GW - 28

REPORTS

YEAR(S):

1987-1986

90-16
90-18
90-17
90-19
90-31
90-28
90-1
90-3
90-32
90-2
90-30
90-P2
90-SE-5
90-27
90-35
90-22
90-34
North Colony Landfarm
90-23
90-24
90-7
90-10
90-8
90-21
90-20
34
44
37
31
EXPLANATION
borehole
Monitor well
surface sample
constant-head permeability test
Navajo
REFINING COMPANY
ENGINEERING DEPARTMENT
ARTESIA NEW MEXICO
REVISIONS
NO
DATE
BY
1
Feb., 1990
2
3
4
5
RECEIVED
APR 25 1990
OIL CONSERVATION DIV.
SANTA FE
DRAWN BY
SCALE
1" = 150'
MATERIAL
CHK'D
DATE
DRAWING NO
TRACED
APP'D
55-Z-1-D

COMPOSITE PLOT PLAN
NORTH & SOUTH DIVISION
AS OF AUGUST 11, 1976

Navajo REFINING COMPANY
ENGINEERING DEPARTMENT
ARTESIA, NEW MEXICO

REVISIONS

NO.	DATE	BY	
1	7/81	A.D.	UPDATED SYSTEM
2	7/85	JJW	UPDATES
3			
4			
5			

RECEIVED
MAY - 5 1988
OIL CONSERVATION DIVISION
SANTA FE

DRAWN BY V.A.	SCALE 1" = 150'	MATERIAL	
CHK'D N.R.L.	DATE 9-15-76	DRAWING NO	55 - Z - 1 - D
TRACED	APP'D		

UNCONTROLLED
DRAINAGE

NEW WASTE WTR. TREAT. PLT.

SOUTHERN UNION GAS CO. METERING STATION

PIPELINE OFFICE

NO. 1 WHSE

NO. 2 WHSE

NO. 3 WHSE

NAVAJO GENERAL OFFICES

INST. SHOP

REF. OFFICE

LAB

S.P.S. SUBSTATION

MOSELEY AVE.

PRISM AVE.

LEWIS ST.

EAST FIFTH ST.

FREEMAN ST.

N.C.O.P.

U.S. HIGHWAY 285

STATE HIGHWAY 82

EAST MAIN ST.

U.S. GYP. CORP.

RAILROAD

File copy

STATE OF NEW MEXICO

ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION

August 3, 1987

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501
(505) 827-5800

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. David Griffin
Environmental Affairs Superintendent
Navajo Refining Company
P.O. Drawer 159
Artesia, New Mexico 88210

RE: Navajo Refinery Discharge Plan, GW-28

Dear Mr. Griffin:

The Oil Conservation Division has received the final report by Geoscience Consultants, LTD., on the ground water investigation in the area of your disposal ponds. We have only recently received (and have enclosed) the laboratory results from our sample trips in April and May. Due to the inconclusive laboratory results from our sampling, we could not independently verify information on volatile hydrocarbons provided in the report. Because of the importance of this issue in discharge plan approval, we have decided to resample selected wells in the pond area including the USGS piezometers. Although we may not agree with all the conclusions in the GCL report, the data it provides does materially aid in completion of the discharge plan review. Comments on any substantial differences with the investigation report will be delayed until our resampling is completed. As you know, resampling is scheduled for Wednesday August 12.

Because of the necessary resampling and because Bureau staff resources since June 1 have been concentrated on resolving an environmental problem in Bloomfield, OCD will not be prepared to grant discharge plan approval before the September 15, 1987, expiration date of the current extension to discharge without an approved plan. Therefore, I will recommend to the Director that an extension, likely to be in range of 90 to 120 days, be granted Navajo to allow evaluation of the additional sampling results, resolve remaining discharge plan issues, and issue discharge plan public notice and allow for public comment.

We are researching previous correspondence to identify remaining issues that need to be resolved before discharge plan approval. Although that has not been completed, I am providing a listing of major issues that remain to be addressed. A complete list with specifics will be provided to you within thirty days. The following information and schedules must be submitted for review before approval is granted:

A. Refinery Area

1. A contingency plan for the reporting and action to be taken if major leaks, spills and upsets of oil, chemicals, wastewater, etc., occur outside of curbed and paved areas. Such plan should include actions to be taken in the event of tank failure even though the area may be diked but not paved.

2. A schedule for the replacement of bolted or riveted tanks over the five year term of the discharge plan and cleanup of oil-saturated areas inside the dikes.

3. Submittal of proposed housekeeping procedures to repair and/or isolate by curbing and paving, small wastewater and oil drips and leaks at tanks, pumps and other discharge points. Many of these were observated at several locations during the April and May inspections. Examples include the pumps at the carbon black loading area, diesel loading area, and the transfer pump south of tank 135.

4. A schedule for initial testing of remaining underground crude oil and product piping for integrity, with repetitive testing every six months until replacement by above ground pipes. Initial testing should commence no later than March 31, 1988. Alternative methods of determining integrity will be considered if they are demonstratively effective.

5. A schedule for testing buried wastewater piping to determine if significant leaks that could impact ground water quality are occurring. Such tests are being required at all gas plants and refineries over twenty years of age as a condition for plan renewal, and must be completed within five years, and repeated prior to each succeeding plan renewal.

6. A method to demonstrate that the old fire pond (with a current TDS concentration 3538 mg/l, Cl of 321 mg/l, SO_4 of 1718 mg/l, and F of 3.4 mg/l) does not cause exceedence of ground water standards at a place of present or future use. Some options previously discussed with Navajo include lining, fresh water storage, dilution with fresh water to below standards, or a demonstration of maximum seepage loss of 0.5 acre-ft/acre/ year. The high fluoride concentration, which exceeds the Part A standard of 1.6 mg/l, will exclude use of the latter method unless the concentration of that constitutent is reduced to the standard.

B. Pond Area

1. A map showing the maximum inundation expected during the 100-yr flood, and demonstration of adequate pond protection from such flooding.

2. A showing of adequate freeboard to protect the pond from runover during maximum wind velocities. Since the pond has been expanded, the large surface area will require more freeboard. Navajo will be required to maintain that freeboard at all times.

3. A map showing the current property boundaries and names of adjacent landowners.

Upon receipt of all sampling results, and review of all information submitted, OCD will prepare a draft summary of all necessary monitoring, commitments and completion dates. Requirements for discharge plan monitoring in the refinery area will depend on decisions regarding the old fire pond. Otherwise ground water monitoring is not expected to be required there as part of the discharge plan, but will be necessary later to monitor product cleanup efforts. At the pond area, monitoring on some regular basis yet to be determined will be necessary for effluent discharge quantity and quality, and for at least some of the monitor wells. The schedule can be readjusted depending on the effectiveness of the new wastewater treatment system.

We look forward to working with you to resolve the remaining issues leading to discharge plan approval.

Sincerely,

David G. Boyer
Hydrogeologist/Environmental Bureau Chief

DGB/cr

Encl.

cc: Les Clements, OCD Artesia
Jack Ellvinger, EID Hazardous Waste

TELEPHONE
(505) 748-3311

Navajo REFINING COMPANY
501 EAST MAIN STREET • P. O. DRAWER 159
ARTESIA, NEW MEXICO 88210

EASYLINK
62905278

June 1, 1987

Mr. Dave Boyer, Hydrogeologist
State of New Mexico Oil Conservation Divison
P. O. Box 2088
Santa Fe, NM 87501-2088

Re: Final Report, Ground Water Investigations of Pond #1 & Conveyance Ditch, Navajo Refining Company, Artesia, New Mexico

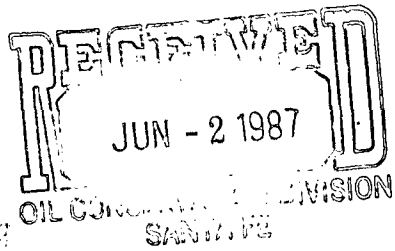
Dear Mr. Boyer:

Navajo Refining Company is pleased to submit our final report on "Ground Water Investigations of Pond #1 and Conveyance Ditch for Navajo Refining Company in Artesia, New Mexico". It is clear from our investigation that no contamination in excess of drinking water standards exists in the pond area, and no contamination was found near the ditch.

Navajo Refining Company does not propose any remedial action at this time.

Please contact me if you have any questions concerning this report.

Sincerely yours,



Zeke Sherman

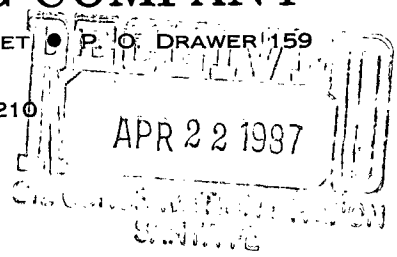
Environmental Compliance Engineer

ZRS/pb
enclosures

TELEPHONE
(505) 748-3311

EASYLINK
62905278

REFINING COMPANY
501 EAST MAIN STREET • P. O. DRAWER 159
ARTESIA, NEW MEXICO 88210



April 20, 1987

Mr. David Boyer
P.O. Box 2088
Land Office Building
Santa Fe, NM 87501

RE: Navajo Refining Company, Progress Report for March, 1987

Dear Mr. Ellvinger:

This letter summarizes our activities at Navajo Refining Company's Artesia facility as of March 31, 1987. Major activities during this period included:

- Re-sampling of well points installed to aid in plume definition.
- Analysis of ground water samples.
- Review of analytical data.

A table of analytical results is attached, along with a copy of a surveyed map showing the locations of the well points. Because the analytical results were received on March 24, 1987, we have not had time to review them in detail. Total VOC's in ug/l are penned in red ink below the points.

It should be noted that none of the analytical results show contaminant levels in excess of NMWQCC standards. Maximum levels detected are given in ug/l with NMWQCC standards in parentheses:

Benzene	0.2	(100)
Toluene	9.7	(750)
Ethylbenzene	0.5	(750)
Xylenes	453.1	(620)

Work is proceeding on our final report, which we anticipate submitting to NMEID on or before June 1, 1987. Please contact me if you have any questions regarding this progress report.

Very truly yours,

Zeke Sherman

Environmental Compliance Engineer

ZRS/pb

enclosures

EXPLANATION

Point: Well point installed in 1987; see attached map.

Location: Surveyed location of well point in feet; Monitor Well #3 used as datum. Well point number 1 (E0007, S0993) is 7 feet east and 993 feet south of Monitor Well #3.

Sample Number: Unique number that encodes year, month, day and time. Number 8703121635 means 1987 (87), March (03), 12th (12), 4:35 p.m. (1635).

Analysis Date: Date analysis was performed.

EB: Ethylbenzene

CBA: Chlorobenzene - A

DCB: Dichlorobenzene

Total VOC: Total of all species detected, in ug/l.

NP: No well point at this location

* : Reported value less than 5 times detection limit; potential quantification error ranges from 50 to 100%.

\- : Not applicable

ND: Not detected

SUMMARY OF ANALYTICAL RESULTS

LOCATION					ANALYTICAL RESULTS (ug/l)				
POINT	X(ft)	Y(ft)	SAMPLE NUMBER	ANALYSIS DATE	BENZENE	TOLUENE	EB	CBA	1,4-DCB
1	E0007	S0993	8703121635	3/18/87	ND	ND	ND	ND	ND
2	E0991	S0977	8703121655	3/18/87	ND	2.0	ND	ND	ND
3	W1020	S1993	8703130815	3/19/87	ND	1.0*	ND	ND	ND
4	E0018	S1999	8703131020	3/20/87	ND	9.7	ND	ND	ND
5	W0980	S3024	8703130840	3/19/87	ND	ND	ND	ND	ND
6	E0039	S2999	8703131005	3/20/87	ND	0.6*	ND	ND	ND
7	E0989	S2970	8703130950	3/20/87	ND	3.8	0.5*	ND	ND
8	W0954	S4050	8703130900	3/19/87	ND	1.1	ND	ND	ND
9	E0036	S3997	8703130915	3/19/87	ND	7.3	ND	ND	ND
9-E	E1036	S3983	8703130930	3/19/87	ND	0.9*	ND	ND	ND
10	W2047	S0027	8703121720	3/19/87	ND	1.1	ND	ND	ND
11	W2027	S1026	8703130755	3/19/87	ND	2.5	ND	ND	ND
12	W2023	S2001	8703121400	3/18/87	ND	ND	ND	ND	ND
13	E3024	N0163	8703121425	3/18/87	ND	ND	ND	ND	ND
14	E3046	S0841	8703121445	3/18/87	ND	2.2	ND	ND	ND
15	E1823	S0980	8703121530	3/18/87	ND	ND	ND	ND	ND
16	E2022	S2028	8703121515	3/18/87	ND	ND	ND	ND	ND
17	E2984	S1874	8703121500	3/18/87	ND	ND	ND	ND	ND
18	NP	NP	-	-	-	-	-	-	-
19	E1019	S1963	8703121610	3/18/87	ND	1.8	ND	ND	ND
HP-2	E0885	S4856	8703131220	3/20/87	ND	ND	ND	ND	ND
HP-3	W1308	S4143	8703131200	3/20/87	ND	0.8*	ND	ND	ND
			Analytical Method (SW-846)		602	602	602	602	602
			Nominal Detection Limit (ug/l)		0.2	0.2	0.3	0.3	0.3

SUMMARY OF ANALYTICAL RESULTS (Continued)

LOCATION					ANALYTICAL RESULTS (ug/l)					
POINT	X(ft)	Y(ft)	SAMPLE NUMBER	ANALYSIS DATE	1,3-DCB	1,2-DCB	P XYLENE	M XYLENE	O XYLENE	TOTAL VOC
1	E0007	S0993	8703121635	3/18/87	ND	ND	ND	ND	ND	ND
2	E0991	S0977	8703121655	3/18/87	ND	ND	3.1	450	ND	455.1
3	W1020	S1993	8703130815	3/19/87	ND	ND	ND	ND	0.4*	1.4
4	E0018	S1999	8703131020	3/20/87	ND	ND	ND	ND	ND	9.7
5	W0980	S3024	8703130840	3/19/87	ND	ND	ND	ND	ND	ND
6	E0039	S2999	8703131005	3/20/87	ND	ND	ND	ND	ND	0.6
7	E0989	S2970	8703130950	3/20/87	ND	ND	0.6*	1.4	1.3	7.6
8	W0954	S4050	8703130900	3/19/87	ND	ND	0.3*	0.9*	0.5*	2.8
9	E0036	S3997	8703130915	3/19/87	ND	ND	ND	ND	ND	7.3
9-E	E1036	S3983	8703130930	3/19/87	ND	ND	ND	ND	ND	0.9
10	W2047	S0027	8703121720	3/19/87	ND	ND	0.3*	1.3	1.6	4.3
11	W2027	S1026	8703130755	3/19/87	ND	ND	0.2*	0.4*	1.5	4.6
12	W2023	S2001	8703121400	3/18/87	ND	ND	ND	ND	ND	ND
13	E3024	N0163	8703121425	3/18/87	ND	ND	ND	1.6	ND	1.6
14	E3046	S0841	8703121445	3/18/87	ND	ND	0.3*	1.4	1.6	5.5
15	E1823	S0980	8703121530	3/18/87	ND	ND	1.5	210	ND	211.5
16	E2022	S2028	8703121515	3/18/87	ND	ND	ND	2.7	ND	2.7
17	E2984	S1874	8703121500	3/18/87	ND	ND	ND	ND	ND	ND
18	NP	NP	-	-	-	-	-	-	-	-
19	E1019	S1963	8703121610	3/18/87	ND	ND	5.1	330	7.4	344.3
HP-2	E0885	S4856	8703131220	3/20/87	ND	ND	ND	0.2*	ND	0.2
HP-3	W1308	S4143	8703131200	3/20/87	ND	ND	ND	ND	ND	0.8
			Analytical Method (SW-846)		602	602	602	602	602	-
			Nominal Detection Limit (ug/l)		0.3	0.4	0.1	0.2	0.1	-

Comprehensive Monitoring Evaluation
for
Navajo Refining Company
Artesia, New Mexico

EPA I.D. NMD048918817

Prepared by:

Alice Barr
Hazardous Waste Section
New Mexico Environmental Improvement Division
Health & Environment Department
Santa Fe, New Mexico

FIGURES

TABLES

APPENDICES

A. Part A Hazardous Waste Notification/Permit Application (with Amended Part A)

B. Characterization of Soils at the North Colony Landfarm

C. Waste Analyses

D. Ground-Water System Installation - Geraghty and Miller, Inc., 1982

E. Ground-Water Quality Assessment Plan

F. Geotechnical Lab Report - Law Engineering

G. Oil Conservation Division Ground-Water Quality Data

H. Revised Sampling and Analysis Plan

I. Original Ground-Water Monitoring Plan - Navajo

J. Notice of Violation from NMEID - August 15, 1985

K. Background Analytical Results from the North Colony Landfarm and the Tel Weathering Area

L. Navajo's Analytical Results - June 1985 Semi-Annual

M. Navajo's Analytical Results - February 1984 Semi-Annual

N. Navajo/EPA's Analytical Results - June 1984 CME

O. Chronology of Enforcement Activity

P. NMEID Ground-Water Inspection Checklist

Introduction

Navajo Refining Company (Navajo), located in Artesia, Eddy County (Figure 1), is a petroleum refinery which processes crude oil into petroleum products including fuel oils, liquid petroleum gases, jet and diesel fuels, gasolines, carbon black oils, and asphalt. Navajo has notified EPA that it generates, treats, stores, disposes hazardous waste as of August 7, 1980 and applied for Interim Status on November 19, 1980 (Appendix A). The facility primarily handles Slop Oil Emulsion Solids (K049), Heat Exchanger Bundle Cleaning Sludge (K050), API Separator Sludge (K051), and Leaded Tank Bottoms (K052). Navajo generates approximately 380.00 ton/year of K049, 5.00 tons/year of K050, 1,452.5 tons/year of K051 and 1.00 tons/year of K052. A land treatment facility, the North Colony Landfarm, and a surface impoundment, the TEL Weathering Area, have been utilized for treatment and disposal of Navajo's refinery waste since November 19, 1980, but only the landfarm is currently in use (Figure 2).

Regulated Units

Four areas have been identified as requiring ground-water monitoring systems pursuant to the New Mexico Hazardous Waste Management Regulations (HWMR-2). These are the North Colony Landfarm, the TEL Weathering Area, the API Separator effluent ditch and Evaporation Pond #1.

The North Colony Landfarm, located approximately 300 feet from Eagle Draw, is used to treat API Separator solids, slop oil emulsion solids, and a small quantity of heat exchanger bundle cleaning sludge. A characterization of the soils associated with this 4 acre landfarm can be found in Appendix B. Detailed analyses of the wastes treated on the landfarm can be found in Appendix C.

The TEL Weathering Area, constructed in 1925, received leaded tank bottoms generated during the cleaning of leaded gasoline storage tanks. This sludge contained arsenic, selenium and lead. Also disposed of in the TEL were API

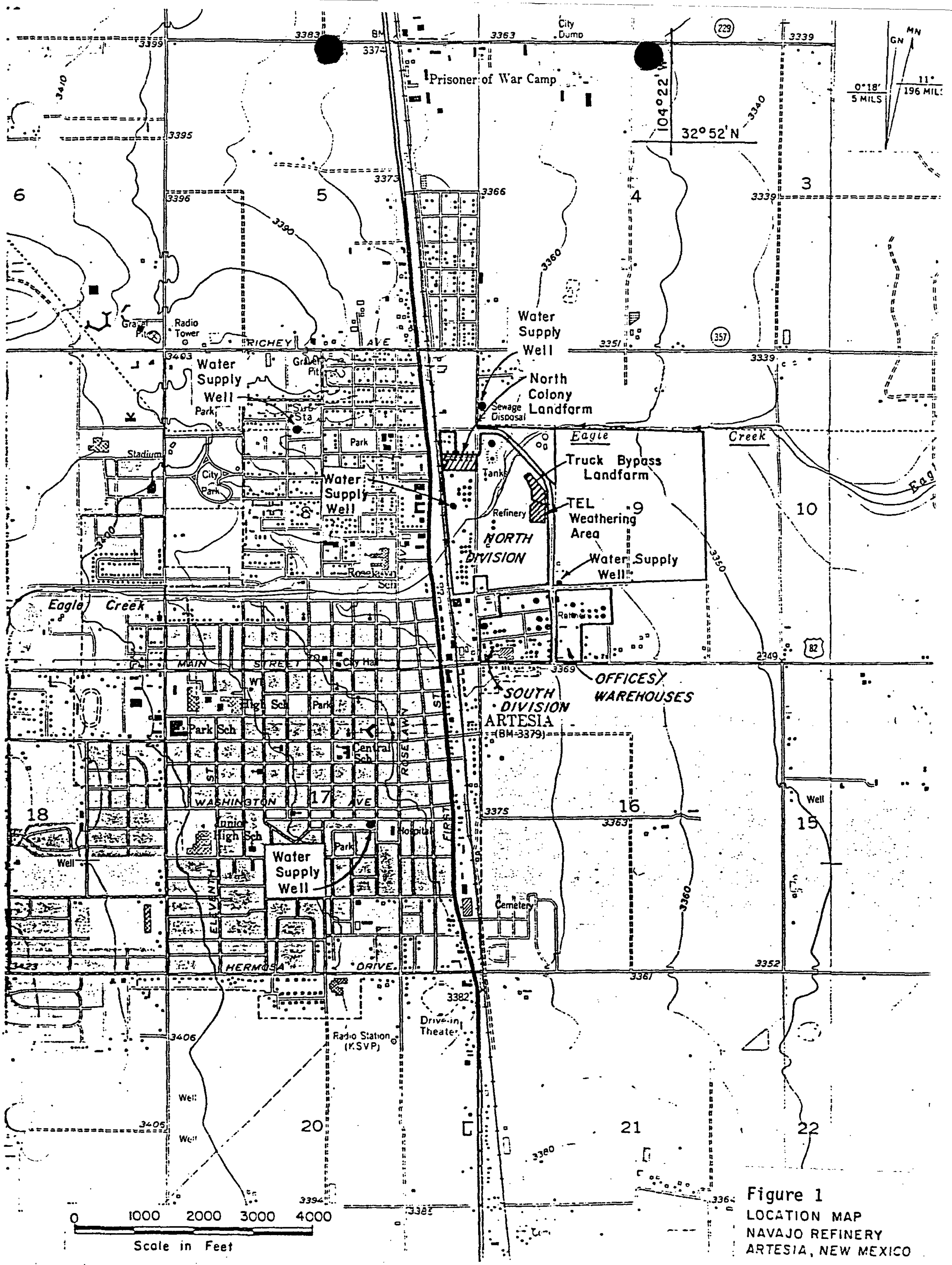


Figure 1
LOCATION MAP
NAVAJO REFINERY
ARTESIA, NEW MEXICO

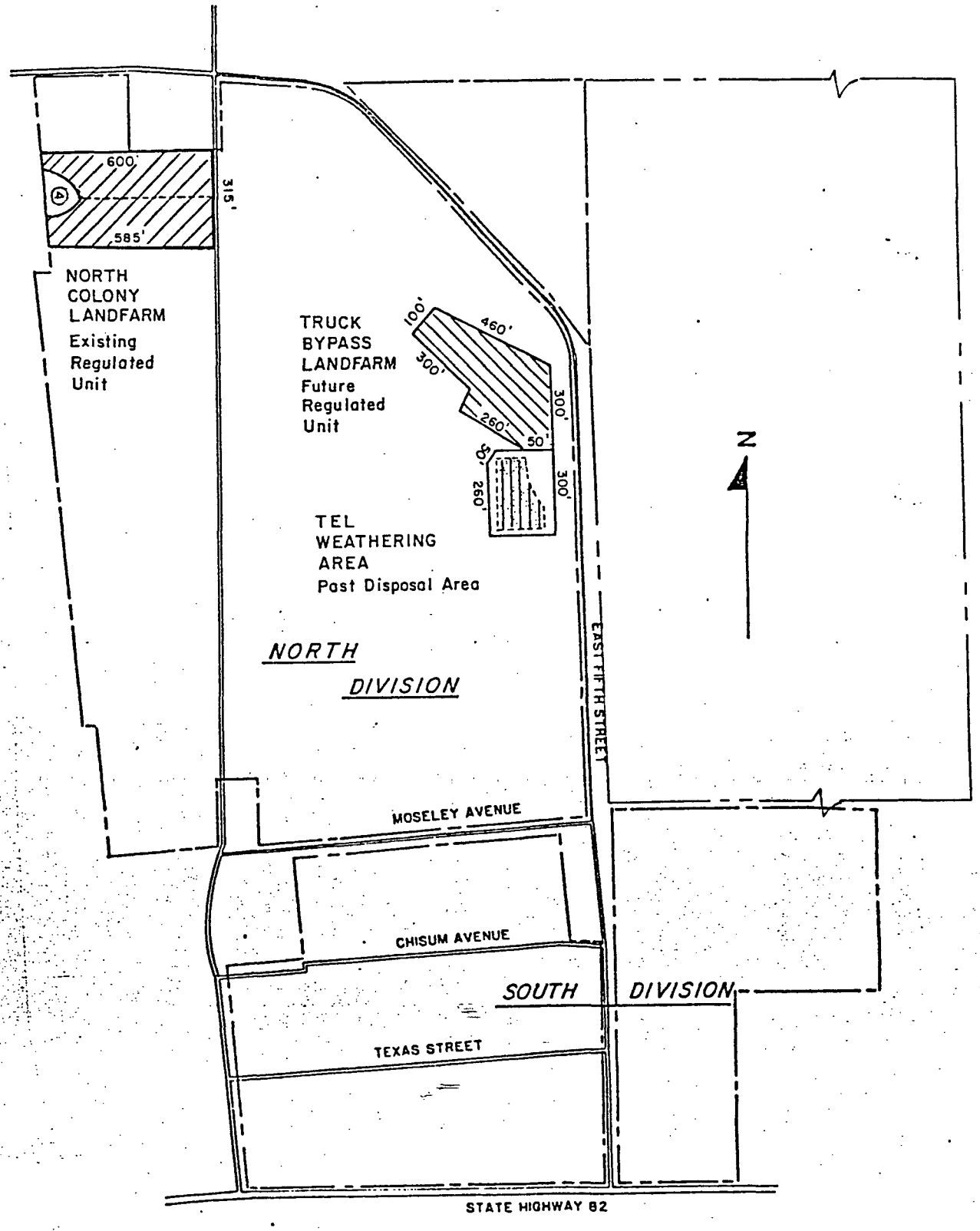


Figure 2
FACILITY DRAWING
NAVAJO REFINERY
ARTESIA, NEW MEXICO

separator sludge, slop oil emulsion solids and oily sludges. The two acre surface impoundment no longer received hazardous waste, as of January 1982.

Navajo maintains two API Separators, the effluent from which is channeled from two unlined ditches to one main ditch leading to three evaporation ponds (also unlined). The ponds, covering an area of approximately 85 acres, lie 3 miles to the east of the main refinery and adjacent to the Pecos River. The main ditch and Evaporation Pond #1 have been found to contain levels of chromium which exceed the EP Toxicity criteria of 5.0 mg/l. Three sediment samples taken from the pond during two sampling events (June 1984 and January 1985) exhibited levels ranging from 7.4 mg/l to 13.5 mg/l. Concentrations in the ditch, approximately 100 feet below the confluence of the two ditches, was found to be 7.50 mg/l. These levels of chromium indicate the presence of what would be defined as a hazardous waste under HWMR-2 201.B.5.c. These areas would, therefore, be regulated as hazardous waste disposal units subject to all the associated ground-water monitoring requirements of HWMR-2.

Navajo has submitted a Part B permit application for the continued use of the North Colony Landfarm and the introduction of hazardous waste at the Truck Bypass Area, a landfarm which currently receives non-hazardous waste. It is presently under review.

Navajo intends to close the TEL Weathering Area and the API Separator effluent ditch and associated evaporation ponds. Navajo has planned to apply the excavated material from the TEL Weathering Area to the Truck Bypass Area provided that the waste can be effectively treated without overloading the metal attenuation capacity and/or the hydrocarbon application rate. The landfarm presently receives non-hazardous waste which, due to the high hydrocarbon and possibly elevated metal content, could affect the loading and application rate. A clear understanding of the landfarm's present condition would be essential prior to the application of any hazardous waste. Closing the evaporation ponds and effluent ditch is somewhat complicated by the need to redirect approximately

950,000 gallons of effluent per day. In lieu of discharging API Separator effluent directly into the Pecos River, Navajo is pursuing the possibility of discharging into the municipal sewage treatment plant following preliminary on-site treatment. This alternative is currently being explored by Navajo with CH_2M Hill, and a compliance schedule for closure is being negotiated with EID.

Geology/Hydrology - Regional

Artesia, New Mexico lies in the Roswell Basin within the Pecos Valley section of the Pecos Plateau. The Pecos Valley is a broad north-south asymmetric depression lying between the Llano Estacado of the High Plains on the east and the Guadalupe and Sacramento Mountains of the Basin and Range Province on the west. The bedrock underlying the Pecos Lowlands is Triassic and Permian in age with widespread Pleistocene and recent alluvial deposits. (NWWA, 1984)

The bedrock units relevant to the regional ground-water supply are the San Andres formation and the Chalk Bluff formation. The San Andres formation, the major artesian aquifer in the Roswell basin, is comprised of limestone and dolomite. This 1000 foot thick formation exhibits karst features and outcrops in the western highlands dipping towards the east. It is overlain by the highly eroded Chalk Bluff formation. The Chalk Bluff ranges in thickness from 400-600 feet in the western portion of the basin to 800-900 feet below the irrigated area to the east. It consists primarily of redbeds, gypsum, and limestone. This formation outcrops to the east of the San Andres outcrop.

The ground water in both formations travels towards the east at a gradient ranging from 3 to 10 feet/mile. Discharge is predominantly through wells and somewhat by upward percolation to springs and alluvium. Due to limestone's low compressibility, little ground water is available from storage and response due to pumping is evident in many surrounding wells, springs and in allvium. Sufficient quantities of ground water are available from these formations to

provide irrigation water throughout the Roswell basin.

The alluvium, unconformably overlying both bedrock units, increases in thickness from west to east reaching over 300 feet near the Pecos River. It receives most of its' ground water through upward leakage and some from precipitation and surficial drainage. Movement of shallow ground water is generally towards the Pecos River and follows the topographic surface.

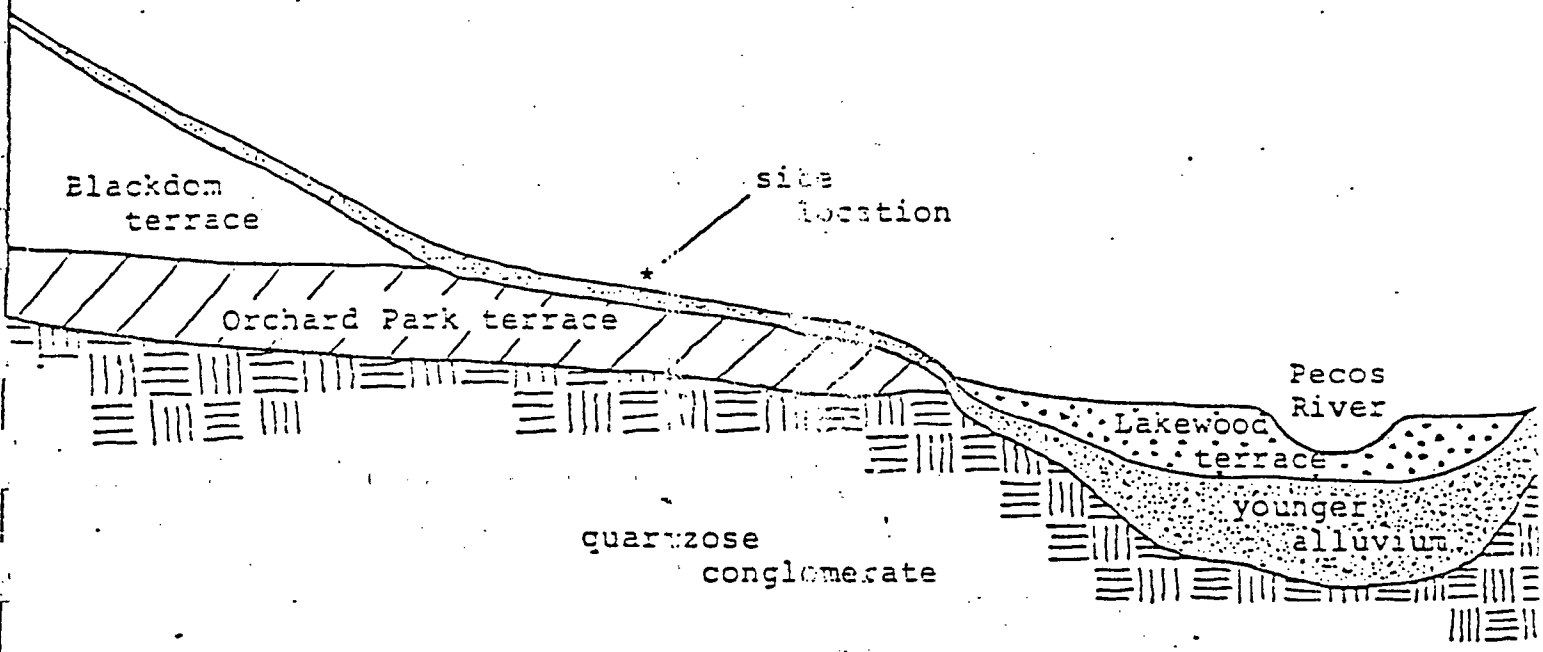
Local

West of the center of the Pecos depression lies the Pecos River. Along the Pecos River three gravel-capped sediments have been deposited: the Blackdom Terrace, the Orchard Park Terrace and the Lakewood Terrace (Figure 3). The Navajo facility is located above the Orchard Park Terrace approximately two miles west of the Pecos River. According to a 1982 Geraghty and Miller report (Appendix D), the Orchard Park Terrace is overlain by a veneer of 5 to 20 feet of younger alluvium deposited by the Pecos River and its tributaries. This younger alluvium is of Pleistocene age and also underlies the Lakewood Terrace and area stream channels to a maximum thickness of approximately 40 feet.

The younger alluvium consists of undisturbed silt, sand, gravel and cobbles. The Orchard Park and Lakewood Terrace deposits are generally finer grained than the same alluvium at higher elevations. Also, the Orchard Park Terrace deposit supplies water to more than 90% of the irrigated farms in the country (NWWA, 1984). The surficial soils of Navajo consist generally of fill underlain with clays, silty clays, sandy silty clays and pebble seams to a depth of approximately 20 feet (Figure 4).

The uppermost aquifer beneath the site is thought to be a confined pebble seam. Cross-sections A & B (Figures 5 & 6) exhibit general subsurface lithology at the North Colony Landfarm and the TEL Weathering Area. A silty clay layer above and a clay layer below the pebble seam apparently provide less permeable confining layers, but little specific permeability data were

Figure 3



GEOLOGIC CROSS SECTION

NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO

Geraghty & Miller Inc	Bouvette	none
	C. Robertson	

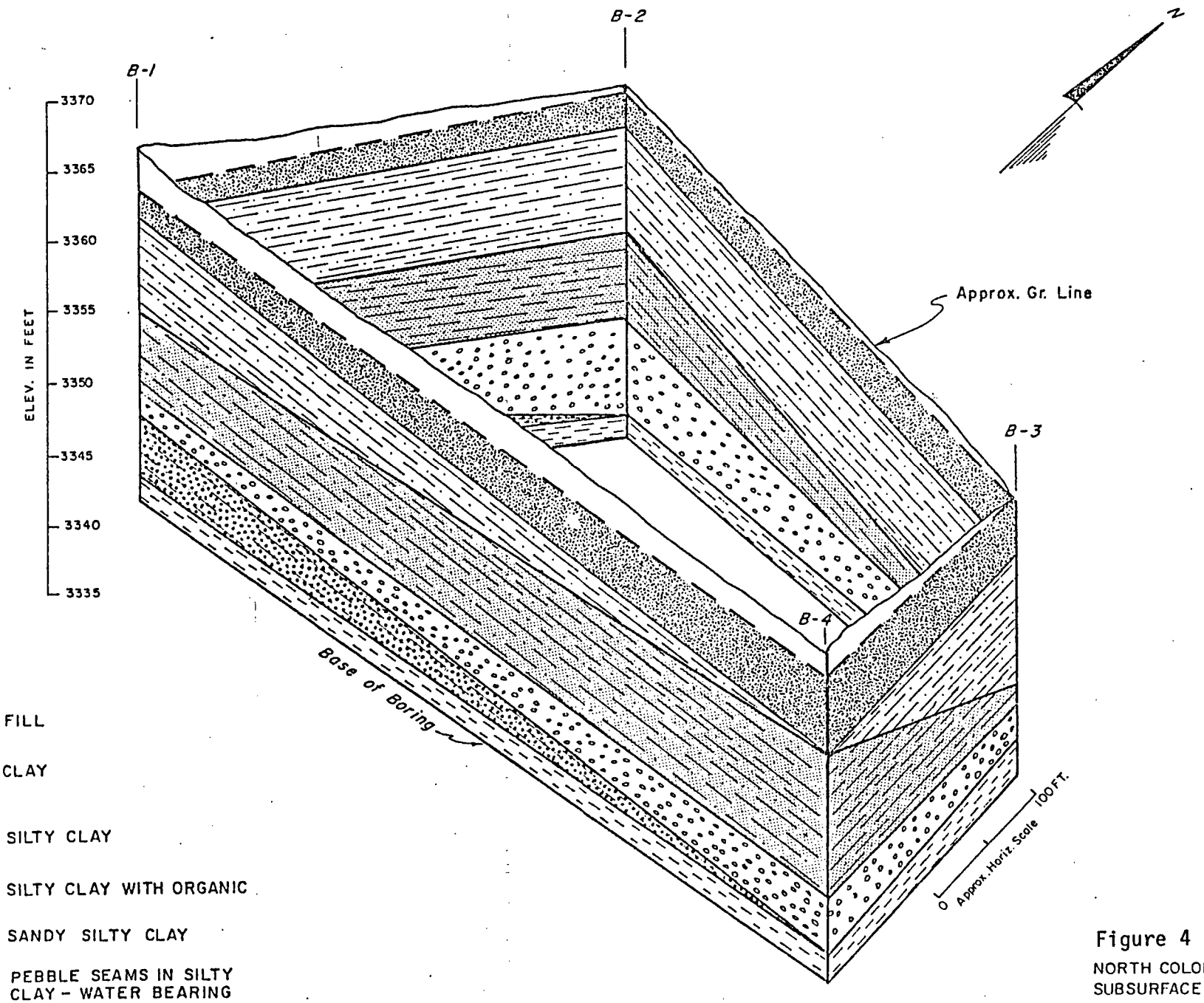


Figure 4

NORTH COLONY LANDFARM
SUBSURFACE SOIL PROFILE
URS ENGINEERS

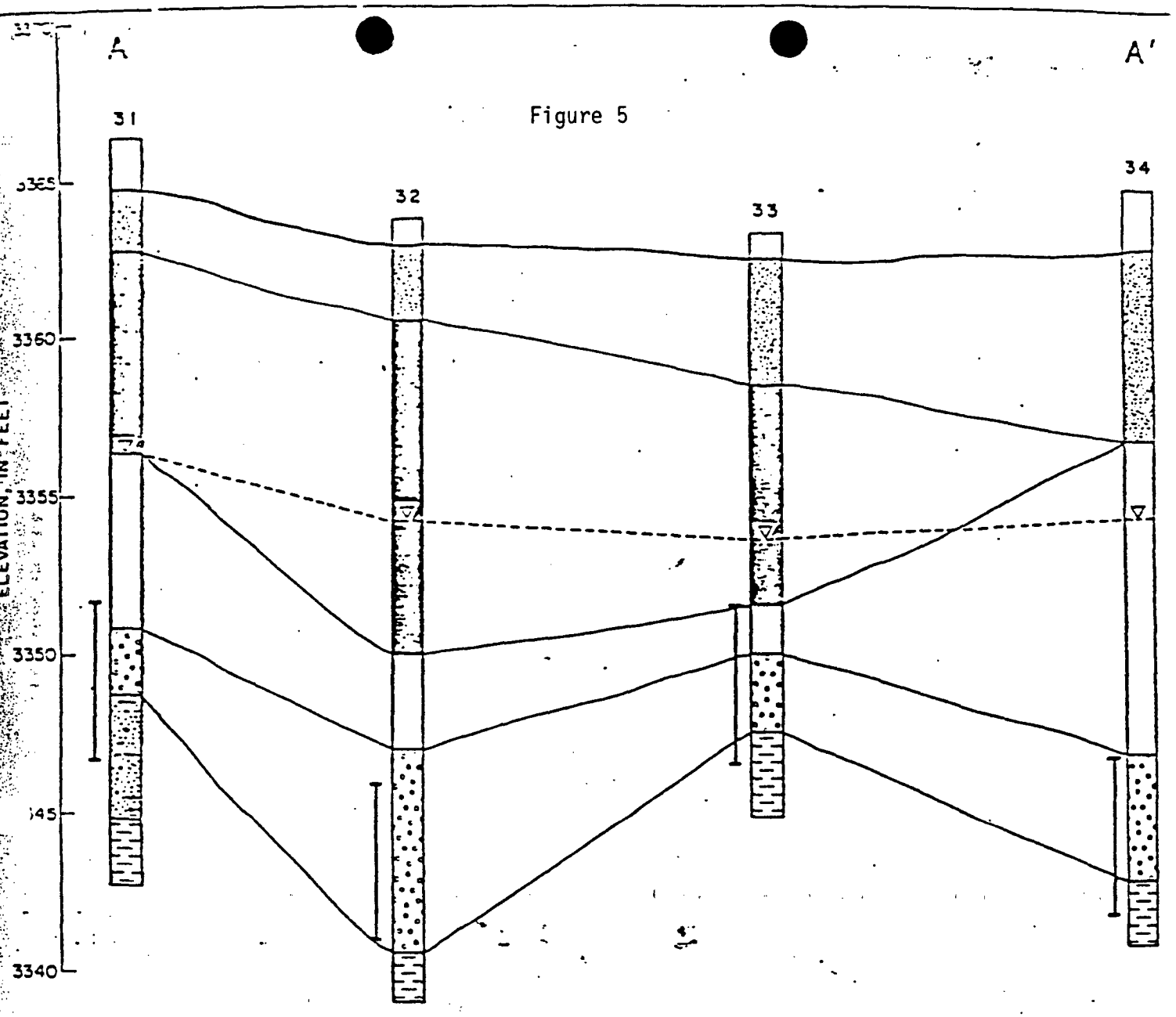
available (Table 1). In response to this lack of data, Navajo has recently installed two additional wells adjacent to the North Colony Landfarm. The soil borings obtained during these installations will be analyzed for permeability and porosity. The first boring encountered a saturated gypsum seam at approximately 16.5 feet from the ground surface (silty clay). Casing was installed and the ground water rose several feet within an hour, indicating a confined situation. The second well does not penetrate the first saturated layer encountered at 16.5 feet and will be used for in-situ permeability tests (falling or constant head permeability tests) to more accurately describe the permeability above this layer. Evidence of water was found above this layer and definition of the upper extent of the saturated zone was requested by EID.

Some degree of aquifer characterization has been performed. A study by Geraghty and Miller (October 1982) concluded that the local potentiometric surface lies about 10 feet from the ground surface (Appendix D). A southwesterly to northeasterly direction of ground-water flow was suggested by contour lines generated from ground-water elevations in the original eight RCRA wells. This has since been confirmed through water level elevations measured quarterly from October 1982 to June 1984, and semi-annually to date (Table 2). The average hydraulic gradient in both the North Colony Landfarm and the TEL Weathering Area is 0.006. Using Navajo's estimated permeability of $1x10^{-3}$ for the upper water bearing zone and Navajo's assumed effective porosity of 0.3, the ground-water flow velocity is projected at 20.7/year (Darcy's Law V = Ki/Ne).

Well Location

One upgradient and three downgradient wells were installed in an effort to comply with RCRA Interim Status requirements at both the North Colony Landfarm and the TEL Weathering Area. An additional downgradient well was later installed at the North Colony Landfarm to ensure down- rather than cross-gradient monitoring.

Figure 5



E X P L A N A T I O N

HORIZONTAL SCALE: NONE

- Fill
- Clay
- Silty Clay
- Silty Clay With Organic
- Sandy Silty Clay
- Pebble Seams In Silty Clay - Water Bearing
- Screened Interval

SUBJECT

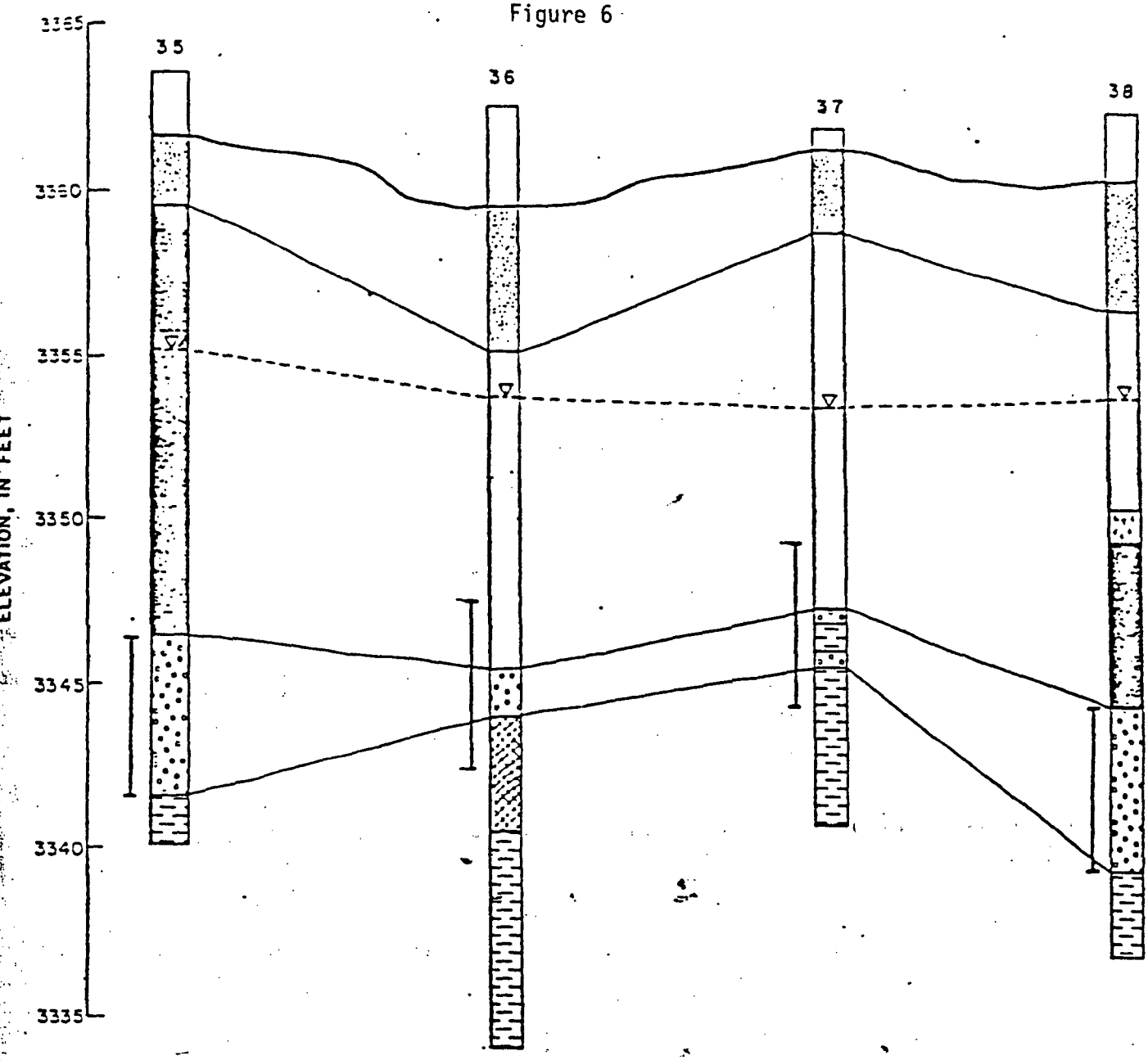
COLONY LANDFARM
GEOLOGIC CROSS SECTION

PREPARED FOR

NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO

Geraghty & Miller, Inc.	COMPILED BY Bouvette/Dauchy	SCALE Shown
	PREPARED BY C. Robertson	DATE
	APPROVED BY Dauchy	Dec. 82

Figure 6



EXPLANATION

- Fill
- Clay
- Silty Clay
- Screened Interval
- Cemented Clay
- Gypsum Clay
- Pebble Seams In Silty Clay - Water Bearing
- Silty Clay With Organic

HORIZONTAL SCALE: NONE

TEL WEATHERING AREA
GEOLOGIC CROSS SECTION

PREPARED FOR
NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO

Geraghty & Miller Inc.
COMPILED BY Bouvette/Dauchy
PREPARED BY C. Robertson
SCALE As Shown
FIGURE

Table 1

Porosity and Hydraulic Conductivity

Boring	Depth (feet)	Laboratory Permeability (cm/sec)	Calculated Permeability (cm/sec)	Porosity
31	20'	4.80×10^{-7}	10^{-6}	.49
33	10'	2.27×10^{-6}	10^{-6}	.33
34	16'	2.20×10^{-4}	10^{-6}	.47
36	15'	-	10^{-6}	-
37	15'	8.17×10^{-8}	10^{-6}	.46
38	10'	-	10^{-3}	-

Table 2
North Colony Landfarm June 1985 Corrections pending
Groundwater Elevations

	Elevation at Top of Casing (ft msl)	Sampling Date	Water Level Readings Depth (ft)	Elevation (ft msl)
Well 31 Upgradient	3366.30	22 October 1982	10.16	3356.14
		1 February 1983	10.17	3356.13
		12 July 1983	12.08	3354.22
		3 October 1983	10.00	3356.30
		12 December 1983	10.75	3355.55
		26 June 1984	10.92	3355.38
		5 February 1985	9.38	3356.92
		25 June 1985	9.58	3356.72
Well 32 Downgradient	3363.72	22 October 1982	9.70	3354.02
		1 February 1983	9.50	3354.22
		12 July 1983	10.92	3352.80
		3 October 1983	11.00	3352.72
		12 December 1983	10.58	3353.14
		26 June 1984	11.79	3351.93
		5 February 1985	9.04	3354.68
		25 June 1985	9.52	3354.20
Well 33 Downgradient	3363.28	22 October 1982	9.81	3353.47
		1 February 1983	9.46	3353.82
		12 July 1983	11.08	3352.20
		3 October 1983	11.83	3351.45
		12 December 1983	11.42	3353.32
		26 June 1984	12.04	3351.24
		4 February 1985	10.27	3353.01
		25 June 1985	10.94	3352.34
Well 34 Downgradient	3364.74	22 October 1982	10.60	3354.14
		1 February 1983	10.71	3354.03
		12 July 1983	12.10	3352.64
		3 October 1983	11.21	3353.53
		12 December 1983	10.75	3352.53
		26 June 1984	13.50	3351.24
		4 February 1985	10.38	3354.36
		26 June 1985	11.42	3353.32
Well 44 Downgradient	3363.23	6 February 1985	9.10	3354.13
		25 June 1985	9.71	3353.52

Feb. 15 '84
Feb. '84 — date is in folder

Note: Water level depth measured from top of casing.

b:ncgwel.tab

Table 2
TEL Impoundment Area - June 1985 corrections pending
Groundwater Elevations

	Elevation at Top of Casing (ft msl)	Sampling Date	Water Level Readings Depth (ft)	Elevation (ft msl)
Well 35 Upgradient	3363.47	22 October 1982	8.37	3355.10
		1 February 1983	8.92	3354.55
		12 July 1983	12.17	3351.30
		3 October 1983	12.77	3350.70
		12 December 1983	11.33	3352.14
		14 February 1984	13.00	3350.47
		5 June 1984	13.31	3350.16
		27 June 1984	10.92	3352.55
		6 February 1985	11.13	3352.34
		26 June 1985	9.75	3353.72
Well 36 Downgradient	3362.53	22 October 1982	8.89	3353.64
		1 February 1983	10.21	3352.32
		12 July 1983	13.46	3349.05
		3 October 1983	14.58	3347.95
		12 December 1983	13.00	3349.53
		14 February 1984	14.65	3347.88
		5 June 1984	14.29	3348.24
		27 June 1984	15.04	3347.49
		7 February 1985	12.75	3349.78
		26 June 1985	12.96	3349.57
Well 37 Downgradient	3361.99	22 October 1982	8.56	3353.43
		1 February 1983	10.42	3351.57
		12 July 1983	13.63	3348.36
		3 October 1983	14.83	3347.16
		12 December 1983	13.50	3348.49
		14 February 1984	13.83	3348.16
		5 June 1984	14.42	3347.57
		27 June 1984	15.27	3346.72
		8 February 1985	13.04	3348.95
		26 June 1985	7.58	3354.41
Well 38 Downgradient	3362.33	22 October 1982	8.51	3353.82
		1 February 1983	10.50	3351.83
		12 July 1983	13.54	3348.79
		3 October 1983	14.25	3348.08
		12 December 1983	13.25	3349.08
		14 February 1984	14.88	3347.45
		5 June 1984	14.00	3348.33
		27 June 1984	14.04	3348.29
		7 February 1985	13.17	3349.16
		26 June 1985	10.50	3351.83

Note: Water level elevations measured from the top of casing.

b:tegwel.tab

Table 2
Truck Bypass Landfarm
Groundwater Elevations

	Elevation at Top of Casing (ft msl)	Sampling Date	Water Level Readings Depth (ft)	Elevation (ft msl)
Well 36 Upgradient	3362.53	22 October 1982	8.89	3353.64
		1 February 1983	10.21	3352.32
		12 July 1983	13.46	3349.05
		3 October 1983	14.58	3347.95
		12 December 1983	13.00	3349.53
		14 February 1984	14.65	3347.88
		5 June 1984	14.29	3348.24
		27 June 1984	15.04	3347.49
		7 February 1985	12.75	3349.78
		26 June 1985	12.96	3349.57
Well 43 Upgradient	3362.80	12 February 1985	11.29	3351.51
		8 July 1985	8.21	3354.59
Well 39 Downgradient	3361.07	8 February 1985	12.00	3349.07
		8 July 1985	13.00	3348.07
Well 40 Downgradient	3361.06	11 February 1985	12.13	3348.93
		8 July 1985	18.31	3342.75
Well 41 Downgradient	3361.53	11 February 1985	11.92	3349.61
		8 July 1985	10.33	3351.20
Well 42 Downgradient	3362.55	12 February 1985	12.48	3350.07
		8 July 1985	10.67	3351.88

Note: Water level elevations measured from top of casing.

b:tbgwel.tab

As was previously mentioned, placement of these wells have consistently confirmed the direction of ground-water flow from the southwest to the northeast. Their number and horizontal location appear to be adequate to detect statistically significant increases above background. NMEID has been notified of such increases in specific conductivity in January of 1984 following confirmation in a downgradient well monitoring the TEL Weathering Area (#37). An assessment plan was submitted and initiated (Appendix E). No additional wells were installed as a result of this assessment. Further discussion of the monitoring status of this unit will follow.

Well Installation

The wells around the North Colony Landfarm and TEL Weathering Area were installed in borings created with a hollow stem auger. The borings average 20 ft. in depth. Split spoon samples were taken at 5 ft. intervals to help characterize the soil lithography. Shelby tube samples were taken to retain soil cores for geotechnical testing to further characterize subsurface conditions. Cores were retained from above, below and in the water bearing zone. The cores were tested for permeability, natural moisture content, grain size distribution and dry unit density (results in Table 1 and Appendix F).

The wells were completed with 2-inch, schedule 40, screw-together PVC casing. All the wells have a gravel pack around the entire 5 feet of the 0.02 slotted screen at the water bearing zone. A bentonite plug was put in place above the gravel pack, followed by a bentonite-cement grout seal from the plug to the ground surface. Also, protective steel casing was placed around the top of each monitoring well. Well completion specifics are presented in Appendix D.

An air-lift method was employed to develop the monitoring wells. The wells were blown out to develop the gravel pack filter around the screen. This procedure helps to insure that the samples obtained are representative

of the in situ groundwater and not the well drilling operation (URS, 1983).

The evaporation ponds and effluent ditch have previously been subject to New Mexico's Oil Conservation Division regulatory requirements and Navajo has installed some ground-water monitoring wells, but little information was available on their construction. Some data were gathered concerning the ground-water quality surrounding the ponds and ditch and can be found in Appendix G.

Ground-Water Sampling and Analysis

Navajo performed their semi-annual sampling during this inspection (June 25-27, 1985). Some problems were observed with the facility's sampling procedures. They were as follows:

- The bailer used to collect samples was dirty and constructed of PVC pipe with a cork on the bottom. PVC is an inappropriate material to sample for volatiles due to its' adsorptive and desorptive properties. Cork will easily retain water and could cross-contaminate samples. A Teflon or stainless steel bailer is considered acceptable sampling equipment by EID. Navajo has, following EID's request, purchased a Teflon bailer and has submitted a revised sampling and analysis plan which includes more appropriate decontamination procedures (Appendix H);
- Navajo's procedure of introducing several gallons of ground water into a large container, transporting and filtering prior to containerizing tends to aerate the samples. This procedure was corrected during the June 25, 26, 27, 1985 sampling event. The corrected procedure is to be used for future sampling;
- The sampling and analysis plan states that field parameters will be collected and stainless steel bailers used, neither of which had been done (Appendix I). The recently submitted sampling and analysis plan has, again, included the collection of pH, specific conductivity and temperature in the field and the use of a Teflon bailer. Navajo agreed to follow this plan;

- The facility representative sounded the depths of all nine wells. Six of these wells appeared deeper than the installation logs described them. The actual depths of the wells was later clarified by Navajo. Approximately 2 feet of blank PVC had been installed below each screen as a sump but not included on the logs.

Sampling Methodology

Water level elevations were determined by dropping the steel tape to the bottom of the well, subtracting the wet section from the total depth of the well and subtracting the depth to water from the elevation of the top of the well casing. The facility has been utilizing this method for several years and, in June 1985, compared its' results to those achieved by the EPA/EID method. EPA/EID typically drops the steel tape past the suspected water level in the well, holds an arbitrary number at the top of the casing (TOC), and then subtracts the wet section from this number to determine the depth to water (DTW) from the TOC. The DTW is then subtracted from the surveyed elevation of the TOC to arrive at the water level elevation. The results were within a couple tenths of a foot; this amount of discrepancy would not alter the perceived direction of flow.

The facility used a PVC bailer to evacuate and sample the wells. The volume of water is calculated by dropping a weighted steel tape to the bottom of the well. The height of the standing water and the diameter of the well are then used to determine the volume of water in the well. Three to five times the volume determined to be present is removed by bailing. As previously mentioned, Navajo bailed the sample water into a large container and transported it to the lab where it was filtered and transferred to individual containers. During the June 1985 sampling event, samples were placed in appropriate labeled containers at the well head and brought immediately to the lab for preservation unfiltered. The sample

containers used were made of the EPA recommended materials. Preservation techniques used can be found in Navajo's Sampling and Analysis Plan, Appendix H. The samples collected for metal analyses were preserved with HNO_3 to a pH<2, the samples for TOC were preserved with H_2SO_4 to a pH<2, and the phenolics samples preserved with H_3PO_4 to pH<4 and 1.0g $CuSO_4$. All samples were refrigerated until they were packed with ice in coolers and shipped via Purolator within 48 hours. Chain of custody forms accompanied the coolers to CEP Laboratory in Santa Fe, New Mexico.

Analytical methods not found in the original sampling and analysis plan were later described in the plan revised pursuant to EID's August 15, 1985 NOV (Appendix J). They can be found in Table IV-6 of the plan in Appendix H.

Proper field quality assurance/quality control was not performed during the June 1985 sampling. Duplicates and field blank samples were not taken. The revised sampling and analysis plan now includes the collection of duplicate and field blank samples. Laboratory QA/QC was not evident in the ground-water analytical submissions to date. Results of precision/accuracy testing and statistical calculations, as well as reference standards and spiked samples will be required of the lab pursuant to the revised sampling and analysis plan.

Parameter Selection and Rationale

Following a statistically significant increase at the TEL Weathering Area, Navajo analyzed ground-water samples for metals (EPA method 6018), mercury (EPA method 7470), volatile organics (EPA method 8240), semivolatile organics (EPA Method 8250), and cyanide (EPA method 9010). Trace amounts of benzene, 1,2-dichloroethane, 2,4-dinitrophenol, 2-nitrophenol, phenol, bis (2-ethylhexyl) phthalate and methylene chloride. Only three of these compounds, phenol, 2,4-dichlorophenol and bis (2-ethylhexyl) phthalate were reported at levels above the detection limits listed in EPA's SW-846. Low levels of methylene chloride are often attributed to lab contamination

and this constituent was not considered further in the analyses. These wells were later resampled and found to contain low levels of 2,4-dichlorophenol, 2-nitrophenol and phenol. The acid extractable fraction of the semivolatile analysis is now reported for both the TEL Weathering Area and the North Colony Landfarm.

The fact that these organics were often found at concentrations higher in the upgradient wells than in the downgradient wells suggests that these low levels of contaminants were not the cause for the statistically significant increase at the TEL Weathering Area. Also, the acidification of the unfiltered metal sample at the well head (June 1985) would have indicated elevated levels of metals perhaps causing the high specific conductivity in the downgradient well. Metal concentrations were relatively low and only fluoride and barium were found to exceed Primary Drinking Water Standards. Background concentrations of flouride in New Mexico are naturally elevated and barium exceeded the standard once by 0.1 ppm. Upon numerical comparison between specific conductivity and sulfates, it appeared evident that the increase was caused by sulfates. This issue should be addressed by the Oil Conservation Division since sulfates are not a regulated substance under RCRA.

Navajo will continue to analyze for the acid extractable fraction and also be required to run a volatile organic scan and the base/neutral fraction for the next few sampling events (the volatile and base/neutral analyses may be eliminated at some future date). The semi-annual and annual parameters required will be continued in all sampling events, as well as specific metals expected to be found in refinery wastes (As, Cd, Cr, Pb, Se, also F^-).

Recordkeeping and Reporting

During the June 1985 inspection, several possible recordkeeping deficiencies were noted. Navajo's second quarter water level elevations

were not found in their files. Navajo had not identified any significant difference from initial background values in the upgradient wells. The statistical results reported for the 2/5/85 sampling event indicated an increase in specific conductance in well #37 but Navajo reported that no increase was observed. Navajo was cited for these deficiencies in the NOV issued August 15, 1985.

All of these issues were addressed in Navajo's response to EID's NOV. The second quarter, as well as all additional water level elevations were submitted and clearly tabulated in Table 2. Navajo reported significant increases in upgradient wells monitoring the North Colony Landfarm and the TEL Weathering Area for the TOX analyses (pH was also 'triggered' but Navajo found these to be "false positive" results). According to Navajo's lab, these high TOX levels were attributed to inorganic chloride interferences although no direct correlation between the chlorides reported and the TOX values was apparent. This lack of correlation could be due to inconsistent and poor sampling techniques. Although low levels of chlorinated phenols have been reported in the ppb range, the TOX level is too high to have been influenced by such low concentrations. Finally, the statistical results did indicate an increase in specific conductance in well #37. Navajo claims that this was "inadvertently" stated otherwise in the 3/6/85 submittal and that this increase was "previously reported and an assessment program initiated."

Navajo's assessment plan proposed to analyze for a broad spectrum of priority pollutants and, if no contaminants were found to be emminating from the TEL Weathering Area, the facility would return to a detection phase. Navajo did return to detection but this decision was questioned in EID's NOV (8/15/85). As previously mentioned, low levels of some organics had been detected. Statistical analysis using the Student's t-test was performed on the two sets of samples collected from existing RCRA wells.

Using only two sets of data drastically reduces the sensitivity of the Student's t-test and would not be acceptable. Additionally, the silt present in the wells may have interfered with the metals' analysis. Navajo had been filtering their metal samples to remove the silt. EPA recommended procedure for analysis of metals requires the reporting of total metals as a combination of metal concentration in the filtered residue and in the filtered liquid. Navajo did not combine these concentrations. Also, Navajo's aeration of the sample (introduction into a large container, transporting and filtering) would tend to "pull" metals out of solution as hydroxides. EPA samples from the June 1984 split sampling event were not filtered, were acidified at the well head and subsequently detected levels exceeding Primary Drinking Water Standards in downgradient wells. Considering that an increase in specific conductance could be reflective of an increase in metals, and that the waste disposed at the TEL Weathering Area would be expected to contain high levels of metals, accurately quantifying metal concentrations is a salient issue.

The opportunity to demonstrate a "false positive" statistical result is acceptable only if the monitoring system is fully capable of detection. The adequacy of the ground-water monitoring system with respect to the screen depth, filter pack, sampling and statistical procedures was in question (see NOV, Appendix J). It follows that Navajo's return to a detection phase may not have been appropriate.

The initial four quarters of background analytical results from the North Colony Landfarm and the TEL Weathering Area have been included in Appendix K.

Analytical Results

The analytical results of Navajo's semi-annual sampling can be found in Appendix L. EID did not split samples with the facility, therefore comparison of results is not applicable. The results are briefly summarized in the following section.

As previously mentioned, three wells (1 up, 2 downgradient) surrounding the North Colony Landfarm and one (upgradient) well monitoring the TEL Weathering Area detected less than 15.0 ppb 2,4-Dimethylphenol. This hazardous constituent is commonly found in refinery waste. 2-Nitrophenol was also detected in a well which monitors the Truck Bypass Area (well #40) at 10 ppb. This constituent has also been found in refinery effluent.

The base/neutral fraction was not run (as requested by EID) during the June 1985 sampling analysis. Consequently, levels of bis (2-ethyhexyl) phthalate, a constituent also commonly found in refinery waste, was not reported but has previously been detected.

Arsenic (0.05 mg/liter, well #35) and selenium (0.01 mg/liter, well #42) were detected at the concentrations of the Primary Drinking Water Standard criteria. Barium (1.1 mg/liter, well #43) and fluoride were found to exceed the Primary Drinking Water Standards although fluoride levels are attributable to natural background levels.

As previously mentioned, both sulfate and specific conductivity were reported at high levels, the highest being 5,240 mg/liter and 12,705 umhos/cm, respectively (well #36). TOX levels were found to be as high as 550 mg/liter (well #41) and TOC levels reached 230 mg/liter (well #43).

The semi-annual analytical results from Navajo's February 1984 sampling and Navajo/EPA's June 1984 sampling can be found in Appendices M and N. A comparison of the EPA results and those obtained by Navajo for the TEL Weathering Area can be found in Tables 3 through 6. Few constituents were detected by both the EPA and Navajo labs except 1,2-dichloroethane, benzene and bis (2-ethylhexyl) phthalate. 1,2-dichloroethane was found by both labs in two wells (#35 upgradient, and #36) at <4.0 ug/l, and by Navajo in well #38 at 1.20 ug/l. Benzene was detected in well #38 at 18 ug/l (EPA) and 0.6 ug/l (Navajo), and in well #35 at 3.8 ug/l by EPA. Bis (2-ethyhexyl) phthalate was detected in well #38 at 230 ug/l (EPA) and 6.0 ug/l (Navajo), and in well #37 at 64 ug/l by Navajo. Arsenic, chromium,

TABLE 3
Analytical Results (June 1984)
TEL Weathering Area Well #35

Compound	EPA ug/l	Navajo ug/l
benzene	3.8	
1,2 dichloroethane	3.7	1.22
ethylbenzene	4.7	
methylene chloride		0.55
dichloromethylphenol		1
phenols		1
arsenic	58.7	60
selenium		20
tentatively identified compounds	X	

TABLE 4
Analytical Results (June 1984)
TEL Weathering Area Well #36

Compound	EPA ug/l	Navajo ug/l
1,2-dichloroethane	3.4	
ethylbenzene	2.5	
toluene	5.5	
p-xylene	26	
dibenzofuran	5	
methylene chloride		31.59
trans-1,3-dichlorcpropene		0.16
dichloromethylpherol		1
phenols	36.0	2
selenium		40.
lead	73	
fluoride	2.69 (mg/l)	
arsenic	67.6	

TABLE 5
Analytical Results (June 1984)
TEL Weathering Area Well #37

Compounds	EPA ug/l	Navajo ug/l
ethylbenzene	6.0	
toluene	4.2	
p-xylene	179	
benzene		0.4
methylene chloride		48.14
bis(2-ethylhexyl) phthalate		64
dichloromethylphenol		2
phenols	71.6	
chronium		66
lead		87
selenium		70
tentatively identified compounds	X	

TABLE 6
Analytical Results (June 1984)
TEL Weathering Area Well #38

Compounds	EPA ug/l	Navajo ug/l
benzene	18	0.6
bis (2-ethylhexyl) phthalate	230	6.0
dibenzofuran	6	
1,2-dichloroethane		1.20
methylene chloride		90.56
2-nitrophenol		1
dichloromethylphenol		6
phenols	35.6	
selenium		40
tentatively identified compounds	X	

lead, selenium and fluoride were found to exceed the Primary Drinking Water Standards but only arsenic was reported by both labs in well #35. EPA sampling detected arsenic 1.3 ug/l less than Navajo's sampling (58.7 ug/l vs. 60.0 ug/l). Arsenic was also reported by EPA at 67.6 ug/l in well #36. Navajo only detected 30 ug/l. Navajo reported levels of selenium which exceeded the Primary Drinking Water Standards in all four wells (20 ug/l in #35, 40 ug/l in #36, 70 ug/l in #37, and 40 ug/l in #38). EPA's detection limit was set above the standard at 12.5 ug/l and selenium was never detected above that concentration. Phenols were detected by EPA at a level of 71.6 ug/l in well #37 while Navajo reported only 1 ug/l. Both labs reported levels of phenols at or exceeding the Secondary Drinking Water Standards of 1 ug/l in three of four wells. EPA detected several tentatively identified compounds in all TEL wells but well #36.

EPA analytical results from the North Colony Landfarm obtained during the June 1984 CME can be found in Table 7. The upgradient well clearly exhibits low level organic contamination which appears to decrease in the downgradient wells. The ground water in well #34 was found to exceed the Primary Drinking Water Standards for lead at 61 mg/l. Well #33 had a level of fluoride which also exceeded these standards at 2.79 mg/l.

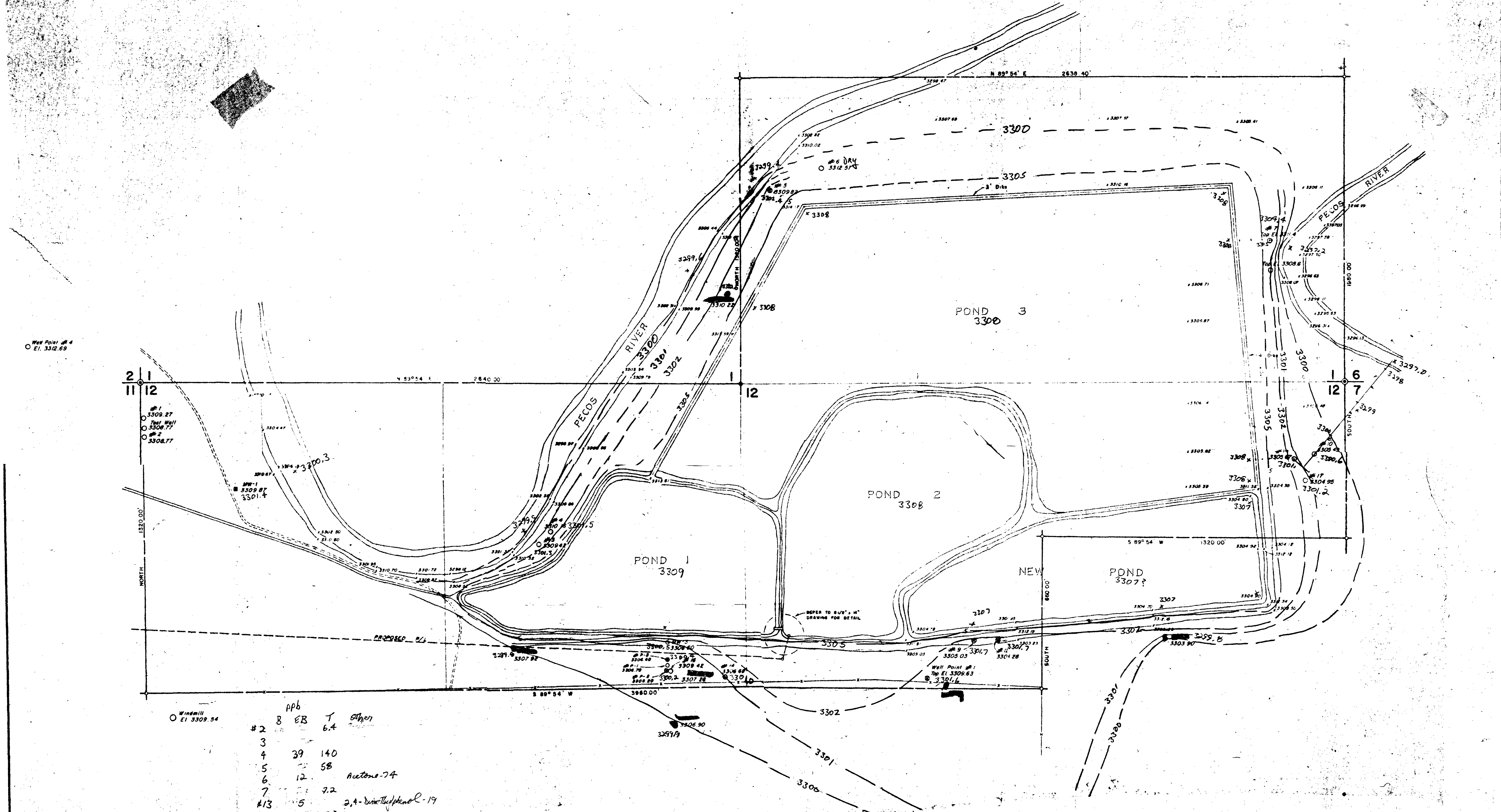
In summary, the results of the EPA/Navajo split sampling indicate low levels of organic compounds in all the wells surrounding the TEL Weathering Area. Few of these compounds were detected by both labs. EPA results also indicate similar refinery-related constituents at the North Colony Landfarm. The source of these contaminants and the QA/QC of Navajo's lab remain unknown.

TABLE 7
Analytical Results (June 1984, EPA)
North Colony Landfarm

Compound (ug/l)	Well #31 (up)	Well #32	Well #33	Well #34
benzene	33			
ethylbenzene	129			
napthalene	38			
bis (2-ethylhexyl) phthalate	6.4	6.0	6.0	
dibenzofuran	12			2
di-n-butyl phthalate	2.0			
phenols	12.8			10.0
lead				61
fluoride mg/l			2.79 (mg/l)	
tentatively identified compounds	X	X		X

Conclusion

A comprehensive ground-water monitoring evaluation was conducted at Navajo Refining Company by NMEID on June 25, 26 and 27, 1985. Alice Barr, representing NMEID, Dave Griffin and Sammy Bejarano from Navajo were present during the sampling. Based on the information reviewed during this evaluation, an NOV (Appendix J) was issued by EID on August 15, 1985 noting several deficiencies and unclear issues. Navajo has responded to the NOV addressing most of the issues cited. The areas of their ground-water monitoring program which were actually deficient have been corrected or will be handled under a compliance schedule. Most of the issues unclear during this evaluation have since been clarified except the source of low level organic constituents in upgradient (and some downgradient) wells and the high TOX levels. Continued sampling using appropriate decontamination, QA/QC, collection and preservation methods will hopefully provide a more accurate scenario of the quality of ground water at the site. A Post-Closure Permit will address the necessary ground-water monitoring requirements for the API Separator effluent ditch and evaporation pond #1.



	ppb			
	B	EB	T	Other
#2			6.4	
3				
4		39	140	
5			58	
6		12		Acetone-74
7			7.2	
#13		5		2,4-Dimethylphenol-19
WP#2		70	70	
#1				

Attachment to 3/30/87 OCD Letter to Navajo
Water Level Contours 8/7/86
Contours Plotted: 3300, 3301, 3302, 3305 El
Drawn by DGB 3/17/87 (OCD)

NAVAJO REFINING CO., INC.

PLATE 2
1" = 200'
NAVAJO PONDS
SITUATE WITHIN
SECTIONS 1 & 12, T 17 S, R 26 E, N.M.P.M.,
EDDY COUNTY, NEW MEXICO

JOHN WEST ENGINEERING CO.
CONSULTANTS
HOBBS NEW MEXICO

Surveyed By J. Love	Drawn By N. Mitchell	Last Rev. Date	Drawing Number
Date Begin	Date 7/19/86	File No.	

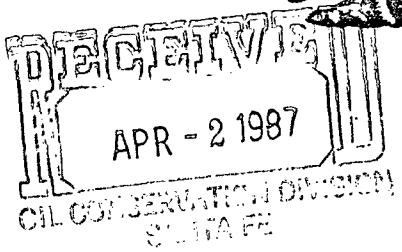
TELEPHONE
(505) 748-3311

EASYLINK
62905278

REFINING COMPANY

501 EAST MAIN STREET • P. O. DRAWER 159

ARTESIA, NEW MEXICO 88210



March 16, 1987

Mr. Jack Ellvinger
Hazardous Waste Section
NMEID
P.O. Box 963
Santa Fe, NM 87504-0968

RE: Navajo Refining Company, Activities during February-March, 1987

Dear Mr. Ellvinger:

This monthly report is to keep you advised of on-going activities at Navajo Refining Company's Artesia refinery, as of March 15, 1987. Field and laboratory activities during this period include:

- Continuation of hydrogeologic investigations of ground water in the area of the evaporation ponds and the Pecos River Valley
- Review of soil-gas in existing ground water data
- Installation, development and sampling of several additional well points
- Survey of well point locations and elevations
- Submission of additional ground water samples for analysis

A total of 19 new well points have been installed and sampled, as shown on the attached map. Due to analytical problems, all well points have been re-sampled and analyses are pending.

Work is also proceeding on the final report summarizing all investigations, results and conclusions. No significant changes in the proposed work plan are presently anticipated, and we expect to submit the final report on or about June 1, 1987.

If we can provide any additional information, please contact me at (505) 748-3311 or Mr. Trent Thomas at (505) 842-0001.

Sincerely,

Z. Sherman

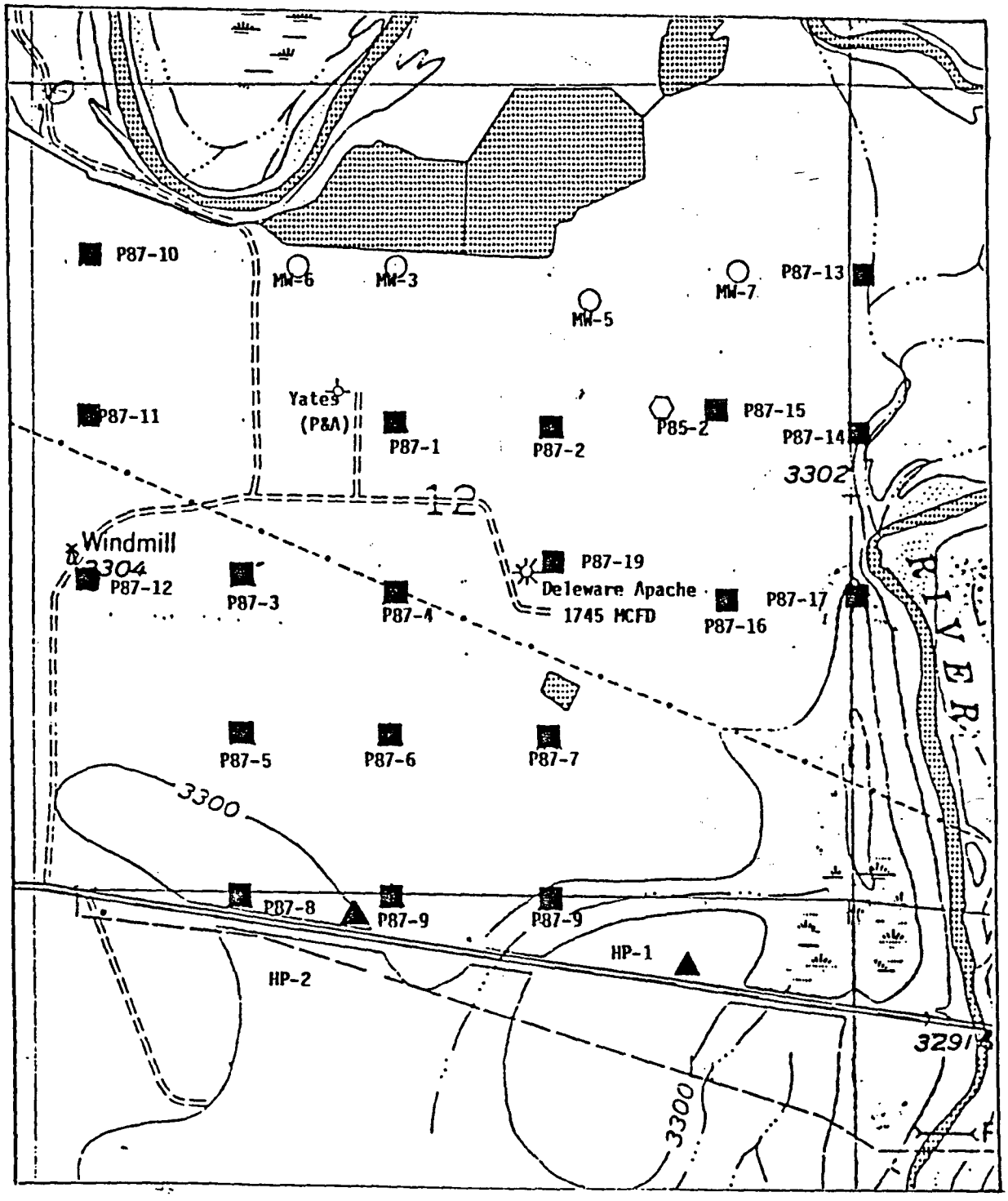
Zeke Sherman

Environmental Compliance Engineer

ZRS/pb

attachment

copies to Dave Boyer - NMOCD
David Griffin - Navajo



LOCATIONS OF WELL POINTS

EVAPORATION POND AREA

- MW-6 Monitor Well
- P87-1 Point installed in this study (1987)
- P85-2 Point installed in earlier study (1985)
- HP-2 Point installed by unknown agency

STATE OF NEW MEXICO

ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501
(505) 827-5800

March 30, 1987

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. David Griffin
Environmental Affairs Superintendent
Navajo Refinery
P.O. Drawer 159
Artesia, New Mexico 88210

RE: Discharge Plan GW-28, Navajo Refinery; comments on 10/29/86 Technical Report to EID

Dear Mr. Griffin:

On January 12, 1987, the Oil Conservation Division received a copy of the technical report prepared for the Environmental Improvement Division (EID) entitled "Proposed Site Investigations of Pond #1 and Conveyance Ditch to Determine Potential Effects to Ground Water Quality, Navajo Refinery, Artesia, New Mexico," revision of October 29, 1986. On that date in January we also received water level elevation maps for September, October and November. Review of that information lead us to question some of the interpretations provided by Navajo's consultants, Geoscience Consultants, Ltd. (GCL). These issues are relevant since much of the same information will be needed by OCD to complete review of the refinery discharge plan before expiration on September 15, 1987, of the current extension to discharge without an approved discharge plan.

Section 4.1 - Geology:

1. On page 19, the Artesia area structure is described as both having a strike and dip to the southeast; since strike and dip are perpendicular to each other, this situation can not occur.
2. The statement on page 20 that ground water does not extend under the refinery site is incorrect. Although there do not appear to be any water bearing zones greater than a few feet thick within 20-25 feet of the surface, these units and wells drilled into them are water bearing (Plate 12). Also, deeper zones are known to contain ground water; some may be as shallow as 30-65 feet in depth (see comments on refinery area hydrogeology).

Section 4.1 - Soils:

1. Contrary to page 20 of the report, the U.S. Soil Conservation Survey map (Plate 7) shows the refinery to be located on Pima silt loam and Reagan loam although the TEL site is on Karro loam. The Reagan and Karro soils may have calcareous or gypsiferous substrata as was observed in cores from wells drilled in the refinery area.
2. The effluent ditch passes through Pima silt and clay loams, Arno silty clay loam, and the Arno-Harkey complex enroute to the ponds (Plates 7 and 8).

Section 4.4 - Local Hydrogeology

A. Refinery area.

1. Plate 9 shows the Bower Sand as permeable bedrock at the southeastern end of the refinery area. The log of RA-768 (located about 350 feet north of RW-5 on Plate 11) shows a sand and gyp layer from 30 to 80 feet. RA-602 (located about 150 feet north of #18 on Plate 11) shows a sand zone from 51 to 59 feet. Both wells are correctly pictured on Plate 9. Numerous monitoring wells have been drilled between RA-768 and RA-602, but with the exception of #28 and several in the TEL area (#21, 39, 40, 41, 42) none have gone below 25 feet. Of these, none went below 33 feet. Three of the wells (#40, 41, 42) found increasing clastic material (silt, sandy silt) below 28 feet in contrast to tight evaporitic material above. Since none of the wells between RA-768 and 602 went to depths of 50 to 60 feet, the existence of permeable sand or other non-evaporitic water bearing zones can not be ruled out. However, at least seven other water wells within a one-half mile of the refinery have reported sand or water sands within this range:

RA#	Depth	RA#	Depth
1090	30-35 ft.	3282	50-60 ft.
2568	61-118	City	30-40
3225	65-70	Southworth	25-58
3262	70-80		

In 1954, wells 3225 and 3262 just north of the refinery were completed in these shallow zones. The existence of a shallow zone, its extent, and water quality may need to be investigated further as part of OCD's evaluation of Navajo's product recovery efforts, which are separate from this discharge plan review.

2. Questions raised by OCD regarding continued use of the unlined fire pond as long as it continues to receive boiler blowdown need to be answered. These were first asked in my letter of February 7, 1985, and repeated on October 1, 1985. The Navajo response of March 5, 1985, was inadequate in this regard. OCD's concern regarding the fire pond would be alleviated if only raw water instead of boiler

effluent was placed in the pond, or if pond contaminant concentrations were kept less than naturally occuring, and agreed upon, background levels.

3. The static water level shown on Plate 12 for wells AA and AB is 10 feet above that shown on Plate 11 for the same wells.

B. Pond Area

1. The ground water level elevation maps provided for September, October, and November, 1986, do not appear to include the ponds as a source of water, nor the river as a possible discharge point. Data for August 7, 1986 (provided in Navajo letter to EID dated 8/15/86) was plotted on Plate 2. Additional data was obtained from the USGS for the Artesia Pecos River Station for that date (Gage height 2.15 ft., gage elevation 3291.92 ft., mean discharge approx. 25 cfs). This data was used along with the river channel topographic gradient (approx. 3.1×10^{-4} ft/ft.) to determine approximate river elevations opposite the appropriate ground water monitoring wells. Calculated river elevations and measured ground water elevations are shown in the below table:

Well #3	Measured Water Level (ft.)	Calculated River Level (ft.)
#3	3301.32	3299.9
#4	3301.47	3299.9
MW2	3302.6	3299.6
#5	3302.38	3299.4
#7	3304.4	3297.2

Pond elevations were approximated after talking with Zeke Sherman of Navajo and are based on elevations shown on Plate 13, dike elevations, and the fact that the ponds were likely still high after inflow during the June, 1986, floods. The attached plate shows ground water movement from the ponds to the river on the three sides of the site where the river is present. Contours were plotted at the 3300, 3301, 3302 and 3305 feet elevations.

If the measurement at Well Point #2 is correct, the August contours show a slight mounding effect southeast of Pond 2. This could indicate more seepage from Ponds 2 and 3 than Pond 1. This would be consistent with some reduction in Pond 1 permeability due to deposition of asphaltic-like sediments from the refinery over the years. The lack of a mound southeast of the new pond may be due to the fact that the pond had only been used for a short period of time (several months maximum) through August, and a mound may not have had time to form in the area of wells #9, 12 and MW-7. The southeastward orientation of the "mound" near Pond 2 is consistent

with the slope of the topographic surface of the flood plain alluvium at this location.

2. An aquifer test was performed by GCL in the pond area on July 17, 1986, using a 4" PVC well installed for the purpose near Pond 1. Two piezometers and an existing well (#13) were used for observation wells. The well was pumped for opproximately 27 hours followed by 19 hours of recovery. Data sheets (included in the GCL report) indicate that the initial pumping rate of 9.6 gpm was reduced to 7.0 gpm about 2.5 hours after the test began. A final rate of 6.5 gpm was used in test calculations. Drawdown data was adjusted for water-table effects by using Jacob's correction. Water levels and the log of the PVC well indicate an effective aquifier thickness of about 25 feet.

   The following comments are made on the test, data analysis, and interpretation:

   A. Only one analysis of the data (and one transmissivity) was shown in the report. No discussion of other methods, and possible errors in interpretation of the results we presented. Especially crucial is whether the Jacob modification of the Theis method is applicable given the relatively short length of the test. Several other methods of analysis are available, and were applied by OCD using the supplied data. Since discharge was not kept constant, curve matching using the Theis method was not used by OCD because less than one log-cycle of time data at a constant rate was available.

      Observation Well #1, r = 15.5', time-drawdown plot:
      T = 7270 gpd/ft., S = 2.65
      Comment: Since S can not exceed specific yield (maximum 0.2 to .3), this value is incorrect. Verification of the Jacob method using S = 2.6 and u less than 0.05 shows minimum time needed for use of method is 4715 minutes (3.3 days).

      Observation Well #2, r = 23.2', time-drawdown plot:
      T = 4613 gpd/ft., S = 0.29
      Comment: Although S range is realistic (but high), the minimum time needed to apply the method is 1816 minutes (u less than 0.05).

      Observation Well #3, r = 48.2' time-drawdown plot:
      T = 11071 gpd/ft., S = 0.089
      Comment: This S value is realistic for a fine grained sand and silt. The minimum time needed to use the method (u less than 0.05) is 1005 minutes (vs. 1624 for the total test). Therefore, the last four data points (which plot as a straight line on semi-long paper) can be used in the calculations.

      Wells #2 and #3, distance-drawdown plot:

T = 6130 gpd/ft., S = 0.18
Comment: These results are similar to those reported by GCL. Well #1 could not be used since drawdown was less than either well #2 or #3, although it was closer to the pumped well. This indicates that the hydraulic connection between #1 and the pumped well is poor, possibly because of the presence of finer grained materials. Verification of the method (u less than 0.05) shows that minimum time must exceed 3600 minutes (2.5 days) for the results using wells #2 and #3 to be acceptable.

Recovery, Pumped well:
T = 10,400 gpd/ft., S can not be determined with this method.
Comment: Use of the 19 hours of recovery data produced a resultant T close to that for observation well #3. Calculations show that the casing storage effects were overcome in the first few minutes after recovery started.

B. From the #3 time-drawdown and pumped well analyses, an average T of approximately 10,700 gpd/ft., and S of 0.09 were determined. The effective aquifer thickness (assuming 100% screen for submerged depth of well) is m = 32 - 7 = 25 feet. Since K = T/m, the horizonal aquifer permeability can be approximated as 430 gallons/day/foot^2. This value is in the upper range of values for silty sands given by Freeze and Cherry (page 29), but would not be expected given the silts, fine grained sands, and silty clays shown in the 4" PVC well log.

C. The transmissivity value (6240) given on pages 36 and 38 of the report is reported in units of permeability (gpd/ft^2) and compared directly to permeabilities for silty and clean sands. As shown in B. above, the correct value is about 430 gpd/ft^2. Using this value, an effective porosity of 0.2, and the hydraulic gradient, a rough estimate of horizontal seepage velocity away from the ponds can be made. Since the hydraulic gradient near the ponds is impacted by the seepage mound, the topographic gradient parallel to the river was used. In the area of the ponds, the flood plain gradient is between 10/5500 and 10/6000 ft/ft, or about 0.0017. The calculated seepage velocity is:

$$V = \frac{430}{7.48} \times \frac{0.0017}{0.2} \frac{ft}{day} = 0.5 ft/day \text{ or } 180 ft/year$$

If the gradient is nearer the straight-line river gradient (10/16,000) the seepage velocity is decreased by about one-third. If a ground water model is prepared using actual water level data, these seepage velocities can be compared with the model velocities.

The OCD is awaiting receipt of further hydrologic and water quality results from recent measurements at the pond site. We plan to collect additional data

during our visit the week of April 27. However, it is apparent that as a result of our examination of the data available to date, Navajo will need to better define the relationship between the ponds, alluvium ground water levels, and the river prior to discharge plan approval. The impact of the unlined fire pond also remains to be determined.

If you have any questions, please contact me at 827-5812.

Sincerely,

David G. Boyer
Hydrogeologist
Environmental Bureau Chief

DGB/cr

cc: GCL Consultants
NM EID Hazardous Waste Section

Attachment

STATE OF NEW MEXICO

ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION

March 13, 1987

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501
(505) 827-5800

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. David G. Griffin
Environmental Affairs Superintendent
Navajo Refining Company
P. O. Drawer 159
Artesia, New Mexico 88210

Dear Mr. Griffin:

This letter is to acknowledge receipt January 12, 1987 of the report entitled "Proposed Site Investigations of Pond #1 and Conveyance Ditch to Determine Potential Effects to Ground Water Quality, Navajo Refinery, Artesia, New Mexico." As discussed with you and Zeke Sherman last week, my staff has reviewed the report and had some questions on some of the technical information presented. I am in the process of completing review, and will provide comments on only those sections that are relevant to the revised discharge plan. You should have these within the next 10 to 14 days.

As I mentioned on the phone today to Zeke Sherman, we are still planning to visit the refinery in late April and will conduct sampling in the pond area. If anyone else will be sampling about that time, please let us know so as to coordinate activities and minimize inconvenience to your staff.

Also, I would appreciate receiving copies of relevant technical data submitted to EID. I understand GCL has been providing monthly reports of their activities to the Hazardous Waste Section and I would appreciate being sent copies of pond investigation updates.

Sincerely,

David G. Boyer
Hydrogeologist/Environmental Bureau Chief

DGB:et

P 612 458 633

RECEIPT FOR CERTIFIED MAIL

NO INSURANCE COVERAGE PROVIDED
NOT FOR INTERNATIONAL MAIL

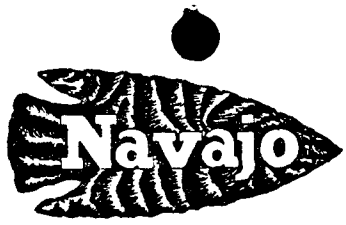
(See Reverse)

Sent to Navajo Refining Co. David G. Griffin	
Street and No. PO Drawer 159	
P.O., State and ZIP Code Artesia, New Mexico 88210	
Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to whom and Date Delivered	
Return receipt showing to whom, Date, and Address of Delivery	
TOTAL Postage and Fees	$
Postmark or Date	

PS Form 3800, Feb. 1982

☆ U.S.G.P.O. 1983-403-517

TELEPHONE
(505) 748-3311



EASYLINK
62905278

REFINING COMPANY
501 EAST MAIN STREET • P. O. DRAWER 159
ARTESIA, NEW MEXICO 88210

January 15, 1987

Mr. Jack Ellvinger
Hazardous Waste Section
NMEID
P.O. Box 968
Santa Fe, NM 87504-0968

RE: Activities During
December-January, 1986

Dear Mr. Ellvinger:

This monthly letter report is to keep you advised of activities that have occurred at Navajo Refining Company's Artesia refinery as of January 15, 1987. The only activities that occurred during this time period were the continuation of the hydrogeologic investigation of the Pond and Pecos River Valley area and the implementation of a combined, shallow soil gas and ground water investigation to define the preliminary boundaries of any existing ground water plume.

During the week of January 5, 1987, GCL personnel installed the first phase of a series of temporary well points to define and characterize potential ground water contamination in the area south of Navajo's evaporation ponds. A total of 10 points were installed; 8 of these were capable of producing water and were developed and sampled.

Samples were forewarded to Assaigai Laboratories for analysis for benzene, toluene, ethylbenzene and xylenes. The points were installed on a 1000-foot center grid, originated at well NM-3. The grid extends 4000 feet south of MW-3, and 1000 feet east and west.

Selected ground water samples were field analyzed by headspace techniques, using an organic-vapor detector. The level of organic vapors does not directly correspond to ground water contamination, but does indicate the potential presence of organic compounds. Ground water analyses should allow the correlation of vapor concentrations with actual levels of organic chemicals in ground water.

Following receipt of analyses, additional ground water sampling and organic-vapor analyses may be necessary.

If I can provide any additional information, please feel free to contact me at (505) 748-3311, or Mr. Trent Thomas at (505) 842-0001.

Sincerely,

David G. Griffin

Supt. of Environmental Affairs & Quality Control

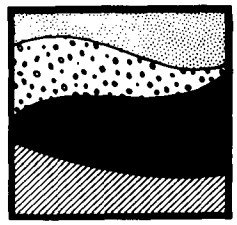
DGG/pb

copies to Henry Stern, Holly Corp.
Dave Boyer, OCD

Geoscience Consultants, Ltd.

500 Copper Avenue NW, Suite 200
Albuquerque, New Mexico 87102
(505) 842-0001 TELEX (505) 842-0595

5513 Twin Knolls Rd., Suite 216
Columbia, Maryland 21045
(301) 596-3760



December 24, 1986

Mr. Dave Boyer
New Mexico Oil Conservation Division
PO Box 2088
Land Office Building
Santa Fe, NM 87501

RE: Requested Additional Data for Discharge Plan GW-28, Navajo Refining Company, Artesia Refinery

Dear Mr. Boyer:

This letter accompanies the additional geohydrologic data that you requested in Item #2 of your July 18, 1986 letter to Mr. David Griffin of Navajo Refining Company. The attached items include:

1) Two copies of the Proposed Investigations of the pond #1 and conveyance ditch areas, as submitted to NMEID

2) Water-table maps of the evaporation-pond area, including maps showing monthly changes

3) Hydrographs of the Pecos River, from the gauging station at the Highway bridge (approximately 1 mile south of the evaporation ponds).

The Proposed Investigations document includes considerable data on site geohydrology and ground water chemistry derived since the submission of the original Discharge Plan. Analyses of these data, including the relationship between shallow ground water and the Pecos River, is continuing. Also, we plan to install and sample additional ground water monitoring points in January, 1987. Reports of progress in these tasks will be submitted to NMOCD in a timely manner.

Please contact me if you have any questions regarding this submission or our future investigations.

Yours very truly,
GEOSCIENCE CONSULTANTS, LTD.

FOR

Trent H. Thomas, MS
Project Director

THT/pe/NAVAJO/BOYER001.LTR

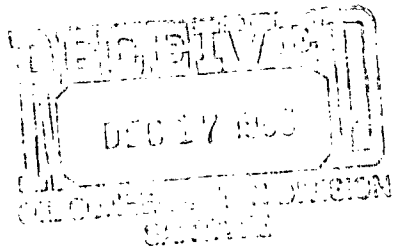
cc: David Griffin, Navajo

Enclosures

TELEPHONE
(505) 748-3311

EASYLINK
62905278

REFINING COMPANY
501 EAST MAIN STREET • P. O. DRAWER 159
ARTESIA, NEW MEXICO 88210



December 15, 1986

Mr. Peter Pache
Hazardous Waste Section
NMEID
P.O. Box 968
Santa Fe, NM 87504-0968

RE: Activities During
November-December, 1986

Dear Mr. Pache:

This monthly letter report is to keep you advised of activities that have occurred at Navajo Refinery Company's Artesia refinery as of December 15, 1986. The only activity that occurred during the time period November 15-December 15, 1986 was the continuation of the hydrogeologic investigation of the Pond and Pecos River Valley area. However, beginning December 22, 1986, Navajo will institute the shallow soil gas investigation that was proposed for defining the limits and extent of any existing contaminant plume.

If I can provide any additional information, please feel free to contact me at (505) 748-3311 or Mr. Trent Thomas at (505) 842-0001.

Sincerely,

David G. Griffin
Supt. of Environmental
Affairs & Quality Control

DGG/ls/NAVAJO/GRIFF027.LTR

Enclosures

TELEPHONE
(505) 748-3311

EASYLINK
62905278

REFINING COMPANY
501 EAST MAIN STREET • P. O. DRAWER 159
ARTESIA, NEW MEXICO 88210

November 15, 1986

Mr. Peter Pache
Hazardous Waste Section
NMEID
P.O. Box 968
Santa Fe, NM 87504-0968

RE: Activities During
October-November, 1986

Dear Mr. Pache:

This monthly letter report is to keep you advised of activities that have occurred at Navajo Refinery Company's Artesia refinery as of November 15, 1986. One major milestone did occur during the time period October 15 through November 15, 1986: Submission of Navajo's revised field investigation proposal as specified in NMEID's CA/CS. Additionally, field work was continued on the investigation of local geohydrology of the Pecos River Valley.

If I can provide any additional information, please feel free to contact me at (505) 748-3311 or Mr. Trent Thomas at (505) 842-0001.

Sincerely,

David G. Griffin
Supt. of Environmental
Affairs & Quality Control

DGG/pe/NAVAJO/GRIFF024.LTR

TELEPHONE
(505) 748-3311

EASYLINK
62905278

REFINING COMPANY
501 EAST MAIN STREET • P. O. DRAWER 159
ARTESIA, NEW MEXICO 88210

October 21, 1986

Mr. Peter Pache, Manager
Hazardous Waste Section
NMEID
P.O. Box 968
Santa Fe, New Mexico 87504-0968

Re: Evaporation Pond Activities During September - October, 1986.

Dear Mr. Pache:

This report is addressed to your attention in light of Ms. Barr leaving your organization. All previous monthly reports were sent directly to her. This monthly report is to keep you advised of activities that have occurred at Navajo Refining Company's Artesia refinery as of October 15, 1986. One major milestone did occur during the time period September 15 - October 15, 1986: receipt of the analytical results from the first ground water sampling that occurred the week of August 4 - 8, 1986.

On August 6 & 7, 1986 the first ground water monitoring samples were collected from wells at Navajo's evaporation ponds and waste conveyance ditch. Three down-gradient wells (MW-6, MW-3 and #13) and one up-gradient well (MW-1) in the evaporation pond area were sampled for Priority Pollutants which were previously analyzed for by EPA in their 1984 and 1985 analyses. Two wells, MW-8 and MW-9, between the waste conveyance ditch and Eagle Draw, were also sampled for the same set of parameters. Additionally, samples were collected for analyses of general water chemistry and selected existing and new wells were also sampled for indicator parameters (i.e. phenols, BTX).

A copy of the analytical results is attached and if you need any additional information, please feed free to contact me at 748-3311 or Mr. Trent Thomas of Geoscience at 842-0001.

Sincerely,

David G. Griffin
Superintendent of Environmental
Affairs and Quality Control

DGGr/sg

Enclosures

cc: HLS, David Boyer-NMOCD

SAMPLE DESCRIPTION INFORMATION

for

Geoscience Consultants, Ltd.

RMA Sample No.	Sample Description	Sample Type	Date Sampled	Date Received
61882-01	MW-8	Water	08/06/86	08/12/86
61882-02	MW-9	Water	08/06/86	08/12/86
61882-03	MW-2	Water	08/06/86	08/12/86
61882-04	MW-6	Water	08/07/86	08/12/86
61882-05	MW-3	Water	08/07/86	08/12/86
61882-06	Equip Blank	Water	08/07/86	08/12/86
61882-07	Field Blank	Water	08/07/86	08/12/86
61882-08	MW-7	Water	08/07/86	08/12/86
61882-09	MW-5	Water	08/07/86	08/12/86
61882-10	MW-1	Water	08/07/86	08/12/86
61882-11	MW-4	Water	08/07/86	08/12/86
61882-12	#13	Water	08/07/86	08/12/86
61882-13	Well Pt #2	Water	08/07/86	08/12/86

September 19, 1986

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

INORGANIC PARAMETERS

Parameter	Units	MW-8 61882-01		MW-9 61882-02		MW-2 61882-03		MW-6 61882-04	
Total Dissolved Solids	mg/L	7420	(10)	NR	-	21600	(10)	10100	(10)
Fluoride	mg/L	2.0	(0.1)	NR	-	NR	-	5.5	(0.1)
Chloride	mg/L	904	(3)	NR	-	NR	-	3080	(3)
Nitrate + Nitrite as N	mg/L	1.7	(0.1)	NR	-	NR	-	2.1	(0.1)
Sulfate	mg/L	3430	(5)	NR	-	NR	-	3000	(5)
Dissolved Sulfide	mg/L	ND	(0.05)	ND	(0.05)	NR	-	ND	(0.05)
Carb. Alk. as CaCO3 at pH 8.3	mg/L	ND	(5)	NR	-	NR	-	ND	(5)
Bicarb. Alk as CaCO3 at pH 4.5	mg/L	384	(5)	NR	-	NR	-	483	(5)
Total Kjeldahl Nitrogen as N	mg/L	0.9	(0.1)	NR	-	NR	-	5.2	(0.1)

Parameter	Units	MW-3 61882-05		MW-7 61882-08		MW-5 61882-09		MW-1 61882-10	
Total Dissolved Solids	mg/L	8080	(10)	10500	(10)	27300	(10)	14900	(10)
Fluoride	mg/L	2.9	(0.1)	NR	-	NR	-	1.0	(0.1)
Chloride	mg/L	1210	(3)	NR	-	NR	-	4250	(3)
Nitrate + Nitrite as N	mg/L	ND	(0.1)	NR	-	NR	-	ND	(0.1)
Sulfate	mg/L	2760	(5)	NR	-	NR	-	3080	(5)
Dissolved Sulfide	mg/L	ND	(0.05)	NR	-	NR	-	0.07	(0.05)
Carb. Alk. as CaCO3 at pH 8.3	mg/L	ND	(5)	NR	-	NR	-	ND	(5)
Bicarb. Alk as CaCO3 at pH 4.5	mg/L	1280	(5)	NR	-	NR	-	391	(5)
Total Kjeldahl Nitrogen as N	mg/L	0.3	(0.1)	NR	-	NR	-	2.6	(0.1)

ND = Not detected. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

INORGANIC PARAMETERS

Parameter	Units	MW-4 61882-11		#13 61882-12		Well PT #2 61882-13	
Total Dissolved Solids	mg/L	13000	(10)	1200	(10)	5100	(10)
Fluoride	mg/L	NR	-	2.1	(0.1)	NR	-
Chloride	mg/L	NR	-	202	(3)	NR	-
Nitrate + Nitrite as N	mg/L	NR	-	ND	(0.1)	NR	-
Sulfate	mg/L	NR	-	257	(5)	NR	-
Dissolved Sulfide	mg/L	NR	-	0.29	(0.05)	NR	-
Carb. Alk. as CaCO3 at pH 8.3	mg/L	NR	-	ND	(5)	NR	-
Bicarb. Alk as CaCO3 at pH 4.5	mg/L	NR	-	184	(5)	NR	-
Total Kjeldahl Nitrogen as N	mg/L	NR	-	7.2	(0.1)	NR	-

ND = Not detected. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PRIORITY POLLUTANT METALS

Parameter	Units	MW-8 61882-01		MW-9 61882-02		MW-6 61882-04		MW-3 61882-05	
Antimony	mg/L	0.006	(0.002)	ND	(0.002)	0.007	(0.002)	0.003	(0.002)
Arsenic	mg/L	0.012	(0.002)	0.020	(0.002)	0.092	(0.002)	0.084	(0.002)
Barium	mg/L	0.049	(0.01)	0.020	(0.01)	0.040	(0.01)	0.22	(0.01)
Beryllium	mg/L	ND	(0.002)	ND	(0.002)	ND	(0.002)	ND	(0.002)
Cadmium	mg/L	ND	(0.008)	ND	(0.008)	ND	(0.008)	ND	(0.008)
Chromium	mg/L	ND	(0.01)	ND	(0.01)	0.019	(0.01)	0.02	(0.01)
Cobalt	mg/L	0.018	(0.06)	0.012	(0.06)	ND	(0.06)	0.007	(0.06)
Copper	mg/L	ND	(0.03)	ND	(0.03)	ND	(0.03)	ND	(0.03)
Lead	mg/L	ND	(0.04)	ND	(0.04)	ND	(0.04)	ND	(0.04)
Mercury	mg/L	ND	(0.0001)	ND	(0.0001)	ND	(0.0001)	ND	(0.0001)
Nickel	mg/L	0.039	(0.02)	0.048	(0.02)	ND	(0.02)	0.02	(0.02)
Selenium	mg/L	ND	(0.04)	ND	(0.04)	ND	(0.04)	ND	(0.04)
Silver	mg/L	ND	(0.006)	ND	(0.006)	ND	(0.006)	ND	(0.006)
Thallium	mg/L	ND	(0.04)	ND	(0.04)	ND	(0.04)	ND	(0.04)
Vanadium	mg/L	0.053	(0.004)	0.048	(0.004)	0.005	(0.004)	0.014	(0.004)
Zinc	mg/L	ND	(0.02)	ND	(0.02)	ND	(0.02)	ND	(0.02)

DISSOLVED MAJOR CATIONS

Parameter	Units	MW-8 61882-01		MW-9 61882-02		MW-6 61882-04		MW-3 61882-05	
Calcium	mg/L	635	(0.2)	NR	-	986	(0.2)	703	(0.2)
Iron	mg/L	1.7	(0.1)	NR	-	19	(0.1)	7.5	(0.1)
Magnesium	mg/L	451	(0.2)	NR	-	248	(0.2)	296	(0.2)
Potassium	mg/L	2.6	(0.6)	NR	-	9.0	(0.6)	7.2	(0.6)
Sodium	mg/L	637	(1)	NR	-	1990	(1)	1220	(1)

ND = Not detected. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PRIORITY POLLUTANT METALS

Parameter	Units	MW-1 61882-10		#13 61882-12	
Arsenic	mg/L	ND	(0.002)	0.064	(0.002)
Antimony	mg/L	0.004	(0.002)	0.006	(0.002)
Barium	mg/L	0.030	(0.025)	0.22	(0.05)
Beryllium	mg/L	ND	(0.005)	ND	(0.001)
Cadmium	mg/L	ND	(0.02)	ND	(0.004)
Chromium	mg/L	ND	(0.025)	0.007	(0.005)
Cobalt	mg/L	ND	(0.015)	ND	(0.003)
Copper	mg/L	ND	(0.03)	ND	(0.03)
Lead	mg/L	ND	(0.1)	ND	(0.02)
Mercury	mg/L	ND	(0.0001)	ND	(0.0001)
Nickel	mg/L	0.10	(0.05)	ND	(0.01)
Selenium	mg/L	ND	(0.04)	ND	(0.004)
Silver	mg/L	ND	(0.015)	ND	(0.003)
Thallium	mg/L	ND	(0.04)	ND	(0.004)
Vanadium	mg/L	ND	(0.01)	0.011	(0.002
Zinc	mg/L	ND	(0.02)	ND	(0.02)

DISSOLVED MAJOR CATIONS

Parameter	Units	MW-1 61882-10		#13 61882-12	
Calcium	mg/L	900	(0.2)	143	(0.1)
Iron	mg/L	1.3	(0.1)	2.7	(0.05)
Magnesium	mg/L	601	(0.2)	27	(0.1)
Potassium	mg/L	9.1	(0.6)	9.3	(0.3)
Sodium	mg/L	2020	(1)	150	(0.5)

ND = Not detected. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PRIORITY POLLUTANT BASE/NEUTRAL ORGANICS

Parameter	Units	MW-8 61882-01		MW-9 61882-02		MW-2 61882-03		MW-6 61882-04	
Acenaphthene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Acenaphthylene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Anthracene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Benzidine	ug/L	BDL	(20)	BDL	(20)	NR	-	BDL	(20)
Benzo(a)anthracene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Benzo(a)pyrene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
3,4-Benzofluoranthene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Benzo(g,h,i)perylene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Benzo(k)fluoranthene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Bis(2-chloroethoxy)methane	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Bis(2-chloroethyl)ether	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Bis(2-chloroisopropyl)ether	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Bis(2-ethylhexyl)phthalate	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
4-Bromophenyl phenyl ether	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Butylbenzyl phthalate	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
2-Chloronaphthalene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
4-Chlorophenyl phenyl ether	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Chrysene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Dibenzo(a,h)anthracene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Dibenzofuran	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
2-Methylnaphthalene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
1,2-Dichlorobenzene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
1,3-Dichlorobenzene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
1,4-Dichlorobenzene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
3,3'-Dichlorobenzidine	ug/L	BDL	(20)	BDL	(20)	NR	-	BDL	(20)
Diethyl phthalate	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Dimethyl phthalate	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Di-n-butyl phthalate	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
2,4-Dinitrotoluene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
2,6-Dinitrotoluene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)

BDL = Below detection limits. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PRIORTIY POLLUTANT BASE/NEUTRAL ORGANICS (Cont.)

Parameter	Units	MW-8 61882-01		MW-9 61882-02		MW-2 61882-03		MW-6 61882-04	
Di-n-octyl phthalate	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
1,2-Diphenylhydrazine*	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Fluoranthene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Fluorene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Hexachlorobenzene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Hexachlorobutadiene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Hexachlorocyclopentadiene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Hexachloroethane	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Indeno(1,2,3-cd)pyrene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Isophorone	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Naphthalene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Nitrobenzene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
N-Nitrosodimethylamine	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
N-Nitrosodi-n-propylamine	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
N-Nitrosodiphenylamine*	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Phenanthrene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Pyrene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
1,2,4-Trichlorobenzene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)

BDL = Below detection limits. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PRIORITY POLLUTANT ACID ORGANICS

Parameter	Units	mw-8 61882-01		mw-9 61882-02		mw-2 61882-03		mw-6 61882-04	
2-Chlorophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)
2,4-Dichlorophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)
2,4-Dimethylphenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)
4,6-Dinitro-o-cresol	ug/L	BDL	(10)	BDL	(10)	BDL	(5)	BDL	(5)
2,4-Dinitrophenol	ug/L	BDL	(10)	BDL	(10)	BDL	(10)	BDL	(10)
2-Methylphenol	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
4-Methylphenol	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
2-Nitrophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)
4-Nitrophenol	ug/L	BDL	(10)	BDL	(10)	BDL	(10)	BDL	(10)
p-Chloro-m-cresol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)
Pentachlorophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)
Phenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)
2,4,6-Trichlorophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)

BDL = Below detection limits. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PRIORITY POLLUTANT VOLATILE ORGANICS

Parameter	Units	MW-8 61882-01		MW-9 61882-02		MW-2 61882-03		MW-6 61882-04	
Acetone	ug/L	BDL	(10)	BDL	(10)	NR	-	74	(10)
Acrolein	ug/L	BDL	(100)	BDL	(100)	NR	-	BDL	(100)
Acrylonitrile	ug/L	BDL	(100)	BDL	(100)	NR	-	BDL	(100)
Benzene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Bromoform	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Carbon tetrachloride	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Chlorobenzene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Chlorodibromomethane	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Chloroethane	ug/L	BDL	(10)	BDL	(10)	NR	-	BDL	(10)
2-Chloroethylvinyl ether	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Chloroform	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Dichlorobromomethane	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
1,1-Dichloroethane	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
1,2-Dichloroethane	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
1,1-Dichloroethylene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
1,2-Dichloropropane	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
1,3-Dichloropropylene (c&t)	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Ethylbenzene	ug/L	BDL	(5)	BDL	(5)	NR	-	12	(5)
Methylbromide	ug/L	BDL	(10)	BDL	(10)	NR	-	BDL	(10)
Methylchloride	ug/L	BDL	(10)	BDL	(10)	NR	-	BDL	(10)
Methylene chloride	ug/L	BDL	(10)	BDL	(10)	NR	-	BDL	(10)
1,1,2,2-Tetrachloroethane	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Tetrachloroethylene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Toluene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
1,2-trans-Dichloroethylene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
1,1,1-Trichloroethane	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
1,1,2-Trichloroethane	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Trichloroethylene	ug/L	BDL	(5)	BDL	(5)	NR	-	BDL	(5)
Vinyl chloride	ug/L	BDL	(10)	BDL	(10)	NR	-	BDL	(10)

Ethylben.

BDL = Below detection limits. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PRIORITY POLLUTANT BASE/NEUTRAL ORGANICS

Parameter	Units	MW-3 61882-05		MW-7 61882-08		MW-5 61882-09		MW-1 61882-10	
Acenaphthene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Acenaphthylene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Anthracene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Benzidine	ug/L	BDL	(20)	NR	-	NR	-	BDL	(20)
Benzo(a)anthracene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Benzo(a)pyrene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
3,4-Benzofluoranthene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Benzo(g,h,i)perylene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Benzo(k)fluoranthene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Bis(2-chloroethoxy)methane	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Bis(2-chloroethyl)ether	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Bis(2-chloroisopropyl)ether	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Bis(2-ethylhexyl)phthalate	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
4-Bromophenyl phenyl ether	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Butylbenzyl phthalate	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
2-Chloronaphthalene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
4-Chlorophenyl phenyl ether	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Chrysene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Dibenzo(a,h)anthracene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Dibenzofuran	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
1,2-Dichlorobenzene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
1,3-Dichlorobenzene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
1,4-Dichlorobenzene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
3,3'-Dichlorobenzidine	ug/L	BDL	(20)	NR	-	NR	-	BDL	(20)
Diethyl phthalate	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Dimethyl phthalate	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Di-n-butyl phthalate	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
2,4-Dinitrotoluene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
2,6-Dinitrotoluene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)

BDL = Below detection limits. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PRIORITY POLLUTANT BASE/NEUTRAL ORGANICS (Cont.)

Parameter	Units	MW-3 61882-05		MW-7 61882-08		MW-5 61882-09		MW-1 61882-10	
Di-n-octyl phthalate	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
1,2-Diphenylhydrazine*	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Fluoranthene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Fluorene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Hexachlorobenzene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Hexachlorobutadiene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Hexachlorocyclopentadiene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Hexachloroethane	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Indeno(1,2,3-cd)pyrene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Isophorone	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
2-Methylnaphthalene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Naphthalene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Nitrobenzene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
N-Nitrosodimethylamine	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
N-Nitrosodi-n-propylamine	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
N-Nitrosodiphenylamine*	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Phenanthrene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Pyrene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
1,2,4-Trichlorobenzene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)

BDL = Below detection limits. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PRIORITY POLLUTANT ACID ORGANICS

Parameter	Units	mw-3 61882-05		mw-7 61882-08		mw-5 61882-09		mw-1 61882-10	
2-Chlorophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)
2,4-Dichlorophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)
2,4-Dimethylphenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)
4,6-Dinitro-o-cresol	ug/L	BDL	(10)	BDL	(10)	BDL	(10)	BDL	(10)
2,4-Dinitrophenol	ug/L	BDL	(10)	BDL	(10)	BDL	(10)	BDL	(10)
2-Methylphenol	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
4-Methylphenol	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
2-Nitrophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)
4-Nitrophenol	ug/L	BDL	(10)	BDL	(10)	BDL	(10)	BDL	(10)
p-Chloro-m-cresol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)
Pentachlorophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)
Phenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)
2,4,6-Trichlorophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)	BDL	(5)

BDL = Below detection limits. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PRIORITY POLLUTANT VOLATILE ORGANICS

Parameter	Units	mw-3 61882-05		mw-7 61882-08		mw-5 61882-09		mw-1 61882-10	
Acetone	ug/L	BDL	(10)	NR	-	NR	-	BDL	(10)
Acrolein	ug/L	BDL	(100)	NR	-	NR	-	BDL	(100)
Acrylonitrile	ug/L	BDL	(100)	NR	-	NR	-	BDL	(100)
Benzene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Bromoform	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Carbon tetrachloride	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Chlorobenzene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Chlorodibromomethane	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Chloroethane	ug/L	BDL	(10)	NR	-	NR	-	BDL	(10)
2-Chloroethylvinyl ether	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Chloroform	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Dichlorobromomethane	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
1,1-Dichloroethane	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
1,2-Dichloroethane	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
1,1-Dichloroethylene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
1,2-Dichloropropane	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
1,3-Dichloropropylene (c&t)	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Ethylbenzene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Methylbromide	ug/L	BDL	(10)	NR	-	NR	-	BDL	(10)
Methylchloride	ug/L	BDL	(10)	NR	-	NR	-	BDL	(10)
Methylene chloride	ug/L	BDL	(10)	NR	-	NR	-	BDL	(10)
1,1,2,2-Tetrachloroethane	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Tetrachloroethylene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Toluene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
1,2-trans-Dichloroethylene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
1,1,1-Trichloroethane	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
1,1,2-Trichloroethane	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Trichloroethylene	ug/L	BDL	(5)	NR	-	NR	-	BDL	(5)
Vinyl chloride	ug/L	BDL	(10)	NR	-	NR	-	BDL	(10)

BDL = Below detection limits. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PRIORITY POLLUTANT BASE/NEUTRAL ORGANICS

Parameter	Units	MW-4 61882-11		#13 61882-12	
Acenaphthene	ug/L	NR	-	BDL	(5)
Acenaphthylene	ug/L	NR	-	BDL	(5)
Anthracene	ug/L	NR	-	BDL	(5)
Benzidine	ug/L	NR	-	BDL	(20)
Benzo(a)anthracene	ug/L	NR	-	BDL	(5)
Benzo(a)pyrene	ug/L	NR	-	BDL	(5)
3,4-Benzofluoranthene	ug/L	NR	-	BDL	(5)
Benzo(g,h,i)perylene	ug/L	NR	-	BDL	(5)
Benzo(k)fluoranthene	ug/L	NR	-	BDL	(5)
Bis(2-chloroethoxy)methane	ug/L	NR	-	BDL	(5)
Bis(2-chloroethyl)ether	ug/L	NR	-	BDL	(5)
Bis(2-chloroisopropyl)ether	ug/L	NR	-	BDL	(5)
Bis(2-ethylhexyl)phthalate	ug/L	NR	-	BDL	(5)
4-Bromophenyl phenyl ether	ug/L	NR	-	BDL	(5)
Butylbenzyl phthalate	ug/L	NR	-	BDL	(5)
2-Chloronaphthalene	ug/L	NR	-	BDL	(5)
4-Chlorophenyl phenyl ether	ug/L	NR	-	BDL	(5)
Chrysene	ug/L	NR	-	BDL	(5)
Dibenzo(a,h)anthracene	ug/L	NR	-	BDL	(5)
Dibenzofuran	ug/L	NR	-	BDL	(5)
1,2-Dichlorobenzene	ug/L	NR	-	BDL	(5)
1,3-Dichlorobenzene	ug/L	NR	-	BDL	(5)
1,4-Dichlorobenzene	ug/L	NR	-	BDL	(5)
3,3'-Dichlorobenzidine	ug/L	NR	-	BDL	(20)
Diethyl phthalate	ug/L	NR	-	BDL	(5)
Dimethyl phthalate	ug/L	NR	-	BDL	(5)
Di-n-butyl phthalate	ug/L	NR	-	BDL	(5)
2,4-Dinitrotoluene	ug/L	NR	-	BDL	(5)
2,6-Dinitrotoluene	ug/L	NR	-	BDL	(5)

BDL = Below detection limits. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PRIORITY POLLUTANT BASE/NEUTRAL ORGANICS (Cont.)

Parameter	Units		MW-4 61882-11		#13 61882-12	
Di-n-octyl phthalate	ug/L	NR	-	BDL	(5)	
1,2-Diphenylhydrazine*	ug/L	NR	-	BDL	(5)	
Fluoranthene	ug/L	NR	-	BDL	(5)	
Fluorene	ug/L	NR	-	BDL	(5)	
Hexachlorobenzene	ug/L	NR	-	BDL	(5)	
Hexachlorobutadiene	ug/L	NR	-	BDL	(5)	
Hexachlorocyclopentadiene	ug/L	NR	-	BDL	(5)	
Hexachloroethane	ug/L	NR	-	BDL	(5)	
Indeno(1,2,3-cd)pyrene	ug/L	NR	-	BDL	(5)	
Isophorone	ug/L	NR	-	BDL	(5)	
2-Methylnaphthalene	ug/L	NR	-	BDL	(5)	
Naphthalene	ug/L	NR	-	BDL	(5)	
Nitrobenzene	ug/L	NR	-	BDL	(5)	
N-Nitrosodimethylamine	ug/L	NR	-	BDL	(5)	
N-Nitrosodi-n-propylamine	ug/L	NR	-	BDL	(5)	
N-Nitrosodiphenylamine*	ug/L	NR	-	BDL	(5)	
Phenanthrene	ug/L	NR	-	BDL	(5)	
Pyrene	ug/L	NR	-	BDL	(5)	
1,2,4-Trichlorobenzene	ug/L	NR	-	BDL	(5)	

BDL = Below detection limits. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PRIORITY POLLUTANT ACID ORGANICS

Parameter	Units	MW-4 61882-11		#13 61882-12		Well PT #2 61882-13	
2-Chlorophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)
2,4-Dichlorophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)
2,4-Dimethylphenol	ug/L	BDL	(5)	19	(5)	BDL	(5)
4,6-Dinitro-o-cresol	ug/L	BDL	(10)	BDL	(10)	BDL	(10)
2,4-Dinitrophenol	ug/L	BDL	(10)	BDL	(10)	BDL	(10)
2-Methylphenol	ug/L	NR	-	BDL	(5)	NR	-
4-Methylphenol	ug/L	NR	-	BDL	(5)	NR	-
2-Nitrophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)
4-Nitrophenol	ug/L	BDL	(10)	BDL	(10)	BDL	(10)
p-Chloro-m-cresol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)
Pentachlorophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)
Phenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)
2,4,6-Trichlorophenol	ug/L	BDL	(5)	BDL	(5)	BDL	(5)

BDL = Below detection limits. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PRIORITY POLLUTANT VOLATILE ORGANICS

Parameter	Units	MW-4 61882-11		#13 61882-12	
Acetone	ug/L	NR	-	BDL	(10)
Acrolein	ug/L	NR	-	BDL	(100)
Acrylonitrile	ug/L	NR	-	BDL	(100)
Benzene	ug/L	NR	-	BDL	(5)
Bromoform	ug/L	NR	-	BDL	(5)
Carbon tetrachloride	ug/L	NR	-	BDL	(5)
Chlorobenzene	ug/L	NR	-	BDL	(5)
Chlorodibromomethane	ug/L	NR	-	BDL	(5)
Chloroethane	ug/L	NR	-	BDL	(10)
2-Chloroethylvinyl ether	ug/L	NR	-	BDL	(5)
Chloroform	ug/L	NR	-	BDL	(5)
Dichlorobromomethane	ug/L	NR	-	BDL	(5)
1,1-Dichloroethane	ug/L	NR	-	BDL	(5)
1,2-Dichloroethane	ug/L	NR	-	BDL	(5)
1,1-Dichloroethylene	ug/L	NR	-	BDL	(5)
1,2-Dichloropropane	ug/L	NR	-	BDL	(5)
1,3-Dichloropropylene (c&t)	ug/L	NR	-	BDL	(5)
Ethylbenzene	ug/L	NR	-	5	(5)
Methylbromide	ug/L	NR	-	BDL	(10)
Methylchloride	ug/L	NR	-	BDL	(10)
Methylene chloride	ug/L	NR	-	BDL	(10)
,1,2,2-Tetrachloroethane	ug/L	NR	-	BDL	(5)
Tetrachloroethylene	ug/L	NR	-	BDL	(5)
Toluene	ug/L	NR	-	BDL	(5)
,2-trans-Dichloroethylene	ug/L	NR	-	BDL	(5)
,1,1-Trichloroethane	ug/L	NR	-	BDL	(5)
,1,2-Trichloroethane	ug/L	NR	-	BDL	(5)
Trichloroethylene	ug/L	NR	-	BDL	(5)
Vinyl chloride	ug/L	NR	-	BDL	(10)

BDL = Below detection limits. NR = Not requested. Detection limits in parentheses.

ANALYTICAL RESULTS

for

Geoscience Consultants, Ltd.

PURGEABLE ORGANICS - METHOD 602

Parameter	Units	MW-2 61882-03		Blank 61882-06		Blank 61882-07		MW-7 61882-08	
Benzene	ug/L	ND	(0.5)	ND	(0.5)	ND	(0.5)	ND	(0.5)
Chlorobenzene	ug/L	ND	(1)	ND	(1)	ND	(1)	ND	(1)
Ethylbenzene	ug/L	ND	(1)	ND	(1)	ND	(1)	ND	(1)
Toluene	ug/L	6.4	(1)	ND	(1)	ND	(1)	7.2	(1)
1,2-Dichlorobenzene	ug/L	ND	(2)	ND	(2)	ND	(2)	ND	(2)
1,3-Dichlorobenzene	ug/L	ND	(2)	ND	(2)	ND	(2)	ND	(2)
1,4-Dichlorobenzene	ug/L	ND	(2)	ND	(2)	ND	(2)	ND	(2)

Parameter	Units	MW-5 61882-09		MW-4 61882-11		well pt #2 61882-13	
Benzene	ug/L	ND	(5)	ND	(5)	ND	(5)
Chlorobenzene	ug/L	ND	(10)	ND	(10)	ND	(10)
Ethylbenzene	ug/L	ND	(10)	39	(10)	ND	(10)
Toluene	ug/L	58	(10)	140	(10)	70	(10)
1,2-Dichlorobenzene	ug/L	ND	(20)	ND	(20)	ND	(20)
1,3-Dichlorobenzene	ug/L	ND	(20)	ND	(20)	ND	(20)
1,4-Dichlorobenzene	ug/L	ND	(20)	ND	(20)	ND	(20)

ND = Not detected. Detection limits in parentheses.

ION BALANCE RESULTS
for sample #61882-01

MW-8

CATION ANALYSIS

ELEMENT	mg/L	meq/L
Ca	635.000	31.6865
Fe+2	1.700	0.0153
Fe+3	ND	0.0000
Mg	451.000	37.1173
K	2.600	0.0666
Na	637.000	27.7095
NH4	ND	0.0000
TOTAL	1727.300	96.5952

ANION ANALYSIS

ELEMENT	mg/L	meq/L
Cl	904.000	25.4928
F	2.000	0.0512
SO4	3430.000	71.3440
Alk	230.400	7.6800
NO2+NO3	1.700	0.1214
TOTAL	4568.100	104.6894

SUMMARY

% DIFFERENCE =-4.021
CATIONS + ANIONS (mg/L) =6295.400
TDS =%7420.000
HARDNESS =3436.600
CALCULATED THEORETICAL CONDUCTIVITY =%13244.0527
MEASURED CONDUCTIVITY = 1.0000
THEORETICAL/MEASURED CONDUCTIVITY RATIO =%13244.053
MEASURED CONDUCTIVITY/TDS RATIO = 0.000

ND - Not Detected

ION BALANCE RESULTS
for sample #61882-04

MW-6

CATION ANALYSIS

ELEMENT	mg/L	meq/L
Ca	986.000	49.2014
Fe+2	19.000	0.1710
Fe+3	ND	0.0000
Mg	248.000	20.4104
K	9.000	0.2304
Na	1990.000	86.5650
NH4	ND	0.0000
TOTAL	3252.000	156.5782

ANION ANALYSIS

ELEMENT	mg/L	meq/L
Cl	3080.000	86.8560
F	5.500	0.1408
SO4	3000.000	62.4000
Alk	289.800	9.6600
NO2+NO3	2.100	0.1499
TOTAL	6377.400	159.2067

SUMMARY

% DIFFERENCE =-0.832
CATIONS + ANIONS (mg/L) =9629.400
TDS =%10100.000
HARDNESS =3481.800
CALCULATED THEORETICAL CONDUCTIVITY =%20425.8847
MEASURED CONDUCTIVITY = 1.0000
THEORETICAL/MEASURED CONDUCTIVITY RATIO =%20425.885
MEASURED CONDUCTIVITY/TDS RATIO = 0.000

ND - Not Detected

ION BALANCE RESULTS
for sample #61882-05

MW-3

CATION ANALYSIS

ELEMENT	mg/L	meq/L
Ca	703.000	35.0797
Fe+2	7.500	0.0675
Fe+3	ND	0.0000
Mg	296.000	24.3608
K	7.200	0.1843
Na	1220.000	53.0700
NH4	ND	0.0000
TOTAL	2233.700	112.7623

ANION ANALYSIS

ELEMENT	mg/L	meq/L
Cl	1210.000	34.1220
F	2.900	0.0742
SO4	2760.000	57.4080
Alk	768.000	25.6000
NO2+NO3	ND	0.0000
TOTAL	4740.900	117.2042

SUMMARY

% DIFFERENCE =-1.932
CATIONS + ANIONS (mg/L) =6974.600
TDS =%8080.000
HARDNESS =2971.100
CALCULATED THEORETICAL CONDUCTIVITY =%14385.3307
MEASURED CONDUCTIVITY = 1.0000
THEORETICAL/MEASURED CONDUCTIVITY RATIO =%14385.331
MEASURED CONDUCTIVITY/TDS RATIO = 0.000

ND - Not Detected

ION BALANCE RESULTS
for sample #61882-10

MW-1

CATION ANALYSIS

ELEMENT	mg/L	meq/L
Ca	900.000	44.9100
Fe+2	1.300	0.0117
Fe+3	ND	0.0000
Mg	601.000	49.4623
K	9.100	0.2330
Na	2020.000	87.8700
NH4	ND	0.0000
TOTAL	3531.400	182.4870

ANION ANALYSIS

ELEMENT	mg/L	meq/L
Cl	4250.000	119.8500
F	1.000	0.0256
SO4	3080.000	64.0640
Alk	234.600	7.8200
NO2+NO3	ND	0.0000
TOTAL	7565.600	191.7596

SUMMARY

% DIFFERENCE =-2.478
CATIONS + ANIONS (mg/L) =%11097.000
TDS =%14900.000
HARDNESS =4714.100
CALCULATED THEORETICAL CONDUCTIVITY =%24321.3227
MEASURED CONDUCTIVITY = 1.0000
THEORETICAL/MEASURED CONDUCTIVITY RATIO =%24321.323
MEASURED CONDUCTIVITY/TDS RATIO = 0.000

ND - Not Detected

ION BALANCE RESULTS
for sample #61882-12
#13

CATION ANALYSIS

ELEMENT	mg/L	meq/L
Ca	143.000	7.1357
Fe+2	2.700	0.0243
Fe+3	ND	0.0000
Mg	27.000	2.2221
K	9.300	0.2381
Na	150.000	6.5250
NH4	ND	0.0000
TOTAL	332.000	16.1452

ANION ANALYSIS

ELEMENT	mg/L	meq/L
Cl	202.000	5.6964
F	2.100	0.0538
SO4	257.000	5.3456
Alk	110.400	3.6800
NO2+NO3	ND	0.0000
TOTAL	571.500	14.7758

SUMMARY

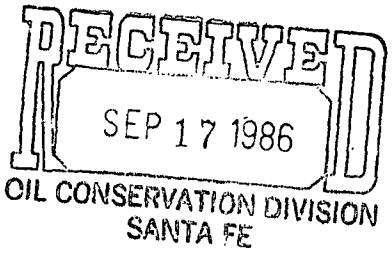
% DIFFERENCE = 4.429
CATIONS + ANIONS (mg/L) = 903.500
TDS =%1200.000
HARDNESS = 468.200
CALCULATED THEORETICAL CONDUCTIVITY =1918.0087
MEASURED CONDUCTIVITY = 1.0000
THEORETICAL/MEASURED CONDUCTIVITY RATIO =%1918.009
MEASURED CONDUCTIVITY/TDS RATIO = 0.001

ND - Not Detected

TELEPHONE
(505) 748-3311

EASYLINK
62905278

REFINING COMPANY
501 EAST MAIN STREET • P. O. DRAWER 159
ARTESIA, NEW MEXICO 88210



September 15, 1986

Ms. Alice Barr
Hazardous Waste Section
NMIED
P. O. Box 968
Santa Fe, NM 87504-0968

RE: Activities During
August, 1986

Dear Ms. Barr:

This monthly letter report is to keep you advised of activities that have occurred at Navajo Refining Company's Artesia refinery during August, 1986. On August 6-7, 1986, Navajo Refining Company completed its first ground water sampling event. As suggested in communications between you and GCL, analysis were conducted for volatiles and semi-volatile constituents by EPA Methods 8240 and 8250, priority pollutant metals and several additional constituents identified by U.S. EPA and Navajo Refining Company in previous waste analyses.

Samples for comprehensive analyses were collected from three down-gradient wells (MW-6, MW-3, #13) and one up-gradient well (MW-1) in the vicinity of Pond #1 and from MW-8 and MW-9 between Eagle Draw and the waste conveyance ditch.

All wells were evacuated and sampled using bottom filling stainless steel bailers. Samples collected for heavy metals analyses were not filtered and were immediately acidified in the field.

The analytical results should be available sometime during the week of September 15-19, 1986 and copies will be forewarded to you as soon as they have been received and reviewed. Once Navajo has reviewed the initial analyses, a list of detected constituents will be compiled to be used in subsequent ground water analyses. The second ground water sampling event will be commenced as soon as feasibly possible after receipt and review of the initial results.

If I can provide any additional information, please feel free to contact me at (505) 748-3311, or Mr. Trent Thomas at (505) 842-0001.

Sincerely,

David G. Griffin
Superintendent of Environmental Affairs & Quality Control

DGG/pb

xc's: Dave Boyer, NMOCD
Henry Stern

TELEPHONE
(505) 748-3311

EASYLINK
62905278

REFINING COMPANY
501 EAST MAIN STREET • P. O. DRAWER 159
ARTESIA, NEW MEXICO 88210

August 15, 1986

Ms. Alice Barr
Hazardous Waste Section
NMEID
P.O. Box 968
Santa Fe, NM 87504-0968

RE: Activities During
July-August, 1986

Dear Ms. Barr:

This monthly letter report is to keep you advised of activities that have occurred at Navajo Refinery Company's Artesia refinery as of August 15, 1986. Two major milestones did occur during the time period July 15-August 15, 1986: development of all RCRA ground water monitoring wells and completion of the first ground water sampling event.

During the period July 16-19, 1986, Navajo completed development of the new ground water monitoring wells installed during June 1986. The following equipment was used for well development: 1 1/2" stainless steel air lift pump and a gas driven compressor. Pumping rates ranged from .5 to .8 gallons per minute depending on the degree of silt and the amount of water the well produced. Each well was pumped for approximately 2 hours. MW-1 was the only well that would not make sufficient water to continually pump for 2 hours. The pump and tubing bundles were steam cleaned after each well was pumped. Table 1 lists the well number and the amount of water removed during development.

During this same time period, a pump test was conducted on the newly installed PVC test well using a 4" submersible pump and a gasoline powered generator. Average pumping rate was 7 gallons/minute. Water level readings were recorded for the pump test well and 3 other wells located 31', 46.4' and 96.4' away from the pumped well. Water levels were taken at approximately 5 minute intervals for the first 15 minutes, at 10 minute intervals for the next 30 minutes, and 15 minute readings were taken for a half hour. The next 5 hours, water levels were measured every hour and the remaining readings were taken 4 hours apart. One well (#16) appears to be plugged as water levels were not consistent with the other wells. Our preliminary data analyses indicates a transmissivity of 6.101×10^3 g/d/ft. A more detailed analysis of the data is needed to provide additional information.

On August 6-7, 1986 the first ground water monitoring samples were collected from wells at the Navajo Refinery evaporation ponds and waste conveyance ditch. Three down-gradient wells (MW-6, MW-3 and #13) and one up-gradient well (MW-1) in the evaporation pond area were sampled for those Priority Pollutants previously analyzed for by EPA in their 1984 and 1985 analyses. Two wells, MW-8 and MW-9, between the waste conveyance ditch and Eagle Draw were also sampled for the same set of parameters. Results for the analyses should be available in approximately 3-4 weeks. Once the analyses have been reviewed, the decision will be made as to whether additional analyses should be conducted for the initial phase of ground water monitoring.

Enclosed, you will also find copies of the surveys recently conducted at Navajo's evaporation ponds and a portion of the waste conveyance ditch. These plates identify the surveyed locations of all new RCRA monitoring wells. Table 2 lists the water levels measured in a number of wells during the August sampling event. Clarification of certain reference elevations is being conducted so that a water table map can be constructed.

Navajo fully expects to proceed on schedule with its proposed assessment program as originally presented to NMEID and as may ultimately be issued in any CO/CS. We anticipate conducting the second ground water monitoring sampling series in September, pending review and evaluation of the first set of analytical results.

If I can provide any additional information, please feel free to contact me at (505) 748-3311 or Mr. Trent Thomas at (505) 842-0001.

Sincerely,

David G. Griffin
Supt. of Environmental
Affairs & Quality Control

DGG/ls/NAVAJO/GRIFF011.LTR

Enclosures

cc: Dave Boyer

TABLE 1
NAVAJO REFINERY WELL DEVELOPMENT

DATE	WELL	WATER QUANTITY	COMMENTS
7-18	MW-1	7 gallons	Pumped well dry allowed well to recover and pumped well dry allowed well to recover and pumped well dry.
7-18	MW-1	6 gallons	
7-19	MW-1	10 gallons	
7-18	MW-2	80 gallons	
7-16	MW-3	100 gallons	
7-18	MW-4	80 gallons	
7-19	MW-5	85 gallons	
7-17	MW-6	75 gallons	
7-19	MW-7	80 gallons	
7-17	MW-8	70 gallons	
7-17	MW-9	85 gallons	

TABLE 2
WATER TABLE ELEVATIONS AT
NAVAJO REFINERY
AUGUST 7, 1986

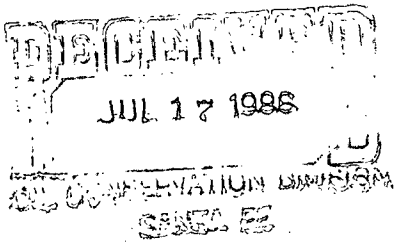
WELL #	H_2O TABLE ELEVATION
Boyer Test Well	3301.47'
MW-1	3301.41'
#3	3301.32'
#4	3301.47'
MW-2	3302.6'
#5	3302.38'
#6	Dry
#7	3304.4'
#10	3300.62'
#14	3300.97'
#17	3301.25'
MW-7	3299.85'
#12	3301.68'
#9	3301.71'
Well Point #1	3301.55'
MW-5	6.21'*
Well Point #2	3301.52'
MW-4	3299.9'
#13	6.81'*
#P-2	3300.2'
#P-3	3300.41'
MW-3	3300.46'
MW-6	3299.77'

*Depth to Water from Top of Casing

TELEPHONE
(505) 748-3311

EASYLINK
62905278

REFINING COMPANY
501 EAST MAIN STREET • P. O. DRAWER 159
ARTESIA, NEW MEXICO 88210



July 15, 1986

Ms. Alice Barr
Hazardous Waste Section
NMEID
P.O. Box 968
Santa Fe, NM 87504-0968

RE: Activities During June 1986

Dear Ms. Barr:

This monthly letter report is to keep you advised of activities which have occurred at Navajo Refining Company's Artesia refinery as originally proposed in Navajo's submittal of May 21, 1986. Two major milestones did occur in June: collection of sludge samples from Pond 1 for a thorough waste characterization and the installation of a RCRA ground water monitoring network.

On June 4, 1986, three composite sludge samples were collected from various locations in Pond 1 and transmitted to Rocky Mountain Analytical Laboratories for analysis. Samples in the eastern 2/3 of the pond were collected using a row boat and driving stainless steel tubes into the sludge layer at eight random locations. Because of the sludge density and the difficulty of driving and retrieving the core tubes, core lengths ranged from approximately 6 to 14 inches. The western 1/3 of the pond proved too shallow to provide enough draft for the row boat to maneuver and wading into the pond to collect samples was not a safe alternative. Therefore, samples for compositing were collected at various locations along the pond perimeter. All samples were shipped to RMA for analysis of "Modified" Skinner List constituents plus additional organic and inorganic constituents that have been previously reported by EPA. Results of the analysis will be forwarded to NMEID in the next monthly report or as soon as they are received and reviewed.

During the period of June 16 - June 22, 1986 a series of 9 RCRA ground water monitoring wells were installed at locations originally proposed in Navajo's May 21, 1986 submittal. The re-survey of the ponds and the new addition has not been completed yet due to heavy rains. Once the survey has been finished, a site map with all well locations will be provided. The wells were drilled using an air rotary rig and completed using stainless steel screens and risers, sand filter packs and cement/ bentonite grout. Preliminary completion diagrams and well logs for each

well are enclosed. Because of the heavy rains that began June 22, 1986, development of the wells had to be postponed until access to the site was again possible. This situation was communicated to you by Mr. Trent Thomas on June 23, 1986 and in subsequent correspondence and oral communications. Heavy rains have continued to fall in the Artesia area over the period of June 30 to July 6, 1986 and vehicular access to the wells is still questionable. Development of the 9 wells will be completed as soon as conditions allow but is presently scheduled for July 17-21.

In addition to the RCRA wells, a 4 inch pump test well was also completed and will be used in conjunction with piezometers installed earlier in June to characterize the hydraulic properties of the shallow aquifer located in the area of the evaporation ponds.

As you can see, Navajo is proceeding as close as possible to the original schedule and we anticipate significant progress by the August 15, 1986 report date.

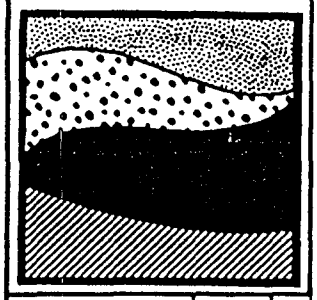
If I can provide any additional information, please feel free to contact me at (505) 748-2211 or Mr. Trent Thomas at (505) 842-0001.

Sincerely,

David G. Griffin
Supt. of Environmental
Affairs & Quality Control

Enclosure

GCL



WELL LOGGING FORM

Client NAVAJO REFINERY Well Number MW-1

__1/4__1/4__1/4__1/4 S 12 T 17S R 26E State NEW MEXICO

County EDDY Contractor LARRY'S DRILLING

Spud Date 6-18-86 Completion Date 6-18-86

Logs Run LITHOLOGY Logged By SELKE

Elevation _____ Spud In (Fm.) _____

Remarks Steam cleaned rig and tools prior to drilling- drill w/ air rotary and temp. casing

DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
0							0-20' v.fn.gr., brown silty clay
							v. tight formation- drilled borehole
							to 40'- 1hr. to recover
5							
10							
15							
20							
25							
30							
35							
40							
45							

Sand

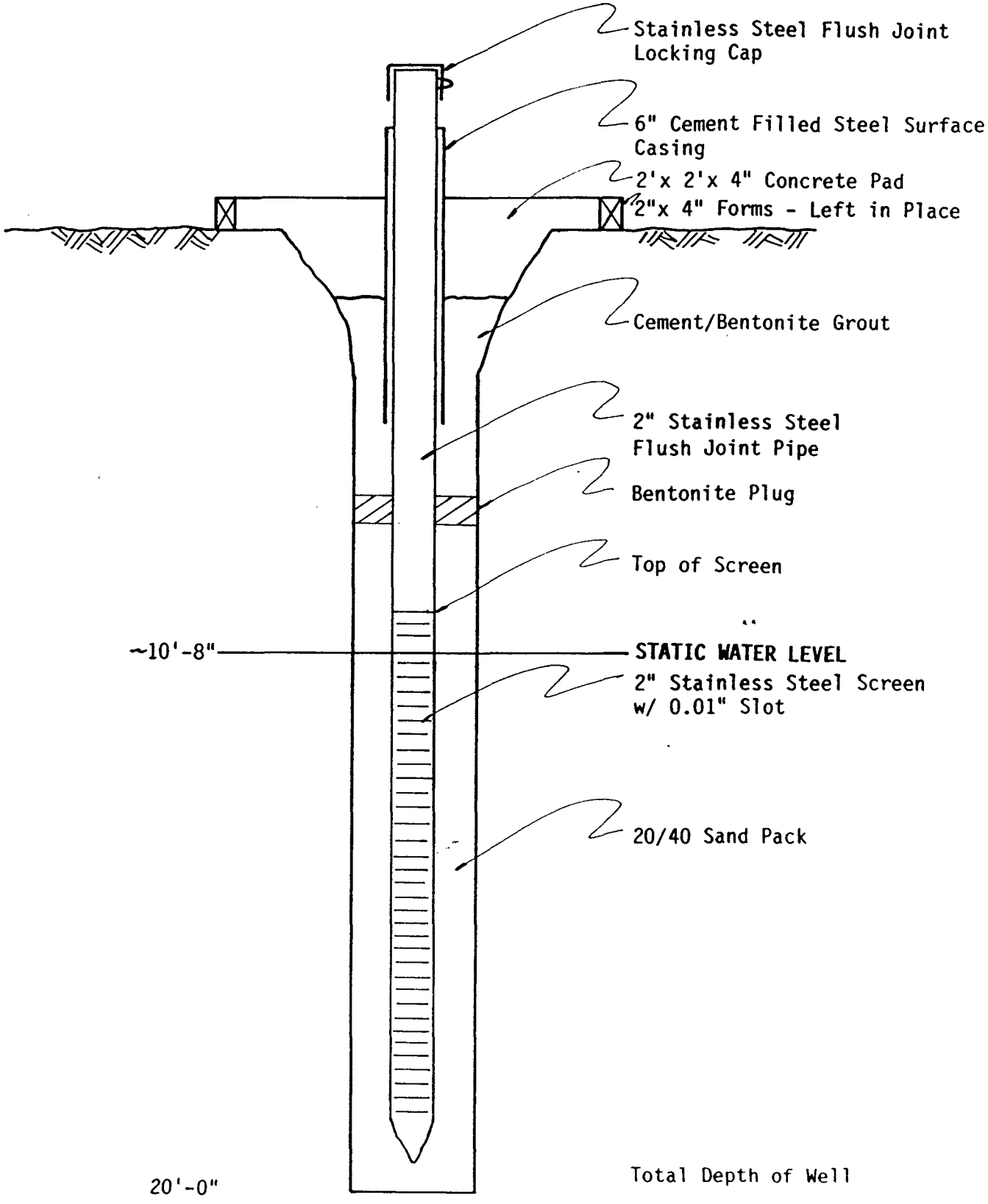
Silt

Clay

Silty Clay

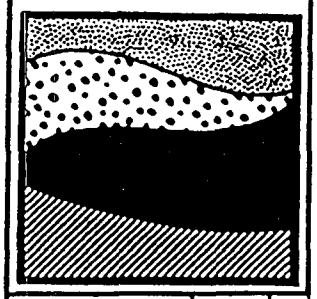
Clayey Silt

Gravel



WELL COMPLETION DIAGRAM
FOR MW-1

GCL



WELL LOGGING FORM

Client NAVAJO REFINERY Well Number MW- 2

1/4 1/4 1/4 1/4 S T R State NEW MEXICO

County EDDY Contractor LARRY'S DRILLING

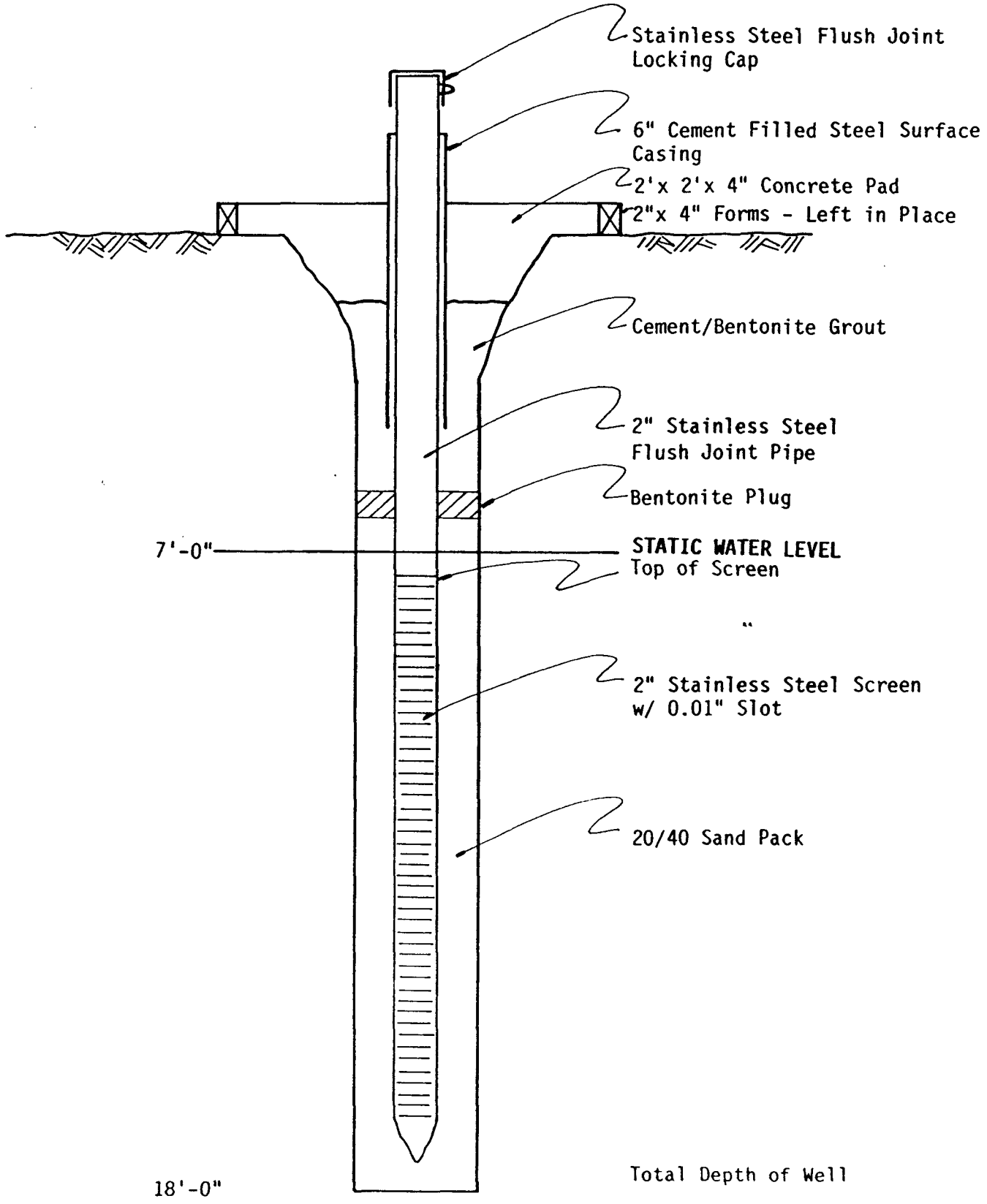
Spud Date 6-18-86 Completion Date 6-18-86

Logs Run LITHOLOGY Logged By SELKE

Elevation Spud In (Fm.)

Remarks Steam cleaned rig and tools prior to drilling- drilled with air rotary and temp. casing

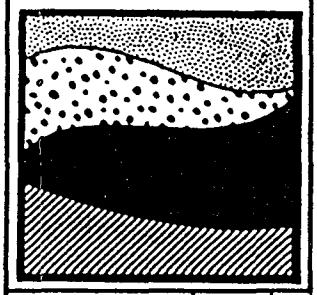
DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
0							0-18' very fine gr., brown, clayey silt and silty clay
Sand							
5							
Silt							
10							
Clay							
15							
Silty Clay							
20							
Clayey Silt							
25							
Gravel							
30							
35							
40							
45							



WELL COMPLETION DIAGRAM

FOR MW-2

GCL



WELL LOGGING FORM

Client NAVAJO REFINERY Well Number MW-3

__1/4 __1/4 __1/4 __1/4 S 12 T 17S R 26E State NEW MEXICO

County EDDY Contractor LARRY'S DRILLING

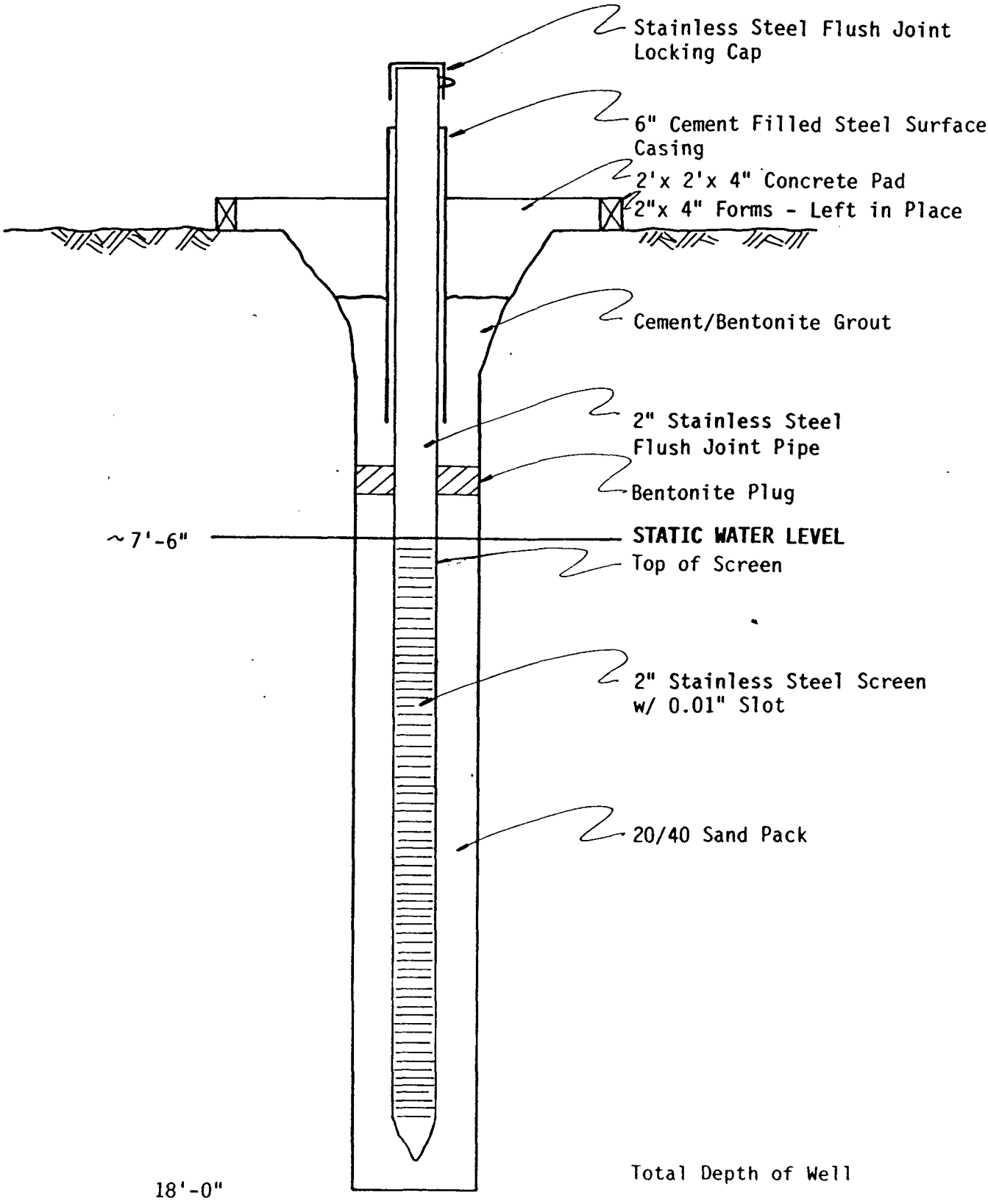
Spud Date 6-17-86 Completion Date 6-17-86

Logs Run LITHOLOGY Logged By SELKE

Elevation _____ Spud In (Fm.) _____

Remarks I/R TH-60 Drill Rig and all tools steam cleaned prior to drilling-drill w/ air rotary and temp. casing
2" stainless steel well casing-.010" slot 20/40 sand pack

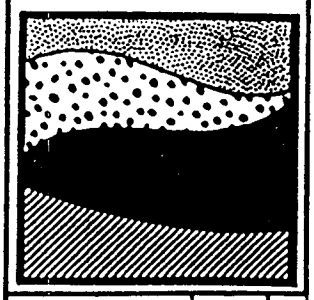
DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
0							
Sand							0-17' v.fn.gr.,clayey silt, brown
5							
Silt							
10							
Clay							
15							
Silty Clay							
20							
Clayey Silt							
25							
Gravel							
30							
35							
40							



WELL COMPLETION DIAGRAM

FOR MW-3

GCL



WELL LOGGING FO

Client NAVAJO REFINERY Well Number MW- 4

___1/4___1/4___1/4___1/4 S 12 T17S R26E State NEW MEXICO

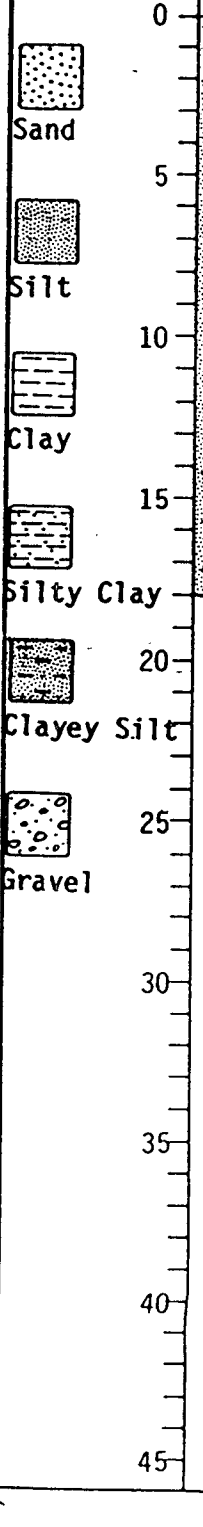
County EDDY Contractor LARRY'S DRILLING

Spud Date 6-17-86 Completion Date 6-17-86

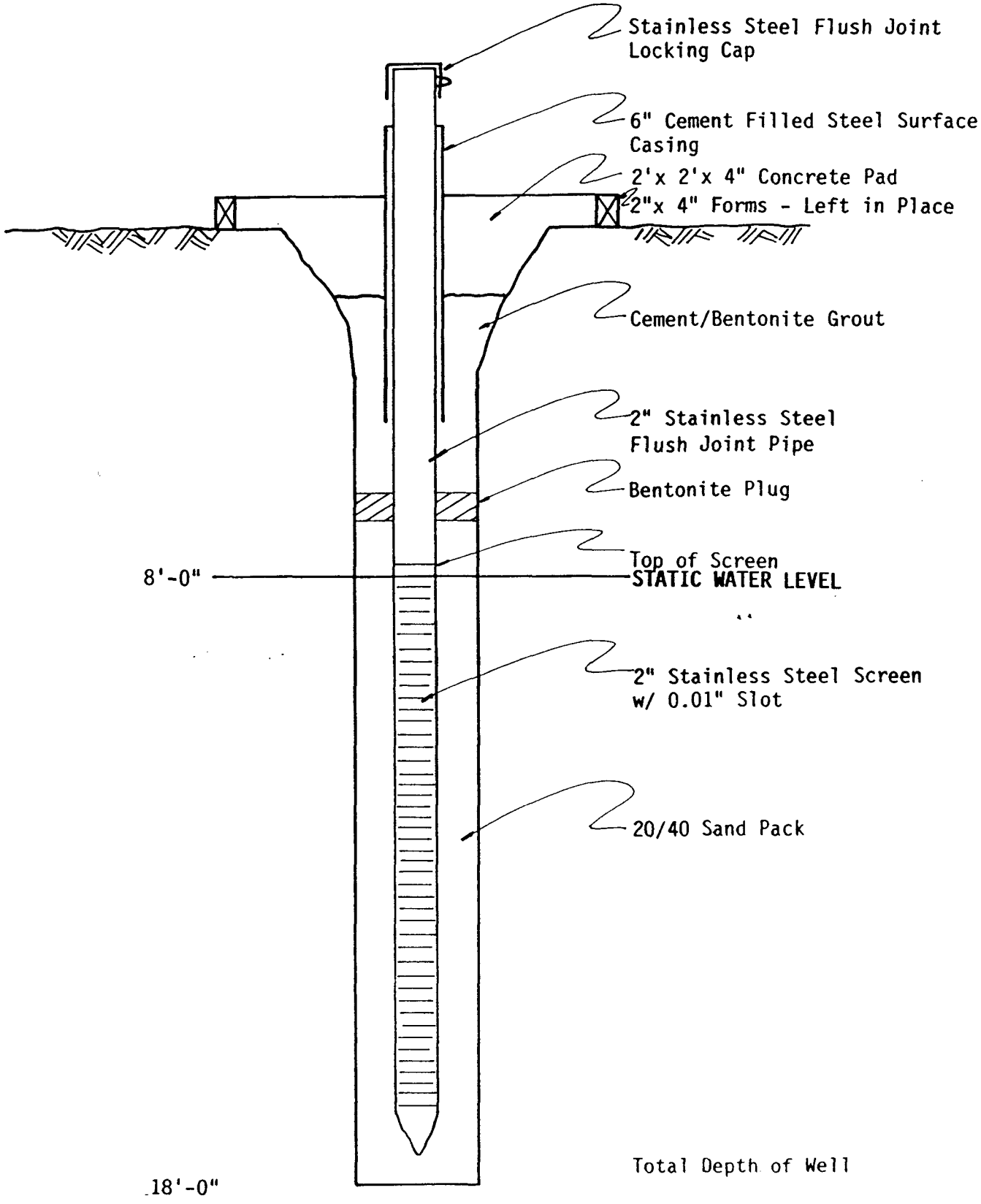
Logs Run LITHOLOGY Logged By SELKE

Elevation _____ Spud In (Fm.) _____

Remarks Steam cleaned rig and tools prior to setting up drill with air rotary and temp. casing



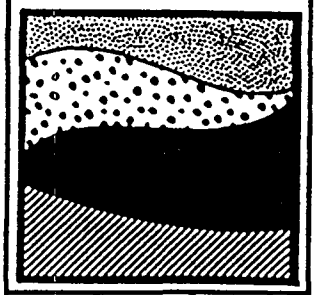
DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
							0-18' v.fn.gr.,brown, clayey silt



WELL COMPLETION DIAGRAM

FOR MW-4

GCL



WELL LOGGING FORM

Client NAVAJO REFINERY Well Number MW-5

1/4 1/4 1/4 1/4 S T R State NEW MEXICO

County EDDY Contractor LARRY'S DRILLING

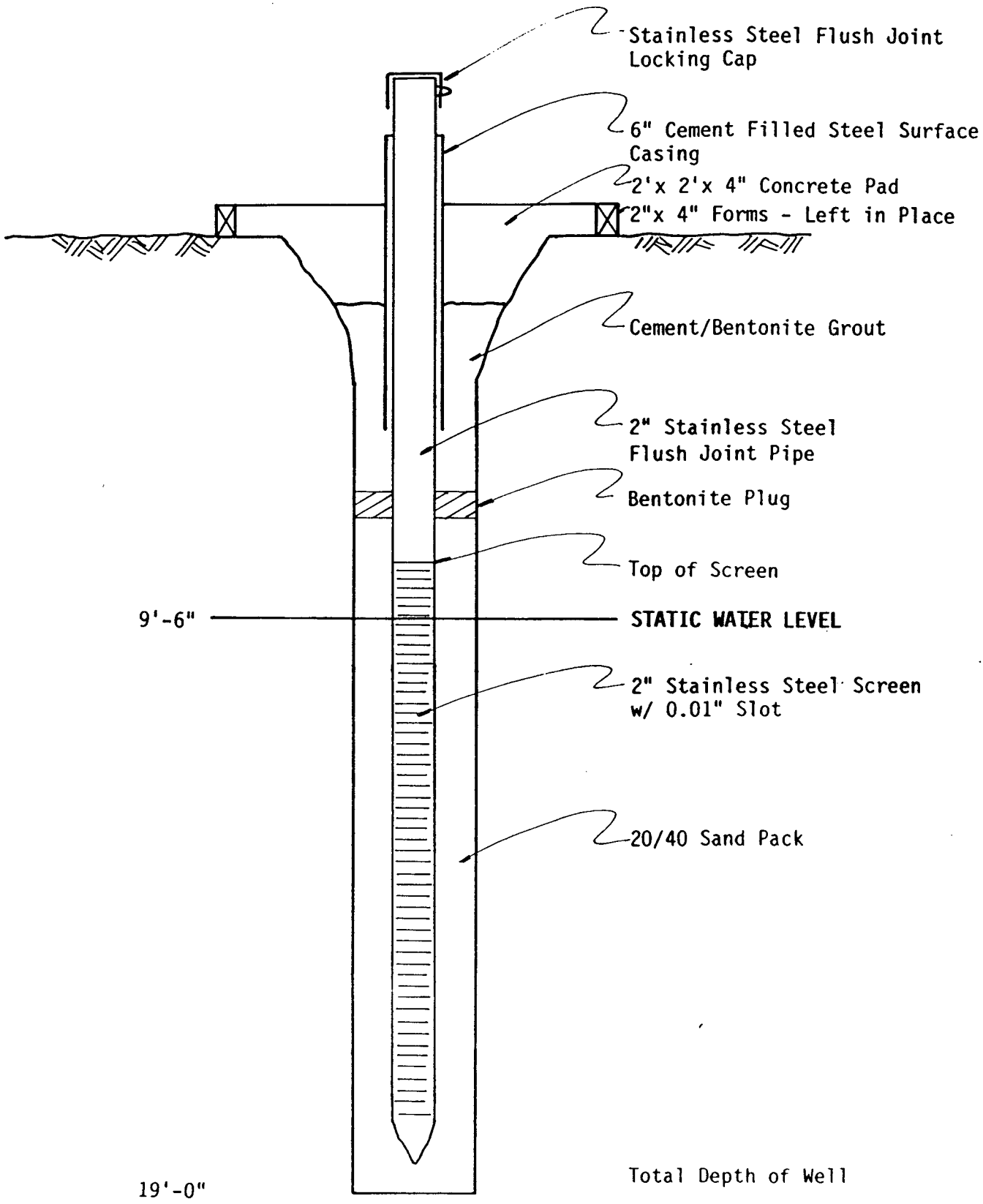
Spud Date 6-19-86 Completion Date 6-19-86

Logs Run LITHOLOGY Logged By SELKE

Elevation Spud In (Fm.)

Remarks Steam cleaned rig and tools prior to drilling-drilled with air rotary- no temporary casing

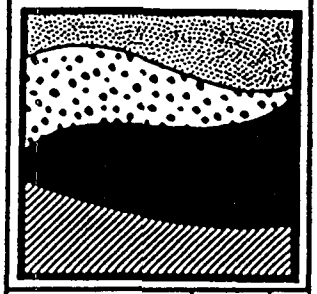
DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
0							0-19' v.fn.gr., brown silty clay, very strong petroliferous odor soils are discolored black beginning at approx. 13'
Sand							
5							
Silt							
10							
Clay							
15							
Silty Clay							
20							
Clayey Silt							
25							
Gravel							
30							
35							
40							
45							



WELL COMPLETION DIAGRAM

FOR MW-5

GCL



WELL LOGGING FORM

Client NAVAJO REFINERY Well Number MW- 6

1/4 1/4 1/4 1/4 S T R State NEW MEXICO

County EDDY Contractor LARRY'S DRILLING

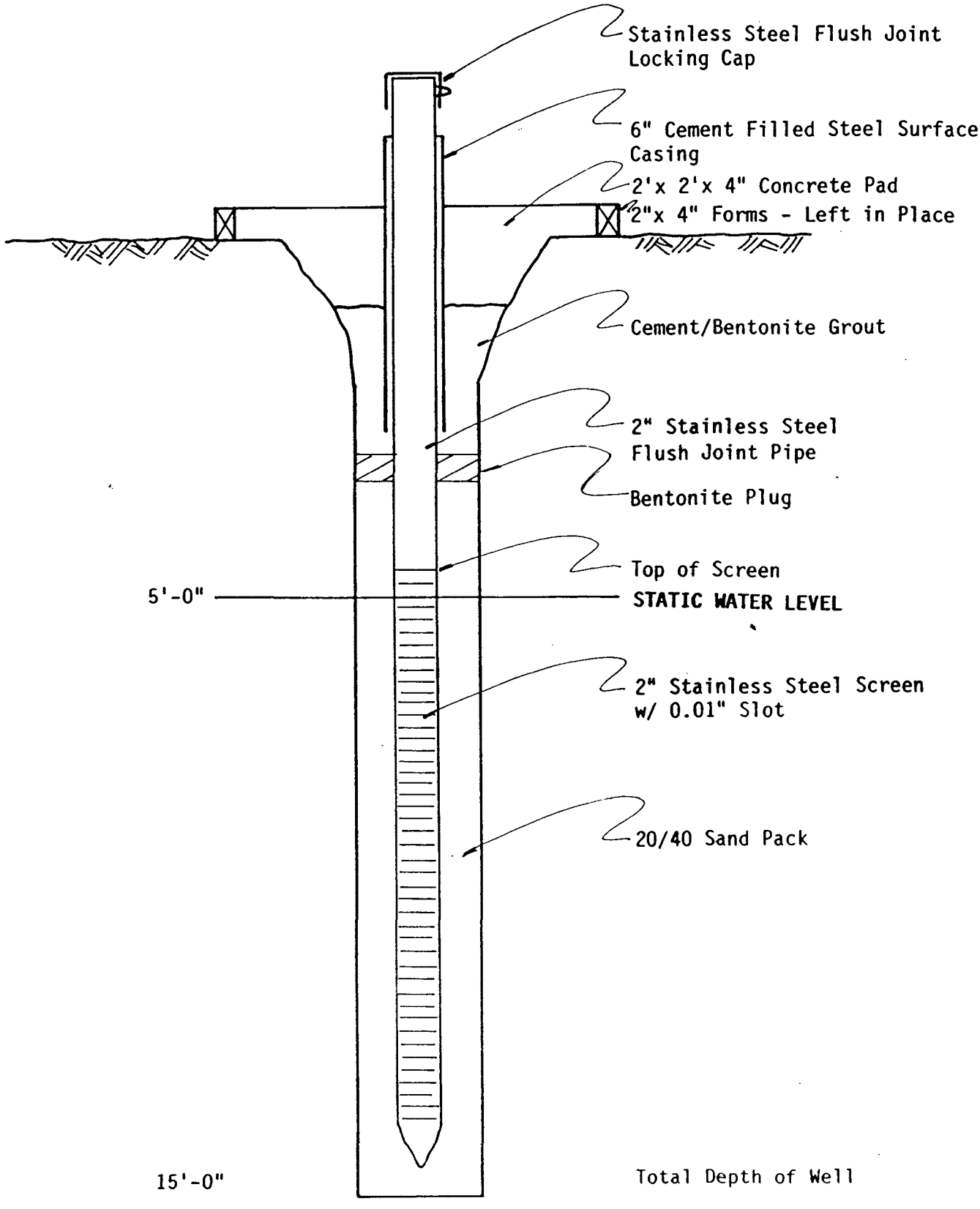
Spud Date 6-19-86 Completion Date 6-19-86

Logs Run LITHOLOGY Logged By SELKE

Elevation Spud In (Fm.)

Remarks Steam cleaned rig and tools prior to drilling- drilled with air rotary

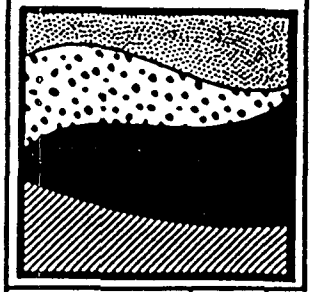
DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
0							0-15' brown, v.fn.gr., silty clay and clayey silt
Sand							
5							at approx. 14' the clay is colored black, green, gray and is extremely petroliferous
Silt							
10							
Clay							
15							
Silty Clay							
20							
Clayey Silt							
25							
Gravel							
30							
35							
40							
45							



WELL COMPLETION DIAGRAM

FOR MW-6

GCL



WELL LOGGING FORM

Client NAVAJO REFINERY Well Number MW-7

1/4 1/4 1/4 1/4 S T R State NEW MEXICO

County EDDY Contractor LARRY'S DRILLING

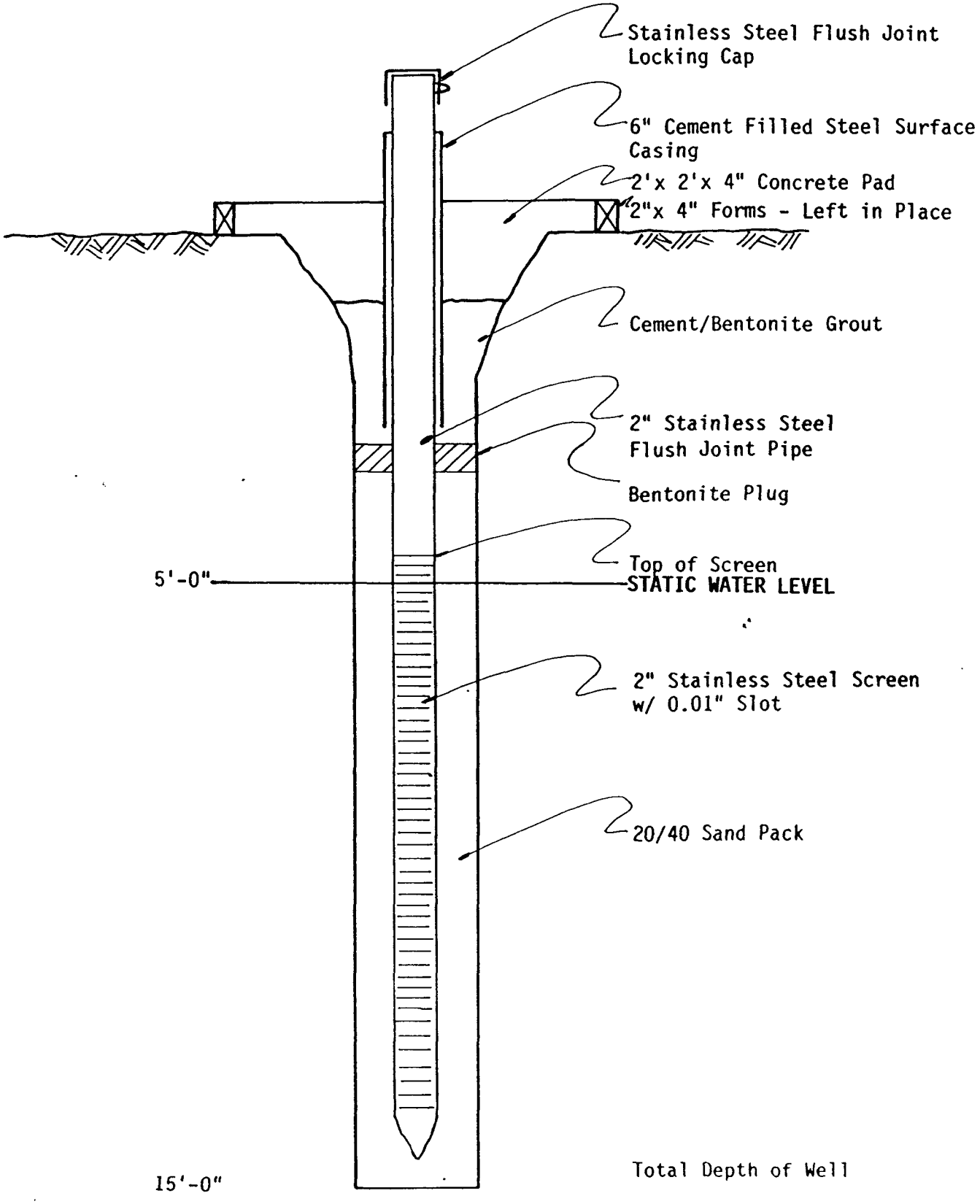
Spud Date 6-19-86 Completion Date 6-19-86

Logs Run LITHOLOGY Logged By SELKE

Elevation Spud In (Fm.)

Remarks Steam cleaned rig and tools prior to drilling-drilled with air rotary- no temp casing necessary

DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
0							0-12' v.stiff, brown clay
Sand							
5							
Silt							at 7' clay is slightly moist and plastic
10							
Clay							12-20' v. fn. gr., brown clayey silt petroliferous odor
15							
Silty Clay							
20							
Clayey Silt							
25							
Gravel							
30							
35							
40							
45							



WELL COMPLETION DIAGRAM

FOR MW-7

GCL

WELL LOGGING FORM

Client NAVAJO REFINERY Well Number MW- 8

1/4 1/4 1/4 1/4 S T R State NEW MEXICO

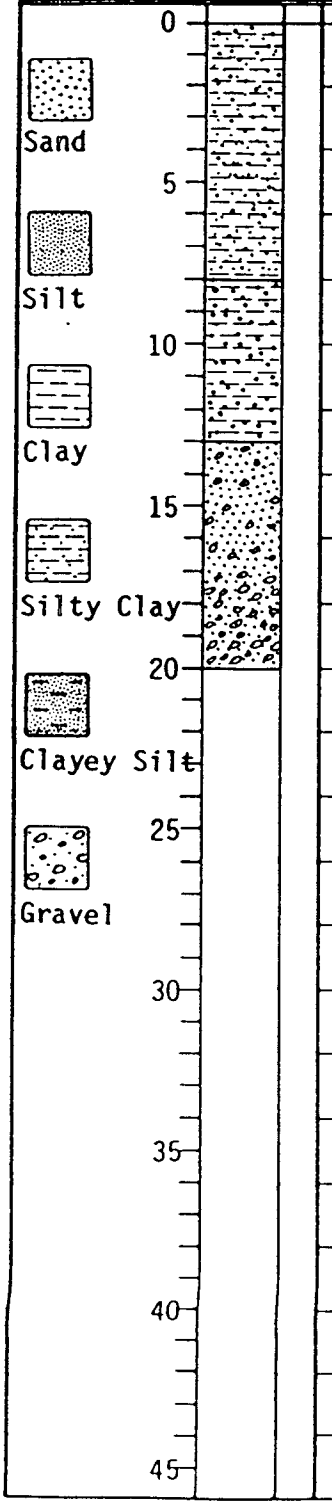
County EDDY Contractor LARRY'S DRILLING

Spud Date 6-20-86 Completion Date 6-20-86

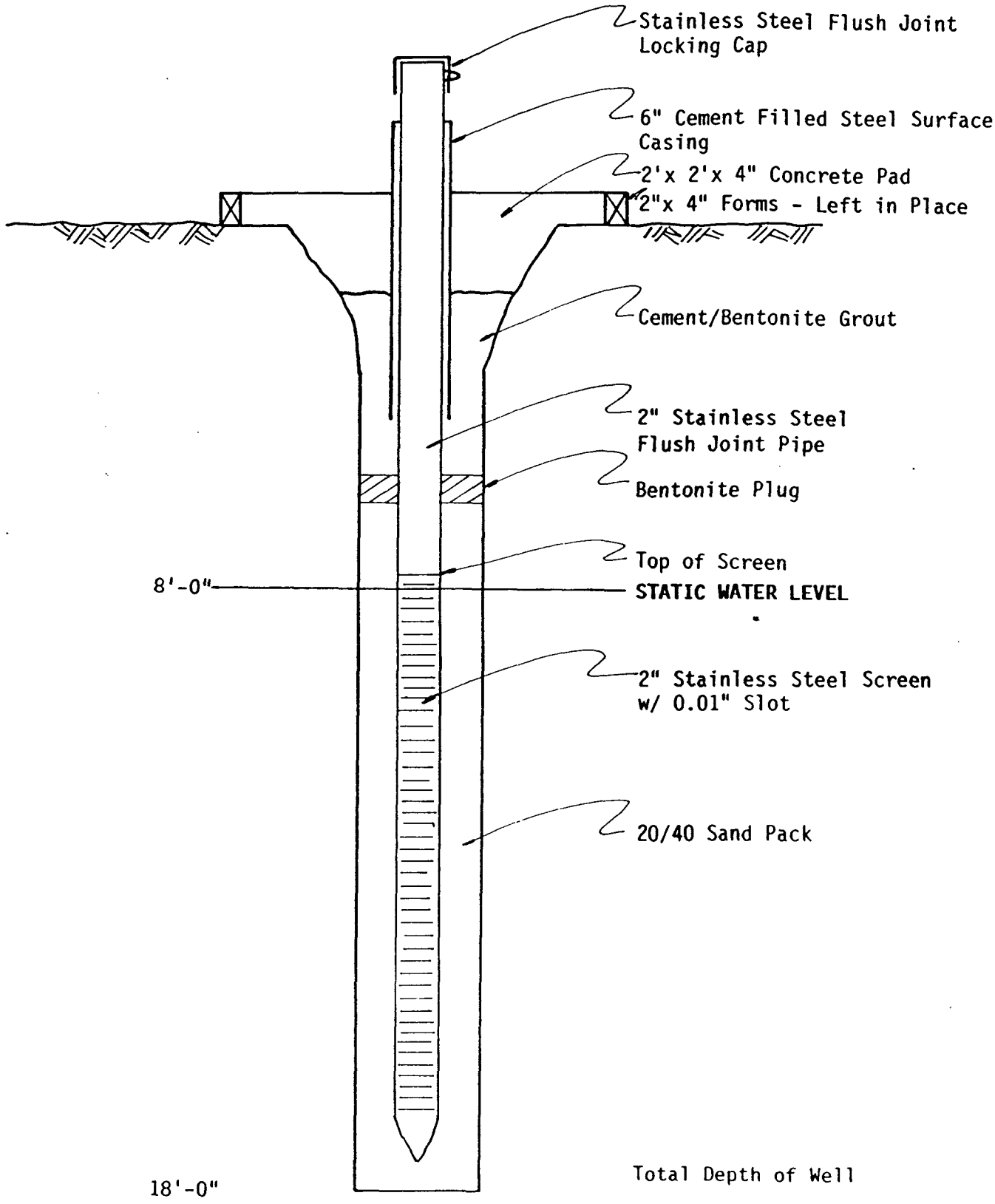
Logs Run LITHOLOGY Logged By SELKE

Elevation Spud In (Fm.)

Remarks Steam cleaned rig and tools prior to drilling - drilled with air rotary



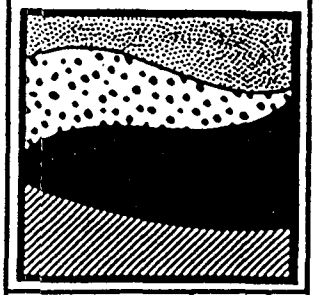
RUN	FROM	TO	SAMPLE DEPTH	REMARKS
				0-8' Brown, silty sandy clay moist at approx. 8'
				8-13' white to gray, sandy clay with moderate amounts of gravel(pea size)
				13-20' lt. brown clayey sand (abund. clay) v. minor gravel at top w/ moderate to abundant gravel at bottom



WELL COMPLETION DIAGRAM

FOR MW-8

GCL



WELL LOGGING FORM

Client NAVAJO REFINERY Well Number MW- 9

1/4 1/4 1/4 1/4 S T R State NEW MEXICO

County EDDY Contractor LARRY'S DRILLING

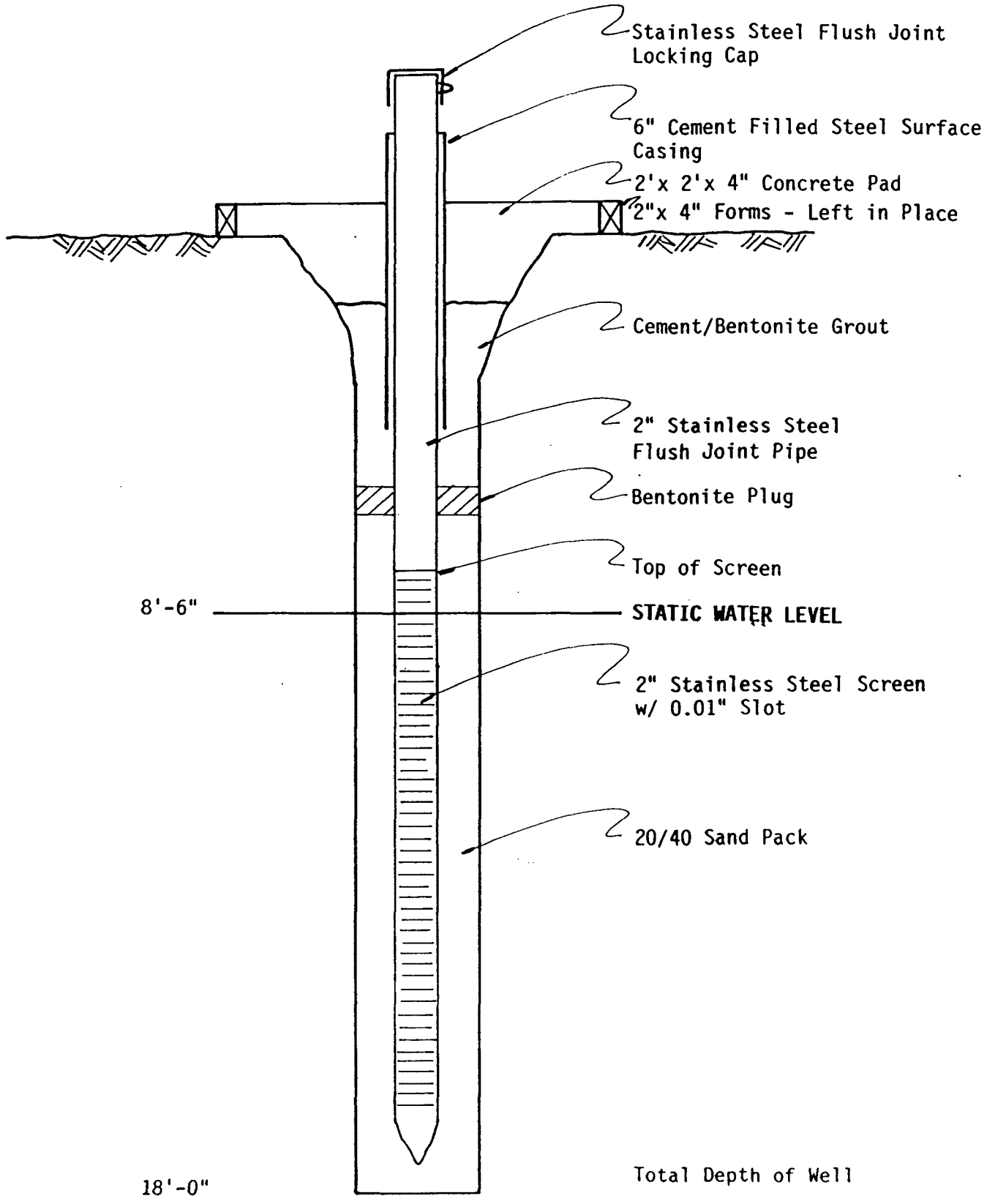
Spud Date 6-20-86 Completion Date 6-20-86

Logs Run LITHOLOGY Logged By SELKE

Elevation Spud In (Fm.)

Remarks Steam cleaned rig and tools prior to drilling- drilled with air rotary- no temporary casing

DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
0							0-approx. 5' brown, silty , sandy clay
Sand							
5							approx. 5'-approx. 15' white to gray, sandy clay
Silt							
10							
Clay							
15							15-20' lt. brown, clayey sand w/ moderate amounts of fine grain gravel
Silty Clay							
20							
Clayey Silt							
25							
Gravel							
30							
35							
40							
45							



WELL COMPETION DIAGRAM

FOR MW-9

Harding Lawson Associates

July 11, 1986

State of New Mexico
Oil Conservation Division
P.O. Box 2088
Land Office Building
Santa Fe, New Mexico 87501

Attention: Mr. David Boyer

Dear Mr. Boyer:

Enclosed please find a copy of our draft report on the hydrogeologic conditions at the Navajo Refinery Company, Artesian Refinery site. The public review copy of the Discharge Plan for Navajo, which you sent me, was extremely useful and, as we agreed, I am sending you our draft report.

I regret that it has taken so long to provide you with a copy of this report. I hope this has not caused you any inconvenience.

Thank you for your assistance.

Yours very truly,

HARDING LAWSON ASSOCIATES

Lauretta J. Dry
Hydrogeologist

LJD/cmc

Enclosure

Engineers
Geologists &
Geophysicists

7655 Redwood Blvd.
P.O. Box 578
Novato, CA 94947

Telephone
415/892-0821
Telex 340523

Alaska
Arizona
California

Colorado
Hawaii
Nevada

Texas