampled as soon as possible and the samples(s) will be analyzed for the parameter(s) for which apparent statistically significant increases were identified. If the resampling data also indicates a statistically significant increase, the increase will be considered to be confirmed, and the TCEQ Executive Director will be notified in writing within seven days of the confirmation. In addition, WCS will immediately sample the groundwater in all monitoring wells that exhibit a confirmed statistically significant increase, analyze these samples for the hazardous constituents listed in 40 CFR Part 264, Appendix IX, and comply with all other applicable requirements of 30 TAC §335.164(7).

The potential for metals to reach the uppermost water bearing zone or aquifer, if a release occurred from the landfill, is limited by sorption and other attenuation processes that metals undergo. These attenuation processes represent a significant reduction in the potential concentration of metals that could reach the uppermost water bearing zone at approximately

225 feet below ground surface. Given these migration-limiting circumstances applicable to metals, and the fact that other parameters not subject to the same degree of attenuation will be evaluated, metals data will not be evaluated statistically. WCS will evaluate the metals data qualitatively through review of graphs of concentration over time and include a discussion of the qualitative data evaluation in the annual groundwater monitoring report.

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TABLES

TABLE 6.3-1
WASTE CONTROL SPECIALISTS LLC
WATER WELLS WITHIN A 2-MILE RADIUS OF THE LANDFILL SITE IN 2004

State	Longitude W	Latitude N	Elevation (feet msl)	Owner	Total Depth (feet)	Date Drilled	Aquifer	Depth to Water (feet)	Measurement Date
TX	103.0444	32.4603	3491	Ed Tinsley	Unknown	00/00/40?	Ogallala	82.47	11/15/74
TX	103.0350	32.4275	3495	Bill Vance	Unknown	Unknown	Ogallala	78.55	12/10/65
TX	103.0314	32.4278	3477	Flying W Ranch	80	Unknown	Ogallala	Unknown	Unknown
NM	103.0845	32.4695	3552	Hard B. Tapp	Unknown	Unknown	Unknown	Unknown	Unknown
TX	103.0111	32.4437	3475	Ralph McWhorter	85	10/13/78	Ogallala	Dry	10/13/78
NM	103.0862	32.4751	3530	Seth Brown	Unknown	Unknown	Unknown	Unknown	Unknown
NM	103.0977	32.4674	3487	W&W.O. Stephens	Unknown	Unknown	Unknown	Unknown	Unknown
NM			3497	Paul Wallach	65	00/00/50	Triassic	36.39	Unknown
NM			3472	Parabo, Inc.	Unknown	00/00/85?	Ogallala	53.5	Unknown

TABLE 6.3-2
WASTE CONTROL SPECIALISTS LLC
SUMMARY OF WATER WELL GROUNDWATER-QUALITY CHARACTERISTICS IN WESTERN ANDREWS COUNTY, TEXAS AND EASTERN LEA COUNTY, NEW MEXICO

	Well No. 26-40-201	Well No. 26-40-201	Well No. 26-40-601	Well No. 26-40-601	Well No. 26-40-602	Parabo, Inc. MW-79*
Aquifer	Ogallala		Ogallala		Ogallala	Triassic
Well Depth (feet)	Unknown		Unknown		80	
Sample Date	10/09/80	05/22/96	10/09/80	08/01/74	10/10/90	01/28/87
Calcium (mg/L)	206	NR	62	60	78	340
Magnesium (mg/L)	17	NR	8	11	21	41.5
Sodium (mg/L)	92	NR	20	20	36	239
Bicarbonate (mg/L)	205	166	233	231	249	NR
Sulfate (mg/L)	196	150	19	15	39	359
Chloride (mg/L)	265	317.5	8	9	39	723
Nitrate (mg/L)	65.5	NR	23.2	24	4.07	NR
Fluoride (mg/L)	0.4	0.51	0.8	1	0.76	NR
Silica (mg/L)	53	34.3	44	39	43	NR
TDS (mg/L)	1070	NR	308	293	429	2386
Cond (mmhos/cm^3)	1250	1109	415	437	459	2450
pH	8.1	8.15	8.0	8.0	7.14	NR

mg/L = miligrams per liter
mmhos/cm = micromhos per cubic centimeter
NR Not Reported

* Terra Dynamics 1993

TABLE 6.4-1
WASTE CONTROL SPECIALISTS LLC
HISTORICAL SEISMIC ACTIVITY WITHIN 250 KM (155 MILE) RADIUS
FACILITY (322.433N, 103.05W)

DATE	LOCATION		DISTANCE	DISTANCE	INTENSITY	MOMENT MAGNITUDE
	LATITUDE (N)	LONGITUDE (W)	(MILES)	(KM)		
08/16/31	30.6	104.1	140	225	VIII	
08/16/31	30.6	104.1	140	225		
08/16/31	30.6	104.1	140	225		
08/16/31	30.6	104.1	140	225		
08/16/31	30.6	104.1	140	225		
08/16/31	30.6	104.2	143	230	VIII	
08/16/31	30.7	104.6	150	241		
08/16/31	30.7	104.6	150	241		
08/18/31	30.6	104.1	140	225		
08/18/31	30.7	104.6	150	241	V	
08/18/31	30.7	104.6	150	241		
08/19/31	30.6	104.1	140	225	V	
08/19/31	30.6	104.1	140	225	VI	
08/19/31	30.7	104.6	150	241	III	
08/26/31	30.6	104.1	140	225	III	
08/26/31	30.7	104.6	150	241	III	
11/03/31	30.7	104.6	150	241	III	
12/20/35	34.4	103.2	136	219	V	
01/08/36	32.4	104.2	67	108	II	
01/08/36	32.4	104.2	67	108	II	
02/02/49	32.4	104.2	67	108	IV	
02/02/49	32.4	104.2	67	108		
05/22/52	33	105	120	193	IV	
01/27/55	30.6	104.5	152	245	IV	
01/27/55	30.6	104.5	152	245	IV	
01/27/55	30.6	104.5	152	245	IV	
12/10/61	32.24	103.86	49	79		
12/10/61	32.26	103.86	48	77		
12/10/61	32.263	103.865	48	77		
03/06/62	31.08	104.55	128	206		
02/11/64	34.35	103.73	138	222		
11/08/64	31.9	103	37	60		
11/08/64	31.93	102.98	35	56		
11/21/64	31.9	103	37	60		
11/21/64	31.92	102.98	35	56		
02/03/65	31.9	103	37	60		
02/03/65	31.92	102.96	35	56		
08/30/65	31.92	102.98	35	56		
08/30/65	32	102.3	53	85	IV	
08/30/65	32.08	102.42	44	71	IV	
08/30/65	32.1	102.3	49	79	IV	
08/30/65	32.1	102.3	49	79		
08/14/66	31.7	103.1	50	80	VI	
08/14/66	31.92	102.98	35	56		
08/14/66	32	102.6	40	64	VI	
08/14/66	32	102.6	40	64	VI	
08/14/66	32.12	102.34	47	76	VI	
05/02/68	33.02	105.27	135	217		

TABLE 6.4-1
WASTE CONTROL SPECIALISTS LLC
HISTORICAL SEISMIC ACTIVITY WITHIN 250 KM (155 MILE) RADIUS
FACILITY (322.433N, 103.05W)

DATE	LOCATION		DISTANCE	DISTANCE	INTENSITY	MOMENT MAGNITUDE
	LATITUDE (N)	LONGITUDE (W)	(MILES)	(KM)		
05/02/68	33.02	105.27	135	217		
07/30/71	31.64	103.17	55	89	III	
07/30/71	31.7	103	50	80	III	
07/30/71	31.7	103.1	50	80	III	
07/30/71	31.72	102.996	49	79		
07/30/71	31.74	103.09	48	77		
07/31/71	31.59	103.12	58	93		
07/31/71	31.65	103.12	54	87	IV	
07/31/71	31.7	103.1	50	80	IV	
07/31/71	31.7	103.1	50	80	IV	
07/31/71	31.703	103.061	50	80		
09/24/71	31.6	103.2	58	93		
09/24/71	31.63	103.18	56	90		
07/26/72	32.68	103.98	56	90		
07/26/72	32.68	103.98	56	90		
10/02/74	31.98	100.71	140	225		
11/12/74	32.06	100.98	123	198		
11/28/74	32.3	104.1	61	98	IV	
11/28/74	32.31	104.14	63	102		4
11/28/74	32.31	104.14	64	103		
11/28/74	32.311	104.143	64	103		
11/28/74	32.63	104.01	57	92		
11/28/74	33.765	104.99	144	232		
12/30/74	30.92	103.11	104	167		
12/30/74	30.92	103.11	104	167		
08/01/75	30.57	104.49	154	248	II	
08/01/75	30.65	104.57	152	245		
08/01/75	31.42	104.01	89	144		5
08/01/75	31.425	104.012	89	143		
01/19/76	30.9	103.1	37	60		
01/19/76	31.9	103.077	37	60		
01/19/76	31.9	103.08	37	60		4
01/19/76	31.9	103.09	37	60	IV	
01/22/76	31.9	103.07	37	60	III	
01/22/76	31.9	103.07	37	60		3
01/22/76	31.9	103.07	37	60		
01/22/76	31.9	103.071	37	60		
01/25/76	31.9	103.08	37	59		4
01/25/76	31.9	103.09	37	60	V	
01/25/76	31.902	103.08	37	60	V	
01/25/76	31.93	103.09	35	56		
04/03/76	31.3	103.17	78	126		
04/21/76	32.21	103.1	16	26		
04/21/76	32.21	103.1	16	26		
05/01/76	32.27	103.14	12	19		
05/01/76	32.4	103.1	3	5		
08/05/76	31.57	103.02	60	97		
08/05/76	31.57	103.02	60	97		

TABLE 6.4-1
WASTE CONTROL SPECIALISTS LLC
HISTORICAL SEISMIC ACTIVITY WITHIN·250 KM (155 MILE) RADIUS
FACILITY (322.433N, 103.05W)

DATE	LOCATION		DISTANCE	DISTANCE	INTENSITY	MOMENT MAGNITUDE
	LATITUDE (N)	LONGITUDE (W)	(MILES)	(KM)		
09/17/76	31.4	102.5	78	126		
09/17/76	32.21	103.1	16	26		
09/17/76	32.21	103.1	16	26		
09/19/76	30.69	104.43	144	232		
12/19/76	32.259	103.08	12	19		
12/19/76	32.26	103.08	12	19		
04/07/77	32.23	103.07	14	23	IV	
04/07/77	32.23	103.07	14	23		
04/26/77	31.9	103.08	37	59		3
04/26/77	31.9	103.08	37	60		
04/26/77	31.902	103.083	37	60		
04/26/77	32	103.1	30	48		
06/07/77	32.85	100.9	128	206		
06/07/77	32.858	100.77	135	217		
06/07/77	33.058	100.749	140	225		
06/07/77	33.06	100.75	141	227		4
06/07/77	33.13	100.94	131	211		
06/08/77	32.7	100.72	136	219		
06/08/77	32.8	100.9	127	204		
06/08/77	32.858	100.77	135	217		
06/08/77	32.89	100.95	126	203		
06/17/77	32.346	100.4	154	248		
06/17/77	32.35	100.4	154	248		
07/22/77	31.8	102.7	48	77		
11/27/77	32.862	100.68	140	225		
11/27/77	33.03	101.08	121	195		
11/28/77	32.95	100.84	134	216		4
11/28/77	32.954	100.837	133	214		
11/28/77	32.96	100.88	131	211		
11/28/77	33.022	100.84	134	216		
02/18/78	31.35	104.56	115	185		
03/02/78	31.52	102.41	73	117		
03/02/78	31.55	102.5	69	111	V	
03/02/78	31.56	102.51	68	110		4
03/02/78	31.562	102.512	68	109	III	
06/16/78	32.87	100.99	123	198		
06/16/78	32.961	100.79	136	219		
06/16/78	32.99	100.88	131	211		
06/16/78	33.03	100.766	138	222		
06/16/78	33.03	100.77	138	222	V	
06/16/78	33.03	100.77	139	224		5
06/16/78	33.067	101.19	116	187		
06/16/78	33.1	101.2	117	188		
06/29/78	31.05	101.94	115	185		
07/05/79	32.9	101.31	105	169		
07/05/79	32.949	100.895	130	209		
07/05/79	32.95	100.89	130	210		3
07/05/79	33	100.92	130	209		

TABLE 6.4-1
WASTE CONTROL SPECIALISTS LLC
HISTORICAL SEISMIC ACTIVITY WITHIN 250 KM (155 MILE) RADIUS
FACILITY (322.433N, 103.05W)

DATE	LOCATION		DISTANCE	DISTANCE	INTENSITY	MOMENT MAGNITUDE
	LATITUDE (N)	LONGITUDE (W)	(MILES)	(KM)		
08/03/79	32.85	100.94	125	201		
08/03/79	32.851	100.74	137	220		
05/08/81	32.212	101.51	91	146		
11/10/81	32	100.67	142	229	III	
01/04/82	31.18	102.49	93	149		4
01/04/82	31.18	102.49	92	148		
01/04/82	31.182	102.492	92	148		
04/26/82	33.02	100.84	135	217		3
04/26/82	33.02	100.84	134	216		
04/26/82	33.021	100.844	134	216		
11/09/82	31.99	100.7	142	228		3
11/28/82	33	100.8	136	219		
11/28/82	33	100.84	135	217		3
11/28/82	33.003	100.842	134	216	IV	
09/11/84	31.991	100.697	140	225		
09/11/84	32	100.7	140	225		
09/19/84	32.027	100.688	140	225		
09/19/84	32.027	100.688	140	225		
09/19/84	32.03	100.69	142	228		3
12/04/84	32.26	103.56	31	50		3
12/04/84	32.266	103.556	32	51		
12/04/84	32.266	103.556	32	51		
01/25/86	32.06	100.73	139	223		3
01/25/86	32.064	100.733	137	220		
01/30/86	32.066	100.693	140	225	IV	
01/30/86	32.07	100.69	140	226		3
01/02/92	32.33	103.1	7/11*	11/18		5
01/02/92	32.336	103.101	7/11*	11/18	V	
08/26/92	32.17	102.71	27	44		3
06/23/93	31.35	102.51	82	132		3
04/14/95	30.28	103.35	149	240		6
04/14/95	30.3	103.35	148	238		3
04/14/95	30.3	103.35	148	238		3
04/14/95	30.3	103.35	148	238		3
04/14/95	30.3	103.35	148	238		3
04/14/95	30.3	103.35	148	238		2
04/14/95	30.3	103.35	148	238		3
04/14/95	30.3	103.35	148	238		2
04/14/95	30.3	103.35	148	238		3
04/14/95	30.3	103.35	148	238		3
04/14/95	30.3	103.35	148	238		2
04/15/95	30.27	103.32	150	241		4
04/15/95	30.3	103.35	148	238		2
04/16/95	30.3	103.35	148	238		2
04/16/95	30.3	103.35	148	238		3
04/16/95	30.3	103.35	148	238		2
04/17/95	30.3	103.35	148	238		3
04/21/95	30.3	103.35	148	238		3

TABLE 6.4-1
WASTE CONTROL SPECIALISTS LLC
HISTORICAL SEISMIC ACTIVITY WITHIN 250 KM (155 MILE) RADIUS
FACILITY (322.433N, 103.05W)

DATE	LOCATION		DISTANCE	DISTANCE	INTENSITY	MOMENT MAGNITUDE
	LATITUDE (N)	LONGITUDE (W)	(MILES)	(KM)		
06/01/95	30.3	103.35	148	238		4
07/06/95	30.3	103.35	148	238		3
07/06/95	30.3	103.35	148	238		3
11/12/95	30.3	103.35	148	238		4
04/15/98	30.19	103.3	Unknown	Unknown		4
03/01/99	32.57	104.66	93	150		3
03/14/99	32.59	104.63	92	148		4
03/17/99	32.58	104.67	94	151		4
05/30/99	32.58	104.66	94	151		4
08/09/99	32.57	104.59	89	144		3
02/02/00	32.58	104.63	91	147		3
02/26/00	30.24	103.61	155	249		3
06/02/01	32.33	103.14	9	14		3
11/22/01	31.79	102.63	52	83		3
09/17/02	32.58	104.63	92	148		4
09/17/02	32.58	104.63	92	148		3
06/21/03	32.67	104.5	85	137		4

Sources: National Oceanographic and Atmospheric Administration (1992)
United States Geological Survey (2004) http://neic.usgs.gov/

Definition of I Tremor not felt, or rarely felt only under especially favorable conditions
II Tremor felt indoors by few people; may cause slight movement of liquids and suspended or delicate objects
III Tremor felt indoors by several people; may cause swinging of suspended objects; movement may be appreciable on upper levels of tall buildings
IV Tremor felt indoors by many people; causing dishes and windows to rattle; noticeable movement of delicate objects
V Tremor felt by nearly all people; causes breakage of many delicate objects (dishes, glassware, etc); trees and bushes shaken slightly
VI Tremor felt by all people, both indoors and outdoors; causes considerable breakage of delicate objects, movement of furnishings, slight cracking of chimneys and plaster wall material.
VIII Fright, general alarm approaches panic; twisting fall of chimneys, columns, monuments and partial collapse of buildings, homes, etc.; moved, overturned very heavy furniture; sand and mud ejected in small amounts

Moment Magnitude: Moment Magnitude is the measure of total energy released by an earthquake, and is based on the area of the fault that ruptured in the earthquake.

* USGS location is at 7 miles: New Mexico Tech location is at 11 miles

TABLE 6.4-2
WASTE CONTROL SPECIALISTS LLC
EROSION RATE MEASUREMENTS AND ESTIMATES FOR THE SOUTHERN HIGH PLAINS

SOURCE	RATE ESTIMATE			BASIS FOR ESTIMATE
Short-term measurements of erosion rates on varied soil types, slopes, and vegetation densities				
	Minimum	Maximum	Unit	
1980 Finley & Gustavson	0.039	0.079	in/yr	Slope denudation for single thunderstorm
1980 Baumgardner	0.016	0.000	in/yr	Extrapolation from 9 years of water data
1981 Finley & Baumgardner	0.000	4.331	in/yr	Vertical scarp retreat
1981 Finley & Baumgardner	0.020	0.000	in/yr	Monitored erosion pins, mean rate
1981 Finley & Baumgardner	0.031	0.079	in/yr	Suspended sediment load
1981 Gustavson et al.	0.004	0.039	in/yr	Stream drainage basins
1981 Gustavson et al.	0.024	0.118	in/yr	Reservoir sedimentation
1981 Gustavson et al.	0.024	0.079	in/yr	Universal soil loss equation
1982 Simpkins et al.	0.106	0.311	in/yr	Monitored erosion pins, means, all slopes
1982 Simpkins et al.	1.142	3.425	in/yr	Retreat rates for vertical scarps only
1982 Simpkins et al.	0.000	2.087	in/yr	Erosion pins, maximum net erosion rate
1986 Simpkins	0.079	1.102	in/yr	Maximum rates, 2 to 4 years erosion data
1986 Simpkins	0.315	0.669	in/yr	Erosion rates, Ogallala caliche only
1986 Simpkins	2.638	28.504	in/yr	Erosion of unconsolidated alluvium only
1989 Gustavson & Simpkins	0.394	0.787	in/yr	Summary compilation of all data
Long-term qualitative estimates of erosion rates based on geomorphic histroy				
1980 Gustavson		5.118	in/yr	Caprock retreat, past 7,200 - 8,600 years
1980 Gustavson		7.087	in/yr	Caprock retreat, past 600,000 years
1980 Gustavson		4.331	in/yr	Caprock retreat, past 3 million years
1980 Gustavson		1.575	in/yr	Widening, Canadian River Valley, 0.6 million years
1982 Simpkins & Baumgardner		7.480	in/yr	Caprock retreat, maximum past 600,000 years
1984 Ostercamp & Wood		1.969	in/yr	Caprock retreat, past ca. 3 million years
1989 Gustavson & Simpkins	2.362	7.087	in/yr	Summary compilation of all data

TABLE 6.5-1

WASTE CONTROL SPECIALISTS LLC
BOREHOLE SUMMARY

		Boring ID		Boring ID		Boring ID		Boring ID
1993 RCRA SITE INVESTIGATION Terra Dynamics/Holt	1	B-1	16	B-16	31	B-31	46	B-42
	2	B-2	17	B-17	32	B-32	47	B-43
	3	B-3	18	B-18	33	B-33	48	B-44
	4	B-4	19	B-19	34	B-34	49	B-45
	5	B-5	20	B-20	35	B-35	50	B-46
	6	B-6	21	B-21	36	B-36	51	B-47
	7	B-7	22	B-22	37	B-37	52	B-48
	8	B-8	23	B-23	38	B-38	53	B-49
	9	B-9	24	B-24	39	B-39	54	B-50
	10	B-10	25	B-25	40	B-40	55	B-51
	11	B-11	26	B-26	41	B-41	56	B-52
	12	B-12	27	B-27	42	B-41E	57	B-53
	13	B-13	28	B-28	43	B-41S	58	B-54
	14	B-14	29	B-29	44	B-41N	59	B-55
	15	B-15	30	B-30	45	B-41W		
1997 MUNICIPAL LANDFILL INVESTIGATION Weaver Boos	60	WB-1	67	WB-8	74	WB-15	81	WB-107
	61	WB-2	68	WB-9	75	WB-101	82	WB-108
	62	WB-3	69	WB-10	76	WB-102	83	WB-109
	63	WB-4	70	WB-11	77	WB-103	84	WB-110
	64	WB-5	71	WB-12	78	WB-104	85	WB-111
	65	WB-6	72	WB-13	79	WB-105		
	66	WB-7	73	WB-14	80	WB-106		
1998 11(e)2 Siting Investigation Holt	86	A-1	103	A-18	120	NMB-1	137	NMB-25
	87	A-2	104	A-19	121	NMB-2	138	NMB-26
	88	A-3	105	A-20	122	NMB-3	139	NMB-27
	89	A-4	106	A-21	123	NMB-4	140	NMB-28
	90	A-5	107	A-22	124	NMB-5	141	NMB-29
	91	A-6	108	A-23	125	NMB-6	142	NMB-30
	92	A-7	109	A-24	126	NMB-7	143	NMB-31
	93	A-8	110	A-25	127	NMB-10	144	NMB-32
	94	A-9	111	A-26	128	NMB-11	145	NMB-33
	95	A-10	112	A-27	129	NMB-12	146	NMB-34
	96	A-11	113	A-28	130	NMB-13	147	NMB-35
	97	A-12	114	B-1-98	131	NMB-14	148	NMB-36
	98	A-13	115	B-2-98	132	NMB-17	149	NMB-37
	99	A-14	116	B-3-98	133	NMB-19	150	NMB-38
	100	A-15	117	B-4-98	134	NMB-22		
	101	A-16	118	B-5-98	135	NMB-23		
	102	A-17	119	B-6-98	136	NMB-24		

TABLE 6.5-1

WASTE CONTROL SPECIALISTS LLC
BOREHOLE SUMMARY

		Boring ID		Boring ID		Boring ID		Boring ID
1999 Texas Tech University Investigation	151	PZ-1	160	PZ-10	169	PZ-19	178	PZ-28
	152	PZ-2	161	PZ-11	170	PZ-20	179	PZ-29
	153	PZ-3	162	PZ-12	171	PZ-21	180	PZ-30
	154	PZ-4	163	PZ-13	172	PZ-22	181	PZ-31
	155	PZ-5	164	PZ-14	173	PZ-23	182	PZ-32
	156	PZ-6	165	PZ-15	174	PZ-24	183	PZ-33
	157	PZ-7	166	PZ-16	175	PZ-25	184	PZ-34
	158	PZ-8	167	PZ-17	176	PZ-26	185	PZ-35
	159	PZ-9	168	PZ-18	177	PZ-27		
1999 11(e)2 Siting Investigation CJI	186	TP-01	190	TP-05	194	TP-09	198	TP-13
	187	TP-02	191	TP-06	195	TP-10	199	PM-9
	188	TP-03	192	TP-07	196	TP-11	200	PM-12
	189	TP-04	193	TP-08	197	TP-12		
Additional CJI Investigations	201	NMP-01	204	LES-B2	207	LES-B5	210	LES-B8
	202	TP-14	205	LES-B3	208	LES-B6	211	LES-B9
	203	LES-B1	206	LES-B4	209	LES-B7		
1996 - 98 RCRA MW Installation Espey, Huston & Associates, Inc.	212	B-1	215	B-4	218	B-34		
	213	B-2	216	B-32	219	B-35		
	214	B-3	217	B-33	220	B-36		

TABLE 6.5-1

WASTE CONTROL SPECIALISTS LLC
BOREHOLE SUMMARY

		MW/PZ	Ref. Boring		MW/PZ	Ref. Boring
	1	7G	B-4	8	9G1	B-21
1993 RCRA Site Investigation	2	4G1	B-5	9	9G2	B-21
	3	4G2	B-5	10	9G3	B-21
Terra Dynamics/Holt	4	4G3	B-5	11	5E	B-30
	5	4C	B-7	12	5C	B-39
	6	2G	B-10	13	6B1	B-48
	7	11D	B-20	14	6B2	B-48
	15	A-16	A-16	18	NMB-23	NMB-23
1998 11(e)2 Siting Investigation	16	A-22	A-22	19	NMB-24	NMB-24
Holt	17	A-24	A-24			
	20	DW-32A	B-32	32	MW-2A	B-2
	21	DW-32B	B-32	33	MW-2B	B-2
1996-98 RCRA Monitor Well Installation	22	DW-33A	B-33	34	MW-3A	B-3
	23	DW-33B	B-33	35	MW-3B	B-3
Espey, Huston & Associates, Inc.	24	DW-34A	B-34	36	MW-4A	B-4
	25	DW-34B	B-34	37	MW-4B	B-4
	26	DW-35A	B-35	38	SW-32	B-32
	27	DW-35B	B-35	39	SW-33	B-33
	28	DW-36A	B-36	40	SW-34	B-34
	29	DW-36B	B-36	41	SW-35	B-35
	30	MW-1A	B-1	42	SW-36	B-36
	31	MW-1B	B-1			
	43	PZ-1	PZ-1	61	PZ-19	PZ-19
	44	PZ-2	PZ-2	62	PZ-20	PZ-20
	45	PZ-3	PZ-3	63	PZ-21	PZ-21
	46	PZ-4	PZ-4	64	PZ-22	PZ-22
	47	PZ-5	PZ-5	65	PZ-23	PZ-23
	48	PZ-6	PZ-6	66	PZ-24	PZ-24
	49	PZ-7	PZ-7	67	PZ-25	PZ-25
1999 Texas Tech University Investigation	50	PZ-8	PZ-8	68	PZ-26	PZ-26
	51	PZ-9	PZ-9	69	PZ-27	PZ-27
	52	PZ-10	PZ-10	70	PZ-28	PZ-28
	53	PZ-11	PZ-11	71	PZ-29	PZ-29
	54	PZ-12	PZ-12	72	PZ-30	PZ-30
	55	PZ-13	PZ-13	73	PZ-31	PZ-31
	56	PZ-14	PZ-14	74	PZ-32	PZ-32
	57	PZ-15	PZ-15	75	PZ-33	PZ-33
	58	PZ-16	PZ-16	76	PZ-34	PZ-34
	59	PZ-17	PZ-17	77	PZ-35	PZ-35
	60	PZ-18	PZ-18			

TABLE 6.5-1

WASTE CONTROL SPECIALISTS LLC
BOREHOLE SUMMARY

		MW/PZ	Ref. Boring		MW/PZ	Ref. Boring
1999 11(e) 2 Siting Investigation **CJI**	78	PM-01	TP-05	91	TP-02	TP-02
	79	PM-02	TP-05	92	TP-03	TP-03
	80	PM-03	TP-05	93	TP-04	TP-04
	81	PM-04	TP-04	94	TP-05	TP-05
	82	PM-05	TP-04	95	TP-06	PM-09
	83	PM-06	TP-04	96	TP-07	PM-12
	84	PM-07	PM-09	97	TP-08	TP-08
	85	PM-08	PM-09	98	TP-09	TP-09
	86	PM-09	PM-09	99	TP-10	TP-08
	87	PM-10	PM-12	100	TP-11	TP-09
	88	PM-11	PM-12	101	TP-12	TP-12
	89	PM-12	PM-12	102	TP-13	TP-13
	90	TP-01	TP-01			

		MW/PZ	Ref. Boring		MW/PZ	Ref. Boring
Additional Investigations **CJI**	103	NMP-01	NMP-01	106	LES-MW2	LES-B9
	104	TP-14	B-T3A	107	LES-MW3	LES-B3
	105	LES-MW1	LES-B7			

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
MARCH 1993												
B-1	5.0	Tan sandy silt		6.8								
	15.0	Reddish tan silty sand		3.5								
	55.0	Reddish brown silty clay		11.9								
	62.0	Red silty clay	CL	7.8	39	23	133	96.9				
	64.0	Reddish brown silty clay	CL							1.63×10^{-9}	2.06×10^{-9}	
	70.0	Red silty clay	CL	8.3	46	27						
	72.5	Red brown silty clay	CH	8.9	54	33	137	97.0	27.8			
	76.0	Reddish brown silty clay					133					
	81.0	Red brown silty clay	CL	8.7	45	27	135	99.8				
	82.0	Red silty clay		9.0								
	88.0	Red silty clay	CL	8.1	39	23						
	94.0	Red silty clay		5.0								
B-2	7.0	Tan cemented sand		12.7								
	42.5	Red silty clay	CL	7.9	49	27	135	99.8			4.54×10^{-9}	
	48.0	Red silty clay	CH		51	32						
	50.0	Red silty clay		10.6								
	60.0	Red silty clay		11.0								
	70.0	Red silty clay	CL	8.6	44	26						
	75.0	Red silty clay	CH	8.4	53	30	136	97.8	32.6		$<1.00 \times 10^{-9}$	
	81.0	Red silty clay		9.7								
B-3	2.0	Tan limestone w/silt layers		2.5			115					
	7.0	Tan limestone w/silt layers		0.7			116					
	13.0	Tan limestone w/silt layers		1.3			114					
	17.0	Light gray clayey silt		5.9								
	18.0	Red silty clay		17.4								
	22.0	Red silty clay		12.6			120					
	26.0	Red silty clay	CL	9.1	45	28		92.5				
	32.0	Red silty clay		9.8	42	25						
	36.0	Red silty clay		8.6			124					

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
	44.0	Red silty clay		8.9			125					
	48.0	Red silty clay	CL	7.7	46	25	138	99.1				
	49.0	Red silty clay	CH	8.6	53	29	132	99.6			4.20×10^{-9}	
	57.0	Red silty clay		8.2								
	62.0	Red siltstone		5.0								
	68.0	Red siltstone		5.0								
	70.0	Reddish brown silty clay		5.0								
	71.0	Reddish brown silty clay		5.5				74.7				
	75.0	Red siltstone		5.5				74.7				
	80.0	Reddish brown silty clay		7.4							3.20×10^{-6}	
	90.0	Reddish brown silty clay		4.0								
	93.0	Purple silty clay		6.9								
	95.0	Purple silty clay		7.1								
B-3	99.5	Purple silty clay		16.0								
B-4	42.0	Red brown silty clay	CH	7.3	52	30	128	98.9			2.32×10^{-9}	
	68.0	Red brown silty clay	CL	7.9	46	26	134	99.1		1.10×10^{-8}	1.35×10^{-9}	
	75.0	Red silty clay w/gray streaks		11.8				87.0				
	80.0	Red silty clay		10.1								
	86.0	Red silty clay		8.7								
	95.0	Reddish brown silty clay		9.2								
	98.0	Gray and red siltstone		1.8								
	105.0	Reddish brown silty clay		11.2								
	110.0	Reddish brown silty clay		20.7								
	118.0	Reddish brown silty clay		21.6								
	125.0	Reddish brown silty clay		21.9				90.9				
	130.0	Reddish brown silty clay		24.5								
	137.0	Reddish brown silty clay		22.5								
	145.0	Reddish brown silty clay		18.3								
	150.0	Reddish brown silty clay		19.9								
	155	Reddish brown silty clay		17.1								

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
	160.0	Reddish brown silty clay		14.8								
	165.0	Reddish brown silty clay		11.2								
	170.0	Reddish brown silty clay		11.7								
	179.0	Reddish brown silty clay		11.5								
B-4	185.0	Reddish brown silty clay		12.5								
	190.0	Light gray & red siltstone		14.6								
	195.0	Light gray & red siltstone		5.0								
	208.0	Tan siltstone									2.06×10^{-8}	
B-5	50.0	Reddish purple silty clay	CL	8.1	49	30		98.8			3.75×10^{-9}	
	58.0	Light gray siltstone									5.60×10^{-8}	
	60.0	Light gray siltstone									7.26×10^{-8}	
	84.0	Red siltstone									8.92×10^{-8}	
B-6	5.0	Tan limestone		2.3								
	17.0	Red silty clay		10.0								
	22.0	Red silty clay		8.0								
	27.0	Red silty clay		6.3			116					
	31.0	Red silty clay		11.5								
	35.0	Red silty clay		12.2								
	40.0	Red silty clay		5.2								
	45.0	Red-gray siltstone		6.0								
	50.0	Red-gray siltstone		3.3	30	13	118					
	54.0	Red-gray siltstone		9.4								
	60.0	Red silty clay		8.2								
	65.0	Red silty clay		6.8								
B-6	70.0	Red silty clay		9.7								
	75.0	Red silty clay		14.1	61	40						
	80.5	Gray siltstone		11.7			119	41.2				
	85.0	Gray siltstone		5.1			126					
	91.3	Red-gray siltstone		3.2			124					
	95.0	Red-gray siltstone		4.0								

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
	99.5	Red silty clay		9.3								
B-7	5.0	Limestone w/silt layers		7.1								
	12.0	Tan cemented sand & gravel		4.4								
	17.0	Tan sandstone		1.2								
	22.0	Tan sandstone		1.8								
	27.0	Tan sand & gravel		3.2			118					
	32.0	Light gray clayey silt		17.6								
	35.0	Red silty clay		9.9								
	37.0	Red silty clay	CL	9.5	36	21	122	92.2	25.7			
	55.0	Red silty clay		8.8								
	60.0	Red silty clay		6.2			130					
	65.0	Red silty clay		7.2								
	70.0	Red silty clay		8.2				92.2	33.7			
	75.0	Red silty clay		7.8								
	80.0	Red silty clay	CL	7.6	44	30	128					
B-7	85.0	Red silty clay		5.8								
	90.0	Red silty clay		10.1								
	95.0	Red silty clay		7.7				91.2				
	100.0	Red silty clay		8.4								
	105.0	Red silty clay		5.7								
	110.0	Gray siltstone		4.0			106					
	115.0	Gray siltstone		4.8			107					
B-8	1.0	Brown silty sand		4.5								
	5.0	Tan sandy silt w/gravel		6.1								
	10.0	Tan sandy silt w/gravel		3.1								
	15.0	White-gray sand		2.3								
	24.0	Yellowish-red brown silty clay		10.3								
	27.0	Red silty clay		10.1								
	41.0	Red silty clay		7.7								

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
	46.0	Tan siltstone		5.4								
	51.0	Tan siltstone		6.6								
	56.5	Red silty clay		7.2								
	64.0	Gray siltstone		4.5								
	67.0	Gray siltstone		3.9								
	72.0	Red silty clay		10.1								
	78.0	Red silty clay		6.4								
B-8	82.0	Red silty clay		7.3								
	87.0	Red silty clay		9.2								
	92.0	Red silty clay		8.4								
	97.0	Red silty clay		7.4								
B-9	3.0	Tan sandy silt		3.8								
	10.0	Tan sandstone		10.4								
	15.0	Tan sandstone		8.2								
	20.0	Tan limestone		6.1					78.6			
	26.0	Tan sandy silt		9.2								
	32.0	Tan sandy silt		12.3								
	37.0	Reddish brown silty clay		13.1								
	42.0	Red silty clay		7.9								
	47.0	Red silty clay		9.1								
	50.0	Red silty clay	CH	10.6	51	29	128	99.2			3.76×10^{-9}	
	59.0	Purple silty clay		13.3								
	65.0	Light gray sandy siltstone		4.0								
	70.0	Light gray sandy siltstone		2.0								
	74.0	Light gray siltstone									2.58×10^{-8}	
	75.0	Light gray sandy siltstone		5.6					57.9			
	76.0	Light gray siltstone									3.91×10^{-8}	
	80.0	Light gray sandy siltstone		7.7								
B-9	85.0	Light gray siltstone		6.2								
	90.0	Red brown silty clay		11.2								
	95.0	Red brown silty clay		12.1								
	100.0	Red brown silty clay		10.1								

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
B-10	3.0	Tan silt		4.2								
	13.0	Tan sandstone		8.3								
	18.0	Tan sandstone		9.2								
	23.0	Tan sandstone		6.9								
	28.0	Tan sandy silt		3.0								
	34.0	Tan sandy silt		12.7								
	39.0	Red silty clay		10.1								
	44.0	Red silty clay		8.0								
	49.0	Red silty clay		14.6								
	54.0	Red silty clay		13.3								
	59.0	Tan siltstone		11.5								
	64.0	Reddish brown silty clay		3.9								
	69.0	Reddish brown silty clay		3.1								
	75.0	Reddish brown silty clay		3.8					49.7			
	80.0	Red silty clay		4.7								
B-11	2.0	Tan limestone w/silt		4.0			104					
	23.0	Red-gray silty clay		8.2								
	27.0	Red-gray silty clay		9.6								
	31.0	Red-gray silty clay		8.7								
	36.0	Red-gray silty clay		13.9			130					
	40.0	Red-gray silty clay		8.1			135					
	47.0	Reddish brown silty clay		6.4			136					
	51.0	Reddish brown clay	CL	5.6	46	24		92.6				
	57.0	Reddish brown clay		8.7								
	62.0	Reddish brown clay		7.4								
	68.0	Reddish brown clay		9.7								
	73.0	Reddish brown clay		15.4				91.5				
	79.0	Reddish brown clay		10.3								
	84.0	Gray siltstone		3.5								
	89.0	Gray siltstone		4.1								

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
	95.0	Gray siltstone		3.3				91.6				
	99.0	Gray siltstone		6.0								
	105.0	Red silty clay		8.3								
	109.0	Red silty clay		11.2								
B-12	1.0	Tan limestone w/silt		6.7								
	7.0	Tan limestone w/silt		10.8								
B-12	13.0	Tan siltstone		4.7								
	18.0	Tan limestone		1.8								
	24.0	Tan limestone		2.6			109					
	28.0	Tan sand & gravel		1.4								
	33.0	Whitish gray silty clay		35.1			126					
	36.0	Gray-red silty clay		16.3								
	41.0	Gray-red silty clay	CH	8.9	54.0	38	129		21.3			
	46.0	Gray-red silty clay		11.8								
	51.0	Dark red silty clay		9.1			128	94.0				
	57.0	Dark red silty clay		7.3								
	60.0	Dark red silty clay		5.4								
	64.0	Dark red silty clay		6.3								
	70.0	Dark red silty clay		5.3								
	74.0	Dark red silty clay	CL	8.7	46.0	27	132	88.7		2.89×10^{-9}	3.55×10^{-9}	
	80.0	Dark red silty clay		6.4			138					
	85.0	Dark red silty clay		5.8								
	90.0	Dark red silty clay		8.3								
	95.0	Dark red silty clay		7.9			134					
	99.5	Dark red silty clay		7.1				86.1				
B-13	4.0	Tan sandy silt		8.3								
	10.0	Tan sandy silt		7.7								
B-13	16.0	Tan limestone		6.5								
	21.0	Tan limestone		1.4								
	27.0	Tan limestone		1.7								
	32.0	Gray-red silty clay		11.3								

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
	37.0	Red silty clay		16.2								
	41.0	Red silty clay	CH	12.6	52.0	33						
	45.0	Red silty clay		12.0								
	51.0	Red silty clay		12.2					30.2			
	56.0	Red silty clay		12.6								
	61.0	Red-gray silty clay		7.8								
	68.0	Red silty clay	CH	10.9	52.0	30	133	99.1				
	74.0	Red silty clay	CH	7.4	55.0	32	135	99.4	17.6		1.77×10^{-9}	
	80.0	Red silty clay		10.6								
	84.0	Red silty clay		7.1								
	90.0	Red silty clay		10.3								
	99.5	Red silty clay		8.6								
B-14	51.0	Gray sandy siltstone		2.3								
	75.0	Reddish brown silty clay						95.8				
	99.5	Reddish brown silty clay						99.0				
B-16	23.5	Reddish brown silty clay						97.8				
	50.0	Reddish brown silty clay						94.6				
	65.0	Purple silty clay	CL								1.76×10^{-6}	
	66.0	Reddish purple silty clay	CL	7.9	46.0	27	135	98.8	36.7			
	75.0	Tan sandy siltstone						2.2				
	80.0	Tan sandy siltstone									1.93×10^{-6}	
	85.0	Tan sandy siltstone									7.64×10^{-7}	
	100.0	Reddish brown silty clay						93.7				
B-17	7.5	Tan weathered limestone		0.5								
	17.0	Tan weathered limestone		6.6								
	25.0	Tan siltstone		3.1				18.1				
	30.0	Tan siltstone		7.0								
	32.0	Tan siltstone		6.9								

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
	40.0	Reddish brown silty clay		10.1								
	46.0	Reddish brown silty clay		10.2								
	52.0	Reddish brown silty clay		7.7				91.6				
	58.0	Reddish brown silty clay		9.0								
	64.0	Reddish purple silty clay		8.6								
	70.0	Reddish purple silty clay		5.4								
	75.0	Reddish purple silty clay		9.0								
	81.0	Reddish purple silty clay		8.4				97.1				
B-17	86.0	Reddish purple silty clay		10.0								
	92.0	Reddish purple silty clay		10.3								
	97.0	Reddish purple silty clay		6.5								
	102.0	Tan-gray siltstone		4.8				70.2				
	108.0	Tan-gray siltstone		2.3								
	112.0	Tan-gray siltstone		2.3								
	116.0	Tan-gray siltstone		1.9								
	122.0	Reddish brown silty clay		7.4								
	125.0	Reddish brown silty clay		8.1								
B-18	6.0	Tan weathered limestone		8.4								
	16.5	Tan weathered limestone		5.5								
	28.5	Tan sand & gravel		6.2								
	35.0	Reddish brown silty clay		16.7								
	39.0	Reddish brown silty clay		13.0								
	40.0	Reddish brown silty clay	CH	8.3	53.0	34.0	138.0	99.6	13.9			
	45.0	Reddish brown silty clay		10.1								
	50.5	Reddish brown silty clay		11.1				94.6				
	61.0	Reddish brown silty clay		9.2								
	65.0	Reddish brown silty clay		9.3								
	72.0	Reddish brown silty clay	CL	7.8	47.0	27.0	136.0	98.7	22.5		1.11 x 10^{-9}	
	77.0	Reddish brown silty clay		7.7				90.0				
B-18	81.0	Reddish brown silty clay	CH	8.9	51.0	29.0	130.0					
	85.5	Reddish brown silty clay		11.0								
	92.0	Reddish brown silty clay		8.1								

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
	99.0	Reddish brown silty clay		14.5				94.2				
B-19	5.0	Tan weathered limestone		1.9								
	13.0	Tan sand & gravel		1.9								
	21.0	Reddish brown silty clay		21.5								
	26.0	Reddish brown silty clay		14.6								
	31.0	Reddish brown silty clay		12.7								
	36.0	Reddish brown silty clay		13.2								
	40.0	Light gray sandy siltstone		5.2								
	45.5	Light gray sandy siltstone		4.2								
	51.0	Light gray sandy siltstone		4.0								
	58.0	Reddish brown silty clay		11.4								
	65.0	Reddish brown silty clay		6.6								
	70.0	Reddish brown silty clay		10.3								
	75.0	Reddish brown silty clay		17.4								
	80.0	Reddish brown silty clay		10.0								
	85.0	Reddish brown silty clay		13.1								
	90.0	Reddish brown silty clay		16.1								
B-19	99.5	Reddish brown silty clay		16.5								
B-25	56.0	Red clayey sandstone									4.41×10^{-7}	
	71.0	Reddish brown silty clay	CH	6.8	52.0	30.0	139.0				2.30×10^{-9}	
B-26	50.0	Reddish brown silty clay	CL	8.7	44.0	25.0	133.0	97.8				
	73.0	Reddish brown siltstone								7.18×10^{-7}	7.86×10^{-7}	
	80.0	Reddish brown silty clay	CL	7.7	46.0	27.0	137.0	99.6	40.5		2.75×10^{-9}	
B-29	60.0	Tan siltstone									3.72×10^{-8}	
	76.0	Reddish brown silty clay	CH	7.5	55.0	34.0	131.0	98.3				
B-30	70.0	Reddish brown silty clay			46.0	29.0						
	74.0	Reddish brown silty clay	CL								3.05×10^{-9}	

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
	76.0	Reddish brown silty clay	CH	9.3	51.0	29.0	136.0	98.7			5.48×10^{-9}	
	80.0	Reddish brown silty clay		2.5			144.0					
	90.0	Light gray siltstone								5.87×10^{-7}	6.42×10^{-7}	
B-31	30.0	Reddish brown silty clay	CL	7.1	47.0	30.0	139.0	99.2				
	74.0	Reddish brown & purple silty clay		8.6	42.0	26.0	135.0	98.9			3.05×10^{-9}	
B-34	40.0	Reddish brown silty clay		8.7	50.0	31.0	138.0	99.5				
	70.0	Reddish brown silty clay		7.7	46.0	30.0		98.2				
	80.0	Reddish brown silty clay		7.3	52.0	31.0		99.9			1.65×10^{-8}	
B-35	32.0	Reddish brown silty clay		31.1								
	35.0	Reddish brown silty clay	CH	22.5	73.0	50.0		99.8				
	40.0	Reddish brown silty clay		12.0								
	45.0	Reddish brown silty clay		10.0								
	50.0	Reddish brown silty clay	CL	8.5	46.0	31.0	132.0	99.4				
	55.0	Reddish brown silty clay		11.1								
	60.0	Reddish brown silty clay		8.8								
	70.0	Reddish brown silty clay	CL	7.6	36.0	23.0						
	75.0	Reddish brown silty clay		5.7								
	76.0	Reddish brown silty clay	CL	8.7	39.0	25.0	129.0	97.9	38.7		2.15×10^{-9}	
	85.0	Reddish brown silty clay		12.2			130.0					
B-39	36.0	Reddish brown silty clay	CH	8.4	54.0	31.0	136.0	96.1				
	40.0	Reddish brown silty clay		12.5								
	45.0	Reddish brown silty clay	CL	12.0	48.0	29.0	124.0	98.9	26.6			
	50.0	Reddish brown silty clay		9.4								
	55.0	Reddish brown silty clay		8.0								
B-39	60.0	Reddish brown silty clay	CL	6.4	35.0	20.0		98.9				
	65.0	Reddish brown silty clay		7.6			142.0					
	70.0	Reddish brown silty clay		7.5								
	71.0	Dark red silty clay	CL								6.75×10^{-9}	

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
	72.0	Reddish brown silty clay	CL	7.7	48.0	30.0		95.5				
	82.0	Reddish brown silty clay		7.6								
	85.0	Reddish brown silty clay		7.5								
	90.0	Reddish brown silty clay		7.6			139.0					
B-40	60.0	Reddish brown silty clay	CH	8.6	51.0	32.0	138.0	95.4				
	80.0	Reddish brown silty clay	CL	7.6	39.0	26.0	131.0	97.1				
	91.5	Reddish brown silty clay					145.0					
	99.5	Reddish brown silty clay		8.3								
B-41	40.0	Reddish brown & purple silty clay		16.4	36.0	27.0	128.0	97.3	28.2			
	50.0	Reddish brown & purple silty clay		8.3	52.0	30.0	136.0	99.4				
	80.0	Reddish brown & purple silty clay		7.1	48.0	30.0	129.0	98.7		3.77 x 10^{-9}	4.44 x 10^{-9}	
B-42	41.0	Reddish brown silty clay	CL	12.8	43.0	28.0	127.0	99.7				
	43.0	Reddish brown silty clay	CL	9.8								
	45.0	Reddish brown silty clay		6.1								
	50.0	Reddish brown silty clay		6.2								
	55.0	Reddish brown silty clay		6.5								
	60.0	Reddish brown silty clay	CL	7.1	43.0	25.0	140.0	92.3				
	65.0	Reddish brown silty clay		6.7								
	70.0	Reddish brown silty clay	CH	8.6	50.0	31.0	137.0	99.7				
	75.0	Reddish brown silty clay		10.1								
	80.0	Reddish brown silty clay		7.0								
	85.0	Reddish brown silty clay		6.9								
B-43	28.0	Reddish brown silty clay		17.2			114.0					
	40.0	Reddish brown silty clay		12.5								
	45.0	Reddish brown silty clay		7.9								
	55.0	Reddish brown silty clay	CL	9.5	45.0	28.0		98.9	18.7			

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
	65.0	Reddish brown silty clay		9.3			135.0					
	70.0	Reddish brown silty clay	CL	5.8	39.0	26.0						
	75.0	Reddish brown silty clay		6.8			143.0					
	80.0	Reddish brown silty clay	CH	10.3	51.0	30.0		99.1	42.4			
	85.0	Reddish brown silty clay		8.2								
B-43	90.0	Reddish brown silty clay		8.3			138.0					
	95.0	Reddish brown silty clay		11.9								
B-46	30.0	Reddish brown silty clay		13.5								
	40.0	Reddish brown silty clay		14.8								
	45.0	Tan silty sandstone		4.8								
	50.0	Tan silty sandstone		2.9			130.0					
	55.0	Reddish purple silty clay		10.4	51.0	35.0		99.0				
	65.0	Reddish purple silty clay		12.2								
	70.0	Reddish purple silty clay		9.7			137.0					
	74.5	Dark red w/gray silty clay		10.5			125.0					
	80.0	Reddish brown silty clay	CL	10.9	49.0	30.0	132.0	98.7	24.3			
B-47	70.0	Reddish brown silty clay			46.0	29.0						
	82.0	Reddish brown silty clay	CH	7.9	52.0	29.0	131.0	96.3			7.66 x 10^{-9}	
B-52	41.0	Reddish brown & purple silty clay		8.7	49.0	30.0		96.3				
	70.0	Reddish brown & purple silty clay		8.3	47.0	28.0	127.0	98.6			5.78 x 10^{-9}	
B-54	54.0	Reddish brown silty clay	CL	8.5	47.0	28.0	133.0	98.3				
	73.0	Reddish brown silty clay	CL	7.6	46.0	25.0	130.0	99.7	37.3			
	109.0	Reddish brown silty clay		11.4			133.0					
B-55	33.0	Reddish brown silty clay	CL	8.6	39.0	25.0	133.0	94.3				
	48.0	Gray siltstone		5.1			138.0					

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
	78.0	Reddish brown/gray sandstone									2.72×10^{-7}	
					7 February 2000							
A-12	58-59	Redbed		5.2	28	13	121.4	98.2			5×10^{-9}	
	70-71	RedBed		4.8	25	10	144.2	65.5			1.7×10^{-5}	
	83.5-84.5	Sandstone		6.3		NP	124.0	30.9			3.95×10^{-6}	
A-14	85-86	Sandstone		3.4		NP	138.8	33.5			7.65×10^{-7}	
A-16	57.5-58.5	Redbed		8.8	47	29	135.8	97.8			5.7×10^{-9}	
A-17	81-82	Redbed		6.8	31	15	131.6	98.9			3.7×10^{-9}	
A-19	69-70	Siltstone		2.1	26.0	11.0	136.7	82.4	136.0			
A-21	58.5-59.5	Redbed		6.4	25	10	144.5	97.9			5.7×10^{-9}	
	76-77	Redbed		5.3	26	11	146.4	89.9			8.2×10^{-9}	
A-22	75-76	Sandstone		2.5		NP	122.0	29.3	47.0			
	82-83	Redbed		6.0	32	16	143.2	99.5	70.0			
	90-91	Siltstone		3.6	22	8	137.8	89.2	89.0			
A-24	58-59	Redbed		7.0	31	15	142.9	98.2	89.0			
	72-73	Redbed		4.1	24	9	148.4	90.0	120.0			
A-26	40-45	Sandstone		5.5	31	15		53.0				
	55-60	Redbed		6.3	32	16		90.1				
	75-80	Redbed		7.6	40	23		93.2				
A-27	45-50	Redbed		9.6	41	24		97.2				
	65-70	Redbed		7.7	34	18		98.6				
	85-90	Redbed		4.7	26	11		79.0				

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
30 December 1998												
B-23	35'	Purple silty clay		10.1	48.0							
	42'	Reddish brown silty clay		5.9								
	52'	Reddish brown silty clay		5.9								
	65'	Reddish brown silty clay		7.4								
	75'	Purple silty clay		8.5								
	80'	Reddish brown silty clay		3.4								
	90'	Reddish brown & purple silty clay		12.9	37.0							
	98'	Reddish brown & purple silty clay		15.4	48.0							
B-24	33'	Reddish silty sandy clay		4.8	26.0							
	40'	Light tan sandstone		1.7								
	50'	Red Bed & reddish brown sandy silty clay		10.3	42	24						
	71'	Light tan sandy silty clay		3.6								
	75'	Reddish brown silty clay		6.6								
	85'.	Reddish brown silty clay		11.4								
	90'	Reddish brown silty clay		10.9	49	30						
	95'	Reddish brown silty clay		10.7								
B-25	34'	Light brown sandstone		2.5			125.3				3.1×10^{-6}	
	41'	Reddish brown silty clay		8.9	44	26						
	50'	Reddish brown silty clay		11.7								
	60'	Dark purple silty clay		9.8								
	81.5'	Purple reddish brown silty clay		13.4	41	24						
	92'	Purple reddish brown silty clay		10.4								
B-26	57'	Reddish brown silty clay		12.7								
	70'	Purple brown silty clay		12.1				99.0				

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
	78'	Reddish brown silty clay		8.0	34	18	136.0				2.3×10^{-9}	
	79'	Reddish brown silty clay		9.3				93.7				
	89'	Reddish brown silty clay		11.3				97.9				
	99'	Reddish brown silty clay		9.9				97.5				
B-27	39'	Reddish brown silty clay		9.4	41	24						
	43'	Tan silty clayey sandstone		6.2	25	10						
	47'	Tan sandstone		1.2			137.3				1.8×10^{-6}	
	48'	Tan sandstone		3.0								
	61'	Purple silty clay		6.6	30	14						
	75'	Light reddish brown silty clay		11.1								
	84'	Reddish brown silty clay		11.1								
	91'	Dark reddish brown silty clay		19.9								
B-28	25'-30'	Reddish brown & purple silty clay		4.0	61	40						
	31'	Reddish brown silty clay		4.1				95.4				
	61'	Brown silty clay		10.5				97.9				
	63'	Purple & dark reddish brown silty clay		10.6	45	27						
	72'	Purple reddish brown silty clay		10.7								
	81'	Dark purple silty clay		15.4								
	94'	Reddish brown silty clay		9.7				96.2				
	100'	Reddish brown silty clay		9.6								
B-29	25'-27'	Purple & reddish brown silty clay			65	44						
	38'	Light brown silty clay		11.1				98.6				
	46'	Reddish brown silty clay		12.4								

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
	54'-60'	Dark purple & reddish brown silty clay		11.3	49	30		99.5				
	63'	Dark reddish brown & light tan silty clay		11.5								
	71'	Reddish brown silty clay		9.1								
	80'	Dark reddish brown silty clay		11.5				95.8				
B-29	87'	Purple & reddish brown silty clay			40	23						
	90'	Dark reddish brown silty clay		15.4								
	97'	Purple silty clay		13.4				98.7				
	--	Compacted standard proctor sample (Red brown silty clay mix)		16.7			107.9				2.9 x 10^{-9}	
B-30	15'-20'	Purple & red silty clay			63	42						
	61'	Reddish brown silty clay		8.9			136.5				1.4 x 10^{-9}	
	64'	Purple & reddish brown silty clay		11.5	47	29		98.1				
	75'	Reddish brown silty clay		5.9	37	20	138.9				5.0x10^{-9}	
	76'	Reddish brown silty clay		11.1								
	84'	purple silty clay		13.5								
	96'	Purple & reddish brown silty clay		13.7								
B-31	40'	Reddish brown silty clay		10.7								
	52'	Red bed purple & reddish silty clay		9.8	44	26						
	61'	Light reddish brown silty clay		10.2			129.0				6.4 x 10^{-9}	
	67.5'	Dark reddish brown silty clay		11.5								

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
B-31	74'	Reddish brown silty clay		7.3			141.5				1.4 x 10^{-9}	
	80'	Reddish brown silty clay		10.6			131.3					
	81'	Reddish brown silty clay		15.3								
	95'	Purple reddish silty clay		15.8								
B-32	23'	Tan clayey sandstone		7.4								
	24'	Tan sandstone		3.8								
	30.5'	Light tan sandstone		6.4								
	39.7'	Light tan clayey silty sand		6.2								
	43.8'	Light brown sandstone		5.3			112.7				1.53 x 10^{-5}	
	49.5'	Tan sandstone		4.7								
	55'	Reddish brown silty clay		11.5								
	73'	Reddish brown silty clay		11.7								
	80'	Reddish brown silty clay		8.4								
	88'	Light reddish brown silty clay		6.2								
	43.8'	Light brown sandstone		5.3							Pending	

24 October 2001

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Liquid Limit	Plasticity Index	Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Horizontal	Vertical	Percent Porosity
TP-01	40-43'	Clay		9.8	49	32						
TP-01	138-139'	Clay		9.2	45	26						
TP-01	221-222'	Sandstone		3.2								
TP-02	30-40'	Sandstone		4.8								
TP-02	122-123'	Sandstone		4.9				14.0				
TP-03	30-40'	Sandstone		2.8								
TP-03	65-70'	Clay		5.0	26	13						0.13
TP-03	144-145'	Clay		6.9	37	19						0.17
TP-03	216-217'	Sandstone		8.3								0.08
TP-08	50-60'	Clayey Sand	SC	11.9	21	4		26.0				0.18
TP-08	105-106'	Clay	CL	11.9	41.0	25.0		99.0				
TP-12	20-30'	Clayey Sand	SC	16.9	34	12	139.0	21.0				
TP-12	48-50'	Clay	CL	8.9	46	32		99.0				
TP-13	20-22'	Clayey Sand	SC	10.3	27	10	137.0	46.0				

TABLE 6.5-2 WASTE MANAGEMENT AREA SUBSURFACE CONDITIONS

Waste Control Specialists LLC Landfill Project,

Boring Number	Depth Below Grade	Stratum	USC Symbol	Moisture Content (%)	Atterberg Limits		Dry Density (PCF)	Percent Passing #200	Unconfined Compressive Strength (TSF)	Permeability		Percent Porosity
					Liquid Limit	Plasticity Index				Horizontal	Vertical	
TP-13	65-75'	Clay with Sand	CL	8.7	36	20		81.0				
29 November 2001												
TP-04	25-30'	Clayey Sand with Gravel	SC	10.6	26	8		12.0				
TP-04	65-70'	Clay	CL	6.8	45	29		95.0				
TP-04	115-120'	Sandstone		1.2								
TP-04	155-160'	Clay	CL	6.0	45	27		99.0				
TP-04	220-225'	Sandstone		4.0								
TP-05	40-45'	Sandstone		1.2								
TP-05	75-80'	Clay	CL	9.6	44	27		98.0				
TP-05	110-115'	Sandstone		1.8								
TP-05	155-160'	Clay	CL	7.9	43	25		97.0				
TP-05	235-240'	Sandstone		6.9								
PM-09	35-40'	Clayey Sand	SC	19.2	24	7		16.0				
PM-09	70-75'	Clay	CL	8.0	44	31		91.0				
PM-09	115-120'	Clay	CL	5.7	41	27		97.0				
PM-09	160-165'	Clay	CL	7.1	41	26		99.0				
PM-09	210-215'	Clay with Sand	CL	7.2	38	22		75.0				
August 2003												
B-21	108-109'	Sandstone		0.6			112					
B-21	219-220'	Sandstone		2.1			140					0.13
B-4	208-209'	Sandstone		2.3			136					0.17
NMB-23	251-252'	Sandstone		2.7			149					0.08
NMB-24	220-221'	Sandstone		1.0			135					0.18
A-22	248-249'	Sandstone		4.3			129					

TABLE 6.6-1
WASTE CONTROL SPECIALISTS LLC
MONITOR WELL AND PIEZOMETER SUMMARY

1993 RCRA Site Investigation
Terra Dynamics/Holt

MW/PZ	Reference Boring	Screen Interval (Feet BGS)	Completion Zone
7G	B-4	185-215	225
4G1	B-5	145-175	Other
4G2	B-5	190-220	Other
4G3	B-5	237-242	Other
4C	B-7	161-191	180
2G	B-10	225-250	Other
11D	B-20	232-257	Other
5E	B-30	145-155	Other
5C	B-39	173-193	180
6B1	B-48	191-201	180
6B2	B-48	262-272	225

1998 11(e)2 Siting Investigation
Holt

MW/PZ	Reference Boring	Screen Interval (Feet BGS)	Completion Zone
A-16	A-16	27-37	OAG
A-22	A-22	245-255	225
A-24	A-24	257-267	225
NMB-23	NMB-23	251-261	225
NMB-24	NMB-24	210-230	225

TABLE 6.6-1
WASTE CONTROL SPECIALISTS LLC
MONITOR WELL AND PIEZOMETER SUMMARY

1996 - 1998 RCRA Monitor Well Installation
Espey, Huston and Associates

MW/PZ	Reference Boring	Screen Interval (Feet BGS)	Completion Zone
DW-32A	B-32	212.5-227.5	225
DW-32B	B-32	229.5-244.5	225
DW-33A	B-33	215-230	225
DW-33B	B-33	230-245	225
DW-34A	B-34	218-233	225
DW-34B	B-34	232-247	225
DW-35A	B-35	218-233	225
DW-35B	B-35	233-248	225
DW-36A	B-36	223-238	225
DW-36B	B-36	238-253	225
MW-1A	B-1	241-256	225
MW-1B	B-1	255.5-270.5	225
MW-2A	B-2	245-260	225
MW-2B	B-2	258-273	225
MW-3A	B-3	249-264	225
MW-3B	B-3	264-279	225
MW-4A	B-4	252-267	225
MW-4B	B-4	267.5-282.5	225
SW-32	B-32	117-127	125
SW-33	B-33	135.5-145.5	125
SW-34	B-34	108-118	125
SW-35	B-35	113-123	125
SW-36	B-36	105-119	125

TABLE 6.6-1
WASTE CONTROL SPECIALISTS LLC
MONITOR WELL AND PIEZOMETER SUMMARY

1999 Texas Tech Univ. Investigation

Texas Tech Univ.

MW/PZ	Reference Boring	Screen Interval (Feet BGS)	Completion Zone
PZ-1	PZ-1	91-106	OAG
PZ-2	PZ-2	78-93	OAG
PZ-3	PZ-3	52-67	OAG
PZ-4	PZ-4	100-115	OAG
PZ-5	PZ-5	70-85	OAG
PZ-6	PZ-6	55-70	OAG
PZ-7	PZ-7	45-60	OAG
PZ-8	PZ-8	49-64	OAG
PZ-9	PZ-9	56-71	OAG
PZ-10	PZ-10	70-85	OAG
PZ-11	PZ-11	55-70	OAG
PZ-12	PZ-12	65-80	OAG
PZ-13	PZ-13	65-80	OAG
PZ-14	PZ-14	61-76	OAG
PZ-15	PZ-15	70-85	OAG
PZ-16	PZ-16	65-80	OAG
PZ-17	PZ-17	75-90	OAG
PZ-18	PZ-18	61-76	OAG
PZ-19	PZ-19	95-110	OAG
PZ-20	PZ-20	86-101	OAG
PZ-21	PZ-21	55-70	OAG
PZ-22	PZ-22	105-120	OAG
PZ-23	PZ-23	92-107	OAG
PZ-24	PZ-24	75-90	OAG
PZ-25	PZ-25	30-45	OAG
PZ-26	PZ-26	35-50	OAG
PZ-27	PZ-27	35-50	OAG
PZ-28	PZ-28	55-70	OAG
PZ-29	PZ-29	70-85	OAG
PZ-30	PZ-30	25-40	OAG
PZ-31	PZ-31	44-59	OAG
PZ-32	PZ-32	78-93	OAG
PZ-33	PZ-33	65-80	OAG
PZ-34	PZ-34	30-45	OAG
PZ-35	PZ-35	110-125	OAG

TABLE 6.6-1
WASTE CONTROL SPECIALISTS LLC
MONITOR WELL AND PIEZOMETER SUMMARY

1999 11(e)2 Siting Investigation
CJI

MW/PZ	Reference Boring	Screen Interval (Feet BGS)	Completion Zone
PM-01	TP-05	52-57	OAG
PM-02	TP-05	113.5-123.5	80
PM-03	TP-05	219-229	225
PM-04	TP-04	53-58	OAG
PM-05	TP-04	126-131	125
PM-06	TP-04	217-227	225
PM-07	PM-09	45-55	OAG
PM-08	PM-09	80-90	80
PM-09	PM-09	197-207	180
PM-10	PM-12	18-23	OAG
PM-11	PM-12	125-135	125
PM-12	PM-12	180-190	Other
TP-01	TP-01	225-240	225
TP-02	TP-02	110-120	125
TP-03	TP-03	212-227	225
TP-04	TP-04	217-227	225
TP-05	TP-05	218228	225
TP-06	PM-09	110-120	Z-4
TP-07	PM-12	140-150	Z-4
TP-08	TP-08	110-120	125
TP-09	TP-09	110-120	125
TP-10	TP-08	80-100	Z-2
TP-11	TP-09	60-70	Z-2
TP-12	TP-12	47-57	OAG
TP-13	TP-13	32.5-42.5	OAG

Additional Investigations
CJI

MW/PZ	Reference Boring	Screen Interval (Feet BGS)	Completion Zone
NMP-01	NMP-01	222-227	225
TP-14	B-T3A	46-51	OAG
LES-MW1	LES-B7	214-229	Other
LES-MW2	LES-B9	217-232	225
LES-MW3	LES-B3	221-236	Other

TABLE 6.6-2
WASTE CONTROL SPECIALISTS
JANUARY-APRIL 2002
GROUNDWATER ELEVATIONS

Well ID	TOC Elevation (ft)	Date	DtW (ft)	Date	DtW (ft)	Date	DtW (ft)	Date	DtW (ft)
DW32A	3461.52	1/22/2002	215.49	2/25/2002	211.18	3/26/2002	227.28	4/19/2002	224.86
DW32B	3461.46	1/22/2002	200.11	2/25/2002	195.19	3/26/2002	235.37	4/19/2002	228.07
DW33A	3464.99	1/22/2002	222.57	2/25/2002	219.99	3/26/2002	230.34	4/19/2002	228.78
DW33B	3465.12	1/22/2002	211.41	2/25/2002	207.48	3/26/2002	239.11	4/19/2002	229.91
DW34A	3468.70	1/22/2002	198.62	2/25/2002	195.51	3/26/2002	222.94	4/19/2002	214.52
DW34B	3468.94	1/22/2002	201.52	2/25/2002	197.65	3/26/2002	238.67	4/19/2002	225.91
DW35A	3467.86	1/22/2002	191.54	2/25/2002	189.91	3/26/2002	205.04	4/19/2002	198.37
DW35B	3467.95	1/22/2002	191.49	2/25/2002	189.88	3/26/2002	204.11	4/19/2002	198.13
DW36A	3467.59	1/22/2002	190.86	2/25/2002	189.12	3/26/2002	205.36	4/19/2002	198.10
DW36B	3467.93	1/22/2002	190.98	2/25/2002	189.27	3/26/2002	204.41	4/19/2002	198.00
NMB-23	3467.85	1/21/2002	139.97	2/22/2002	138.79	3/26/2002	137.72		
NMB-24	3439.15	1/21/2002	116.19	2/22/2002	116.16	3/26/2002	116.13		
MW1A	3480.79	1/21/2002	151.11	2/22/2002	148.48	3/26/2002	146.25		
MW1B	3480.61	1/21/2002	142.02	2/22/2002	140.89	3/26/2002	139.81		
MW2A	3481.72	1/21/2002	158.58	2/22/2002	156.50	3/26/2002	154.62		
MW2B	3481.93	1/21/2002	190.58	2/22/2002	185.22	3/26/2002	180.40		
MW3A	3483.04	1/21/2002	154.56	2/22/2002	152.98	3/26/2002	151.50		
MW3B	3483.10	1/21/2002	153.81	2/22/2002	152.26	3/26/2002	150.81		
MW4A	3484.70	1/21/2002	139.78	2/22/2002	139.05	3/26/2002	138.35		
MW4B	3484.74	1/21/2002	139.63	2/22/2002	138.94	3/26/2002	138.22		
A-22-99	3460.00	1/21/2002	168.69	2/22/2002	167.91	3/26/2002	167.56		
A-24-99	3464.20	1/21/2002	158.09	2/22/2002	159.26	3/26/2002	159.61		
6B-2	3487.07	1/21/2002	137.61	2/22/2002	136.43	3/26/2002	135.90		
7G	3448.57	1/21/2002	138.35	2/22/2002	138.04	3/26/2002	137.61		
TP-01	3485.38	1/22/2002	98.5	2/22/2002	98.50	3/26/2002	98.31		
TP-02	3436.14	1/22/2002	122.62	2/22/2002	122.62	3/26/2002	122.63		
TP-03	3487.98	1/22/2002	225.81	2/22/2002	223.78	3/26/2002	221.58		
TP-04	3489.05	1/22/2002	133.85	2/22/2002	134.07	3/26/2002	134.04		
TP-05	3488.35	1/22/2002	119.72	2/22/2002	119.62	3/26/2002	119.51		
PM-03	3487.99	1/22/2002	119.73	2/22/2002	119.77	3/26/2002	119.63		
PM-06	3489.59	1/28/2002	134.08	2/22/2002	134.26	3/26/2002	134.27		

TABLE 6.6-2
WASTE CONTROL SPECIALIST
MAY - JULY 2002
GROUNDWATER ELEVATIONS

Well ID	TOC Elevation (ft)	Date	DtW (ft)	Date	DtW (ft)	Date	DtW (ft)	Date	DtW (ft)
DW32A	3461.52	5/1/2002	223.75	5/29/2002	225.52	6/25/2002	223.1	7/30/2002	220.06
DW32B	3461.46	5/1/2002	224.98	5/29/2002	226.72	6/25/2002	219.16	7/30/2002	209.78
DW33A	3464.99	5/1/2002	227.92	5/29/2002	230.56	6/25/2002	228.46	7/30/2002	225.67
DW33B	3465.12	5/1/2002	225.68	5/29/2002	228.92	6/25/2002	221.65	7/30/2002	215.95
DW34A	3468.70			5/29/2002	215.93	6/25/2002	209.18	7/30/2002	203.28
DW34B	3468.94	5/1/2002	220.85	5/29/2002	224.37	6/25/2002	215.48	7/30/2002	207.44
DW35A	3467.86			5/29/2002	199.11	6/25/2002	196.13	7/30/2002	193.73
DW35B	3467.95			5/29/2002	198.91	6/25/2002	196.02	7/30/2002	193.71
DW36A	3467.59			5/29/2002	199.50	6/25/2002	195.92	7/30/2002	193.16
DW36B	3467.93			5/29/2002	199.39	6/25/2002	195.98	7/30/2002	193.26
NMB-23	3467.85	5/6/2002	136.37	5/28/2002	135.65	6/24/2002	134.78	7/29/2002	133.22
NMB-24	3439.15	5/6/2002	116.13	5/28/2002	115.92	6/24/2002	115.81	7/29/2002	115.54
MW1A	3480.79	5/6/2002	143.8	5/28/2002	142.62	6/24/2002	141.46	7/29/2002	140.21
MW1B	3480.61	5/6/2002	138.48	5/28/2002	137.94	6/24/2002	137.42	7/29/2002	136.90
MW2A	3481.72	5/6/2002	152.38	5/28/2002	151.26	6/24/2002	150.14	7/29/2002	148.86
MW2B	3481.93	5/6/2002	174.86	5/28/2002	172.11	6/24/2002	169.13	7/29/2002	165.08
MW3A	3483.04	5/2/2002	149.72	5/28/2002	149.58	6/24/2002	148.46	7/29/2002	147.37
MW3B	3483.10	5/2/2002	149.22	5/28/2002	148.89	6/24/2002	147.82	7/29/2002	146.77
MW4A	3484.70	5/2/2002	137.57	5/28/2002	137.43	6/24/2002	136.93	7/29/2002	136.42
MW4B	3484.74	5/2/2002	137.46	5/28/2002	137.30	6/24/2002	136.86	7/29/2002	136.43
A-22-99	3460.00	5/6/2002	167.7	5/30/2002	169.00	6/24/2002	168.45	7/30/2002	167.81
A-24-99	3464.20	5/6/2002	159.61	5/30/2002	160.56	6/24/2002	159.47	7/30/2002	158.81
6B-2	3487.07	5/6/2002	135.49	5/29/2002	138.37	6/24/2002	136.92	7/30/2002	136.00
7G	3448.57	5/6/2002	142.56	5/29/2002	138.84	6/25/2002	137.9	7/30/2002	137.70
TP-0001	3485.38	5/6/2002	98.16	5/30/2002	98.18	6/24/2002	98.66	7/30/2002	98.32
TP-0002	3436.14	5/6/2002	122.61	5/30/2002	122.53	6/24/2002	122.54	7/30/2002	122.55
TP-0003	3487.98	5/6/2002	218.66	5/30/2002	216.77	6/24/2002	214.78	7/30/2002	211.38
TP-0004	3489.05	5/6/2002	134.86	5/30/2002	133.64	6/24/2002	133.67	7/30/2002	133.54
TP-0005	3488.35	5/6/2002	119.32	5/30/2002	119.31	6/24/2002	119.34	7/30/2002	119.45
PM-0003	3487.99	5/6/2002	119.43	5/30/2002	119.41	6/24/2002	119.44	7/30/2002	119.51
PM-0006	3489.59	5/6/2002	134.27	5/30/2002	134.20	6/24/2002	134.22	7/30/2002	134.23

TABLE 6.6-2
WASTE CONTROL SPECIALIST
AUGUST - SEPTEMBER 2002
GROUNDWATER ELEVATIONS

Well ID	TOC Elevation (ft)	Date	DtW (ft)	Date	DtW (ft)	Date	DtW (ft)
DW32A	3461.52	8/27/2002	216.59			9/12/2002	215.82
DW32B	3461.46	8/27/2002	203.85			9/12/2002	201.13
DW33A	3464.99	8/27/2002	223.44			9/12/2002	222.26
DW33B	3465.12	8/27/2002	212.69			9/12/2002	211.30
DW34A	3468.70	8/27/2002	232.59	8/28/2002	231.75	9/11/2002	224.64
DW34B	3468.94	8/27/2002	248.03	8/28/2002	247.47	9/11/2002	240.94
DW35A	3467.86	8/27/2002	226.54	8/28/2002	225.17	9/11/2002	209.22
DW35B	3467.95	8/27/2002	217.99	8/28/2002	216.94	9/11/2002	207.93
DW36A	3467.59	8/27/2002	222.3	8/28/2002	220.18	9/11/2002	206.85
DW36B	3467.93	8/27/2002	217.89	8/28/2002	216.54	9/11/2002	206.19
NMB-23	3467.85	8/27/2002	131.18			9/12/2002	130.22
NMB-24	3439.15	8/27/2002	115.29			9/12/2002	115.28
MW1A	3480.79	8/27/2002	139.28			9/12/2002	138.91
MW1B	3480.61	8/27/2002	136.42			9/12/2002	136.27
MW2A	3481.72	8/27/2002	147.87			9/12/2002	147.41
MW2B	3481.93	8/27/2002	163.09			9/12/2002	161.38
MW3A	3483.04	8/27/2002	146.51			9/12/2002	146.19
MW3B	3483.10	8/27/2002	145.94			9/12/2002	145.63
MW4A	3484.70	8/27/2002	136.14			9/12/2002	136.07
MW4B	3484.74	8/27/2002	136.07			9/12/2002	135.99
A-22-99	3460.00			8/28/2002	168.64	9/12/2002	168.33
A-24-99	3464.20			8/28/2002	158.59	9/12/2002	157.38
6B-2	3487.07	8/27/2002	137.73			9/12/2002	137.02
7G	3448.57	8/27/2002	139.13			9/12/2002	138.38
TP-0001	3485.38			8/28/2002	98.32	9/12/2002	98.40
TP-0002	3436.14			8/28/2002	122.57	9/12/2002	122.57
TP-0003	3487.98			8/28/2002	208.46	9/12/2002	206.72
TP-0004	3489.05			8/28/2002	133.51	9/12/2002	133.46
TP-0005	3488.35			8/28/2002	119.35	9/12/2002	119.41
PM-0003	3487.99			8/28/2002	119.45	9/12/2002	119.51
PM-0006	3489.59			8/28/2002	134.24	9/12/2002	134.24

TABLE 6.6-2
WASTE CONTROL SPECIALIST
NOVEMBER - DECEMBER 2002
GROUNDWATER ELEVATIONS

Well ID	TOC Elevation (ft)	Date	DtW (ft)	Date	DtW (ft)	Date	DtW (ft)
DW32A	3461.52	10/29/2002	220.98	11/25/2002	218.38	12/20/2002	215.43
DW32B	3461.46	10/29/2002	205.32	11/25/2002	200.45	12/20/2002	196.77
DW33A	3464.99			11/25/2002	224.51	12/20/2002	222.41
DW33B	3465.12			11/25/2002	212.56	12/20/2002	209.97
DW34A	3468.70			11/25/2002	212.04	12/20/2002	207.48
DW34B	3468.94			11/25/2002	219.71	12/20/2002	212.96
DW35A	3467.86			11/25/2002	199.27	12/20/2002	197.06
DW35B	3467.95			11/25/2002	199.13	12/20/2002	196.99
DW36A	3467.59	10/29/2002	202.91	11/25/2002	199.03	12/20/2002	196.59
DW36B	3467.93	10/29/2002	202.75	11/25/2002	199.05	12/20/2002	196.64
NMB-23	3467.85	10/29/2002	127.62	11/25/2002	126.32	12/19/2002	125.29
NMB-24	3439.15	10/29/2002	115.21	11/25/2002	115.38	12/19/2002	115.38
MW1A	3480.79	10/29/2002	137.78	11/25/2002	137.18	12/19/2002	136.65
MW1B	3480.61	10/29/2002	135.6	11/25/2002	135.06	12/19/2002	134.57
MW2A	3481.72	10/29/2002	146.08	11/25/2002	145.33	12/19/2002	144.65
MW2B	3481.93	10/29/2002	158.35	11/25/2002	156.58	12/19/2002	155.12
MW3A	3483.04	10/29/2002	146.32	11/25/2002	145.34	12/19/2002	144.61
MW3B	3483.10	10/29/2002	145.72	11/25/2002	144.78	12/19/2002	144.05
MW4A	3484.70	10/29/2002	136.1	11/25/2002	135.64	12/19/2002	135.27
MW4B	3484.74	10/29/2002	135.94	11/25/2002	135.57	12/19/2002	135.19
A-22-99	3460.00	10/29/2002	168.02	11/25/2002	169.71	12/20/2002	168.97
A-24-99	3464.20	10/29/2002	159.64	11/25/2002	161.84	12/20/2002	160.39
6B-2	3487.07	10/29/2002	135.81	11/25/2002	140.59	12/19/2002	138.64
7G	3448.57	10/29/2002	138.8	11/25/2002	139.26	12/20/2002	137.91
TP-0001	3485.38	10/29/2002	98.32	11/25/2002	98.38	12/20/2002	98.31
TP-0002	3436.14	10/29/2002	122.58	11/25/2002	122.6	12/20/2002	122.59
TP-0003	3487.98	10/29/2002	200.04	11/25/2002	193.87	12/20/2002	188.35
TP-0004	3489.05	10/29/2002	133.55	11/25/2002	133.86	12/20/2002	133.8
TP-0005	3488.35	10/29/2002	119.34	11/25/2002	119.45	12/20/2002	119.39
PM-0003	3487.99	10/29/2002	119.43	11/25/2002	119.54	12/20/2002	119.5
PM-0006	3489.59	10/29/2002	134.26	11/25/2002	134.29	12/20/2002	134.29

TABLE 6.6-2
WASTE CONTROL SPECIALISTS
JANUARY - APRIL 2003
GROUNDWATER ELEVATIONS

Well ID	TOC Elevation (ft)	Date	DtW (ft)	GW Elevation (ft)	Date	DtW (ft)	Date	DtW (ft)	GW Elevation (ft)
DW32A	3461.52	1/28/2003	210.31	3251.21	2/28/2003	206.55	3/31/2003	203.07	3051.90
DW32B	3461.46	1/28/2003	192.15	3269.31	2/28/2003	189.19	3/31/2003	186.67	3085.60
DW33A	3464.99	1/28/2003	218.99	3246.00	2/28/2003	215.53	3/31/2003	212.37	3037.09
DW33B	3465.12	1/28/2003	206.77	3258.35	2/28/2003	204.63	3/31/2003	202.56	3057.93
DW34A	3468.70	1/28/2003	202.06	3266.64	2/28/2003	198.81	3/31/2003	196.23	3073.66
DW34B	3468.94	1/28/2003	205.57	3263.37	2/28/2003	201.43	3/31/2003	198.56	3068.95
DW35A	3467.86	1/28/2003	194.57	3273.29	2/28/2003	192.93	3/31/2003	191.57	3083.36
DW35B	3467.95	1/28/2003	194.51	3273.44	2/28/2003	192.88	3/31/2003	191.55	3083.52
DW36A	3467.59	1/28/2003	193.91	3273.68	2/28/2003	192.14	3/31/2003	190.73	3084.72
DW36B	3467.93	1/28/2003	194	3273.93	2/28/2003	192.25	3/31/2003	190.85	3084.83
NMB-23	3467.85	1/27/2003	123.86	3343.99	2/28/2003	122.80	3/27/2003	121.98	3223.07
NMB-24	3439.15	1/27/2003	115.48	3323.67	2/28/2003	115.41	3/27/2003	115.31	3208.43
MW1A	3480.79	1/27/2003	135.81	3344.98	2/28/2003	135.15	3/27/2003	134.54	3211.10
MW1B	3480.61	1/27/2003	133.89	3346.72	2/28/2003	133.26	3/27/2003	132.73	3214.62
MW2A	3481.72	1/27/2003	143.59	3338.13	2/28/2003	142.69	3/27/2003	141.91	3197.12
MW2B	3481.93	1/27/2003	152.96	3328.97	2/28/2003	151.31	3/27/2003	149.96	3180.66
MW3A	3483.04	1/27/2003	143.63	3339.41	2/28/2003	142.76	3/27/2003	142.06	3198.22
MW3B	3483.10	1/27/2003	143.08	3340.02	2/28/2003	142.24	3/27/2003	141.56	3199.30
MW4A	3484.70	1/27/2003	134.84	3349.86	2/28/2003	134.35	3/27/2003	133.96	3216.39
MW4B	3484.74	1/27/2003	134.77	3349.97	2/28/2003	134.26	3/27/2003	133.89	3216.59
A-22	3460.00	1/27/2003	169.04	3290.96	2/11/2003	175.89	3/28/2003	169.00	3115.11
A-24	3464.20	1/27/2003	160.63	3303.57	2/11/2003	168.26	3/28/2003	159.58	3136.36
6B-2	3487.07	1/27/2003	137.24	3349.46	2/11/2003	142.61	3/27/2003	138.31	3206.15
7G	3448.57	1/27/2003	138.93	3309.64	2/11/2003	145.09	3/31/2003	138.04	3310.96
TP-01	3485.38	1/27/2003	98.31	3387.07	2/28/2003	98.21	3/28/2003	98.30	3288.87
TP-02	3436.14	1/27/2003	122.59	3313.55	2/28/2003	122.59	3/27/2003	122.53	3191.02
TP-03	3487.98	1/27/2003	184.78	3303.20	2/28/2003	181.81	3/28/2003	179.69	3126.48
TP-04	3489.05	1/27/2003	133.82	3355.23	2/28/2003	133.76	3/28/2003	133.80	3221.49
TP-05	3488.35	1/27/2003	119.40	3368.95	2/28/2003	119.31	3/28/2003	119.36	3249.68
PM-03	3487.99	1/27/2003	119.52	3368.47	2/28/2003	119.42	3/28/2003	119.45	3249.12
PM-06	3489.59	1/27/2003	134.29	3355.30	2/28/2003	134.31	3/28/2003	134.30	3220.98

TABLE 6.6-2
WASTE CONTROL SPECIALISTS
MAY-AUGUST 2003
GROUNDWATER ELEVATIONS

Well ID	TOC Elevation (ft)	Date	DtW (ft)	Date	DtW (ft)	GW Elevation (ft)	Date	DtW (ft)
DW32A	3461.52	4/24/2003	200.49	5/21/2003	197.91	3263.61	6/18/2003	195.38
DW32B	3461.46	4/24/2003	188.89	5/21/2003	183.21	3278.25	6/18/2003	181.64
DW33A	3464.99	4/7/2003	211.67	5/21/2003	210.92	3254.07	6/18/2003	208.35
DW33B	3465.12	4/7/2003	202.09	5/21/2003	201.84	3263.28	6/18/2003	199.89
DW34A	3468.70	4/7/2003	195.71	5/21/2003	194.84	3273.86	6/18/2003	193.12
DW34B	3468.94	4/7/2003	197.69	5/21/2003	196.75	3272.19	6/18/2003	194.68
DW35A	3467.86	4/7/2003	191.26	5/21/2003	190.93	3276.93	6/18/2003	189.92
DW35B	3467.95	4/7/2003	191.22	5/21/2003	190.94	3277.01	6/18/2003	189.89
DW36A	3467.59	4/7/2003	190.43	5/21/2003	190.49	3277.10	6/18/2003	189.27
DW36B	3467.93	4/7/2003	190.54	5/21/2003	190.63	3277.30	6/18/2003	189.41
NMB-23	3467.85	4/24/2003	121.38	5/21/2003	120.85	3347.00	6/12/2003	120.42
NMB-24	3439.15	4/24/2003	115.36	5/21/2003	115.28	3323.87	6/12/2003	115.13
MW1A	3480.79	4/24/2003	134.15	5/21/2003	133.75	3347.04	6/10/2003	134.16
MW1B	3480.61	4/24/2003	132.42	5/21/2003	132.21	3348.40	6/10/2003	154.31
MW2A	3481.72	4/24/2003	141.33	5/21/2003	140.79	3340.93	6/12/2003	140.39
MW2B	3481.93	4/24/2003	148.03	5/21/2003	147.78	3334.15	6/12/2003	146.98
MW3A	3483.04	4/7/2003	141.92	5/21/2003	141.66	3341.38	6/12/2003	141.17
MW3B	3483.10	4/7/2003	141.41	5/21/2003	141.15	3341.95	6/12/2003	140.70
MW4A	3484.70	4/7/2003	133.95	5/21/2003	133.78	3350.92	6/12/2003	133.55
MW4B	3484.74	4/7/2003	133.83	5/21/2003	133.73	3351.01	6/12/2003	133.48
A-22	3460.00	4/24/2003	169.11	5/22/2003	169.13	3290.87	6/12/2003	170.55
A-24	3464.20	4/24/2003	159.38	5/22/2003	159.15	3305.05	6/12/2003	159.33
6B-2	3487.07	4/24/2003	137.42	5/22/2003	136.74	3350.33	6/12/2003	140.68
7G	3448.57	4/24/2003	139.62	5/22/2003	138.11	3306.01	6/18/2003	138.99
TP-01	3485.38	4/24/2003	98.24	5/21/2003	98.49	3386.89	6/9/2003	98.45
TP-02	3436.14	4/24/2003	122.62	5/21/2003	122.63	3313.51	6/12/2003	122.64
TP-03	3487.98	4/24/2003	177.48	5/21/2003	175.22	3312.76	6/12/2003	173.30
TP-04	3489.05	4/24/2003	134.67	5/19/2003	134.36	3354.69	6/12/2003	133.97
TP-05	3488.35	4/24/2003	122.49	5/19/2003	123.28	3365.07	6/9/2003	123.30
PM-03	3487.99	4/24/2003	124.81					
PM-06	3489.59	4/24/2003	135.52					
NM-P01	3429.61	4/24/2003	dry	5/19/2003	137.03	3292.58	6/10/2003	136.38

TABLE 6.6-2
WASTE CONTROL SPECIALISTS
SEPTEMBER - DECEMBER 2003
GROUNDWATER ELEVATIONS

Well ID	TOC Elevation (ft)	Date	DtW (ft)	GW Elevation (ft)	Date	DtW (ft)	Date	DtW (ft)
DW32A	3461.52	7/21/2003	192.58	3073.56	8/27/2003	189.79	37879.00	190.86
DW32B	3461.46	7/21/2003	179.94	3099.88	8/27/2003	178.28	37879.00	177.81
DW33A	3464.99	7/21/2003	205.47	3051.17	8/27/2003	202.6	37879.00	201.30
DW33B	3465.12	7/21/2003	197.91	3067.32	8/27/2003	195.98	37879.00	195.74
DW34A	3468.70	7/21/2003	191.42	3084.16	8/27/2003	189.88	37879.00	188.76
DW34B	3468.94	7/21/2003	192.70	3081.56	8/27/2003	190.95	37879.00	189.90
DW35A	3467.86	7/21/2003	188.85	3089.09	8/27/2003	187.75	37879.00	187:23
DW35B	3467.95	7/21/2003	188.84	3089.22	8/27/2003	187.74	37879.00	186.95
DW36A	3467.59	7/21/2003	188.10	3090.22	8/27/2003	186.96	37879.00	186.08
DW36B	3467.93	7/21/2003	188.23	3090.29	8/27/2003	187.12	37879.00	186.52
NMB-23	3467.85	7/18/2003	119.87	3227.56	8/27/2003	119.26	37879.00	119.18
NMB-24	3439.15	7/18/2003	114.97	3209.05	8/27/2003	114.74	37879.00	114.67
MW1A	3480.79	7/14/2003	134.82	3211.81	8/20/2003	134.89	37873.00	134.72
MW1B	3480.61	7/14/2003	140.74	3185.56	8/20/2003	134.86	37873.00	134.41
MW2A	3481.72	7/18/2003	139.97	3201.36	8/27/2003	139.57	37873.00	139.45
MW2B	3481.93	7/18/2003	145.79	3189.16	8/27/2003	144.6	37873.00	144.52
MW3A	3483.04	7/18/2003	140.58	3201.29	8/27/2003	140.02	37873.00	140.06
MW3B	3483.10	7/18/2003	140.14	3202.26	8/27/2003	139.57	37873.00	139.52
MW4A	3484.70	7/18/2003	133.34	3217.81	8/27/2003	133.11	37873.00	133.08
MW4B	3484.74	7/18/2003	133.31	3217.95	8/27/2003	133.05	37873.00	133.11
A-22-99	3460.00	7/17/2003	169.06	3120.39	8/11/2003	174.19	37879.00	171.86
A-24-99	3464.20	7/17/2003	158.89	3145.98	8/11/2003	163.46	37879.00	162.51
6B-2	3487.07	7/18/2003	138.2	3208.19	8/11/2003	143.17	37873.00	140.24
7G	3448.57	7/18/2003	140.31	3310.67	8/11/2003	145.61	37873.00	144.30
TP-0001	3485.38	7/17/2003	98.63	3288.30	8/27/2003	98.65	37880.00	98.60
TP-0002	3436.14	7/17/2003	122.68	3190.82	8/27/2003	122.67	37879.00	122.60
TP-0003	3487.98	7/17/2003	170.27	3144.41	8/27/2003	166.71	37880.00	165.92
TP-0004	3489.05	7/17/2003	133.98	3221.10	8/27/2003	133.76	37880.00	133.51
TP-0005	3488.35	7/17/2003	121.61	3243.44	8/27/2003	120.7	37880.00	120.32
PM-0003	3487.99				8/21/2003	126.43	37879.00	123.48
PM-0006	3489.59				8/21/2003	141.92	37875.00	134.86
NM P01	3429.61	7/14/2003	136.67	3156.56	8/20/2003	136.46	37873.00	136.36

TABLE 6.6-2
WASTE CONTROL SPECIALIST
OCTOBER-DECEMBER 2003
GROUNDWATER ELEVATONS

Well ID	TOC Elevation	Date	DtW	Date	DtW	Date	DtW
	(ft)		(ft)		(ft)		(ft)
DW32A	3461.52	10/15/2003	189.19	11/19/2003	186.67	12/12/2003	186.71
DW32B	3461.46	10/15/2003	179.07	11/19/2003	177.02	12/12/2003	177.14
DW33A	3464.99	10/30/2003	198.27	11/19/2003	197.11	12/12/2003	197.05
DW33B	3465.12	10/30/2003	192.93	11/19/2003	192.08	12/12/2003	191.96
DW34A	3468.70	10/15/2003	189.61	11/19/2003	188.10	12/12/2003	188.13
DW34B	3468.94	10/15/2003	193.28	11/19/2003	189.44	12/12/2003	189.21
DW35A	3467.86	10/30/2003	186.14	11/19/2003	185.79	12/12/2003	185.62
DW35B	3467.95	10/30/2003	186.17	11/19/2003	185.81	12/12/2003	185.84
DW36A	3467.59	10/15/2003	189.92	11/19/2003	185.39	12/12/2003	185.35
DW36B	3467.93	10/15/2003	189.92	11/19/2003	185.53	12/12/2003	185.42
NMB-23	3467.85	10/29/2003	118.48	11/17/2003	118.22	12/12/2003	118.07
NMB-24	3439.15	10/29/2003	114.48	11/17/2003	114.55	12/12/2003	114.32
MW1A	3480.79	10/29/2003	134.68	11/17/2003	133.67	12/8/2003	133.7
MW1B	3480.61	10/29/2003	134.39	11/17/2003	132.32	12/8/2003	132
MW2A	3481.72	10/15/2003	140.62	11/17/2003	140.88	12/12/2003	140.67
MW2B	3481.93	10/15/2003	145.83	11/17/2003	144.76	12/12/2003	144.25
MW3A	3483.04	10/30/2003	139.26	11/17/2003	138.04	12/12/2003	138.96
MW3B	3483.10	10/30/2003	138.84	11/17/2003	138.63	12/12/2003	138.47
MW4A	3484.70	10/15/2003	134.43	11/17/2003	132.94	12/12/2003	132.35
MW4B	3484.74	10/15/2003	134.45	11/17/2003	132.85	12/12/2003	132.78
A-22-99	3460.00	10/30/2003	168.31	11/20/2003	168.46	12/12/2003	168.22
A-24-99	3464.20	10/30/2003	158.76	11/20/2003	158.04	12/12/2003	147.76
6B-2	3487.07	10/30/2003	137.23	11/20/2003	136.74	12/12/2003	136.47
7G	3448.57	10/30/2003	138.87	11/20/2003	138.38	12/12/2003	135.02
TP-0001	3485.38	10/30/2003	98.56	11/17/2003	98.64	12/12/2003	98.67
TP-0002	3436.14	10/30/2003	122.66	11/17/2003	122.7	12/12/2003	122.73
TP-0003	3487.98	10/30/2003	161.31	11/17/2003	159.78	12/12/2003	159.55
TP-0004	3489.05	10/30/2003	133.82	11/17/2003	133.89	12/12/2003	133.92
TP-0005	3488.35	10/30/2003	120.31	11/17/2003	120.17	12/12/2003	120.11
PM-0003	3487.99	10/17/2003		11/17/2003	120.29	12/12/2003	120.22
PM-0006	3489.59	10/30/2003		11/12/2003	134.8	12/12/2003	142.63
NM P01	3429.61	10/29/2003	136.21	11/17/2003	136.34	12/8/2003	136.31

TABLE 6.6-2
WASTE CONTROL SPECIALISTS LLC
TEXAS TECH GROUNDWATER LEVELS

Well ID	TOC Elevation	Date	DtW	Date	DtW	Date	DtW
	(ft)		(ft)		(ft)		(ft)
PZ-1	3542	3/99	75	2001	75.69	12/17/2003	75.89
PZ-2	3519	3/99	68	2001	78.03	12/17/2003	77.55
PZ-3	3491	3/99	57	2001	58.04	12/17/2003	57.96
PZ-4	3513	4/99	na	2001	dry	12/17/2003	dry
PZ-5	3492	3/99	dry	2001	81.87	12/17/2003	83.97
PZ-6	3465	3/99	62	2001	63.98	12/17/2003	63.66
PZ-7	3455	3/99	dry	2001	69.21	12/17/2003	69.03
PZ-8	3490	3/99	dry	2001	dry	12/17/2003	69.9
PZ-9	3483	3/99	54	2001	55.15	12/17/2003	56.29
PZ-10	3484	3/99	74	2001	73.93	12/17/2003	74.15
PZ-11	3449	3/99	61	2001	62.53	12/17/2003	63.71
PZ-12	3429	3/99	60	2001	60.27	12/17/2003	60.88
PZ-13	3468	3/99	56	2001	56.20	12/17/2003	56.54
PZ-14	3484	3/99	59	2001	61.24	12/17/2003	61.37
PZ-15	3447	3/99	dry	2001	dry	12/17/2003	dry
PZ-16	3520	3/99	68	2001	68.57	12/17/2003	68.58
PZ-17	3465	4/99	83	2001	83.66	12/17/2003	83.75
PZ-18	3481	4/99	64	2001	65.14	12/17/2003	65.17
PZ-19	3432	4/99	dry	2001	dry	12/16/2003	dry
PZ-20	3440	3/99	dry	2001	dry	12/16/2003	dry
PZ-21	3401	4/99	dry	2001	dry	12/16/2003	dry
PZ-22	3393	4/99	dry	2001	dry	12/16/2003	dry
PZ-23	3412	4/99	dry	2001	dry	12/16/2003	dry
PZ-24	3416	4/99	dry	2001	dry	12/16/2003	dry
PZ-25	3410	3/99	dry	2001	dry	12/16/2003	dry
PZ-26	3433	3/99	36	2001	38.03	12/16/2003	38.61
PZ-27	3405	3/99	dry	2001	dry	12/16/2003	dry
PZ-28	3375	3/99	dry	2001	dry	12/16/2003	dry
PZ-29	3384	3/99	dry	2001	dry	12/16/2003	dry
PZ-30	3416	4/99	dry	2001	dry	12/16/2003	dry
PZ-31	3461	3/99	dry	2001	dry	12/16/2003	dry
PZ-32	3484	3/99	71	2001	70.70	12/16/2003	70.83
PZ-33	3474	3/99	62	2001	63.05	12/16/2003	63.67
PZ-34	3432	3/99	3432	2001	35.23	12/16/2003	35.29

TABLE 6.6-3
WASTE CONTROL SPECIALISTS LLC
MAXIMUM AND MINIMUM GROUNDWATER ELEVATIONS OF THE "225-ZONE"

Well ID	TOC Elevation (msl)	Date	Maximum DtW (ft)	Minimum GW Elev. (msl)	Date	Minimum DtW (ft)	Maximum GW Elev. (msl)
DW32A	3461.52	5/29/2002	225.52	3236.00	11/19/2003	186.67	3274.85
DW32B	3461.46	3/26/2002	235.37	3226.09	11/19/2003	177.02	3284.44
DW33A	3464.99	5/29/2002	230.56	3234.43	12/12/2003	197.05	3267.94
DW33B	3465.12	3/26/2002	239.11	3226.01	12/12/2003	191.96	3273.16
DW34A	3468.70	8/27/2002	232.59	3236.11	12/12/2003	188.13	3280.57
DW34B	3468.94	8/27/2002	248.03	3220.91	12/12/2003	189.21	3279.73
DW35A	3467.86	8/27/2002	226.54	3241.32	12/12/2003	185.62	3282.24
DW35B	3467.95	8/27/2002	217.99	3249.96	12/12/2003	185.84	3282.11
DW36A	3467.59	8/27/2002	222.3	3245.29	12/12/2003	185.35	3282.24
DW36B	3467.93	8/27/2002	217.89	3250.04	12/12/2003	185.42	3282.51
NMB-23	3467.85	1/21/2002	139.97	3327.88	12/12/2003	118.07	3349.78
NMB-24	3439.15	1/21/2002	116.19	3322.96	12/12/2003	114.32	3324.83
MW1A	3480.79	1/21/2002	151.11	3329.68	11/17/2003	133.67	3347.12
MW1B	3480.61	1/21/2002	142.02	3338.59	12/8/2003	132	3348.61
MW2A	3481.72	1/21/2002	158.58	3323.14	9/12/2003	139.45	3342.27
MW2B	3481.93	1/21/2002	190.58	3291.35	12/12/2003	144.25	3337.68
MW3A	3483.04	1/21/2002	154.56	3328.48	11/17/2003	138.04	3345.00
MW3B	3483.10	1/21/2002	153.81	3329.29	12/12/2003	138.47	3344.63
MW4A	3484.70	1/21/2002	139.78	3344.92	12/12/2003	132.35	3352.35
MW4B	3484.74	1/21/2002	139.63	3345.11	12/12/2003	132.78	3351.96
A-22-99	3460.00	2/11/2003	175.89	3284.11	12/12/2003	168.22	3291.78
A-24-99	3464.20	8/11/2003	163.46	3300.74	12/12/2003	147.76	3316.44
6B-2	3487.07	2/11/2003	142.61	3344.46	5/6/2002	135.49	3351.58
7G	3448.57	2/11/2003	145.09	3303.48	12/12/2003	135.02	3313.55
TP-01	3485.38	12/12/2003	98.67	3386.71	5/6/2002	98.16	3387.22
TP-02	3436.14	12/12/2003	122.73	3313.41	3/27/2003	122.53	3313.61
TP-03	3487.98	1/22/2002	225.81	3262.17	12/12/2003	159.55	3328.43
TP-04	3489.05	5/6/2002	134.86	3354.19	9/12/2002	133.46	3355.59
TP-05	3488.35	6/9/2003	123.30	3365.05	5/30/2002	119.31	3369.04
PM-03	3487.99	8/21/2003	126.43	3361.56	2/28/2003	119.42	3368.57
PM-06	3489.59	12/12/2003	142.63	3346.96	1/28/2002	134.08	3355.51
NMP-01	3429.61	1/28/2002	136.67	3292.94	10/29/2003	136.46	3293.15

The MW and DW series wells are not static (equilibrated) groundwater measurements.

PM-12 had groundwater in it only once. It has been dry since 2/2002.

TABLE 6.6-4 UNIT GROUNDWATER DETECTION MONITORING SYSTEM

Waste Management Unit/Area Name						
Well Number(s)	MW-1A	MW-1B	MW-2A	MW-2B	MW-3A	MW-3B
Hydrogeologic Unit Monitored	225	225	225	225	225	225
Type- point of compliance (POC), background (BG), observation (Observ)	BG	BG	BG	BG	BG	BG
Up or Down Gradient (UG, DG)	UG	UG	UG	UG	UG	UG
Casing Diameter and Material	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC
Screen Diameter and Material	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC
Screen Slot Size (in.)	0.010"	0.010"	0.010"	0.010"	0.010"	0.010"
Top of Casing Elevation (ft, MSL)	3480.79	3480.72	3481.93	3481.93	3483.04	3483.10
Grade or Surface Elevation (ft, MSL)	3477.5	3477.4	3478.7	3478.8	3480.0	3480.1
Well Depth (ft,)	257	271.5	261	274	265	280
Screen Interval, From(ft) To(ft)	241 256	255 270	245 260	258 273	249 264	264 279
Facility Coordinates (e.g., lat/long or company coordinates)						
32º26'	47.18"	47.23"	48.07"	48.12"	48.88"	48.93"
130º03'	46.00"	45.50"	44.20"	44.09"	42.73"	42.63"

TABLE 6.6-4 UNIT GROUNDWATER DETECTION MONITORING SYSTEM - continued

Waste Management Unit/Area Name						
Well Number(s)	MW-4A	MW-4B	DW-32A	DW-32B	6W-32	DW-33A
Hydrogeologic Unit Monitored	225	225	225	225	225	225
Type- point of compliance (POC), background (BG), observation (Observ)	BG	BG	POC	POC	Observ	POC
Up or Down Gradient (UG, DG)	UG	UG	DG	DG	DG	Dg
Casing Diameter and Material	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC
Screen Diameter and Material	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC
Screen Slot Size (in.)	0.010"	0.010"	0.010"	0.010"	0.010"	0.010"
Top of Casing Elevation (ft, MSL)	3484.70	3484.74	3461.52	3461.46	3461.45	3464.99
Grade or Surface Elevation (ft, MSL)	3481.6	3481.5	3481.5	3458.4	3458.5	3462.0
Well Depth (ft.)	268	283.5	228.5	244.5	128	231
Screen Interval, From(ft)	252	267.5	212.5	229.5	117	215
To(ft)	267	282.5	227.5	244.5	127	230
Facility Coordinates (e.g., lat/long or company coordinates)						
32º26'	49.81"	49.86"	26.60"	26.56"	26.64"	26.15"
130º03'	41.39"	41.29"	47.52"	47.42"	47.63"	45.84"

TABLE 6.6-4 UNIT GROUNDWATER DETECTION MONITORING SYSTEM - continued

Waste Management Unit/Area Name						
Well Number(s)	DW-33B	SW-33	DW-34A	DW-34B	SW-34	DW-35A
Hydrogeologic Unit Monitored	225	125	225	225	125	225
Type- point of compliance (POC), background (BG), observation (Observ)	POC	Observ	POC	POC	Observ	POC
Up or Down Gradient (UG, DG)	DG	DG	DG	DG	DG	DG
Casing Diameter and Material	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC
Screen Diameter and Material	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC
Screen Slot Size (in.)	0.010"	0.010"	0.010"	0.010"	0.010"	0.010"
Top of Casing Elevation (ft, MSL)	3465.12	3464.84	3468.70	3468.94	3468.58	3467.86
Grade or Surface Elevation (ft, MSL)	3462.2	3461.9	3465.7	3465.9	3465.6	3465.4
Well Depth (ft,)	246	146.5	234	248	119	233.5
Screen Interval, From(ft) To(ft)	230 245	135.5 145.5	218 233	232 247	108 118	218 233
Facility Coordinates (e.g., lat/long or company coordinates)						
32º26'	26.12"	26.19"	25.68"	25.64"	25.72"	25.21"
130º03'	45.74"	45.95"	44.15"	44.04"	44.26"	42.73"

TABLE 6.6-4 UNIT GROUNDWATER DETECTION MONITORING SYSTEM - continued

Waste Management Unit/Area Name						
Well Number(s)	DW-35B	SW-35	DW-36A	DW-36B	SW-36	
Hydrogeologic Unit Monitored	225	125	22	225	125	
Type- point of compliance (POC), background (BG), observation (Observ)	POC	Observ	POC	POC	Observ	
Up or Down Gradient (UG, DG)	DG	DG	DG	DG	DG	
Casing Diameter and Material	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC	
Screen Diameter and Material	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC	
Screen Slot Size (in.)	0.010"	0.010"	0.010"	0.010"	0.010"	
Top of Casing Elevation (ft, MSL)	3467.95	3467.95	3467.59	3467.93	3467.22	
Grade or Surface Elevation (ft, MSL)	3465.4	3465.5	3465.0	3465.4	3464.7	
Well Depth (ft,)	249	123.5	238.5	253.5	118.5	
Screen Interval, From(ft) To(ft)	233 248	113 123	223 238	238 253	108 118	
Facility Coordinates (e.g., lat/long or company coordinates)						
32º26'	25.18"	25.24"	24.83"	24.80"	24.86"	
130º03'	42.62"	42.85"	41.25"	41.14"	41.37"	

TABLE 6.6-5
WASTE CONTROL SPECIALISTS LLC
GROUNDWATER SAMPLE ANALYSIS

For each well or group of wells, specify the suite of parameters for which groundwater samples will be analyzed.

Well No(s). 32A, 32B, 33A, 33B, 34A, 34B, 35A, 35B, 36A, 36B

Parameter	*Sampling Frequency*	*Analytical Method*	*Detection Limits*	*Concentration Limits*[1]
Volatile Organic Priority Pollutant Monitoring Parameters				
Acetone	Staggered Semi-Annual	SW-846 8260/EPA Method 624	100 µg/L	100 µg/L
Benzene	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
Bromoform	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
Carbon Disulfide	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
Carbon Tetrachloride	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
Chlorobenzene	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
Chlorodibromomethane	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
Chloroethane	Staggered Semi-Annual	SW-846 8260/EPA Method 624	10 µg/L	10 µg/L
Chloroform	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
Dichlorobromomethane	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
1.1-Dichloroethane	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
1,2-Dichloroethane	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
1,1-Dichloroethylene	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L

[1] The concentration limit is the basis for determining whether a release has occurred from the waste management unit/area.

TABLE 6.6-5
WASTE CONTROL SPECIALISTS LLC
GROUNDWATER SAMPLE ANALYSIS

For each well or group of wells, specify the suite of parameters for which groundwater samples will be analyzed.
Well No(s). 32A, 32B, 33A, 33B, 34A, 34B, 35A, 35B, 36A, 36B

Parameter	*Sampling Frequency*	*Analytical Method*	*Detection Limits*	*Concentration Limits*[1]
Volatile Organic Priority Pollutant Monitoring Parameters (concluded)				
1,2-Dichloropropane	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
cis-1,3_Dichloropropylene	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
trans-1,3_Dichloropropylene	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
Ethylbenzene	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
Methyl Bromide	Staggered Semi-Annual	SW-846 8260/EPA Method 624	10 µg/L	10 µg/L
Methyl Chloride	Staggered Semi-Annual	SW-846 8260/EPA Method 624	10 µg/L	10 µg/L
1,1,2,2-Tetrachloroethane	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
Tetrachloroethylene	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
Toluene	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
1,2-trans-Dichloroethylene	Staggered Semi-Annual	SW-846 8260/EPA Method 624	10 µg/L	5 µg/L
1,1,1-Trichloroethane	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
1,1,2-Trichloroethane	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
Trichloroethylene	Staggered Semi-Annual	SW-846 8260/EPA Method 624	5 µg/L	5 µg/L
Vinyl Chloride	Staggered Semi-Annual	SW-846 8260/EPA Method 624	10 µg/L	10 µg/L

[1] The concentration limit is the basis for determining whether a release has occurred from the waste management unit/area.

TABLE 6.6-5
WASTE CONTROL SPECIALISTS LLC
GROUNDWATER SAMPLE ANALYSIS

For each well or group of wells, specify the suite of parameters for which groundwater samples will be analyzed.

Well No(s). 32A, 32B, 33A, 33B, 34A, 34B, 35A, 35B, 36A, 36B

Parameter	*Sampling Frequency*	*Analytical Method*	*Detection Limits*	*Concentration Limits*
Semi-Volatile Monitoring Parameter				
Phenol	Staggered Semi-Annual	SW-846 8270/EPA Method 625	10 µg/L	10 µg/L
1, 4 Dioxane	Staggered Semi-Annual	SW-846 8270/EPA Method 625	10 µg/L	10 µg/L
Metal Monitoring Parameters				
Arsenic	Staggered Semi-Annual	SW-846 6010/EPA Method 200.7	0.01 mg/L	NA
Nickel	Staggered Semi-Annual	SW-846 6010/EPA Method 200.7	0.005 mg/L	NA
Cadmium	Staggered Semi-Annual	SW-846 6010/EPA Method 200.7	0.005 mg/L	NA
Selenium	Staggered Semi-Annual	SW-846 6010/EPA Method 200.7	0.005 mg/L	NA

[1] The concentration limit is the basis for determining whether a release has occurred from the waste management unit/area.

TABLE 6.6-6
SUMMARY OF METALS CONCENTRATIONS IN INDIVIDUAL LEACHATE SAMPLES AT THE WCS FACILITY

METAL	LEACHATE CONCENTRATIONS (PPB)				MAXIMUM LEACHATE CONCENTRATION (PPB)	AVERAGE LEACHATE CONCENTRATION (PPB) [1]
	CELL A	CELL B	CELL C	CELL D		
Antimony	NA	NA	NA	NA	ND	ND
Arsenic	50.3	128	141	231	231	137.6
Barium	34.5	33	35.6	32.8	35.6	34.0
Beryllium	NA	NA	NA	NA	ND	ND
Cadmium	113	<5	<5	<5	113	30.1
Chromium	<10	<10	<10	<10	ND	ND
Cobalt	28.7	47	<10	27.3	47	27.0
Copper	224	56.6	26	15.5	224	80.5
Lead	40.2	36.9	16.1	15.7	40.2	27.2
Mercury	0.27	0.21	<0.20	<0.20	0.27	0.17
Nickel	201	216	68.3	<40	216	126.3
Selenium	<15	<15	17.1	<15	17.1	9.9
Silver	<10	<10	<10	<10	ND	ND
Vanadium	18.7	15.9	<10	<10	18.7	11.2

NA - Not Analyzed

[1] Where a parameter was detected in one or more cells and also not detected in one or more cells, the average concentration was calculated using one-half the reporting limit.

TABLE 6.6-7
CALCULATIONS FOR SOIL-LEACHATE PARTITION FACTOR FOR METALS AT THE WCS FACILITY

INPUT PARAMETERS

Parameter	Description	Value	Source
Kd	Soil-water partition coefficient (cm3-water/g-soil)	Chemical-Specific	See footnotes below calculations table
H'	Dimensionless Henry's Law Constant	Chemical-Specific	TCEQ Physical/Chemical Properties Table, updated 31 March 2003
ρb	Soil bulk density (g/cm3)	1.67	Default Value, TRRP Tier 2 Soil-to-GW PCL Equation
θws	Volumetric water content of vadose zone soils (cm3-water / cm3-soil)	0.31	Site-specific: clay, sandy, low plasticity; Soil Attenuation Model, Table 2, Groundwater Services, Inc. July, 1997.
θas	Volumetric air content of vadose zone soils (cm3-air / cm3-soil)	0.07	Site-specific: clay, sandy, low plasticity; Soil Attenuation Model, Table 2, Groundwater Services, Inc. July, 1997.
K_{sw}	Soil-leachate partitian factor for COC (mg/L-water / mg/kg-soil)	Calculated	TRRP Tier 2 Soil-to-Groundwater PCL Equation; Also see Soil Attenuation Model, Groundwater Services, Inc., July 1997

EQUATION FOR SOIL-LEACHATE PARTITION FACTOR

$$K_{sw} = \frac{\rho_b}{\theta_{ws} + K_d\rho_b + H'\theta_{as}}$$

CALCULATIONS TABLE

METAL	H'	Kd - Values				Calculated Ksw (mg/L-water / mg/kg-soil)			
		pH 5.0	pH 6.0	pH 7.0	pH 8.0	pH 5.0	pH 6.0	pH 7.0	pH 8.0
Antimony (1)	0	45	45	45	45	2.21E-02	2.21E-02	2.21E-02	2.21E-02
Arsenic (2)	0	25	27	29	31	3.97E-02	3.68E-02	3.43E-02	3.21E-02
Barium (2)	0	12	30	42	52	8.21E-02	3.31E-02	2.37E-02	1.92E-02
Beryllium (2)	0	26	82	1700	100000	3.82E-02	1.22E-02	5.88E-04	1.00E-05
Cadmium (2)	0	17	37	110	4300	5.82E-02	2.69E-02	9.08E-03	2.33E-04
Chromium (2)	0	1900	200000	2500000	4300000	5.26E-04	5.00E-06	4.00E-07	2.33E-07
Cobalt (5)	0	45	45	45	45	2.21E-02	2.21E-02	2.21E-02	2.21E-02
Copper (4)	0	50.1	794	15849	25119	1.99E-02	1.26E-03	6.31E-05	3.98E-05
Lead (3)	0	597	597	597	597	1.67E-03	1.67E-03	1.67E-03	1.67E-03
Mercury (2)	0.474	0.06	4	82	200	3.77E+00	2.38E-01	1.22E-02	4.99E-03
Nickel (2)	0	18	38	88	1900	5.50E-02	2.62E-02	1.13E-02	5.26E-04
Silver (2)	0	0.13	1	13	110	3.17E+00	8.43E-01	7.58E-02	9.08E-03
Selenium (2)	0	17	9	4	2	5.82E-02	1.09E-01	2.39E-01	4.58E-01
Vanadium (1)	0	1000	1000	1000	1000	1.00E-03	1.00E-03	1.00E-03	1.00E-03

(1) Kd value obtained from 30 TAC 350.73(e)(1)(C); non-pH dependent inorganic.

(2) Kd value obtained from 30 TAC 350.73(e)(1)(C): pH dependent inorganics.

(3) Kd value obtained from 30 TAC 350.73(e)(1)(A). Loamy soils with pH ranging between 5 and 9.

(4) Kd value obtained from Table B-2, Overview of CSST Procedures fro the Derivation of Soil Quality Matrix Standards for Contaminated Sites, Risk Assessment Unit, Environmental Protection Department, Government of British Columbia, dated 31 January 1996

(5) Kd value obtained from TCEQ Chemical/Physical Table updated March 31, 2003. No pH specific values are known to be available for this constituent.

TABLE 6.6-8
WASTE CONTROL SPECIALISTS LLC
CONCENTRATION-WEIGHTED MOBILITY FACTORS

Maximum Leachate Concentration Factors

METAL	Calculated Ksw (mg/L-water / mg/kg-soil)			Maximum Leachate	Concentration * Ksw	Concentration * Ksw	Concentration * Ksw
	pH 6.0	pH 7.0	pH 8.0	Concentration	pH 6.0	pH 7.0	pH 8.0
Arsenic (2)	3.68E-02	3.43E-02	3.21E-02	231	8.50E+00	7.914854329	7.407258065
Barium (2)	3.31E-02	2.37E-02	1.92E-02	35.6	1.18E+00	0.843889283	0.682180149
Cadmium (2)	2.69E-02	9.08E-03	2.33E-04	113	3.04E+00	1.02554209	0.026277935
Cobalt (5)	2.21E-02	2.21E-02	2.21E-02	47	1.04E+00	1.040153724	1.040153724
Copper (4)	1.26E-03	6.31E-05	3.98E-05	228	2.87E-01	0.014385597	0.009076727
Lead (3)	1.67E-03	1.67E-03	1.67E-03	40.2	6.73E-02	0.067315753	0.067315753
Mercury (2)	2.38E-01	1.22E-02	4.99E-03	0.27	6.42E-02	0.003284452	0.001348614
Nickel (2)	2.62E-02	1.13E-02	5.26E-04	216	5.66E+00	2.449378692	0.113673105
Selenium (2)	1.09E-01	2.39E-01	4.58E-01	17.1	1.86E+00	4.085407725	7.823835616
Vanadium (1)	1.00E-03	1.00E-03	1.00E-03	18.7	1.87E-02	0.018696529	0.018696529

(1) Kd value obtained from 30 TAC 350.73(e)(1)(C); non-pH dependent inorganic.

(2) Kd value obtained from 30 TAC 350.73(e)(1)(C); pH dependent inorganics.

(3) Kd value obtained from 30 TAC 350.73(e)(1)(A). Loamy soils with pH ranging between 5 and 9.

(4) Kd value obtained from Table B-2, Overview of CSST Procedures fro the Derivation of Soil Quality Matrix Standards for Contaminated Sites, Risk Assessment Unit, Environmental Protection Department, Government of British Columbia, dated 31

(5) Kd value obtained from TCEQ Chemical/Physical Table updated March 31, 2003. No pH specific values are known to be available for this constituent.

Average Leachate Concentration Factors

METAL	Calculated Ksw (mg/L-water / mg/kg-soil)			Average Leachate	Concentration * Ksw	Concentration * Ksw	Concentration * Ksw
	pH 6.0	pH 7.0	pH 8.0	Concentration	pH 6.0	pH 7.0	pH 8.0
Arsenic (2)	3.68E-02	3.43E-02	3.21E-02	137.575	5.06E+00	4.713792573	4.411487135
Barium (2)	3.31E-02	2.37E-02	1.92E-02	33.975	1.13E+00	0.805369056	0.651041308
Cadmium (2)	2.69E-02	9.08E-03	2.33E-04	30.125	8.10E-01	0.273402261	0.007005512
Cobalt (5)	2.21E-02	2.21E-02	2.21E-02	27	5.98E-01	0.597535118	0.597535118
Copper (4)	1.26E-03	6.31E-05	3.98E-05	80.525	1.01E-01	0.005080703	0.003205717
Lead (3)	1.67E-03	1.67E-03	1.67E-03	27.225	4.56E-02	0.04558884	0.04558884
Mercury (2)	2.38E-01	1.22E-02	4.99E-03	0.17	4.04E-02	0.002067988	0.000849128
Nickel (2)	2.62E-02	1.13E-02	5.26E-04	126.325	3.31E+00	1.432489645	0.066480347
Selenium (2)	1.09E-01	2.39E-01	4.58E-01	9.9	1.08E+00	2.365236052	4.529589041
Vanadium (1)	1.00E-03	1.00E-03	1.00E-03	11.15	1.11E-02	0.011147931	0.011147931

(1) Kd value obtained from 30 TAC 350.73(e)(1)(C); non-pH dependent inorganic.

(2) Kd value obtained from 30 TAC 350.73(e)(1)(C); pH dependent inorganics.

(3) Kd value obtained from 30 TAC 350.73(e)(1)(A). Loamy soils with pH ranging between 5 and 9.

(4) Kd value obtained from Table B-2, Overview of CSST Procedures fro the Derivation of Soil Quality Matrix Standards for Contaminated Sites, Risk Assessment Unit, Environmental Protection Department, Government of British Columbia, dated 31

(5) Kd value obtained from TCEQ Chemical/Physical Table updated March 31, 2003. No pH specific values are known to be available for this constituent.

TABLE 6.6-9
WASTE CONTROL SPECIALISTS LLC
CONCENTRATION/MOBILITY RANKING BASED ON MAXIMUM LEACHATE CONCENTRATIONS

Ranking - Soil pH 6.0

METAL	Calculated Ksw (mg/L-water / mg/kg-soil) Soil pH 6.0	Maximum Leachate Concentration	Concentration * Ksw
Arsenic	3.68E-02	231	8.50E+00
Nickel	2.62E-02	216	5.66E+00
Cadmium	2.69E-02	113	3.04E+00
Selenium	1.09E-01	17.1	1.86E+00
Barium	3.31E-02	35.6	1.18E+00
Cobalt	2.21E-02	47	1.04E+00
Copper	1.26E-03	228	2.87E-01
Lead	1.67E-03	40.2	6.73E-02
Mercury	2.38E-01	0.27	6.42E-02
Vanadium	1.00E-03	18.7	1.87E-02

Ranking - Soil pH 7.0

METAL	Calculated Ksw (mg/L-water / mg/kg-soil) Soil pH 7.0	Maximum Leachate Concentration	Concentration * Ksw
Arsenic	3.43E-02	231	7.914854329
Selenium	2.39E-01	17.1	4.085407725
Nickel	1.13E-02	216	2.449378692
Cobalt	2.21E-02	47	1.040153724
Cadmium	9.08E-03	113	1.02554209
Barium	2.37E-02	35.6	0.843889283
Lead	1.67E-03	40.2	0.067315753
Vanadium	1.00E-03	18.7	0.018696529
Copper	6.31E-05	228	0.014385597
Mercury	1.22E-02	0.27	0.003284452

Ranking - Soil pH 8.0

METAL	Calculated Ksw (mg/L-water / mg/kg-soil) Soil pH 8.0	Maximum Leachate Concentration	Concentration * Ksw
Selenium	4.58E-01	17.1	7.823835616
Arsenic	3.21E-02	231	7.407258065
Cobalt	2.21E-02	47	1.040153724
Barium	1.92E-02	35.6	0.682180149
Nickel	5.26E-04	216	0.113673105
Lead	1.67E-03	40.2	0.067315753
Cadmium	2.33E-04	113	0.026277935
Vanadium	1.00E-03	18.7	0.018696529
Copper	3.98E-05	228	0.009076727
Mercury	4.99E-03	0.27	0.001348614

TABLE 6.6-10
WASTE CONTROL SPECIALISTS LLC
CONCENTRATION/MOBILITY RANKING BASED ON AVERAGE LEACHATE CONCENTRATIONS

Ranking - Soil pH 6.0

METAL	Calculated Ksw (mg/L-water / mg/kg-soil) Soil pH 6.0	Average Leachate Concentration	Concentration * Ksw
Arsenic	3.68E-02	137.575	5.06E+00
Nickel	2.62E-02	126.325	3.31E+00
Barium	3.31E-02	33.975	1.13E+00
Selenium	1.09E-01	9.9	1.08E+00
Cadmium	2.69E-02	30.125	8.10E-01
Cobalt	2.21E-02	27	5.98E-01
Copper	1.26E-03	80.525	1.01E-01
Lead	1.67E-03	27.225	4.56E-02
Mercury	2.38E-01	0.17	4.04E-02
Vanadium	1.00E-03	11.15	1.11E-02

Ranking - Soil pH 7.0

METAL	Calculated Ksw (mg/L-water / mg/kg-soil) Soil pH 7.0	Average Leachate Concentration	Concentration * Ksw
Arsenic	3.43E-02	137.575	4.713792573
Selenium	2.39E-01	9.9	2.365236052
Nickel	1.13E-02	126.325	1.432489645
Barium	2.37E-02	33.975	0.805369056
Cobalt	2.21E-02	27	0.597535118
Cadmium	9.08E-03	30.125	0.273402261
Lead	1.67E-03	27.225	0.04558884
Vanadium	1.00E-03	11.15	0.011147931
Copper	6.31E-05	80.525	0.005080703
Mercury	1.22E-02	0.17	0.002067988

Ranking - Soil pH 8.0

METAL	Calculated Ksw (mg/L-water / mg/kg-soil) Soil pH 8.0	Average Leachate Concentration	Concentration * Ksw
Selenium	4.58E-01	9.9	4.529589041
Arsenic	3.21E-02	137.575	4.411487135
Barium	1.92E-02	33.975	0.651041308
Cobalt	2.21E-02	27	0.597535118
Nickel	5.26E-04	126.325	0.066480347
Lead	1.67E-03	27.225	0.04558884
Vanadium	1.00E-03	11.15	0.011147931
Cadmium	2.33E-04	30.125	0.007005512
Copper	3.98E-05	80.525	0.003205717
Mercury	4.99E-03	0.17	0.000849128

TABLE 6.6-11
WASTE CONTROL SPECIALISTS LLC
ORGANIC CONSTITUENTS DETECTED IN LANDFILL LEACHATE

	Concentration, ppb							Log Kow	Solubility (mg/L)
	Composite Samples			Individual Cell Samples (March 2002)					
	Q1 02	Q2 02	Q3 02	A	B	C	D		
Volatile Organic Analytes									
Acetone	14 B	22	13	14	<10	<10	<10	-0.235	600,000
Benzene	<1.0	<1.0	0.64 J	<1.0	<1.0	<1.0	<1.0	1.99	1,770
Carbon Disulfide	0.73 J	3.3	0.71 J	<1.0	2	2.6	<1.0	1.94	2,300
1,4 Dioxane (1)	NA	NA	NA	<200	780	<200	<200	-0.32	900,000
Toluene	1.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.54	530
Chloroform	<1.0	0.29 J	0.82 J	<1.0	<1.0	<1.0	<1.0	1.52	7,920
Napthalene	NA	NA	NA	<1.0	1.3	<1.0	<1.0	3.17	31.4
Vinyl Chloride	<1.0	<1.0	0.86 J	<1.0	<1.0	<1.0	<1.0	1.62	2,760
Semi-volatile Organic Analytes									
Bis(2-ethlyhexyl)phthlate	7.3 J	100	<10	<10	46	<10	<10	2.65	1,080
Phenol	<10	68	3.6 J	<10	<10	<10	<10	1.51	87,000
4-Chloro-3-Methlyphenol	<10	<10	5.5 J	<10	<10	<10	<10	2.99	5,430
1,4 Dioxane (1)	<10	120	<10	NA	NA	NA	NA	-0.32	900,000
Ethylene glycol (2)	<25	7.4 J	<25	NA	NA	NA	NA	-1.2	1,000,000
Herbicides/Pesticides									
Methyl parathion	<0.5	0.12 J	<0.5	NA	NA	NA	NA	2.75	50
2,4-D	<4.0	<4.0	1.1 J	NA	NA	NA	NA	2.62	890
4,4-DDE	0.011 J, COL	<0.050	<0.050	NA	NA	NA	NA	6	0.065
2,4,5-TP (Silvex)	0.035 J, COL	<1.0	<1.0	NA	NA	NA	NA	3.68	140
PCBs									
Arochlor 1248	NA	NA	NA	<1.0	<1.0	2.9	<1.0	6.3	0.0555
Arochlor 1254	NA	NA	NA	<1.0	<1.0	1.3	<1.0	6.3	0.0555

NA = Not Analyzed

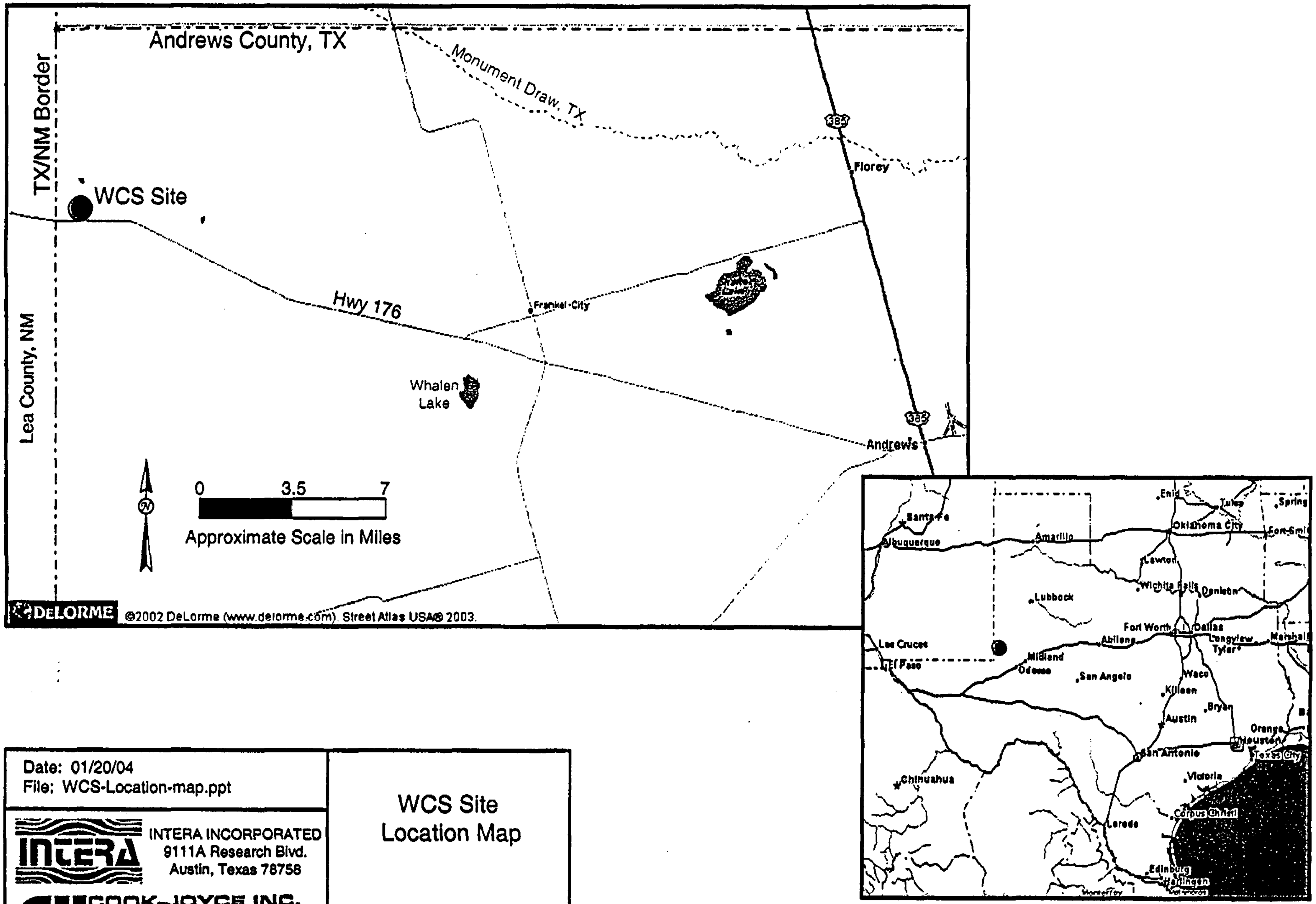
(1) 1,4-Dioxane was reported using Method 8260 (for volatile organics) for the special leachate sampling event conducted in March 2002. For the routine leachate monitoring, the analytical laboratory reported 1,4-Dioxane using Method 8270 (for semi-volatile organics).

(2) Ethylene glycol is analyzed for the routine leachate monitoring using Method 8015. All other detected semi-volatile organics are analyzed using Method 8270.

TABLE 6.6-12
WASTE CONTROL SPECIALISTS LLC
PROPOSED DETECTION MONITORING PARAMETERS

Proposed Monitoring Parameter	Analytical Method
Arsenic	SW-846 6010/EPA Method 200.7
Cadmium	SW-846 6010/EPA Method 200.7
Nickel	SW-846 6010/EPA Method 200.7
Selenium	SW-846 6010/EPA Method 200.7
Volatile Organic Constituents:	
acetone	SW-846 8260/EPA Method 624 (for all volatile organic parameters)
benzene	
bromoform	
carbon disulfide	
carbon tetrachloride	
chlorobenzene	
chlorodibromomethane	
chloroethane	
chloroform	
dichlorobromomethane	
1,1-dichloroethane	
1,2-dichloroethane	
1,1-dichloroethylene	
1,2-dichloropropane	
cis-1,3-dichloropropylene	
trans-1,3-dichloropropylene	
ethylbenzene	
methyl bromide	
methyl chloride	
1,1,2,2-tetrachloroethane	
tetrachloroethylene	
toluene	
1,2-trans-dichloroethylene	
1,1,1-trichloroethane	
1,1,2-trichloroethane	
trichloroethylene	
vinyl chloride	
Semi-volatile Organic Constituents:	
phenol	SW-846 8270/EPA Method 625 (for all semi-volatile parameters)
1,4-dioxane	

FIGURES



Date: 01/20/04
File: WCS-Location-map.ppt

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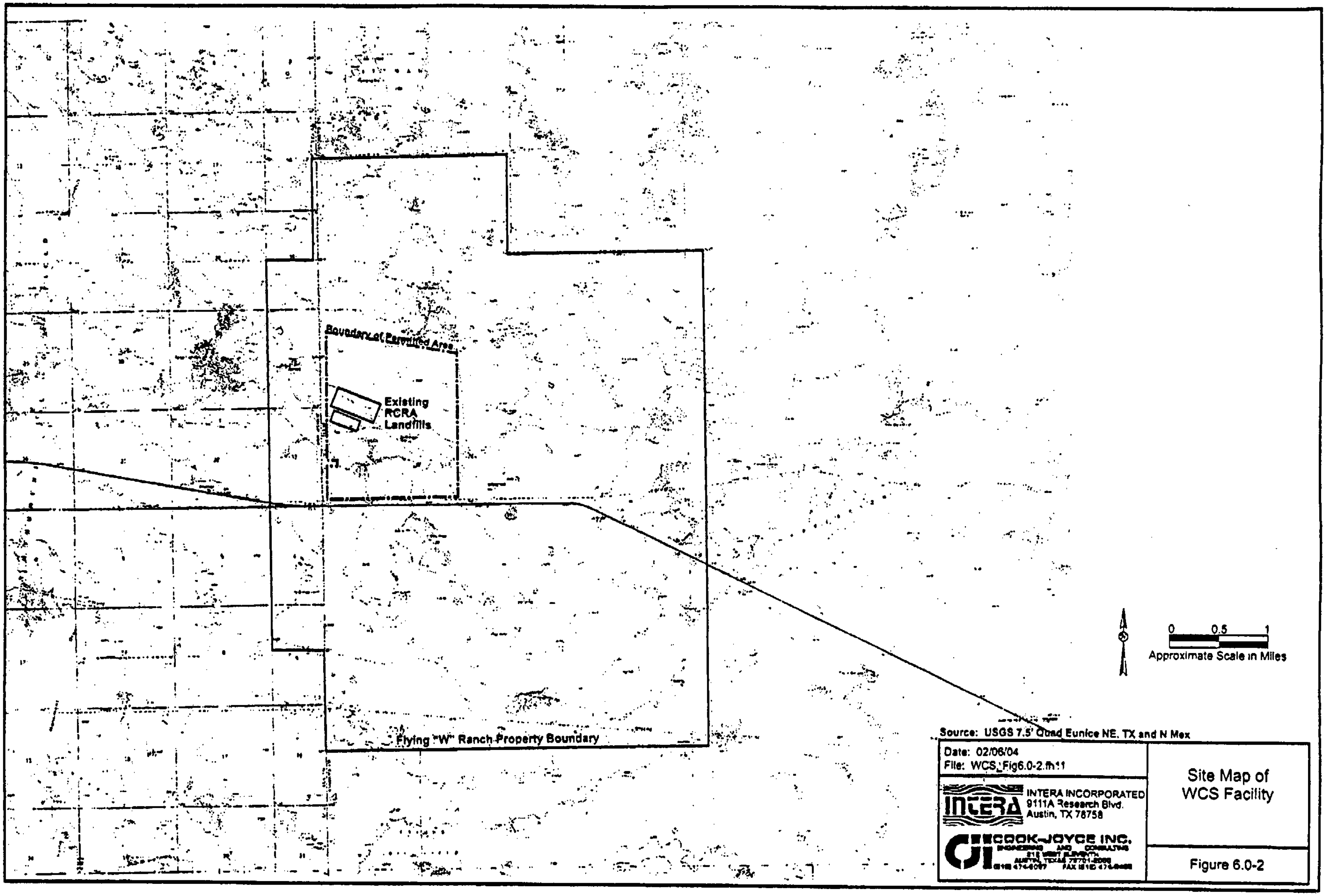
WCS Site Location Map

Figure 6.0-1



Source: USGS 7.5' Quad Eunice NE. TX and N Mex

Date: 02/06/04
File: WCS_Fig6.0-2.fh11

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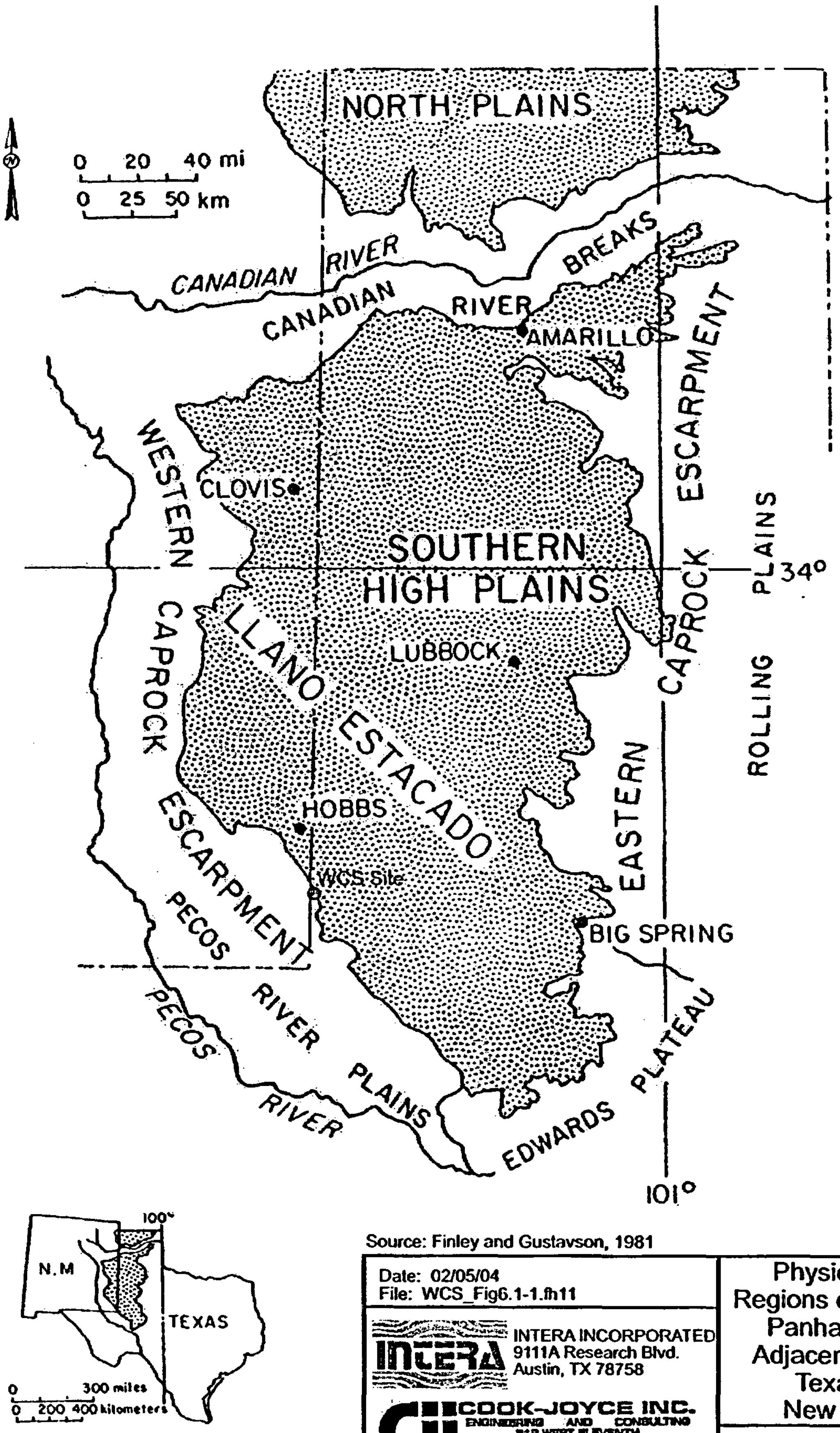
Site Map of WCS Facility

Figure 6.0-2



Source: Finley and Gustavson, 1981

Date: 02/05/04
File: WCS_Fig6.1-1.fh11

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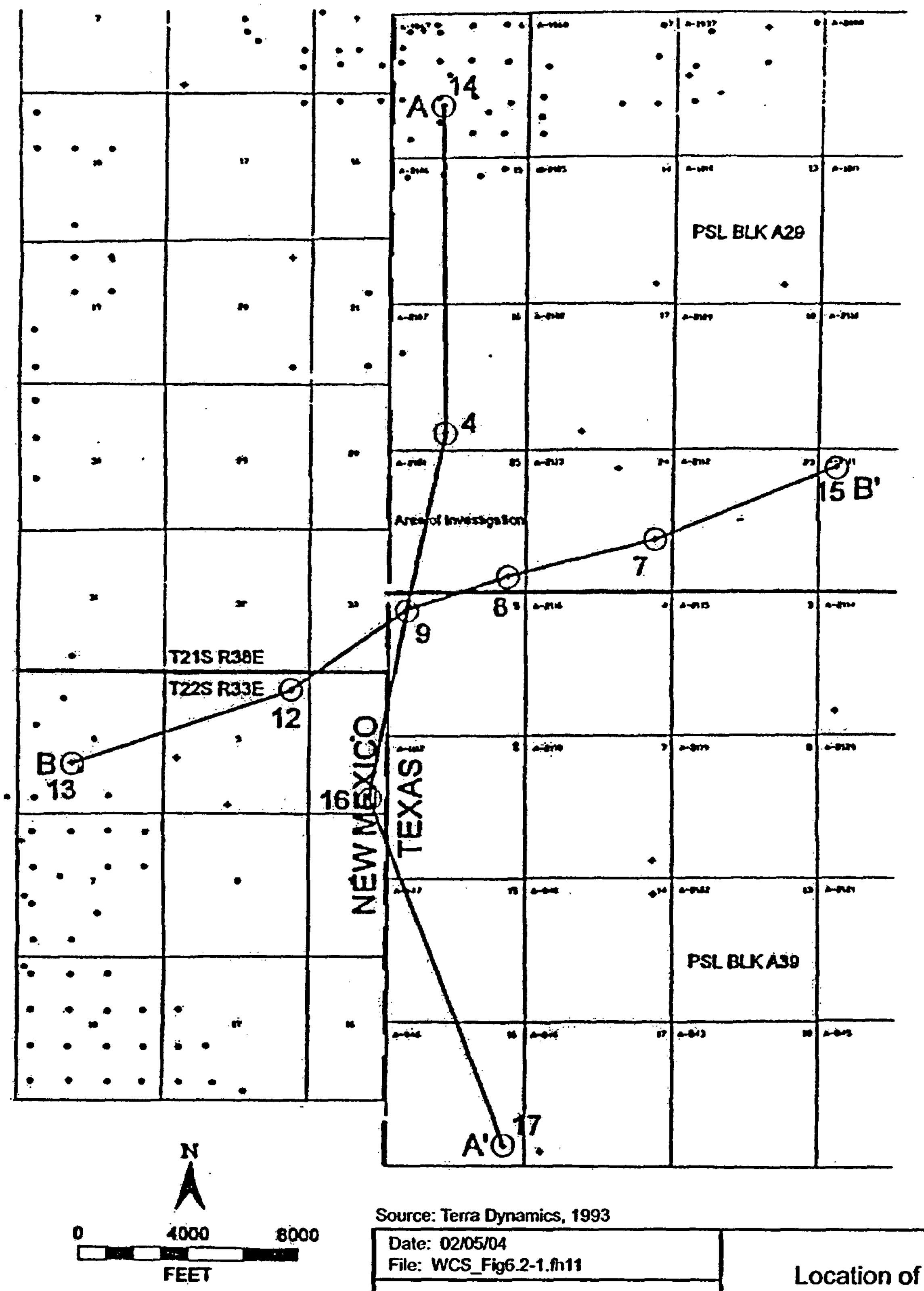
Physiographic Regions of the Texas Panhandle and Adjacent Areas of Texas and New Mexico

Figure 6.1-1



Source: Terra Dynamics, 1993

Date: 02/05/04
File: WCS_Fig6.2-1.fh11

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Location of Stratigraphic Cross Sections

Figure 6.2-1

Years BP (millions)	SYSTEM/SERIES		GROUP	FORMATION	
0.01	QUATERNARY		RECENT/HOLOCENE	Windblown Sand	Playa Deposits
			PLEISTOCENE	Blackwater Draw or Tahoka	
1.6	TERTIARY			Ogallala	Gatuna
66	CRETACEOUS		COMMANCHEAN	Duck Creek	
				Kiamichi	
				Edwards	
				Comanche Peak	
				Walnut	
				Antlers	
144	JURASSIC				
208	TRIASSIC		DOCKUM	Redonda	
				Cooper Canyon	
				Trujillo	
				Tecovas	
				Santa Rosa	
245	PERMIAN	OCHOA		Dewey Lake	
				Rustler	
				Salado	
		GUADALUPE	WHITEHORSE	Tansill	
				Yates	
				Seven Rivers	
				Queen	
				Grayburg	
			SAN ANDRES	Glorieta	
		LEONARD	CLEAR FORK	U. Clear Fork	
				Tubb Sd.	
				L. Clear Fork	
			WICHITA	Wichita-Abo	
		WOLFCAMP	WOLFCAMP		
286	PENNSYLVANIAN	CISCO	CISCO		
		CANYON	CANYON		
		STRAWN	STRAWN		
		ATOKA	ATOKA		
320	MISSISSIPPIAN	MERAMEC		Mississippian Lime	
		KINDERHOOK	KINDERHOOK		
360	DEVONIAN	UPPER	WOODFORD	Woodford Shale	
		LOWER	DEVONIAN		
408	SILURIAN	U. NIAGARAN		Upper Silurian Shale	
		L. NIAGARAN	FUSSELMAN		
		ALEXANDRIAN			
438	ORDOVICIAN	UPPER	MONTOYA		
		MIDDLE	SIMPSON		
		LOWER	ELLENBURGER		
505	CAMBRIAN				
570	PRECAMBRIAN			Igneous and Metamorphic Rocks	

------ Denotes Unconformity

Source: Modified from WTGS, 1976; Bebout & Meador, 1985

Date: 02/06/04
File: WCS_Fig6.2-2.ai

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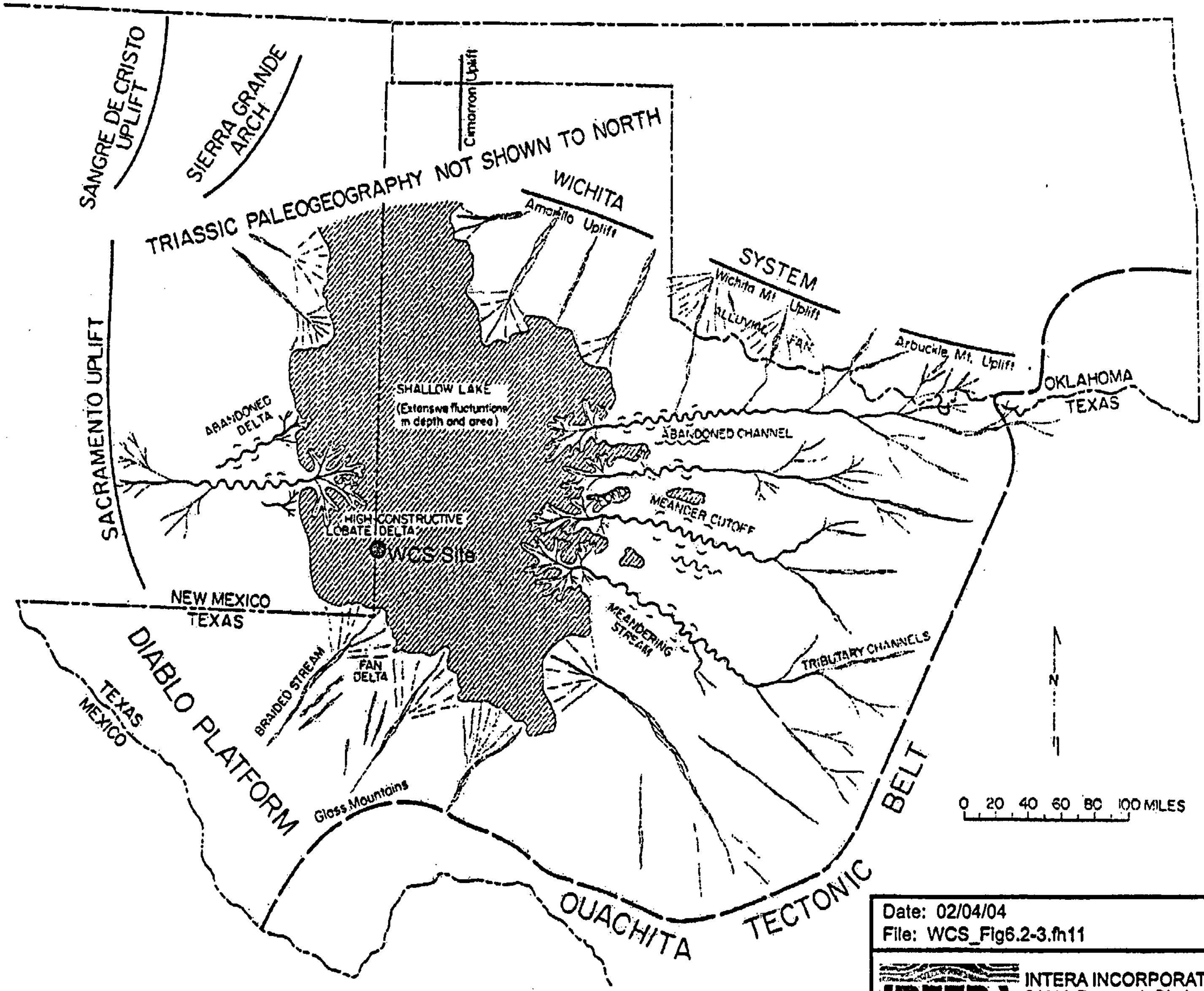
Stratigraphic Column Central Basin Platform

Figure 6.2-2



Source: McGowen et al., 1979

Date: 02/04/04
File: WCS_Fig6.2-3.fh11

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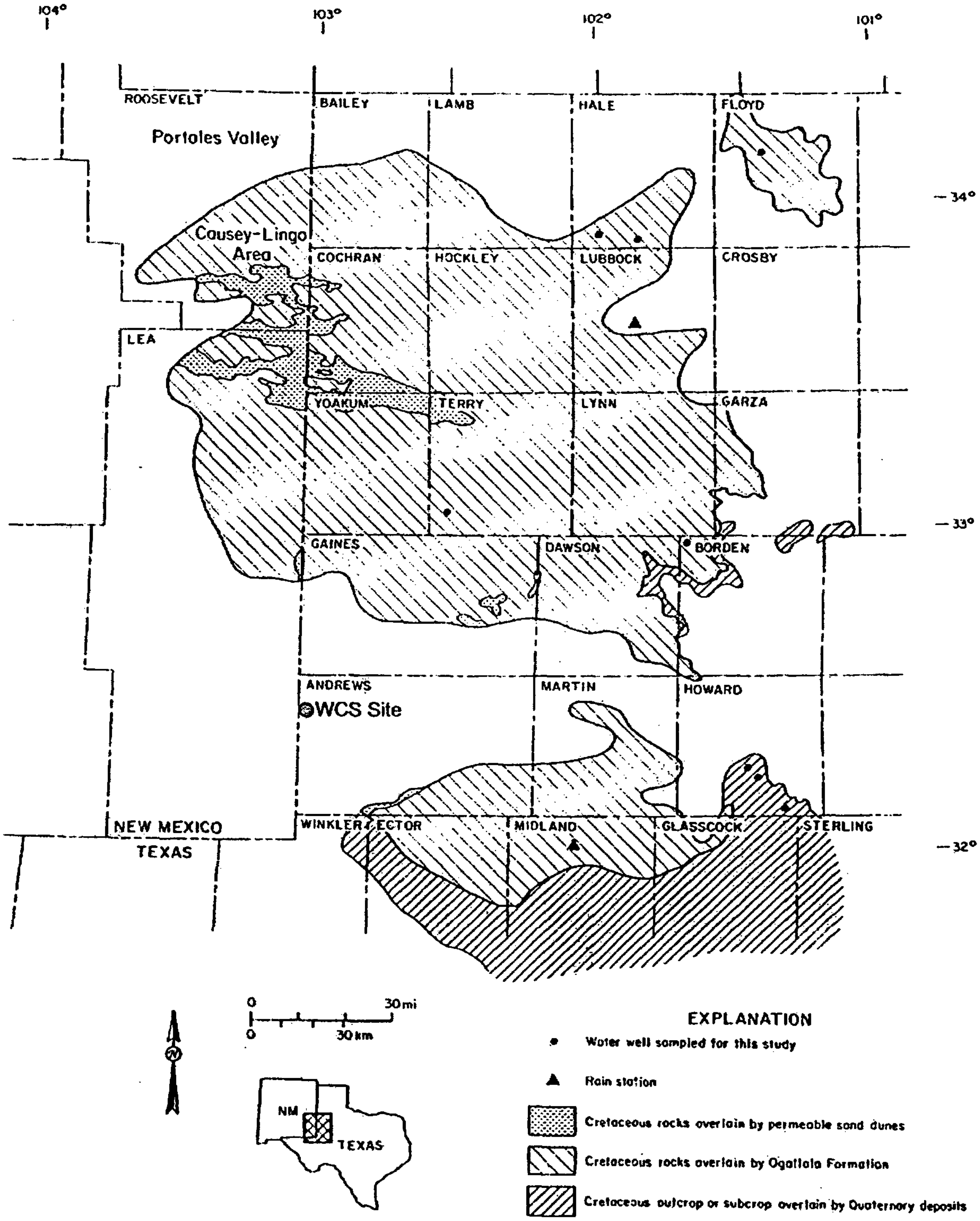
Inferred Paleogeography of Dockum Sedimentation

Figure 6.2-3



Source: Nativ and Gutierrez, 1988

Date: 02/04/04
File: WCS_Fig6.2-4.fh11

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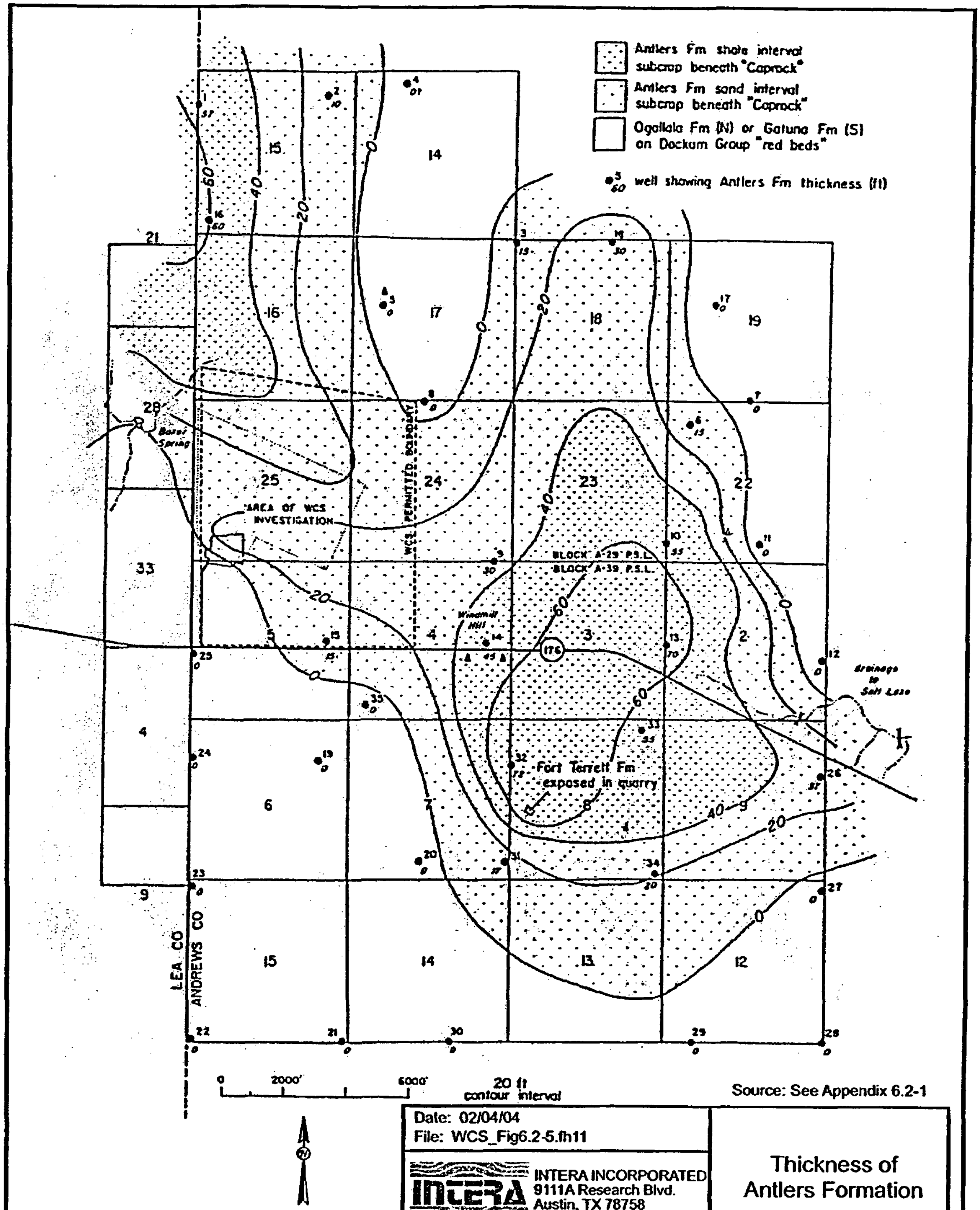
Map of Cretaceous Subcrops

Figure 6.2-4



Source: See Appendix 6.2-1

Date: 02/04/04
File: WCS_Fig6.2-5.fh11

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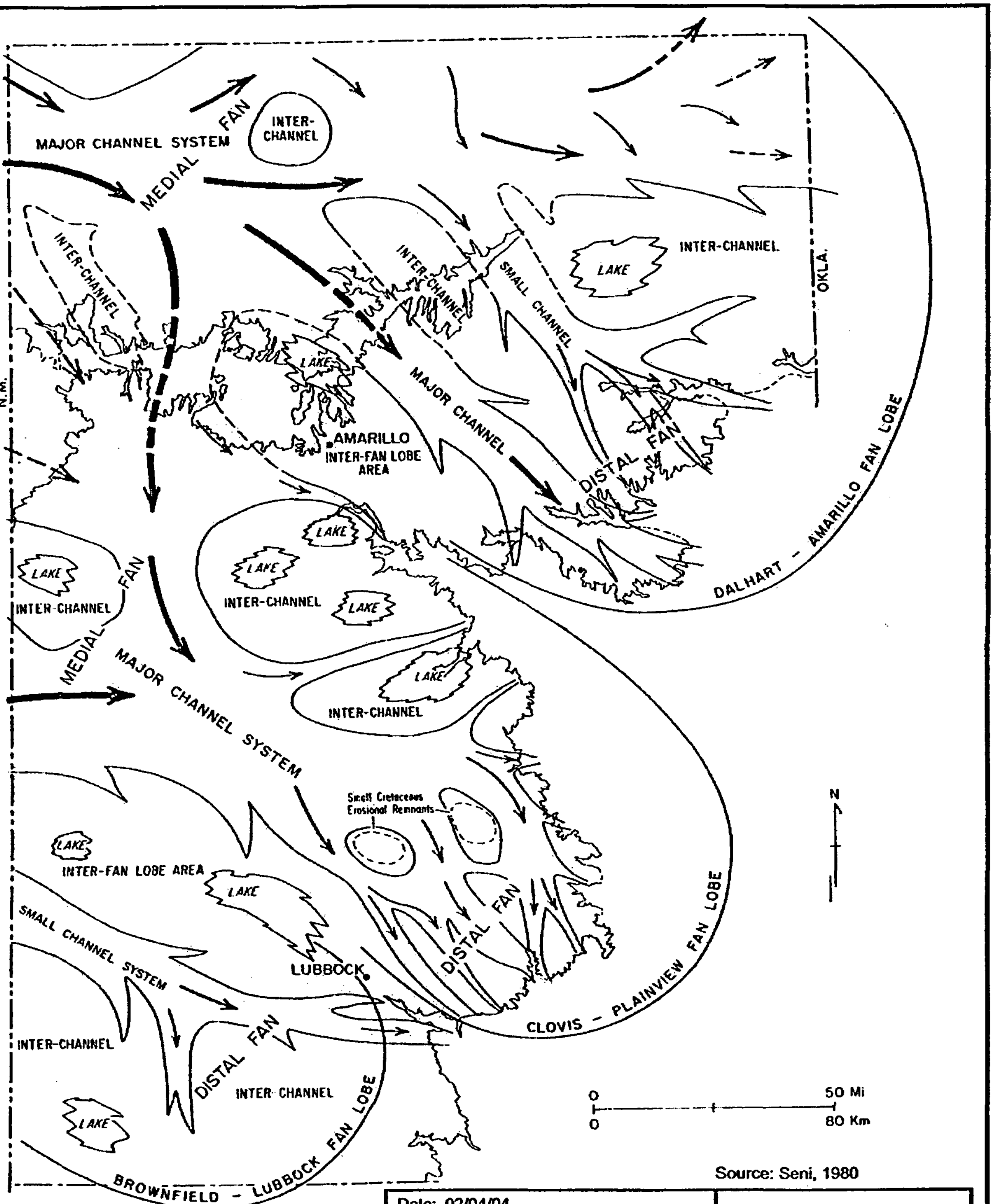
Thickness of Antlers Formation

Figure 6.2-5



Source: Seni, 1980

Date: 02/04/04
File: WCS_Fig6.2-6.fh11

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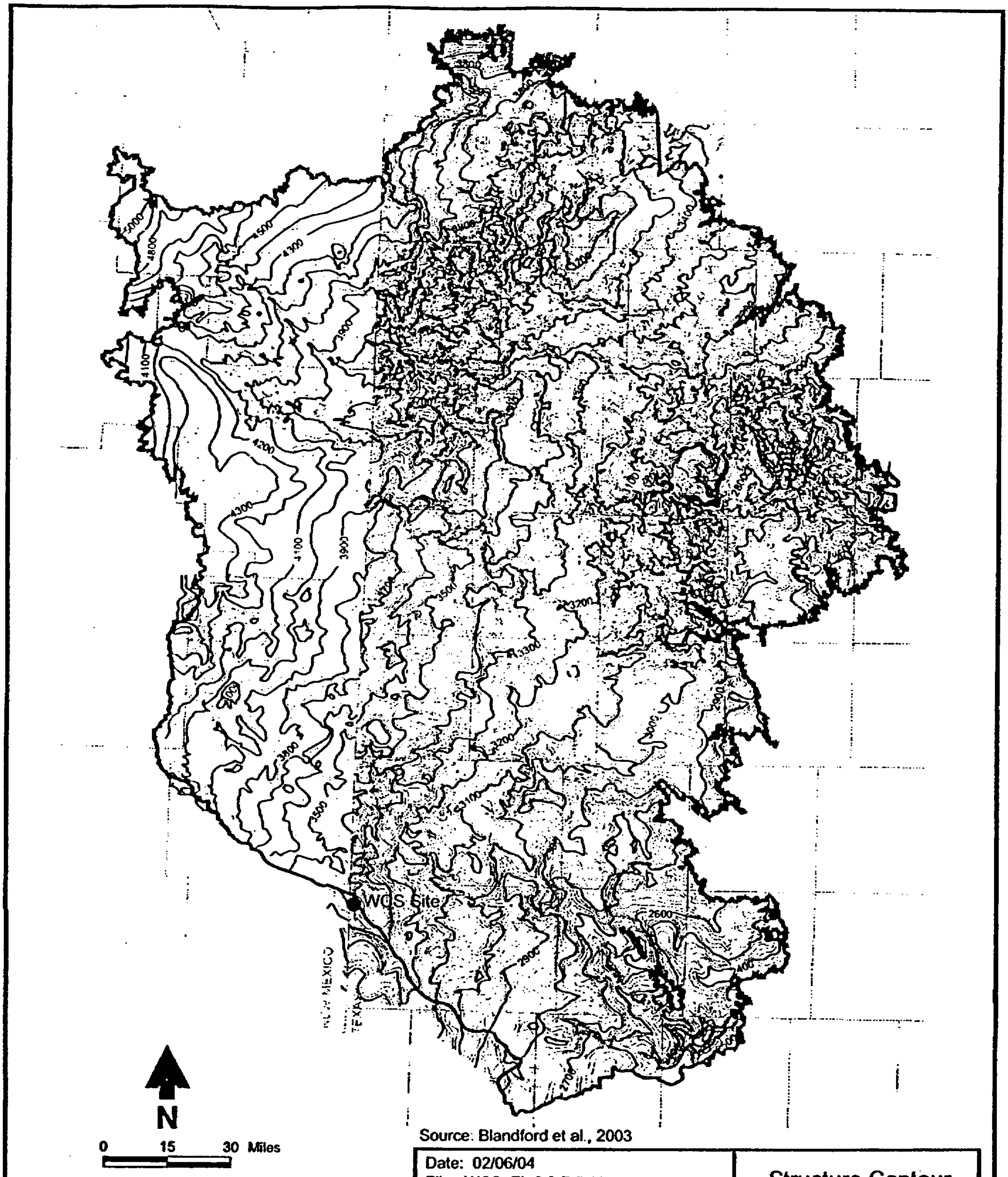
Ogallala Depositional Facies Map

Figure 6.2-6



Source: Blandford et al., 2003

Date: 02/06/04
File: WCS_Fig6.2-7.fh11

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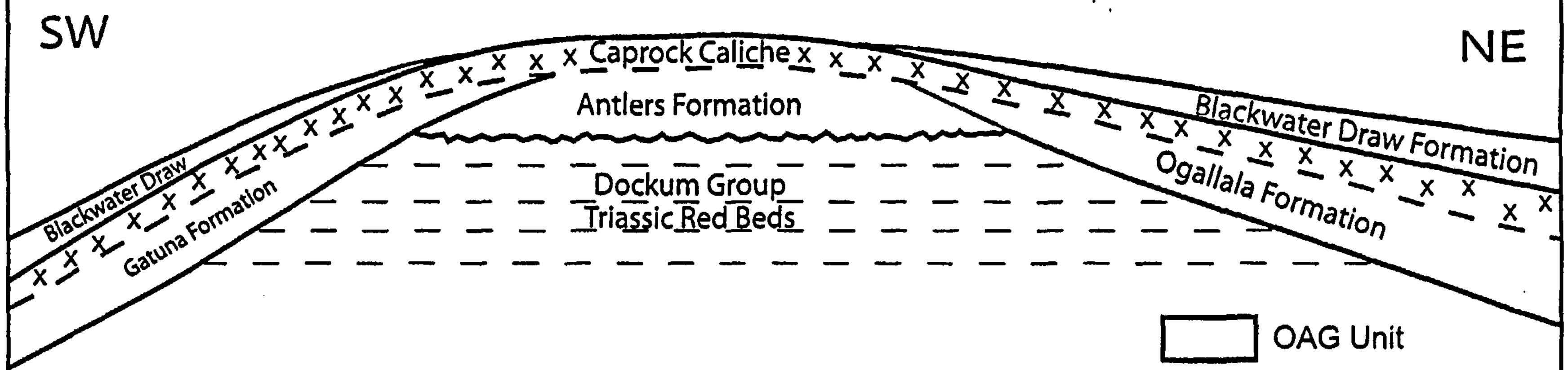
Structure Contour Map of the Base of the Ogallala Formation

Figure 6.2-7



Date: 02/06/04
File: WCS_Fig.fh11

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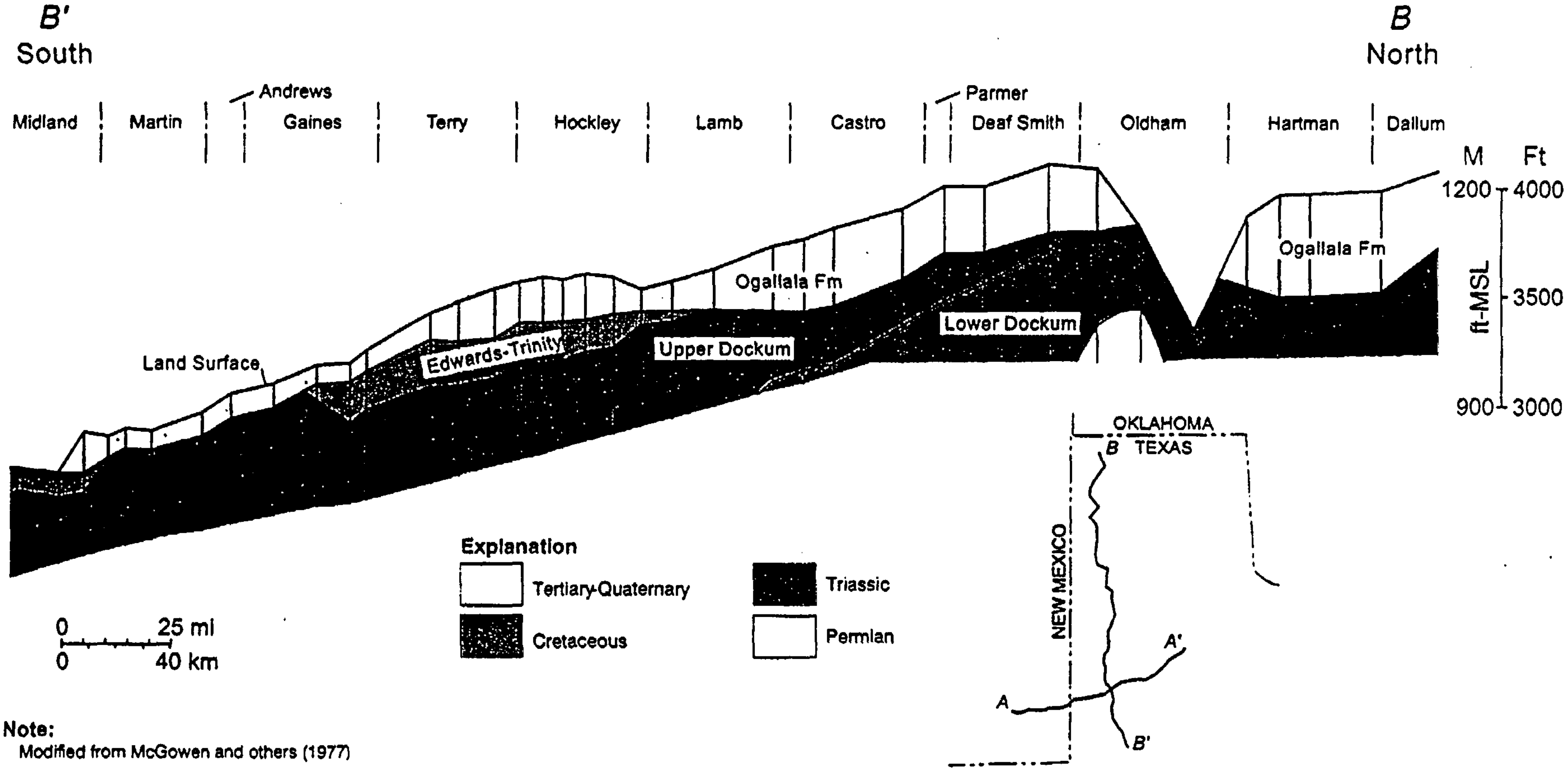
Schematic Cross Section of the OAG (Ogallala, Antlers, Gatuna) Unit at the WCS Facility

Figure 6.2-8



Note:
Modified from McGowen and others (1977)

Source: Blandford et al., 2003

Date: 02/04/04
File: WCS_Fig6.3.1.fh11

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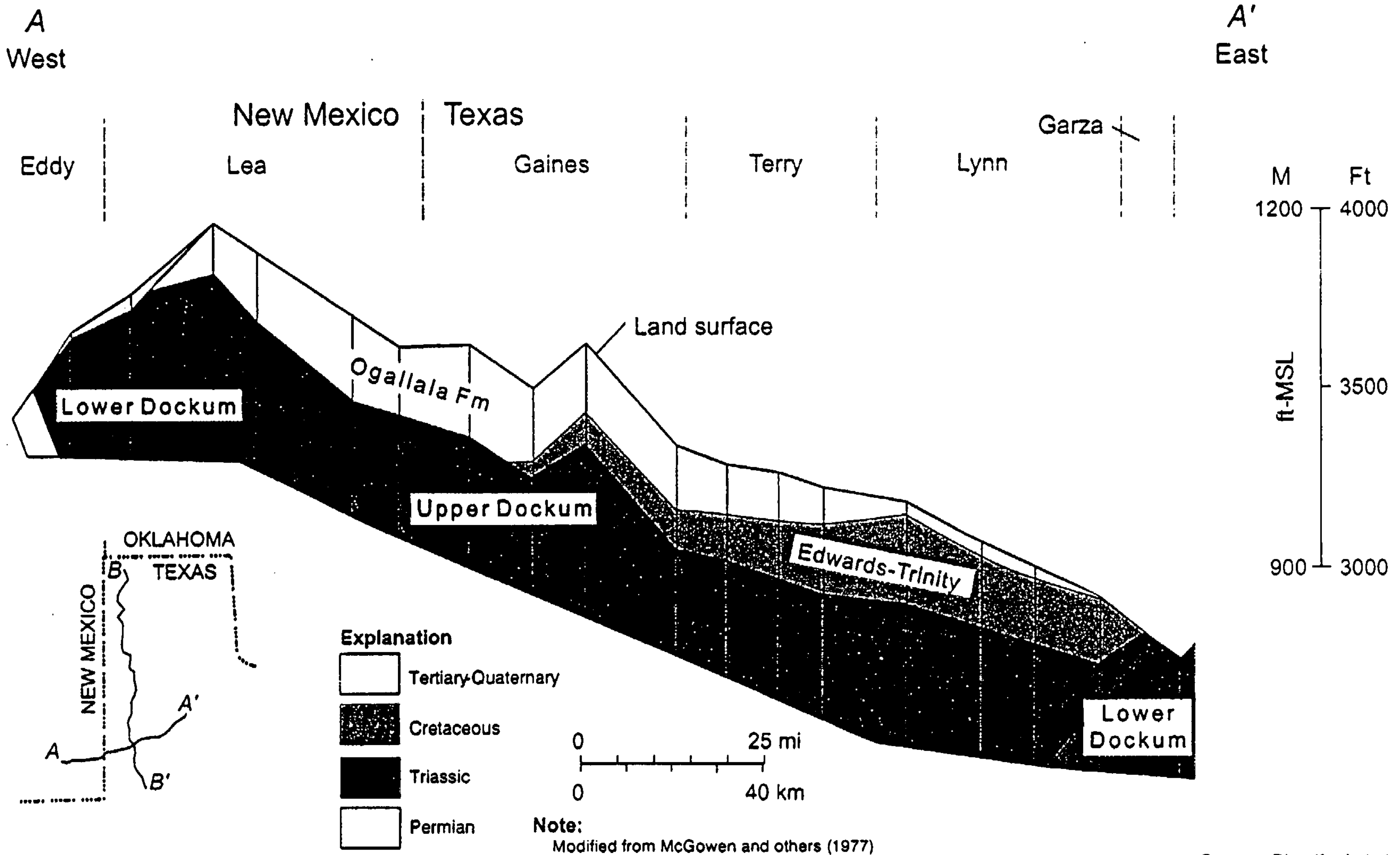
North to South Geologic Cross Section Showing Relationship of Ogallala Formation to Underlying Strata

Figure 6.3-1



Note:
Modified from McGowen and others (1977)

Source: Blandford et al., 2003

Date: 02/04/04
File: WCS_Fig6.3.2.fh11

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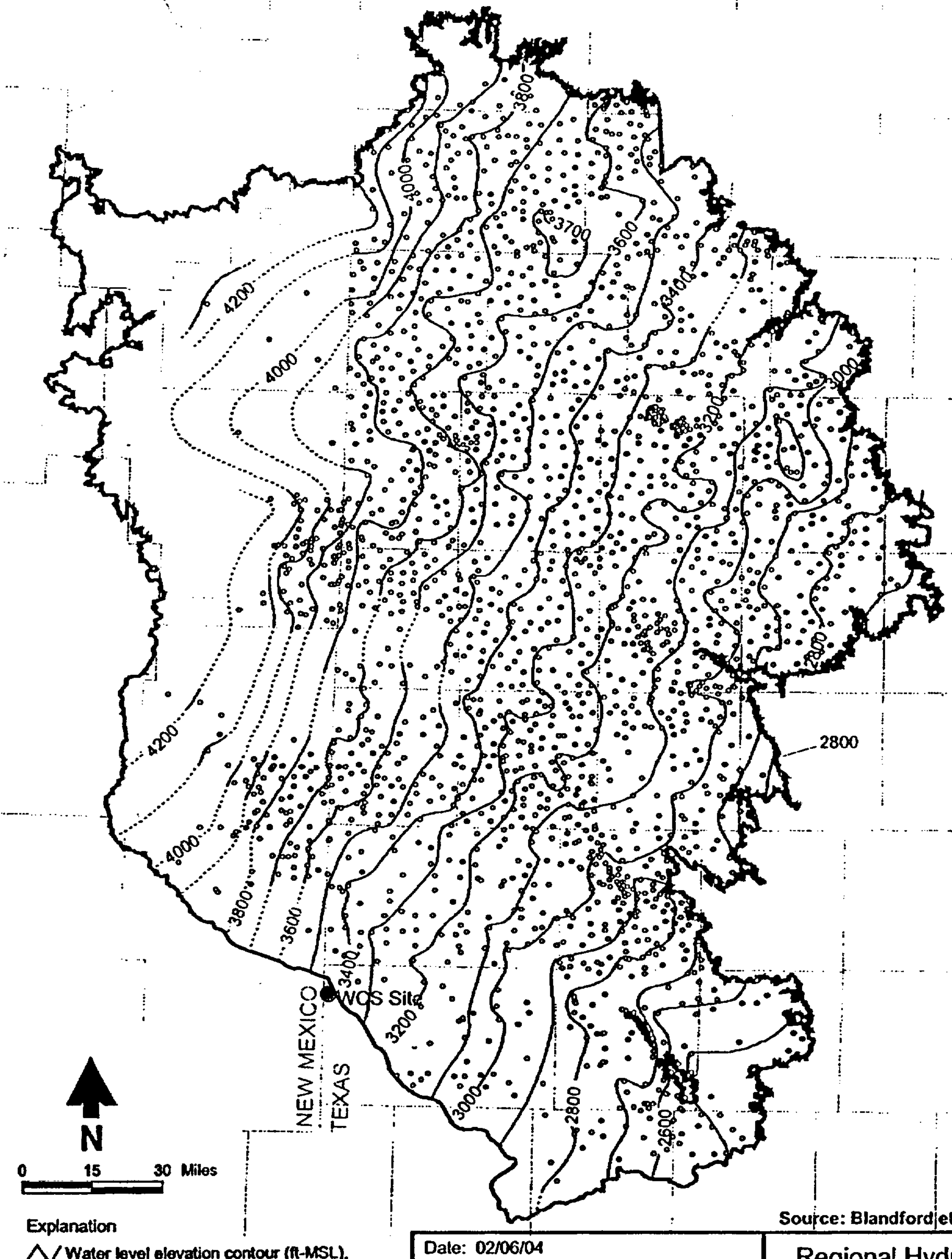
West to East Geologic Cross Section Showing Relationship of Ogallala Formation to Underlyging Strata

Figure 6.3-2



Source: Blandford et al., 2003

Date: 02/06/04
File: WCS_Fig6.3-3.fh11

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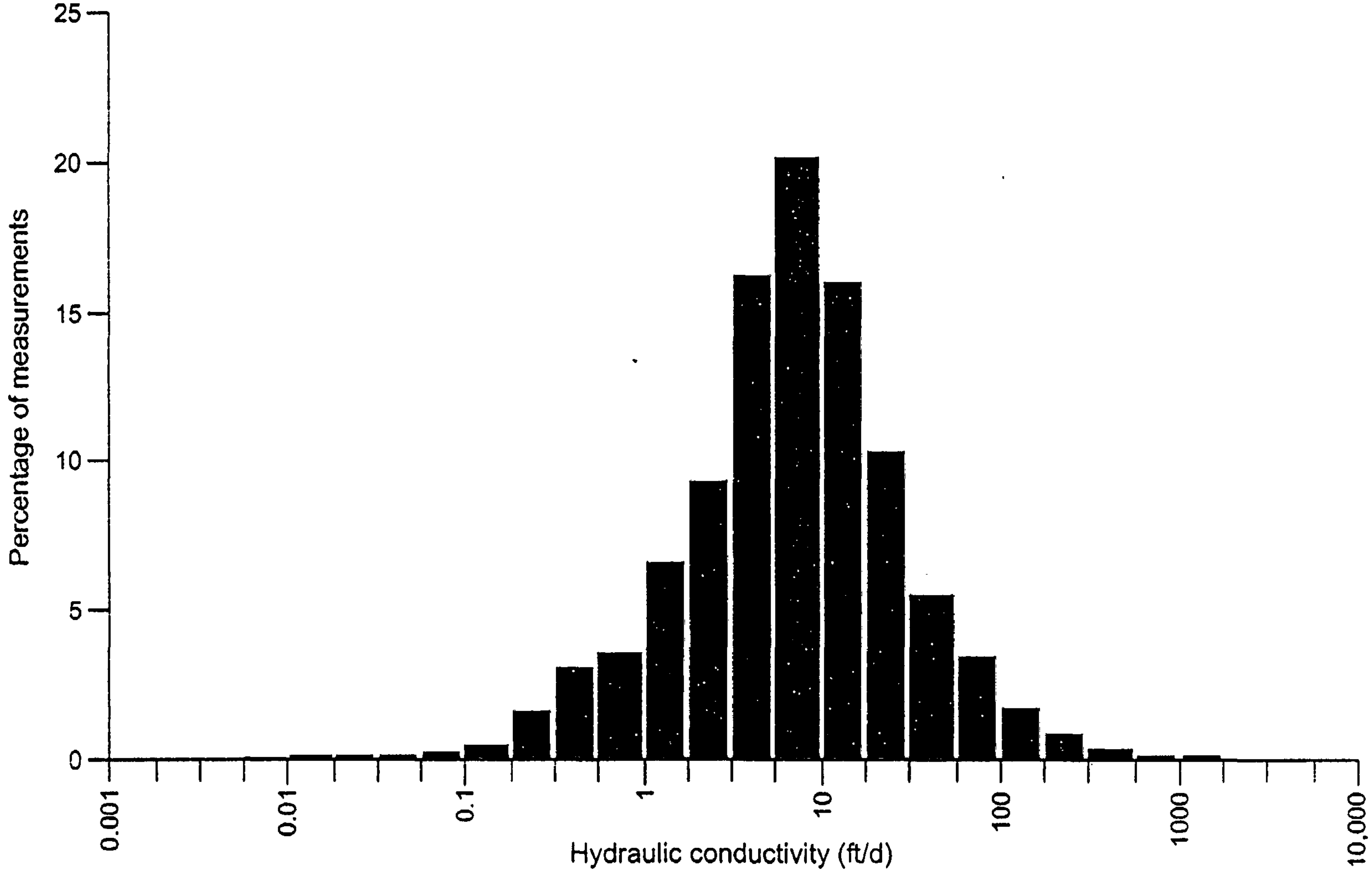
Regional Hydraulic Gradient of the Ogallala Aquifer, November 1999 - April 2000

Figure 6.3-3



Source: Blandford et al., 2003

Date: 02/04/04
File: WCS_Fig6.3-4.fh11

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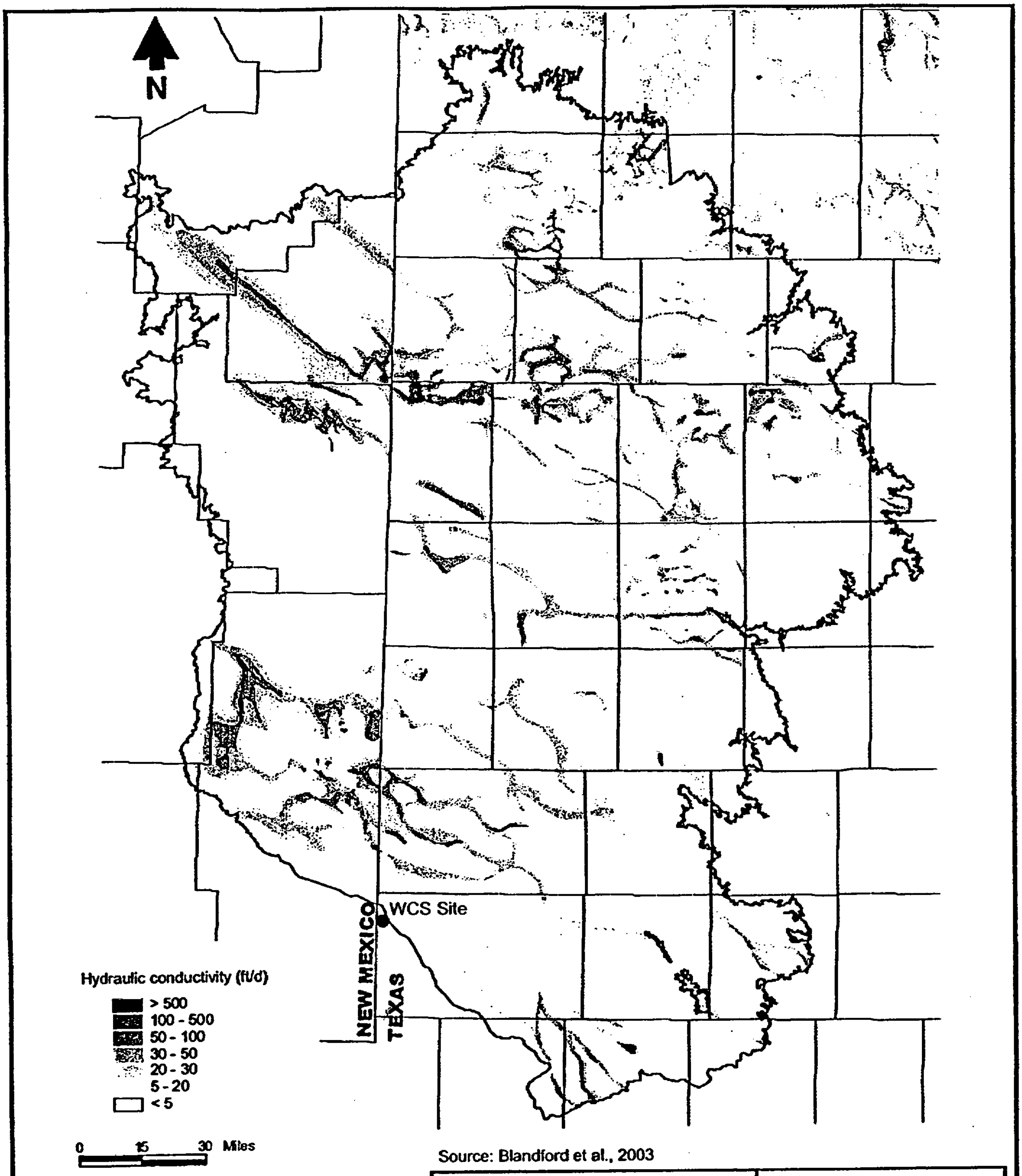
Histogram of Hydraulic Conductivity of the Ogallala Aquifer

Figure 6.3-4



Source: Blandford et al., 2003

Date: 02/05/04
File: WCS_Fig6.3-5.fh11

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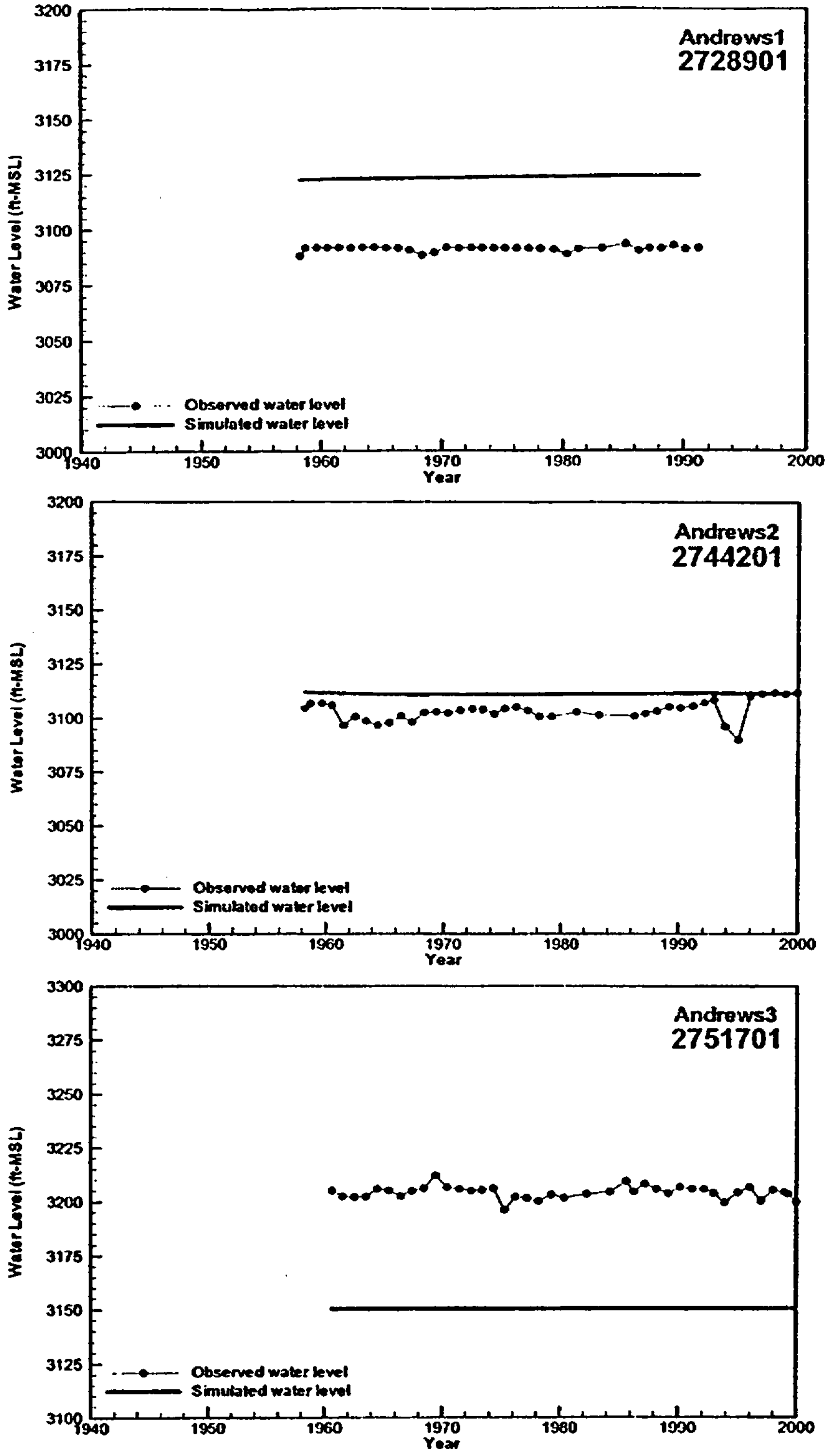
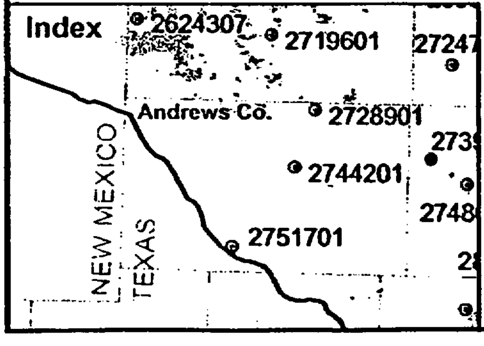
Distribution of Hydraulic Conductivity in the Ogallala Aquifer

Figure 6.3-5





Source: Blandford et al., 2003

Date: 02/05/04
File: WCS_Fig6.3-6.fh11

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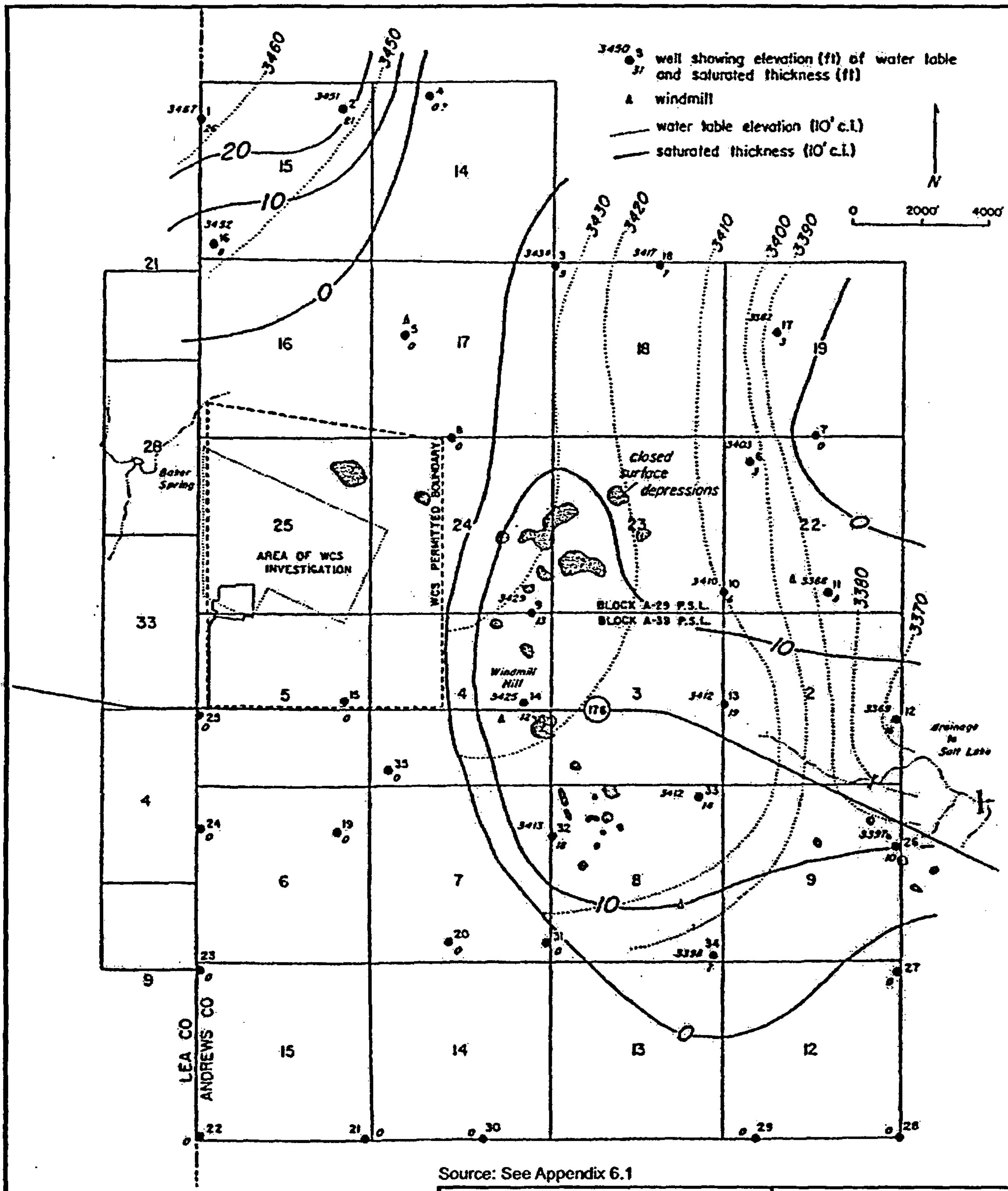
Water Levels in the Ogallala Aquifer in Andrews County, Approximately 1960 to Present

Figure 6.3-6



Source: See Appendix 6.1

Date: 02/05/04
File: WCS_Fig6.3-7.fh11

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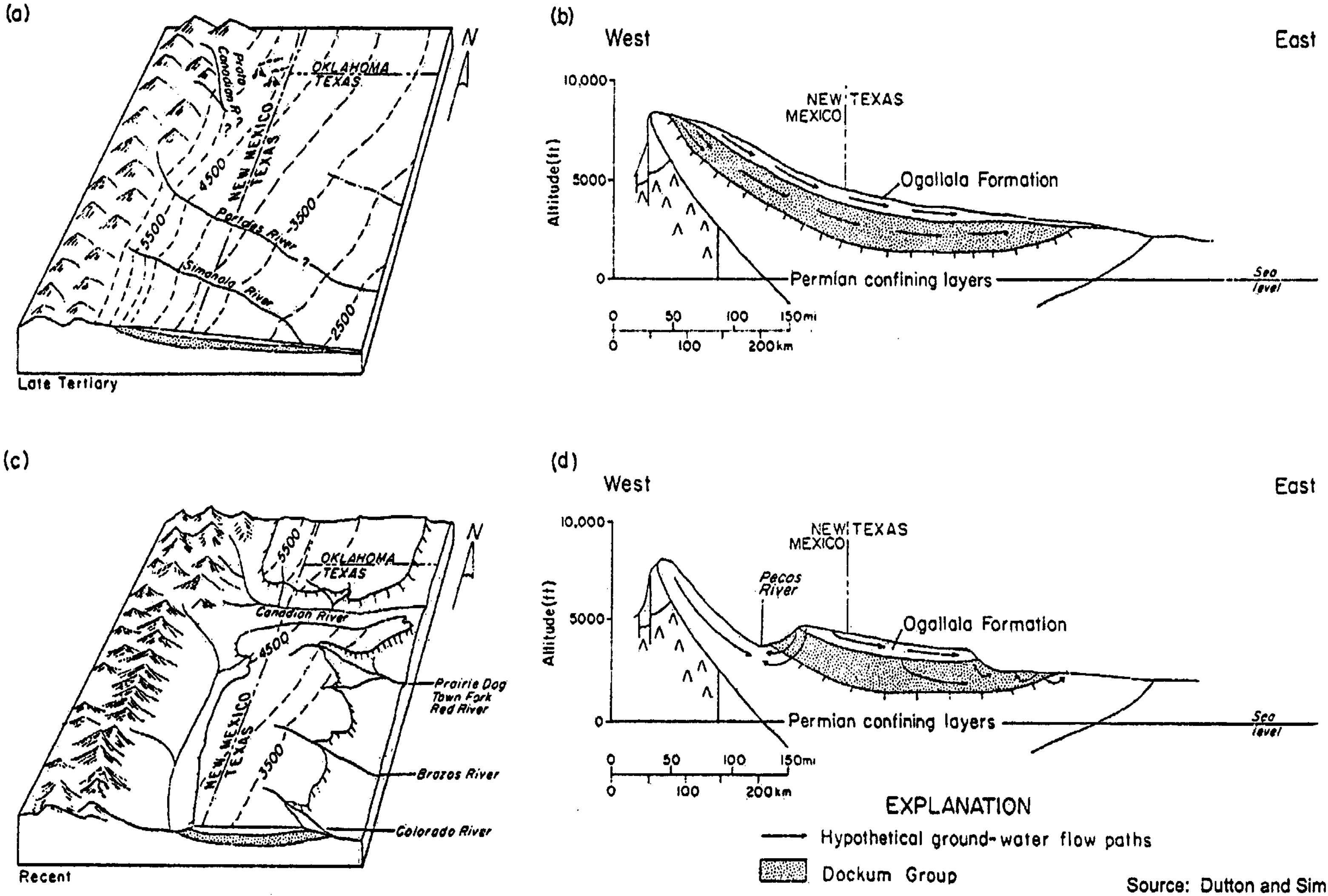
Groundwater Elevation and Saturated Thickness in the Vicinity of the WCS Facility

Figure 6.3-7



Source: Dutton and Simpkins, 1986

Date: 02/05/04
File: WCS_Fig6.3-8.fh11

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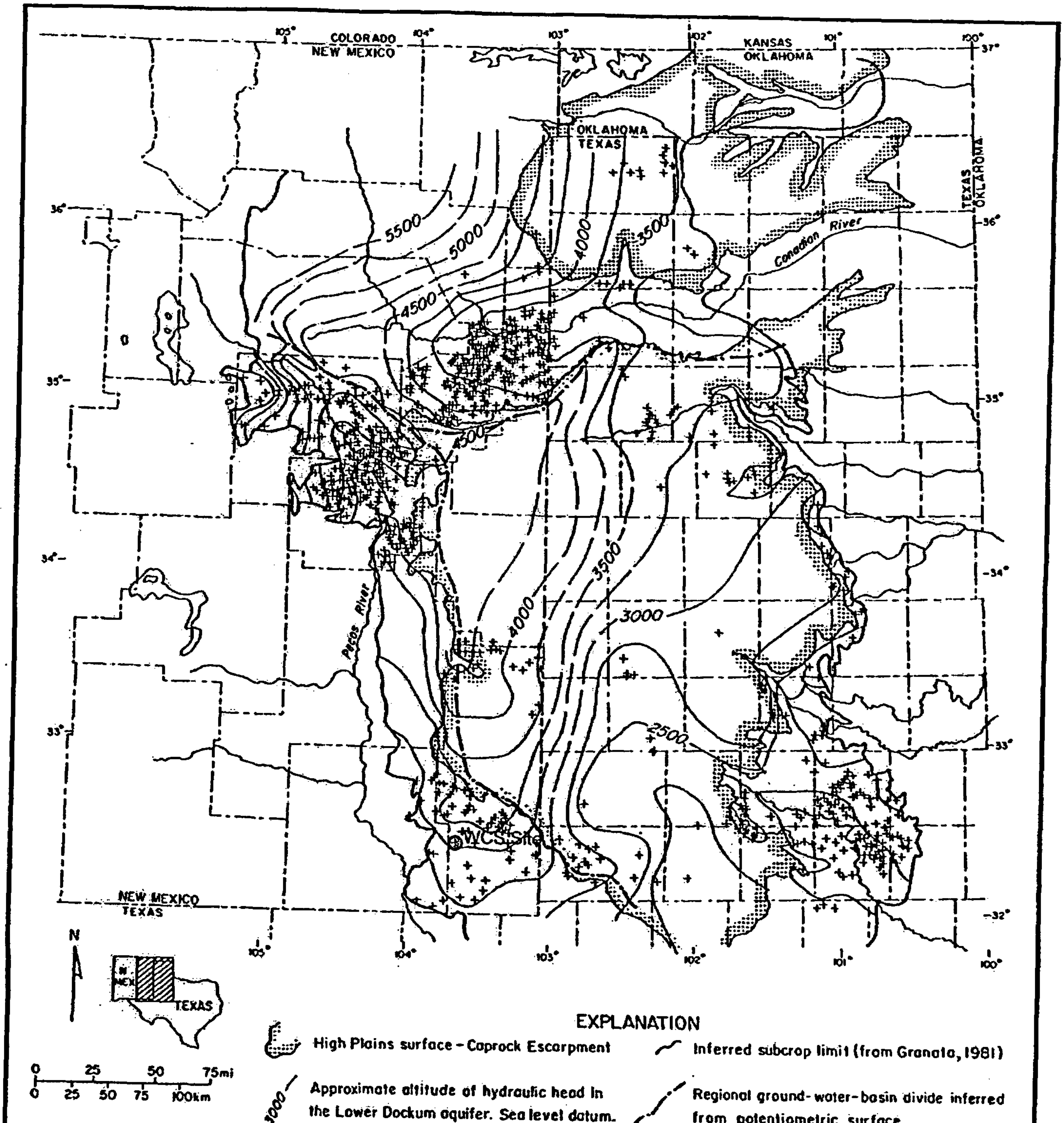
Schematic Showing Recharge to the Dockum Group Before and After Development of the Pecos River

Figure 6.3-8



EXPLANATION

High Plains surface - Caprock Escarpment

Inferred subcrop limit (from Granata, 1981)

3000 Approximate altitude of hydraulic head in the Lower Dockum aquifer. Sea level datum. Contour interval: 250 ft (76.2m)

Regional ground-water-basin divide inferred from potentiometric surface

\+ Data from water wells in Dockum Group

Source: Dutton and Simpkins, 1986

Date: 02/06/04
File: WCS_Fig6.3-9.fh11

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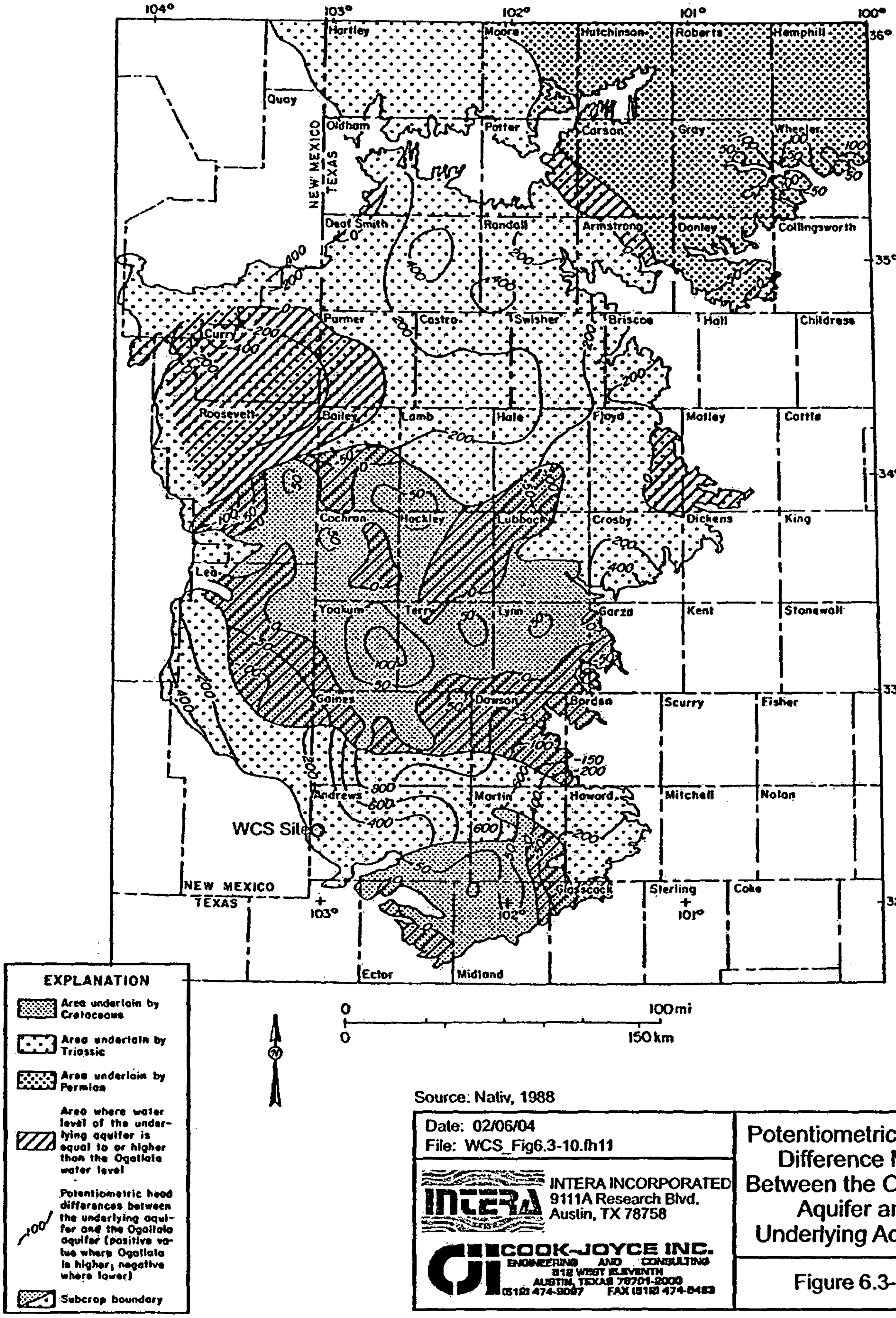
Potentiometric Surface Map of the Dockum Group Aquifer

Figure 6.3-9



Source: Nativ, 1988

Date: 02/06/04
File: WCS_Fig6.3-10.fh11

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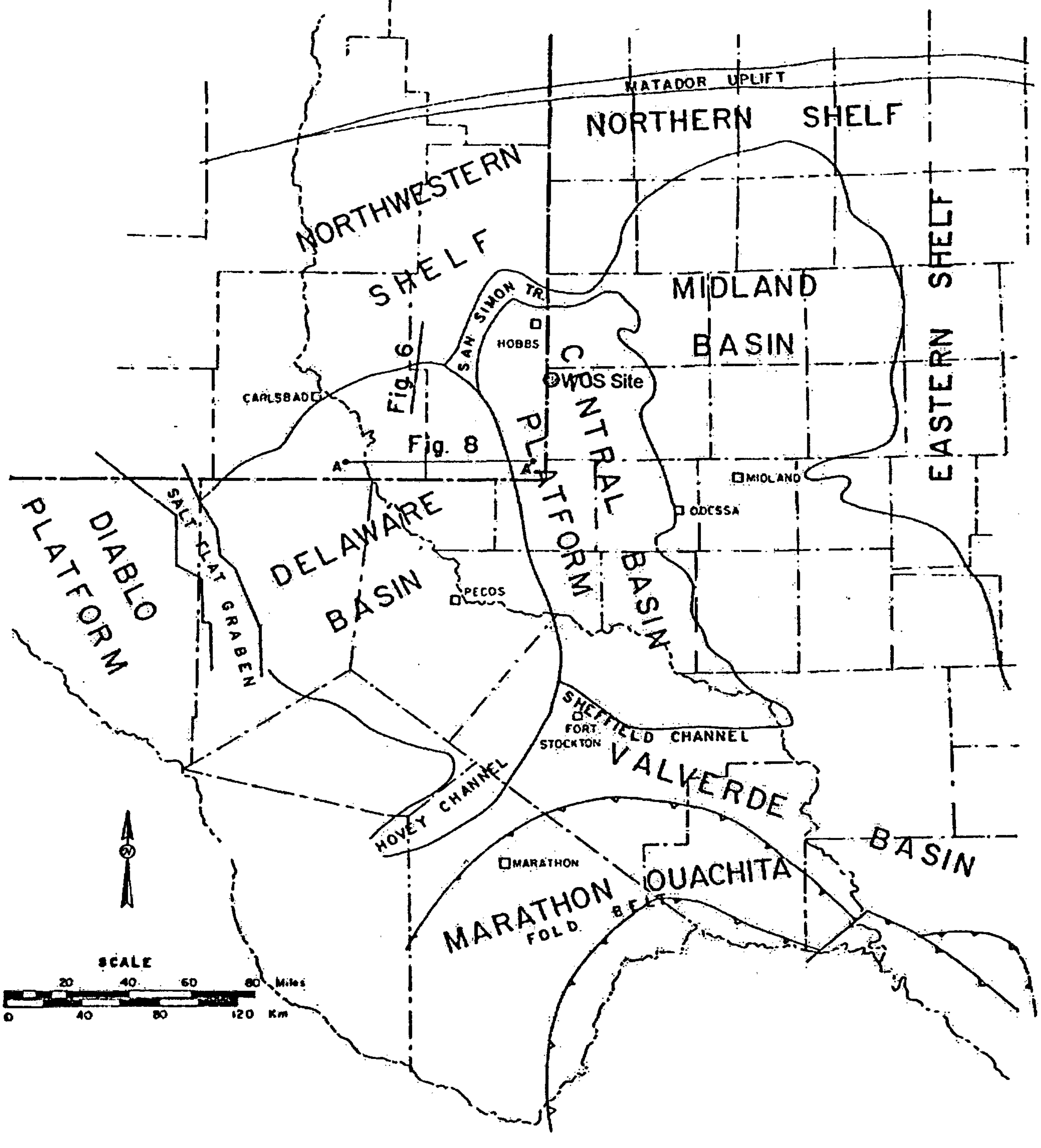
Potentiometric Head-Difference Map Between the Ogallala Aquifer and Underlying Aquifers

Figure 6.3-10



Source: Hills, 1985

Date: 02/04/04
File: WCS_Fig6.4-1.fh11

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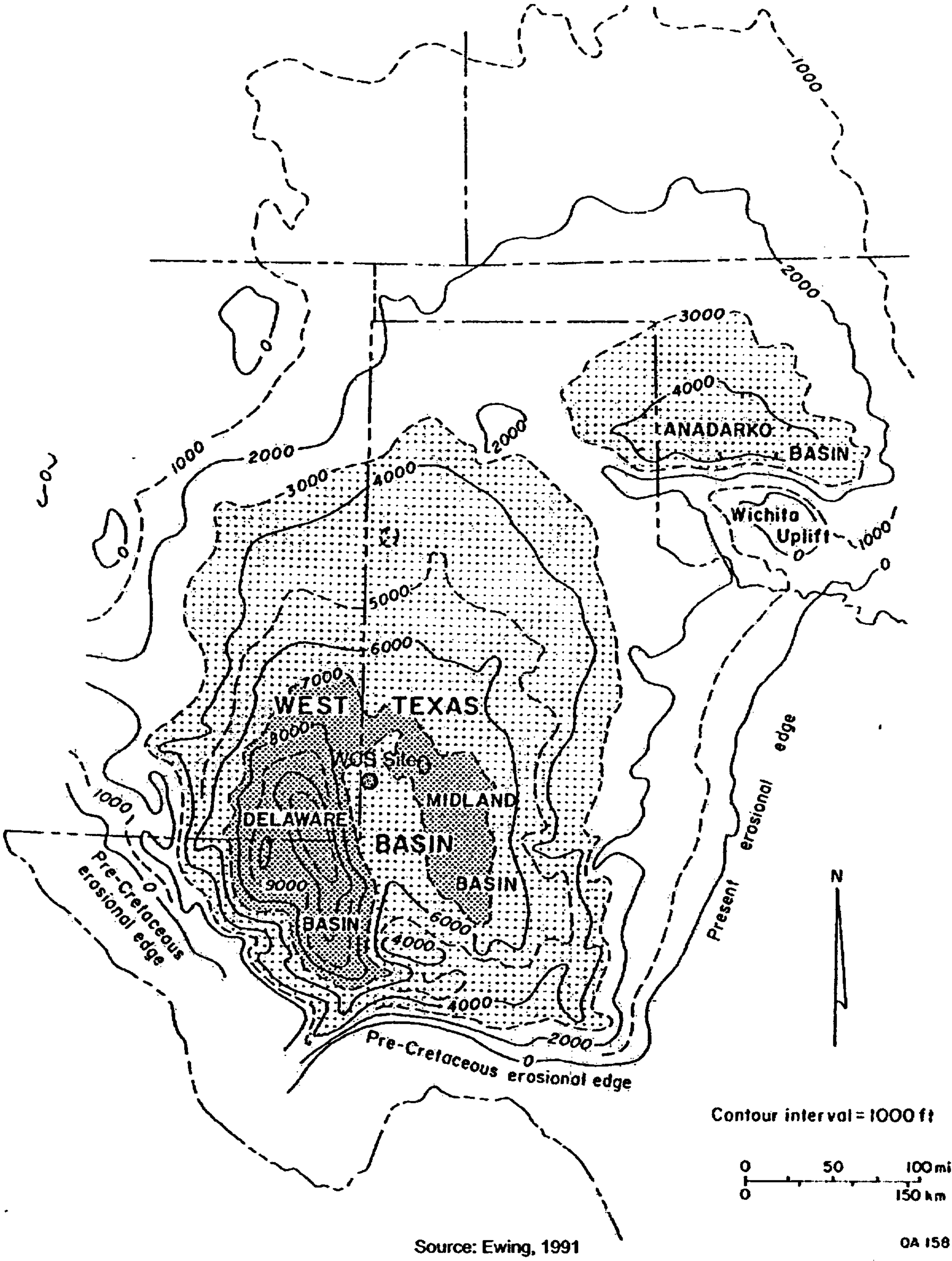
Major Structural Provinces of West Texas and Southeastern New Mexico

Figure 6.4-1



Source: Ewing, 1991

OA 15820

Date: 02/04/04
File: WCS_Fig6.4-2.fh11

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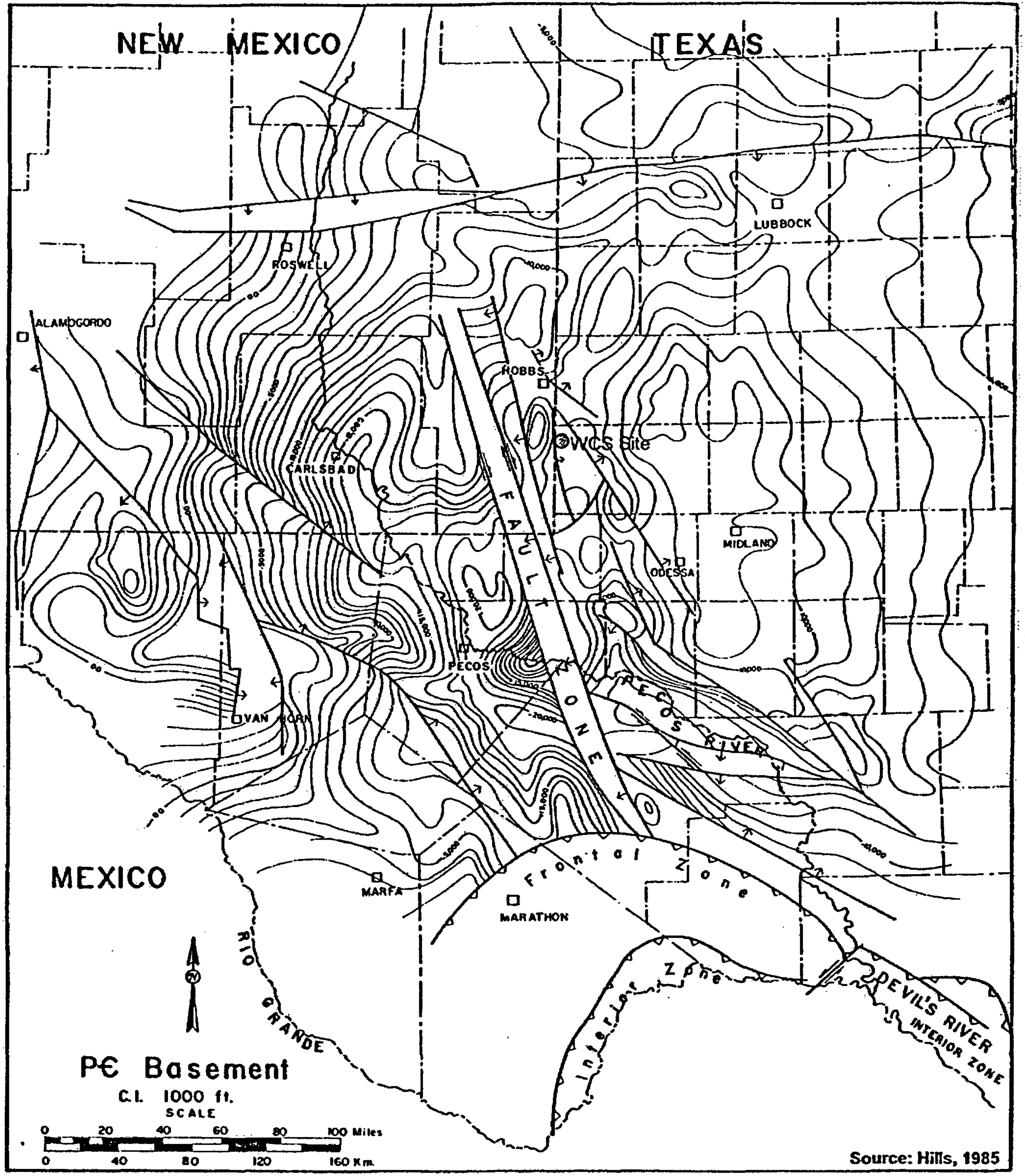
Isopach Map of post-Wolfcampian Permian Strata in the West Texas and Andarko Basins

Figure 6.4-2



Source: Hills, 1985

Date: 02/04/04
File: WCS_Fig6.4-1.fh11

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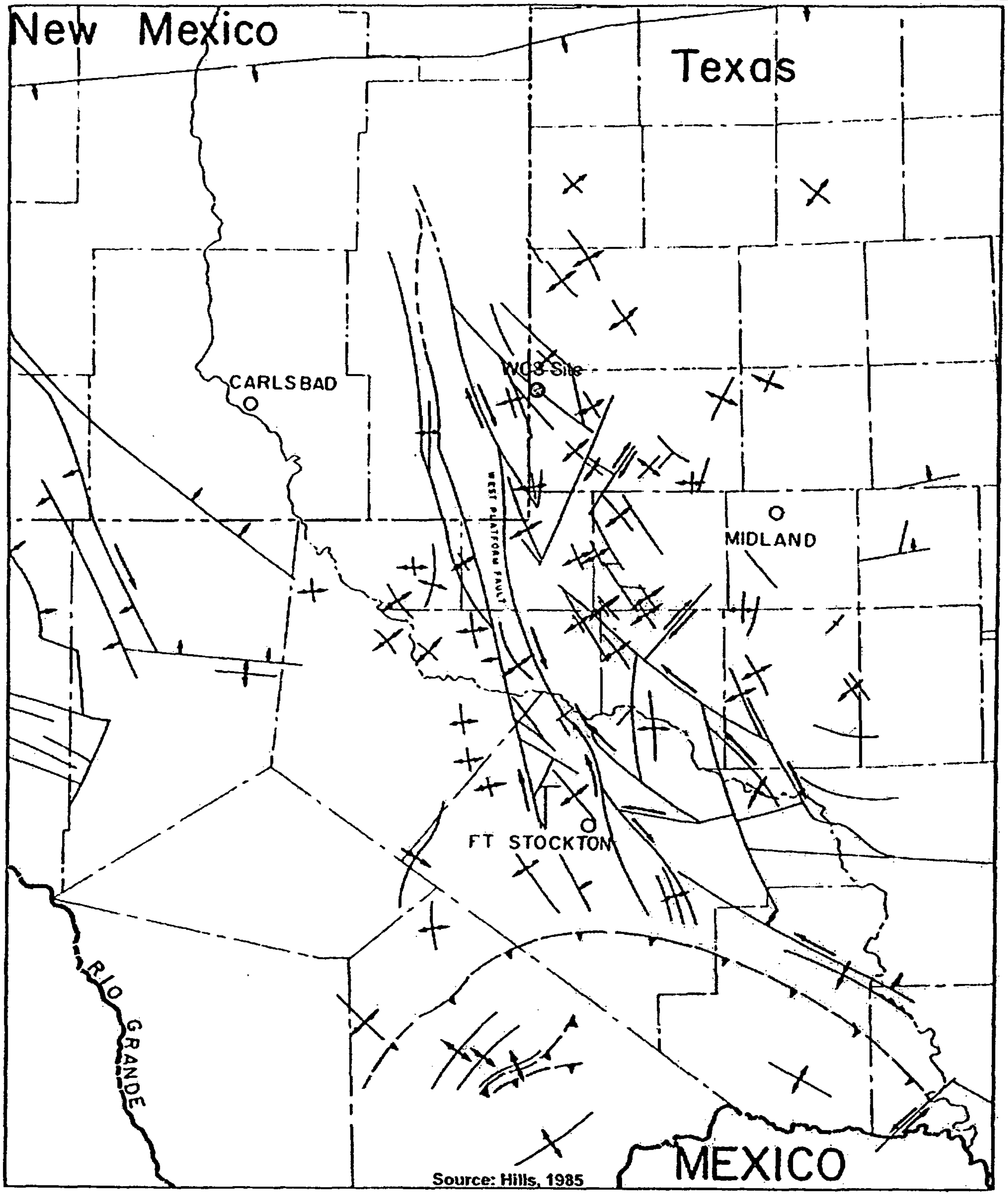
Regional Structure Contour Map of the Precambrian Basement

Figure 6.4-3



Source: Hills, 1985

Date: 02/04/04
File: WCS_Fig6.4-4.fh11

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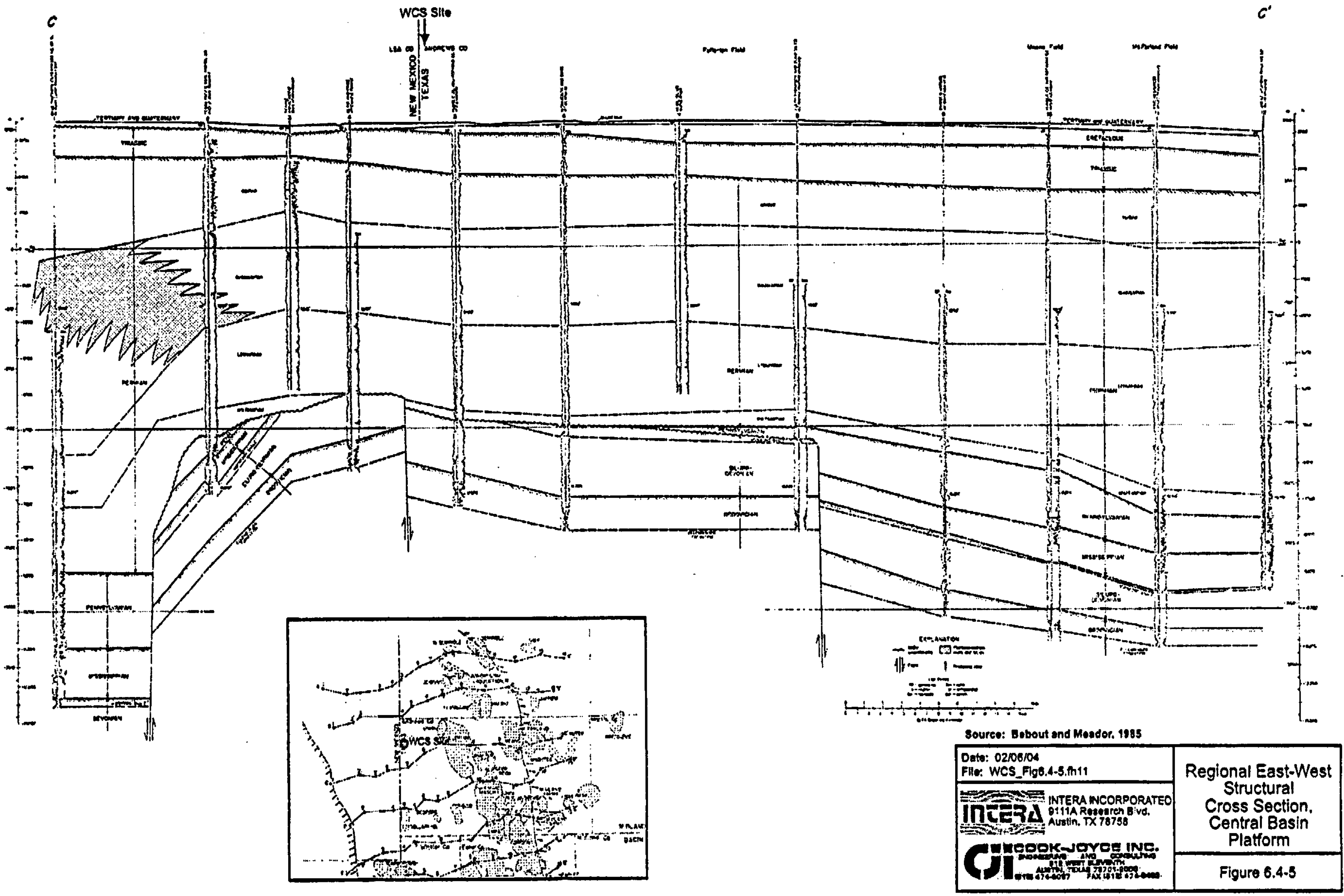
Major Tectonic Features of the Permian Basin - Late Mississippian to Early Permain

Figure 6.4-4



Source: Bebout and Meador, 1985

Date: 02/06/04
File: WCS_Fig6.4-5.fh11

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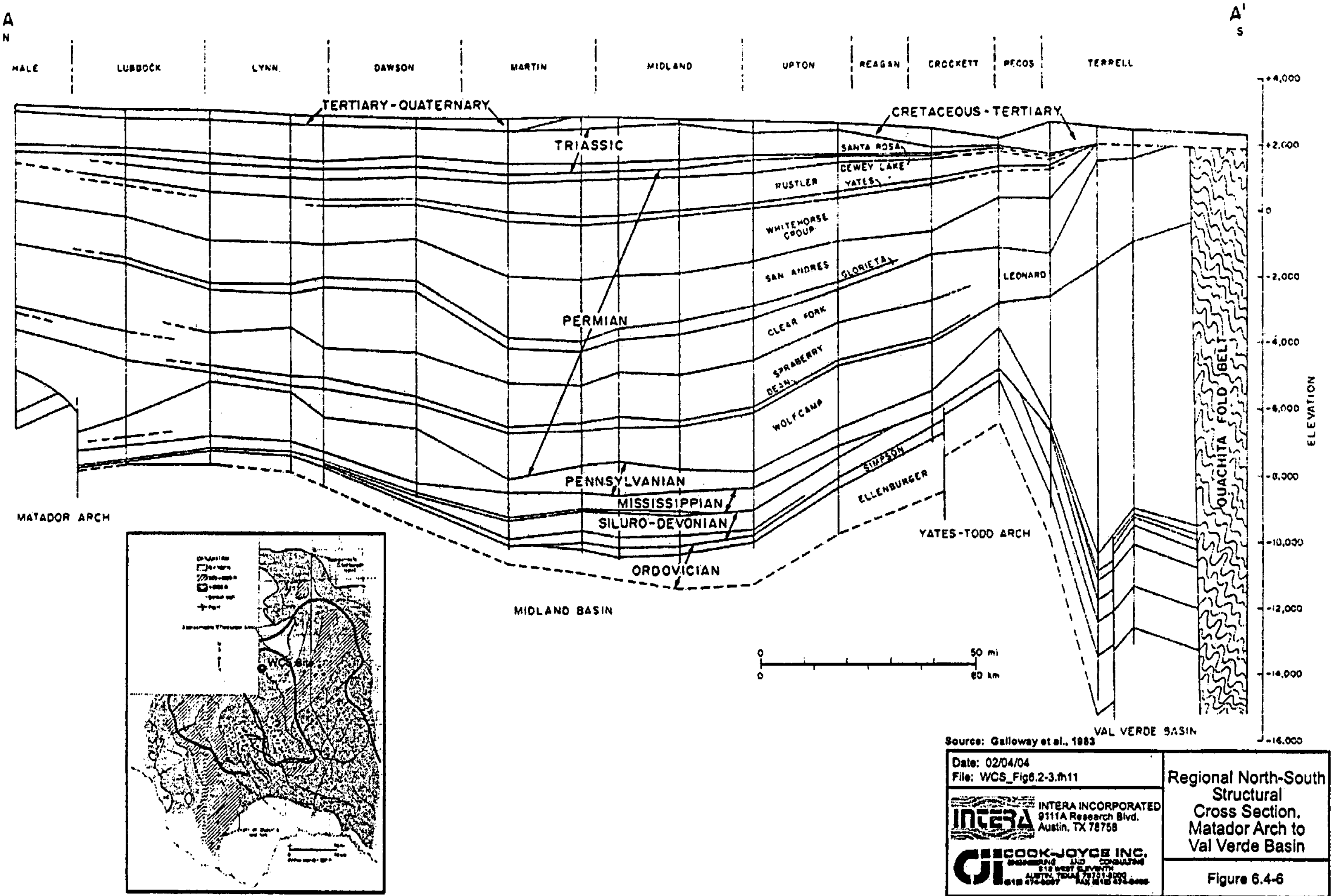
Regional East-West Structural Cross Section, Central Basin Platform

Figure 6.4-5



Source: Galloway et al., 1983

Date: 02/04/04
File: WCS_Fig6.2-3.fh11

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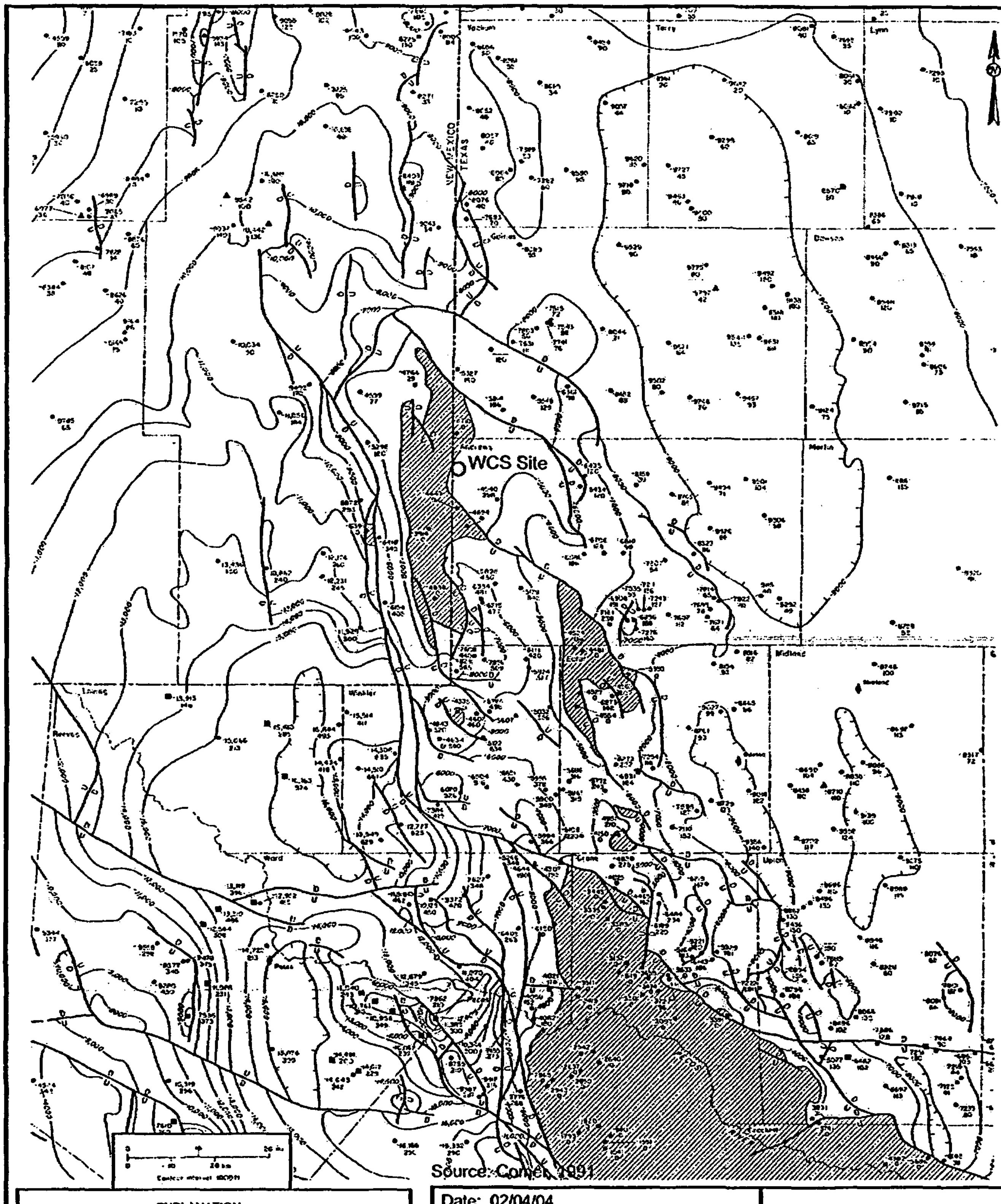
Regional North-South Structural Cross Section, Matador Arch to Val Verde Basin

Figure 6.4-6



Source: Comer, 1991

EXPLANATION

●	Wireline log	-4307	Subsea elevation, top of Woodford (ft)
■	Scout ticket	193	Thickness of Woodford (ft)
▲	Core	—7000—	Structure contour in feet below sea level, drawn on top of Woodford Formation; extrapolated where control is sparse on the basis of elevation of top of Ellenburger (SE) or top of Devonian (NW)
▨	Woodford absent		

Date: 02/04/04
File: WCS_Fig6.4-7.fh11

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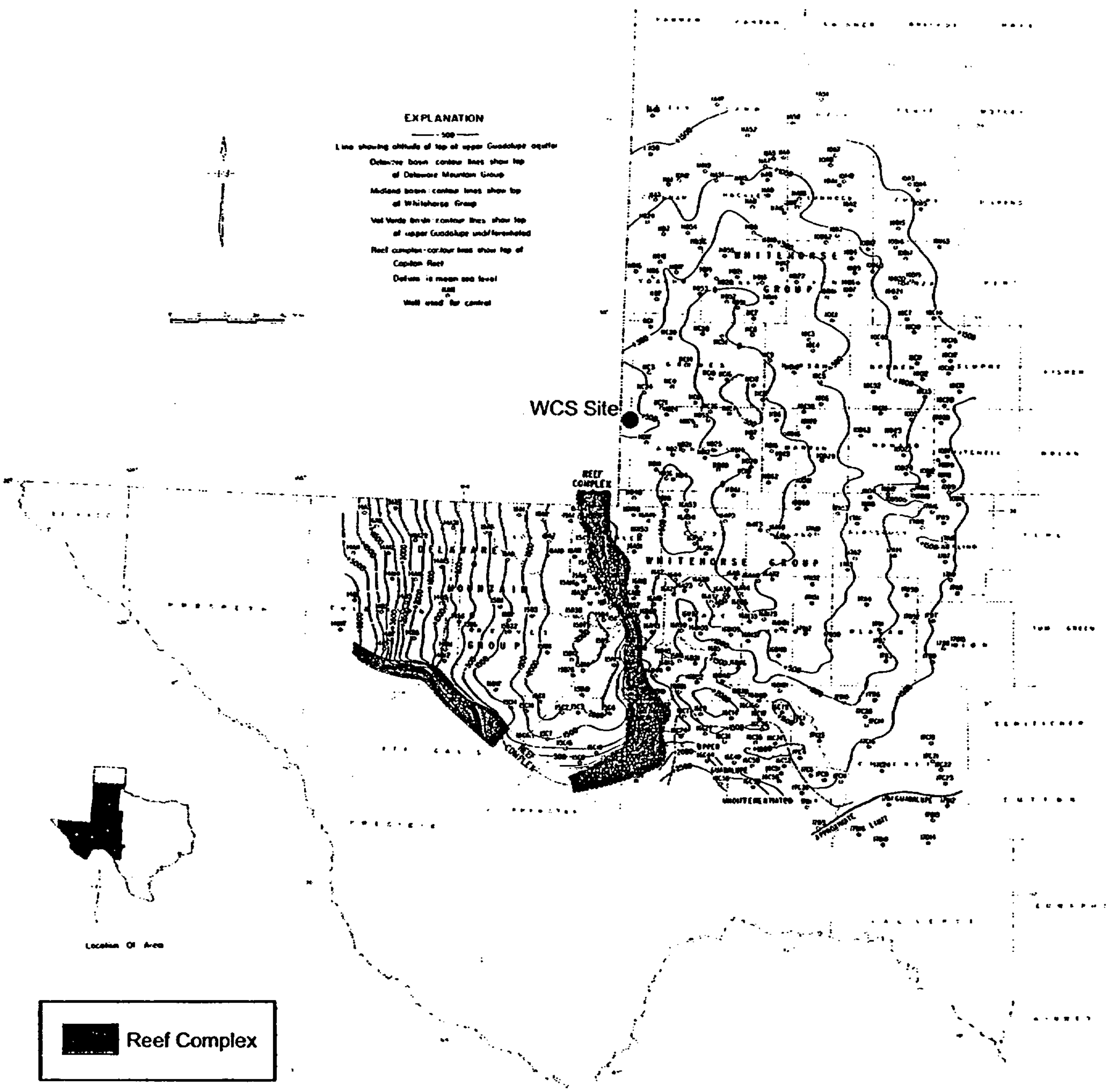
Regional Structure Contour Map of the Woodford Formation

Figure 6.4-7



Source: Texas Water Development Board, 1972

Date: 02/04/04
File: WCS_Fig6.4-8.fh11

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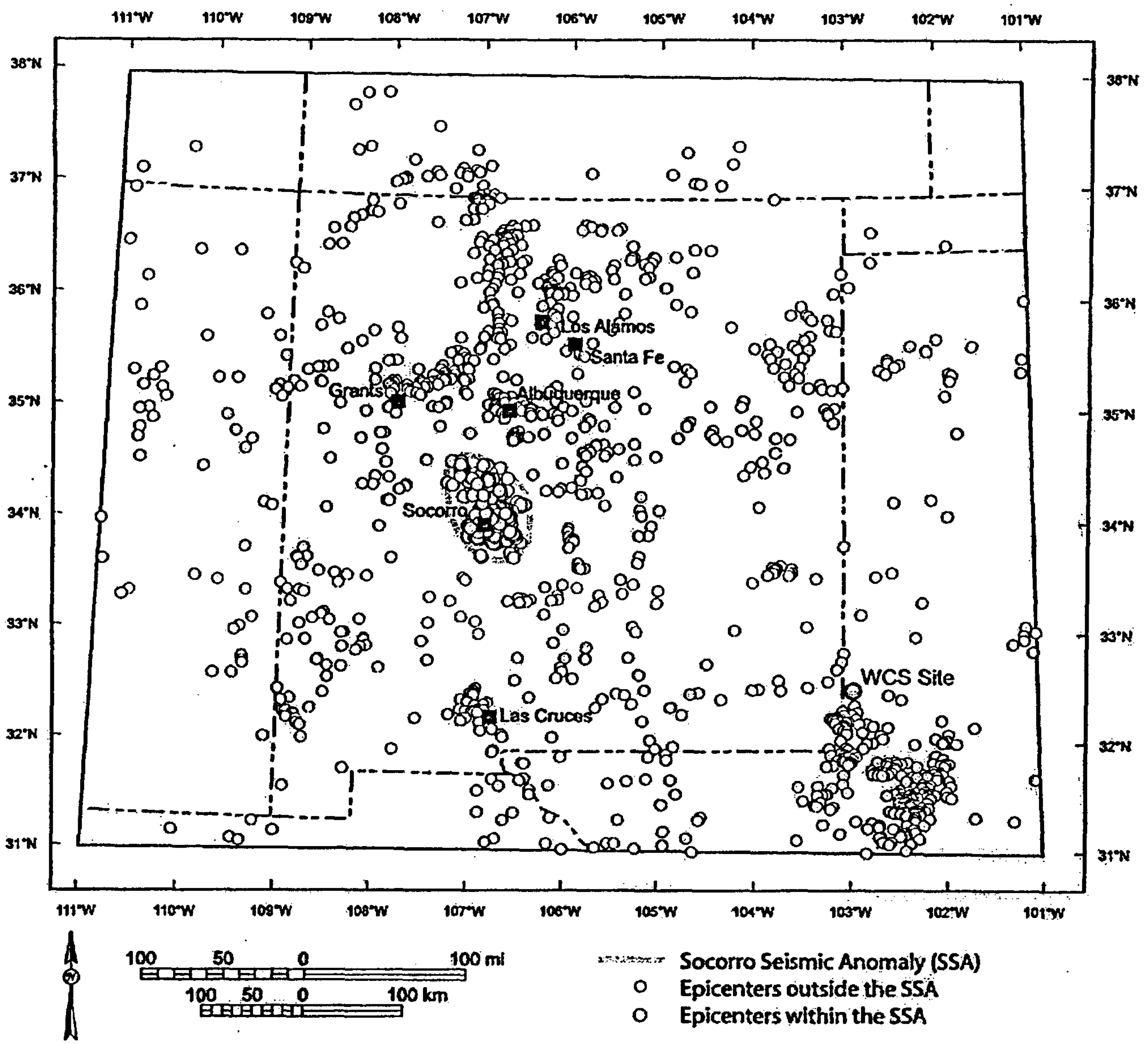
Regional Structure Contour Map of the Upper Guadalupe (Whitehorse Group)

Figure 6.4-8



Source: Sanford et al., 2002

Date: 02/04/04
File: WCS_Fig6.4-9.fh11

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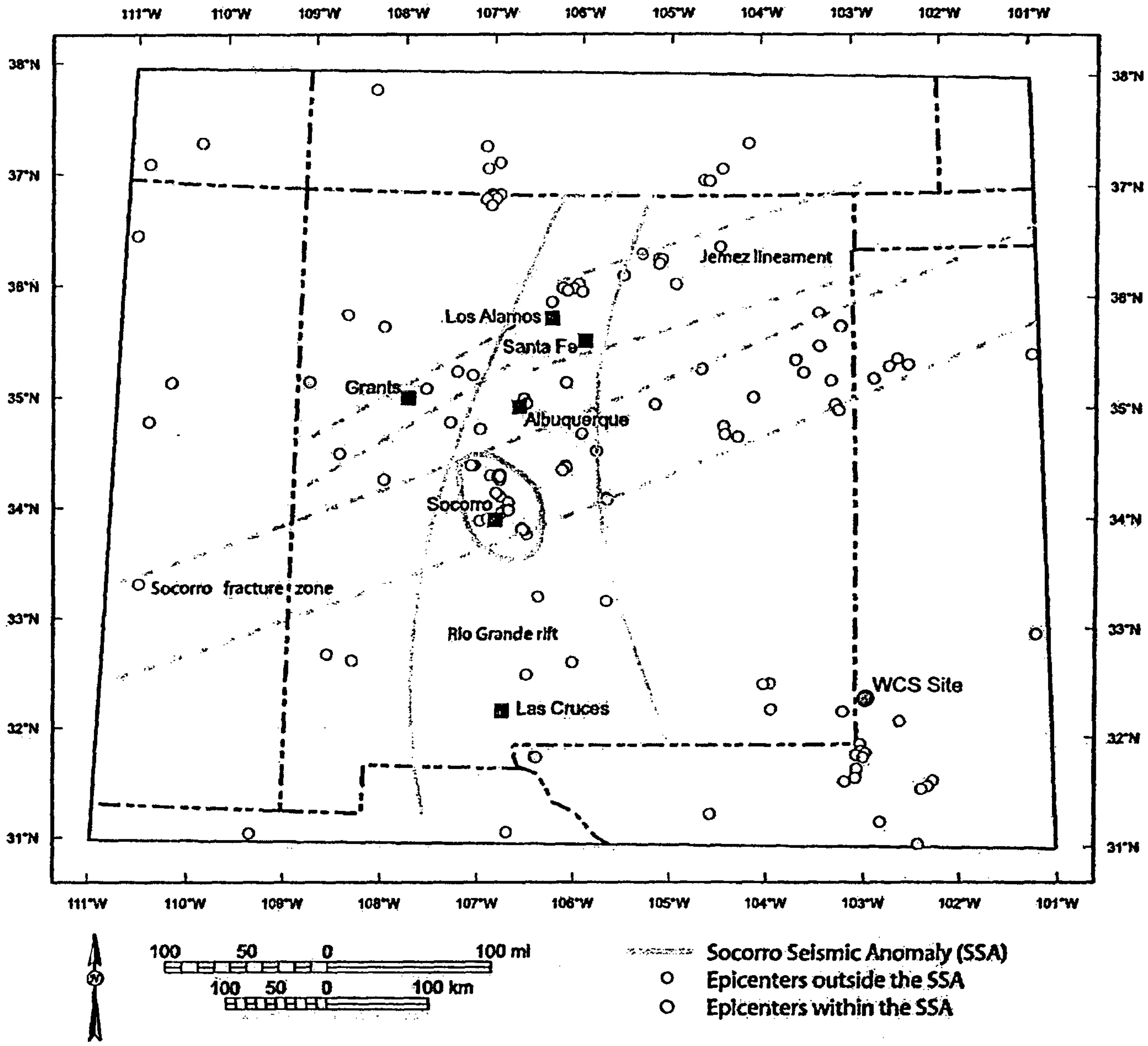
Seismicity of New Mexico and Bordering Areas
(1962 - 1995; Moment Magnitudes > 1.3)

Figure 6.4-9



Source: Sanford et al., 2002

Date: 02/05/04
File: WCS_Fig6.4-10.fh11

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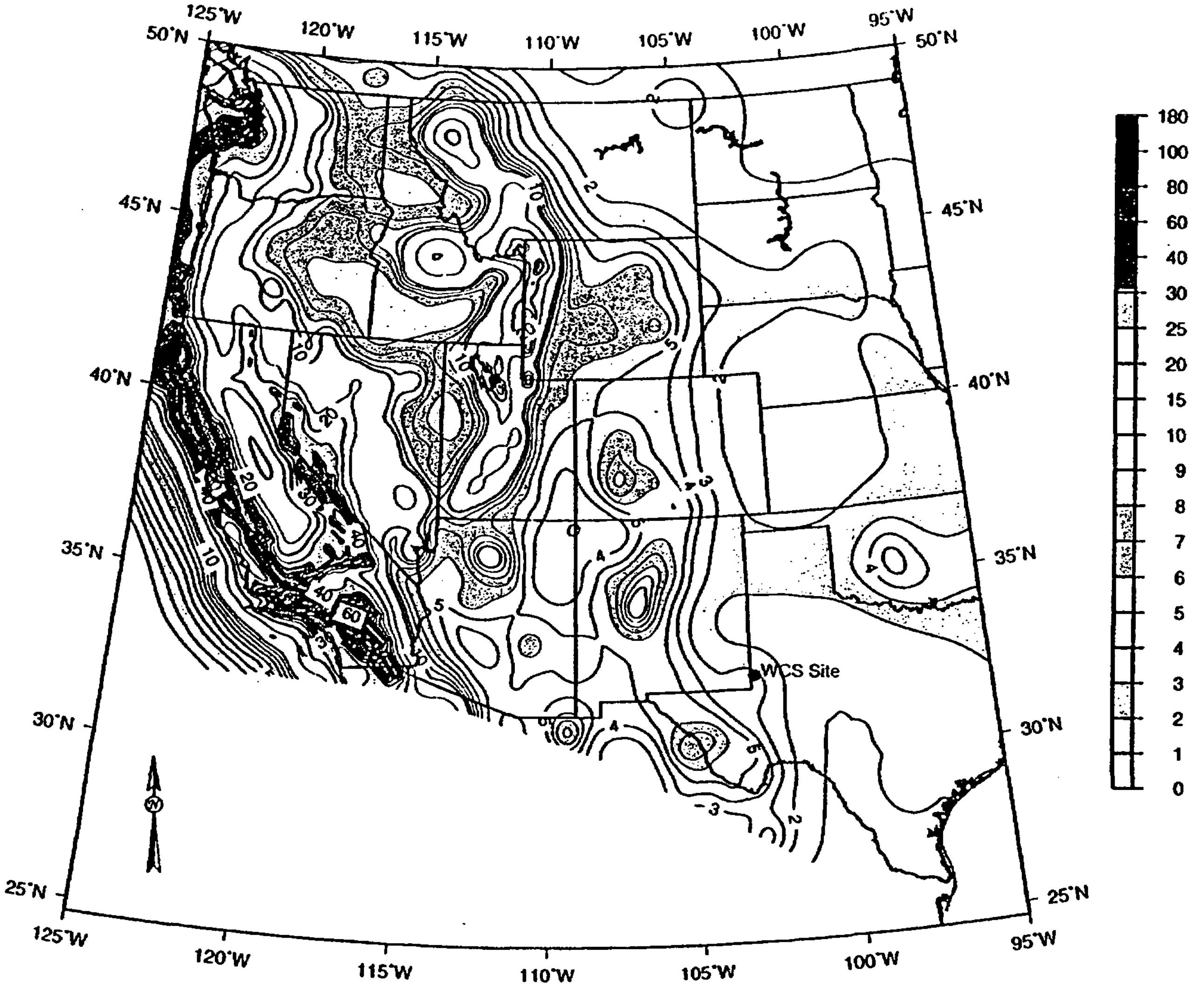
Seismicity of New Mexico and Bordering Areas (1962 - 1995; Moment Magnitudes > 3)

Figure 6.4-10



Source: http://geohazards.cr.usgs.gov/eg

Date: 02/06/04
File: WCS_Fig6.4-11.fh11

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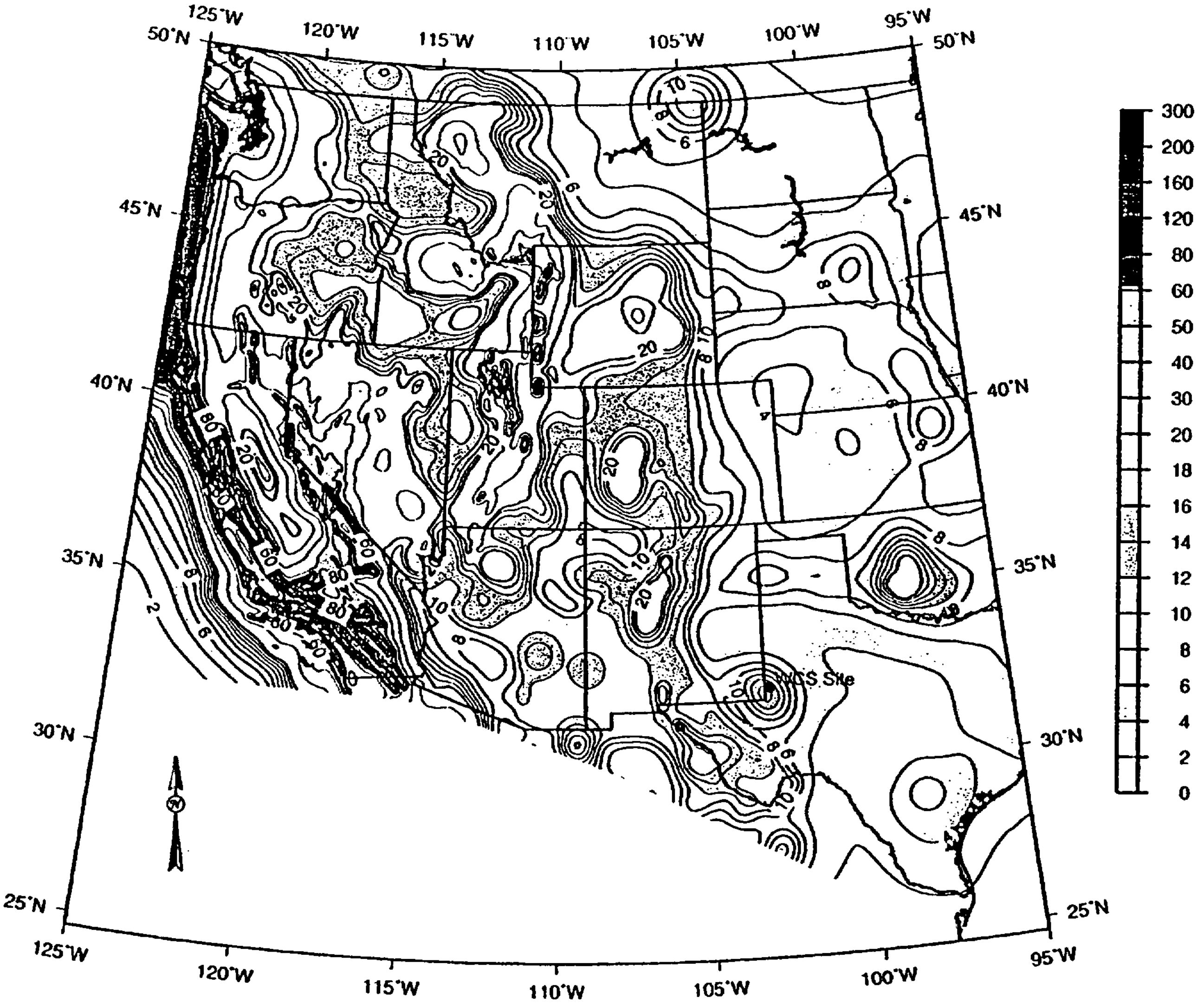
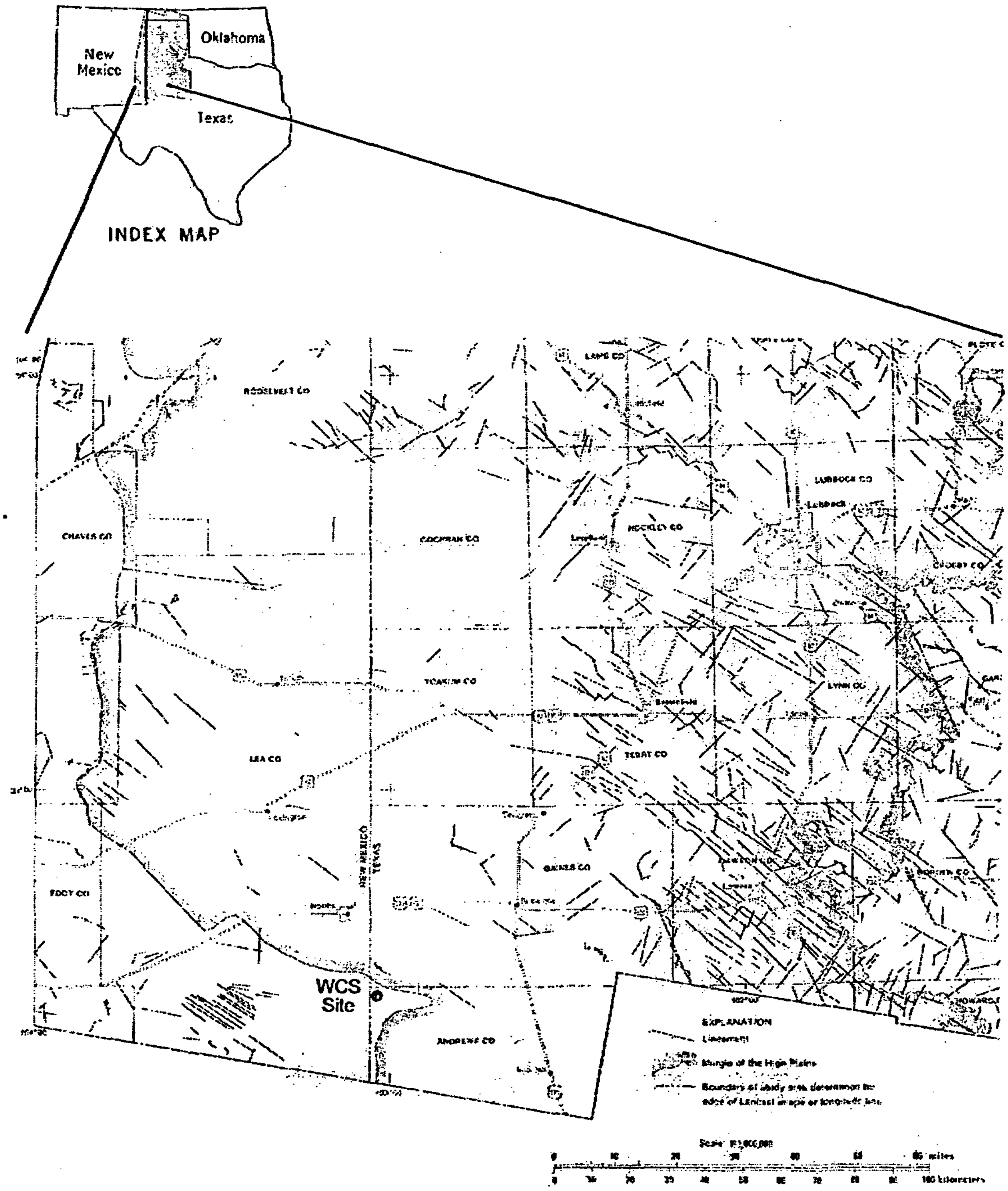
Peak Ground Acceleration (%g) with 10% Probability of Exceedance in 50 Years

Figure 6.4-11



Source: http://geohazards.cr.usgs.gov/eq

Date: 02/06/04 File: WCS_Fig6.4-12.fh11	Peak Ground Acceleration (%g) with 2% Probability of Exceedance in 50 Years
INTERA INCORPORATED 9111A Research Blvd. Austin, TX 78758 COOK-JOYCE INC. ENGINEERING AND CONSULTING 812 WEST ELEVENTH AUSTIN, TEXAS 78701-2000 (512) 474-9097 FAX (512) 474-8463	Figure 6.4-12



Source: Finley and Gustavson, 1981

Date: 02/06/04
File: WCS_Fig6.4-13.fh11

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Lineament Map of the Texas Panhandle and Parts of Oklahoma and New Mexico

Figure 6.4-13

Date: 02/06/04
File: WCS_Fig6.4-14.fh11

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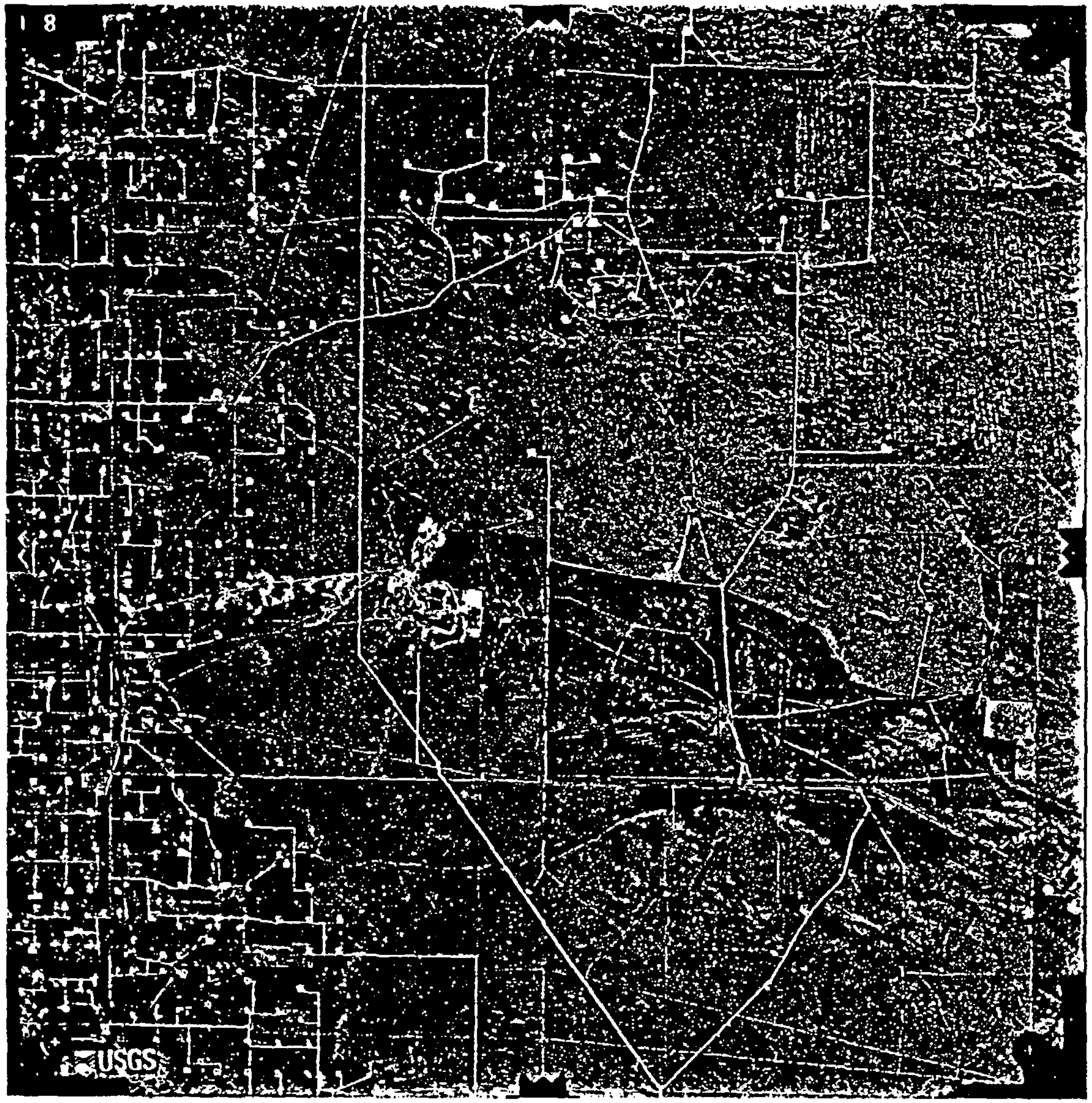
1983 Color Infrared Photograph - WCS Area

Figure 6.4-14



0 1 2
Approximate Scale in Miles

Lineaments

RCRA Permitted Area

Date: 02/06/04
File: WCS_Fig6.4-15.fh11

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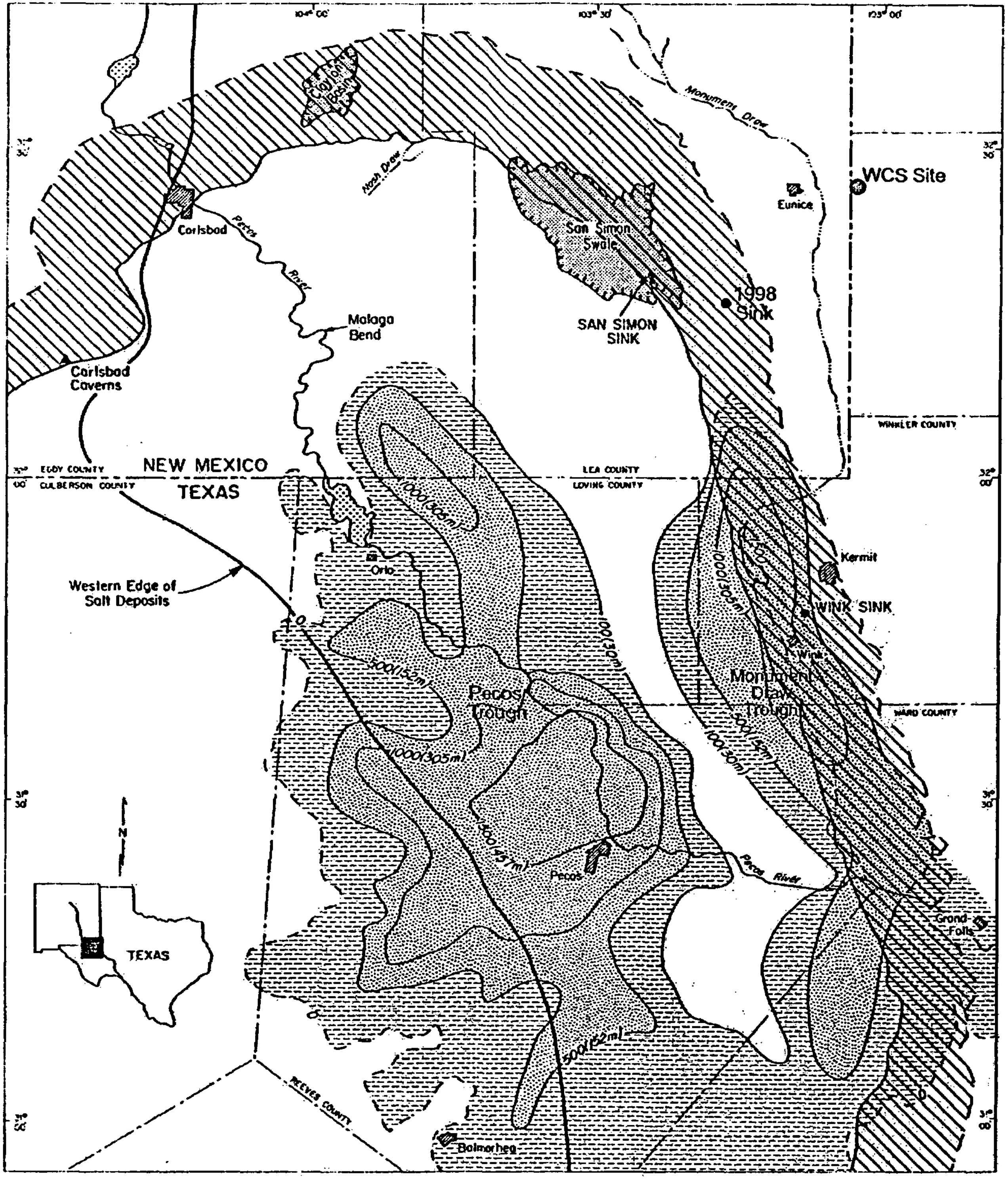
1986 Color Infrared Photograph - WCS Area

Figure 6.4-15



Source: Baumgardner et al., 1982

▤ Cenozoic fill. Limit dashed where inferred.

▒ Cenozoic fill over 500 feet thick

▨ Capitan Reef. Margin dashed where inferred.

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File: WCS_Fig6.4-16.fh11

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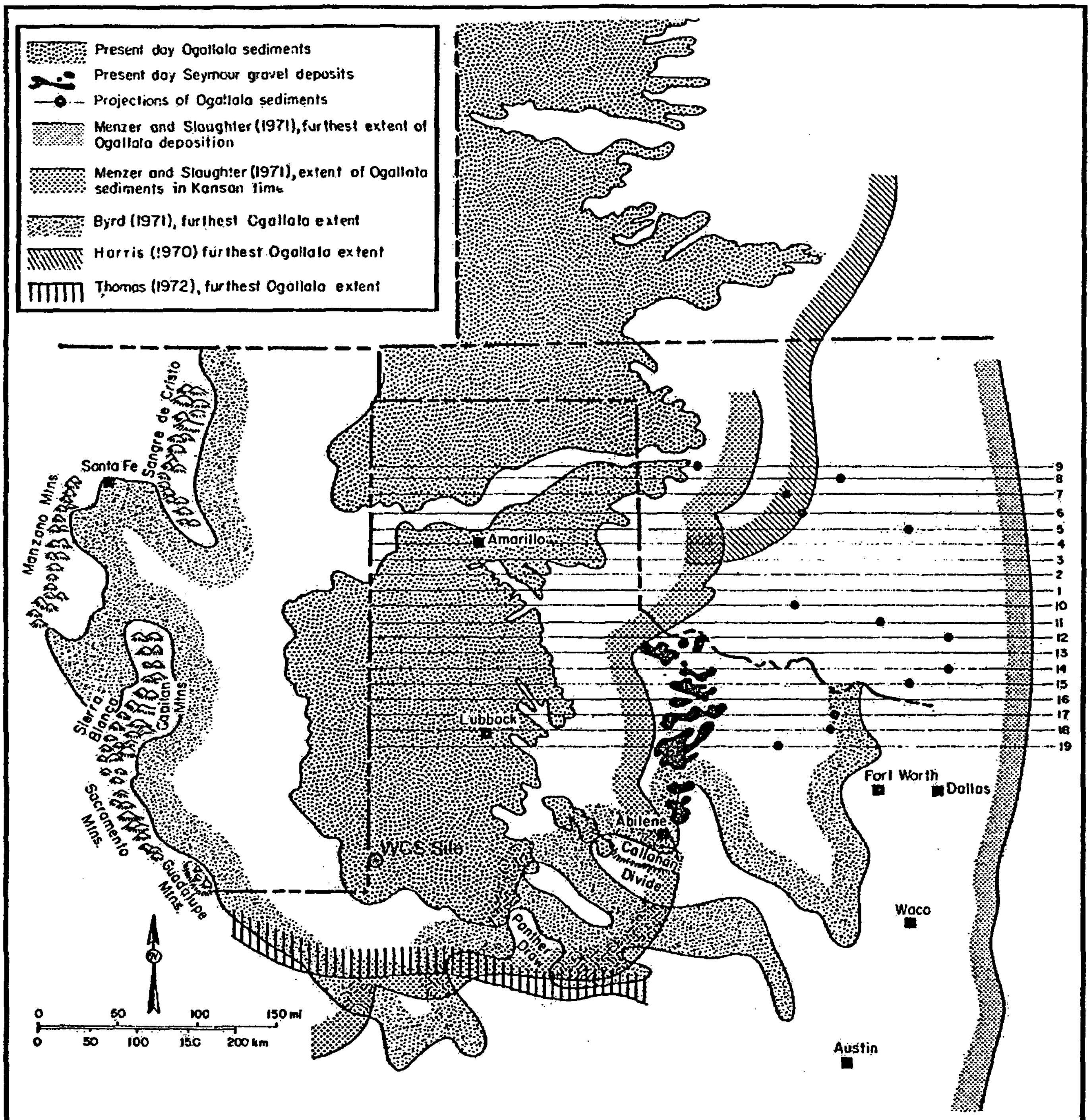
Location of Nearest Subsidence Features

Figure 6.4-16



Source: Gustavson et al., 1980

Date: 02/06/04
File: WCS_Fig6.4-17.fh11

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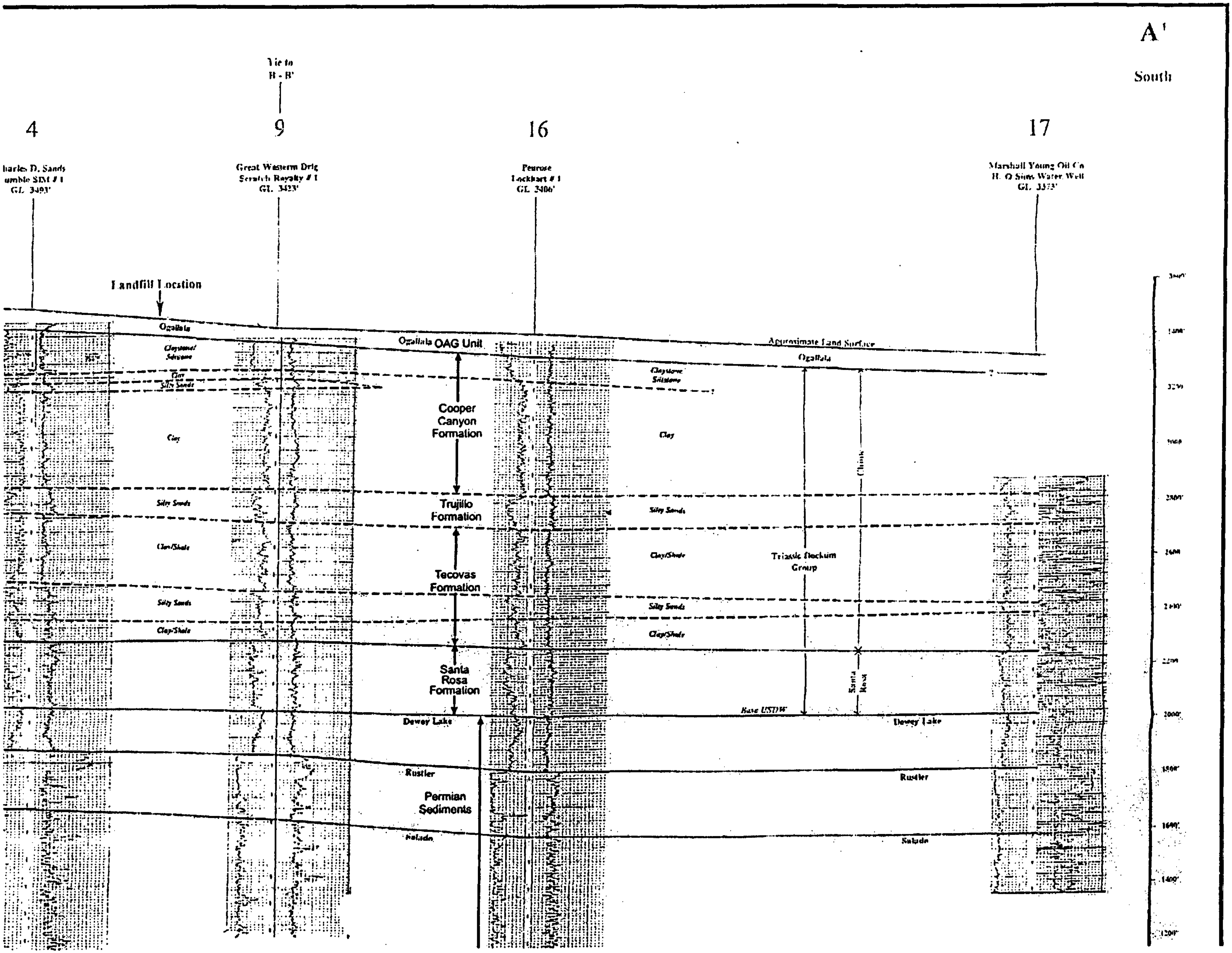
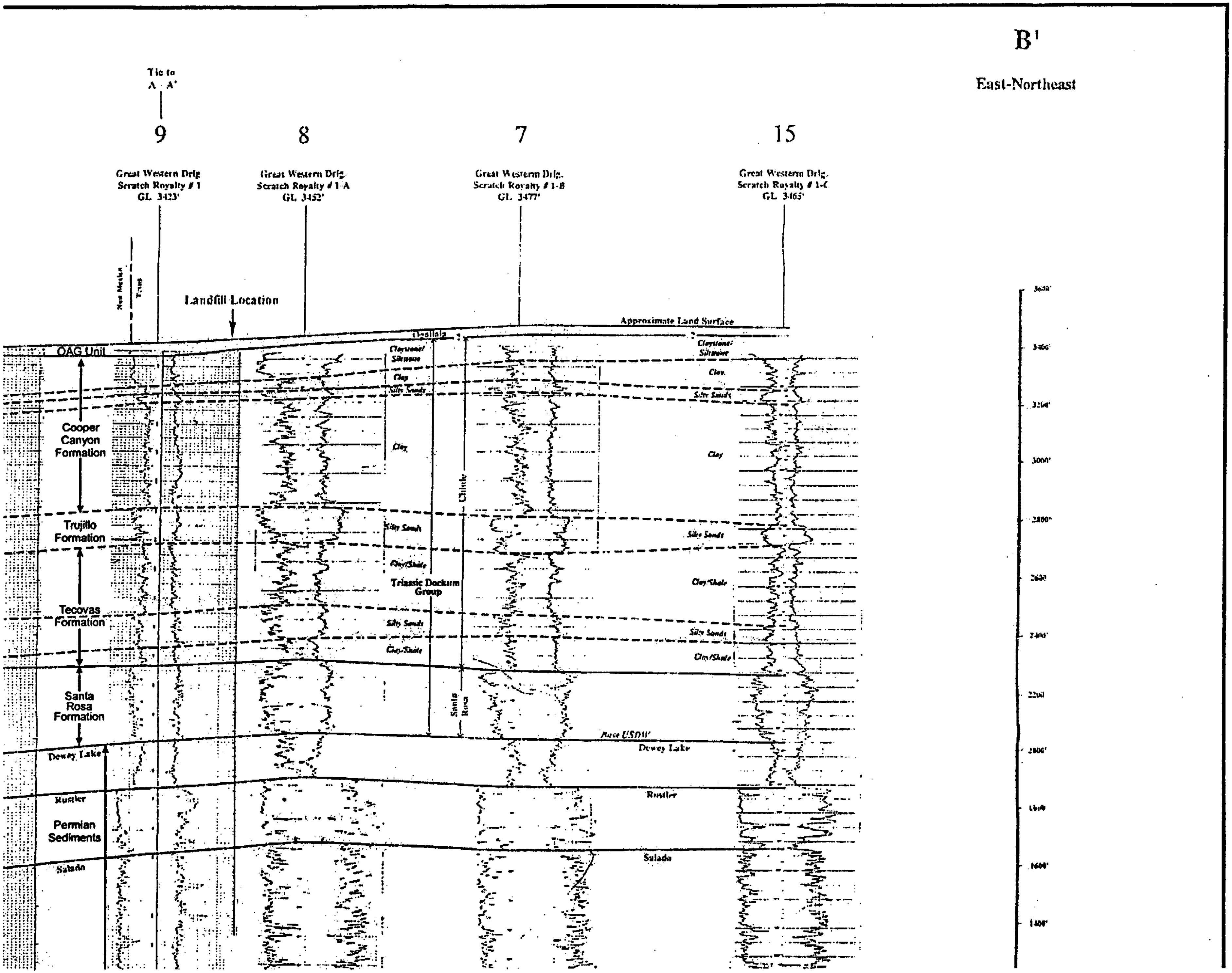
Original and Modern Location of the Ogallala Formation

Figure 6.4-17


A'
South
Tie to
B - B'
4
harles D. Sands
umble SIM # 1
GL 3493'
9
Great Westerm Drlg
Scratch Royalty # 1
GL 3423'
16
Penrose
Lockhart # 1
GL 3406'
17
Marshall Young Oil Co
H. O Sims Water Well
GL 3373'
Landfill Location
Ogallala
Claystone/
Siltstone
Clay
Silty Sands
Clay
Silty Sands
Clay/Shale
Silty Sands
Clay/Shale
Ogallala OAG Unit
Cooper
Canyon
Formation
Trujillo
Formation
Tecovas
Formation
Santa
Rosa
Formation
Dewey Lake
Rustler
Permian
Sediments
Salado
Approximate Land Surface
Ogallala
Claystone
Siltstone
Clay
Silty Sands
Clay/Shale
Silty Sands
Clay/Shale
Triassic Dockum
Group
Chinle
Santa
Rosa
Base USDW
Dewey Lake
Rustler
Salado
3600'
3400'
3200'
3000'
2800'
2600'
2400'
2200'
2000'
1800'
1600'
1400'
1200'


B'
East-Northeast
Tie to A - A'
9
8
7
15
Great Western Drlg Scratch Royalty # 1 GL 3423'
Great Western Drlg. Scratch Royalty # 1-A GL 3452'
Great Western Drlg. Scratch Royalty # 1-B GL 3477'
Great Western Drlg. Scratch Royalty # 1-C GL 3465'
New Mexico
Texas
Landfill Location
Approximate Land Surface
Ogallala
OAG Unit
Cooper Canyon Formation
Trujillo Formation
Tecovas Formation
Santa Rosa Formation
Dewey Lake
Rustler
Permian Sediments
Salado
Claystone/Siltstone
Clay
Silty Sands
Clay
Silty Sands
Clay/Shale
Triassic Dockum Group
Silty Sands
Clay/Shale
Chinle
Santa Rosa
Base USDW
Dewey Lake
Rustler
Salado
3600'
3400'
3200'
3000'
2800'
2600'
2400'
2200'
2000'
1800'
1600'
1400'