GW - 21

REPORTS

YEAR(S):

1991

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

June 28, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Boyer:

Please find enclosed the additional information requested in your May 15, 1991 letter pertaining to the subsurface leak discovered south of the Indian Basin Gas Plant on April 12, 1991.

Should you have any questions, please direct them to A. J. Kavran in Midland at (915) 687-8528.

Sincerely,

R. F. Unger
Production Manager
Midland Operations

RFU/elg

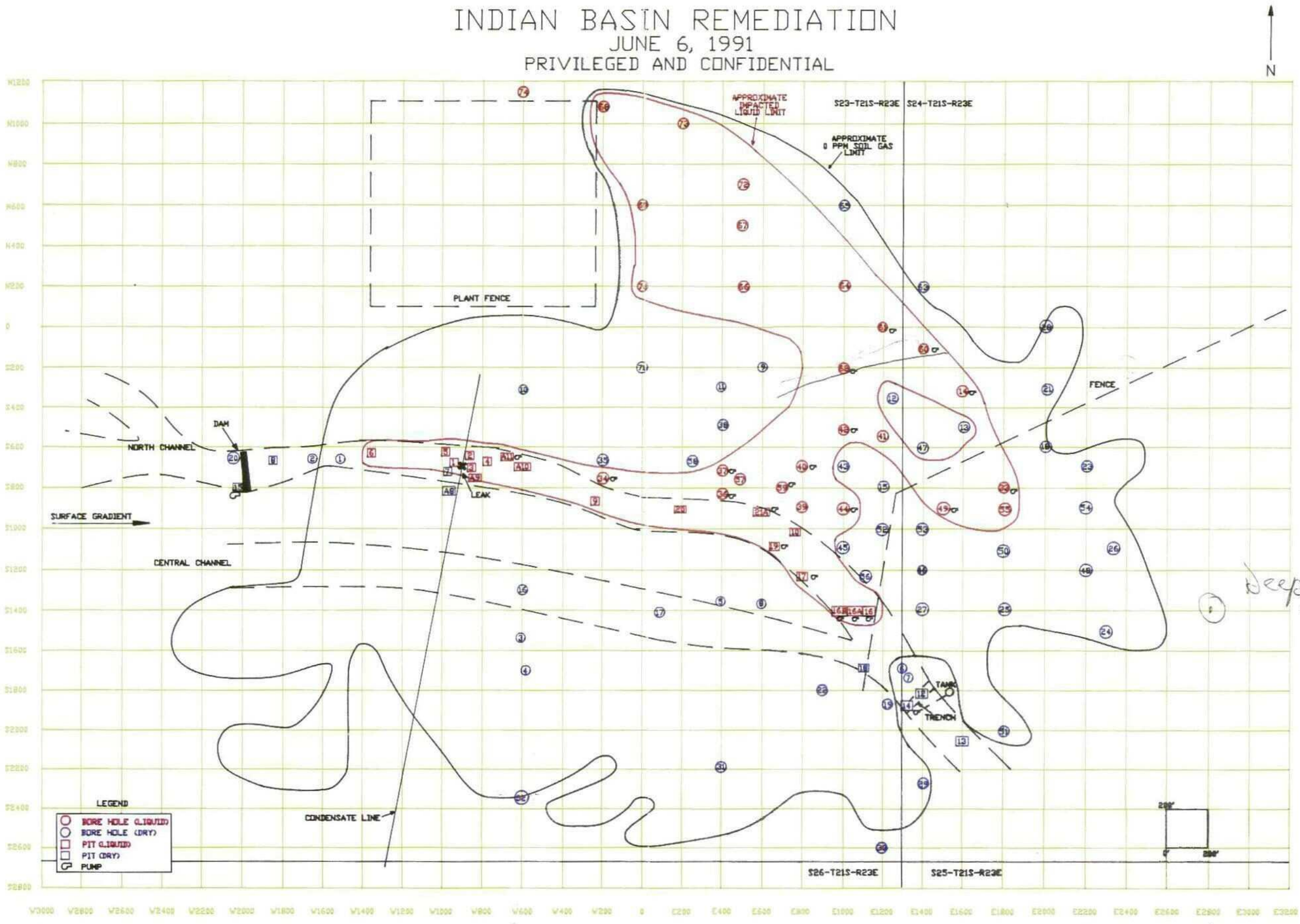
Enclosure

cc: A. Collar (BLM-Roswell)
D. L. Manus (BLM-Carlsbad)
G. A. Stephens (BLM-Santa Fe)
J. L. Benson
A. J. Kavran
A. R. Kukla
File

INDIAN BASIN REMEDIATION

JUNE 6, 1991

PRIVILEGED AND CONFIDENTIAL



Deep Monitor well

UNGER FAX
(915) 687-8217

DRAFT

May 13, 1991

CERTIFIED MAIL
RETURN RECEIPT NO. P-327-278-118

Mr. R. F. Unger, Production Manager
Midland Operations
Marathon Oil Company
P. O. Box 552
Midland, Texas 79702

RE: April 12, 1991, Leak of Condensate and Produced Water, Marathon Indian Basin Gas Field, Eddy County, New Mexico

Dear Mr. Unger:

The New Mexico Oil Conservation Division (OCD) has received your April 22, 1991, written notification of the above leak of fluids. Verbal notification was provided to OCD on the morning of the leak discovery, as required by OCD Rule 116. Subsequent to the written notification, on April 29, 1991, OCD received a copy of the "Site Characterization Plan" (SCP) provided to the Bureau of Land Management. Both the OCD notification letter and the Site Characterization Plan provide information on the circumstances of the incident, volumes of fluids lost and interim measures being taken to investigate the extent of the spill and recover fluids.

The NMOCD has authority under both the Oil and Gas Act (70-2-1 et seq., NMSA 1978) and the New Mexico Water Quality Act (74-6-1 et seq., NMSA 1978), and rules and regulations adopted thereunder, to require actions be taken to protect public health and the environment and prevent water pollution; and to require corrective actions as are necessary or appropriate to contain, remove or mitigate the damage caused by a discharge of water pollutants. This letter is a request for your continued voluntary compliance in taking the corrective actions needed to investigate, assess, contain, remove and mitigate actual or potential environmental pollution that has been or may be caused by this spill.

OCD requests that further information be provided this agency regarding the circumstances of the incident, the progress of the technical investigation and other actions proposed to be taken by Marathon. OCD will review and comment in writing on actions already taken, review for approval proposed actions, and, if necessary, require that additional actions be undertaken if to prevent or abate pollution. The Site Characterization Plan already submitted was an excellent report providing timely information on the circumstances of the spill and immediately actions taken by Marathon in response to the spill.

Request For Information

In addition to the information provided in the SCP, Marathon is required to provide the following information:

A. Investigation Activities

1. Supply an updated map of remediation locations (soil gas measurement points, pits, borings, etc.) Please provide an updated map weekly during the investigation phase of the remediation.

2. Provide updated copies of Tables 2, 3 and 4 weekly during the investigation phase. Please revise Table 3 (Soil Boring Details) to include information on whether fluids were detected and type (water and/or condensate), fluid thickness, and indicate quality (fresh or produced water) of fluids. Include information as to whether the boreholes were completed as monitor and/or extraction wells.

3. Provide information on trenching activities (locations, rock characteristics, and type and quantity of any fluids encountered).

4. Provide weekly summaries of types and volumes of fluids recovered.

B. Site Geology

1. Provide lithologic information on the bedrock (both sandstone and dolomite) encountered at the leak site.

2. Provide additional information ~~(including from core holes located at I-24-21S-23E, and E-23-21S-23E)~~ on the lithologic and structural characteristics of ~~subface~~ material beneath the spill site to first deep ground water (Lower Queen aquifer). Include information and interpretation on possible occurrence and continuity vertical joint/fracture patterns in the subsurface. ~~(Core holes~~ & core holes were referenced in the attached site characterization of the Contingency Plan ~~attached~~.) having shallow geologic data

3. Some soil boring records (Appendix G) were illegible due to photocopying problems. Please provide complete copies of all logs.

C. Water Quality

1. Provide an analysis of the quality of the produced water discharged with the condensate. The analysis should include both general water chemistry parameters and the ICAP metal constituents shown on the attached sheets, plus arsenic, selenium and mercury by the appropriate EPA atomic adsorption method.

2. Provide information on whether any shallow fresh water has been detected by the investigation in the vicinity of the spill. Indicate which boreholes, pits or trenches, if any, have ~~intersected~~ fresh water.

3. In a phone call on May 8th with Mr. Tony Kavran of Marathon and myself, Marathon committed to weekly sampling of nearby domestic water wells. Please furnish the names and locations of those wells to be sampled, and constituents to be analyzed. We request that at least one sample at each well be analyzed for general water chemistry parameters.

4. In addition to the domestic wells we request that you sample the #6 and #13 stock wells shown on Exhibit 8 of the SCP, Indian Big Springs (21S-24E-Sec. 27.210), and the first seepage water in Rocky Arroyo downstream from the spill. Propose a schedule for future periodic monitoring of these locations.

D. Miscellaneous Information

1. Provide information on the material and age of the failed section of condensate line (the SCP does not make clear whether the failed section was PVC or steel, see p. 8 and 21) and whether the failure was likely due to internal or external corrosion.

2. Exhibit 9 (5-7-91) shows elevated soil-gas concentrations at some locations that appear isolated from the spill. ~~What might be the cause of these elevated levels? Are these locations near other gathering lines or production sites.~~ These locations will require further

3. Provide information on material, age and testing program for other sections of the Indian Basin Gathering lines so that a reoccurrence of this incident does not occur. Provide a map showing the location of these lines.

Proposed Remediation

A. Groundwater Monitoring

Prior to drilling deep (Lower Queen) ground water monitoring wells, locations and construction details must be approved by OCD. Because of the possibility of cross-contamination, ~~OCD is opposed to drilling deep~~ monitor wells within the defined plume area. Any such drilling will require that special precautions be taken to prevent downward movements of contaminated fluids.

B. Remediation Plan

As discussed on page 31 of the SCP, submit a plan for product recovery and remediation of the affected area for OCD review and approval. After review of the plan, OCD will provide comments to Marathon and the BLM. During the time of review, OCD will coordinate with BLM to prevent, to the extent possible, duplication of effort. However, OCD recognizes that as the surface owner, BLM may require work in addition to that which OCD would require. Therefore, it will be necessary for Marathon consult with BLM as to their additional requirements.

Unfortunately, due to staff limitations, OCD can not provide a full-time staff person to be on-site during investigation and remediation efforts. However, OCD Artesia and OCD Santa Fe staff will visit the site periodically to monitor progress and communicate with you or your staff on the remediation.

If you have any questions regarding the information requests in this letter or on any other issue, please contact me at the above address or by phone at (505) 827-5812.

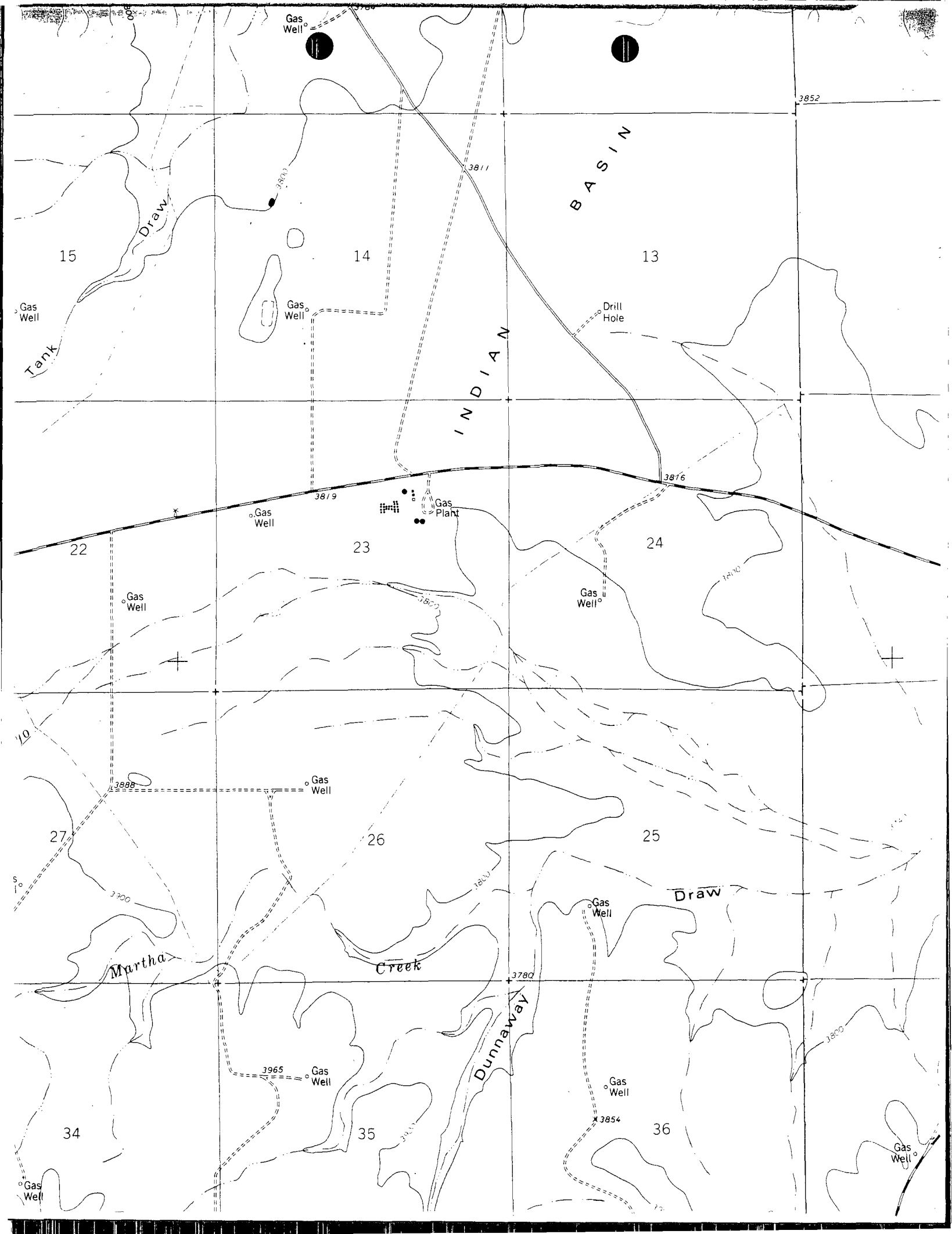
Sincerely,

David G. Boyer, Hydrogeologist
Environmental Bureau Chief

DGB/sl

Enclosure

cc: OCD Artesia Office
Kathy Sisneros, WWMD, Environment Department
Dick Manus, BLM - Carlsbad Office
Al Collar, BLM - Roswell Office


Gas Well
3852
3811
BASIN
INDIAN
Draw
15
14
13
Gas Well
Drill Hole
Tank
3816
3819
Gas Plant
22
23
24
Gas Well
3888
27
26
25
Draw
Martha
Creek
3780
Dunnaway
3965
34
35
36
3854

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

PANAFAX TRANSMITTAL SHEET

SEND THE FOLLOWING PAGES TO:

NAME Dave Boyer

COMPANY NAME NMOCD

LOCATION Santa Fe

PANAFAX NUMBER: @ 505 827-5741

FROM:

NAME TONY KAVANAUGH EXT. 528

TOTAL NUMBER OF PAGES: 29 (including cover sheet).

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Delwar Hosa-P.

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Bill - Please give quick scan. Any sticking problems?

A

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

June 12, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Boyer:

Please find attached the work plan for the drilling of the four wells into bedrock at the locations mutually agreed upon at our meeting on June 10. The plan was developed for Marathon by Roberts/Schornick and Associates and contains additional detail as to the completion procedures. As agreed to at our meeting, drilling operations will be suspended at any of the locations, should saturation be encountered which contains free or dissolved phase condensate. The well would then be completed at that depth as a monitoring/recovery well.

As you know, present plans are for the drill rig to arrive on site Friday, June 14, 1991, with drilling operations to immediately commence thereafter.

Should you have any questions, or wish to further discuss, please contact me at your convenience.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elg

Attachment

cc: J. L. Benson
A. R. Kukla
R. F. Unger
D. L. Manus (BLM-Carlsbad)
File

PHASE II WORK PLAN

SUBSURFACE INVESTIGATION

BEDROCK MONITORING WELLS

MARATHON OIL COMPANY

INDIAN BASIN GAS PLANT

EDDY COUNTY, NEW MEXICO

Prepared by

Roberts/Schornick and Associates, Inc.

Environmental Consultants

Norman, Oklahoma

(405) 321-3895

June 12, 1991

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PLATE	
1	Site Plan Showing Borings, Existing Monitoring Wells, and Proposed Bedrock Monitor Wells

1.0 INTRODUCTION

Roberts/Schornick and Associates, Inc. (RSA) has been retained by Marathon Oil Company (Marathon) to prepare and implement a Phase II Subsurface Investigation Work Plan for the Indian Basin Gas Plant (Site) located in Eddy County, New Mexico. Phase I and II investigations are being conducted to assess the extent of impact to soils and groundwater at the Site resulting from a pipeline release of condensate and produced water. The location of the release is shown on Plate 1.

Phase I investigations, which were conducted in accordance with the April 29, 1991 Site Characterization Work Plan, consisted of the sampling of 196 soil gas probes, drilling and sampling of 79 shallow (less than 35 feet deep) boreholes primarily drilled through the alluvial material, and the installation of 53 shallow alluvial monitoring wells. The locations of Phase I borings and monitoring wells are shown on Plate 1. The scope of the Phase II investigation was the subject of a June 10, 1991 meeting between representatives of the United States Bureau of Land Management (BLM), Marathon, New Mexico Oil Commission Division (OCD), and RSA. This work plan for Phase II investigation has been prepared in accordance with the program for site investigation discussed in the June 10, 1991 meeting. The scope of the Phase II investigation will consist of drilling and installation of one (1) deep (approximately 180 to 220 feet) and three (3) shallow

(approximately 60 feet) bedrock monitoring wells. Proposed bedrock monitoring well locations are shown on Plate 1.

2.0 PHASE II INVESTIGATION

2.1 Scope of Investigation

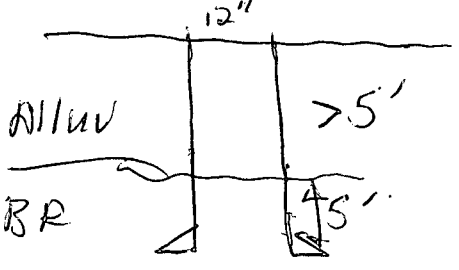
The scope of the Phase II investigation consists of the drilling of three (3) boreholes to depths of approximately 60 feet and installation of three (3) shallow bedrock monitoring wells in each of the boreholes. In addition, one (1) deep borehole will be drilled to a depth of approximately 180 to 220 feet and one (1) deep bedrock monitoring well will be installed. Surface conductor casings will be installed in all borings prior to drilling to prevent possible cross-contamination. Proposed Phase II monitoring well locations are shown on Plate 1.

2.2 Surface Conductor Installation - Shallow Borings

2.2.1 Surface Conductors (Areas With Alluvium)

In areas with alluvial cover greater than five (5) feet, a 12-inch steel surface conductor will be installed from ground surface to approximately five (5) feet into bedrock. The conductor will be installed by drilling a 14-inch borehole with a truck-mounted rotary drill rig with a 14-inch tri-cone bit. The borehole may be drilled using air. If drilling with air is not possible then water as a drilling fluid will be used; however, should borehole stability problems occur, sodium bentonite may be added to the drilling fluid.

less than 5 feet?
To use shallow bedrock as design?
Yes



During drilling, air monitoring for volatile organics will occur. If drilling fluid is used then the fluid will be monitored for evidence of a hydrocarbon sheen and cuttings samples will be obtained for headspace testing approximately every two (2) feet. Samples will be collected in glass jars, fitted with an aluminum foil seal, and tested in the manner described in Section 2.7.

The 12-inch conductor will be pressure grouted from the base of the conductor up through the annulus to the surface with a cement/bentonite slurry consisting of one sack of Portland Cement, five pounds sodium bentonite, and six gallons of water. The grout will be allowed to set up for 24 hours without being disturbed. After installation of the surface conductor, the borehole will be cored to at least 15 feet into bedrock as described in Section 2.5. If evidence of contamination is observed such as a sheen or staining in the rock core or drill fluid or elevated headspace soil gas readings in the upper portion of bedrock, an additional surface conductor will be installed. The second conductor will be installed by drilling a borehole with a truck-mounted rotary air or water rig fitted with an 11 7/8-inch tri-cone bit. Drilling fluid will be either air or water only unless borehole stability problems necessitate the use of a sodium bentonite additive. An 8-inch conductor pipe will be inserted into the borehole and will be extended from total depth to

ground surface. The 8-inch conductor pipe will be installed with a bottom cap to prevent contamination of the inner casing during installation. The conductor will be pressure grouted from the base of the conductor up through the annulus to the surface with a cement/bentonite slurry. The conductor will be allowed to set up for at least 24 hours without being disturbed. After installation of conductor casings, boreholes will be drilled to depths of approximately 60 feet using the methods described in Section 2.4. Conductor casing installation diagrams for shallow bedrock wells are included as Figures 1, 2, and 3.

2.2.2 Surface Conductors (Areas Where Bedrock Outcrops)
In areas where bedrock outcrops, an 8-inch surface conductor will be utilized. However, prior to conductor installation, the borehole will be cored to at least 15 feet below grade as described in Section 2.5. After coring, the borehole will be evaluated in the field to determine the appropriate depth to install the surface conductor casing.

The surface conductor will be installed by drilling a borehole with a truck-mounted rotary air or water rig fitted with an 11 7/8-inch tri-cone bit. Drilling fluid will be air or water only unless borehole stability problems necessitate the use of a sodium bentonite additive. An 8-inch PVC conductor pipe will be inserted into the borehole and will be extended from

total depth to ground surface. The 8-inch conductor will be installed with a bottom cap to prevent contamination of the inner casing during installation. The conductor will be pressure grouted from the base of the conductor up through the annulus to the surface with a cement/bentonite slurry. The conductor will be allowed to set up for at least 24 hours without being disturbed. After installation of conductor casings, boreholes will be drilled to depths of approximately 60 feet using the methods described in Section 2.4.

2.3 Surface Conductor Installation - Deep Boring

A 12-inch steel surface conductor will be installed from ground surface to approximately five feet into bedrock in the deep boring. The conductor will be installed by drilling a 14-inch borehole with a truck-mounted rotary drill rig with a 14-inch tri-cone bit. The borehole will be drilled using only air or water as a drilling fluid if possible; however, should borehole stability problems occur, sodium bentonite may be added to the drilling fluid.

During drilling, the drilling fluid will be observed for evidence of a hydrocarbon odor or sheen and cuttings samples will be obtained for headspace testing approximately every two (2) feet. Samples will be collected in glass jars fitted with an aluminum foil seal and tested in the manner described in Section 2.7.

The 12-inch conductor will be pressure grouted from the base of the conductor up through the annulus to the surface with a cement bentonite slurry consisting of one sack of Portland Cement, five pounds sodium bentonite, and six gallons of water. The grout will be allowed to set up for 24 hours without being disturbed. After installation of the surface conductor, the borehole will be cored to at least 30 feet into bedrock, as described in Section 2.5. Borehole core samples will be examined to determine the appropriate depth to install the second conductor casing. Depth of installation will likely be approximately 60 feet. The second conductor will be installed by drilling a borehole with a truck-mounted rotary air or water rig fitted with a 11 7/8-inch tri-cone bit. Drilling fluid will be air or water only unless borehole stability problems necessitate the use of a sodium bentonite additive. An 8-inch steel conductor pipe will be inserted into the borehole and will be extended from total depth to ground surface. The conductor will be installed with a bottom cap to prevent contamination of the inner casing during installation. The conductor will be pressure grouted from the base of the conductor up through the annulus to the surface with a cement/bentonite slurry. The conductor will be allowed to set up for at least 24 hours without being disturbed. A diagram of typical conductor casing installation for the bedrock well is included as Figure 4. After installation of surface conductors, the borehole will be drilled to a total

depth of approximately 180 to 220 feet using the methods described in Section 2.4.

2.4 Drilling Methods

After conductor casing installation, boreholes will be drilled and/or cored to total depths using the methods described below. Shallow bedrock borings will be drilled to approximately 60 feet below grade and the deep bedrock boring will be drilled to approximately 180 to 220 feet.

2.4.1 Air Rotary

Air rotary drilling involves the use of circulating air to remove the drill cuttings and maintain an open borehole as drilling progresses. The use of the air-rotary drilling technique is best suited for use in hard rock formations. The air from the compressor on the rig must be filtered to ensure that the oil from the compressor is not introduced into the groundwater system. The air rotary drilling method will be the primarily drilling method used in hard rock formations. To allow for 4-inch monitor well installation, a 7 7/8-inch tri-cone bit will be utilized.

2.4.2 Water Rotary

Water rotary is the second preferred method of drilling in hard rock formations. Water rotary involves the introduction of water into the borehole through the drill pipe and

subsequent circulation of water back up to the hole to remove cutting. If possible, no borehole well stabilization additives will be used. The water used in this drilling method will be obtained from wells located at the Indian Basin Gas Plant to ensure that the water is potable water. To allow for 4-inch monitor well installation, a 7 7/8-inch tri-cone bit will be utilized.

2.5 Sampling Methods

2.5.1 NX or Christianson Corebarrel

An NX or Christianson corebarrel is the preferred sampling method in consolidated rock formations. A hollow diamond or carbide bit that is 3.125 inches outside diameter and 2.2-inches inside diameter cuts a 2.2-inch core approximately 5-feet to 10-feet long. Upon coring 5 to 10-feet the corebarrel is brought to the surface, split open, and the core removed. Once the sample is exposed it will be measured and described by an RSA hydrogeologist. Sample description will include amount of recovery; interval thickness, depth of lithology change; color according to the Munsel Color chart; grain size distribution; macro-features and physical characteristics; mineralogy, and soil classification system (ASTM D2487 and D2488). Samples will be retained or spilt for headspace soil gas testing. All core samples will be labeled, packaged, and placed in water-proof core boxes for storage.

Joints Fractures open or degree of cement-ation? OK

2.5.2 Grab Samples

When not coring, grab samples of cuttings will be obtained at approximately 2-foot intervals. Grab samples will be placed into glass jars, sealed with aluminum foil, and tested for organic vapors as described in Section 2.6. Each sample will be described and logged by an RSA hydrogeologist.

2.6 Monitor Well Construction

After drilling/coring shallow borings to approximately 60 feet below grade and the deep boring to approximately 180 to 220 feet, the boreholes will be reamed with a 7 7/8-inch tri-cone bit to allow for monitoring well installation. Prior to monitoring well installation, borehole water levels will be allowed to stabilize for at least 24 hours and water levels will be measured to determine appropriate screen intervals. Shallow bedrock monitor wells will be screened in the uppermost significant groundwater zone to be determined in the field based on fractures and degree of saturation.

OK

What if no fluids? complete at 50-60 ft?

All groundwater monitoring wells will be constructed of 4-inch schedule 40 PVC casing and a factory slotted 0.02 inch screen size. A bottom sump (approximately 0.5 foot long) will extend below the screen for fines catchment. All monitoring wells will be fitted with centralizers to maintain uniform annulus spacings. The PVC screen used in all wells will be no greater than 20 feet in length, but typically will be 10 feet

Good

Screen at least 2 feet above sat. OK

in length. A clean 8-20 sieve size silicon sand pack will be placed around the screen to serve as a filter medium between the well and screen. The sand pack will extend to approximately 2-feet above the top of the screen. A 2-foot thick layer of sodium bentonite pellets will then be placed on top of the sand pack and then hydrated with deionized water. A cement-bentonite grout (Volclay Gold Grout) will be mixed to a mud weight of 10.6 pounds per gallon and will then be pressure grouted through a tremie line (the line will extend to near the top of the hydrated bentonite) and circulated to approximately 2-feet from ground surface. A vented cap will be placed on top of the PVC well casing. A sloped concrete pad (2' x 2' x 6" thick) and a steel locking protector (6 or 8 inches in diameter) will be placed over the well. Monitor well completion diagrams are included on Figures 1, 2, 3, and 4.

2.7 Headspace Gas Survey

A headspace gas survey is the measurement of relative volatile organic hydrocarbon concentrations in the soil pores. This measurement includes both the unsaturated and saturated zones at various intervals, vertically, in the soil boring. In the unsaturated or vadose zone, volatile hydrocarbons can exist as vapor in soil pore spaces, they can be adsorbed onto the soil particles, or exist as free hydrocarbon liquid in soil pore spaces. In the saturated zone, these hydrocarbons will

usually be adsorbed onto aquifer materials over the zone of groundwater fluctuation or exist as free liquid in the soil pore spaces. Obtaining soil gas headspace data vertically at each soil boring provides information that defines the depth of impact. The soil gas headspace survey is used to supplement analytical test results and also acts as a soil screening device.

Samples will be prepared for vapor analysis using the following methodologies. Outer surfaces of the cores collected by the samplers will be trimmed off (if possible) and the remaining sample composited over either one (1) or two (2) foot lengths and placed in glass jars leaving the top 1/4 of the jar vacant for vapor accumulation. A layer of aluminum foil is placed over the top of the jars and the caps screwed in-place, sealing the jars. The organic vapor monitor (OVM) photoionization detector probe is used to pierce the aluminum foil and an organic vapor headspace reading is obtained. The resulting OVM headspace gas readings are in parts per million (ppm) of total ionizable hydrocarbon based upon an isobutylene standard. The OVM detector has a limit of detection of 100 parts per billion (ppb) of total ionizable hydrocarbon.

Why not HNu w/ benzene std. BTEX same ionization range approximately same sensitivity for BTEX

2.8 Equipment Decontamination and Site Reclamation

All equipment coming into contact with soils or groundwater will be properly cleaned prior to use. Drilling equipment

(i.e. drill bits, drill rod, sampling equipment, etc.) which contacts the borehole will be cleaned using a hot water pressure washer between boreholes. All sampling equipment will be pressure washed and then rinsed with deionized water prior to use. All sampling equipment and the drill rig will be cleaned with the high pressure hot water washer between borings. Sampling equipment will be washed with Alconox and deionized water between sampling events. All monitoring well casings will be washed with Alconox and deionized water prior to installation. Clean surgical gloves will be worn by all personnel handling the monitoring well materials during well completion.

No alcohol?

All decontamination will be conducted in an area designated by Marathon. All wash water will be collected in the decontamination area. All protective clothing and wastes generated by the drilling or soil/groundwater sampling programs will also be containerized for proper disposal. In addition, all drilling fluids will be containerized for proper disposal by Marathon.

All drilling activities will be conducted in such a manner as to minimize any disturbance to the ground surface in the drilling area. Only portable mud pits will be utilized at the Site. A minimum number of vehicles will be brought to each drill site. All cuttings generated during drilling activities

will be containerized and removed from the drill site. Steps will be taken to minimize or prevent the discharge of drilling fluids or developed groundwater on the ground surface. Any accidental discharges will be cleaned up.

2.9 Well Development

Following completion of the monitoring well installations, all wells will be thoroughly developed. The purpose of monitoring well development is to remove any fluids lost to the formation during drilling (if fluids were used in the drilling process) and insure proper development of the sand pack and formation surrounding the screen. To insure proper curing of the cement-bentonite grout seals, no development will occur for forty-eight (48) hours following well completion. Development will consist of the removal of sufficient casing volumes until the discharged water is free from suspended sediment and the pH, specific conductivity, and temperature of the groundwater has stabilized. In addition, any fluids lost during drilling will be recorded and, at a minimum, this quantity and at least three (3) times the casing and sand pack volume (assume 30% porosity) will be removed. All development water will be containerized for proper disposal by Marathon.

The basic procedure for well development is to remove any drilling fluids and silt and clay fines from the well screen and surrounding gravel pack by hydraulic surging. Provided that the formation recharge rate is high enough, groundwater will flow from the formation, through the gravel pack and screen, and into the well.

An air-lift pump, or precleaned dedicated bailers will be utilized to develop the wells. All development equipment will be properly decontaminated (cleaned) prior to use in any well. If bailers are used in the development, care will be taken to prevent the bailer line (monofilament nylon line) from contacting the ground. A layer of visquene will be placed around the well during development to prevent the bailer line from accidentally contacting the ground. Clean surgical gloves will be worn by all personnel participating in the well development activities.

Prior to development, the water levels within the well and the well depth will be measured and recorded. These measurements will be used to calculate the fluid volume in the wells and sand pack prior to development. Measurements on the discharge volume, water clarity, pH, temperature and specific conductivity will be recorded on field forms. Water levels will be taken and recorded before, during, and after well development.

2.10 Well Survey for Horizontal and Vertical Control

All monitor wells at the site be surveyed for vertical elevation and horizontal control. The top of the inner PVC casing (with cap removed) will be surveyed to the nearest 0.01 foot and referenced to the USGS mean sea level elevation datum. The ground surface elevation next to each well will also be measured and noted to the nearest 0.1 foot. The wells will be located laterally to the nearest 1 foot. All surveying will be conducted by a professional land surveyor licensed to practice in the State of New Mexico.

2.11 Water Level Measurements

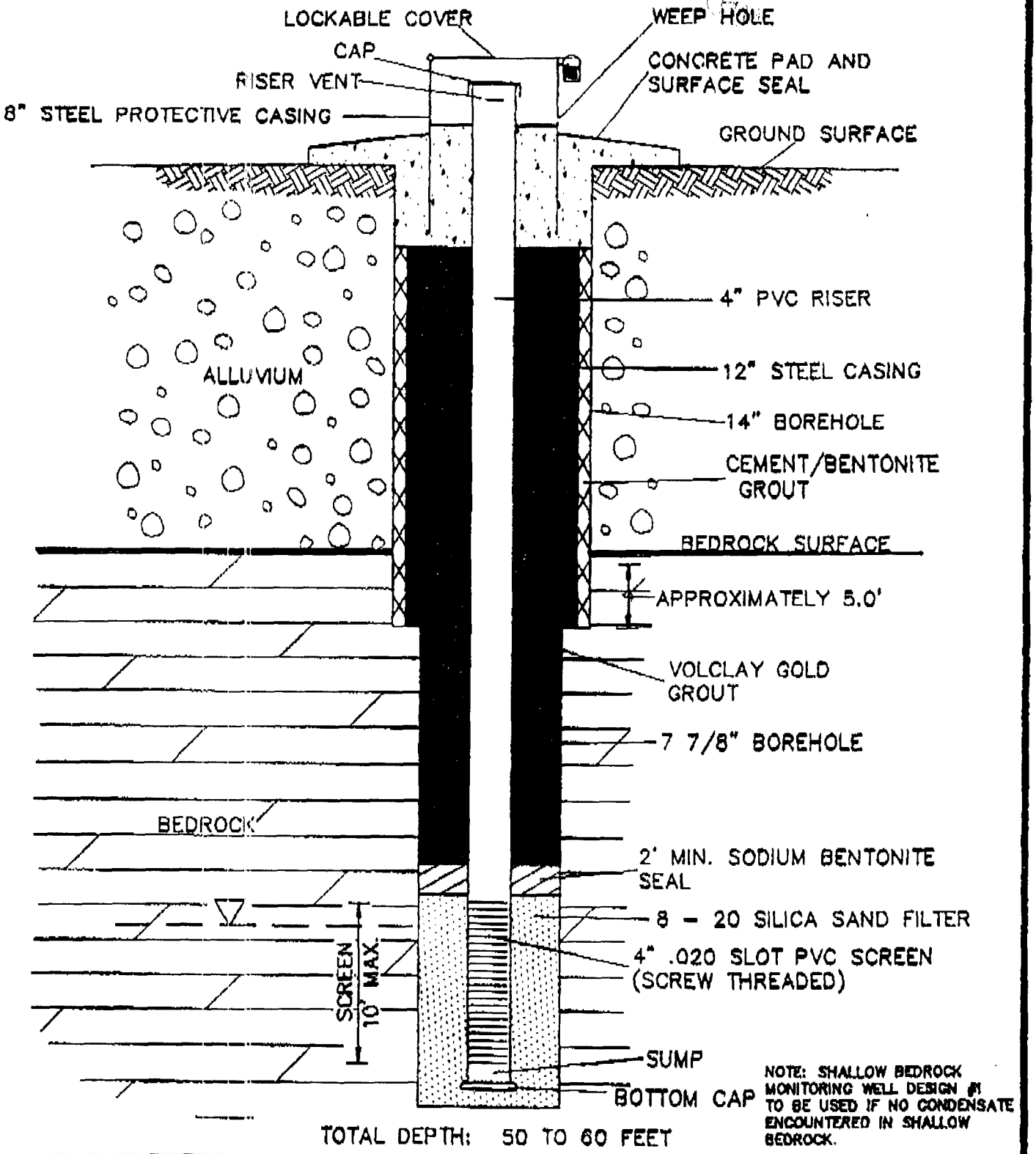
Water level measurements will be taken in all wells upon stabilization. The water level data will be evaluated and presented as depth-to-water and potentiometric (groundwater elevation) maps. The potentiometric maps will be prepared to determine the hydraulic gradients and groundwater flow direction. Water level measurements will typically be made with an electric sounder, however an organic interface probe will be used if immiscible organics are present on the groundwater surface in thicknesses greater than 1/8-inch.

2.12 Borehole Geophysics

Geophysical borehole logging may be conducted in each of the bedrock boreholes/wells. The exact suite of geophysical logs (if needed) will be provided by Marathon's Site Geologist.

Decision
Gamma Ray - Lithologic correlation
Density - Porosity
Induction - Fluid Saturation

FIGURES

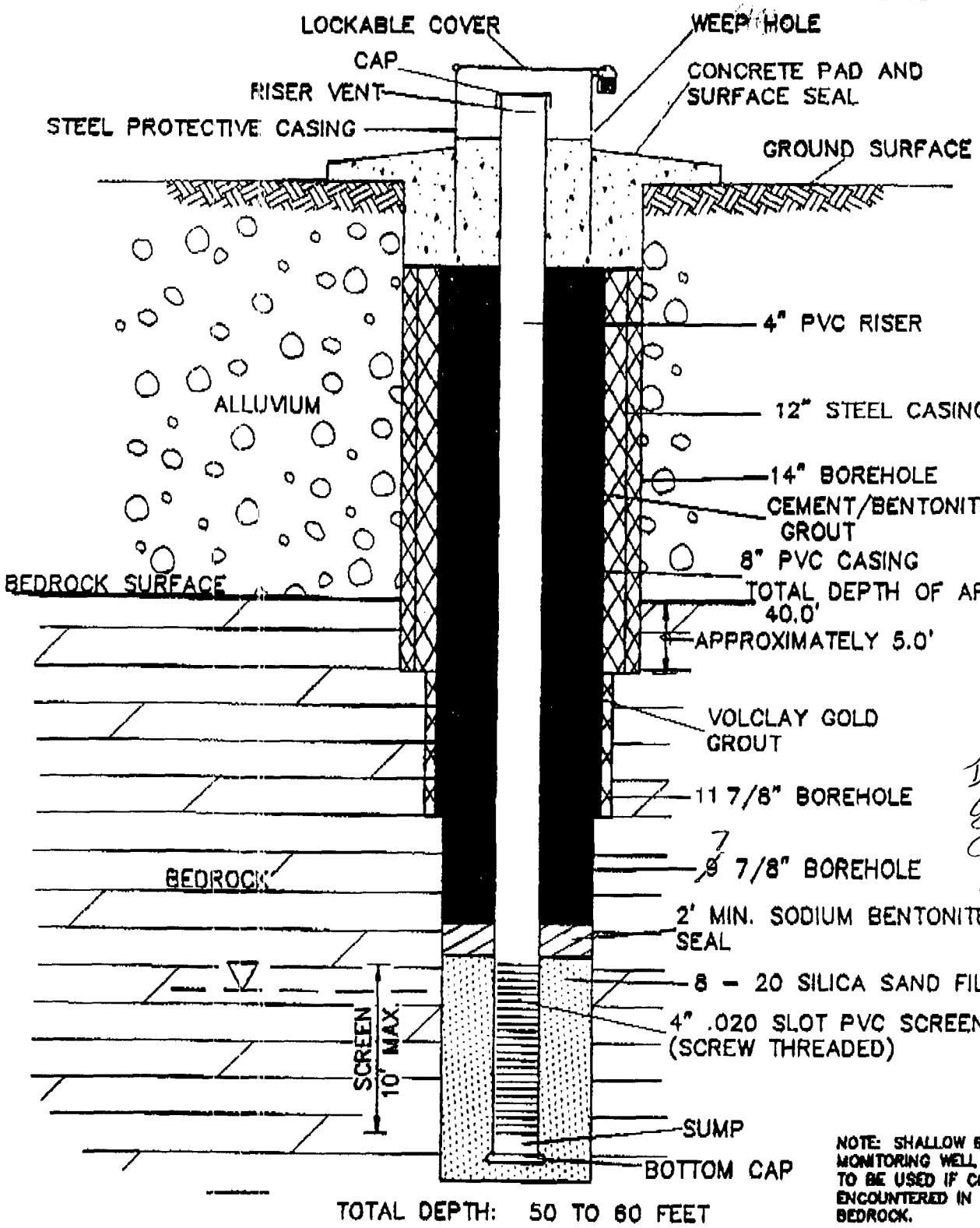


NOTE: SHALLOW BEDROCK MONITORING WELL DESIGN #1 TO BE USED IF NO CONDENSATE ENCOUNTERED IN SHALLOW BEDROCK.

Figure Title: SHALLOW BEDROCK MONITORING WELL DESIGN #1 (TYPICAL)	Client: MARATHON OIL COMPANY
Document Title: PHASE II WORK PLAN	Location: CARLSBAD, NEW MEXICO

ROBERTS/SCHORNICK & ASSOCIATES, INC.
Environmental Consultants
3700 West Robinson, Suite 300
Norman, Oklahoma 73072
(405) 321-3896

DATE: 6/11/91	PREPARED BY: W.E.P
SCALE: NTS	CHECKED BY: W.E.P
PROJECT NO: 94029 F04	DRAFTED BY: S.A.R
	FIGURE NO.: 1



If have 8" casing Can't drill 9 7/8 borehole

NOTE: SHALLOW BEDROCK MONITORING WELL DESIGN #2 TO BE USED IF CONDENSATE ENCOUNTERED IN SHALLOW BEDROCK.

Figure Title: SHALLOW BEDROCK MONITORING WELL DESIGN #2 (TYPICAL)	Client: MARATHON OIL COMPANY
Document Title: PHASE II WORK PLAN	Location: CARLSBAD, NEW MEXICO

ROBERTS/SCHORNICK & ASSOCIATES, INC.
Environmental Consultants
3700 West Robinson, Suite 200
Norman, Oklahoma 73072
(405) 321-3695

DATE: 8/11/91	PREPARED BY: W.E.P
SCALE: NTS	CHECKED BY: W.E.P
	DRAFTED BY: S.A.R
PROJECT NO: 91029 F03	FIGURE NO.: 2

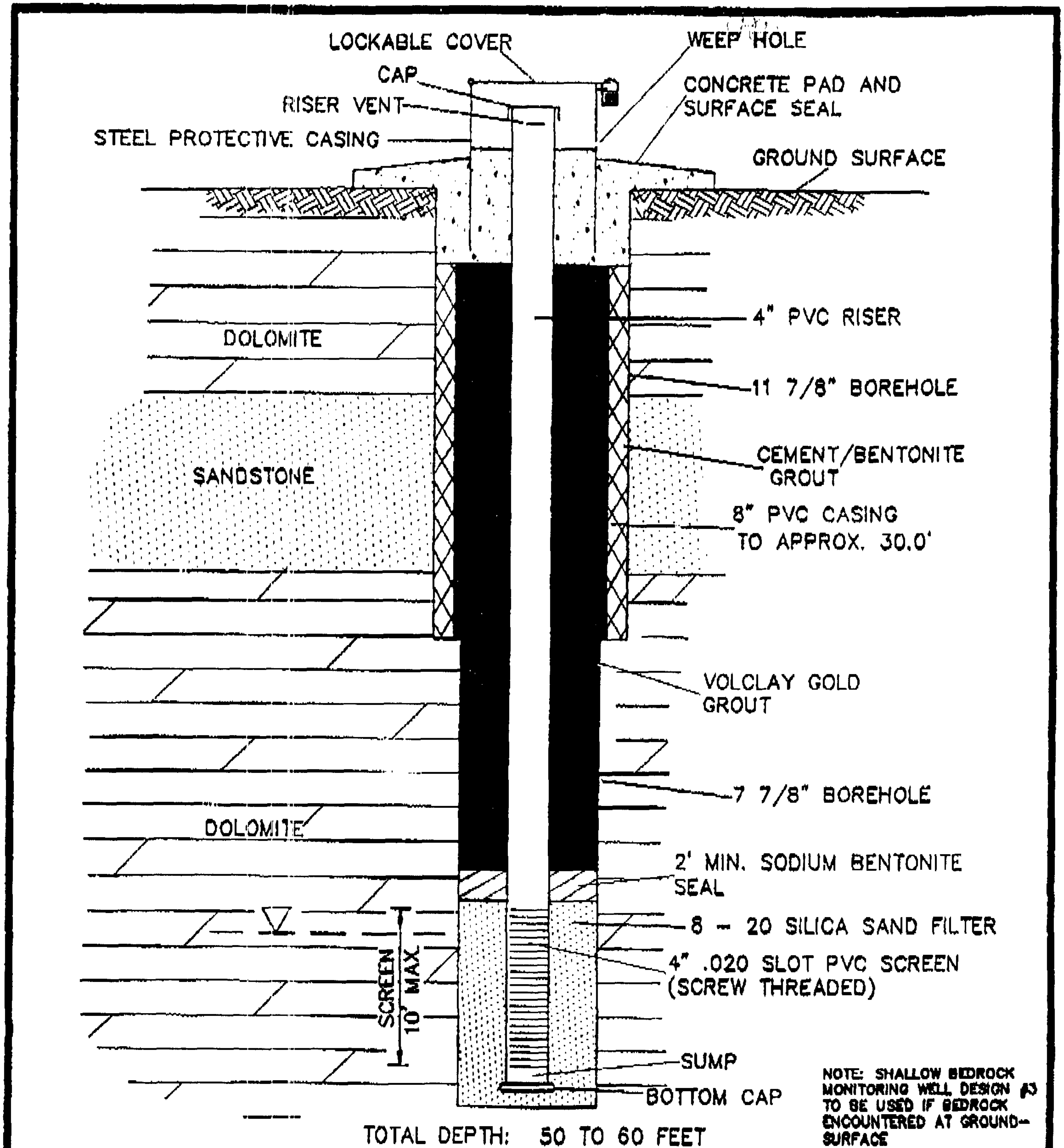


Figure Title: SHALLOW BEDROCK MONITORING WELL DESIGN #3 (TYPICAL)	Client: MARATHON OIL COMPANY
Document Title: PHASE II WORK PLAN	Location: CARLSBAD, NEW MEXICO

ROBERTS/SCHORNICK & ASSOCIATES, INC.
Environmental Consultants
3700 West Robinson, Suite 200
Norman, Oklahoma 73072
(405) 321-3895

DATE: 6/11/91	PREPARED BY: W.E.P
	CHECKED BY: W.E.P
SCALE: NTS	DRAFTED BY: S.A.R
PROJECT NO: 95029 F05	FIGURE NO.: 3

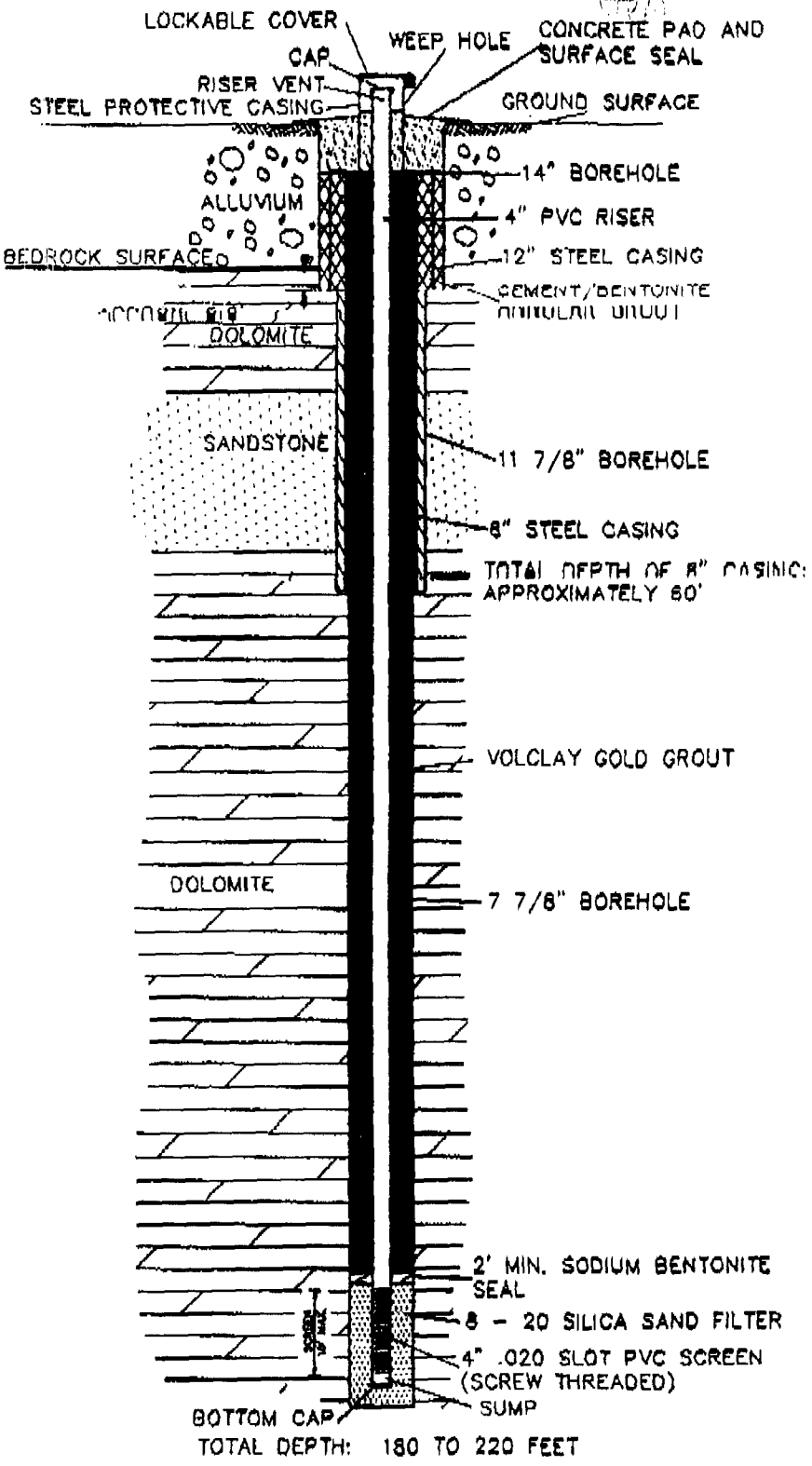


Figure Title: DEEP BEDROCK MONITORING WELL DESIGN (TYPICAL)	Client: MARATHON OIL COMPANY
Document Title: PHASE II WORK PLAN	Location: CARLSBAD, NEW MEXICO

ROBERTS/SCHORNICK & ASSOCIATES, INC.
Environmental Consultants
3740 West Robinson, Suite 200
Norman, Oklahoma 73072
(405) 321-3895

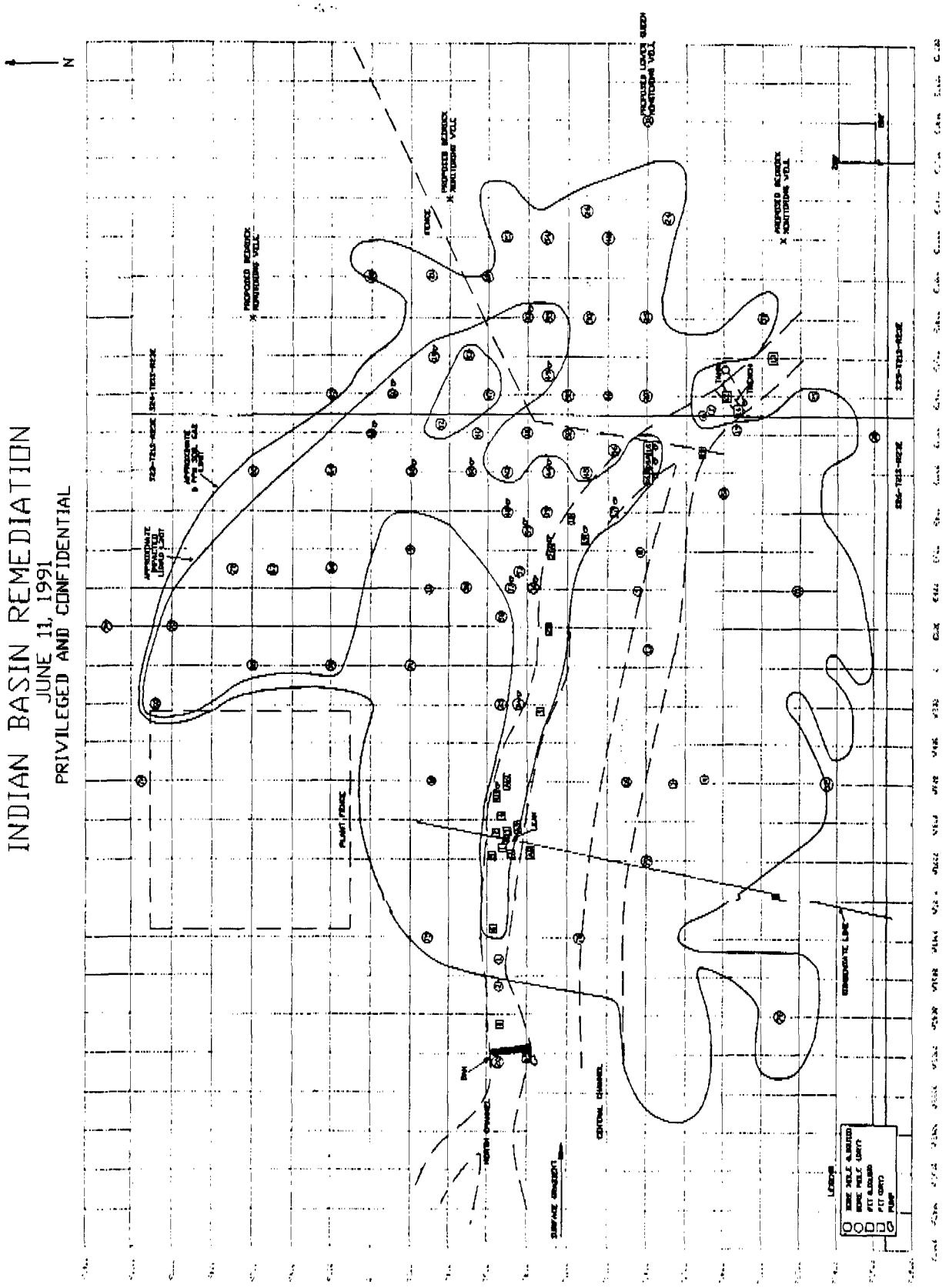
DATE: 6/11/91	PREPARED BY: W.E.P
	CHECKED BY: W.E.P
SCALE: NTS	DRAFTED BY: S.A.R
PROJECT NO: 91029 F02	FIGURE NO.: 4

PLATES

INDIAN BASIN REMEDIATION

JUNE 11, 1991

PRIVILEGED AND CONFIDENTIAL



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LIST OF APPENDICES

LIST OF EXHIBITS

EXHIBIT NO.

INTRODUCTION

A letter was received from Mr. David G. Boyer, Environmental Bureau Chief, of the Oil Conservation Division (OCD) on May 20, 1991 in response to Marathon's submission of a Site Characterization Plan (SCP) pertaining to a subsurface leak discovered south of the Indian Basin Gas Plant (IBGP) on April 12, 1991. A copy of the letter is included in APPENDIX A.

The OCD letter contains a request for information in addition to that which has already been submitted. This document has been prepared to fulfill this request for information and is structured in a format similar to the original request to ensure that each item is adequately addressed.

INVESTIGATION ACTIVITIES

1. OCD Request:

   Supply an updated map of remediation locations (soil-gas measurement points, pits, borings, etc.). Please provide an updated map weekly during the investigation phase of the remediation.

   Response:

   Marathon has supplied several updated maps indicating activities at the site during the investigation phase. Included herein as EXHIBIT 1 is the most recent map which shows all actual and boreholes planned as of that date.

2. OCD Request:

Provide updated copies of Tables 2, 3 and 4 weekly during the investigation phase. Please revise Table 3 (Soil Boring Details) to include information on whether fluids were detected and type (water and/or condensate), fluid thickness, and to indicate quality (fresh or produced water) of fluids. Include information as to whether the boreholes were completed as monitor and/or extraction wells.

Response:

An update of Table 2, Summary of Soil Gas Survey Data, is included in APPENDIX B. An update of Table 3, Summary of Soil Characterization Boring Details, is included in APPENDIX C. Please note the table has been revised to include information on whether or not fluid was detected, initial fluid column and water quality. It also indicates if the borehole was completed as a monitoring/recovery well. An update to Table 4, Summary of Soil Boring Headspace Gas Measurements, is included in APPENDIX D.

3. OCD Request:

Provide information on trenching activities (locations, rock characteristics, and type and quantity of any fluids encountered).

Response:

Included in APPENDIX E is a table providing the requested information on trenching activities. It should be noted that Pit Numbers 12, 14, and 15 were incorporated into the diversion dam and containment trench that were

put in place as part of the Rainwater Action Plan. It should also be noted that Pit Numbers 1, 3, A8, 18, and 20 have already been backfilled. Logs were not made for each excavation. The logs from those excavations for which this information was recorded are provided in Appendix F.

4. OCD Request:

Provide weekly summaries of types and volumes of fluids recovered.

Response:

Marathon has supplied several summaries of types and volumes of fluids recovered and is currently preparing and submitting the summary on Tuesday of each week. Cumulative recovery as of June 19, 1991 totaled 3151 barrels of condensate and 4166 barrels of water.

SITE GEOLOGY

1. OCD Request

Provide lithologic information on the bedrock (both sandstone and dolomite) encountered at the leak site.

Response:

The bedrock surface consists of sandstone, sandy dolomite and dolomite lithologies of the Permian Queen formation. The dolomite and sandy dolomite have very little visual porosity and appear to form a partial seal to down-

ward fluid movement. Where these rocks outcrop in the immediate area they do have a well developed joint system which has been partially mineralized. The extent to which these joints are connected and their fluid transmissibility is currently unknown, however, recent deeper bedrock tests have encountered contamination. This new information suggests the fracture system does allow fluids to slowly percolate downward from the bedrock surface.

The sandstone substrata is more porous and samples recovered from trenches in the affected area show one to three inches of staining. However, the sandstones do not appear to be as fractured as the dolomites and recent cores confirm this conclusion. These sandstones are very fine grained and look comparable to those which outcrop in other areas of Rocky Arroyo.

2. OCD Request:

Provide additional information on the lithologic and structural characteristics of subsurface material beneath the spill site to first deep groundwater (Lower Queen Aquifer). Include information and interpretation on possible occurrence and continuity of vertical joint/fracture patterns in the subsurface. (Several core holes having shallow geologic data were referenced in the attached site characteristics section of the Gas Plant Discharge Plan.)

Response:

EXHIBIT 2 is a subsurface map of the bedrock surface below the alluvial layer in Rocky Arroyo south of the IBGP. The bedrock surface dips generally from west to east in conformance with the draining pattern in the Rocky Arroyo. Several closed lows occur with relief from five to 10 feet and

these low areas appear to be important collection locations for products released from Line 4.

Cores taken from deeper bedrock wells (80-83) have shown the sandstone section to be porous and lightly fractured. The dolomites are nonporous and have varying degrees of fracturing which is sometimes extensive. However, this fracturing is related to jointing and does not appear to be well connected. The perched contaminants which have been encountered in the deep wells suggest tight lithologic sections exist within this dolomite section between the Upper and Lower Queen Aquifers. This is apparently confirmed by the deepening of well #83 to the Lower Queen Aquifer which encountered uncontaminated groundwater, as determined by field analyses.

Lithologic correlation of the deeper boreholes show that regional dip is approximately 2^{o} to the northeast. This is conformable with the regional dip of several shallow subsurface zones in the Indian Basin area.

EXHIBIT 3 is a sample log from a well drilled in Section 24, T-21-S, R-23-E. The first 60' of this well penetrated a predominantly sandstone section with thin beds of dolomite and sandy dolomite. This section may correlate to a portion of the Upper Queen Aquifer, however, it is difficult to determine without an adequate log suite for correlation. The interval between 60 ' to 190' represents the section which most likely is the bedrock surface in the majority of the affected area. It is predominantly lower porosity sandstones and dolomites of the "dry zone" described in Mr. Collins report on the groundwater of this area. In the section below 190' are the Lower Queen Aquifer and the San Andres formation at approximately 500'. It appears Mr. Collins' conclusion that Upper and Lower Queen Aquifers are not in communi-

cation through porous zones or fracturing is supported by the available subsurface data.

Also included in EXHIBIT 3 are well logs from nearby oil and gas wells which were also verbally requested.

3. OCD Request:

Some soil boring records (APPENDIX G) were illegible due to photocopying problems. Please provide complete copies of all logs.

Response:

Copies of soil boring records for the 79 shallow boreholes are included in APPENDIX G.

WATER QUALITY

1. OCD Request:

Provide an analysis of the quality of the produced water discharged with the condensate. The analysis should include both general water chemistry parameters and ICAP metal constituents (both shown on the attached sheets), plus arsenic, selenium and mercury by the appropriate EPA atomic adsorption method.

Response:

Marathon has commenced a weekly sampling program as described above. Wells that are being sampled are listed below:

DESCRIPTION	LOCATION
Lyman Water Well	21.24.20.333
Biebelle Water Well	23.21.24.3230
Lee Water Well	21.23.23.133241
IBGP Water Supply Well	21.23.23.232
IBGP Water Supply Well	21.23.23.23214

Analytical results for general water chemistry parameters for samples obtained from these wells are included in APPENDIX K. However, the normal weekly sampling program includes analyses for BTEX and chlorides only.

4. OCD Request:

In addition to the domestic wells we request that you sample the #6 and #13 stock wells shown on EXHIBIT 8 of the SCP, Indian Big Springs (21S-24E-Sec. 27.210), and the first seepage water in Rocky Arroyo downstream from the spill. Propose a schedule for future periodic monitoring of these locations.

Response:

Well #6 on EXHIBIT 8 of the SCP could not be physically located. No files exist on this well in the State Engineer's Office. Consequently, a sample could not be obtained.

Well #13 has been located. Apparently, this well has been abandoned for quite some time as it was originally equipped with a wooden windmill that has since toppled over. The well is still present, but has its casing open to atmosphere. Due to the questionable integrity of this well, a sample was not obtained.

Seepage water in Rocky Arroyo has been located approximately 4.75+ miles east of the release site. Four sites are currently being sampled. Mr. Walter Biebelle, the nearest resident, has identified them as follows:

- Upper Indian Hills Spring East
- Upper Indian Hills Spring West
- Lower Indian Hills Spring
- Arroyo Spring Water

Marathon is currently sampling these sites on a weekly basis. Analytical results are included in APPENDIX L. Once the bedrock assessment wells are completed, Marathon proposes to reduce the sampling frequency at these sites to quarterly.

Response:

A complete sample of produced water was obtained from Line #4 on May 23, 1991. Analytical results are included as APPENDIX H.

2. OCD Request:

Provide information on whether any shallow fresh water has been detected by the investigation in the vicinity of the spill. Indicate which boreholes, pits or trenches, if any, have intercepted fresh water.

Response:

The map included as EXHIBIT 1 identifies the area where boreholes and excavations encountered fluid. Sampling of these monitoring wells and sumps was initiated on May 23, 1991. A Table summarizing the analytical results is included in APPENDIX I and the actual laboratory analytical reports are included in APPENDIX J.

3. OCD Request:

In a phone call on May 8th with Mr. Tony Kavran of Marathon and myself, Marathon committed to weekly sampling of nearby domestic water wells. Please furnish the names and locations of those wells to be sampled, and constituents to be analyzed. We request that at least one sample at each well be analyzed for general water chemistry parameters.

1. OCD Request:

Provide information on the material and age of the failed section of condensate line (the SCP does not make clear whether the failed section was PVC or steel, see page 8 and 21) and whether the failure was likely due to internal or external corrosion.

Response:

The failed section of pipe was six-inch schedule 40 steel pipe. Analysis of the failed section proved the failure to be due to internal H_2S corrosion within the aqueous layer in the bottom of the externally wrapped pipe. This pipe had been in service approximately 4.5 years at the time of failure.

2. OCD Request:

EXHIBIT 9 (5-7-91) shows elevated soil-gas concentrations at some locations that appear isolated from the spill. These locations require further investigation to determine the source of this gas.

Response:

Substantially elevated soil-gas concentrations (100 ppm+) located outside of the area, where there has been liquid impact on top surface of the bedrock, have been investigated. In each case boreholes have been drilled to confirm the presence or absence of underlying liquids.

3. OCD Request:

Provide information on material, age and testing program for other sections of the Indian Basin gathering lines so that a reoccurrence of this incident does not occur. Provide a map showing the location of these lines.

Response:

The liquid gathering system was originally constructed of PVC and installed in 1965. A map of the gas gathering system is included as EXHIBIT 4. Since installation, it has been modified due to well depletions and replacement well connections; however, the majority of the current system consists of the original PVC. The connecting line from each wellhead production unit is welded steel pipe with approximately six feet of steel being buried. A transition from steel to PVC or poly pipe is then made at each well. Since the steel section at the Rocky Arroyo crossing was removed from service, no significant amount of steel pipe remains other than the connection pieces discussed above.

Direct integrity tests of the pipeline system (i.e., pressure testing) has not been performed in the past except as new lines are installed. New lines are tested prior to connection. The pipelines are checked periodically for leaks by driving the right-of-ways and visually inspecting for surface signs of leakage. Until this incident, surface checking the lines have detected leaks of less than five BBLS and was considered effective.

As a result of this incident, Marathon is currently scheduling an integrity test of the liquid gathering system during a scheduled turnaround in September, 1991. The results of this test will be analyzed to determine its effectiveness and future testing frequency.

Metering equipment will be installed on each of the four liquid gathering lines at the entrance to the plant. This will provide additional information which should be useful in identification of future leaks. Additionally, the Rocky Arroyo crossing is currently under study to determine a method for leak identification and/or containment in this area.

APPENDIX A

OIL CONSERVATION DIVISION'S MAY 15, 1991 LETTER

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

RECEIVED
MARATHON OIL COMPANY
MAY 2 0 1991
PRODUCTION MANAGER
MIDLAND OPERATIONS
MIDLAND, TEXAS

May 15, 1991

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

Environmental & Safety
Mid-Continent Region

Route	Action
AJK	
JDH	
JNK	
RFM	
BAS	
TFZ	
ELG	
FILE	

CERTIFIED MAIL
RETURN RECEIPT NO. P-327-278-118

Mr. R. F. Unger, Production Manager
Midland Operations
Marathon Oil Company
P. O. Box 552
Midland, Texas 79702

RE: April 12, 1991, Leak of Condensate and Produced Water, Marathon Indian Basin Gas Field, Eddy County, New Mexico

Dear Mr. Unger:

The New Mexico Oil Conservation Division (OCD) has received your April 22, 1991, written notification of the above leak of fluids. Verbal notification was provided to OCD on the morning of the leak discovery, as required by OCD Rule 116. Subsequent to the written notification, on April 29, 1991, OCD received a copy of the "Site Characterization Plan" (SCP) provided to the Bureau of Land Management. Both the OCD notification letter and the Site Characterization Plan provide information on the circumstances of the incident, volumes of fluids lost and interim measures being taken to investigate the extent of the spill and recover fluids.

The NMOCD has authority under both the Oil and Gas Act (70-2-1 et seq., NMSA 1978) and the New Mexico Water Quality Act (74-6-1 et seq., NMSA 1978), and rules and regulations adopted thereunder, to require actions be taken to protect public health and the environment and prevent water pollution; and to require corrective actions as are necessary or appropriate to contain, remove or mitigate the damage caused by a discharge of water pollutants. This letter is a request for your continued voluntary compliance in taking the corrective actions needed to investigate, assess, contain, remove and mitigate actual or potential environmental pollution that has been or may be caused by this spill.

MCR

MAY 2 1 1991

Environmental & Safety

cc. ADE
JLB.

file.

OCD requests that further information be provided this agency regarding the circumstances of the incident, the progress of the technical investigation and other actions proposed to be taken by Marathon. OCD will review and comment in writing on actions already taken, review for approval proposed actions, and, if necessary, require that additional actions be undertaken if to prevent or abate pollution. The Site Characterization Plan already submitted was an excellent report providing timely information on the circumstances of the spill and immediately actions taken by Marathon in response to the spill.

Request For Information

In addition to the information provided in the SCP, Marathon is required to provide the following information:

A. Investigation Activities

1. Supply an updated map of remediation locations (soil gas measurement points, pits, borings, etc.) Please provide an updated map weekly during the investigation phase of the remediation.

2. Provide updated copies of Tables 2, 3 and 4 weekly during the investigation phase. Please revise Table 3 (Soil Boring Details) to include information on whether fluids were detected and type (water and/or condensate), fluid thickness, and indicate quality (fresh or produced water) of fluids. Include information as to whether the boreholes were completed as monitor and/or extraction wells.

3. Provide information on trenching activities (locations, rock characteristics, and type and quantity of any fluids encountered).

4. Provide weekly summaries of types and volumes of fluids recovered.

B. Site Geology

1. Provide lithologic information on the bedrock (both sandstone and dolomite) encountered at the leak site.

2. Provide additional information on the lithologic and structural characteristics of subsurface material beneath the spill site to first deep ground water (Lower Queen aquifer). Include information and interpretation on possible occurrence and continuity of vertical joint/fracture patterns in the subsurface. (Several core holes having shallow geoligic data were referenced in the attached site characteristics section of the Gas Plant Discharge Plan.)

3. Some soil boring records (Appendix G) were illegible due to photocopying problems. Please provide complete copies of all logs.

C. Water Quality

1. Provide an analysis of the quality of the produced water discharged with the condensate. The analysis should include both general water chemistry parameters and ICAP metal constituents (both shown on the attached sheets), plus arsenic, selenium and mercury by the appropriate EPA atomic adsorption method.

2. Provide information on whether any shallow fresh water has been detected by the investigation in the vicinity of the spill. Indicate which boreholes, pits or trenches, if any, have intercepted fresh water.

3. In a phone call on May 8th with Mr. Tony Kavran of Marathon and myself, Marathon committed to weekly sampling of nearby domestic water wells. Please furnish the names and locations of those wells to be sampled, and constituents to be analyzed. We request that at least one sample at each well be analyzed for general water chemistry parameters.

4. In addition to the domestic wells we request that you sample the #6 and #13 stock wells shown on Exhibit 8 of the SCP, Indian Big Springs (21S-24E-Sec. 27.210), and the first seepage water in Rocky Arroyo downstream from the spill. Propose a schedule for future periodic monitoring of these locations.

D. Miscellaneous Information

1. Provide information on the material and age of the failed section of condensate line (the SCP does not make clear whether the failed section was PVC or steel, see p. 8 and 21) and whether the failure was likely due to internal or external corrosion.

2. Exhibit 9 (5-7-91) shows elevated soil-gas concentrations at some locations that appear isolated from the spill. These locations require further investigation to determine the source of this gas.

3. Provide information on material, age and testing program for other sections of the Indian Basin Gathering lines so that a reoccurrence of this incident does not occur. Provide a map showing the location of these lines.

Proposed Remediation

A. Groundwater Monitoring

Prior to drilling deep (Lower Queen) ground water monitoring wells, locations and construction details must be approved by OCD. Because of the possibility of cross-contamination, OCD discourages the drilling of deep monitor wells within the defined plume area. Any such drilling will require that special precautions be taken to prevent downward movement of contaminated fluids.

B. Remediation Plan

As discussed on page 31 of the SCP, submit a plan for product recovery and remediation of the affected area for OCD review and approval. After review of the plan, OCD will provide comments to Marathon and the BLM. During the time of review, OCD will coordinate with BLM to prevent, to the extent possible, duplication of effort. However, OCD recognizes that as the surface owner, BLM may require work in addition to that which OCD would require. Therefore, it will be necessary for Marathon consult with BLM as to their additional requirements.

Unfortunately, due to staff limitations, OCD can not provide a full-time staff person to be on-site during investigation and remediation efforts. However, OCD Artesia and OCD Santa Fe staff will visit the site periodically to monitor progress and communicate with you or your staff on the remediation.

If you have any questions regarding the information requests in this letter or on any other issue, please contact me at the above address or by phone at (505) 827-5812.

Sincerely,

David G. Boyer, Hydrogeologist
Environmental Bureau Chief

DGB/sl

Enclosures

cc: OCD Artesia Office
Kathy Sisneros, WWMD, Environment Department
Dick Manus, BLM - Carlsbad Office
Al Collar, BLM - Roswell Office

DATE: 8/18/89 REVISED:	SITE CHARACTERISTICS	PAGE 3 of 4

GEOLOGIC DESCRIPTION OF DISCHARGE SITE

The memorandum "Queen and Related Aquifers in the Indian Basin" by R. B. Collins, Jr., (Appendix D) states that no water was encountered above about 240 feet when the Marathon Water Well #1 was drilled in July, 1965. This well is referred to as Water Well 21.23.23.232 in the Collins report. The upper Queen aquifer is not in the vicinity of the gas plant. The available evidence indicates that the upper and lower Queen aquifers are not interconnected.

Information from core hole I-24-21S-23E drilled by Marathon in an adjacent section was correlated with the log of well E-23-21S-23E drilled near the Indian Basin Gas Plant. The formation characteristics from the surface to the lower Queen aquifer are:

0-60' Mainly sandstone with some dolomite

60-130' Mainly dolomite

130-530' Dolomite and Anhydrite

The interpretation of this information indicates the interval from approximately 60 feet to the lower Queen aquifer is a tight formation. This geological condition should protect the lower Queen

DATE: 8/18/89 REVISED:	SITE CHARACTERISTICS	PAGE 4 of 4

aquifer from surface contaminants.

FLOOD PROTECTION

The potential for flooding at the Indian Basin Gas Plant is virtually non-existent. Rocky Arroyo is located at a lower elevation than the gas plant. The arroyo periodically has flowing water due to runoff, but does not pose a threat to the plant.

A diversion berm has been placed on the north and west sides of the gas plant to divert flow that may occur during a major precipitation and runoff event. Runoff tends to flow in a southeasterly direction towards Rocky Arroyo.

ITEM	ANALYSIS DESCRIPTION	ITEM PRICE

032 Metals By ICAP Method 6010 — In Water [redacted]

Aluminum	Lead
Antimony	Magnesium
Arsenic	Manganese
Barium	Molybdenum
Beryllium	Nickel
Boron	Potassium
Cadmium	Selenium
Calcium	Silicon
Chromium	Silver
Cobalt	Sodium
Copper	Thallium
Iron	Vanadium
	Zinc

In Water Method 6010 [redacted]
In Soil Method 3050 [redacted]

033 Cations and Anions (General Chemistry)

Method: From 40 CFR 136.3 List of approved inorganic test procedures.

Compond	Method
Calcium	EPA Method 215.1
Potassium	EPA Method 258.1
Magnesium	EPA Method 242.1
Sodium	EPA Method 273.1
Bicarbonate	APHA 263
Carbonate	APHA 263
Chloride	EPA Method 325.3
Sulfate	EPA Method 375.4
Total dissolved solids	EPA Method 160.1
Cation/Anion Balance (5%)	
pH	
Conductivity	

In Water [redacted]

ITEM	ANALYSIS DESCRIPTION		ITEM PRICE
022	Arsenic: AA Method 7060	In Water	[redacted]
023	Barium: AA Method 7080	In Water	[redacted]
024	Chromium: AA Method 7190	In Water	[redacted]
025	Chromium (Hexavalent) AA Method 7198	In Water	[redacted]
026	Cadmium: AA Method 7130	In Water	[redacted]
027	Lead: AA Method 7421	In Water	[redacted]
028	Mercury(L): AA Method 7470	In Water	[redacted]
029	Mercury(S): AA Method 7471	In Soil ~~Water~~	[redacted]
030	Selenium: AA Method 7741	In Water	[redacted]
	OR		
031	Selenium: AA Method 7740	In Water	[redacted]

APPENDIX B

SUMMARY OF SOIL GAS SURVEY DATA

TABLE 2: SUMMARY OF SOIL GAS SURVEY DATA FROM SOIL PROBES, MARATHON OIL COMPANY, INDIAN BASIN GAS PLANT, CARLSBAD, NEW MEXICO

SOIL PROBE NUMBER	*DEPTH FT.	OVM READING, PPM (PEAK, VAC APPLIED)	OVM READING, PPM, INITIAL (PEAK, W/O VACUUM)
SP-1	REFUSAL	---	---
SP-2	1.0	36.0	---
SP-2	1.3	30.0	---
SP-3	REFUSAL	---	---
SP-4	0.7	46.1	45.0
SP-4A	0.8	35.3	21.0
SP-5	1.0	75.1	34.0
SP-5	3.5	55.3	11.0
SP-6	3.5	55.3	11.0
SP-7	1.2	3.9	2.1
SP-8	1.1	16.0	94.7
SP-9	1.0	0.9	12.0
SP-10	1.0	0.9	---
SP-11	1.0	0.0	0.0
SP-11	3.9	0.0	0.0
SP-12	1.0	25.2	71.0
SP-12	1.4	35.0	27.0
SP-13	1.0	1.0	6.0
SP-13	5.0	0.5	1.5
SP-14	1.0	0.5	1.0
SP-14	5.0	1.0	0.4
SP-15	1.0	2.1	5.5
SP-15	1.4	3.2	9.0
SP-16	1.0	0.3 B.G.	0.0
SP-16	5.0	0.3 B.G.	0.0
SP-17	1.0	0.3 B.G.	0.0
SP-17	5.0	0.3 B.G.	0.0
SP-18	1.0	0.9	0.3
SP-18	5.0	5.6	4.0
SP-19	1.0	0.3 B.G.	0.0
SP-19	5.1	0.3 B.G.	0.0
SP-20	1.0	0.0	0.4
SP-20	5.2	0.4	0.6
SP-21	1.0	4.1	12.0
SP-21	5.0	9.9	54.6
SP-22	1.0	0.4	0.4
SP-22	5.2	0.4	0.4
SP-23	1.0	0.4	0.4
SP-23	5.0	1.3	0.4
SP-24	1.0	66.0	160.0
SP-24	5.0	180.0	205.0
SP-24	7.0	242.0	161.0
SP-25	1.0	223.0	---
SP-25	5.1	55.0	158.4
SP-26	1.0	26.5	40.1
SP-26	5.2	148.0	309.0
SP-27	1.0	0.0	0.0
SP-27	5.2	0.0	0.0
SP-27	8.0	0.0	0.0
SP-28	1.0	1.7	0.5
SP-28	4.0	0.0	1.0
SP-29	1.0	1.7	0.0
SP-29	5.1	0.5	0.5

NOTE: OVM READINGS ARE PEAK READINGS WITH THE VACUUM PUMP ON.
* DENOTES DEPTH FROM GROUND LEVEL.
B.G. DENOTES OVM BACKGROUND CONCENTRATION.

TABLE 2: CONTINUED

SOIL PROBE NUMBER	*DEPTH FT.	OVM READING, PPM (PEAK, VAC APPLIED)	OVM READING, PPM, INITIAL (PEAK, W/O VACUUM)
SP-30	1.0	0.0	0.0
SP-30	5.1	20.0	1.0
SP-31	1.0	7.0	4.4
SP-31	5.0	1.9	0.6
SP-31	7.0	2.0	4.7
SP-32	1.0	0.0	0.0
SP-32	5.0	0.0	0.0
SP-33	1.1	0.0	2.0
SP-34	1.0	2.5	2.5
SP-35	1.0	0.0	0.0
SP-35	5.0	0.8	0.8
SP-35	7.0	0.0	0.8
SP-36	1.0	0.7 B.G.	0.7
SP-36	3.0	3.9	0.0
SP-37	1.0	0.7 B.G.	0.7
SP-37	5.0	0.8	0.8
SP-38	1.0	12.2	19.9
SP-38	3.0	22.0	6.3
SP-39	1.0	5.8	8.6
SP-39	3.0	13.3	30.2
SP-40	1.0	34.1	58.8
SP-40	3.0	77.1	156.8
SP-41	1.0	0.0	0.4
SP-41	3.0	0.7	0.1
SP-42	1.0	0.0	0.0
SP-42	3.5	0.0	0.4
SP-43	1.0	5.0	5.1
SP-43	5.0	6.1	5.6
SP-44	1.0	0.1	0.7
SP-44	5.1	0.0	0.4
SP-45	1.0	0.0	0.0
SP-45	5.2	0.6	0.6
SP-46	1.0	0.0	0.0
SP-46	5.2	0.0	0.0
SP-47	1.0	30.7	54.1
SP-47	3.0	44.2	128.0
SP-48	REFUSAL	---	---
SP-49	1.1	3.9	2.6
SP-50	1.1	13.5	60.5
SP-51	1.0	19.5	43.8
SP-52	REFUSAL	---	---
SP-53	1.0	0.0	0.0
SP-53	2.0	0.0	0.0
SP-54	1.0	0.0	0.0
SP-54	2.0	0.0	0.0
SP-54	3.0	0.0	0.0
SP-54	4.0	0.0	0.0
SP-54	4.4	0.0	0.0
SP-55	1.0	8.0	4.0
SP-55	2.0	10.0	8.0
SP-55	3.0	22.0	22.0
SP-55	4.0	22.0	12.0
SP-55	4.4	16.0	16.0
SP-56	1.0	34.0	42.0

NOTE: OVM READINGS ARE PEAK READINGS WITH THE VACUUM PUMP ON.
* DENOTES DEPTH FROM GROUND LEVEL.
B.G. DENOTES OVM BACKGROUND CONCENTRATION.

TABLE 2: CONTINUED

SOIL PROBE NUMBER	*DEPTH FT.	OVM READING, PPM (PEAK, VAC APPLIED)	OVM READING, PPM, INITIAL (PEAK, W/O VACUUM)
SP-56	2.0	36.0	50.0
SP-57	1.0	57.0	57.0
SP-57	1.5	76.0	71.0
SP-58	1.0	16.0 (22)	19.0 (22)
SP-59	1.0	16.0	8.0
SP-59	1.2	24.0	16.0
SP-60	1.0	0.0	0.0
SP-60	1.7	0.0	0.0
SP-61	REFUSAL	---	---
SP-62	1.0	0.0	0.0
SP-62	1.6	0.0	0.0
SP-63	1.0	0.0	0.0
SP-63	2.0	0.0	0.0
SP-64	0.8	0.0	0.0
SP-65	1.0	12.0	16.0
SP-65	1.2	32.0	9.0
SP-66	0.7	0.0	0.0
SP-67	1.0	10.0	10.0
SP-67	2.0	14.0	14.0
SP-67	3.0	17.0	28.0
SP-67	3.2	28.0	24.0
SP-68	1.0	24.0	28.0
SP-69	1.0	0.0	0.0
SP-69	2.0	0.0	0.0
SP-69	3.0	0.0	0.0
SP-70	1.0	0.0	0.0
SP-70	2.0	10.0	0.0
SP-70	3.0	7.0	7.0
SP-70	4.0	3.8	7.0
SP-70	1.0	0.0	0.0
SP-70 REPEAT	2.0	2.0	0.0
SP-70 REPEAT	3.0	2.0	2.0
SP-70 REPEAT	4.0	2.0	2.0
SP-71	1.0	0.0	7.0
SP-71 REPEAT	1.0	0.0	0.0
SP-71 REPEAT	1.0	0.0	0.0
SP-72	1.0	0.0	0.0
SP-73	1.0	0.0	2.0
SP-73	1.5	0.0	0.0
SP-73 REPEAT	1.0	0.0	0.0
SP-74	0.8	0.0	0.0
SP-74 REPEAT	1.0	2.4	2.4
SP-74 REPEAT	2.0	7.4	4.1
SP-74 REPEAT	2.5	271.0	306.0
SP-75	1.0	7.0	0.0
SP-75	2.0	5.0	2.8
SP-75	2.6	2.2	5.0
SP-75 REPEAT	1.0	2.6	1.7
SP-75	2.0	7.0	9.7
SP-75	2.6	6.0	7.0
SP-76	0.08	7.0	7.2
SP-77	1.0	1.4	1.4
SP-77	2.0	0.8	0.4
SP-77	3.0	0.9	0.7

NOTE: OVM READINGS ARE PEAK READINGS WITH THE VACUUM PUMP ON.
* DENOTES DEPTH FROM GROUND LEVEL.
B.G. DENOTES OVM BACKGROUND CONCENTRATION.

TABLE 2: CONTINUED

SOIL PROBE NUMBER	*DEPTH FT.	OVM READING, PPM (PEAK, VAC APPLIED)	OVM READING, PPM, INITIAL (PEAK, W/O VACUUM)
SP-77	4.0	0.0	0.0
SP-78	1.0	2.0	0.4
SP-78	2.0	2.0	2.0
SP-78	3.0	1.8	2.0
SP-78	4.0	133.0	1.6
SP-78	5.0	17.0	70.0
SP-78	6.0	9.0	12.0
SP-78	6.5	29.0	8.0
SP-78 REPEAT	1.0	3.0	13.0
SP-78 REPEAT	2.0	21.0	6.0
SP-78 REPEAT	3.0	11.8	16.0
SP-78 REPEAT	4.0	4.8	10.2
SP-78 REPEAT	5.0	0.0	4.8
SP-78 REPEAT	5.8	10.0	0.0
SP-78 REPEAT	1.0	1.9	0.9
SP-78 REPEAT	2.0	0.9	0.9
SP-78 REPEAT	3.0	216.0	311.0
SP-78 REPEAT	4.0	18.0	120.0
SP-78 REPEAT	5.0	4.0	16.0
SP-78 REPEAT	5.5	174.0	723.0
SP-79	0.6	1.6	2.0
SP-79 REPEAT	1.0	8.7	61.0
SP-79 REPEAT	1.7	2.0	2.8
SP-80	1.0	4.4	1.4
SP-81	1.0	13.8	14.3
SP-81	2.0	26.3	27.4
SP-81	2.5	29.4	28.9
SP-82	1.0	2.0	5.0
SP-82	1.5	0.0	0.8
SP-83	1.0	0.0	2.4
SP-84	1.0	0.8	0.8
SP-84	1.7	0.8	0.8
SP-85	1.0	0.0	0.0
SP-85	2.0	0.8	0.0
SP-85	3.0	0.0	0.0
SP-85	4.0	0.0	0.0
SP-86	0.7	0.0	0.8
SP-87	1.0	0.0	0.0
SP-87	1.6	0.0	0.0
SP-87	2.0	0.0	0.0
SP-88	0.6	0.0	0.0
SP-88	0.9	0.0	0.0
SP-89	1.0	0.0	0.0
SP-89	2.0	2.0	9.0
SP-89	2.5	0.0	3.0
SP-90	0.8	3.0	7.4
SP-91	1.0	0.0	0.0
SP-91	2.0	0.0	0.0
SP-91	3.0	0.0	0.0
SP-91	4.0	0.0	0.0
SP-91	4.4	0.0	0.0
SP-92	1.0	0.0	0.0
SP-92	2.0	0.0	0.0
SP-93	1.0	6.0	0.0
SP-94	1.0	33.0	53.7

NOTE: OVM READINGS ARE PEAK READINGS WITH THE VACUUM PUMP ON.
* DENOTES DEPTH FROM GROUND LEVEL.
B.G. DENOTES OVM BACKGROUND CONCENTRATION.

TABLE 2: CONTINUED

SOIL PROBE NUMBER	*DEPTH FT.	OVM READING, PPM (PEAK, VAC APPLIED)	OVM READING, PPM, INITIAL (PEAK, W/O VACUUM)
SP-94	2.0	61.9	25.0
SP-95	1.0	12.0	42.0
SP-95	2.0	0.0	9.0
SP-95	3.0	0.0	0.0
SP-95	4.0	0.0	0.0
SP-95	5.0	0.0	0.0
SP-95	5.5	0.0	0.0
SP-95 REPEAT	7.5	0.0	0.0
SP-95 REPEAT	1.0	---	---
SP-95 REPEAT	1.0	9.0	10.0
SP-96	1.0	0.0	0.0
SP-96	2.0	0.0	0.0
SP-96	3.0	0.0	0.0
SP-96	3.5	0.0	0.0
SP-97	1.0	45.2	45.2
SP-97	2.0	9.4	28.4
SP-97	3.0	5.2	7.3
SP-97	4.0	1.0	5.2
SP-98	1.0	0.0	0.0
SP-99	1.0	0.0	0.0
SP-99	2.0	0.0	0.0
SP-99	3.0	0.5	0.7
SP-100	1.0	39.3	82.0
SP-100	1.7	11.7	18.5
SP-101	1.0	2.5	7.2
SP-101 REPEAT	1.0	2.2	2.0
SP-102	1.4	0.7	1.2
SP-102	2.0	0.5	0.7
SP-102	2.4	0.5	0.5
SP-103	1.0	0.3	0.0
SP-103	2.0	0.0	0.0
SP-103	2.8	0.0	0.0
SP-104	1.0	1.0	3.1
SP-105	1.0	137.8	0.0
SP-105	2.0	28.0	106.3
SP-105	2.5	9.4	24.0
SP-106	1.0	0.0	5.2
SP-107	1.0	0.0	0.0
SP-107	2.0	7.4	0.0
SP-107	3.0	7.3	5.2
SP-108	1.0	5.4	6.9
SP-108	2.0	4.6	4.6
SP-108	3.0	4.6	3.4
SP-109	1.0	0.0	0.0
SP-109	2.0	0.0	0.0
SP-109	2.8	0.0	0.0
SP-110	1.0	0.0	0.0
SP-110	1.6	0.0	0.0
SP-111	1.0	0.0	0.0
SP-111	2.0	0.4	0.0

NOTE: OVM READINGS ARE PEAK READINGS WITH THE VACUUM PUMP ON.
* DENOTES DEPTH FROM GROUND LEVEL.
B.G. DENOTES OVM BACKGROUND CONCENTRATION.

TABLE 2: CONTINUED

SOIL PROBE NUMBER	*DEPTH FT.	OVM READING, PPM (PEAK, VAC APPLIED)	OVM READING, PPM, INITIAL (PEAK, W/O VACUUM)
SP-112	1.0	3.9	3.0
SP-113	1.0	4.8	1.4
SP-113	2.0	3.9	2.9
SP-113	2.8	2.4	3.4
SP-114	1.0	1.6	1.6
SP-114	2.0	0.0	0.0
SP-115	1.0	0.0	0.0
SP-115	1.5	0.0	0.0
SP-116	1.0	0.0	0.0
SP-116	2.0	0.0	0.5
SP-116	3.0	0.0	0.0
SP-117	1.0	0.5	0.5
SP-117	2.0	0.5	0.5
SP-117	3.0	0.0	0.0
SP-118	1.0	0.0	0.0
SP-118	2.0	0.0	0.0
SP-119	1.0	0.0	0.5
SP-119	1.5	0.0	0.0
SP-120	1.0	0.0	0.0
SP-120	2.0	0.0	0.0
SP-120	2.6	0.0	0.0
SP-121	1.4	0.0	0.0
SP-122	1.0	0.0	0.0
SP-122	2.0	0.0	0.0
SP-123	1.0	0.5	1.0
SP-124	1.0	1.0	0.0
SP-125	1.0	8.7	0.0
SP-125	1.4	2.1	1.6
SP-126	1.0	0.5	0.0
SP-127	1.0	0.0	0.5
SP-128	0.8	0.0	0.0
SP-129	1.0	0.0	0.0
SP-129	1.5	0.0	0.0
SP-130	1.0	2.6	8.0
SP-131	1.0	0.0	0.0
SP-132	1.0	0.0	0.0
SP-132	2.0	0.0	0.0
SP-132	3.0	0.0	0.0
SP-133	1.0	0.0	0.0
SP-133	1.5	108.0	50.8
SP-133 REPEAT	1.0	0.8	6.2
SP-133 REPEAT	1.4	277.0	236.0
SP-134	1.0	40.3	91.5
SP-134	2.0	9.8	31.6
SP-134	3.0	4.4	6.2
SP-135	1.0	0.8	2.6
SP-136	1.0	0.0	0.0
SP-136	2.0	0.0	0.0
SP-136	3.0	0.0	0.0
SP-136	4.0	0.0	0.0
SP-136	5.0	0.0	0.0
SP-137	1.0	0.0	0.0
SP-137	2.0	0.0	0.0

NOTE: OVM READINGS ARE PEAK READINGS WITH THE VACUUM PUMP ON.
* DENOTES DEPTH FROM GROUND LEVEL.
B.G. DENOTES OVM BACKGROUND CONCENTRATION.

TABLE 2: CONTINUED

SOIL PROBE NUMBER	*DEPTH FT.	OVM READING, PPM (PEAK, VAC APPLIED)	OVM READING, PPM, INITIAL (PEAK, W/O VACUUM)
SP-138	1.0	0.0	0.0
SP-138	2.0	0.0	0.0
SP-138	3.0	0.6	0.0
SP-138	4.0	0.8	0.0
SP-138	5.0	8.0	0.8
SP-138	5.5	11.6	9.8
SP-139	1.0	0.0	0.0
SP-140	1.0	4.4	6.2
SP-141	1.0	0.0	0.0
SP-142	1.0	8.0	15.1
SP-143	1.0	0.0	0.0
SP-144	1.0	15.1	27.6
SP-144	2.0	2.0	9.8
SP-144	2.5	2.6	4.2
SP-145	1.0	0.0	0.0
SP-145	2.0	0.0	0.0
SP-146	1.0	0.0	0.0
SP-147	1.0	0.0	0.0
SP-147	2.0	0.0	0.0
SP-147	3.0	0.0	0.0
SP-147	4.0	0.0	0.0
SP-147	5.0	0.0	0.0
SP-148	1.0	14.3	20.0
SP-148	2.0	32.0	18.5
SP-149	1.0	8.4	21.2
SP-149	2.0	21.7	12.8
SP-150	1.0	10.6	12.8
SP-150	2.0	20.2	10.6
SP-150	3.0	27.0	23.9
SP-151	1.0	0.5	18.3
SP-151	2.0	0.0	1.1
SP-152	1.0	6.2	4.7
SP-152	2.0	10.7	6.2
SP-152	3.0	14.4	10.6
SP-152	4.0	18.5	14.4
SP-152	5.0	19.5	15.1
SP-153	1.0	0.0	16.5
SP-153	1.5	262.0	391.0
SP-154	1.0	23.4	127.2
SP-154	2.0	23.9	29.3
SP-155	1.0	7.7	5.5
SP-155	1.5	5.5	9.2
SP-156	1.0	2.5	7.7
SP-156	2.0	1.8	3.3
SP-156	3.0	1.1	2.2
SP-156	4.0	0.5	2.2
SP-156	5.0	1.1	2.5
SP-157	1.0	1.1	0.0
SP-157	2.0	0.0	0.0
SP-157	3.0	0.3	0.0
SP-158	1.0	4.4	5.6
SP-158	2.0	8.9	3.3
SP-159	1.0	7.8	8.9

NOTE: OVM READINGS ARE PEAK READINGS WITH THE VACUUM PUMP ON.
* DENOTES DEPTH FROM GROUND LEVEL.
B.G. DENOTES OVM BACKGROUND CONCENTRATION.

TABLE 2: CONTINUED

SOIL PROBE NUMBER	*DEPTH FT.	OVM READING, PPM (PEAK, VAC APPLIED)	OVM READING, PPM, INITIAL (PEAK, W/O VACUUM)
SP-160	1.0	0.0	1.1
SP-160	1.5	1.1	1.1
SP-161	1.0	37.0	34.8
SP-161	2.0	44.4	41.5
SP-161	3.0	48.3	48.3
SP-162	1.0	44.9	40.8
SP-163	1.0	20.2	39.8
SP-163	2.0	30.3	24.7
SP-164	1.0	40.4	40.4
SP-164	2.0	79.4	64.0
SP-164	3.0	92.0	91.3
SP-165	1.0	6.3	5.4
SP-165	2.0	6.7	5.6
SP-166	1.0	0.0	1.1
SP-166	2.0	0.0	0.0
SP-167	1.0	62.9	59.6
SP-167	2.0	88.2	75.1
SP-168	1.0	13.4	17.9
SP-168	2.0	24.7	23.5
SP-168	3.0	32.5	39.3
SP-169	1.0	1.1	1.1
SP-170	1.0	121.3	117.3
SP-170	2.0	87.6	96.8
SP-171	1.0	76.8	79.7
SP-171	2.0	71.9	69.6
SP-171	3.0	47.1	98.2
SP-171	4.0	29.2	39.3
SP-172	1.0	3.3	3.2
SP-172	2.0	0.0	0.0
SP-172	3.0	0.0	0.0
SP-173	1.0	1.1	3.3
SP-173	2.0	1.1	2.2
SP-173	3.0	0.0	0.0
SP-174	1.0	0.0	0.0
SP-174	2.0	0.0	0.0
SP-174	2.5	0.0	0.0
SP-175	1.0	0.0	0.0
SP-175	2.0	0.0	0.0
SP-176	1.0	0.0	0.0
SP-176	2.0	0.0	0.0
SP-176	3.0	0.0	0.0
SP-177	1.0	0.0	0.0
SP-177	2.0	33.3	0.0
SP-177	2.5	5.1	5.1
SP-178	1.0	0.0	0.0
SP-178	2.0	0.0	0.0
SP-179	1.0	94.8	94.8
SP-179	2.0	117.9	125.6
SP-180	1.0	15.3	41.5
SP-180	2.0	2.0	7.6
SP-181	1.0	0.0	0.0
SP-181	2.0	0.0	0.0
SP-182	1.0	69.2	71.7
SP-182	2.0	89.7	105.1

NOTE: OVM READINGS ARE PEAK READINGS WITH THE VACUUM PUMP ON.
* DENOTES DEPTH FROM GROUND LEVEL.
B.G. DENOTES OVM BACKGROUND CONCENTRATION.

TABLE 2: CONTINUED

SOIL PROBE NUMBER	*DEPTH FT.	OVM READING, PPM (PEAK, VAC APPLIED)	OVM READING, PPM, INITIAL (PEAK, W/O VACUUM)
SP-183	1.0	30.7	17.9
SP-183	2.0	117.9	123.0
SP-184	1.0	2.5	2.5
SP-185	1.0	1.0	2.1
SP-186	1.0	32.9	62.6
SP-187	1.0	7.6	20.5
SP-188	1.0	0.1	3.1
SP-188	2.0	1.0	0.0
SP-189	1.0	0.0	0.0
SP-189	2.0	0.0	0.0
SP-189 REPEAT	1.0	0.0	0.0
SP-189 REPEAT	2.0	0.0	0.0
SP-189 REPEAT	3.0	0.0	0.0
SP-190	1.0	0.0	0.0
SP-190	2.0	0.0	0.0
SP-190	3.0	0.0	0.0
SP-190	4.0	21.9	70.3
SP-191	1.0	10.9	5.0
SP-191	2.0	0.0	0.0
SP-191	3.0	0.0	0.0
SP-191	4.0	0.0	0.0
SP-191 REPEAT	1.0	1.6	0.0
SP-191 REPEAT	2.0	0.0	1.0
SP-191 REPEAT	3.0	0.0	0.0
SP-192	1.0	0.0	0.0
SP-193	1.0	0.0	0.0
SP-194	1.0	205.0	466.0
SP-194 REPEAT	1.0	408.0	942.0
SP-194 REPEAT	1.0	0.0	0.0
SP-194 REPEAT	1.0	0.0	0.0
SP-195	1.0	0.0	0.0
SP-195	2.0	0.0	0.0
SP-195	3.0	0.0	0.0
SP-196	1.0	0.0	0.0
SP-196	2.0	0.0	0.0
SP-196	3.0	0.0	0.0

NOTE: OVM READINGS ARE PEAK READINGS WITH THE VACUUM PUMP ON.
* DENOTES DEPTH FROM GROUND LEVEL.
B.G. DENOTES OVM BACKGROUND CONCENTRATION.

APPENDIX C

SUMMARY OF SOIL CHARACTERIZATION BORING DETAILS

Yes or No for Availability of data

Appendix C

SUMMARY OF SOIL CHARACTERIZATION BORING DETAILS

TVOC OVM >100? >100?

Soil Boring #	Monitor Well #	Date Drilled	Drilling Method	**Total Depth, Ft.	**Depth to Bedrock Ft.	Free Fluid Encountered	Condensate (C) and/or Water (W)	Initial Fluid Column Ft	Water Quality Chlorides (mg/L)	Water Quality TDS (mg/L)
BH-1		4/18/91	HSA	5.1	---	No	NA	NA	NA	NA
BH-2		4/19/91	HSA	3.0	---	No	NA	NA	NA	NA
BH-3		4/19/91	HSA	12.7	12.7*	No	NA	NA	NA	NA
BH-4		4/22/91	HSA	11.2	11.0	No	NA	NA	NA	NA
BH-5		4/20/91	HSA	7.5	7.5*	No	NA	NA	NA	NA
BH-6		4/21/91	HSA	4.0	4.0	No	NA	NA	NA	NA
BH-7		4/21/91	HSA	4.1	4.0	No	NA	NA	NA	NA
BH-8		4/22/91	HSA	11.2	11.0	No	NA	NA	NA	NA
BH-9		4/23/91	HSA	9.0	9.0*	No	NA	NA	NA	NA
BH-10		4/23/91	HSA	13.0	13.0*	No	NA	NA	NA	NA
BH-11		4/24/91	HSA	13.1	13.0	No	NA	NA	NA	NA
Yes — BH-12		4/24/91	HSA	12.5	12.3	No	NA	NA	NA	NA
yes - BH-13		4/25/91	HSA	14.2	14.1	No	MA	NA	NA	NA
Yes Yes - BH-14	MW-1	4/25/91	HSA	15.1	15.0	Yes	C&W	3.75	310	820
BH-15		4/25/91	HSA	13.0	13.0*	No	NA	NA	NA	NA
BH-16		4/26/91	HSA	14.0	14.0*	No	NA	NA	NA	NA
BH-17		4/26/91	HSA	10.0	10.0*	No	NA	NA	NA	NA
BH-18		4/26/91	HSA	14.5	14.5	No	NA	NA	NA	NA
BH-19		4/27/91	HSA	13.6	13.6*	No	NA	NA	NA	NA
BH-20		4/28/91	HSA	12.0	11.5	No	NA	NA	NA	NA
BH-21	MW-36	4/30/91	HSA	5.1	5.1*	No	NA	NA	NA	NA
BH-22		4/30/91	HSA	14.4	14.2	No	NA	NA	NA	NA
BH-23	MW-2	5/01/91	HSA	13.8	13.8*	No	NA	NA	NA	NA
BH-24	MW-3	5/02/91	HSA	15.3	15.0	No	NA	NA	NA	NA
BH-25		5/03/91	HSA	2.6	2.6*	No	NA	NA	NA	NA
BH-26	MW-4	5/03/91	HSA	16.9	16.8	No	NA	NA	NA	NA
BH-27		5/04/91	HSA	3.4	3.4*	No	NA	NA	NA	NA
BH-28	MW-5	5/04/91	HSA	11.2	3.7	No	NA	NA	NA	NA

Note: --- No Data
HSA - Hollow Stem Auger
* - Estimated Based on Auger Refusal Depth
**Depth Measured from Ground Surface in Feet
NA - Not Applicable

SUMMARY OF SOIL CHARACTERIZATION BORING DETAILS (CONT'D)

TVOC OVM >100? >100?	Soil Boring #	Monitor Well #	Date Drilled	Drilling Method	**Total Depth, Ft.	**Depth to Bedrock Ft.	Free Fluid Encountered	Condensate (C) and/or Water (W)	Initial Fluid Column Ft	Water Quality Chlorides (mg/L)	Water Quality TDS (mg/L)
	BH-29	MW-6	5/05/91	HSA	12.3	12.3*	No	NA	NA	NA	NA
	BH-30	MW-7	5/06/91	HSA	16.25	15.5	No	NA	NA	NA	NA
	BH-31	MW-8	5/06/91	HSA	15.5	15.5*	No	NA	NA	NA	NA
Missing	BH-32	MW-9	5/07/91	HSA	12.0	9.5	No	NA	NA	NA	NA
yes	BH-33	MW-10	5/07/91	HSA	16.5	16.5*	Yes	C&W	1.01	60	1600
yes	BH-34	MW-11	5/08/91	HSA	22.5	22.2	Yes	C&W	0.5	---	---
yes	BH-35	MW-12	5/09/91	HSA	23.2	23.0	No	NA	NA	NA	NA
yes	BH-36	MW-13	5/10/91	HSA	19.7	19.2	Yes	C&W	---	---	---
yes	BH-37	MW-14	5/11/91	HSA	22.0	20.5	Yes	C&W	---	---	---
	BH-38	MW-15	5/11/91	HSA	17.4	17.4*	No	NA	NA	NA	NA
yes	BH-39	MW-16	5/12/91	HSA	21.0	20.5	Yes	C&W	---	---	---
yes	BH-40	MW-17	5/13/91	HSA	17.7	17.7*	Yes	C&W	1.8	---	---
yes	BH-41	MW-18	5/14/91	HSA	15.2	15.2*	Yes	C&W	1.3	310	1580
yes	BH-42	MW-19	5/15/91	HSA	17.3	17.3*	Yes	C&W	2.5	320	1540
yes	BH-43	MW-20	5/16/91	HSA	14.1	14.1*	No	NA	NA	NA	NA
No! NO!	BH-44	MW-21	5/16/91	HSA	21.2	18.0	Yes	C&W	0.7	230	1220
	BH-45	MW-22	5/17/91	HSA	15.6	15.5	No	NA	NA	NA	NA
	BH-46	MW-23	5/17/91	HSA	10.9	10.8	No	NA	NA	NA	NA
	BH-47	MW-24	5/18/91	HSA	11.0	10.9	No	NA	NA	NA	NA
	BH-48	MW-25	5/18/91	HSA	8.3	8.2	No	NA	NA	NA	NA
yes	BH-49	MW-26	5/18/91	HSA	19.5	19.4	Yes	C&W	1.8	440	1650
	BH-50	MW-27	5/19/91	HSA	16.0	16.0*	No	NA	NA	NA	NA
	BH-51		5/20/91	HSA	7.0	1.5	No	NA	NA	NA	NA
	BH-52	MW-28	5/20/91	HSA	17.0	17.0*	No	NA	NA	NA	NA
	BH-53	MW-29	5/20/91	HSA	12.3	12.3*	No	NA	NA	NA	NA
	BH-54	MW-30	5/21/91	HSA	12.5	10.5	No	NA	NA	NA	NA
No!	BH-55	MW-31	5/21/91	HSA	17.4	17.4*	Yes	C&W	0.4	---	---
	BH-56	MW-32	5/22/91	HSA	14.5	14.5*	No	NA	NA	NA	NA
yes	BH-57	MW-33	5/23/91	HSA	18.65	18.5	Yes	C&W	---	---	---
yes	BH-58	MW-34	5/23/91	HSA	18.6	18.6*	No	NA	NA	NA	NA
yes	BH-59	MW-35	5/24/91	HSA	18.9	18.9	Yes	C&W	2.1	---	---

Note: --- No Data
HSA - Hollow Stem Auger
* - Estimated Based on Auger Refusal Depth
**Depth Measured from Ground Surface in Feet
NA - Not Applicable

SUMMARY OF SOIL CHARACTERIZATION BORING DETAILS (CONT'D)

VOC >100?	OVM >100?	Soil Boring #	Monitor Well #	Date Drilled	Drilling Method	**Total Depth, Ft.	**Depth to Bedrock Ft.	Free Fluid Encountered	Condensate (C) and/or Water (W)	Initial Fluid Column Ft	Water Quality Chlorides (mg/L)	Water Quality TDS (mg/L)
	yes -	BH-60	MW-37	5/26/91	HSA	19.3	19.2	Yes	W	6.3	---	---
yes	yes -	BH-61	MW-38	5/27/91	HSA	18.4	14.2	Yes	W	3.4	60	790
NO	yes -	BH-62	MW-39	5/27/91	HSA	19.5	17.8	Yes	W	---	9.6	---
		BH-63	MW-40	5/27/91	HSA	12.1	12.1*	No	NA	NA	NA	NA
	yes -	BH-64	MW-41	5/27/91	HSA	23.0	23.0	Yes	W	8.0	---	---
		BH-65	MW-42	5/30/91	HSA	22.0	7.5	No	NA	NA	NA	NA
	yes -	BH-66	MW-43	5/31/91	HSA	22.4	19.4	Yes	W	4.7	---	---
	missing -	BH-67	MW-44	6/01/91	HSA	22.3	22.1	Yes	W	7.6	---	---
ND		BH-68	MW-45	6/02/91	HSA	24.0	9.3	Yes	W	5.5	451	5440
	yes -	BH-69	MW-46	6/02/91	HSA	18.2	17.9	Yes	W	5.7	---	---
	yes -	BH-70	MW-47	6/03/91	HSA	19.7	19.7*	Yes	W	---	---	---
	yes -	BH-71	MW-48	6/04/91	HSA	32.0	19.0	No	NA	NA	NA	NA
		BH-72	MW-49	6/05/91	HSA	24.0	3.0	Yes	W	---	---	---
NO	yes -	BH-73	MW-50	6/05/91	HSA	35.0	2.5	Yes	W	9.0	376	6070
		BH-74	MW-51	6/06/91	HSA	18.5	17.9	Yes	W	2.0	---	---
		BH-75	MW-52	6/07/91	HSA	19.2	19.0	No	NA	NA	NA	NA
	49ppm	BH-76		6/07/91	HSA	3.5	3.5	No	NA	NA	NA	NA
		BH-77	MW-53	6/07/91	HSA	13.6	3.6*	No	NA	NA	NA	NA
		BH-78		6/08/91	HSA	6.4	6.4*	No	NA	NA	NA	NA
		BH-79		6/08/91	HSA	3.8	2.0	No	NA	NA	NA	NA

Note: --- No Data
HSA - Hollow Stem Auger
* - Estimated Based on Auger Refusal Depth
(Depth Measured from Ground Surface in Feet
NA - Not Applicable

APPENDIX D

SUMMARY OF SOIL BORING HEADSPACE GAS MEASUREMENTS

TABLE 4: SUMMARY OF SOIL GAS HEADSPACE MEASUREMENTS FROM SOIL BORINGS
MARATHON OIL COMPANY, INDIAN BASIN GAS PLANT, CARLSBAD, NEW MEXICO

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-1	18-Apr-91	0.0 - 2.5	NS	BACKGROUND
		2.5 - 3.5	0.1	SOIL: 0.1 PPM
		3.5 - 4.0	NR	AIR: 0.2 PPM
		4.0 - 5.1	0.1	
		5.1 - 5.5	NR	
BH-2	19-Apr-91	0.0 - 2.5	NS	BACKGROUND
		2.5 - 3.7	1.0	SOIL: 0.1 PPM
		3.7 - 4.0	NR	AIR: 0.2 PPM
BH-3	19-Apr-91	0.0 - 1.5	0.1	BACKGROUND
		1.5 - 2.5	NS	SOIL: 0.1 PPM
		2.5 - 3.3	1.8	AIR: 0.1 PPM
		3.3 - 4.0	NR	
		4.0 - 5.1	4.8	
		5.1 - 5.5	NR	
		5.5 - 9.0	NS	
		9.0 - 10.2	0.3	
		10.2 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 12.4	0.2	
		12.4 - 12.7	NR	
BH-4	22-Apr-91	0.0 - 1.0	0.2	BACKGROUND
		1.0 - 2.5	NS	SOIL: 0.1 PPM
		2.5 - 4.0	0.4	AIR: 0.4 PPM
		4.0 - 5.5	0.4	
		5.5 - 9.0	NS	
		9.0 - 9.8	0.2	
		9.8 - 10.5	NR	
BH-5	20-Apr-91	0.0 - 1.0	0.7	BACKGROUND
		1.0 - 2.5	NS	SOIL: 0.1 PPM
		2.5 - 3.7	1.8	AIR: 0.2 PPM
		3.7 - 4.0	NR	
		4.0 - 5.2	0.8	
		5.2 - 5.5	NR	
		5.5 - 6.0	NS	
		6.0 - 7.2	0.6	
		7.2 - 7.5	NR	
BH-6	21-Apr-91	0.0 - 2.5	NS	BACKGROUND
		2.5 - 3.0	0.1	SOIL: 0.1 PPM
		3.0 - 3.5	NR	AIR: 0.1 PPM
		3.5 - 4.0	NS	
BH-7	21-Apr-91	0.0 - 2.5	NS	BACKGROUND
		2.5 - 3.9	0.1	SOIL: 0.1 PPM
		3.9 - 4.0	NR	AIR: 0.1 PPM
BH-8	22-Apr-91	0.0 - 1.0	0.7	BACKGROUND
		1.0 - 4.0	NS	SOIL: 0.2 PPM
		4.0 - 4.8	0.4	AIR: 0.4 PPM

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
		4.8 - 5.5	NR	
		5.5 - 9.0	NS	
		9.0 - 9.9	1.0	
		9.9 - 10.6	NR	
		10.6 - 11.0	NR	
BH-9	23-Apr-91	0.0 - 2.0	0.4	BACKGROUND
		2.0 - 2.6	0.2	SOIL: 0.1 PPM
		2.6 - 3.0	NR	AIR: 0.2 PPM
		3.0 - 5.0	0.2	
		5.0 - 6.1	NR	
		6.1 - 9.0	NS	
		9.0 - 9.5	NR	
BH-10	23-Apr-91	0.0 - 1.0	0.3	BACKGROUND
		1.0 - 2.5	NS	SOIL: 0.2 PPM
		2.5 - 4.0	0.7	AIR: 0.2 PPM
		4.0 - 4.8	0.5	
		4.8 - 5.5	NR	
		5.5 - 9.0	NS	
		9.0 - 9.5	0.4	
		9.5 - 13.0	NS	
		13.0 - 13.2	0.2	
BH-11	24-Apr-91	0.0 - 1.0	0.3	BACKGROUND
		1.0 - 2.5	NR	SOIL: 0.1 PPM
		2.5 - 4.0	0.1	AIR: 0.1 PPM
		4.0 - 5.2	0.1	
		5.2 - 5.5	NR	
		5.5 - 9.0	NS	
		9.0 - 10.1	0.1	
		10.1 - 10.5	NR	
		10.5 - 13.0	NS	
		13.0 - 13.1	42.0	
BH-12	24-Apr-91	0.0 - 1.0	0.2	BACKGROUND
		1.0 - 2.5	NS	SOIL: 0.1 PPM
		2.5 - 3.8	0.3	AIR: 0.1 PPM
		3.8 - 4.0	NR	
		4.0 - 5.0	0.3	
		5.0 - 5.5	NR	
		5.5 - 9.0	NS	
		9.0 - 9.8	0.2	
		9.8 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 12.2	220.0	
		12.2 - 12.5	NR	
BH-13	25-Apr-91	0.0 - 1.0	0.6	BACKGROUND
		1.0 - 2.5	NS	SOIL: 0.2 PPM
		2.5 - 3.7	0.2	AIR: 1.5 PPM
		3.7 - 4.0	NR	
		4.0 - 5.5	0.2	
		5.5 - 9.0	NS	
		9.0 - 10.5	0.2	
		10.5 - 14.0	NS	
		14.0 - 14.1	320.0	
		14.1 - 14.2	NR	

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-14 (MW-1)	25-Apr-91	0.0 - 1.0	0.2	BACKGROUND
		1.0 - 2.5	NS	SOIL: 0.2 PPM
		2.5 - 3.6	0.2	AIR: 0.5 PPM
		3.6 - 4.0	NR	
		4.0 - 9.0	NS	
		9.0 - 9.8	0.4	
		9.8 - 10.5	NR	
		10.5 - 13.5	NS	
		14.7 - 15.0	220.0	
		15.0 - 15.1	NR	
BH-15	25-Apr-91	0.0 - 1.0	0.2	BACKGROUND
		1.0 - 2.5	NS	SOIL: 0.1 PPM
		2.5 - 3.3	0.8	AIR: 0.8 PPM
		3.3 - 4.0	NR	
		4.0 - 4.9	1.0	
		4.9 - 5.0	NR	
		5.0 - 9.0	NS	
		9.0 - 9.6	2.6	
		9.6 - 10.5	NR	
		10.5 - 13.0	NS	
		13.0 - 13.1	30.0	
BH-16	26-Apr-91	0.0 - 1.0	---	BACKGROUND
		1.0 - 2.5	NS	SOIL: 0.0 PPM
		2.5 - 3.3	---	AIR: 0.0 PPM
		3.3 - 4.0	NR	
		4.0 - 4.5	---	
		4.5 - 5.5	NR	
		5.5 - 8.0	NS	
		8.0 - 9.0	---	
		9.0 - 9.5	NR	
		9.5 - 14.0	NS	
		14.0 - 14.2	NR	
BH-17	26-Apr-91	0.0 - 1.0	---	BACKGROUND
		1.0 - 2.5	NS	SOIL: 0.0 PPM
		2.5 - 4.0	---	AIR: 0.0 PPM
		4.0 - 4.3	---	
		4.3 - 5.5	NR	
		5.5 - 9.0	NS	
		9.0 - 9.8	---	
		9.8 - 10.0	NR	
BH-18	26-Apr-91	0.0 - 1.0	---	BACKGROUND
		1.0 - 2.5	NS	SOIL: 0.0 PPM
		2.5 - 3.5	---	AIR: 0.0 PPM
		3.5 - 4.0	NR	
		4.0 - 4.5	---	
		4.5 - 5.5	NR	
		5.5 - 9.0	NS	
		9.0 - 10.5	---	
		10.5 - 14.0	NS	
		14.0 - 15.5	---	

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-19	27-Apr-91	0.0 - 2.5	NS	BACKGROUND
		2.5 - 3.0	0.0	SOIL: 0.0 PPM
		3.0 - 4.0	NR	AIR: 2.0 PPM
		4.0 - 5.0	NS	
		5.0 - 5.9	0.0	
		5.9 - 6.5	NR	
		6.5 - 7.5	NS	
		7.5 - 8.8	0.0	
		8.8 - 9.0	NR	
		9.0 - 10.0	NS	
		10.0 - 11.2	0.0	
		11.2 - 11.5	NR	
		2.5 - 3.3	0.0	SOIL: 0.0 PPM
		3.3 - 4.0	NR	AIR: 2.0 PPM
		4.0 - 5.0	NS	
		5.0 - 5.9	0.0	
		5.9 - 6.5	NR	
		6.5 - 7.5	NS	
		7.5 - 9.0	0.0	
		9.0 - 10.0	NS	
		10.0 - 11.3	0.0	
		11.3 - 11.5	NR	
		11.5 - 11.8	0.0	
BH-21	30-Apr-91	0.0 - 2.5	NS	BACKGROUND
		2.5 - 3.5	1.4	SOIL: 0.0 PPM
		3.5 - 4.1	NS	AIR: 0.0 PPM
		4.1 - 5.1	1.0	
BH-22	30-Apr-91	0.0 - 2.5	NS	BACKGROUND
		2.5 - 3.9	0.9	SOIL: 0.0 PPM
		3.9 - 4.0	NR	AIR: 0.0 PPM
		4.0 - 4.2	0.2	
		4.2 - 7.5	NS	
		7.5 - 8.0	1.9	
		8.0 - 9.0	NS	
		9.0 - 10.3	2.7	
		10.3 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 13.5	2.9	
		13.5 - 13.7	NS	
		13.7 - 14.4	1.7	
BH-23 (MW-2)	01-May-91	0.0 - 2.5	NS	BACKGROUND
		2.5 - 3.7	7.0	SOIL: 0.0 PPM
		3.7 - 4.0	NR	AIR: 0.0 PPM
		4.0 - 5.0	NS	
		5.0 - 6.4	1.6	
		6.4 - 6.5	NR	
		6.5 - 7.0	NS	
		7.0 - 7.3	2.0	
		7.3 - 9.0	NS	
		9.0 - 9.9	3.5	
		9.9 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 12.8	3.1	
		12.8 - 13.7	NR	
		13.7 - 13.9	NS	

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-24 (MW-3)	02-May-91	0.0 - 2.5	NS	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		2.5 - 4.0	0.0	
		4.0 - 5.0	NS	
		5.0 - 6.0	0.0	
		6.0 - 6.5	NR	
		6.5 - 7.5	NS	
		7.5 - 8.6	0.0	
		8.6 - 9.0	NR	
		9.0 - 10.0	NS	
		10.0 - 10.8	0.0	
		10.8 - 11.5	NR	
		11.5 - 12.5	NS	
		12.5 - 13.3	0.8	
		13.3 - 14.0	NR	
		14.0 - 15.0	2.9	
		15.0 - 15.3	NR	
BH-25	03-May-91	0.0 - 2.0	NS	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		2.0 - 2.6	3.5	
BH-26 (MW-4)	03-May-91	0.0 - 2.5	NS	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		2.5 - 3.4	0.0	
		3.4 - 4.0	NR	
		4.0 - 5.5	0.0	
		5.5 - 7.0	NS	
		7.0 - 8.0	0.0	
		8.0 - 8.5	NR	
		8.5 - 9.0	NS	
		9.0 - 9.8	0.0	
		9.8 - 10.5	NR	
		10.5 - 12.5	NS	
		12.5 - 13.0	NR	
		13.0 - 13.5	NS	
		13.5 - 14.1	0.0	
		14.1 - 14.5	NR	
		14.5 - 16.9	NS	
BH-27	04-May-91	0.0 - 2.5	NS	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		2.5 - 3.4	37.0	
BH-28 (MW-5)	04-May-91	0.0 - 2.5	NS	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		2.5 - 3.7	0.0	
		3.7 - 4.0	NR	
		4.0 - 5.0	NS	
		5.0 - 6.0	0.0	
		6.0 - 7.0	NS	
		7.0 - 7.6	2.0	
		7.6 - 9.0	---	
		9.0 - 9.3	0.0	
		9.3 - 11.0	NS	
		11.0 - 11.2	0.0	

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-29 (MW-6)	05-May-91	0.0 - 2.5	NS	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		2.5 - 3.6	13.0	
		3.6 - 4.0	NR	
		4.0 - 5.0	NS	
		5.0 - 5.7	6.0	
		5.7 - 7.0	NS	
		7.0 - 8.2	6.0	
		8.2 - 8.5	NS	
		8.5 - 9.1	11.0	
		9.1 - 12.3	NS	
BH-30 (MW-7)	06-May-91	0.0 - 0.6	0.2	BACKGROUND SOIL: 0.2 PPM AIR: 0.2 PPM
		0.6 - 2.5	NR	
		2.5 - 4.0	42.0	
		4.0 - 5.5	38.0	
		5.5 - 8.0	NS	
		8.0 - 9.5	NR	
		9.5 - 9.9	16.0	
		9.9 - 10.3	NR	
		10.3 - 12.0	NS	
		12.0 - 12.6	0.7	
		12.6 - 13.5	NR	
		13.5 - 15.0	0.2	
		15.0 - 16.0	NR	
		16.0 - 16.25	NS	
BH-31 (MW-8)	06-May-91	0.0 - 1.0	0.9	BACKGROUND SOIL: 0.2 PPM AIR: 0.2 PPM
		2.0 - 2.5	---	
		2.5 - 3.2	369.0	
		3.2 - 4.0	NR	
		4.0 - 5.1	5.3	
		5.1 - 5.5	NR	
		5.5 - 7.0	NS	
		7.0 - 7.8	24.1	
		7.8 - 8.5	NR	
		8.5 - 9.0	NS	
		9.0 - 10.0	0.2	
		10.0 - 12.0	NS	
		12.0 - 12.4	0.2	
		12.4 - 14.0	NS	
		14.0 - 14.1	0.2	
		14.1 - 15.0	NS	
		15.0 - 15.3	NR	

NOTE:
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NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-34 (MW-11)	08-May-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.2 PPM
		1.0 - 2.5	NS	
		2.5 - 3.6	0.0	
		3.6 - 4.0	NR	
		4.0 - 5.1	0.0	
		5.1 - 5.5	NR	
		5.5 - 7.0	NS	
		7.0 - 8.1	0.0	
		8.1 - 8.5	NR	
		8.5 - 9.0	NS	
		9.0 - 10.3	2.5	
		10.3 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 13.5	8.6	
		13.5 - 15.0	NS	
		15.0 - 15.2	NR	
		15.2 - 17.5	NS	
		17.5 - 19.0	479.0	
		19.0 - 20.0	NS	
		20.0 - 21.2	545.0	
		21.2 - 21.3	NR	
		21.3 - 22.0	NS	
		22.0 - 22.5	605.0	
BH-35 (MW-12)	09-May-91	0.0 - 0.5	0.8	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		0.5 - 2.5	NS	
		2.5 - 4.0	1.1	
		4.0 - 4.5	0.2	
		4.5 - 5.5	NR	
		5.5 - 7.0	NS	
		7.0 - 8.5	1.6	
		8.5 - 9.5	NS	
		9.5 - 10.5	2.5	
		10.5 -11.0	NR	
		11.0 - 12.0	NS	
		12.0 - 12.3	1.1	
		12.3 - 12.5	NR	
		12.5 - 13.0	NS	
		13.0 - 14.0	NS	
		14.0 - 14.8	9.1	
		14.8 - 15.5	NR	
		15.5 - 17.5	NS	
		17.5 - 19.0	47.1	
		19.0 - 19.7	157.5	
		19.7 - 20.0	NR	
		20.0 - 22.5	NS	
		22.5 - 23.0	440.0	
BH-36 (MW-13)	10-May-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.5	0.0	
		3.5 - 4.0	NR	
		4.0 - 4.5	0.0	
		4.5 - 5.5	NR	
		5.5 - 7.0	NS	
		7.0 - 7.4	0.0	
		7.4 - 8.5	NR	

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NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
		8.5 - 9.0	NS	
		9.0 - 10.1	0.0	
		10.1 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 13.5	0.0	
		13.5 - 14.0	NS	
		14.0 - 14.4	0.0	
		14.4 - 17.0	NS	
		17.0 - 18.0	204.0	
		18.0 - 18.5	NR	
		18.5 - 19.0	NS	
		19.0 - 19.7	460.0	
BH-37 (MW-14)	11-May-91	0.0 - 1.0	1.7	BACKGROUND SOIL: 0.2 PPM AIR: 0.2 PPM
		1.0 - 2.5	NS	
		2.5 - 3.8	18.1	
		3.8 - 4.0	NR	
		4.0 - 5.1	253.0	
		5.1 - 5.5	NR	
		5.5 - 7.0	NS	
		7.0 - 7.4	213.0	
		7.4 - 8.5	NR	
		8.5 - 9.0	NS	
		9.0 - 9.7	728.0	
		9.7 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 13.0	228.0	
		13.0 - 14.0	NS	
		14.0 - 14.5	109.0	
		14.5 - 17.0	NS	
		17.0 - 17.8	269.0	
		17.8 - 18.0	NR	
		18.0 - 19.0	NS	
		19.0 - 19.5	322.0	
		19.5 - 22.0	NS	
		22.0 - 22.5	342.0	
BH-38 (MW-15)	11-May-91	0.0 - 1.0	1.1	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.7	1.0	
		3.7 - 4.0	NR	
		4.0 - 5.1	0.2	
		5.1 - 5.3	NR	
		5.3 - 7.0	NS	
		7.0 - 7.4	1.1	
		7.4 - 8.3	NR	
		8.3 - 9.0	NS	
		9.0 - 9.8	4.4	
		9.8 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 12.4	4.9	
		12.4 - 14.0	NS	
		14.0 - 15.0	35.0	
		15.0 - 15.5	NR	
		15.5 - 17.0	NS	
		17.0 - 17.4	NR	

NOTE:
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*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-39 (MW-16)	12-May-91	0.0 - 1.0	0.8	BACKGROUND SOIL: 0.1 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.4	2.1	
		3.4 - 4.0	NR	
		4.0 - 5.0	0.2	
		5.0 - 5.5	NR	
		5.5 - 7.0	NS	
		7.0 7.8	0.7	
		7.8 - 8.5	NR	
		8.5 - 9.0	NS	
		9.0 - 9.8	0.7	
		9.8 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 12.8	2.6	
		12.8 - 13.5	NR	
		13.5 - 14.5	NS	
		14.5 - 15.1	6.8	
		15.1 - 15.5	NR	
		15.5 - 17.0	NS	
		17.0 - 17.8	17.1	
		17.8 - 18.5	NR	
		18.5 - 19.0	NS	
		19.0 - 19.9	269.0	
		19.9 - 20.5	NR	
		20.5 - 21.0	268.0	
BH-40 (MW-17)	13-May-91	0.0 - 2.5	NS	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		2.5 - 3.4	0.0	
		3.4 - 4.0	NR	
		4.0 - 5.0	NS	
		5.0 - 5.4	0.0	
		5.4 - 6.5	NR	
		6.5 - 7.0	NS	
		7.0 - 8.1	7.0	
		8.1 - 10.0	NS	
		10.0 - 10.5	0.0	
		10.5 - 11.5	NR	
		11.5 - 12.0	NS	
		12.0 - 12.1	0.0	
		12.1 - 12.7	NS	
		12.7 - 13.0	11.0	
		13.0 - 14.0	NS	
		14.0 - 14.5	30.0	
		14.5 - 17.0	NS	
		17.0 - 17.1	276.0	
		17.1 - 17.7	NS	

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*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-41	14-May-91	0.0 - 2.5	NS	BACKGROUND
(MW-18)		2.5 - 3.7	11.5	SOIL: 0.0 PPM
		3.7 - 4.0	NR	AIR: 0.0 PPM
		4.0 - 5.0	NS	
		5.0 - 6.1	0.0	
		6.1 - 6.5	NR	
		6.5 - 7.5	NS	
		7.5 - 8.5	2.8	
		8.5 - 9.0	NR	
		9.0 - 10.0	50.0	
		10.0 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 12.5	378.0	
		12.5 - 13.5	NR	
		13.5 - 13.6	408.0	
		13.6 - 15.2	NS	
BH-42	15-May-91	0.0 - 2.5	NS	BACKGROUND
(MW-19)		2.5 - 3.5	0.0	SOIL: 0.0 PPM
		3.5 - 4.0	NR	AIR: 0.0 PPM
		4.0 - 5.0	NS	
		5.0 - 6.3	0.0	
		6.3 - 6.5	NR	
		6.5 - 7.5	NS	
		7.5 - 8.5	0.0	
		8.5 - 9.0	NR	
		9.0 - 9.9	59.0	
		9.9 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 13.1	124.0	
		13.1 - 14.0	NS	
		14.0 - 15.0	344.0	
		15.0 - 17.0	NS	
		17.0 - 17.2	716.0	
BH-43	16-May-91	0.0 - 2.5	NS	BACKGROUND
(MW-20)		2.5 - 3.1	609.0	SOIL: 0.0 PPM
		3.1 - 4.0	NR	AIR: 0.0 PPM
		4.0 - 5.0	NS	
		5.0 - 5.4	55.0	
		5.4 - 6.0	NR	
		6.0 - 6.3	168.0	
		6.3 - 9.0	NS	
		9.0 - 9.9	51.0	
		9.9 - 12.0	NS	
		12.0 - 12.7	13.0	
		12.7 - 13.0	NR	
		13.0 - 14.1	NS	
BH-44	16-May-91	0.0 - 2.5	NS	BACKGROUND
(MW-21)		2.5 - 3.8	0.0	SOIL: 0.0 PPM
		3.8 - 4.0	NR	AIR: 0.0 PPM
		4.0 - 5.0	NS	
		5.0 - 6.1	0.0	
		6.1 - 6.5	NR	
		6.5 - 7.0	NS	
		7.0 - 7.7	0.0	
		7.7 - 9.0	NS	

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*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
		9.0 - 9.6	3.0	
		9.6 - 12.0	NS	
		12.0 - 12.4	7.0	
		12.4 - 14.0	NS	
		14.0 - 14.9	11.0	
		14.9 - 15.5	NR	
		15.5 - 17.0	NS	
		17.0 - 18.5	23.0	
		18.5 - 19.0	NS	
		19.0 - 20.1	7.0	
		20.1 - 20.5	NR	
		20.5 - 20.7	2.0	
		20.7 - 21.2	NR	
BH-45 (MW-22)	17-May-91	0.0 - 2.5	NS	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		2.5 - 2.6	0.0	
		2.6 - 4.0	NR	
		4.0 - 5.2	0.0	
		5.2 - 7.0	NS	
		7.0 - 7.5	0.0	
		7.5 - 9.0	NS	
		9.0 - 10.1	3.0	
		10.1 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 12.7	0.0	
		12.7 - 14.0	NS	
		14.0 - 15.1	3.0	
		15.1 - 15.5	NS	
		15.5 - 15.6	NS	
BH-46 (MW-23)	17-May-91	0.0 - 2.5	NS	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		2.5 - 4.0	0.0	
		4.0 - 5.0	NS	
		5.0 - 6.1	0.0	
		6.1 - 6.5	NR	
		6.5 - 7.0	NS	
		7.0 - 8.5	0.0	
		8.5 - 9.0	NS	
		9.0 - 10.5	NR	
		10.5 - 10.9	NS	
BH-47 (MW-24)	18-May-91	0.0 - 2.5	NS	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		2.5 - 3.5	3.0	
		3.5 - 4.0	NR	
		4.0 - 5.0	NS	
		5.0 - 6.1	10.0	
		6.1 - 6.5	NR	
		6.5 - 7.0	NS	
		7.0 - 8.1	1.5	
		8.1 - 8.5	NR	
		8.5 - 9.0	NS	
		9.0 - 10.0	21.0	
		10.0 - 10.9	NS	
		10.9 - 11.0	NS	

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NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-48 (MW-25)	18-May-91	0.0 - 2.5	NS	BACKGROUND
		2.5 - 3.5	0.0	SOIL: 0.0 PPM
		3.5 - 4.0	NR	AIR: 0.0 PPM
		4.0 - 5.0	NS	
		5.0 - 6.0	0.0	
		6.0 - 6.5	NR	
		6.5 - 7.0	NS	
		7.0 - 7.9	0.0	
		7.9 - 8.2	NS	
		8.2 - 8.3	25.0	
BH-49 (MW-26)	18-May-91	0.0 - 2.5	NS	BACKGROUND
		2.5 - 4.0	0.0	SOIL: 0.0 PPM
		4.0 - 5.1	0.0	AIR: 0.0 PPM
		5.1 - 7.0	NS	
		7.0 - 8.0	0.0	
		8.0 - 9.0	NS	
		9.0 - 10.0	0.0	
		10.0 - 12.0	NS	
		12.0 - 13.1	4.6	
		13.1 - 13.5	NR	
		13.5 - 14.0	NS	
		14.0 - 15.0	35.0	
		15.- - 15.1	NR	
		15.1 - 17.0	NS	
		17.0 - 17.9	296.0	
		17.9 - 18.5	NR	
		18.5 - 19.0	NS	
		19.0 - 19.4	NS	
		19.4 - 19.5	546.0	
BH-50 (MW-27)	19-May-91	0.0 - 2.5	NS	BACKGROUND
		2.5 - 3.1	10.7	SOIL: 0.0 PPM
		3.1 - 4.0	NR	AIR: 0.0 PPM
		4.0 - 5.0	NS	
		5.0 - 5.6	46.0	
		5.6 - 6.5	NR	
		6.5 - 7.5	NS	
		7.5 - 8.6	0.0	
		8.6 - 9.0	NR	
		9.0 - 10.0	NS	
		10.0 - 10.4	36.0	
		10.4 - 12.3	NS	
		12.3 - 12.5	0.0	
		12.5 - 14.0	NS	
		14.0 - 14.8	21.0	
		14.8 - 15.7	NS	
		15.7 - 16.0	0.0	
BH-51	20-May-91	0.0 - 1.0	0.0	BACKGROUND
		1.0 - 2.5	NS	SOIL: 0.0 PPM
		2.5 - 3.6	0.0	AIR: 0.0 PPM
		3.6 - 4.0	NR	
		4.0 - 4.5	3.5	
		4.5 - 5.5	NR	
		5.5 - 7.0	NS	
		7.0 - 7.2	NR	

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TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-52 (MW-28)	20-May-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.5	0.0	
		3.5 - 4.0	NR	
		4.0 - 5.0	0.0	
		5.0 - 5.5	NR	
		5.5 - 7.0	NS	
		7.0 - 7.4	0.0	
		7.4 - 8.0	NR	
		8.0 - 9.0	NS	
		9.0 - 9.4	0.0	
		94. - 10.0	NR	
		10.0 - 12.0	NS	
		12.0 - 12.2	7.5	
		12.2 - 13.0	NR	
		13.0 - 14.0	NS	
		14.0 - 15.0	24.6	
		15.0 - 15.5	NR	
		15.5 - 17.0	NS	
		17.0 - 17.2	NR	
BH-53 (MW-29)	20-May-91	0.0 - 1.0	1.5	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 2.7	0.0	
		2.7 - 4.0	NR	
		4.0 - 4.5	0.0	
		4.5 - 5.5	NR	
		5.5 - 7.0	NS	
		7.0 - 8.0	0.0	
		8.0 - 8.5	NR	
		8.5 - 9.0	NS	
		9.0 - 9.9	0.0	
		9.9 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 12.3	NR	
		12.3 - 12.7	NR	
BH-54 (MW-30)	21-May-91	0.0 - 1.0	0.2	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.6	32.5	
		3.6 - 4.0	NR	
		4.0 - 5.0	32.3	
		5.0 - 5.5	NR	
		5.5 - 7.0	NS	
		7.0 - 7.7	19.9	
		7.7 - 8.5	NR	
		8.5 - 9.0	NS	
		9.0 - 9.2	NR	
		9.2 - 12.0	NS	
		12.0 - 12.1	NR	

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-55 (MW-31)	21-May-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.6	0.0	
		3.6 - 4.0	NR	
		4.0 - 5.1	0.0	
		5.1 - 5.5	NR	
		5.5 - 7.0	NS	
		7.0 - 8.1	0.0	
		8.1 - 8.5	NR	
		8.5 - 9.0	NS	
		9.0 - 9.7	0.0	
		9.7 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 12.5	9.2	
		12.5 - 13.0	NR	
		13.0 - 14.0	NS	
		14.0 - 14.5	21.5	
		14.5 - 14.7	NR	
		14.7 - 17.0	NS	
		17.0 - 17.4	45.0	
BH-56 (MW-32)	22-May-91	0.0 - 2.5	NS	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		2.5 - 2.7	NR	
		2.7 - 4.3	NS	
		4.3 - 4.4	10.7	
		4.4 - 5.0	NR	
		5.0 - 7 0	NS	
		7.0 - 7.3	0.0	
		7.3 - 7.5	NR	
		7.5 - 9.0	NS	
		9.0 - 10.0	47.0	
		10.0 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 12.2	NR	
		12.2 - 14.0	NS	
		14.0 - 14.2	NR	
BH-57 (MW-33)	23-May-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.6	0.0	
		3.6 - 4.0	NR	
		4.0 - 4.8	0.0	
		4.8 - 5.5	NR	
		5.5 - 7.0	NS	
		7.0 - 8.5	0.0	
		8.5 - 9.0	NS	
		9.0 - 9.5	1.5	
		9.5 - 10.0	NR	
		10.0 - 12.0	NS	
		12.0 - 13.0	6.1	
		13.0 - 13.5	NR	
		13.5 - 14.0	NS	
		14.0 - 14.2	NS	
		14.2 - 14.5	NR	
		14.5 - 17.0	NS	
		17.0 - 17.8	232.0	
		17.8 - 18.0	NR	
		18.0 - 18.5	NS	
		18.5 - 18.6	330.0	

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-58	23-May-91	0.0 - 1.0	0.0	BACKGROUND
(MW-34)		1.0 - 2.5	NS	SOIL: 0.0 PPM
		2.5 - 3.1	0.0	AIR: 0.0 PPM
		3.1 - 4.0	NR	
		4.0 - 5.0	NR	
		5.0 - 7.0	NS	
		7.0 - 7.5	0.0	
		7.5 - 7.7	NR	
		7.7 - 9.0	NS	
		9.0 - 9.9	150.7	
		9.9 - 10.5	NR	
		10.5 - 12.0	NS	
		12.0 - 13.0	0.0	
		13.0 - 13.5	NR	
		13.5 - 14.0	NS	
		14.0 - 14.2	NR	
		14.2 - 17.0	NS	
		17.0 - 17.5	327.0	
		17.5 - 17.8	NR	
		17.8 - 18.0	NS	
		18.0 - 18.6	298.0	
BH-59	24-May-91	0.0 - 1.0	0.0	BACKGROUND
(MW-35)		1.0 - 2.5	NS	SOIL: 0.0 PPM
		2.5 - 3.5	0.0	AIR: 0.0 PPM
		3.5 - 4.0	NR	
		4.0 - 5.1	0.0	
		5.1 - 5.5	NR	
		5.5 - 7.5	NS	
		7.5 - 9.0	14.8	
		9.0 - 10.5	1.6	
		10.5 - 12.5	NS	
		12.5 - 13.0	1.0	
		13.0 - 14.0	NR	
		14.0 - 14.7	46.7	
		14.7 - 15.5	NR	
		15.5 - 17.5	NS	
		17.5 - 18.0	414.0	
		18.0 - 18.9	NR	
BH-60	26-May-91	0.0 - 1.0	0.0	BACKGROUND
(MW-37)		1.0 - 2.5	NS	SOIL: 0.0 PPM
		2.5 - 3.6	0.0	AIR: 0.0 PPM
		3.6 - 4.0	NR	
		4.0 - 5.4	0.0	
		5.4 - 7.5	NS	
		7.5 - 9.0	0.0	
		9.0 - 10.3	0.0	
		10.3 - 10.5	NR	
		10.5 - 12.5	NS	
		12.5 - 13.4	0.0	
		13.4 - 14.0	NR	
		14.0 - 14.5	449.0	
		14.5 - 15.5	NR	
		15.5 - 17.8	NS	
		17.8 - 18.5	388.0	
		18.5 - 19.0	NS	
		19.0 - 19.3	583.0	

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-61 (MW-38)	27-May-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.8	0.0	
		3.8 - 4.0	NR	
		4.0 - 5.5	0.0	
		5.5 - 7.5	NS	
		7.5 - 9.0	0.0	
		9.0 - 9.6	0.0	
		9.6 - 10.5	NR	
		10.5 - 12.5	NS	
		12.5 - 13.1	0.0	
		13.1 - 14.0	NR	
		14.0 - 15.0	112.0	
		15.0 - 15.5	NR	
		15.5 - 17.6	NS	
		17.6 - 18.4	126.5	
BH-62 (MW-39)	27-May-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 4.0	0.0	
		4.0 - 4.4	0.0	
		4.4 - 5.5	NR	
		5.5 - 7.5	NS	
		7.5 - 8.3	0.0	
		8.3 - 9.0	NR	
		9.0 - 9.4	0.0	
		9.4 - 10.0	NR	
		10.0 - 12.5	NS	
		12.5 - 14.0	0.0	
		14.0 - 14.8	935.0	
		14.8 - 15.5	NR	
		15.5 - 17.5	NS	
		17.5 - 18.0	538.0	
		18.0 - 19.0	NS	
		19.0 - 19.5	30.0	
BH-63 (MW-40)	28-May-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 4.0	0.0	
		4.0 - 5.0	0.0	
		5.0 - 5.5	NR	
		5.5 - 7.5	NS	
		7.5 - 8.0	0.0	
		8.0 - 9.0	NS	
		9.0 - 9.2	0.0	
		9.2 - 12.0	NS	
		12.0 - 12.1	0.0	
BH-64 (MW-41)	29-May-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.8	0.0	
		3.8 - 4.0	NR	
		4.0 - 5.2	0.0	
		5.2 - 5.5	NR	
		5.5 - 7.5	NS	
		7.5 - 9.0	0.0	
		9.0 - 10.0	0.0	
		10.0 - 10.5	NR	

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
		10.5 - 12.5	NS	
		12.5 - 13.5	0.0	
		13.5 - 14.0	NR	
		14.8 - 15.5	NR	
		15.5 - 17.5	NS	
		17.5 - 18.3	685.0	
		18.3 - 19.0	NR	
		19.0 - 19.5	407.0	
		19.5 - 22.5	NS	
		22.5 - 22.8	39.0	
		22.8 - 23.0	NR	
BH-65 (MW-42)	30-May-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 4.0	0.0	
		4.0 - 5.0	0.0	
		5.0 - 5.5	NR	
		5.5 - 7.5	NS	
		7.5 - 7.7	0.0	
		7.7 - 9.0	NS	
		9.0 - 9.3	0.0	
		9.3 - 10.5	NS	
		10.5 - 10.8	6.6	
		10.8 - 12.5	NS	
		12.5 - 12.6	1.6	
		12.6 - 14.0	NS	
		14.0 - 14.2	3.3	
		14.2 - 17.0	NS	
		17.0 - 17.1	13.2	
		17.1 - 19.0	NS	
		19.0 - 19.2	0.0	
		19.2 - 22.0	NS	
BH-66 (MW-43)	31-May-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 4.0	0.0	
		4.0 - 5.5	0.0	
		5.5 - 7.5	NS	
		7.5 - 7.7	0.0	
		7.7 - 9.0	NS	
		9.0 - 10.1	0.0	
		10.1 - 10.5	NR	
		10.5 - 12.5	NS	
		12.5 - 13.0	0.0	
		13.0 - 14.0	NS	
		14.0 - 15.1	0.0	
		15.1 - 17.0	NS	
		17.0 - 18.3	781.0	
		18.3 - 19.0	NS	
		19.0 - 19.6	826.0	
		19.6 - 22.0	NS	
		22.0 - 22.4	246.0	
		9.0 - 9.8	0.0	
		9.8 - 12.5	NS	
		12.5 - 13.5	0.0	
		13.5 - 14.0	NR	
		14.0 - 15.0	180.0	
		15.0 - 17.5	NS	
		17.5 - 18.8	359.0	

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
		18.8 - 19.0	NR	
		19.0 - 20.2	375.0	
		20.2 - 22.0	NS	
		22.0 - 22.3	187.0	
BH-68 (MW-45)	02-Jun-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 4.0	0.0	
		4.0 - 5.5	0.0	
		5.5 - 7.5	NS	
		7.5 - 9.0	0.0	
		9.0 - 9.9	0.0	
		9.9 - 12.5	NS	
		12.5 - 14.0	NS	
		14.0 - 14.2	0.0	
		14.2 - 17.0	NS	
		17.0 - 17.6	0.0	
		17.6 - 19.0	NS	
		19.0 - 19.6	9.9	
		19.6 - 22.5	NS	
		22.5 - 22.9	28.0	
		22.9 - 24.0	NS	
BH-69 (MW-46)	02-Jun-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.5	0.0	
		3.5 - 4.0	NS	
		4.0 - 5.1	47.0	
		5.1 - 7.5	NS	
		7.5 - 8.6	49.0	
		8.6 - 9.0	NS	
		9.0 - 9.4	120.0	
		9.4 - 10.5	NS	
		10.5 - 11.0	764.0	
		11.0 - 12.5	NS	
		12.5 - 13.3	575.0	
		13.3 - 14.0	NS	
		14.0 - 15.0	305.0	
		15.0 - 17.5	NS	
		17.5 - 18.2	556.0	
BH-70 (MW-47)	03-Jun-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.5	0.0	
		3.5 - 4.0	NS	
		4.0 - 5.0	33.0	
		5.0 - 7.5	NS	
		7.5 - 8.0	11.5	
		8.0 - 9.0	NS	
		9.0 - 9.4	23.1	
		9.4 - 12.5	NS	
		12.5 - 13.5	87.2	
		13.5 - 14.0	NS	
		14.0 - 15.0	767.0	
		15.0 - 17.5	NS	
		17.5 - 18.5	562.0	
		18.5 - 19.0	NS	
		19.0 - 19.5	540.0	

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-71 (MW-48)	04-Jun-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.5	0.0	
		3.5 - 4.0	NS	
		4.0 - 5.0	0.0	
		5.0 - 7.5	NS	
		7.5 - 8.0	0.0	
		8.0 - 9.0	NS	
		9.0 - 9.3	0.0	
		9.3 - 12.5	NS	
		12.5 - 13.2	0.0	
		13.2 - 14.0	NS	
		14.0 - 15.0	109.0	
		15.0 - 17.5	NS	
		17.5 - 17.7	738.0	
		17.7 - 19.0	NS	
		19.0 - 19.3	694.0	
		19.3 - 22.5	NS	
		22.5 - 22.8	428.0	
		22.8 - 24.0	NS	
		24.0 - 24.5	216.0	
		24.5 - 27.5	NS	
		27.5 - 28.0	11.0	
		28.0 - 29.0	NS	
		29.0 - 29.5	16.0	
		29.5 - 32.0	NS	
BH-72 (MW-49)	05-Jun-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 4.0	0.0	
		4.0 - 4.5	0.0	
		4.5 - 7.5	NS	
		7.5 - 7.7	0.0	
		7.7 - 9.0	NS	
		9.0 - 9.2	0.0	
		9.2 - 12.5	NS	
		12.5 - 12.8	0.0	
		12.8 - 14.0	NS	
		14.0 - 14.3	0.0	
		14.3 - 17.5	NS	
		17.5 - 17.7	0.0	
		17.7 - 19.0	NS	
		19.0 - 19.6	71.0	
		19.6 - 20.5	NS	
		20.5 - 24.0	NS	
		24.0 - 24.4	26.0	

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-73 (MW-50)	05-Jun-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.8	0.0	
		3.8 - 4.0	NS	
		4.0 - 4.3	0.0	
		4.3 - 7.5	NS	
		7.5 - 7.8	0.0	
		7.8 - 9.0	NS	
		9.0 - 12.5	NS	
		12.5 - 12.8	0.0	
		12.8 - 14.0	NS	
		14.0 - 17.5	NS	
		17.5 - 18.1	0.0	
		18.1 - 19.0	NS	
		19.0 - 19.5	0.0	
		19.5 - 22.5	NS	
		22.5 - 22.7	0.0	
		22.7 - 24.0	NS	
		24.0 - 27.5	NS	
		27.5 - 28.5	NS	
		28.5 - 29.0	125.0	
		29.0 - 32.5	NS	
		32.5 - 33.0	160.0	
		33.0 - 34.0	NS	
		34.0 - 35.0	74.0	
BH-74 (MW-51)	06-Jun-91	0.0 - 1.0	0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.5	0	
		3.5 - 4.0	NS	
		4.0 - 4.1	0	
		4.1 - 7.5	NS	
		7.5 - 8.5	0	
		8.5 - 9.0	NS	
		9.0 - 9.6	0.0	
		9.6 - 12.5	NS	
		12.5 - 13.1	0.0	
		13.1 - 14.0	NS	
		14.0 - 14.7	0.0	
		14.7 - 17.5	NS	
		17.5 - 18.0	0.0	

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-75	06-Jun-91	0.0 - 1.0	0.0	BACKGROUND
(MW-52)		1.0 - 2.5	NS	SOIL: 0.0 PPM
		2.5 - 3.7	0.0	AIR: 0.0 PPM
		3.7 - 4.0	NS	
		4.0 - 4.9	0.0	
		4.9 - 7.5	NS	
		7.5 - 8.1	0.0	
		8.1 - 9.0	NS	
		9.0 - 10.1	0.0	
		10.1 - 12.5	NS	
		12.5 - 14.0	NS	
		14.0 - 15.0	0.0	
		15.0 - 17.5	NS	
		17.5 - 18.0	0.0	
		18.0 - 19.0	NS	
		19.0 - 19.2	0.0	
BH-76	07-Jun-91	0.0 - 1.0	0.0	BACKGROUND
(MW-39)		1.0 - 2.5	NS	SOIL: 0.0 PPM
		2.5 - 3.2	49.0	AIR: 0.0 PPM
BH-77	07-Jun-91	0.0 - 1.0	0	
(MW-53)		1.0 - 2.5	NS	
		2.5 - 3.5	46.2	
		3.5 - 4.0	NR	
		4.0 - 4.2	0.0	
		4.2 - 5.5	NR	
		5.5 - 7.5	NS	
		7.5 - 8.2	0.0	
		8.2 - 8.5	NR	
		8.5 - 9.0	NS	
		9.0 - 9.5	0.0	
		9.5 - 9.7	0.0	
		9.7 - 10.0	NR	
		10.0 - 11.0	NS	
		11.0 - 11.6	0.0	
		11.6 - 12.5	NR	
		12.5 - 13.0	NS	
		13.0 - 13.2	0.0	
		13.2 - 13.6	NR	

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

TABLE 4: CONTINUED

SOIL BORING NUMBER	SAMPLE DATE	*SAMPLE INTERVAL, FT.	**OVM HEADSPACE READING, PPM	COMMENTS
BH-78 (MW-38)	08-Jun-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 2.8	0.0	
		2.8 - 4.0	NR	
		4.0 - 4.4	0.0	
		4.4 - 5.5	NR	
		5.5 - 6.4	NS	
		6.4 - 6.5	0.0	
BH-79	08-Jun-91	0.0 - 1.0	0.0	BACKGROUND SOIL: 0.0 PPM AIR: 0.0 PPM
		1.0 - 2.5	NS	
		2.5 - 3.1	NR	
		3.1 - 3.8	NS	

NOTE:
ALL SAMPLES COLLECTED DURING HOLLOW STEM AUGER DRILLING WITH SPLIT-SPOON SAMPLER
NS - NO SAMPLE OBTAINED, AUGER DRILLED
NR - NO SAMPLE RECOVERY, SPLIT SPOON SAMPLE
*MEASURED IN FEET BELOW GROUND LEVEL
**OVM READINGS ARE IN PPM OF TOTAL IONIZABLE HYDROCARBON BASED UPON AN ISOBUTYLENE STANDARD

APPENDIX E

TRENCHING SUMMARY

TRENCHING SUMMARY

Pit #	Approximate Location	Approximate Total Depth	Depth to Bedrock	Bedrock Type	Log Available	Initial Depth To Fluid	Fluid Type
1	S700/W900	9.5'	NE	NE	Yes	7.5'	Condensate
2	S640/W860	8.0'	NE	NE	Yes	7.1'	Condensate & Water
3	S700/W910	8.0'	NE	NE	Yes	5.5'	Condensate & Water
4	S700/W1000	8.5'	NE	NE	Yes	NE	NE
5	S620/W980	8.0'	NE	NE	Yes	7.0'	Condensate
6	S600/W1380	12.0'	12.0'	Sandstone	Yes	11.5'	Condensate
7	S800/W860	3.0'	NE	NE	Yes	NE	NE
8	S800/W1800	8.5'	8.5'	Sandstone	Yes	NE	NE
A8	S800/W1000	9.0'	NE	NE	Yes	NE	NE
9	S850/W200	13.0'	13.0'	Sandstone	Yes	13.0'	Condensate
A9	S770/W820	9.5'	NE	NE	Yes	9.1'	Condensate & Water
10	S1100/E800	14.5'	14.5'	Dolomite-Sandstone	Yes	14.5'	Condensate & Water
A10	S680/W600	11.7'	NE	NE	Yes	10.4'	Condensate & Water
A11	S640/W670	13.5'	NE	NE	Yes	11.5'	Condensate & Water
12	S1800/E1400	4.5'	4.5'	Dolomite	Yes	NE	NE
13	S2050/E1600	15.5'	15.5'	Dolomite	Yes	NE	NE
14	S1900/E1300	NA	NA	NA	No	NA	NE
15	S850/W2000	10.5'	10.5'	Dolomite	Yes	NE	NE
16	S1400/E1150	14.24'	NA	NA	No	NA	Condensate & Water
16A	S1400/E1100	13.42'	NA	NA	No	NA	Condensate & Water
16B	S1400/E1000	15.75'	NA	NA	No	NA	Condensate & Water
17	S1250/E800	10.23'	NA	NA	No	NA	Condensate & Water
18	S1700/E1100	NA	NA	NA	No	NA	NE
19	S1100/E650	12.52'	NA	NA	No	NA	NE
20	S900/E200	NA	NA	NA	No	NA	NE
21A	S920/E600	10.67'	NA	NA	No	NA	Condensate & Water

NE = NOT ENCOUNTERED NA = NOT AVAILABLE

APPENDIX F

EXCAVATION LOGS

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	Gravel, Sandy, Silty with Cobbles up to 2.0' Brown (Alluvium)	GP							0
	5									5
										CONDENSATE
	10	Condensate @ 7.5' 4-14-91								10
	15									15
	20	LOCATED IN ARROYO								20
	25									25
		LOC ≈ S 700 W 900								
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Indian Basin

BORING NUMBER P.t #1

DATE DRILLED 4-12-91

DRILLING METHOD Backhoe

DRILLED BY

LOGGED BY 4-13-91 B. Schatz

CHECKED BY

DRAWN BY:

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
										BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
		GROUND SURFACE:								
	0	Gravel, Sandy, silty with cobbles up to 2.0' (Alluvium) Brown	GP							0
	5	Sand, Silty, clayey with fine gravel, Brown	SM							5 Condensate
		Gravel as above	GP							
	10	Condensate @ 7.1' 4-14-91 + WATER								10
	15	LOCATED IN ARROYO								15
	20									20
		LOC ≈ S640 W860								
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Indian Basin

BORING NUMBER Pit #2

DATE DRILLED 4-13-91
DRILLING METHOD Backhoe
DRILLED BY
LOGGED BY R. Schatz
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 16)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	Gravel, sandy, silty with cobbles up to 2.0' (Alluvium) Brown	GP							
	5									CONDENSATE
	10	Condensate @ 5.5' + WATER								
	15	LOCATED IN ARROYO								
	20	LOC. ≈ S700 W910								
	25									
	30									
	35									

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Indian Basin

BORING NUMBER Pit #3

DATE DRILLED 4-13-91
DRILLING METHOD Backhoe
DRILLED BY
LOGGED BY B Schatz
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	Gravel, sandy, silty with cobbles up to 2.0' Brown, dry	GP							0
	5									5
	10	4-15-91 Dry Located in arroyo								10
	15	LOC ≈ S700 W1000								15
	20									20
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Indian Basin

BORING NUMBER P.T #4

DATE DRILLED 4-15-91
DRILLING METHOD Backhoe
DRILLED BY
LOGGED BY B. Schatz
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	Gravel, Sandy, Silty, w/Cobbles upto 2.0' Brown, Dry	GP							0
	5									5
	10	Refusal @ 8.0' Black Soil @ 6.0' Some condensate @ 7.0' Dry 4/15/91 LOCATED IN ARROYO LOC ≈ S 620 W 980								10
	15									15
	20									20
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Indian Basin

BORING NUMBER Pit #5

DATE DRILLED 4-14-91
DRILLING METHOD Backhoe
DRILLED BY
LOGGED BY B Schatz
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3805.7								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	Gravel, Sandy, Silty, w/cobbles up to 2.0' Brown, Dry	GP							0
	5									5
	10	moist, cobbley clay layer above bedrock								10 Condensate
		SANDSTONE BEDROCK: Fine grained, weathered, Lt. green, grey, 3" of condensate on bedrock surface, in bedrock (Queen FM)								
	15									15
	20	Condensate @ 11.5' 4-17-91								20
		EXCAVATED to 6.5' 4-15-91 with backhoe, completed to 12.5' 4-16-91 with track hoe								
	25	LOCATED in ARROYO								25
	30	LOC ≈ S 600 W 1380								30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Indian Basin

BORING NUMBER P.t #6

DATE DRILLED 4-15-91 4-16-91

DRILLING METHOD

DRILLED BY

LOGGED BY

CHECKED BY

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 16)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	Gravel, Sandy, Silty, w/ cobbles up to 2.0' Brown, dry	GP							0
		LEL READING of 97 Stopped digging								
	5	LOCATED IN ARROYO								5
		LOC. W 860 S 800								
	10									10
	15									15
	20									20
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Indian Basin

BORING NUMBER Pit #7

DATE DRILLED 4-16-91
DRILLING METHOD Backhoe
DRILLED BY B Schatz
LOGGED BY
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ___ (2 4 6 8 10 12 14 15 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3811.6								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	Gravel, Sandy, Silty w/cobbles up to 2.0' Brown, Dry	GP							0
	5	moist cobbley clay layer above bedrock								5
		BEDROCK SANDSTONE							X	
	10	↑ fine grained, weathered, lt. green, gray, (Queen FM.) NO LEL READINGS, NO CONDENSATE								10
	15	NO FLUID 4-17-91								15
	20	LOCATED IN ARROYO								20
		LOC ≈ W1800 S800								
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Indian Basin

BORING NUMBER Pit # 8

DATE DRILLED 4/16/91
DRILLING METHOD Trackhoe
DRILLED BY
LOGGED BY B Schatz
CHECKED BY
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	Gravel, sandy, silty with cobbles and boulders up to 3.0', Brown, DRY	GP							0
	5									5
	10	HI LEL Filled in 4-17-91								10
	15	~ S 800 ~ W 1000								15
	20									20
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Indian Basin

BORING NUMBER Pit* A8

DATE DRILLED 4-17-91
DRILLING METHOD Backhoe
DRILLED BY
LOGGED BY J Green
CHECKED BY
DRAWN BY:

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 16)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3797.7								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	Gravel, sandy, silty, with cobbles up to 2.0' occasional boulders up to 3.0', Brown, Dry	GP							0
	5									5
	10	moist, cobbley clay layer above bedrock								10 Condensate
		Bedrock: Sandstone								
	15	Fine grained, slightly weathered w/ black stained layers (Condensate stained) Blue-green Condensate @ 13.0' Condensate flowing into hole 4-18-91 Condensate @ 13.0' + WATER								15
	20									20
	25	Loc ≈ 200W 850S								25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Indian Basin

BORING NUMBER Pit #9

DATE DRILLED 4-17-91
DRILLING METHOD Trackhoe
DRILLED BY
LOGGED BY B Schatz
CHECKED BY
DRAWN BY:

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	Gravel, sandy, silty with cobbles and boulders up to 30', Brown, dry	GP							0
	5									5
	10	Excavated to 6.0' 4-16-91 Deepened to 9.4' 4-17-91 HI LEL LEVELS Fluid level @ 9.1' Condensate 4-18-91 LOC≈ 770 S 820 W								Condensate 10
	15									15
	20									20
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Indian Basin

BORING NUMBER P.t # A9

DATE DRILLED 4-16-91 and 4-17-91
DRILLING METHOD Backhoe and Trackhoe
DRILLED BY
LOGGED BY L. Green
CHECKED BY
DRAWN BY:
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GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 16)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3793.6								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	GRAVEL, SANDY, SILTY W/ COBBLES AND BOULDERS UP TO 3.0'. OCCASIONAL SAND LAYERS, BROWN, DRY	GP							0
	5	HILEL CONDENSATE SMELL								5
	10	MOIST COBBLE/CLAY LAYER ABOVE BEDROCK								10
	15	BEDROCK: SANDSTONE - DOLOMITIC						X		condensate 15
	20	FINE GRAINED, BLUE-GREEN (QUEEN FM) TRACE OF CONDENSATE SMELL, SEEPAGE OF WATER AND CONDENSATE INTO HOLE @ 14.5'								20
	25	LOC ≈ 800 E 1100 S								25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER INDIAN BASIN

BORING NUMBER P.T #10

DATE DRILLED 4-17-91
DRILLING METHOD TRACK HOE
DRILLED BY
LOGGED BY B. Schatz
CHECKED BY
DRAWN BY:

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	Gravel, sandy, silty with cobbles and boulders up to 3.0', Brown, dry	GP							0
	5									5
	10									10 Condensate
		Condensate @ 10.4' 4-18-91 +WATER								
	15	LOC ≈ 600 W 680 S								15
	20									20
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Indian Basin

BORING NUMBER Pit # A10

DATE DRILLED 4-17-91
DRILLING METHOD Backhoe
DRILLED BY
LOGGED BY J Green
CHECKED BY
DRAWN BY:

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 16)	SAMPLE: NUMBER	SAMPLE: OVM READING	SAMPLE: RECOVERY	SAMPLE: DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	Gravel, sandy, silty with cobbles and boulders up to 3.0', Brown, Dry	GP							0
	5	HI LEL								5
	10									10 Condensate
	15	Condensate @ 11.5' + WATER								15
	20	LOC ≈ 640S 670W								20
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Indian Basin

BORING NUMBER P+A 11

DATE DRILLED 4/17/91
DRILLING METHOD TRACK HOE
DRILLED BY
LOGGED BY W. Nixon
CHECKED BY
DRAWN BY:

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 16)	SAMPLE: NUMBER	SAMPLE: OVM READING	SAMPLE: RECOVERY	SAMPLE: DEPTH	REMARKS
										BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	GROUND SURFACE: Gravel, sandy, silty w/ cobbles and boulders up to 3.0', Brown, Dry	GP							0
	5	Bedrock Dolomite, finely xtalline, gray, brown (QUEEN FM.) NO FLUIDS ENCOUNTERED								5
	10	LOC ≈ 1400 E 1800 S								10
	15									15
	20									20
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER INDIAN BASIN

BORING NUMBER TP#12

DATE DRILLED 4-27-91
DRILLING METHOD Backhoe
DRILLED BY
LOGGED BY R Schatz
CHECKED BY
DRAWN BY: PAGE OF

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 16 18)	SAMPLE: NUMBER	SAMPLE: OVM READING	SAMPLE: RECOVERY	SAMPLE: DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	Gravel, sandy, silty w/ cobbles and boulders up to 3.0', Brown, Dry	GP							0
	5									5
	10									10
	15	Bedrock - Dolomite, finely, xtalline, gray, brown (Queen Fm.)								15
	20	NO LEL LEVELS NO Condensate Smell NO HNU reading								20
	25	Dry to 15.5' 4/28/91								25
	30	LOCATION ≈ 400' SE OF S1800, E1400 IN ARROYO ≈ S2060 E1600								30
	35									35

- CME CONTINUOUS AUGER SAMPLER
- STANDARD PENETRATION TEST
- UNDISTURBED SAMPLE
- WATER TABLE (24 HOURS)
- WATER TABLE (TIME OF BORING)
- L LABORATORY TEST LOCATION
- \+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER INDIAN BASIN

BORING NUMBER TP#13

DATE DRILLED 4-27-91

DRILLING METHOD BACKHOE

DRILLED BY

LOGGED BY C Schatz

CHECKED BY

DRAWN BY: PAGE OF

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	Sand, silty, clayey Brown, Dry	SM							0
	5	Gravel, silty, sandy w/ cobbles up to 3.0' + Boulders, Brown, Dry	GP							5
	10	Bedrock: Dolomite, finely xtalline Gray (Queen Fm.)								10
	15	NO FLUID No Condensate smell								15
		Backfilled 4/29/91								
	20	LOC ≈ 2000W 850 S								20
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER INDIAN BASIN

BORING NUMBER TP # 15

DATE DRILLED 4/29/91
DRILLING METHOD TRACK HOE
DRILLED BY
LOGGED BY B Schatz
CHECKED BY
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APPENDIX G

SOIL BORING LOGS

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		Start: 16:11 Stop: 16:32 GROUND SURFACE: 3804.8								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	ALLUVIUM BOULDERY COBBLELY SILT: UNCON SOLIDATED, COBBLES AND BOULDERS FROM 1.0 CM TO 3 M., RNDED., DOLOMITIZED, DRY, GRAYISH BROWN, 10 YR 7/2, TO PALE BROWN, 5 YR 5/2	GW			NS			2.5	0
						1	0.1	0.8	3.3	
						NR			4.0	
	5					2	0.1	1.1	5.1	5
		BORING TERMINATED AT 5.0' GROUNDWATER NOT OBSERVED DURING BORING BOREHOLE OVM READING: 4.0 PPM SOIL VENT OVM READING AFTER 24 HOURS: 4.6 PPM				NR			5.5	
	10									10
	15									15
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-1***

DATE DRILLED 4/18/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		Start: 10:00 Stop: 10:25								BACKGROUND OVM READING: SOIL: 0.1 PPM AIR: 0.2 PPM
		GROUND SURFACE:								
	0	BOULDERY COBBLELY GRAVELLY SILT: NONIMBRICATED, UNCONSOLIDATED, BOULDERS-COBBLES FROM 10CM - 3M., DOLOMITE, WELL RNDED., PEBBLES AND GRAVEL	GW			NS			2.5	0
	3.0	AUGER REFUSAL AT 3.0' GROUNDWATER NOT OBSERVED				1	1.0	1.2	3.7	
		SOIL VENT AT 2.37'				NR			4.0	
	5	BOREHOLE OVM READING: 0.3 PPM BACKGROUND: 0.3 PPM SOIL VENT OVM READING AFTER 24 HOURS: 0.1 PPM								5
	10									10
	15									15
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-2***

DATE DRILLED 4/19/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		Start: 14:45 Stop: 16:19								BACKGROUND OVM READING: SOIL: 0.1 PPM AIR: 0.1 PPM
	0	GROUND SURFACE:								
		BOULDERY COBBLELY SILT: UNCONSOLIDATED, COBBLES AND BOULDERS FROM 10CM TO 3M., RNDED., DOLOMITIZED, DRY, GRAYISH BROWN, 10 YR 5/2	GW			1	0.1		1.5	
						NS			2.5	
						2	1.8	0.8	3.3	
						NR			4.0	
	5					3	4.8	1.1	5.1	
						NR			5.5	
						NS			9.0	
	10					4	0.3	1.2	10.2	
						NR			10.5	
						NS			12.0	
	12.7					5	0.2	0.4	12.4	
		AUGER REFUSAL AT 12.0'				NR			12.7	
	15	GROUNDWATER NOT OBSERVED DURING DRILLING								
		BOREHOLE OVM READING: 0.21 PPM								
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

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JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-3***

DATE DRILLED 4/19/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		Start: 10:45 Stop: 11:30		
		GROUND SURFACE:		
	0	BOULDERY COBBLELY GRAVELLY SILT: UNCONSOLIDATED, LIGHT BROWNISH GRAY TO GRAYISH BROWN, 10 YR 6/2 TO 5/2, DRY, VERY HARD DRILLING, COBBLES-BOULDERS FROM 10CM - 2M., GRAVELLY, RNDED., POORLY SORTED	GW	
	5			
	10			
	11.0 11.2	DOLOMITE: GRAYISH BROWN, 10 YR 5/2, MASSIVE, HARD	DOLOMITE	
		AUGER REFUSAL AT 11.2'		
		GROUNDWATER NOT OBSERVED DURING DRILLING		
	15	BOREHOLE OVM (THROUGH AUGERS): 0.1 PPM		
		SOIL VENT INSTALLED TO 8.0' SOIL VENT HEADSPACE AFTER 24 HOURS: 0.1 PPM		
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 1.0 — 2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.2		1.0
NS			2.5
2	0.4	1.5 /	4.0
3	0.4	1.5 /	5.5
NS			9.0
4	0.2	0.8 /	9.8
NR			10.5

REMARKS

BACKGROUND OVM READING:
SOIL: 0.1 PPM
AIR: 0.4 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-4***

DATE DRILLED 4/22/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		Start: 17:50 Stop: 18:33								BACKGROUND OVM READING: SOIL: 0.1 PPM AIR: 0.2 PPM
	0	GROUND SURFACE:								
		BOULDARY COBBLELY SILT: GRAYISH BROWN, 10 YR 5/2 TO LIGHT BROWNISH GRAY, 10 YR 6/2, COBBLES-BOULDERS FROM 10CM – 1.5M., GRAVELLY, DRY, VERY HARD DRILLING	GW			1	0.7		1.0	
						NS			2.5	
						2	1.8	1.2	3.7	
						NR			4.0	
	5					3	0.8	1.2	5.2	
						NR			5.5	
						NS			6.0	
						4	0.6	1.2	7.2	
	7.5					NR			7.5	
		AUGER REFUSAL AT 7.5 GROUNDWATER NOT OBSERVED DURING DRILLING								
	10	BOREHOLE OVM : 1.2 PPM								
		SOIL VENT TUBE AT 6.25'								
		BOREHOLE OVM FROM SOIL VENT TUBE AFTER 24 HOURS: 7.0 PPM								
	15									
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-5***

DATE DRILLED 4/20/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		Start: 9:55 Stop: 10:10		
		GROUND SURFACE:		
	0	BOULDERY COBBLELY GRAVELLY SILT: LIGHT GRAYISH BROWN, 10 YR 6/2, POORLY SORTED, GRAVEL FROM 1.0CM TO 10CM., COBBLES-BOULDERS FROM 10CM TO 1M., RNDED., DOLOMITIZED	GW	
	4.0	DOLOMITE: LIGHT BROWN, 10 YR 5/2, MASSIVE, JOINTED, FRACTURED		
	5	AUGER REFUSAL AT 4.0' GROUNDWATER NOT OBSERVED DURING DRILLING BOREHOLE OVM THROUGH AUGERS: 0.1 PPM SOIL VENT TUBE AT 2.5' SOIL VENT OVM READING AFTER 24 HOURS: 0.1 PPM		
	10			
	15			
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 1.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	0.1	0.5	3.0
NR			3.5
NS			4.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.1 PPM
AIR: 0.1 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-6***

DATE DRILLED 4/21/91
DRILLING METHOD HSA
DRILLED BY HSB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		Start: 10:50 Stop: 11:40 GROUND SURFACE:								BACKGROUND OVM READING: SOIL: 0.1 PPM AIR: 0.1 PPM
	0	BOULDERY COBBLELY GRAVELLY SILT: LIGHT GRAYISH BROWN TO GRAYISH BROWN, 10 YR 6/2 TO UNCONSOLIDATED, DRY, COBBLES-BOULDERS FROM 10CM - 3M., RNDED., DOLOMITE, POORLY SORTED	GW			NS			2.5	0
	4.0					1	0.1	1.4	3.9	
	4.1	DOLOMITE: GRAYISH BROWN, 10 YR 6/2, MASSIVE FRACTURED, JOINTED	DOLOMITE			NR			4.0	
	5	AUGER REFUSAL AT 4.0' GROUNDWATER NOT OBSERVED DURING DRILLING BOREHOLE OVM READING (THROUGH AUGERS): 0.1 PPM SOIL VENT TUBE INSTALLED TO 2.0' SOIL VENT HEADSPACE READING AFTER 24 HOURS: 0.1 PPM								5
	10									10
	15									15
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

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JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-7***

DATE DRILLED 4/21/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		Start: 16:31 Stop: 17:03	
		GROUND SURFACE:	
	0	BOULDERY COBBLELY SILT: UNCONSOLIDATED, GRAYISH BROWN, 10 YR 5/2, POORLY SORTED, RNDED., COBBLES-BOULDERS FROM 10CM TO 2M., GRAVELLY, VERY HARD DRILLING	GW
	5		
	10		
	11.0		DOLOMITE
	11.2	DOLOMITE: GRAYISH BROWN, 10 YR 5/2, MASSIVE, VERY HARD	
		AUGER REFUSAL AT 11.0'	
		BOREHOLE OVM READING (THROUGH AUGERS): 0.1 PPM	
	15	GROUNDWATER NOT OBSERVED DURING DRILLING	
		SOIL VENT TUBE INSTALLED TO 8.0'	
		SOIL VENT HEADSPACE 24 HOURS:	
	20		
	25		
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS
PPM X 1.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.7		1.0
NS			
			4.0
2	0.4	0.8	4.8
NR			5.5
NS			
			9.0
3	1.0	0.9	9.9
NR			10.5
NR			11.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.2 PPM
AIR: 0.4 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-8***

DATE DRILLED 4/22/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		Start: 12:20 Stop: 13:12		
	0	GROUND SURFACE:		
		CLAYEY SILT: YELLOWISH BROWN, 10 YR 5/4, DRY, UNCONSOLIDATED, ROOTLETS TO 1.0', CALICHE VEINS BELOW 1.7', VERY FINE QUARTZ, 60% SILT, 40% CLAY, VERY LOW PLASTICITY	CL	
	5			
	6.0	COBBLELY BOULDERY SILT: GRAYISH BROWN, 10 YR 5/2, WELL RNDED., POORLY SORTED UNCONSOLIDATED	GW	
	9.0	AUGER REFUSAL AT 9.0'		
	10	GROUNDWATER NOT OBSERVED DURING DRILLING		
		BOREHOLE OVM READING:		
		SOIL VENT TUBE INSTALLED TO 7.5'		
		SOIL VENT OVM READING AFTER 24 HOURS: 0.9 PPM		
	15	BACKGROUND: 0.5 PPM		
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM x 1.0 — 2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.4	2.6	2.0
2	0.2		2.6
NR			3.0
3	0.2	2.0	5.0
NR			6.1
NS			9.0
NR			9.5

REMARKS

BACKGROUND OVM READING:
SOIL: 0.1 PPM
AIR: 0.2 PPM

- SPLIT-SPOON SAMPLER
- STANDARD PENETRATION TEST
- UNDISTURBED SAMPLE
- WATER TABLE (24 HOURS)
- WATER TABLE (TIME OF BORING)
- LABORATORY TEST LOCATION
- \+ PENETROMETER (TONS/SQ. FT.)
- NR: NO RECOVERY
- NS: NOT SAMPLED

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JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-9*

DATE DRILLED 4/23/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		Start: 16:37 Stop: 17:05		
	0	GROUND SURFACE:		
		CLAYEY SILT: BROWN, 10 YR 5/3, DRY, VERY LOW PLASTICITY, VERY FINE QUARTZ, 60% SILT, 40% CLAY, CALICHE VEINS, UNCONSOLIDATED	CL	
	5 5.5	BOULDERY COBBLELY SILT: GRAYISH BROWN, 10 YR 5/2, UNCONSOLIDATED, POORLY SORTED, COBBLES/BOULDERS FROM	GL	
	10			
	13.0	AUGER REFUSAL AT 13.0'		
	15	GROUNDWATER NOT OBSERVED DURING DRILLING		
		BOREHOLE OVM THROUGH AUGER:		
		AUGER: 7.8 PPM		
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 1.0 — 2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.3		1.0
NS			2.5
2	0.7	2.5	
3	0.5	0.8	4.8
NR			5.5
NS			9.0
4	0.4	0.5	9.5
NS			13.0
5	0.2	0.2	13.2

REMARKS

BACKGROUND OVM READING:
SOIL: 0.2 PPM
AIR: 0.2 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-10***

DATE DRILLED 4/23/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		Start: 11:17 Stop: 12:04	
		GROUND SURFACE: 3801.2	
	0	CLAYEY SILT: BROWN, 2.5 YR 5/2, DRY, MOD. COMPACTED, VERY LOW PLASTICITY, CAHUCHE VEINS BELOW 3.0', 60% SILT, 40% CLAY, VERY FINE QUARTZ	CL
	6.5	BOULDERY COBBLELY SILT: GRAYISH BROWN, 10 YR 5/2, UNCONSOLIDATED, POORLY SORTED. COBBLES/BOULDERS FROM 10CM TO 0.5M, GRAVELLY, ROUNDED	GW
	13.0		DOLOMITE
	13.1	DOLOMITE: GRAY, 5 Y 6/1, CRYSTALINE, MASSIVE, VERY HARD, NONEFFERVESENT ON SURFACE, EFFERVESENT OR SCRATCHED SURFACE WITH HCl	
	15	BORING TERMINATED AT 13.1'	
		GROUNDWATER NOT OBSERVED DURING DRILLING	
		BOREHOLE OVM READING AT 13.0' THROUGH AUGERS: 152 PPM	
		BOREHOLE OVM READING THROUGH AUGERS (14:20): 156 PPM	
	20	NO FREE PRODUCT	
	25		
	30		
	35		

OVM SOIL GAS PPM X 21.0 (2 4 6 8 10 12 14 16 18)

GRAPHIC LOG

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.3		1.0
NS			2.5
2	0.1	1.5	4.0
3	0.1	1.2	5.2
NR			5.5
NS			9.0
4	0.1	1.1	10.1
NR			10.5
NS			13.0
5	420.0	0.1	13.1

REMARKS

BACKGROUND OVM READING:
SOIL: 0.1 PPM
AIR: 0.1 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-11***

DATE DRILLED 4/24/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		Start: 14:55 Stop: 16:04 GROUND SURFACE: 3793.7		
	0	CLAYEY SILT: BROWN, 7.5 YR 5/2, DRY, UNCONSOLIDATED, VERY LOW PLASTICITY, CALICHE VEINS, 60% SILT, 40% CLAY, VERY FINE QUARTZ	CL	
	5 5.2	BOULDERY COBBLELY SILT: GRAYISH BROWN, 10 YR 5/2, DRY, UNCONSOLIDATED, POORLY SORTED, COBBLES/BOULDERS FROM 10CM TO 50CM, ROUNDED, GRAVELLY	GW	
	10 12.1 12.3 12.5	CLAYEY SAND: BROWN, 7.5 YR 5/2, MOIST, MED. PLASTICITY, QUARTZ, FINE GRAIN, STRONG HYDROCARBON ODOR, SAMPLE WET WITH HYDROCARBON, 60% CLAY, 25% SAND, 15% SILT DOLOMITE: LIGHT GRAYISH BROWN, 10 YR 5/2, MASSIVE, VERY HARD	CL	
	15	AUGER REFUSAL AT 12.5' BOREHOLE OVM READING THROUGH AUGERS: 5.0 PPM		
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 11.0 — 2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.2		1.0
NS			2.5
2	0.3	1.3	3.8
NR			4.0
3	0.3	1.0	5.0
NR			5.5
NS			9.0
4	0.2	0.8	9.8
NR			10.5
NS			12.0
5	220.0	0.2	12.2
NR			12.5

REMARKS

BACKGROUND OVM READING:
SOIL: 0.1 PPM
AIR: 0.1 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-12***

DATE DRILLED 4/24/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		Start: 10:15 Stop: 11:55 GROUND SURFACE: 3790.6		
	0	CLAYEY SILT: BROWN, 7.5 YR 5/2, DRY, VERY LOW PLASTICITY, UNCONSOLIDATED FROM 0.0-1.5', MOD. COMPACTED BELOW 1.5', CALICHE VEINS, 60% SILT, 40% CLAY, VERY FINE QUARTZ	CL	
	8.0	BOULDERY COBBLELY SILT: GRAYISH BROWN, 10 YR 5/2, UNCONSOLIDATED TO MOD. COMPACTED, GRAVELLY, COBBLES/BOULDERS FROM 5 CM TO 20 CM, GRAVEL TO 5 CM., RND-SUBRND.	GW	
	14.0 14.1 14.2	SANDY CLAY: GRAYISH BROWN, 10 YR 5/2, WET WITH HYDROCARBON, STRONG ODOR, FINE QUARTZ DOLOMITE: LIGHT GRAYISH BROWN, 10 YR 6/2, MASSIVE	CL	
		AUGER REFUSAL AT 14.2', BOREHOLE OVM THROUGH AUGERS AT 13.5': 220 PPM 12:55 NO BOREHOLE FLUID OBSERVED		

OVM SOIL GAS PPM x 16.0 — 2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.6		1.0
NS			2.5
2	0.2	1.2	3.7
NR			4.0
3	0.2	1.5	5.5
NS			
			9.0
4	0.2	1.5	10.5
NS			
5	320.0	0.1	14.0 14.1 14.2
NR			

REMARKS

BACKGROUND OVM READING:
SOIL: 0.2 PPM
AIR: 1.5 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-13***

DATE DRILLED 4/25/91
DRILLING METHOD HSA
DRILLED BY HSB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

Start: 13:38
Stop: 14:30

GROUND SURFACE: 3791.4

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
	0	CLAYEY SILT: BROWN, 7.5 YR , DRY FROM 0.0-9.0', LOW TO MED. PLASTICITY, VERY FINE QUARTZ 60% SILT, 40% CLAY	CL	
	5			
	10	MOIST BELOW 9.0'		
▽ 11.26'				
	13.5	SANDY GRAVEL: DARK GRAY, 10 YR 5/1, COARSE GRAVEL, FINE GRAIN, SATURATED, QUARTZ, RND TO STRONG SUBANG., POORLY SORTED, STRONG ODOR	GW	
	15 15.1	DOLOMITE: LIGHT GRAYISH BROWN, 10 YR 5/2, MASSIVE		
		AUGER REFUSAL AT 15.1'		
	20			
	25			
	30			
	35			

OVM SOIL GAS
PPM X 11.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.2		1.0
NS			2.5
2	0.2	1.1	3.6
NR			4.0
NS			9.0
3	0.4	0.8	9.8
NR			10.5
NS			13.5
6	11.1	1.5	14.7
7	220.0		15.0
NR			15.1

REMARKS

BACKGROUND OVM READING:
SOIL: 0.2 PPM
AIR: 0.3 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-14 (MW-1)***

DATE DRILLED 4/25/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		Start: 16:40 Stop: 17:40 GROUND SURFACE: 3794.1	
	0	CLAYEY SILT: BROWN, 7.5 YR 5/2, DRY, VERY LOW PLASTICITY, UNCONSOLIDATED FROM 0.0–1.5', CALICHE DEPOSITS, 60% SILT, 40% CLAY	CL
	4.2	GRAVELLY COBBLELY SILT: UNCONSOLIDATED TO MOD. CONSOLIDATED, PEBBLES TO 2 CM., COBBLES TO 10 CM., ROUND	GW
	13.1	AUGER REFUSAL AT 13.1' GROUNDWATER NOT OBSERVED DURING DRILLING BOREHOLE OVM READING THROUGH AUGER: 0.6 PPM	

GRAPHIC LOG

OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.2		1.0
NS			2.5
2	0.8	0.8	3.3
NR			4.0
3	1.0	0.9	4.9
NR			5.0
NS			9.0
4	2.6	0.6	9.6
NR			10.5
NS			13.0
5	2.0	1.0	13.1

REMARKS

BACKGROUND OVM READING:
SOIL: 0.1 PPM
AIR: 0.8 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-15***

DATE DRILLED 4/25/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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DRAFT

BORING RECORD

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		Start: 10:08 Stop: 12:37 G.L. Elev.								BACKGROUND HNU READING: SOIL: ____ PPM AIR: ____ PPM
	0	Sandy clay, dark Yellowish brown, 10YR 4/6, dry, V. low Plasticity, V. fine grained, 60% clay, 40% silt	CL			1			0 1.0	
						NR				
						1		0.8	2.5	3.2 ppm
	3.5					2			3.3	
						NR			4.0	
						3		0.5	4.5	
	5.0	Boulders - Cobbley Silt, grayish brown, 10YR5/2 Poorly Sorted, Not to Poorly consolidated, Cobbles/boulders from 5-cm to 15-cm, porous	GW			NR			5.5	
						NS				
						4		1.0	9.0	
						ND			9.5	
	10.0					NS				
						NR		0.0	14.0	
	14.0								10.2	
		Auger Refusal at 14.0' Groundwater Not observed during drilling NR: No Recovery NS: Not Sampled Borehole HNU through Augers: 22 ppm								

CME CONTINUOUS AUGER SAMPLER

WATER TABLE (TIME OF BORING)

WATER TABLE (24 HOURS)

JOB NAME / NUMBER Marathon/91029

BH-16

DATE DRILLED 04-26-91

DRILLING METHOD HSA

DRILLED BY SNB

LOGGED BY MJL
BJS

ROBERTS/SCHORNICK & ASSOCIATES, INC.

Location: S 1313
W 600

DRAFT

BORING RECORD

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x____ 2 4 6 8 10 12 14 16 18	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		Start: 13:30 Stop: 14:22 G.L. Elev.								BACKGROUND HNU READING: SOIL: ____ PPM AIR: ____ PPM
	0	Silty clay, brown, 10 YR 5/3, V. low plasticity, dry, V. fine grain, 60% clay, 40% silt	CL			1			1.0	
						NS			2.5	
	3.0					2		1.5	4.0	
		Boulders - Cobbly Silt, grayish brown, 10YR 5/2. Poorly sorted, Cobbles/ boulders from 5-cm to 15cm, round	GW			3			4.5	
						NR			5.5	
						4		0.8	9.6	
	10.0					NR			7.8 10.6	
		Auger refusal at 10' Groundwater Not observed during drilling Borehole HNU Reading through Augers: 66 ppm NR: No Recovery NS: Not Sampled								

CME CONTINUOUS AUGER SAMPLER

WATER TABLE (TIME OF BORING)

JOB NAME / NUMBER Marathon/91029

BH-17

WATER TABLE (24 HOURS)

ROBERTS/SCHORNICK & ASSOCIATES, INC.

DATE DRILLED 04-26-91

DRILLING METHOD HSA

DRILLED BY SHB

LOGGED BY MJL

BJS

Location: S 1400
E 100

DRAFT

BORING RECORD

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		Start: 16:14 Stop: 17:02 G.L. Elev.								BACKGROUND HNU READING: SOIL: ____ PPM AIR: ____ PPM
	0	Sandy clay, Brown, 7.5 YR 5/4, dry, V. low plasticity, Caliche veins.				1			1.0	
						NS		1.0	2.5	
						2			3.5	
						NR			4.0	
	5.0	Dark brown, 10 YR 4/3 below 4.0'	CL			3		0.5	4.5	
						NR			5.5	
						NS		1.5	9.0	
	10.0	Clayey Silt, dark brown, 10 YR 4/3, V. Fine quartz, Moist, low Plasticity, Most Caliche, Sandy, V. fine quartz, Caliche Veins. 60% Silt, 40% clay	CL			4			10.5	
						NS		1.5	14.0	
	14.5 14.7	Gravelly clay, brown, 10 YR 4/3, pebbles to 3-cm, sand, 60% clay, 20% silt, 20% pebbles.	CL			5			15.5	
		Dolomite, grayish brown, 10 YR 5/2, Massive								
		Auger Refusal at 14.5'								
		Groundwater Not Observed During Drilling								
		Background HNU through Auger: 0.6 PPM								
		NR: No Recovery								
		NS: Not Sampled								

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/FT.^{2})

JOB NAME / NUMBER Manatthan/91029
BORING NUMBER BH-18
DATE DRILLED 04-26-91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
Page 1 of 1

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3700 W. Robinson
Norman, Oklahoma 73072
(405) 321-3695

RSA FORM 10/84 Rev. 2

Location: E 2000
S 570

Original Location: E 2000
S 600
Moved 30' N Due to Pipeline from gas well

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE:	
	0	SANDY SILT: VERY FINE GRAIN SAND, 10% SAND, 90% SILT, NO PLAST., 10 YR 5/3, BROWN, DRY, SUBRND., DOLOMITE COBBLES TO 1.0', DIAMETER, GRASS AND ROOTS AT SURFACE	SM
	1.0	COBBLEY GRAVELLY SILT: GRAVEL TO 0.15' DIAMETER, SUBRND, DOLOMITE, VERY FINE GRAIN SAND, 20% GRAVEL AND COBBLES, 80% SILT, 10 YR 6/2, LIGHT GRAYISH BROWN, DRY, UNCONSOLIDATED	GM
	5		
	10	SLIGHTLY MOIST AT 11.5'	
	13.6	AUGER REFUSAL 13.6'	
	15	NO GROUNDWATER AFTER DRILLING	
		BOREHOLE OVM: 0.0 PPM	
	20		
	25		
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS PPM x 1.0 — 2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	0.0	0.6	3.0
NR			4.0
NS			5.0
2	0.0	0.9	5.9
NR			6.5
NS			7.5
3	0.0	1.3	8.8
NR			9.0
NS			10.0
4	0.0	1.2	11.2
NR			11.5
NS			12.5
5	0.0	0.5	13.0
6	0.0	0.6	13.6

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 2.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-19***

DATE DRILLED 4/27/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
	0	GROUND SURFACE:		
	0 – 1.0	SANDY SILT: VERY FINE GRAIN SAND, 10% SAND, 90% SILT, NO PLAST., 10 YR 6/3, PALE BROWN, DRY, UNCONSOLIDATED	SM	
	1.0 – 11.5	COBBLELY GRAVELLY SILT: SUBRND., DOLOMITE GRAVEL AND COBBLES, 10 YR 6/2, LIGHT GRAYISH BROWN, DRY, UNCONSOLIDATED	GM	
	11.5 – 12.0	DOLOMITE: 10 YR 6/1, GRAY TO LIGHT GRAY, VERY HARD	DOLOMITE	
		AUGER REFUSAL 12.0'		
		NO GROUNDWATER AT TIME OF BORING		
		BOREHOLE OVM READING 0.0 PPM		

OVM SOIL GAS PPM x 1.0 — 2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	0.0	0.8	3.3
NR			4.0
NS			5.0
2	0.0	0.9	5.9
NR			6.5
NS			7.5
3	0.0	1.5	9.0
NS			10.0
4	0.0	1.3	11.3
NR			11.5
5	0.0	0.3	11.8
NS			12.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 2.0 PPM

0 5 10 15 20 25 30 35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-20***

DATE DRILLED 4/28/91
DRILLING METHOD hsa
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3791.4								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	GRAVELLY SILT: GRAVEL TO 0.5' DIAMETER, 10% GRAVEL, 90% SILT, 10 YR 6/3, PALE BROWN TO 0.6', 10 YR 8/2, WHITE AFTER 0.6', DRY	SM			NS			2.5	
						1	1.4	1.0	3.5	
						NS			4.1	
	5 5.1	AUGER REFUSAL 5.1'				2	1.0	1.0	5.1	
		NO GROUNDWATER AT TIME OF BOREHOLE								
		BOREHOLE OVM: 0.0 PPM								
	10									
	15									
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-21 (MW-36)***

DATE DRILLED 4/30/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3792.7		
	0	COBBLELY SILT: 10% DOLOMITE COBBLES, 90% SILT, NO PLASTICITY, 10 YR 6/3, PALE BROWN, AFTER 0.5', 10 YR 7/2, LIGHT GRAY, DRY, COBBLES TO 0.6' DIAMETER AFTER 2.0', 30% COBBLES, 70% SILT	SM	
	5	INCREASING COBBLES WITH DEPTH		
	10	12.8–13.3', 7.5 YR 5/4, BROWN, SLIGHTLY MOIST, SILT MINOR GRAVEL TO .05' DIAMETER 5% CLAY, BINDED, MOIST		
	14.2 14.4	SANDY DOLOMITE: VERY FINE GRAIN SAND, 20% SAND, 80% DOLOMITE, VERY HARD, DRY, MINOR 2.5 Y 8/6, YELLOW TO 10 YR 6/8, BROWNISH YELLOW, IRON OXIDE, POSSIBLE SULFER STAINING	SAND/ DOLOMITE	
	15	NO GROUNDWATER ENCOUNTERED TO 14.4'		
	20			
	25			
	30			
	35			

OVM SOIL GAS
PPM X 1.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	0.9	1.4	3.9
NR			4.0
2	1.2	0.2	4.2
NS			7.5
3	1.9	0.5	8.0
NS			9.0
4	2.7	1.3	10.3
NR			10.5
NS			12.0
5	2.9	1.5	12.5
NS			13.7
6	1.7	0.7	14.4

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-22***

DATE DRILLED 4/30/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3786.9		
	0	CLAYEY SILT: 10% CLAY, 90% SILT, LOW PLAST., 7.5 YR 6/4, LIGHT BROWN, DRY, MASSIVE	ML	
	4.0	SANDY CLAYEY SILT: 10% SAND, 10% CLAY, 80% SILT, VERY FINE GRAIN SILICA SAND, LOW PLAST., 7.5 YR 7/2, PINKISH GRAY, DRY	ML	
	7.3	COBBLEY SILT: ABUNDANT DOLOMITE COBBLES, MINOR SUBROUNDED DOLOMITE GRAVEL, UNCONSOLIDATED, DRY, 5 YR 7/1, LIGHT GRAY	GM	
	13.9	AUGER REFUSAL 13.9'		
		NO GROUNDWATER ENCOUNTERED		

OVM SOIL GAS PPM X 1.0 — 2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	7.0	1.2	3.7
NR			4.0
NS			5.0
2	1.6	1.4	6.4
NR			6.5
NS			7.0
3	2.0	0.3	7.3
NS			9.0
4	3.5	0.9	9.9
NR			10.5
NS			12.0
5	3.1	0.8	12.8
NR			13.7
NS			13.9

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

0 5 10 15 20 25 30 35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-23 (MW-2)***

DATE DRILLED 5/1/91
DRILLING METHOD HSA
DRILLED BY SBH
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3785.4	
	0	SANDY CLAYEY SILT: 10% SAND, 10% CLAY, 80% SILT, VERY FINE GRAIN SAND, MINOR DOLOMITE GRAVEL, 10 YR 6/4, LIGHT YELLOWISH BROWN, DRY, UNCONSOLIDATED	ML
	10.8	COBBLEY SILT: 10 YR 7/3, VERY PALE BROWN, DOLOMITE COBBLES, DRY, UNCONSOLIDATED, MINOR DOLOMITE GRAVEL > 0.1' DIAMETER	GM
	15.3	SANDY DOLOMITE: VERY FINE GRAIN SAND, 10 YR 6/3, PALE BROWN VERY HARD, DRY	DOLOMITE
		AUGER REFUSAL 15.3'	
		NO GROUNDWATER ENCOUNTERED	
		BOREHOLE OVM: 0.0 PPM	

GRAPHIC LOG

OVM SOIL GAS PPM x 1.0 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	0.0	1.5	4.0
NS			5.0
2	0.0	1.0	6.0
NR			6.3
NS			7.5
3	0.0	1.1	8.6
NR			9.0
NS			10.0
4	0.0	0.8	10.8
NR			11.5
NS			12.5
5	0.8	0.8	13.3
NR			14.0
6	2.9	1.0	15.0
NR			15.3

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

0 5 10 15 20 25 30 35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/90129***

BORING NUMBER ***BH-24 (MW-3)***

DATE DRILLED 5/2/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3789.8								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SANDY CLAYEY SILT: VERY FINE GRAIN SAND, 10% SAND, 10% CLAY, 80% SILT, 10 YR 6/3, PALE BROWN, DRY, UNCONSOLIDATED AFTER 0.3', 10 YR 7/2, LIGHT GRAY	ML			NS			2.0	0
	2.6	AUGER REFUSAL 2.6' NOT ABLE TO SAMPLE BEDROCK NO GROUNDWATER ENCOUNTERED BOREHOLE OVM: 1.1 PPM				1	3.5	0.6	2.6	
	5									5
	10									10
	15									15
	20									20
	25									25
	30									30
	35									35

- SPLIT-SPOON SAMPLER
- STANDARD PENETRATION TEST
- UNDISTURBED SAMPLE
- WATER TABLE (24 HOURS)
- WATER TABLE (TIME OF BORING)
- LABORATORY TEST LOCATION
- \+ PENETROMETER (TONS/SQ. FT.)
- NR: NO RECOVERY
- NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-25***

DATE DRILLED 5/3/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3784.1								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SANDY CLAYEY SILT: VERY FINE GRAIN SAND, 10% SAND, 10% CLAY, 80% SILT, LOW PLAST., 10 YR 6/4, LIGHT YELLOWISH BROWN, DRY, UNCONSOLIDATED, MINOR SUBRND. DOLOMITE GRAVEL	ML			NS				
	2.0	COBBLEY SILT: DOLOMITE, COBBLES, 10 YR 7/2, LIGHT GRAY, DRY, UNCONSOLIDATED, ABUNDANT GRAVEL TO 0.15" DIAMETER	GM						2.5	
						1	0.0	0.9	3.4	
						NR			4.0	
	5					2	0.0	1.5	5.5	
						NS			7.0	
						3	0.0	1.0	8.0	
						NR			8.5	
						NS			9.0	
	10					4	0.0	0.8	9.8	
						NR			10.5	
						NS			12.5	
						NR			13.0	
						NS			13.5	
	15					5	0.0	0.6	14.1	
						NR			14.5	
						NS				
	16.8									
	16.9	SANDSTONE: VERY FINE GRAIN QUARTZ, 10 YR 7/2, LIGHT GRAY, DRY, HARD, WEAK CEMENTATION, FRIABLE	SANDSTONE						16.9	
		AUGER REFUSAL 16.9' NO GROUNDWATER ENCOUNTERED BOREHOLE OVM: 0.0 PPM								
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

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JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-26 (MW-4)***

DATE DRILLED 5/3/91 - 5/4/91
DRILLING METHOD HSA
DRILLED BY SBH
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 1.9 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3793.1								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SANDY CLAYEY SILT: NO PLAST., VERY FINE GRAIN SAND, 10 YR 6/3, 80% SILT, 10% SAND, 10% CLAY, PALE BROWN, DRY, MINOR SUBRND. DOLOMITE GRAOVEL, UNCONSOLIDATED	SM			NS			2.5	
	3.4	AUGER REFUSAL 3.4' NO GROUNDWATER ENCOUNTERED				1	37.0	0.9	3.4	
	5									
	10									
	15									
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-27*

DATE DRILLED 5/4/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3799.8		
	0	SANDY SILT: 20% VERY FINE GRAIN SAND, 80% SILT, NO PLAST., 10 YR 7/3, VERY PALE BROWN, DRY, UNONSOLIDATED	SM	
	3.7	SILTY SANDSTONE: VERY FINE GRAIN QUARTZ, 10 YR 8/2, WHITE, DRY, WEAKLY CEMENTED, FRIABLE	SILTY SANDSTONE	
	5	MOIST AT 8.0', 2.5 Y 7/4, PALE YELLOW,		
		VERY MOIST AT 9.0'		
	10	AFTER 11.0', VERY HARD		
	11.2	AUGER REFUSAL 11.2' NO GROUNDWATER ENCOUNTERED BOREHOLE OVM: 8 PPM		
	15			
	20			
	25			
	30			
	35			

OVM SOIL GAS
PPM X 1.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	0.0	1.2	3.7
NR			4.0
NS			5.0
2	0.0	1.0	6.0
NS			7.0
3	2.0	0.6	7.6
NS			9.0
4	0.0	0.3	9.3
NS			11.0
5	0.0	0.2	11.2

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

- SPLIT-SPOON SAMPLER
- STANDARD PENETRATION TEST
- UNDISTURBED SAMPLE
- WATER TABLE (24 HOURS)
- WATER TABLE (TIME OF BORING)
- LABORATORY TEST LOCATION
- PENETROMETER (TONS/SQ. FT.)
- NR: NO RECOVERY
- NS: NOT SAMPLED

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JOB NAME/NUMBER ***MARATHON/90129***

BORING NUMBER ***BH-28 (MW-5)***

DATE DRILLED 5/4/91 & 5/5/91
DRILLING METHOD HSA
DRILLED BY SBH
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3783.2		
	0	COBBLEY SILT: DOLOMITE COBBLES TO 1.5" DIAMETER, 10 YR 5/3, BROWN, DRY, UNCONSOLIDATED	GM	
		AFTER 0.9', 10 YR 8/2, WHITE, ABUNDANT SUBRND. DOLOMITE GRAVEL		
	5			
	10			
	12.3	AUGER REFUSAL 12.3'		
		NO GROUNDWATER ENCOUNTERED		
	15			
	20			
	25			
	30			
	35			

OVM SOIL GAS
PPM X 1.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	13.0	1.1	3.6
NR			4.0
NS			5.0
2	6.0	0.7	5.7
NS			7.0
3	6.0	1.2	8.2
NS			8.5
4	11.0	0.6	9.1
NS			12.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/90129***

BORING NUMBER ***BH-29 (MW-6)***

DATE DRILLED 5/5/91
DRILLING METHOD HSA
DRILLED BY SBH
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		Start: 8:10 Stop: 10:50	
		GROUND SURFACE: 3783.5	
	0	BOULDERY COBBLEY SILT: BROWN, 7.5 YR 5/6, DRY, UNCONSOLIDATED, COBBLES/BOULDERS FROM 5 CM TO 1 M, VERY FINE QUARTZ, GRAVELLY, WELL ROUNDED PEBBLES	GW
	13.5	SILTY CLAY: BROWN, 10 YR 5/6, VERY FINE QUARTZ, LOW PLASTICITY, DRY, MED. COMPACTED, ABUNDANT CALICHE AND ROOT CHANNELS, 60% CLAY, 40% SILT, WEATHERED AT CONTACT, CALICHE CEMENTED	CL
	15.5		DOLOMITE
	16.3	DOLOMITE: LIGHT GRAYISH BROWN, 10 YR 5/2, VERY HARD, SANDY, MASSIVE	
		AUGER REFUSAL AT 16.25'	
		GROUNDWATER NOT OBSERVED DURING DRILLING	

GRAPHIC LOG

OVM SOIL GAS PPM X 2.1 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.2		0.6
NS			2.5
2	42.0	1.5	4.0
3	3.8		5.5
NS			8.0
NR		0.0	9.5
4	1.6	0.4	9.9
NR			10.3
NS			12.0
5	0.7	0.6	12.6
NR			13.5
6	0.2	1.5	15.0
NS			16.0
NR			16.3

REMARKS

BACKGROUND OVM READING:
SOIL: 0.2 PPM
AIR: 0.2 PPM

0 5 10 15 20 25 30 35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-30 (MW-7)***

DATE DRILLED 5/6/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		Start: 15:05 Stop: 17:40 GROUND SURFACE: 3792.8		
	0	BOULDERY COBBLEY SILT: BROWN, 10 YR 5/6, DRY, VERY LOW PLASTICITY, UNCONSOLIDATED, GRAVELLY, COBBLES/BOULDERS FROM 5 CM TO 1 M, ROUNDED	GW	
	15.3	AUGER REFUSAL AT 15.5' GROUNDWATER NOT OBSERVED DURING DRILLING		

OVM SOIL GAS
PPM x 18.5
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.9	1.0	1.0
NS			2.5
2	369.0	0.8	3.3
NR			4.0
3	5.3	1.1	5.1
NR			5.5
NS			7.0
4	24.1	0.8	7.8
NR			8.5
NS			9.0
5	0.2	1.0	10.0
NS			12.0
6	0.2	0.4	12.4
NS			14.0
7	0.2	0.1	14.1
NS			15.0
NR		0.0	15.3

REMARKS

BACKGROUND OVM READING:
SOIL: 0.2 PPM
AIR: 0.2 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-31 (MW-8)***

DATE DRILLED 3/6/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		Start: 8:45 Stop: 10:08 GROUND SURFACE: 3805.6		
	0	CLAYEY SILT: DARK BROWN, 7.5 YR 4/2, VERY FINE QUARTZ, DRY, VERY LOW PLASTICITY, GRAVELLY, 60% SILT, 40% CLAY, CALICHE DEPOSITS	CL	
	5	BOULDERY COBBLEY SILT: BROWN, 7.5 YR 5/2, DRY, UNCONSOLIDATED, GRAVELLY, COBBLES/ BOULDER FROM 5 CM TO 50 CM, ROUNDED	GW	
	9.5 10	SANDSTONE: QUARTESE, GRAYISH YELLOW TO YELLOWISH GRAY, 5 Y 8/4 TO 7/2, FINE GRAIN, WELL SORTED, POORLY CEMENTED, FRIABLE	SANDSTONE	
	12.0	AUGER REFUSAL AT 12.0' BOREHOLE REAMED TO 13.90' TO INSTALL MONITOR WELL GROUNDWATER NOT OBSERVED DURING DRILLING		
	15			
	20			
	25			
	30			
	35			

OVM SOIL GAS
PPM x 1.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.2		0.6
NS			2.5
2	0.2	0.6	3.1
NR			4.0
3	0.2	0.3	4.3
NR		0.5	5.5
NS			7.0
4	0.2	0.1	7.1
NS			9.0
5	0.2	0.6	9.6
NR			10.0
NS			12.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-32 (MW-9)***

DATE DRILLED 5/7/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		Start: 13:00 Stop: 14:44 GROUND SURFACE: 3788.7		
	0	CLAYEY SILT: YELLOWISH BROWN, 10 YR 5/4, DRY, VERY LOW PLASTICITY, VERY FINE QUARTZ, CALICH DEPOSITS, 60% SILT, 40% CLAY	CL	
	5	SILTY CLAY: DARK BROWN, 10 YR 4/3, VERY FINE QUARTZ, LOW PLASTICITY, MOD. COMPACTED,	CL	
	10	MOIST BELOW 9.5', LOW PLASTICITY		
	12.6	BOULDERY COBBLEY GRAVEL: LIGHT GRAYISH BROWN, 10 YR 5/2 TO 6/2, ROUND, CALICHE, CEMENTED, HARD	GW	
	13.5	CLAYEY SAND: SANDY CLAY, BROWN, 10 YR 5/3, QUARTZ, FINE GRAIN, WELL SORTED, SATURATED, MED. PLASTICITY, STRONG HYDROCARBON ODOR	CL/SM	
▽ 16.0'	15			
	16.5	AUGER REFUSAL AT 16.5' BOREHOLE REEMED 10 INCHES TO A DEPTH OF 17.01', 5/8/91		
	20			
	25			
	30			
	35			

OVM SOIL GAS
PPM X 27.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	1.0		0.5
NS			2.5
2	1.1	0.6	3.1
NR			4.0
3	0.2	1.1	5.1
NR			5.5
NS			9.0
4	0.2	0.8	9.8
NR			10.5
NS	0.0		12.0
5	23.0	0.7	12.7
NR			13.0
NS			13.5
6	540.0	4.3	14.8
NR			15.0
NS			16.5
NR		0.0	16.6

REMARKS

BACKGROUND OVM READING:
SOIL: 0.2 PPM
AIR: 0.7 PPM

- SPLIT-SPOON SAMPLER
- STANDARD PENETRATION TEST
- UNDISTURBED SAMPLE
- WATER TABLE (24 HOURS)
- WATER TABLE (TIME OF BORING)
- LABORATORY TEST LOCATION
- PENETROMETER (TONS/SQ. FT.)
- NR: NO RECOVERY
- NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-33 (MW-10)***

DATE DRILLED 5/7/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

Start: 14:23
Stop: 16:40

GROUND SURFACE: 3804.8

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
	0	CLAYEY SILT: YELLOWISH BROWN, 10 YR 5/4, DRY, UNCONSOLIDATED, VERY LOW PLASTICITY, VERY FINE QUARTZ, 70% SILT, 30% CLAY	CL
	4.5	GRAVELLY COBBLEY SILT: GRAYISH BROWN, 10 YR 5/2, VERY FINE QUARTZ, POORLY SORTED, ANGULAR, ABUNDANT, K-FELDSPARS/BIOTITE, MOD. COMPACTED, STRUCTURELESS, CaCo3	SM
	7.5	COBBLEY BOULDERY SILT: GRAYISH BROWN, 10 YR 5/2, POORLY SORTED, COBBLES/BOULDERS FROM 5 CM TO 1 M, ROUND DOLOMITE	GW
	10		
	15		
		HYDROCARBON ODOR BELOW 18.01', MOIST	
	20		
▽ 22.0'	22.2	HYDROCARBON SATURATED AT CONTACT	
	22.5	SANDSTONE: LIGHT OLIVE GRAY, 5 Y 6/2, QUARTZ ORE, FINE GRAIN, WELL SORTED, MICACEOUS, FRIABLE, NOCALCAREOUS	SANDSTONE
		AUGER REFUSAL AT 22.5'	
	25		
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS
PPM X 31.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0		1.0
NS			2.5
2	0.0	1.1	3.6
NR			4.0
3	0.0		5.1
NR			5.5
NS			7.0
4	0.0	1.1	8.1
NR			8.5
NS			9.0
5	2.5	1.3	10.3
NR			10.5
6	8.6	1.5	13.5
NS			15.0
NR			15.2
NS			17.5
7	479.0	1.5	19.0
NS			20.0
8	545.0	1.2	21.2
NR			21.3
NS			22.0
9	605.0	2.5	22.5

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.2 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-34 (MW-11)***

DATE DRILLED 5/8/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		Start: 14:30 Stop: 17:35	
		GROUND SURFACE: 3807.9	
	0	CLAYEY SILT: LIGHT YELLOWISH BROWN, 10 YR 6/4, DRY, VERY FINE QUARTZ, UNCONSOLIDATED, 60%SILT, 40% CLAY, CALICHE DEPOSITS	CL
	4.0	BOULDER COBBLEY SILT: LIGHT GRAYISH BROWN, 10 YR 6/2, POORLY SORTED, GRAVELLY, COBBLES, BOULDERS FROM 5 CM TO 1 M, ROUND	GW
	5		
	10		
	15		
	20	CLAYEY BELOW 19.5', SANDY, QUARTZ, MEDL GRAIN, MOIST, MEDL PLASTICITY, STRONG HYDROCARBON ODOR	
	23.0 23.3	SANDSTONE: LIGHT OLIVE GRAY, 5 Y 6/2, QUARTZ ORE, FINE GRAIN, POORLY CEMENTED, NON-CALCAREOUS, FRIABLE, MICACEOUS	SANDSTONE
	25	BORING TERMINATED 25.25'	
		GROUNDWATER NOT OBSERVED DURING DRILLING	
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS
PPM X 22.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.8		0.5
NS			2.5
2	1.1	1.5	4.0
3	0.2	0.5	4.5
NR			5.5
NS			7.0
4	1.6	1.5	8.5
NS			9.5
5	2.5	1.0	10.5
NR			11.0
NS			12.0
6	1.1	0.5	12.3
NR			12.5
NS			13.0
NS			14.0
7	9.1	0.8	14.8
NR			15.5
NS			17.5
8	47.1	1.5	19.0
9	157.5	0.7	19.7
NR			20.0
NS			22.5
10	440.0	0.5	23.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-35 (MW-12)***

DATE DRILLED 5/9/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		Start: 13:10 Stop: 15:00 GROUND SURFACE: 3799.5		
	0	CLAYEY SILT: YELLOWISH BROWN, 10 YR 5/4, VERY FINE QUARTZ, DRY, VERY LOW PLASTICITY, 70% SILT, 30% CLAY	CL	
	7.2	BOULDERY COBBLEY SILT: GRAVEL, LIGHT GRAYISH BROWN, 10 YR 6/2, POORLY SORTED, COBBLES/ BOULDERS FROM 5 CM TO 1 M., ROUND	GW	
	12.5	SANDY GRAVELLY CLAY: BROWN, 7.5 YR 5/4, MOIST, MED. PLASTICITY, FINE GRAIN QUARTZ, FIRM, OCCASIONAL LARGE GRAVEL, 60% CLAY, 40% SAND, CALICHE DEPOSITS	CL	
	13.5	BOULDERY COBBLEY SILT: GRAVELLY, LIGHT GRAYISH BROWN, 10 YR 6/2, POORLY SORTED, COBBLES/BOULDERS FROM 5 CM TO 1 M, ROUND	GW	
	17.5	GRAVEL: GRAY, 10 YR 5/1, MOD. WELL SORTED, ANGULAR, PEBBLES 5-10 MM, HYDROCARBON SATURATED	GP	
	19.2	SANDSTONE: PALE OLIVE, 5 Y 6/4, FINE GRAIN, WELL SORTED, POORLY CEMENTED, FRIABLE, NONCALCAREOUS, MICACIOUS	SANDSTONE	
		BORING TERMINATED AT 19.99' NO GROUNDWATER ENCOUNTERED DURING DRILLING		

OVM SOIL GAS
PPM x 23.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0		1.0
NS			2.5
2	0.0	1.0	3.5
NR			4.0
3	0.0	0.5	4.5
NR			5.5
NS			7.0
4	0.0	0.4	7.4
NR			8.5
NS			9.0
5	0.0	1.1	10.1
NR			10.5
NS			12.0
6	0.0	1.5	13.5
NS			14.0
7	0.0	0.4	14.4
NS			17.0
8	204.0	1.0	18.0
NR			18.8
NS			19.0
9	460.0	0.7	19.7

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

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JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-36 (MW-13)*

DATE DRILLED 5/10/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		Start: 07:40 Stop: 10:00 GROUND SURFACE: 3801.6	
	0	CLAYEY SILT: BROWN, 7.5 YR 5/4, DRY, VERY LOW PLASTICITY, CALICHI DEPOSITS, VERY FINE QUARTZ, 70% SILT, 30% CLAY	CL
	7.3	BOULDER COBBLEY SILT: LIGHT BROWNISH GRAY, 10 YR 6/2, GRAVELLY, POORLY SORTED, COBBLES/BOULDERS FROM 5 CM TO 50 CM.,	GW
	10	ABUNDANT GRAVEL FROM 12.0–14.0', PEBBLES FROM 1.0 CM TO 3.0 CM CLAYEY FROM 14.0–14.5', SANDY, MOIST, MED. GRAIN QUARTZ, MED. PLASTICITY BOULDERS > 1M BELOW 14.5'	
	15		
	17.2	GRAVEL: GRAY TO GRAYISH BROWN, 10 YR 5/1 TO 5/2, MODERATLY SORTED, VERY COARSE GRAIN QUARTZ, PEBBLES 0.5 TO 1.0 CM, RND TO SUBRND., COBBLEY, HYDROCARBON SATURATED CLAYEY BELOW 17.0'	GP
	20		
	20.5	SANDSTONE: BROWN, 10 YR 5/3, FINE GRAIN, QUARTZORE, WELL SORT, POORLY CEMENTED, FRIABLE	SANDSTONE
	22.1	BORING TERMINATED AT 22.0' BOREHOLE REEMED TO .10'	
	25		
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS
PPM X 37.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	1.7		1.0
NS			2.5
2	18.1	1.3	3.8
NR			4.0
3	253.0	1.1	5.1
NR			5.5
NS			7.0
4	213.0	0.4	7.4
NR			8.5
NS			9.0
5	728.0	0.7	9.7
NR			10.5
NS			12.0
6	228.0	1.0	13.0
NS			14.0
7	109.0	0.5	14.5
NS			17.0
8	269.0	0.8	17.8
NR		0.0	18.0
NS			19.0
9	322.0	0.5	19.5
NS			22.0
10	342.0	0.5	22.5

REMARKS

BACKGROUND OVM READING:
SOIL: 0.2 PPM
AIR: 0.2 PPM

SPLIT–SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH–37 (MW–14)***

DATE DRILLED 5/11/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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(405) 321–3895

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DRAFT

BORING RECORD

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x 2 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		Stop: 15:45 Start: 17:00 @ 12.5' Resume: 10:00 Finish: 10:30 G.L. Elev.								BACKGROUND HNU READING: SOIL: ____ PPM AIR: ____ PPM
	0	Clayey Silt, Light Yellowish Brown, 10YR 6/4, V. fine grained, dry, V. low plasticity, Caliche deposits. 70% Silt. 30% clay	CL			1	1.1		1.0	
						NS			2.5	
						2	1.0	1.2	3.7	
	5.0					NR				
						3	0.2	1.1	5.1	
	6.5					NR				
		Cobbley - bouldery Silt, Light grayish brown to Yellowish brown, 10YR 6/2 to 6/4, gravelly, Poorly Sorted, Cobbley/ boulders from 3cm to 50cm, rounded to Subround				NS			7.0	
						4	1.1	0.9	7.4	
						NR			8.3	
						NS			9.0	
	10.0					5	4.4	0.5	9.9	
						NR			10.5	
						NS		0.4	12.0	
						6	4.9		12.9	
		Clayey from 9.0' to 9.8', Sandy, fine to med grain Sands, firm, med to low Plasticity,				NS			14.0	
	15.0					7	35.0	1.0	15.0	
						NR				
	16.0					NS			17.0	
						NR			17.6	
	20.0									

11.38
?.70

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
\+ PENETROMETER (TONS/FT.^{2})

JOB NAME / NUMBER Marathon/91029
BORING NUMBER BH-38 (MW-15)
DATE DRILLED 05-11-91 - 05-12-91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY RUL
CHECKED BY BJS
Page 1 of 1

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RSA FORM 10/84 Rev. 2

Location 400 E
450 S

BORING RECORD

Background HNU reading: Soil: 0.1 PPM; Air: 0.1 PPM

HNU soil gas survey PPM x 15

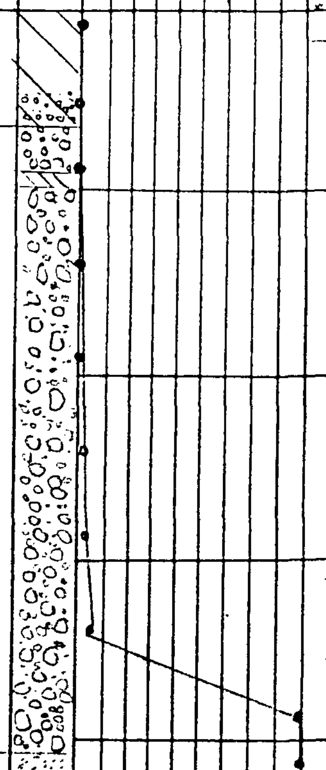
Start: 13.15
Stop.
GL Elev.

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
	0 – 5.0	Clayey Silt, v. pale brown to light yellowish brown, 10YR 7/4 to 6/4, dry, v. low plasticity, gravelly below 3.0', pebbles to 1cm. round, v. fine grained matrix, 65% silt 35% clay, 5% gravel	CL
	5.0 – 20.5	Bouldery - Cobbly Silt, light brownish gray 10YR 6/2, gravelly, poorly sorted, cobbles/boulders from 4cm to 1m, rounded, Clayey from 4.5' to 5.0'	GW
	20.5 – 21.0	Sandstone, light olive gray, 5Y 6/2, quartzose fine grain, well sorted, poorly cemented, friable, micaceous, iron oxide cement	

Boring Terminated at 21'

Groundwater Not observed During Drilling

NR: No Recovery
NS: Not Sampled



SAMPLE NUMBER	HNU READING	RECOVERY	DEPTH
			0
1	0.8		1.0
NS			2.5
2	2.1	0.9	3.4
NR			4.0
3	0.2	1.0	5.0
NR			5.5
NS			7.0
4	0.7	0.5	7.8
NR			8.5
NS			9.0
5	0.7	0.8	9.8
NR			10.5
NS			12.0
6	2.6	0.7	12.8
NR			13.5
NS			14.5
7	6.8	1.1	15.1
NR			15.5
NS			17.0
8	17.1	0.1	17.8
NR			18.5
NS			19.5
9	269	0.7	19.9
NR			20.5
10	268		21.0

REMARKS

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/FT.²)

JOB NAME / NUMBER: BH-39 (MW-16)
BORING NUMBER: Marathon/91029
DATE DRILLED: 05-12-91
DRILLING METHOD: HSA
DRILLED BY: SHB
LOGGED BY: TJL
CHECKED BY: BJS
Page 1 of 1

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RSA FORM 10/84 Rev. 2

Location E 800
S 900

BORING RECORD

DRAFT

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM x 20 (2 4 6 8 10 12 14 15 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	CLAYEY SANDY SILT: VFG SAND, 10% CL, 10% SD, 80% SILT, UNCONSOLIDATED, DRY, 7.5YR 7/4 PINK	SM			NS	1	1	2.5	
						1	0	.9	3.4	
						UR	=		4.0	
						NS	-	-	5	
	5					2	0	.4	5.4	
	6	ABUNDANT COBBLES AFTER 6 FEET				NR	-		6.5	
						NS	-	-	7.0	
						3	7	1.1	8.1	
	9.4					NS	-	-	10	
	10	COBBLEY SILTY SAND: 10% COBBLES 20% SILT 70% SD, VFG SILICA SAND, SL. MOIST, 7.5YR 7/4 PINK, UNCONSOLIDATED, DOLO. COBBLES	GM			4	0		10.5	
						NR	-	0.5	11.5	
						NS	-	-	12	
						DC	0	0.1	12.5	
	14					6	11	0.3	13	
		COBBLEY SANDY SILT: VFG SD, SL MOIST, 7.5YR 7/4, PINK, UNCONSOL., DOLO. COBBLES	GM			NS	-	-	14	
						7	30	.5	14.5	
	15.9					NS	-	-	17	19 ppm
						5	376	-	17.1	
	17.7					VS	-	-	17.7	
	20	AUGER REFUSAL 17.7'								
		NO GW ENCOUNTERED								
		BH OVM = 19 PPM								
	25									
	30									
	35									

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON
BORING NUMBER BH-40 (MW-17) 5700 EE
DATE DRILLED 5/13/91 & 5/19/91
DRILLING METHOD HSA
DRILLED BY
LOGGED BY WEP
CHECKED BY
DRAWN BY:
PAGE OF

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NORMAN, OKLAHOMA 73072
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE:		
	0	CLAYEY SILT: 10% CL, 90% SILT, LOW PLASTICITY, 10YR 6/3 PALE BN, UNCONSOL., DRY	SC	
	5			
	6	GRAVELLY COBBLEY SILT: 10YR 7/2 LT GY, UNCONSOL., SUBRND. DOLOMITE GRVL AND COBBLES, DRY	GM	
	10	COBBLEY SANDY SILT: VFG SD, 10% COBBLES 20% SD 70% SILT, SL MOIST, 10YR 7/2 LT GY, UNCONSOL., STRONG CONSTRN. ODOR	GM	
13.9 13.4		VERY MOIST AFTER 12.5'		
	15	AUGER REFUSAL 15.2' G/W DETECTED AT 13.9'		
	20			
	25			
	30			
	35			

OVM SOIL GAS SURVEY PPM X 23 (2 4 6 8 10 12 14 15 16)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
NS	–	–	2.5	BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
1	11.5	1.2	3.7	4.0
NR	–			
NS	–	–	5.0	
2	0	1.0	6.5	
NR	–		7.5	
NS	–	–		
3	2.8	1.0	8.5	
NR	–		9.0	
4	50	1.0	10	
NR	–		10.5	
NS	–	–	12	
5	378	0.5	12.5	
NR	–		13.5	13.6
6	400	0.1		
NS	–	–	15.2	

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON

BORING NUMBER BH-41 (MW-18) 1200 E 5755

DATE DRILLED 5-14-91
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X 40 (2 4 6 8 10 12 14 15 16)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
17.2 7.5	0	CLAYEY SILT: 10% CL, 90% SILT, 10YR 6/3 PALE BN, DRY UNCONSOL.	SC			NS	–	–	2.5	
						1	0	.98	3.5	
						NR	–	/	4.0	
	5	SLIGHTLY MOIST AFTER 5.0'				NS	–	–	5.0	
	6	COBBLEY CLAYEY SILT: 10% COBBLES, 10% CL, 80% SILT, 10YR 6/3 DALE BN, SM, UNCONSOL.	GM			2	0	1.3	6.3	6.5
						NR	–	/		
						NS	–	–	7.5	
						3	0	1.0	8.5	
						NR	–	/	9.0	
	10 10.2	COBBLEY SANDY SILT: VFG SAND, DOLO. COBBLES, 10YR 7/1 LT GY, DRY, UNCONSOL	GM			4	59	0.9	9.9	2PPM
						NR	–	/	10.5	
						NS	–	–	12	
	12.3	COBBLEY CLAYEY SILT: 10YR 7/1 LT GY DOLO. COBBLES, 10YR 5/4 YEL BN SILTY CLAY BINDER, MOIST, MOD. CONSOLIDATED	GM			5	124	1.1	12.1	
14.8'						NS	–	–	14	
	15					6	344	1.0	15	
16.7		COBBLEY SANDY SILT: VFG SD, DOLO COBBLES, 10YR 7/1 LT GY, SATURATED, STRONG CONDEN. ODOR	GM			NS	–	–	17	
	17.3	AT 17 FEET, SATURATED WITH 5YR 3/1 V. DK GY, VISCOUS MATERIAL, STRONG CONDENSATE ODOR				7	716	0.3	17.2	
	20	AUGER REFUSAL TO 17.3'								
		GW ENCOUNTERED 14.8'								
	25	HEAVING SANDS AT TO 17.3'								
	30									
	35									

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON

BORING NUMBER BH-42 (MW-19) E1000 S SC

DATE DRILLED 5-15-91

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	CLAYEY SLT: 10% CL 90% SLT, 10YR 6/3 PALE BN, DRY TO SL MOIST, NO PLAST.	CL			NS	–	–	2.5	
	3.5	COBBLEY SANDY SILT: 10YR 7/3 V. PALE BN, SM TO DRY, UNCONSOLIDATED, DOLOMITE COBBLES TO APPROXIMATE 0.5 FEET DIAM AFTER 6 FEET, CLAYEY SILT BINDER, SL MOIST	GM			1	609	0.9	3.1	
						NR	–	1	4.0	
	5					NS	–	–	5.0	
						2	55	0.4	5.4	
						NR			6.0	
						3	168	0.3	6.3	
	9					NS	–	–	9	
	10	COBBLEY SDY SILT: VEG SD 10YR 8/2 WHITE, DRY, UNCONSOLIDATED, DOLO. COBBLES, MINOR DOLO. GRAVEL MINOR CLAYEY SILT BINDER AFTER 12 FEET, SL MOIST	GM			4	51	0.9	9.9	
						NS	–	–	12	
						5	13	0.7	12.7	
						NR			13	
	14.1					NS	–	–	14.1	
	15	AUGER REFUSAL 14.1 FEET NO GW ENCOUNTERED								
	20									
	25									
	30									
	35									

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON

BORING NUMBER BH-93 (MW-20)

DATE DRILLED 5-16-91

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ___ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ___ PPM AIR: ___ PPM
	0	SANDY CLAYEY SILT: VFG SD, 10% SD, 10% CL, 80% SILT, NO PLAST., 7.5YR 7/2 PINK GY, DRY, MINOR CALICHE, UNCONSOLIDATED	SM			NS	–	–	2.5	0
						1	0	1.3	3.8	
						NR	–		4.0	
						NS	–	–	5.0	
	5					2	0	1.1	6.1	5
						NR	–		6.5	
	6.5	COBBLEY SANDY SILT: VFG SAND 10YR 7/2 LT GY, DOLO. COBBLES AND GRAVEL, DRY, UNCONSOLIDATED	GM			NS	–	–	7.0	
						3	0	0.7	7.7	
						NS	–	–	9.0	
						4	3	0.6	9.6	
	10	AFTER 12 FEET, CALICHE CEMENTATION, MINOR SL. MOIST 7.5YR 6/4 LT BN, CLAY BINDER				NS	–	–	12	10
						5	7	0.4	12.4	
		SLIGHTLY MOIST AFTER 14'				NS	–	–	14	
						6	11	0.9	14.9	
	15					NR	–		15.5	15
						NS	–	–	17	
						7	23	1.5	18.5	
		SANDSTONE: VFG SILICA, HIGHLY WEATHERED AND FRACTURED, 2.5Y 7/4 PALE YELLOW, FRACTURE IN-FILLING WITH MOTTLED 7.5YR 5/4 BROWN SILTY CLAY, SL. MOIST IN FRAC., MOIST IN SANDSTONE HIGHLY FRIABLE AND MOIST AFTER 20 FEET AFTER 20.6 FEET, V. HARD SANDSTONE	SAND-STONE			NS	–	–	19	
20.44	20					8	7	1.1	20.1	20.7 20
						NR	–		20.5	
	21.2					NR	2	.1		21.2
	25	AUGER REFUSAL 20.7'								25
		NO GW ENCOUNTERED								
10.0? .43	30									30
	35									35

Legend:
- CME CONTINUOUS AUGER SAMPLER
- STANDARD PENETRATION TEST
- UNDISTURBED SAMPLE
- WATER TABLE (24 HOURS)
- WATER TABLE (TIME OF BORING)
- LABORATORY TEST LOCATION
- PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER: MARATHON

BORING NUMBER: BH-44 (MW-21) S900 E100

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 16)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	COBBLEY SANDY SILT: VFG SD, 10YR 6/3 PALE BN, DRY, UNCONSOL., DOLO. COBBLES AND GRAVEL AFTER 3' 10YR 7/2 LT GY, CALICHE CEM, 2-3'	GM			NS	–	–	2.5	0
						1	0	1	2.6	
	4					NR	–	0.1	4.0	
	5	COBBLEY SILTY SAND: 10% COBBLES 30% SILT 60% SD, VF-F SD, 10YR 8/3 V PALE BN, DRY, DENSE	GM			2	0	1.2	5.2	5
						NS	–	–	7	
						3	0	0.5	7.5	
	8					NS	–	–	9	
		COBBLEY SANDY SILT: VFG SD, 10YR 7/4 V PALE BN, SL MOIST UNCONSOLIDATED, DOL. COBBLES	GM			4	3		10.1	
	10					NR	–	–	10.5	10
		AFTER 12' MINOR 7.5 YR 6/4 LT BN, MOIST				NS	–	–	12	
		CLAYEY SANDY SILT BINDER				5	0	0.7	12.7	
	14.5					NS	–	–	14	
	15	SILTY CLAY: 40% SILT 60% CLAY, LOW PLASTICITY, STIFF, 10YR 5/4 YEL BN, MOIST, MINOR SUBRND DOLO. GRAVEL	CL			6	3	1.1	15.1	
	15.5					NS	–	–	15.5	
	15.6	DOLOMITE: V. HARD, MICROX, 10YR 6/1 LT GY-GY, DRY								15.6
	20	AUGER REFUSAL 15.6								20
		NO GW ENCOUNTERED								
		NO GW 24 HRS								
	25									25
	30									30
	35									35

CVE CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON

BORING NUMBER BH-45 (MW-22)

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S-1100E

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 16)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	CLAYEY SILT: 10% cl 90% SICT, 10YR 7/4 V PALE BRN, DRY TO SM, UNCONSOL, NO PLASTICITY	CL			NS	-	—	2.0	0
		GRAVELLY SILT: 10YR 8/3, V. PALE BN, DRY-SM SUBRND DOLOMITE GRAVEL TO 0.08 FEET DIAMETER	GM			1	0	1.5	4.0	
A-5	5					NS	-	-	5	5
		COBBLEY SANDY SILT: VFG SD, 10YR 8/3 VERY PALE BN, DRY SL MOIST, UNCONSOL. DOLOMITE COBBLES, MINOR CALICHE CEMENTATION	GM			2	0	1.1	6.1	
						NR	-		6.5	
						NS	-	-	7	
						3	0	1.5	8.5	
						NS	-	—	9.0	
	10					NR	-	0	10.5	
	10.8					NC	-	—	10.9	
	10.9	SANDY DOLOMITE: UFG SD, 10YR 7/2 LIGHT GY, VERY HARD, DRY	DOL							
		AUGER REFUSAL 10.9'								
		NO GW ENCOUNTERED								
		NO GW 24 HRS								
	15									15
5.04 .49										
	20									20
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON

BORING NUMBER BH-46 (MW-23) E1400 5/2

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 15 16)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS: BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	GROUND SURFACE:								
		CLAYEY SILT: 10% CL, 90% SILT, 10YR 7/4 V. PALE BN, NO PLAST., DRY, UNCONSOL.	CL			NS	–	–	2.5	
						1	3	1.0	3.5	
						NR	–	–	4.0	
	5					NS	–	–	5.0	
		SLIGHTLY MOIST AFTER 6'				2	10	1.1	6.1	
						NR	–	–	6.5	
	7.5					NS	–	–	7.0	
		COBBLEY SANDY SILT: VFG SD, 10YR 8/2 WHITE, DRY, SUBRND DOLO COBBLES AND MINOR GRAVEL, UNCONSOL. CALICHE CEMENTATION AFTER 8.5 FEET	GM			3	1.5	1.1	8.1	
						NR	–	–	8.5	
	9.5					NS	–	–	9.0	
	10		GC			4	21	1	10	
	10.9					NS	–	–	10.9	
	11					5		0.1	11	
		COBBLEY SILTY CLAY: 10% COBBLES, 30% SILT, 60% CL, MINOR CALICHE CEM. 10YR 5/4 YEL BN, MOIST, DOLO. COBBLES, UNCONSOL.								
	15	SANDY DOLOMITE: VFG SILICA, 10YR 7/1 LT GY, DRY								
	20	AUGER REFUSAL 11'								
		NO GW ENCOUNTERED								
	25									
	30									
	35									

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON S 600 G1400

BORING NUMBER BH-47 (MW-24)

DATE DRILLED 5-16-91

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BORING RECORD

GEOLOG UNIT	DEPTH (INCHES)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM ~~HNU~~ SOIL GAS SURVEY PPM x ____ 2 4 6 8 10 12 14 16 18	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
	0									BACKGROUND HNU READING: SOIL: ____ PPM AIR: ____ PPM
	1	CLAYEY SILT; 10% CL 90% SILT 10YR 7/3 V PL BN, DRY UNCONSOLIDATED	CL			NS	—	—	2.5	
			GM			1	0	1.1		
		GRAVELLY SANDY SILT: 10YR 8/3 V. PALE BN, DRY, UNCONSOLIDATED				NR	—		4.0	
	5					NS	—	—	5.0	
						2	0	1.0	6.0	
		SLIGHTLY MOIST AFTER 7'				NR	—		6.5	
						NS	—	—	9.0	
	8.2					3	0	0.6	7.9	8.2
	8.3	SANDY DOLOMITE: VFG SD, 10YR 7/1 LT GY, DRY, V. HARD				~~3~~	—	0.1	—	8.3
	10						2.5			
		AUGER REFUSAL 8.3'								
		NO GW ENCOUNTERED								
		NO GW 24 HRS								

CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

\+ PENETROMETER, (TONS / FT.^{2})

JOB NAME / NUMBER: MARATHON

BORING NUMBER: BH-A8 (MW-25) S1200 E2

DATE DRILLED 5-18-91

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BORING RECORD

GEOLOG UNIT	DEPTH (INCHES)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	~~HNU~~ OVM SOIL GAS SURVEY PPM x ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
	0	CLAYEY SANDY SILT: VFG SILICA SAND, 10% CL 10% SD 80% SILT, 10YR 8/4 V PALE BN, DRY, NO PLAST., UNCONSOL., MINOR CALICHE	CL			NS	–	–	2.5	BACKGROUND HNU READING: SOIL: ____ PPM AIR: ____ PPM
						1	0	1.5	4.0	
	4					2	0	1.1	5.1	
	5	COBBLEY SANDY SILT: VFG SILICA SAND, 10YR 8/3 V. PALE BN, CALICHE CEMENT., DRY-SL MOIST	GM			NS	–	–	7	
		ABUNDANT SURROUNDED DOLOMITE GRAVEL				3	0	1	8	
						NS	–	–	9	
						4	0	1	10	
	10					NS	–	–	12	
		AFTER 12 FEET, MINOR MOIST 7.5YR 5/4 BROWN, SILTY CLAY BINDER				5	4.6	1.1	13.1	
						NR	–	–	13.5	
						NS	–	–	14	
	15					6	35	1	15	
						NR	–		15.1	
17.66		SATURATION AFTER 17' STRONG CONDENSATE ODOR				NS	–	–	17	
						7	296	0.9	17.9	
						NR	–		18.5	
						NS	–	–	19	
	19.4 RS 20	SANDSTONE: VFG SILICA 2.5Y 7/2 LT GY WITH 2.5Y 5/0 GRAY BANDS, VERY HARD	SS			NS	–	–	19.4	19.5
							596	0.1		
		AUGER REFUSAL AT 19.5'								
	25	GW ENCOUNTERED AT 17.66'								

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER, (TONS / FT.²)

JOB NAME / NUMBER: MARATHON
BORING NUMBER: BH-49 (MW-26) S 9010 E 1510
DATE DRILLED 5-18-91
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BORING RECORD

GEOLOG UNIT	DEPTH (INCHES)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
										BACKGROUND HNU READING: SOIL: ____ PPM AIR: ____ PPM
	0	SANDY SILT: VFG SD, 10YR 6/4 LT YEL BN, DRY, UNCONSOL.	SM			NS	—	—	2.5	
	2.8	COBBLEY SANDY SILT: VFG SILICA SAND, 10YR 8/2 WHITE, DRY, UNCONSOLIDATED, AGGRD. DOLOMITE GRAVEL	GM			1	10.7	0.6 / 1'	3.1	
						NR	—		4.0	
	4.5					NS	—	—	5.0	
	5	SILTY SAND: VF – F SILICA SAND, 20% SILT 80% SD, 10YR 6/4 LT YEL BN, SL MOIST, UNCONSOLIDATED	SM			2	96	0.6 / 1'	5.6	
						NR	—		6.5	
						NS	—	—	7.5	
	8.3					3	0	1.1 / 1'	8.6	
		COBBLEY SANDY SILT: VFG SD, 10YR 7/3V PALE BN, DRY, UNCONSOLID. DOLOMITE COBBLES AND MINOR SUBRND GRAVEL	GM			NR	—		9	
	10					NS	—	—	10	
		CALICHE CEMENTATION AFTER 12.5 FEET				4	36	0.4	10.4	
						NS	—	—	12.3	
						5	0	0.2		12.5
						NS	—	—	H	
	14.8					6	21	0.8	14.8	
	15	AFTER 15.5', SL MOIST 5YR5/4 RED BRN, SILTY CLAY BINDER				NS	—	—	15.7	
	16					7	0	0.3		16
		AUGER REFUSAL 16' NO GW ENCOUNTERED								

CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

\+ PENETROMETER, (TONS / FT.^{2})

JOB NAME / NUMBER: MARATHON

BORING NUMBER: BH-50 (MW-27) 51100

DATE DRILLED 5-19-91

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BORING RECORD

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x 0.5 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		Start: 07:40 Stop: 09:35 G.L. Elev.								BACKGROUND HNU READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	Clayey Silt, brown, 10YR 5/3, dry, v. low Plasticity, 70% silt, 30% clay	CL			1	0.0		1.0	
	1.5					NS			2.5	
		Sandstone, White to pale Yellow, 2.5Y 8/2 to 8/4, quartzose, fine grained, well sorted, flat bedded, interbedded with Mudstone Seams, 3 0.5' thick, thinbedded	Sand-stone			2	0.0		3.6	
						NR				
	5.0					3	3.5		4.5	
						NR			5.5	
		Dolomite, light brown-ish gray, 10YR 6/2, Massive, v. hard	Dolomite			NS			7.0	
	7.0					NR			7.2	
		Auger Refusal at 7.0' groundwater not encountered during drilling NR: No Recovery NS: Not Sampled								

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
\+ PENETROMETER (TONS/FT.^{2})

JOB NAME / NUMBER Marathon/91029

BORING NUMBER BH-51

DATE DRILLED 05-20-91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS

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RSA FORM 10/84 Rev. 2

Location: E 1800
S 2000

BORING RECORD

Start: 10:05
Stop: 12:50

G.L. Elev.

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
	0	Clayey Silt, light yellowish brown, 10YR 6/4, dry, V. low plasticity, Caliche deposits; 70% silt, 30% clay	CL	
	5.0			
	6.0	Boulders - Cobbly Silt, light yellowish brown to light brownish gray, 10YR 6/2 to 6/4, gravelly, poorly sorted, Cobbles/ boulders, firm, 3 cm to 0.5 m, round, dolomite	GW	
	10.0			
	12.5	Clayey - Gravelly Soil, brown, 7.5YR 5/2, Moist, V. Fine to fine grained, low plasticity, Manganese Nodules	CL	
	15.0	dolomite pebbles from 0.5 to 1 cm, round, 70% Sand, 20% clay, 10% pebbles		
	17.0			

Auger refusal at 17'
groundwater not observed during drilling

NR: No Recovery
NS: Not Sampled

HNU SOIL GAS SURVEY PPM x 1.5
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	HNU READING	RECOVERY	DEPTH
1	0.0		1.0
NS		1.0	2.5
2	0.0		3.5
NR			4.0
3	0.0	1.0	5.0
NR			5.5
NS			7.0
4	0.0	0.4	7.5
NR			8.0
NS		0.4	9.0
5	0.0		9.4
NR			10.0
NS			
6	1.5	0.2	12.0
NR			13.0
NS		1.0	14.0
7	24		15.0
NR			15.5
NS		0.0	17.0
NR			17.5

REMARKS
BACKGROUND HNU READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/FT.²)

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JOB NAME / NUMBER Marathon/91029
BORING NUMBER BH-52 (MW-28)
DATE DRILLED 05-20-91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJC
CHECKED BY RJS

RSA FORM 10/84 Rev. 2

Location: E1200
51000

BORING RECORD

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		Start: 15:10 Stop: 16:20 G.L. Elev.		
	0	Clayey Silt, brown 10YR 5/3, dry, V. low Plasticity, V. fine gravel, 70% Silt, 10% clay, 25% Sand	CL	
	3.0	Bouldery - Cobbly Silt, brown to light brownish gray, 10 YR 5/3 to 6/2, gravelly, poorly sorted, Cobbles/ boulders from 5cm to 0.5m, round to subround, dolomite,	GW	
	7.0	Clayey from 9.0 to 10', Sandy/gravelly brown to strong brown, 10YR 5/6 to 5/8, moist, low plasticity, fine to V. fine gravel,		
	10.0			
	12.5	Auger refusal at 12.5' Groundwater Not Observed During Drilling NR: No Recovery NS: Not Sampled		

HNU SOIL GAS SURVEY PPM x 0.1
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	HNU READING	RECOVERY	DEPTH
1	1.5		1.0
NS			2.5
2	0.0	3.2	2.7
NR			4.0
3	0.0	1.5	4.5
NR			5.5
NS			7.0
4	0.0	1.0	8.0
NR			8.5
NS			9.0
5	0.0	0.7	9.9
NR			10.5
NS			12.0
NR			12.7
NR			12.8

REMARKS
BACKGROUND HNU READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
\+ PENETROMETER (TONS/FT.^{2})

JOB NAME / NUMBER Marathon/91029
BORING NUMBER BH-53 (MW-29)
DATE DRILLED 05-20-91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MUL
CHECKED BY BJS

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RSA FORM 10/84 Rev. 2

Location E1400 S1000

BORING RECORD

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x 2 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		Start: 08:40 Stop: 09:50 G.L. Elev.								BACKGROUND HNU READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	Clayey Silt, brown to brownish yellow, 10YR 5/3 to 5/4, dry, V. low plasticity, calcitic deposits, 70% silt, 30% clay, V. fine grained	CL			1	0.2		0-1.0	
						NS			1.0-2.5	
						2	32.5	1.1	2.5-3.6	
						NR			3.6-4.0	
	5.0					3	32.3	1.0	4.0-5.0	
						NE			5.0-5.5	
						NS		0.7	5.5-7.0	
	7.5	Cobbly Silt, brown to light gray-brown, 10YR 5/2 to 6/2, Mod. Well Sorted, Cobbles from 4 cm to 10 cm, gravelly, unconsolidated.	GW			4	19.9		7.0-7.7	
						NR			7.7-8.5	
	10.0					NS		0.0	8.5-9.0	
	10.5					NR			9.0-9.5	
						NS			9.5-12.0	
	12.5	Dolomite, light gray-brown, 10YR 6/2, Massive, hard				NR		0.0	12.0-12.5	
		Boring Terminated at 12.5' Groundwater Not observed During Drilling NR: No Recovery NS: Not Sampled								

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
\+ PENETROMETER (TONS/FT.^{2})

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JOB NAME / NUMBER Marathon / 91029
BORING NUMBER BH-54 (MW-30)
DATE DRILLED 05-21-91
DRILLING METHOD HSA
DRILLED BY SHG
LOGGED BY MJC
CHECKED BY BJS

RSA FORM 10/84 Rev. 2

Location: E 2200
S 900

BORING RECORD

DRAFT

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM = 2 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		Start: 13:20 Stop: 14:40 G.L. Elev.								BACKGROUND HNU READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	Clayey Silt, brown to very pale brown, 10 YR 5/3 to 7/4, dry, v. low plasticity, alluvial deposits, 70% silt, 30% clay, v. fine grained	CL			1	0.0		0 2.0	
						NS			2.5	
						2	0.0	14	3.6	
						NR			4.0	
	5.0					3	0.0	1.1	5.1	
						NR			5.5	
		Slightly Moist below 7.0'				NS			7.0	
		Moist from 9.0' to 9.5', gravelly, dark brown, 10 YR 4/3				4	0.0	1.1	8.1	
	9.5					NR			8.5	
	10.0	Boulder-Cobbly Silt, dark brown to light grayish brown, 10 YR 4/3 to 6/2, gravelly, poorly sorted, Cobbles/boulders from 3.0cm to >20 cm, rounded to Subround	GW			NS			9.0	
						5	0.0	0.7	9.7	
						NR			10.5	
						NS			12.0	
						6	9.2	0.5	12.5	
						NR			13.0	
						NS		0.5	14.0	
						7	21.5		14.5	
						NR			15.7	
	16.9' ▽					NS			17.0	
	17.4					8	45	0.4	17.5	
		Clayey from 12.0 to 12.5', Moist								
		V. hard from 13' to 14.0',								
		Clayey from 14.0 to 14.5, Moist								
		Clayey from 17' to 17.4', Saturated								
		Auger refusal at 17.4'								
		NR: No Recovery								
		NS: Not Sampled								

21 3 17

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
\+ PENETROMETER (TONS/FT.^{2})

JOB NAME / NUMBER Marathon/91029

BORING NUMBER BH-55 (MW-31)

DATE DRILLED 05-21-91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS

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RSA FORM 10/84 Rev. 2

Location:
E 1800
S 900

BORING RECORD

DRAFT

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x 20 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		Start: 11:15 Stop: 15:07 G.L. Elev.								BACKGROUND HNU READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	Conglomerate, Very pale brown to light grayish brown, 10 YR 7/3 to 6/2, limestone / dolomite pebbles, cobbles, boulders, cobbles / boulders from 5 cm to 2 m, round to subround, $CaCO_3$ cement, unweathered at surface, hard	Gs			NS NR		0.0	2.5 5.0	
	5.0					NS NR	10.4	0.0	4.4 5.0	
	8.5					NS NR	0.3	0.2	7.0 7.2	
	10.0	Boulder - Cobbly Silt, brown to light grayish brown, 10YR 5/3 to 6/2, gravelly, poorly sorted cobbles / boulders from 4cm to 20cm, round to subround, V. fine gravel	Gw			VS 3 NR	47.0	1.0	9.0 10.0	
	14.5					NS NR		0.0	12.0 12.2	
		Auger refusal at 14.5'				NS NR		0.0	14.5 14.6	
		Groundwater not observed during drilling								
		NR: No Recovery NS: Not Sampled								

CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

\+ PENETROMETER (TONS/FT.^{2})

JOB NAME / NUMBER Marathon/91029

BORING NUMBER B14-56 (MW-32)

DATE DRILLED 05-22-91

DRILLING METHOD HSA

DRILLED BY SHB

LOGGED BY MJL

CHECKED BY BS

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RSA FORM 10/84 Rev. 2

Location:
E 1090
S 1210

BORING RECORD

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE NUMBER	HNU READING	RECOVERY	DEPTH	REMARKS
		Start: 07:30 Stop: 09:45							BACKGROUND HNU READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	G.L. Elev.							
		Clayey Silt, light brown, 7.5YR 6/4, dry, v. low p[illegible], [illegible], v.f. [illegible] sand, [illegible] 70% silt, 30% clay	ML		1	0.0		1.0	20.75
					NS			2.5	21.0
					2	0.0	1.1	3.6	18.65
	4.5				NR			4.0	
					3	0.0	0.8	4.5	20.52 / .75
	5.0	Bouldery-Cobbley Silt, light brown to light brownish gray, 7.5YR 6/4 10YR 6/2, poorly sorted, [illegible], cobbles/boulders from 2cm to > 15cm, rounded to subrounded.			NR			5.5	.25'
					NS			7.0	
					4	0.0	1.5	8.5	
					NS			9.0	
					5	1.5		9.5	
	10.0				NR			10.0	
					NS			12.0	
			Gm		6	6.1	1.0	13.0	
					NR			13.5	
					NS		0.2	14.0	
	15.0				NR			14.5	
					NS			17.0	
		Clayey below 17.5', Sandy, fine to med. grain quartz, Moist, v. strong hydrocarbon odor. Saturated below 18.0, condensate			7	252	0.8	17.8	
	18.5 / 18.65				NR			17.9	
					NS		0.15	18.5	
		Dolomite, light grayish brown, 10YR 6/2, Massive, hard			8	330		18.65	

Auger refusal at 18.65'

NR: No Recovery
NS: Not Sampled

HNU SOIL GAS SURVEY PPM x 20
2 4 6 8 10 12 14 16 18

Legend		Legend	
▱	CME CONTINUOUS AUGER SAMPLER		WATER TABLE (TIME OF BORING)
⊠	STANDARD PENETRATION TEST	L	LABORATORY TEST LOCATION
■	UNDISTURBED SAMPLE	+	PENETROMETER (TONS/FT.²)
	WATER TABLE (24 HOURS)		

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JOB NAME / NUMBER Marathon/91029
BORING NUMBER BH-57 (MW-33)
DATE DRILLED 05-23-91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS

RSA FORM 10/84 Rev. 2

Location: E 500
S 750

BORING RECORD

DRAFT

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x 20 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	HNU READING	RECOVERY	DEPTH	REMARKS
		Start: 14:33 Stop: 15:44 Resume: Finish: 11:35 G.L. Elev.								BACKGROUND HNU READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0 – 2.7 – 5.0	Clayey Silt, pale brown to brown 10 YR 5/3 to 6/3, dry, v. low plasticity, v. fine quartz, caliche deposits, 70% silt, 30% clay	ML			1	0.0		1.0	
						NS			2.5	
						2	0.0	C6	3.1	
						NC			4.0	
						NR			5.0	
	5.0 – 10.0 – 15.0 – 18.6	Boulder – Cobbly Silt, brown to light grayish brown, 10YR 5/3 to 6/2, poorly sorted, cobbles/boulders from 5cm to > 50cm, round to subround dolomite w/caliche weathering, gravelly, hydrocarbon odor from 9.0' to 9.9', dry. Strong hydrocarbon odor below 14.0', v. moist, sandy, coarse grain quartz	GM			NS			7.0	
						3	0.0		7.5	
						NS			9.0	
						4	150.7		9.9	
						NR			10.5	
						NS			12.0	
						5	0.0		13.0	
						NR			13.5	
						NS			14.0	
						NR			14.2	
						NS			17.0	
						6	327		17.5	
						NR			17.9	
						7	298		18.6	
		Auger Refusal at 18.6'. Groundwater Not Observed During Drilling. NR: No Recovery. NS: Not Sampled								

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/FT.²)

JOB NAME / NUMBER Marathon/91029
BORING NUMBER BH-58 (MW-34)
DATE DRILLED 05-23-91 – 05-24-91
DRILLING METHOD HSA
DRILLED BY SHR
LOGGED BY MJL
CHECKED BY BJS
Page 1 of 1

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RSA FORM 10/84 Rev. 2

Location
E 300
S 700

BORING RECORD

DRAFT

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		START: 1458 (5-24-91) STOP: 0845 (5-25-91) (EAST 700, SOUTH 800)								BACKGROUND OVM READING: SOIL: 0 PPM AIR: 0 PPM
	0	GROUND SURFACE: CLAYEY, SLT, YELLOWISH GRAY (5Y7/2), LOOSE, DRY, NO PLAST CALICHE DEPOSITS TO 2.9 FT. 10% CLAY, CALICHE 60%	mL			1	0	1.0	1.0	
	2.9	CLAYEY SLT, DUSKY YELLOW (5Y 6/4), DRY, LOOSE V. SL PLASTIC, 10% CLAY	mL			NS	–	–	2.5	
						2	0	1.0	3.5	
						NR	–		4.0	
	5					3	0	1.1	5.1	
						NR	–		5.5	
		CLAYEY SLT, LIGHT BROWN (5YR 6/4) SL PLASTIC, 30% CLAY, CALICHE DEPOS 25%, DRY	CL			NS	–	–	7.5	
	8.0					4	14.8	1.5	9.0	
		CLAYEY SILT LIGHT BROWN (7.5 YR 6/4), FIRM, 30% CLAY SL PLASTIC, FRIABLE, DRY	CL			5	1.6	0.9	10.5	
	10									
	11.0	GRAVEL AND COBBLES IN CLAYEY SILT, 50% COARSE TO FINE, GRAVELS FINE TO COARSE 5 MM TO 75, SEGMENTS OF COBBLES SIZE UNKNOWN	GM			NS	–	–	12.5	
	14.5					6	1.0	0.9	13.4	
						NR			14.0	
	15					7	46.7	0.7	14.7	
						NR	–		15.5	
▽		CLAYEY SILT, PINKISH GRAY (7.5YR 7/2) LOOSE, DRY V LOW PLAST, COBBLES AND GRAVEL, W. RND, POLY SORTED DOLOMITIC, GRAY LIMESTONE	GM			NS	–	–	15.5	
F.L. 16.84	16.9					8	414	–	16.4	OVM 517 UNITS IN AUGERS AT TD
		GRAVELS AND COBBLES, COARSE GRAVELS 25-75 MM, COBBLE SIZE TO BOULDER SIZE DECREASING CLAY CONT TO 20%, LIMESTONE FRACTION TYPICALLY LT. BROWNISH GRAY (2.5Y 6/2) FROM CHIP OF HOLLOW CHERT AT 14.5 FT, V. SL MOIST, 30% 25 GRAVEL, 50% COBBLES SATURATED W/ HYDRO CARBONS				NR	–	–	17.9	
AFTER 3 HRS 16.84 COINCIDENTAL	20								20	
17.37 WATER BOTH FROM G.L.	25								25	
		HSA REFUSAL 16.9 FT BEDROCK LT BROWNISH GRAY DOLOMITIC LIMESTONE, DENSE, (10YR 6/2)								
	30	LOST SPLIT SPOON SAMPLER WHEN DRIVING 12.5 TO 14 FT SAMPLE INTERVAL. COULD NOT FISH. WILL GROUT UP HOLE. MOVE RIG 10 FT EAST AND REDRILL							30	
	35								35	

414.0 UNITS

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON IBGP / 91029

BORING NUMBER BH-59 (MW-35)

DATE DRILLED 5-24-91 TO 5-25-91

DRILLING METHOD HSA / SS

DRILLED BY DT

LOGGED BY GNR

CHECKED BY

DRAWN BY:

PAGE 1 OF 1

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ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

DRAFT

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SURVEY PPM X 2 4 6 8 10 12 14 16 18	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		START 0910 STOP 1050								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
		GROUND SURFACE:								
	0	SILT, BRWN (7.5YR 5/3), LOOSE, NO PLAST, DRY	ML			1	0		1.0	
						NS	–	–	2.5	
	2.7	CLAYEY SILT, LIGHT BROWN (7.5YR 6/4), SL PLAST, DRY, 10% CLAY, SOME CALICHE DEPOSITS 10% SOFT, LOOSE	ML			2	0	1.3	3.8	
						NR	–			
	5					3	0	4.5	4.0 5.4	
						NS	–	–	7.5	
	7.8									
		CLAYEY SILT, LIGHT BROWN (7.5YR 6/4) AND PINK (7.5 YR 7/3) SL PLAST, FIRM, DRY, 35% CLAY, 5% CALICHE DEPOSITS	CL			4	0	1.5	9.0	
	9.3					5	0	1.3	10.3	
	10		CL			NR	–		10.5	
		SILTY CLAY, BROWN (7.5YR 5/3) 20% SILT, 5% CALICHE DEPOSITS SL PLAST, HARD, DRY, SL MOIST AT 12.5 TO 12.9 FT, NO ODOR				NS	–	–	12.5	
	12.9					6	0	0.9	13.4	
	14.0	SILTY GRAVEL, LIGHT BROWN (7.5 YR 6/4), GRAVELS, CS W/ SOME FINE 5MM TO 30MM, SL MOIST, PRLY SORTED, HIT HYDROCARBON SATURATION BELOW 13.4 FT	GM			NR	–		14.0	
			GP			7	449	0.5	14.5	
FLUID LEVEL 12.95 (BGL) ON 5-27-91 0700 HRS	15					NR	–		15.5	
						NS	–	–	17.5	
	17.2					8	388		18.5	
	19.3	SANDY GRAVEL, DARK GRAY (7.5 YR N4/0) SATURATED, SAND 10% COARSE GRND, SUBANG, GRAVELS FINE TO COARSE 10-50 MM STRONG HYDROCARBON ODOR POORLY GRADED, LARGER GRAVELS W. ROUNDED				NS	–	–	19.0	
	20					9	↑ 583		19.3	
		BEDROCK, LIMESTONE, BROWN, DOLOMITIC, DENSE, HARD, WEATHERED GRAY ON SURFACES	DOLOMITIC LIMESTONE							
	25									OVM IN BORING 323 UNITS
		TOTAL DEPTH OF HSA REFUSAL 19.3 ft BGL								
	30									
		LOCATION 1400-E 100-S								
	35									

105

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON/91029
BORING NUMBER BH-60 (MW-37)
DATE DRILLED 5-26-91
DRILLING METHOD HSA/SS
DRILLED BY SHB
LOGGED BY GHP
CHECKED BY BJS
DRAWN BY:
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14.55
1.16
2.55

BORING RECORD

DRAFT

START: 0715
STOP: 0955
LOCATION: 1200-E, 0-S
GROUND SURFACE:

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
	0	SILT, BROWN (7.5YR 5/3), LOOSE, NO PLAST, DRY	ML
	3.2	CLAYEY SILT, BROWN (7.5YR 5/4), CLAY 20%, CALICHE DEPOSITS 10%, FRGM, FRIABLE, DRY	CL
	4.6	CLAYEY SILT, LIGHT BROWN (7.5YR 6/4), 30% CLAY, 20% CALICHE DEPOSITS, SL PLAST, MOD FRIABLE, DRY	CL
	12.0	SILTY GRAVEL, LIGHT REDDISH BROWN (5YR 6/3), SILT 30% GRAVEL COARSE UP TO 3/4in, AND FINE TO 3/4in, MODERATELY SORTED, DRY, GRAVELS DOLOMITIC LIMESTONE, LIGHT GRAY (7.5YR N7/0) DENSE, DRY	GM
	14.2	WEATHERED DOLOMITIC LIME	
	15	DOLOMITIC LIMESTONE WEATHERED, FRACTURED, BEDDED IN PART LIGHT GRAY (7.5YR N7/0), SATURATED	
	18.3		
	18.4	SANDSTONE, GRAY (7.5YR N5/0) POORLY CEMENTED, FRIABLE, STRONG HYDROCARBON ODOR, V. FINE-FINE GRAINED, SATURATED	SANDSTONE
	20	TOTAL DEPTH OF AUGERED HOLE 18.4 ft HSA REFUSAL	
	25		
	30		
	35		

W.L. ON 5-28-91 14.95' BGL NO NAPL OBSERVED

OVM SOIL GAS SURVEY PPM R — 2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0	1.0	1.0
NS	-	-	2.5
2	0	1.3	3.8
NR	-	1.0	4.0
3	0	1.5	5.5
NS	-	-	7.5
4	0	1.5	9.0
5	0	0.6	9.6
NR	-		10.5
NS	-	-	12.5
6	0	0.6	13.1
NR	-		14.0
7	112	0.8	15.5
NR	-		
NS	-	-	17.5
8	1265	0.9	18.4

REMARKS

BACKGROUND OVM READING:
SOIL: _____ PPM
AIR: _____ PPM

87 UNITS IN OPEN BOREHOLE

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON 91029.01
BORING NUMBER SH-61 (MW-38)
DATE DRILLED 5-27-91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY:
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BORING RECORD

DRAFT

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		START: 1430 STOP: 1700								BACKGROUND OVM READING: SOIL: 0 PPM AIR: 0 PPM
	0	GROUND SURFACE: SILT, BROWN (7.5YR 5/3) LOOSE, NO PLAST, DRY	ML			1	0	1.0	1.0	
						NS	–	–	2.5	
	3.6	CLAYEY SILT, PALE RED (10R 6/3) 10% CLAY, 20% CALICHE DUP FIRM, FRIABLE, DRY, GRADING TO PINKISH WHITE (5YR 8/2) BELOW 4 ft, DRY	CL			2	0	1.5	4.0	
	5					3	0	0.4	4.4	
						NR	–		5.5	
	7.5					NS	–	–	7.5	
		SILTY, GRAVELLY SAND, PINKISH WHITE (5YR 8/2), LOOSE, ANGULAR, FINE GRAINED DRY, 30% SILT, 15% CLAY	GM			4	0	0.8	8.3	
	9.5					NR	–		9.0	
	10					5	0	0.9	9.9	OVM IN OPEN BOREHOLE 173 UNITS
						NR	–		10.5	
	12.5	CLAYEY SILT, BROWN (7.5YR 5/4), 25% CLAY, TRACE CALICHE CLASTS, SOFT, LOOSE DRY	ML			NS	–	–	12.5	
	14.3					6	0	1.5	14.0	
			GC			7	935	0.8	14.8	
	15	CLAYEY GRAVEL AND FOSS COBBLES, LIGHT BROWN (7.5YR 6/4), CLAY 25%, V. SL PLAST, MOIST, NO ODOR, GRAVEL 50% GRAY (7.5YR N5/0), COARSE AND FINE 5–40 mm	GP			NR	–		15.5	
						NS				
	17.8					8	538	0.5	17.5	
	19.2		WEATHERED SAND STONE						18.0	
	19.5		SANDSTONE			NS	–	–	19.0	
	20					9	30		19.5	
		SILTY GRAVEL AND COBBLES SILT 10%, GRAVEL 50%, COBBLES 40%, W. ROUNDED SOME GREASY DARK GRAY SUBSTANCE ON GRAVEL SURFACE (7.5YR N4/0) STRONG HYDROCARBON ODOR, WET								
	25	WEATHERED SANDSTONE, LIGHT BROWN (7.5YR 6/3), V. FN GRAINED, POORLY CEMENTED, FRIABLE, ODOR, WET, SOME SILT 20%								
	30	STOP SANDSTONE, LIGHT GRAY (2.5Y N6/0), CALCAREOUS CEMENT, V FN GRN, WET, SOFT, POORLY CEMENT, FRIABLE								
		HSA REFUSAL @ 19.5 ft								
	35									

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON (IBGP) 91029.01

BORING NUMBER BH-62 (MW-39) E-1000, S-200

DATE DRILLED 5-27-91

DRILLING METHOD HSA / SS

DRILLED BY SHB

LOGGED BY GAR

CHECKED BY BJS

DRAWN BY:

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BORING RECORD

2840 RIG RUNNING NGA

DRAFT

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY (PPM) 2 4 6 8 10 12 14 16	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		START: 0840 STOP: 1040								BACKGROUND OVM READING: SOIL: 0 PPM AIR: 0 PPM
	0	GROUND SURFACE: SILT, PINKISH GRAY (7.5YR 7/2) LOOSE, DRY	ML			1		1.0	1.0	
						NS	-	-	2.5	
	3.0	CLAYEY SILT, LIGHT BROWN (7.5YR 6/4) 20% CLAY, 10% CALICHE DEPOSITS, V. SL PLASTIC, FRIABLE TO LOOSE	ML			2		1.5	4.0	
	5	GRADING TO PINKISH WHITE (7.5YR 8/2) AT 7.0 FT, DRY				3		1.0	5.0	
						NR	-		5.5	
						NS	-	-	7.5	
						4		0.5	8.0	
	9.2					NS	-	0.2	9.0	
	10	SANDSTONE, V PALE BROWN (10YR 8/3), V. FN GRND, SILTY CALC. CEMENT, MOD CEMENTED, BUT FRIABLE, DRY	DOLOMITE			5			9.2	
	10.0					NS	-	-		
	12.1	DOLOMITE, LIGHT BROWNISH GRAY (10YR 6/2), DENSE, HARD, DRY				6		0.1	12.0	
		HSA REFUSAL AT 12.1 ft							12.1	
	15									
	20									
	25									
	30									
	35									

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON (IBGP) 91029.01

BORING NUMBER BH-63 (MW-40)

DATE DRILLED 5-28-91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BTS
DRAWN BY:

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BORING RECORD

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GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
										BACKGROUND OVM READING: SOIL ____ PPM AIR: ____ PPM
	0	GROUND SURFACE: SILT, WEAK RED (2.5YR 5/2), LOOSE, DRY	ML			1	0	1.0	1.0	
						NS	–	–	2.5	
	2.8	SILTY CLAY, REDDISH BROWN (5YR 5/3), 25% SILT, 15% CALICHE DEPOSITS, FIRM FRIABLE, DRY	CL			2	0	1.3	3.0	
	4.7					NR	–		4.8	
	5					3	0	1.2	5.2	
						NR	–		5.5	
		SILTY CLAY, PINK (7.5YR 7/3), 20% SILT, 30% CALICHE DEPOSITS, FIRM FRIABLE, DRY	CL			NS	–	–	7.5	
	8.5					4	0	1.5	9.0	
		CLAYEY GRAVEL AND COBBLES GRAVEL IS DOLOMITIC LIMESTONE GRAY (5YR 5/1) DENSE, 60% GRAVEL 40% COBBLES 40% CLAY, CLAY IS LIGHT BROWN (7.5YR 6/3) DRY	GC			5	0	1.0	10.0	
	10					NR	–		10.5	
						NS	–	–	12.5	
						6	0	1.0	13.5	
	14.5					NR	–		14.6	
		CLAYEY GRAVEL AND COBBLES AS ABOVE BUT SATURATED BELOW 14.5 ft W/ STRONG HYDROCARBON ODOR	GC			7	46	0.8	14.8	
	15					NR	–		15.5	
FLUID LEVEL @ 1455 ON 5-30-91 15.03 NO FREE FLOATING NAPL						NS	–	–	17.5	
	18.0	SILTY SANDSTONE OLIVE GRAY (5Y 5/2), V. SOFT, V. FN GRAINED, V. POORLY CEMENTED, V. FINELY BEDDED SATURATED, STRONG HYDROCARBON ODOR	SILTY SANDSTONE			8	685	0.8	18.3	
						NR	–	0.5	19.0	
	20					9	407	–	19.5	
						NS	–	–		
	22.5						39	0.3	22.5	
	23.0	POSSIBLY DOLOMITE BELOW 22.8 ft, V. HARD				NS	–	–	22.8	
		TOTAL DEPTH 23.0 ft							23.0	
	25									
	30									
	35									

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

LOCATION 1000-E 200-N

JOB NAME/NUMBER MARATHON (IBGP) 71029.01

BORING NUMBER BH-64 (MW-41)

DATE DRILLED 5-29-91
DRILLING METHOD HSA/SS
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BTS
DRAWN BY:

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BORING RECORD

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GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
	0	GROUND SURFACE:		
		SILT, BROWN (7.5YR 5/4), LOOSE, DRY	ML	
	2.8	CLAYEY SILT, PINK (7.5YR 7/3) 25% CLAY, SL LOOSE, DRY, V SL PLASTIC	ML	
	4.8	CLAYEY SILT, PINKISH GRAY (5YR 6/2), LOOSE, DRY 25% CLAY, CONTAINS TRACE OF GRAVEL	ML	
	7.5	SANDSTONE, PINKISH GRAY (7.5YR 7/2), POORLY CEMENTED CALC. CEMENT, FRIABLE DRY V. FINE GRAINED, SILTY, DRY	SILTY SAND STONE	
	9.0	SANDSTONE, V SILTY LIGHT GRAY, (5YR 7/1) HARD FRIABLE, V F/I GRAINED, FAIRLY WELL CEMENTED, CALCAREOUS, DRY V. FNLY BEDDED	SAND STONE	
	14.0	SANDSTONE, BROWN (7.5YR 5/2) SLIGHTLY DOLOMITIC, CALCAREOUS CEMENT, FR WELL CEMENTED HARD, V.SL FRIABLE, DRY	SAND STONE	
	22.0	TOTAL DEPTH 22.0 ft TO HSA REFUSAL		
	35			

OVM SURVEY PPM X — 2 4 6 8 10 12 14 16

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
1	0		1.0	BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
NS	-	-	2.5	
2	0	1.5	4.0	
3	0	1.5	5.0	
NR	-		5.5	
NS	-	-	7.5	
4	0	0.2	7.7	
NS	-	0.3	9.0	
5	V		9.3	
NS	-	0.3	12.5	
6	6.6		10.8	
NS	-	-	12.5	
7	1.6	0.1	12.6	
NS	-	-	14.0	
8	3.3	0.2	14.2	
NS	-	-	17.0	
9	32	0.1	17.1	
NS	-	-	9.0	
10	0			
NS	-	-	22.0	

0 5 10 15 20 25 30 35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON (IBGP) 91029.01

BORING NUMBER BH-65 (MW-42)

DATE DRILLED 5-30-91
DRILLING METHOD HSA/SS
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY:

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BORING RECORD

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GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL SURVEY PPM (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	SILT, LIGHT BROWN (7.5YR 6/4) LOOSE, DRY	ML			1	0	1.0	1.0	
						NS	-	-	2.5	
	3.0	CLAYEY SILT, BROWN (7.5YR 5/4), FIRM, FRIABLE, 20% CLAY 10% CALICHE DEPOSITS, DRY NO PLAST	ML			2	0	1.2	4.0	
	5					3	0	1.0	5.5	
	6.0	SILT, GRAVEL AND COBBLES 20% SILT, 60% GRAVEL COARSE TO FINE 10-40mm, TRACE POSSIBLE COBBLES DRY LOOSE GRAVEL, SL DOLOMITIC LIMESTONE AND CALICHE LIMESTONE, VUGULAR IN PART, SILT FINISH WHITE (5YR 8/2)	GM			NS	-	-	7.5	
						4	0	0.2	7.5 / 9.0	
	10					5	0	1.1	10.1	
		15% clay in matrix at 14.5'-18.5'				NS	-	-	12.5	
						6	0	0.6	13.0	
		wet at 17.7'				NS	-	-	14.0	
	15					7	0	1.9	15.1	
		strong hydrocarbon odor and dk color (black) at 17'-19.4'				NS	-	-	17.0	
17.7'						8	781	1.3	18.3	
	19.4					NS	-	-	19.0	
	20	sandstone, 2.5Y 5/4, light olive brown, v fn grain, moderately hard, hydrocarbon odor	SS			9	826		19.6	
						NS	-	-	22.0	
	22.4					10	246	0.4	22.4	
		TD → 22.4' Auger Refusal								
	25	Borehole OVM - 1.0 ppm								
	30									
	35									

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
LOCATION 500-E 200-N

JOB NAME/NUMBER MARATHON (±BGP) 91029.01

BORING NUMBER BH-66 (MW-43)

DATE DRILLED 5-31-91
DRILLING METHOD HSA/SS
DRILLED BY SHB
LOGGED BY GHR + SNB
CHECKED BY BTS
DRAWN BY:

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BORING RECORD

DRAFT

GEOLOG UNIT	DEPTH (INCHES)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		845								BACKGROUND HNU READING: SOIL: ____ PPM AIR: ____ PPM
	0	silt, 7.5YR 6/4, light brown, soft, dry, loose,	ML			1	0		1.0	
						NS	–	1.2	2.5	
	3.3	clayey silt, 7.5YR 5/4, brown, firm, caliche nodules, dry, friable, 15% clay, 10% caliche, 75% silt				#2	0		3.7	
						NS	–		4.0	
	5		ML			3	0	1.0	5.0	
						NS	–	–	7.5	
	9.0					4	0	1.3	8.8	
		silt, gravel 2.5Y 6/2, light w. cobbles, brownish gray and 7.5YR 7/2 pinkish gray, lightly cement ($CaCO_3$), hard, dry, w. silty dolomitic limestone gravels wet at 14.3'				NS	–	–	9.0	
	10					5	0	1.8	9.8	
						NS	–	–	12.5	
	14.3'					6	0	1.0	13.5	
						NS	–	–	14.0	
	15	clayey silt, 10YR 4/4, soft, wet, laminated, strong hydrocarbon odor, 30% clay, 70% silt (lens) at 14.4 – 15.0	GM			7	180	1.0	15.0	
						NS	–	–	17.5	
						8	359	1.3	18.8	
	20					NS	–	–	19.0	
						9	875	1.2	20.2	
						NS	–	–	22.0	
	22.1 22.3	sandstone, 2.5Y 5/4, light olive brown, fine grained silty, hard, strong hydrocarbon odor	SS			10	107	2.3	22.3	
		TD = 22.3								
		Borehole OVM = 350 PPM								
		Auger Refusal								

CME CONTINUOUS AUG. SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

\+ PENETROMETER, (TONS / FT.^{2})

ROBERTS/SCHORNICK & ASSOCIATES, INC.
Environmental Consultants

500 N 500 E

JOB NAME / NUMBER: Marathon (IBCA) 91029.01

BORING NUMBER: BH-67 (MW-44)

DATE DRILLED 6-1-91

DRILLING METHOD HSA

DRILLED BY S H & B

LOGGED BY JMB

CHECKED BY ____

PAGE ____ OF ____

RSA FORM .6 .0/84 REV. 1

BORING RECORD

DRAFT

GEOLOG UNIT	DEPTH (INCHES)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	HNU READING	RECOVERY	DEPTH	REMARKS (BACKGROUND HNU READING: SOIL: __ PPM AIR: __ PPM)
	0	silt, 7.5YR 6/4, light brown, loose, soft, dry,	ML			1	0		1.0	
						NS	–	–	2.5	
	2.7	clayey silt, 7.5YR 5/4, brown, non-plastic, dry, friable, caliche nodules, 15% clay, 10% caliche, 75% silt	ML			2	0	1.5	4.0	
	5					3	0	1.5	5.5	6/1/91
						NS	–	–	7.5	
						4	0	1.5	9.0	
	9.3	sandstone, 2.5Y 8/4, pale yellow, moderately hard, slightly cemented, fn grained, silty				5	0	0.9	9.9	
	10	– color changes to 2.5Y 5/6 light olive brown with increased moisture				NS	–	–	12.5	*
						NS	–	0.2	14.0	
						6	0		14.2	
	15	2.5Y 4/4 olive brown and 2.5Y 5/6 light olive brown at 17.6', cemented, hard to 18.0 wet at 18.5	GM			NS	–	–	17.0	
						7	0	0.6	17.6	
18.5'						NS	–	–	19.0	
						8	9.9	0.6	19.6	
	20					NS			22.5	
						9	28	0.4	22.9	
						NS	–	–	24.0	
	24.0	TD → 24								

* no recovery at 12.5'

CME CONTINUOUS AUGER SAMPLER — WATER TABLE (TIME OF BORING)
STANDARD PENETRATION TEST — L LABORATORY TEST LOCATION
UNDISTURBED SAMPLE — + PENETROMETER, (TONS / FT.²)
WATER TABLE (24 HOURS)

200W, 1050N

ROBERTS/SCHORNICK & ASSOCIATES, INC.
Environmental Consultants

JOB NAME / NUMBER: Marathon (IBGP) 91029.01
BORING NUMBER: BH-68
DATE DRILLED 6-1-91 + 6-2-91
DRILLING METHOD HSA
DRILLED BY SH & B
LOGGED BY JMB
CHECKED BY
PAGE OF

RSA FORM .6 .0/84 REV. 1

BORING RECORD

DRAFT

GEOLOG UNIT	DEPTH (INCHES)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x (2 4 6 8 10 12 14 16 18)	SAMPLE NUMB	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
	0	silt, 7.5YR 6/4, light brown, dry, loose, soft,	ML			1	0	1.0	1.0	BACKGROUND HNU READING SOIL: ___ PPM AIR: ___ PPM
						NS	–	–	2.5	
	32 4.0	clayey silt, 7.5 YR 5/4, brown, dry, friable, caliche nodules and precipitation, 15% clay, 10% caliche, 75% silt	ML			2	0	4.0	3.5	
	5					NS	–	–	4.0	
						3	47	1.1	5.1	
						NS	–	–	7.5	
		silt, gravel, and cobbles, 7.5YR 7/2, pinkish gray, gravel: fine to coarse, dry, dolomitic limestone and cherty gravels + cobbles	GM			4	49	1.1	8.6	
						NS	–	–	9.0	
						5	120	0.4	9.4	
	10					NS	–	0.5	10.5	
						6	764		11.0	*
	12.5	wet at 12.5'				NS	–	–	12.5	
		dk gray sludge at 11.0 ↓				7	575	0.8	13.3	
						NS	–	–	14.0	
	15					8	305	1.0	15.0	
						NS	–	–	17.5	
	17.9 18.2	sandstone, 2.5Y 5/4, light olive brown, fine grained, hard,	SS			9	556		18.2	
		TD → 18.5								
		Auger Refusal								
		Borehole OVM → 80 PPM								
		* sampled 10.5-11.0 to break up rock for drilling								

CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

+ PENETROMETER, (TONS / FT.²)

0 E-W, 625 N

ROBERTS-SCHORNICK & ASSOCIATES, INC.
Environmental Consultants

JOB NAME / NUMBER: Marathon (IBGP) 91029.01

BORING NUMBER: BH-69

DATE DRILLED 6-2-91

DRILLING METHOD HSA

DRILLED BY S, H, & B

LOGGED BY JMB

CHECKED BY

PAGE OF

ASA FORM .6 .1/84 REV. 1

DRAFT

GEOLOG UNIT	DEPTH (INCHES)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM 2 4 6 8 10 12 14 16 18	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
										BACKGROUND HNU READING: SOIL: ____ PPM AIR: ____ PPM
	0	silt, 7.5YR5/4, light brown, dry, loose, soft	ML			1	0		1.0	
						NS	–	–	2.5	
	30					2	0	1.0	3.5	
	3.7	clayey silt, 7.5YR5/4, brown, hard, dry, caliche, 15% clay, 25% caliche, 60% silt	ML			NS	–	–	4.0	
	5					3	33	1.0	5.0	
		silt, gravels, cobbles, 7.5YR 7/0, pinkish gray, dolomitic limestone, v. hard, dry, black hydrocarbon sludge at 4.8', cobbles + gravel are 10YR 7/1, light gray at 6.5-TD				NS	–	–	7.5	
						4	11.5	0.5	8.0	
						NS	–	0.5	9.0	
						5	231		9.4	
	10		SM			NS	–	–	12.5	
						6	822	1.0	13.5	
						NS	–	–	14.6	
	15					7	767	1.0	15.0	
						NS	–	–	17.5	
						8	562	1.0	18.5	
						NS	–	0.5	19.0	
	19.7					9	540		19.5	
		TD - 19.7 Auger Refusal Borehole DVM→								

CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

+ PENETROMETER (TONS / FT.²)

ROBERTS-SCHORNICK & ASSOCIATES, INC.
Environmental Consultants

JOB NAME / NUMBER: Marathon (IBCA) 91029.01

BORING NUMBER: BH-70

DATE DRILLED 6-3-91

DRILLING METHOD HSA

DRILLED BY SHB

LOGGED BY JMB

CHECKED BY

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RSA FORM .6 3/84 REV. 1

BORING RECORD

DRAFT

GEOLOG UNIT	DEPTH (INCHES)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x ___ (2 4 6 8 10 12 14)	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
	0	silt, 7.5YR 6/4, light brown, loose, soft, dry	ML			1	0		1.0	BACKGROUND HNU READING: SOIL: ___ PPM AIR: ___ PPM
						NS	—	—	2.5	
	3.0	clayey silt, 7.5YR 5/4, brown, non-plastic, dry, friable, caliche present, 15% clay, 10% caliche	ML			2	0	1.0	3.5	
						NS	—	—	4.0	
	5					3	0	1.0	50	
		silt, gravels, cobbles, silt is 7.5YR 7/2, pinkish gray, gravels + cobbles are 10YR 7/1 light gray to 7.5YR 6/4 light brown, gravels are dolomitic limestone, loose, caliche in silt	GM			NS	—	—		
						4	0	0.5	7.5	
						NS	—	0.3	8.0	
	10					5	0		10	
						NS	—	—		
						6	0	0.7	12.5	
						NS	—	—	13.2	
						7	107	1.0	14.0	
	15								150	
						NS	—	—		
						8	138	0.3	17.5	
	19.0					NS	—	0.3	18.0	
						9	69		19.3	
	20	sandstone, 2.5Y 5/6, light olive brown, moderately hard, fn grained, slight hydrocarbon odor, moist at 22.0'	SS			NS	—	—		
						10	428	0.3	22.5	
		color changes to 2.5Y 4/4, dk brown at 22.0' ↓							0.8	
								0.5	240	
	25					11	216		24.3	
						NS	—	—		
						12	11	0.5	27.5	
									28.0	
	29.0					NS	—	0.3	29.0	
	30	sandstone, 2.5Y 6/10 to 7/0, grey to light grey, dry, hard, fn grained	SS			13	16		29.5	
						NS				
	32								32.0	
		7.0 → 32.0'								

CME CONTINUOUS AUGER SAMPLER | WATER TABLE (TIME OF BORING)

STANDARD PENETRATION TEST | L LABORATORY TEST LOCATION

UNDISTURBED SAMPLE | + PENETROMETER, (TONS / FT.²)

WATER TABLE (24 HOURS) | OE-W, 200 S

ROBERTS-SCHORNICK & ASSOCIATES, INC.
Environmental Consultants

JOB NAME / NUMBER: Marathon (IRGP) 91029.01

BORING NUMBER: BH-71

DATE DRILLED 6-4-91

DRILLING METHOD HSA

DRILLED BY SNB

LOGGED BY JMB

CHECKED BY ___

PAGE ___ OF ___

RSA FORM .6 3/84 REV. 1

BORING RECORD

DRAFT

GEOLOG UNIT	DEPTH (INCHES)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x ____ (2 4 6 8 10 12 14 16)	SAMPLE NUMBER	SAMPLE HNU	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
	0	silt, 10YR 7/3, v. pale brown, loose, dry, soft,	ML			1	0		1.0	BACKGROUND HNU READING: SOIL: ____ PPM AIR: ____ PPM
						NS	—	—	2.5	
		Sandstone, 2.5Y 8/2, white, [illegible], highly weathered, soft to moderately hard, slightly moist at 4.0,				2	0	1.5	4.0	
	5'					3	0	0.3	4.5	
		2.5Y 7/4, pale yellow slightly cemented at 7.5 moderately hard to hard, color changes to 2.5Y 7/2, light gray				NS	—	—		
						4	0	0.2	7.5	
						NS	—	—	7.0	
	10					5	0	0.2	9.2	
		— 2.5Y 6/8, olive yellow at 9.5'				NS	—	—		
						6	0	0.3	12.5	
						NS	—	0.3	14.0	
	15	cemented hard layer at 17.0-17.3', 17.8-18.0'				7	0		14.3	
						NS	—	—		
						8	0	0.2	17.5	
						NS	—	—	19.1	
						9	11	0.6	19.6	
						NS	—	—		
									22.5	No Recovery
						NS	—	—	24.0	
	240					10	26	0.4	24.4	
		TD → 24.0								
		Borehole OVM → 59.0 PPM								
		Note: No recovery from the split spoon sample at 22.5'								

CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

\+ PENETROMETER, (TONS / FT.²)

500 E, 700 N

ROBERTS-SCHORNICK & ASSOCIATES, INC.
Environmental Consultants

JOB NAME / NUMBER: Marathon (IBGP) 91029.01

BORING NUMBER: BH-72

DATE DRILLED 6-5-91

DRILLING METHOD HSA

DRILLED BY SLB

LOGGED BY JMB

CHECKED BY

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ASA FORM .6 .0/24 REV. 1

BORING RECORD

DRAFT

GEOLOG UNIT	DEPTH (INCHES)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	NHU SOIL GAS SURVEY PPM x 2 4 6 8 10 12 14 16	SAMPLE NUMBER	SAMPLE NHU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
										BACKGROUND NHU READING: SOIL ____ PPM AIR ____ PPM
	0	silty, 10YR7/3, v pale brown, loose, dry, cobbly	ML			1	0		1.0	
	2.5'	sandstone, 2.5Y 8/3, v pale brown, dry, moderately hard, v. fine grained, silty, weathered				NS	—	—	2.5	
						2	0	X 1.3	3.8	
	5					3	0		4.3	
		2.5Y 7/4 pale yellow @ 4.0'				NS	—	—		
		moist at 9.0'				4	0	0.3	7.5	
						NS	—	—	9.0	No Recovery
	10	2.5Y 6/8; olive yellow at 8.5'	SS			NS	—	—		
		- cemented layer at 13.0'				5	0	0.3	12.5	
		- 17.5'				NS	—	—	14.0	No Recovery
	15					NS	—	—		
								0.6	17.5	
		v. moist to wet at 19.0'				6	0	X	18.1	
						NS	—	—	19.0	
						7	0	X	19.5	
	20	2.5Y4/4, olive brown at 20.0'				NS	—	—		
						8	0	0.2	22.5	
		v. hard + cemented at 24.0'-25.0'				NS	—	—	24.0	No Recovery
	25					NS	—	—		
	26.0'								27.5	No Recovery
	28.0'					NS	—	—	28.5	
						9	1.5		29.0	
	30					NS	—	—	32.5	
						10	160	—	33.0	
						NS	—	—	34.0	
		0 → 35.0'				11	74		35.0	
	35									

CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

\+ PENETROMETER (TONS / FT.²)

200 E, 1000 N

ROBERTS-SCHORNICK & ASSOCIATES, INC.
Environmental Consultants

Marathon (IBGA)

JOB NAME / NUMBER: 91029.01

BORING NUMBER: BH-73

DATE DRILLED 6-5-91

DRILLING METHOD HSA

DRILLED BY SHB

LOGGED BY JMB

CHECKED BY _____

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RSA FORM .6 3/84 REV. 1

BORING RECORD

DRAFT

GEOLOG UNIT	DEPTH (INCHES)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	KNU SOIL GAS SURVEY PPM x 2 4 5 8 10	SAMPLE NUMBER	SAMPLE KNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
	0	silt, 7.5 YR 6/4, light brown, loose, dry, soft	ML			1	0	1.0	1.0	BACKGROUND KNU READING: SOIL: ___ PPM AIR: ___ PPM
	2.8	clayey silt, 7.5 YR 5/4, brown, firm, friable, dry, caliche, 15% clay, 10% caliche	ML			NS	—	—	2.5	
	5					2	0	1.0	3.5	
						NS	—	—	4.0	
						NS	—	—	7.5	
	8.5	silt, gravel, cobbles, silt is 10 YR 6/4 to 5/4, light yellowish brown to yellowish brown, dry, gravel - cobbles are 2.5 Y 5/0 to 4/0, gray to dk gray and are dolomitic limestone, vuggy porosity, limestone is also 2.5 Y 6/0 light brownish gray	ML			4	0	1.0	8.5	
						NS	—	—	9.0	
	10					5	0	0.6	9.6	
						NS	—	—	10.5	
						6	0	0.6	13.1	
						NS	—	—	14.0	
	15					7	0	0.7	14.7	
	16.5					NS	—	—	17.5	
	17.9					8	0	0.5	18.0	
	18.5	sandstone, 2.5 Y 6/6, olive yellow, hard, fn grain, silty	SS							
		TD → 18.5' Borehole OVM - 0 PPM								

CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

+ PENETROMETER (TONS / FT.²)

600 lb = 1200 N

ROBERTS-SCHORNICK & ASSOCIATES, INC.
Environmental Consultants

JOB NAME / NUMBER: Marathon (FRCP) 91029.01

BORING NUMBER: BH-74

DATE DRILLED 6-6-91

DRILLING METHOD HSA

DRILLED BY SHB

LOGGED BY JMB

CHECKED BY

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RSA FORM .6 W/24 REV. 1

DRAFT

GEOLOG UNIT	DEPTH (INCHES)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x ___ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
										BACKGROUND HNU READING SOIL: ___ PPM AIR: ___ PPM
	0	Silt, 7.5YR 6/4, light brown, rootlets top 2.0", loose, soft, dry	ML			1	0		1.0	
						NS	—	—	2.5	
	2.8	clayey silt, 7.5YR 5/4, brown, friable, firm, non-plastic, dry, caliche, 15% clay, 10% caliche	ML			2	0	1.2	3.7	
	5 4.7					NS	—	.04	4.0	
						3	0		4.9	
		silt, gravel, cobbles, silt is 10YR 6/4 to 5/4, light yellowish brown, to yellowish brown, dry, gravel - cobbles are 2.5Y 5/0 to 4/0, gray to dk gray to 2.5Y 6/2, light brownish gray, gravels are dolomitic limestone, vuggy porosity				NS	—	—		
						4	0	.06	7.5	
						NS	—	—	8.1	
	10					5	0	1.0	9.0	
						NS	—	—	10.1	
			GM			6	0		12.5	No Recovery
						NS	—	—	14.0	
	15					7	0	10	15.0	
						NS	—	—	17.5	6-6-91
	19.0					8	0	.23	18.0	
KJS		dolomitic limestone, 7.5YR 6/2 pinkish gray, v. hard, vuggy porosity, moist								
		TD = 19.25'								
		Borehole OVM = 0 ppm								

CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

+ PENETROMETER, (TONS / FT.²)

ROBERTS-SCHORNICK & ASSOCIATES, INC.
Environmental Consultants

JOB NAME / NUMBER: Marathon (JBGA) 91029.01

BORING NUMBER: BH-75

DATE DRILLED: 6-6-91 + 6-7-91

DRILLING METHOD: HSA

DRILLED BY: SH B

LOGGED BY: JMB

CHECKED BY: ___

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ASA FORM .6 .J/84 REV. 1

GEOLOG UNIT	DEPTH (INCHES)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM x ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
	0	silt, 10YR 4/3, brown to dk brown, loose, soft, dry	ML			1	0		10	HNU READING: SOIL: ____ PPM AIR: ____ PPM
	3.0/3.5	silt, gravels - 5YR 7/1, light gray, gravel is limestone, juicy roots, dry	GM			NS	—	—	2.5	
	5	dolomite, 2.5Y 6/2, light brownish gray, v. hard				2	49	X	3.5	
	10	TD → 3.5' Auger Refusal on the Dolomite at 3.5'								
	15									

DRAFT

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER, (TONS / FT.²)

1800W, 2100S

ROBERTS-SCHORNICK & ASSOCIATES, INC.
Environmental Consultants

JOB NAME / NUMBER: Marathon (IBGP) 91029.01
BORING NUMBER: BH-76
DATE DRILLED 6-7-91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
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ASA FORM .6 -1/84 REV. 1

BORING RECORD

DRAFT

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		Start: 14:00 Stop: 15:30 G.L. Elev.		
	0	Cobbly Clayey Silt, brown 10 yr 4/3, dry, v. low plasticity (cobbles from 3 cm to 10 cm), subround		
	5.0		Gr	
		Boulder below 7.5', round, > 50 cm		
	10.0	Clayey and gravelly to 11.5',		
	13.6	Auger refusal at 13.6'		
		Groundwater not observed during drilling		
		NR: No Recovery NS: Not Sampled		
		~ W1400 S1000 - 1200		
		~ W1400 BH- S1047 78		

HNU SOIL GAS SURVEY PPM = 2.5

SAMPLE NUMBER	HNU READING	RECOVERY	DEPTH
			0
1	0.0		1.0
NS		1.0	2.5
2	46.2		3.5
NR			4.0
3	0.0	0.2	4.2
NR			5.5
NS		0.7	7.5
4	0.0		8.2
NR			8.5
NS		0.6	9.0
5	0.0		9.5
NR			11.1
NS		0.6	11.6
6	0.0		12.5
NR			13.0
NS			13.2

REMARKS

BACKGROUND HNU READING:
SOIL 0.0 PPM
AIR 0.0 PPM

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
\+ PENETROMETER (TONS/FT.²)

JOB NAME / NUMBER Marathon/91029
BORING NUMBER BH-77 (MW-53)
DATE DRILLED 06-07-91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS

ROBERTS/SCHORNICK & ASSOCIATES, INC.
Environmental Consultants
3700 W. Robinson
Norman, Oklahoma 73072
(405) 321-3895

RSA FORM 10/84 Rev. 2

Location W1000 S1400

BORING RECORD

DRAFT

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		Start: 08:35 Stop: 09:05 G.L. Elev.		
	0	Cobbly Clayey Silt, brown, 10YR 5/3, dry, V. low plasticity, V. fine grained, cobbles from 3 cm to 10 cm, subround,	GM	
	6.4	Auger Refusal at 6.4' Groundwater Not Observed During Drilling NR: No Recovery NS: Not Sampled		

HNU SOIL GAS SURVEY PPM 0 0 2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	HNU READING	RECOVER	DEPTH	REMARKS
1	0.0		1.0	BACKGROUND HNU READING: SOIL: 0.0 PPM AIR: 0.0 PPM
NS			2.5	
2	0.0	0.3	2.5	
NR			4.0	
3	0.0	0.4	4.4	
NR			5.5	
NS		0.0	6.4	
NR			6.7	

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
\+ PENETROMETER (TONS/FT.^{2})

JOB NAME / NUMBER Marathon/91029

BORING NUMBER BH-78

DATE DRILLED 06-08-91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY TUL
CHECKED BY BJS

ROBERTS/SCHORNICK & ASSOCIATES, INC.
Environmental Consultants
3700 W. Robinson
Norman, Oklahoma 73072
(405) 321-3695

RSA FORM 10/84 Rev. 2

Location W 1400
S 1047

BORING RECORD

DRAFT

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	HNU SOIL GAS SURVEY PPM 2 4 6 8 10 12 14 16 18	SAMPLE NUMBER	SAMPLE HNU READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		Start: 13:00 Stop: 13:25 G.L. Elev.								BACKGROUND HNU READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	Clayey Silt, Yellowish brown, 10YR5/4, quartz, V. fine sand grained, dry	NR			1	0.0		1.0	
	2.0		SS			NS				
	3.8	Sandstone, Pale to V. Pale brown, 10YR6/3 to 7/3, quartzose, V. fine grain, weathered from 2.5 to 3.0', competent - hard below 3.0', CaCO3 present				NR		0.0	2.5 3.1	
		Dolomite, slight brownish gray, 10YR6/2, sandy, Massive, V. hard	Dol.			NS		0.0	3.8 3.5	
		Auger Refusal at 3.8' Groundwater Not Observed During Drilling NR: No Recovery NS: Not Sampled								

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
\+ PENETROMETER (TONS/FT.^{2})

JOB NAME / NUMBER Marathon/91029

BORING NUMBER BH-79

DATE DRILLED 06-08-91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY TUL
CHECKED BY BJS

ROBERTS / SCHORNICK & ASSOCIATES, INC.
Environmental Consultants
3700 W. Robinson
Norman, Oklahoma 73072
(405) 321-3895

RSA FORM 10/84 Rev. 2

Location E 200
N 1305

7

1700

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	CLAYEY SILT: 10% CL 90%, 7.5YR 6/4, UNCONSOLIDATED, DRY	CL			NS	-	-	3.0	
	3.5	SILTSTONE: 2.5 YR 8/1 WHITE, HARD, DRY	SILTSTONE				0	0.6	3.6	
	5					NR	-		4.0	
HSA TO WATER CORE - NX	6.0	SANDY DOLOMITE: VFG SILICA SAND, 10YR 7/1 LT GY, V HARD, FRACTURED, DRY	SANDY DOLOMITE			NS	-	-	5.0	
	8.0	SANDSTONE: VFG SILICA WELL SORTED, HARD, MOIST, 10YR 7/2 LT GY, MASSIVE, MINOR IRON OXIDE MOTTLING FRACTURES (HORIZONTAL) AT 5.1, 8.8, 9.7 TO 10.3 FEET SANDY DOLOMITE INTERBED 10.3 TD 10.6 FEET FRACTURES AT 6.2, 9.0, 10.2, 11.7, 12.9, 13.4, 13.9, 15.4	SANDSTONE SANDY DOLOMITE			3	4	0.9	6.3	
	10					NS	-		8.0	
LOST CIRCULATION @ 11'						4	0		10	
						5	0		12	
						6	0	10.8	14	
	15	VERY MOIST AFTER 12.6 FEET				7	0		16	
						8	82		16.8	
						NR	-		19.5	
	20	VARYING DEGREES OF CARB. CEMENTATION,				9	9		21.5	
		AFTER 22 FEET 10YR 5/2 GY BN, NO CARBONATE CEMENT, M.D. HARD. FRACTURES AT 17.7, 18.8, 20.5, 20.9, 24.5 FEET				10	0		23.5	
						11	0	10.0	25.5	
	25					12	47		27.5	
		27 TO 27.3 FEET 2.5Y 7/4 PALE YELLOW				13	0		29.5	
		2.5Y 5/2 GRAY BN AFTER 30'								
	30	FRACTURES AT 29.7, 29.8, 29.9, 30.1, 30.2, 30.4, 30.6, 31, 32.2, 31.5, 31.9, 32.3, 32.5, 33.1, 33.5, 33.9, 34.1, 34.5, 34.9, 35.5, 36.6, 37.2, 37.5, 37.9 38.9 FEET IRON OXIDE FRACTURE CALCITE AND IRON OXIDE FILL AFTER 34 FEET.				14	0		34.5	
						15	0	10.0	35.5	
	35					16	0			

HSA TO 6.0

- ONE CONTINUOUS AUGER SAMPLER
- STANDARD PENETRATION TEST
- UNDISTURBED SAMPLE
- WATER TABLE (24 HOURS)
- WATER TABLE (TIME OF BORING)
- L LABORATORY TEST LOCATION
- + PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON

BORING NUMBER BH-80/MW-54A N600E,

DATE DRILLED 6/15/91 / 6/17/91

DRILLING METHOD HSA / LONGYEAR CORE

DRILLED BY SHB

LOGGED BY RJCP

CHECKED BY

DRAWN BY:

PAGE ___ OF ___

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ___ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS (BACKGROUND OVM READING: SOIL: ___ PPM AIR: ___ PPM)
		GROUND SURFACE:								
39	35	AFTER 35.1 FEET, MODERATELY WELL CEMENTED ABUNDANT FRACTURES EVERY .2 FEET AFTER 36 FEET 2.5Y 6/2 LT BN GY TO 2.5Y 6/4 LT YL BN IRON OXIDE STAINING, MOIST MOD. WELL CEMENTED AFTER 38.8 FEET 2.5Y 4/2 DK GY BN GRADING INTO 10YR 3/1 V DK GY, VERY FINE GRAIN SANDSTONE BETWEEN 42.5 AND 43.5 FEET VERY FINE GRAIN SILTY SANDSTONE 5Y 4/1 DK GY	SS			17	4.6		35.5 / 37.5	35
						18	0		38.8	CONC 37.
						NR	-		39.5	
	40					19	0		41.5	40
						20	0	5	43.5	
8" PVC CONDUCTOR SET TO 46'	45					21	0		44.5	45
						NR	-		46	
		SANDSTONE: VFG, 10YR 5/1 GRAY TO 10YR 3/1 VERY DK GY, VERY HARD, MODERATELY FRACTURED, AFTER 47 FEET, 2.5YR 7/0 LT GY MOTTLED WITH 10YR 6/3 PALE BN, SLIGHTLY DOLOMITIC AFTER 50.7 FEET, BETW 54.8 AND 55 FEET 5YR 4/1 DK GY CONTINUING ALTERNATING BANDS OF 10YR 5/1 GRAY AND 2.5YR 7/0 LT GY MOTTLED WITH 10YR 6/3 PALE BN	SS			22	1.0		48	
	50					23	1.0		50	50
						24	7.2	10	52	
						25	39		54	
	55					26	4.6		56	55
						27	1.0		58	
	60					28	0		60	60
						29	7	10	62	
		BETWEEN 62.6 AND 62.7 FEET: SILTY SANDSTONE 5Y 5/2 OLIVE GY, HIGHLY WEATHERED				30	8.3		64	
	65					31	3.3		66	65
						32	1.0		68	
	70	66, 7, 7.3, 7.1, 8.7, 9				33	58		70	70

Legend		
CME CONTINUOUS AUGER SAMPLER	WATER TABLE (TIME OF BORING)	
STANDARD PENETRATION TEST	LABORATORY TEST LOCATION	
UNDISTURBED SAMPLE	PENETROMETER (TONS/SQ. FT.)	
WATER TABLE (24 HOURS)		

JOB NAME/NUMBER: MARATHON

BORING NUMBER: BH-EO

DATE DRILLED: 6/17/91 / 6/21/91

DRILLING METHOD: LONG YEAR WATER CORE

DRILLED BY: SWC

LOGGED BY: WCJ

CHECKED BY:

DRAWN BY: DATE:

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NORMAN, OKLA. 73072

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	70		SS							70
		DOLOMITE: GRADATIONAL CONTACT WITH SANDSTONE, 5YR 5/1 GRAY, VERY HARD, HORIZONTAL FRACTURES AT 72.6, 73, 73.3, 73.4, 74.7, 75 FEET STRONG CONDENSATE ODOR AT 76 FEET	DOL.			1	3	10	72	
						2	1		74	
	75					3	1		76	25
		70 76 FEET W/L AFTER DRILLING 14.90 FEET								
	80									80
	15	* SAMPLES BROKEN PRIOR TO OVM								15
	20									20
	25									25
		7								
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON
BORING NUMBER B11-80
DATE DRILLED
DRILLING METHOD
DRILLED BY
LOGGED BY
CHECKED BY
DRAWN BY:
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING SOIL: ____ PPM AIR: ____ PPM
	0									0
	5									5
	10	12" CONDUCTOR TO 11 FEET								10
	11	SANDSTONE: VFG, 10YR 6/3 PALE BN, 10YR 5/3 BROWN, MOD-HD TO VERY HARD, SL MOIST WEATHERED, MOIST AND FRIABLE BETWEEN 18.5 AND 21.5 FEET AFTER 21.5 FEET VERY HARD, FRACTURES LARGELY CEMENTED, FRACTURES AT 15.2, 16, 16.8, 17.2, 17.5, 18.5, 19.7, 20, 20.8, 21-21.5, 23.3, 24 FEET, NO ODOR	SANDSTONE							11
	15					N	-	-	15	15
							1.9		17	
							0		19	
	20						0	10	21	20
							0		23	
							0		25	
	25	10YR 5/2 GY BN AFTER 25 FEET								25
		FRACTURE (HORIZONTAL) @ 26.5 FEET					13		27	
							2.0		29	
	30						9.9	10	31	30
	30.5	SANDY DOLOMITE: VFG SAND, 10Y 6/1 LT GY-GY, VERY HARD	SDY DOLOMITE							
	31.5	DOLOMITE: MICROCRYST, 2.5Y 6/2 LT BN GY, VERY HARD, FRACTURES AT 31.6, 32.6, 32.2, 32.5 - 33.5, 33.6, 33.9, 34.1, 35.7 FEET	DOLOMITE				0		33	
							0		35	
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON
BORING NUMBER BH-81
DATE DRILLED 6/20/91 — 6/21/91
DRILLING METHOD LONGYEAR CORE - WATER
DRILLED BY SHA
LOGGED BY WRA
CHECKED BY
DRAWN BY:
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ___ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS (BACKGROUND OVM READING: SOIL: ___ PPM AIR: ___ PPM)
		GROUND SURFACE:								
	35	32.1 TO 32.2 FEET, FRIABLE SILTY SANDSTONE INTERBED, 5Y 5/3 OLIVE, MOIST IRON OXIDE AND PYRITE ALONG FRACTURES BELOW 33 FEET AFTER 34.3 FEET VERY HARD, FRACTURES LARGELY CEMENTED AFTER 35 FEET, GRADES	DOLOMITIC SANDSTONE				3.3		37	35
							16.5		39	
	39.6 / 40	DOLOMITIC SANDSTONE: VFG SAND, GRADATIONAL CONTACT WITH DOLOMITE, VERY HARD 10YR 6/1 LT GY-GY 10YR 5/2 GY BN 38.9 TO 39.6 FEET, FRACTURES 38.9, 39.8, 39.9, 42 + 43.9, 44, 44.7 FEET	SANDSTONE				84	10	41	40
							15.2		43	
			SILTSTONE / DOLOMITIC SANDSTONE				9		45	
	45	SANDSTONE: VFG SILICA, 2.5Y 6/2 LT BN GY, V HARD BETWEEN 6.9 AND 7.4 FEET 10YR 4/1 DK GY ZONE* SILTSTONE INTERBED BETWEEN 42.6 AND 43.4 FEET: HIGHLY FRIABLE AND WEATHERED, 2.5Y 4/2 DK GY BN BETWEEN 43.4 AND 44.4 FEET DOLOMITIC SANDSTONE: VFG, 10YR 6/1 LT GY-GY AFTER 44.4 FEET SANDSTONE VFG 5Y 4/1 DK GY, MOD HD 5YR 4/1 DK GY 45-46.1 FEET	SANDSTONE / DOLOMITIC SS				44		47	45 *SMI TO Y SEE II BH-8
							9.9		49	
	50	DOLOMITIC SANDSTONE: VFG, 7.5YR 7/0 LT GY, VERY HD, HORIZONTAL FRACTURES AT 49.1 FEET	SANDY DOLOMITE				78	10	51	50
							7		53	
							362		55	
	55	SANDY DOLOMITE: VFG SD, 10YR 6/2 LT BN GY, VERY HARD, HORIZONTAL FRACTURES AT 49.9, 51.9, 52.7, 53.5, 53.7, 45° FRACTURE AT 49.9 FEET, VERTICAL FRACTURE AT 44.2 TO 55 FEET, PYRITE, CALCITE AND HEMATITE FRACTURE FILL, STRONG CONDENSATE ODOR AFTER 53 FEET	DOLOMITE				4		57	55
							7.2		59	
	60	DOLOMITE: 10YR 6/2 LT BN GY, HIGHLY FRACTURED WITH THIN INTERBEDS OF DOLOMITIC SILTSTONE AND SANDSTONE, STRONG CONDENSATE ODOR					3	10	61	60
							1		63	
							36		65	
	65	TO 65' W/L AFTER DRILLING 15.9								65
	70									70

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Marathon
BORING NUMBER BH-81
DATE DRILLED 6/20/91 - 6/21/91
DRILLING METHOD Water Core
DRILLED BY SHR
LOGGED BY ___

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X —— (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
32.3 4.3										BACKGROUND OVM READING: SOIL: 0 PPM AIR: 0 PPM
		GROUND SURFACE:								B17: 1 LENG.
	0	CLAYEY SILT: 20% CLAY 80% SILT, 10YR 5/3 BROWN, DRY, UNCONSOLIDATED, LOW PLASTICITY	CL			1	0	GRAB COMP	2.0	CONDUC. = 1.06 / 15.01
ADDED H_2O to AIR STREAM						NS	-	-	4.0	
	5					2	2.0	GC	5.0	AIR ROTARY W/ 6.1
	6.0	SILTY CLAY: 30% SILT 70% CLAY, 10YR 5/3 BROWN, SOFT, MED PLASTICITY, MINOR SUBANG. DOLOMITE GRAVEL TO ¼ INCH, MINOR	CL			NS	-	-	7.0	
	9.5	DOLOMITE CABLES TO APPROXIMATELY 3 INCHES	DOLOMITE			3	55	GC	8.0	
	10	DOLOMITE: 10YR 4/1 DARK GREY, TO 10YR 6/1 GRAY-LT GY, DRY, HARD				NS	-	-	9.0	
CASING TO 14.2' AIR ROTARY TO 15' TO BOTTOM OF CORE						4	25	GC	10.0	
						5	25.3	GC	12.0	
						6	5.0	GC	14.0	
	15					7	0	GC	15.0	
		VERTICAL FRACTURE AT 16.2 & 17 FEET				8	0	8	17	
	17.7	MODERATELY FRACTURED BELOW 17 FEET	DOLOMITE SILTY DOLOM.			9	0		19	NOTE V. SIL TO 1 BIT-
		DOLOMITE: WITH INTERBEDS OF SILTY DOLOMITE, 10YR 5/2 GY BN, 10YR 6/2 LT BRN TO 5 10YR 5/1 GY, ABUNDANT HEMATITE-REPLACED FOSSIL - POSSIBLY BRACHIOPOD SPINE SPICULES, AT 21 FEET, CHERT-LIKE CONCHOIDAL FRACTURING				10	0		21	LO. CIR LAY 22
	20					11	0		23	
						NR	--		25	
	25	DOLOMITE: 10YR 5/2 GY BRN, MICROCRYST, VERY HARD, HIGHLY FRACTURED, 2.5Y 6/2 LT BRN GY SILT ALONG HORIZ. FRACTURES, MINOR IRON OXIDE STAINING				12	1.0		27	
						13	1.7		29	
	30					14	8	9	31	
0800 6/21/91 32.75'		STRONG CONDENSATE ODOR IN FRACTURE AT 37.8 FEET IN FRACTURE 45° FROM VERTICAL				15	9		33	
						16	--		34	
	35					17	-		35	

ONE CONTINUOUS AUGER SAMPLER	WATER TABLE (TIME OF BORING)
STANDARD PENETRATION TEST	LABORATORY TEST LOCATION
UNDISTURBED SAMPLE	PENETROMETER (TONS/SQ. FT.)
WATER TABLE (24 HOURS)	

JOB NAME/NUMBER MARATHON

BORING NUMBER BH-82/MW-56B E2280 S.

DATE DRILLED 6/15/91 6/19/91

DRILLING METHOD SCHRAMM ROTARY/CORE

DRILLED BY BOYLES BROS & SHB

LOGGED BY WJP

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X —— (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL ____ PPM AIR ____ PPM
	35	STRONG CONDENSATE ODOR IN FRACTURES TO 35.6 FEET AFTER 36.6 FEET, FRACTURES LARGELY CEMENTED	DOLOMITE			17	224	5/	37	
						18	0		39	
	40					19	0		41	40 ROTA DIAMO CORE BARR
		TD 41.2 FEET GW @ 32.75 FEET 1/8" FLOATING PRODUCT STRONG CONDENSATE ODOR (6/21/91								
	45									45
		Actual TD 50'. Well depth 9'.								
	15									15
	20									20
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON

BORING NUMBER BH-82

DATE DRILLED 6/18 — 6/19/91

DRILLING METHOD AIR ROTARY / WATER CASE

DRILLED BY BROCKS / SHR

LOGGED BY WSP

CHECKED BY

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
AUGER TO 2.1'	0	SANDY SILT: VFG SAND, 20% SD 80% SILT, LOOSE, UNCONSOLIDATED, MASSIVE, 7.5YR 5/4 BROWN, DRY	SM			1		6"	1.0	
	2.1	SANDY DOLOMITE: VF-F GR SILICA SAND, 10YR 6/2 LT GRN GY	SANDY DOLOMITE			NR	-	-	2.1	
LONGYEAR WATER CORE	5	SANDY DOLOMITE: VF G SILTY SAND, 7.5YR GN PINK GY VERY HARD, DRY, PITTED IN MATRIX AND LACING FRACTURE FILL, 10% PRIMARY POROSITY IN MATRIX. FRACTURES @ 2.3, 2.5, 2.6, 2.9, 3.1, 3.3, 3.7, 4.0, 4.1, 4.6, 5.0, 5.4 VERTICAL FRACTURE AT 3.3 TO 4.0 FEET				NR	-	-	3.1	
						2	0	3.9	5.0	
						3	0		7.0	
?						4	0	2.0	7.0	
	10	CHERTY AFTER 7.0 FEET				NR	-		10.0	
		7.3 TO 7.5: SILTSTONE: 10YR 5/2 GY BN, HIGHLY WEATHERED, FIRM, VERY MOIST, IRON OXIDE STAINING HORIZONTAL FRACTURES @ 9.4, 9.5, 10, 10.2, AND 10.7 FT MINOR VERTICAL FRACTURES	DOLOMITE SILTY, CHERT			5	0		17	
						6	0		19	
	15					7	0	19.5	16	
0800 7/18/91 18.5		INTERBEDDED DOLOMITE AND SILTSTONE AND CHERT: VERY HARD, 10YR 6/2 LT BN GY, 10YR 7/2 LT GY AND 7.5YR 7/2 PINK GY, MODERATELY FRACTURED, POSSIBLE CALCITE ALONG FRACTURE AT 11.7 FEET, CONCHOIDAL FRACTURES				8	0		18	
						9	0		19.5	
	20					NR	-		20	
QSA		DOLOMITE: MICROCRYSTALLINE, 10YR 5/2 GY BN, 10YR 5/1 GY AND 10YR 4/1 OK GY, VERY HARD, UNSATURATED, VERY LOW PRIMARY POROSITY HORIZONTAL FRACTURES AT 20.3, 20.6, 21.6, 22, 22.4, 22.5, 22.9, 23, 23.2, 24.8, 25, 27.2, 28, 28.5, 28.8, 29.2, 29.7 FEET, MINOR IRON OXIDE STAINING IN FRACTURES ALSO 10YR 3/1 OK GY ALONG PARTINGS	DOLOMITE			NS	-	20		
6/17/91 1100 29.5'	25									
	30	HIGHLY FRACTURED AFTER 30.5 FEET TO 32.6							30	
CAVITY AT 31'		10YR 6/3 PALE BN MINOR POSSIBLE CALCITE AND HEMATITE ALONG FRACTURE				10	0		32	
	35					11	0	8	34	

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON

BORING NUMBER BH-83/MW-57A 2100 S

DATE DRILLED 6/17/91 - 6/18/91

DRILLING METHOD HSA

DRILLED BY SHL

LOGGED BY WLE

CHECKED BY

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ___ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS (BACKGROUND OVM READING: SOIL: ___ PPM AIR: ___ PPM)
	35	GROUND SURFACE: 10YR 6/2 LT BN GY	DOLOMI			12	0		36.0	35.0
						13	18		38.0	
TD	38'									
	40									40
	10									10
	15									15
	20									20
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Marathon
BORING NUMBER MI-83
DATE DRILLED 6/17/91-6/18/91
DRILLING METHOD WATER CORE
DRILLED BY SHB
LOGGED BY WKP
CHECKED BY

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

Start: 11:07 at 35'
End: 3:15pm at 50.5'

GROUND SURFACE:

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
...MING PREVIOUSLY DRILLED WITH CORE RIG	35	Dolomite, 10YR 6/2 light brownish gray, slight odor, dry, dense, thin siltstone layers, HCL(+) on scratchings	Dolomite	1	—	GC	36	35
		same, no siltstone, HCL(+)		2	—	GC	38	
6/20/91 0600 41.7	40	same, interbedded with silty dolomite, HCL(+), drilled soft at 41.6', minor karstific		3	—	GC	40	40
				4	—	GC	42	
				5	—	GC	44	
	45	Dolomite, interbedded different colors, 10YR 6/1 gray 10YR 6/1 brownish yellow 10YR 3/1 v. dark gray, dry, dense, no odor, minor black reduced staining		6	—	GC	46	45
		Dolomite, dominant color 10YR 6/3 pale brown, prominent black staining, no odor, dense		7	—	GC	48	
	50	same		8	—	GC	50	50

TD 50.50' Dry
Dry 1 hr. later.

Depth scale: 20, 25, 30, 35

OVM SOIL GAS SURVEY PPM X ___ : 2 4 6 8 10 12 14 16 18

REMARKS: BACKGROUND OVM READING: SOIL: ___ PPM AIR: ___ PPM

GC = 6mb Comp

(symbol)	CME CONTINUOUS AUGER SAMPLER
(symbol)	STANDARD PENETRATION TEST
(symbol)	UNDISTURBED SAMPLE
(symbol)	WATER TABLE (24 HOURS)
(symbol)	WATER TABLE (TIME OF BORING)
L	LABORATORY TEST LOCATION
+	PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER Marathon

BORING NUMBER BH-83

DATE DRILLED 6/19/9 (air rotary rig)

DRILLING METHOD Air

DRILLED BY Eagles Bros

LOGGED BY L.C.

CHECKED BY

DRAWN BY

PAGE 1 OF 1

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ___ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		DRILLED CEMENT 40 TO 50 ft								BACKGROUND OVM READING: SOIL: ___ PPM AIR: ___ PPM
		GROUND SURFACE:								
10 5/8" DRILLED TO 50.5 ft	50 / 50.5	Dolomite, dark gray (2.5Y N4/0) and light gray (7.5 YR N7/0), V. FN XLN, no primary porosity observed, V. SL sandy texture	Dolomite			1	23.1	GC	50.5 / 52	
						2	17.8	GC	54	
	55 / 56	Dolomite, gray (7.5 YR N6/0) and pinkish gray 7.5 YR 6/2, micro XLN, dense, hard, dry	Dolomite			3	93.3	GC	56	
	58					4	9.9	GC	58	
	60	Dolomite, light gray (7.5 YR N7/0), V. FN XLN, SL sandy texture, dense, hard, dry, light hydrocarbon odor in 60-62 ft sample, more condensate odor present in 62-64 ft sample	Dolomite			5	175.4	GC	60	
						6	809	GC	62	
						7	957	GC	64	
	65	Gypsum, white (5Y 8/1) soft, dry, chalky	Gypsum			8	442	GC	66	
		Dolomite, light gray (10YR 7/1), V. FN XLN, hard, dense, dry, light hydrocarbon odor	Dolomite			9	27.1	GC	68	
	70	Dolomite, grayish brown (10YR 5/2) and pinkish gray (7.5YR 7/2), micro XLN, cherty, hard, dense, dry, hydrocarbon odor decreasing slightly from above				10	8.6	GC	70	
						11	130.4	GC	72	
	74					12	141.7	GC	74	
	75 / 76	Dolomite, dark gray (7.5 YR N4/0), V FN XLN, dense, hard, dry, faint odor	Dolomite			13	305	GC	76	
		Dolomite, pinkish gray (7.5 YR 6/2), micro XLN, dense, hard, dry, cherty, SL hydrocarbon odor				14	114.5	GC	78	
	80					15	130.4	GC	80	
		Total depth 80 ft								
		Hole was dry at total depth								
	85									

Remarks: At 62 ft shut down rig to repair air compressor. No breakthrough detected.

GC = GRAB

CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

-|- PENETROMETER (TONS/SQ. FT.)

ROBERTS/SCHORNICK & ASSOCIATES, INC.

JOB NAME/NUMBER MARATHON 91029.01

BORING NUMBER BH-83

DATE DRILLED 6-23-91

DRILLING METHOD 7-5/8" AIR ROTARY

DRILLED BY BOYLES BROS

LOGGED BY CHK

BORING RECORD

Depth (feet)	Lithologic Description	Unified Soil Classification	Sample Number	OVM Reading	Recovery	Sample Depth	Remarks
80	DOLOMITE, LIGHT BROWNISH GRAY (10YR 6/2), AND PINKISH GRAY (7.5YR 6/2) MICRO XLN, DENSE, CHERTY, DRY, NO ODOR OBSERVED	DOLOMITE	1	4.6	GC	82	80
			2	0.6	GC	84	
85			3	1.0	GC	86	85
87	DOLOMITE AS ABOVE W/ COLOR GRADING TO GRAY (2.5Y N5/0) AT 87 ft	DOLOMITE	4	1.0	GC	88	
	DOLOMITE, LIGHT BROWNISH GRAY (10YR 6/2), V. FN XLN, DENSE, DRY	DOLOMITE	5	0	GC	90	
90	SILTSTONE, DUSKY YELLOW GREEN (5GY 5/2), SOFT, FRIABLE, DRY	SILTSTONE	6	0	GC	92	90
90.5	DOLOMITE, LIGHT BROWNISH GRAY (10YR 6/2), V. FN XLN, DENSE, DRY, HARD, NO ODOR OBSERVED	DOLOMITE	7	0	GC	94	GC: GRAB CUTTINGS
95			8	0	GC	96	95
96	DOLOMITE, PINKISH GRAY (7.5 YR 6/2) MICRO XLN, DENSE, CHERTY, W/ INTERBEDDED MINOR SILTSTONE, DUSKY YELLOWISH GREEN (5GY 5/2), SOFT, FRIABLE,	DOLOMITE W/ [illegible] SILTSTONE	9	0	GC	98	
			10	0	GC	100	
100	DOLOMITE, PINKISH GRAY (7.5 YR 6/2) AND (7.5YR 7/2) V. FN XLN, DENSE, HARD, DRY W/ MINOR INTERBEDDED SILTSTONE, DUSKY YELLOWISH GREEN (5GY 5/2), HARD, FRIABLE, FISSILE		11	0	GC	102	100
			12	0	GC	104	
105			13	0	GC	106	105
106	DOLOMITE, LIGHT GRAY (10YR 7/2) FN XLN TO SL SANDY, SOME CALCAREOUS CEMENT, SOME INTERBEDDED SILTSTONE, CALCAREOUS, [illegible] FRIABLE, VERY PALE BROWN (10YR 8/3)	DOLOMITE / SILTSTONE	14	0	GC	108	
108		LIMESTONE	15	0	GC	110	
110	LIMESTONE, PINKISH GRAY (5YR 6/2) SL DOLOMITIC, V. FN XLN, MOD. HARD, CHALKY, INTERBEDDED W/ SILTSTONE, POORLY CEMENTED, SOFT, POWDERY IN CUTTINGS, DRY, NO ODOR		16	0	GC	112	110
			17	0	GC	114	
115			18	0	GC	116	115

GEOLOG. UNIT | GRAPHIC LOG | OVM SOIL GAS SURVEY PPM X ___ (2 4 6 8 10 12 14 16 18)

REMARKS: BACKGROUND OVM READING: SOIL: ___ PPM AIR: ___ PPM

GROUND SURFACE:

- CME CONTINUOUS AUGER SAMPLER
- STANDARD PENETRATION TEST
- UNDISTURBED SAMPLE
- WATER TABLE (24 HOURS)
- WATER TABLE (TIME OF BORING)
- LABORATORY TEST LOCATION
- \+ PENETROMETER (TONS/SQ. FT.)

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(405) 321-3895

JOB NAME/NUMBER: MARATHON 91029.01
BORING NUMBER: BH-83
DATE DRILLED: 6-24-91
DRILLING METHOD: AIR HAMMER 7-5/8"
DRILLED BY: ROTLESS BROS.
LOGGED BY: [illegible]
CHECKED BY: [illegible]
DRAWN BY:

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE:	
	115	LIMESTONE, AS ABOVE	LIMESTONE
	119 / 120	LIMESTONE, VERY PALE BROWN (10YR 8/4), V. SILTY, FIRM TO SOFT, V. CHALKY, DRY, NO ODOR,	LIMESTONE
	122	DOLOMITE, LIGHT GRAY (5YR7/1) W/ SCATTERED HEMATITE REDDISH RED (5YR 5/6), HARD, V FN XLN, SL CALCAREOUS, W/ MINOR INTERBEDDED, SILTSTONE, SL CALCAREOUS, SOFT	DOLOMITE
	125 / 126	LIMESTONE, VERY PALE BROWN (10YR 8/4), FN XLN, SOFT-FIRM, CHALKY, SILTY, SL. GYPSIFEROUS LIMESTONE, POWDERY APPEARANCE IN CUTTINGS, NO ODOR, DRY	LIMESTONE
	130		
		LIMESTONE, VERY PALE BROWN (10YR 8/4) TO WHITE (5YR 8/1), FNXLN, FIRM-SOFT, SL. GYPSIFEROUS V. CHALKY, SILTY, 50% OF CUTTINGS ARE POWDER ON SAMPLE, NO ODOR, DRY	
	135		
	140	LIMESTONE AS ABOVE BECOMING V. SILTY AND INTERBEDDED W/ SILTSTONE	LIMESTONE
		SILTSTONE, LIGHT BROWNISH GRAY (10YR 6/2), V POORLY CEMENTED, V. SL MOIST, CALCAREOUS CEMENT, INTERBEDDED W/ MINOR LIMESTONE AS ABOVE	SILTSTONE
	145		
		LIMESTONE, LT YELLOWISH BROWN (10YR6/4) SANDY, FN XLN, FIRM, FRIABLE	LIMESTONE
	150		LIMESTONE

OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
18	0	GC	116
19	0	GC	118
20	0	GC	120
21	0	GC	122
22	0	GC	124
23	1.3	GC	126
24	0	GC	128
25	0	GC	130
26	0	GC	132
27	0	GC	134
28	0	GC	136
29	0	GC	138
30	0	GC	140
31	0	GC	142
32	1.0	GC	144
33	4.6	GC	146
34	3.3	GC	148
35	0.6	GC	150

REMARKS

BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM

115, 120, 125, 130, 135, 140, 145, 150

GC GRAB COMP.

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON 11024.01

BORING NUMBER BH-03

DATE DRILLED 6-24-91
DRILLING METHOD 7 5/8" AIR ROTARY
DRILLED BY BUYERS
LOGGED BY HB
CHECKED BY
DRAWN BY:

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& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	150	LIMESTONE, VERY PALE BROWN (10YR 8/2) SANDY, INTERBEDDED W/ SANDSTONE AND SILTSTONE, V. FINE GRAINED, CALCAREOUS V. SL. MOIST, POORLY CEMENTED, LIGHT BROWNISH GRAY (10YR 6/2)	Limestone and Sandstone			36	0		152	150
						37	0		154	
	154									
	155	AS ABOVE BUT PREDOMINANTLY SILTSTONE AND V. FN GRAINED SANDSTONE, V. SL. MOIST, CALC. NO FREE WATER, SL POROUS	Siltstone and Sandstone			38	0		156	155
						39	1.9	SC	158	
		LIMESTONE, VERY PALE BROWN (10YR 8/2), V. SANDY, INTERBED W/ SILTSTONE, V. SLIGHTLY MOIST, MOISTURE INCREASING BELOW 162 ft.	Limestone and Sandstone			40	3.3	GC	160	
	160									160
						41	1.0	GC	162	
	162	LIMESTONE, PINKISH GRAY (5YR 7/2) V. FN XLN, DOLOMITIC, CHALKY DULL APPEARANCE, VUGULAR, FRACTURED, HARD, SATURATED, HOLE IS MAKING SMALL VOLUME OF WATER, NO HYDROCARBON ODOR OBSERVED	Limestone			42	0	GC	164	
C-24-91 6-25-91	164									
	165					43	0	GC	166	165
			Dolomite			44	0	GC	168	
		DOLOMITE, LT BROWNISH GRAY (10YR 6/2), V. FN XLN TRACE AMOUNT OF VUGULAR POROSITY, HARD, SAT, NO ODOR, SLIGHTLY CALCAREOUS, BECOMING DENSE BELOW 170 ft W/ TRACE OF FRACTURES				45	0	GC	170	
	170									170
	172					46	0	GC	172	
		GRADING TO DOLOMITIC SANDSTONE, MEDIUM GRAINED AND SANDY DOLOMITE, GRAYISH BROWN (10YR 5/2), AND LT BROWNISH GRAY (10YR 6/2), MODERATELY CEMENTED, GOOD INTERGRANULAR POROSITY SATURATED, HOLE IS MAKING LARGE VOLUME OF WATER BELOW 172 ft.				47	0	GC	174	
	175					48	0	GC	175	175
		TOTAL DEPTH 175 ft								
	180									180
	185									185

- ONE CONTINUOUS AUGER SAMPLER
- STANDARD PENETRATION TEST
- UNDISTURBED SAMPLE
- WATER TABLE (24 HOURS)
- WATER TABLE (TIME OF BORING)
- LABORATORY TEST LOCATION
- PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON 91027.01

BORING NUMBER BH-83

DATE DRILLED 6-24-91

DRILLING METHOD 7-5/8" AIR HAMMER

DRILLED BY BOYLES BROS.

LOGGED BY CHR

CHECKED BY RJS

DRAWN BY:

PAGE 7 OF 7

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ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3885

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ___ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		92' 8" PVC CONDUCTOR TO 30.21' BGL; GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ___ PPM AIR: ___ PPM
	30	SANDSTONE, LIGHT BROWNISH GRAY (10YR 6/2) AND PALE BROWN (10YR 6/3), SL. MOD [illegible], VFG, [illegible], [illegible] SILICEOUS [illegible], MASSIVE, [illegible]	SANDSTONE			1	2.0	GC	32.0	30
						2	79	GC	34.0	
	35					3	0	GC	36.0	35
						4	0	GC	38.0	
		SANDSTONE AS ABOVE BUT BECOMING V. POORLY CEMENTED TO UNCONSOLIDATED BELOW 40 ft, SILTY				5	0	GC	40.0	
	40					6	115	GC	42.0	40
		SANDSTONE, LIGHT GRAY (7.5YR 7/0) SL. DOLOMITIC, SILICEOUS, VFG, MOD HARD, FRIABLE, DRY	SANDSTONE			7	918	GC	44.0	
	45	SANDSTONE, LIGHT BROWN (7.5YR 6/4) SILICEOUS, VFG, V. POORLY CEM, DRY, SILTY	SANDSTONE			8	0	GC	46.0	45
						9	0	GC	48.0	
		GRADING TO SANDSTONE, LIGHT BROWNISH GRAY (10YR 6/2) VFG, SL DOLOMITIC, HARD, DRY, WELL CEMENTED	SANDSTONE			10	0	GC	50.0	
	50					11	122	GC	52.0	50
						12	13.9	GC	54.0	
	55					13	260	GC	56.0	55
		SANDSTONE, BROWN (7.5YR 5/3), VFG, SILICEOUS, V. POORLY CEM, LOOSE, MOIST, SILTY	SAND STONE			14	0	GC	58.0	
	60					15	0	GC	60.0	60
						16	0	GC	62.0	
						17	0	GC	64.0	
	65					18	0	GC		65

G
G[illegible]
CC
SA

CME CONTINUOUS AUGER SAMPLER	WATER TABLE (TIME OF BORING)
STANDARD PENETRATION TEST	LABORATORY TEST LOCATION
UNDISTURBED SAMPLE	PENETROMETER (TONS/SQ. FT.)
WATER TABLE (24 HOURS)	

JOB NAME/NUMBER MOC - IBGP 91023.01

BORING NUMBER BH-84

DATE DRILLED 6-29-91
DRILLING METHOD 7-7/8" AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY GHK
CHECKED BY BJ[illegible]
DRAWN BY:

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ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
	65.0	GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
		SANDSTONE BROWN (7.5YR 5/2) VFG, SILICEOUS, V. POORLY CEMENTED, LOOSE, MOIST, SILTY, INTERBEDDED W/ MINOR DOLOMITIC SANDSTONE	SANDSTONE			18	0	GC	66.0	65
						19	152	GC	68.0	
	70					20	0	GC	70.0	70
						21	0	GC	72.0	
						22	146	GC	74.0	
	75					23	0	GC	76.0	75
	76.2	DOLOMITE, LIGHT GRAY (5YR 6/1), MICROXLN, CHALKY, HARD, DRY	DOLOMITE			24	0	GC	78.0	
						25	0	GC	80.0	80
	80					26	0	GC	82.0	
	82	SANDSTONE, LIGHT GRAY (7.5YR N7/0), VFG, SL DOLOMITIC, MOD HARD, FRIABLE, DRY	SANDSTONE			27	0	GC	84.0	
	84					28	0	GC	86.0	85
	85	SANDSTONE GREYISH BROWN (10YR 5/2) SOFT, V. POORLY CEMENTED, VFG, MOIST	SANDSTONE			29	0	GC	88.0	
		BELOW 88 FT, SANDSTONE AS ABOVE: INTERBEDDED W/ SANDSTONE (7.5YR N7/0) VFG, V. SL DOLOMITIC, MOD SILICEOUS CEMENT, FRIABLE, THINLY BEDDED				30	0	GC	90.0	90
	90					31	47.4	GC	92.0	
	96					32	0	GC	94.0	
	95	SANDSTONE, DOLOMITIC, GRAY (10YR 6/1), MOD. HARD, VFG, MOD CEMENTED, DRY	SANDSTONE			33	18.3	GC	96.0	95
	97					34	66.1	GC	98.0	
		DOLOMITE, GRAYISH BROWN (10YR 5/2) PREDOMINATELY MICROXLN, TRACE FN XLN SL SANDY DOLOMITE) HARD, DENSE, DRY	DOLOMITE			35	0	GC	100	100
	100									

mod - IBGP

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
\+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER 91029.0)

BORING NUMBER B11-84

DATE DRILLED 6-29-91
DRILLING METHOD 7-7/8" AIR HAMMER
DRILLED BY Parker Bros.
LOGGED BY BNR
CHECKED BY BJS
DRAWN BY:

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3805

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE:	
	100–104	DOLOMITE, GRAYISH BROWN (10YR 5/2) MICRO XLN, SOME FN XLN W/ SANDY TEXTURE, HARD, DENSE, DRY, V SL CALC.	DOLOMITE
	104–112	DOLOMITE, GRAYISH BROWN (10YR 5/2) AND BROWN (10YR [illegible]/3), MICRO XLN, CHERTY, DENSE, HARD, DRY, INTERBEDDED W/ SILTSTONE, MINOR DUSKY YELLOWISH GREEN (5GY 5/2) SOFT, FISSILE	DOLOMITE
	110	BECOMING V. SILTY DOLOMITE BELOW 110 FT.	
	112–118	SANDY DOLOMITE, LIGHT GRAY (10YR 6/1), CSE XLN, DENSE, HARD, DRY, INTERBEDDED W/ SILT, LIGHT GRAY (10YR 7/1), V [illegible] [illegible] [illegible], [illegible] IN [illegible] DRY	DOLOMITE SANDY W/ INTERBED SILT
	118–124	SANDY DOLOMITE, GRAY (7.5YRN6/0) FN XLN, SANDY DULL APPEARANCE, HARD, MASSIVE, DRY	
	124–135	DOLOMITE, LIGHT GRAY (10YR 6/1), MICRO XLN, DENSE, CHERTY, HARD, DRY, V SL SILTY	DOLOMITE

OVM SOIL GAS SURVEY PPM X ___ (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
36	0	GC	102
37	0	GC	104
38	0	GC	106
39	0	GC	108
40	0	GC	110
41	0	GC	112
42	0	GC	114
43	246	GC	116
44	78	GC	118
45	223	GC	120
46	0	GC	122
[illegible]	0	GC	124
[illegible]	0	GC	126
[illegible]	0	GC	128
	0	GC	130
51	0	CC	132
52	0	GC	134
53	0	GC	

REMARKS: BACKGROUND OVM READING: SOIL: ______ PPM AIR: ______ PPM

Depth scale: 100, 105, 110, 115, 120, 125, 130, 135

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MOC-IBGP 11027.01

BORING NUMBER BH-84

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

DATE DRILLED 6-29-91
DRILLING METHOD 7-5/8" AIR HAMMER
DRILLED BY BORUS BROS.
LOGGED BY GAR
CHECKED BY TSJ
DRAWN BY:

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
	135	GROUND SURFACE:								BACKGROUND OVM READING: SOIL ____ PPM AIR: ____ PPM
	136	DOLOMITE, LIGHT GRAY (10YR 6/1), MICRO XLN, DENSE, CHERTY, HARD, DRY, SOME V. SL. SILTY	DOLOMITE			53	0	GC	136	135
	138					54	0	GC	138	
	140	DOLOMITE, AS ABOVE, INTERBEDDED WITH LIMESTONE, GRAYISH BROWN, (10YR 5/2), SOFT, V. POOR CEMENT, DRY	DOLOMITE w/ INTERBEDS LIMESTONE			55	0	GC	140	140
	142					56	0	GC	142	
	144	SANDY DOLOMITE LIGHT BROWNISH GRAY (10YR 6/2), V FN XLN, SL SILTY, [illegible], HARD, DRY	SANDY DOLOMITE			57	0	GC	144	
	145					58	0	GC	146	145
	148					59	0	GC	148	
	150	SANDY DOLOMITE, AS ABOVE, GRADING TO GRAY (7.5YR N6/0), HARD, DRY, [illegible], DENSE				60	0	GC	150	150
	152					61	0	GC	152	
	154					62	0	GC	154	
	155					63	0	GC	156	155
	158					64	0	GC	158	
6-29-91	160					65	0	GC	160	160
6-30-91	162	HOLE HAD APPROXIMATELY 2 FT OF WATER IN THE OPEN BORE HOLE THIS MORNING, NO ODOR	SLIGHTLY DOLOMITIC			66	1.4	GC	162	
	164	REMAINING DRILLING SANDY DOLOMITE AS ABOVE TO 164 FT				67	1.4	GC	164	
	165	[illegible] (10YR 8/1) TO PINKISH WHITE (7.5YR 8/2), [illegible] W/ DOLOMITE, V FN XLN, DENSE, HARD, SLIGHTLY V POOR CEMENTATION, POWDERY IN SAMPLES, LOOSE, DRY [illegible] W/ INCREASING DOLOMITE BELOW 164 FT	SLIGHTLY DOLOMITIC W/ INTERBEDS LIMESTONE			68	2.8	GC	166	165
	168					69	0	GC	168	
	170					70	0	GC	170	170

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

MOC-ZBGP
JOB NAME/NUMBER 91029.01
BORING NUMBER BH-84
DATE DRILLED 6-29-91
DRILLING METHOD 7-5/8" AIR HAMMER
DRILLED BY BOWLES BROS
LOGGED BY GHOR

ROBERTS/SCHORNICK
[illegible] ASSOCIATES, INC

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ___ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
	170	GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ___ PPM AIR: ___ PPM
	172		[illegible] AND [illegible]			71	1.4	GC	172	170
		DOLOMITE, LIGHT BROWNISH GRAY (10YR 6/2), V. FIN XLN TO MICROXLN [illegible], [illegible], [illegible] W/ SOME DOLOMITIC [illegible] [illegible] FRACTURED (10YR 8/2), [illegible], MASSIVE	DOLOMITE AND CHERTY DOLOMITE			72	0	GC	174	
	175					73	0	GC	176	175
						74	0	GC	178	
						75	0	GC	180	
	180					76	0	GC	182	180
						77	0	GC	184	
	185					78	1.4	GC	186	185
						79	0	GC	188	
						80	0	GC	190	
	190					81	0	GC	192	190
	192	DOLOMITE, LIGHT GRAY (5YR 6/1), MICRO XLN, CHERTY, [illegible], [illegible] [illegible], DRY	DOLOMITE			82	0	GC	194	
	195					83	0	GC	196	195
						84	0	GC	198	
		DOLOMITIC LIMESTONE, PINK (7.5YR 8/3) AND PINKISH GRAY (7.5YR 7/2), SOFT, MED HARD, CHALKY, FN XLN, DRY, HYDROCARBON ODOR IN SAMPLE #85.	DOLOMITIC LIMESTONE			85	25	GC	200	
	200					86	21	GC	202	200
	202	LIMESTONE, WHITE (10YR 8/2), SOFT; ARGILLACEOUS, V. CHALKY W/ FAIR HYDROCARBON ODOR IN SAMPLE 88				87	2.8	GC	204	
						88	280	GC		
	205									205

CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MOC-IBGP 91029.01

BORING NUMBER BH-84

DATE DRILLED 6-30-91

DRILLING METHOD 7-5/8" AIR HAMMER

DRILLED BY BOYLES BROS.

LOGGED BY CBHR

ROBERTS/SCHORNICK

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
	205	GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
		LIMESTONE, AS ABOVE, AND V. SANDY LIMESTONE, V. PALE BROWN (10YR 8/3) AND WHITE (10YR 8/2), FAIR HYDROCARBON ODOR, MOD CONSOLIDATED, V. SLIGHTLY MOIST	Limestone Sandy / Sandy Zone			89	280	GC	206	
207 Y WTR TO SURFACE	207					89	245	GC	208	
	210	SANDSTONE, LIGHT BROWNISH GRAY, (10YR 6/2), DOLOMITIC, V. POORLY CEMENTED, MEDIUM GRAINED, SOME FINE GRAINED, POORLY SORTED, ANGULAR V. PERMEABLE, SATURATED, NO HYDRO CARBON ODOR DETECTED				90	29.5	GC	210	210
						91	1.0	GC	212	
	215					92	0	GC	214	215
						93	0	GC	216	
		TOTAL DEPTH 216 ft								
		BOREHOLE IS MAKING LARGE AMOUNT OF WATER								
	220									220
	225									225
	230									230
	235									235
	240									240

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

MOC - IBGP
JOB NAME/NUMBER 91029.01
BORING NUMBER BH-84
DATE DRILLED 6-30-91
DRILLING METHOD 7-5/8" AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY GHR

ROBERTS/SCHORNICK

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 3 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	0	CLAY, SLT, LIGHT BROWN (7.5YR 6/4) 10% CLAY, SOFT, V. FRIABLE, DRY	ML			1	0	GC	2.0	
	3.0	DOLOMITE, LIGHT GRAY (10YR 7/2) V. FN XLN T.I. MICRO XLN, CHERTY, DENSE, DRY	DOLOMITE			2	0	GC	4.0	
	5					3	0	GC	6.0	5
						4	0	GC	8.0	
		SILTSTONE, YELLOWISH GRAY 7/2 LIMONITIC, SILICEOUS CEMENT, SLIGHT BANDED APPEARANCE, MOD HARD, DRY	SILTSTONE			5	0	GC	10.0	
	10					6	2.4	GC	12.0	10
		GRADING TO SANDSTONE, LIGHT GRAY (2.5Y 7/2) TO LIGHT BROWNISH GRAY (2.5Y 6/2), V.FG, SILICEOUS CEMENT, DENSE, DRY	SANDSTONE			7	0	GC	14.0	
	15					8	14.9	GC	16.0	15
		DOLOMITE, LIGHT GRAY (10YR 7/2), MICRO XLN, W/ TRACE OF CSLY XLN DOLOMITE, DENSE, DRY, INTERBEDDED W/ MINOR SILTSTONES AND SANDSTONES AS ABOVE	DOLOMITE W/ INTERBEDD SANDSTONE & SILTSTONE			9	0	GC	18.0	
	20					10	0	GC	20.0	20
		SANDSTONE, PINKISH GRAY (7.5 YR 6/2), V FG, V SLTY MATRIX, SLIGHTLY HARD, FRIABLE, SL. CALC CEMENT, MOD. SILICEOUS, DRY	SANDSTONE SILTY			11	0	GC	22.0	
						12	14.2	GC	24.0	
	25					13	0	GC	26.0	25
						14	0	GC	28.0	
						15	3.9	GC	30.0	
	30	TOTAL DEPTH 30.0 ft								30
		BOREHOLE DRY AT T.D.								
	35									35

- CME CONTINUOUS AUGER SAMPLER
- STANDARD PENETRATION TEST
- UNDISTURBED SAMPLE
- WATER TABLE (24 HOURS)
- WATER TABLE (TIME OF BORING)
- L LABORATORY TEST LOCATION
- \+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MOC - IBGP 91029.01

BORING NUMBER BH-85 E-3900 S-300 (MW

DATE DRILLED 6-28-91

DRILLING METHOD 10-5/8" AIR ROTARY

DRILLED BY BOYLES BROS.

LOGGED BY GMR

CHECKED BY BJS

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BORING RECORD

OLOG. NIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ___ (2 4 6 8 10 12 14 16 18 20)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
										BACKGROUND OVM READING: SOIL ___ PPM AIR ___ PPM
		GROUND SURFACE:								
	30	SANDSTONE: VF G, SILTY, 10YR 5/2 GY BN, MOD. HARD, DRY, WEAKLY CEMENTED	SANDSTONE			16	9	6C	32	30
	34	DOLOMITIC SANDSTONE: VF G SILTY SD, 2.5Y 5/2 GY BN MODERATELY HD, SLIGHT CONS. ODOR, SL MOIST, MINOR INTERBEDS OF 10YR 5/1 GRAY, HARD DOLOMITIC SANDSTONE	DOLO SS			17	44	6C	34	
	35					18	65	6C	36	35
						19	34	6C	38	
						20	98	6C	40	
	40					21	23.2	6C	42	40
						22	27	6C	44	
	45					23	18.4	6C	46	45
	47	SANDSTONE: VF G SILTY SD, WELL SORTED, WEAKLY CEMENTED, SILTY, 2.5Y 4/2 GY BN SL HARD & MOIST	SS			24	7.8	6C	48	
	48		DOLO SS			25	26	6C	50	
	50	DOLOMITIC SANDSTONE: VF G SD, 10YR 5/1 GY WITH MINOR 10YR 3/1 V DK GY VFG SS INTERBEDS MODERATELY HD, MASSIVE COLOR VARIES FROM 10YR 5/1 GY TO 2.5Y 4/2 DK GY BN TO 10YR 3/1 V DK GY WITH DEPTH, MINOR VEG IRON PLATE ARE NOTED				26	20	6C	52	50
						27	37	6C	54	
	55					28	21	6C	56	55
						29	88	6C	58	
	60					30	56	6C	60	60
						31	36	6C	62	
						32	278	6C	64	
	65									65

* NOTE ELEVATED HYDRO READINGS MAY BE DUE TO HYD. FLUID IN AIR STREAM

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON

BORING NUMBER B11 85 S 300 E 370

DATE DRILLED 7/1/91

DRILLING METHOD AIR HAMMER 7 3/8"

DRILLED BY BOYLES BROTHERS

LOGGED BY WCS

CHECKED BY

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
	65	GROUND SURFACE:	DOLO-STONE			33	28	GC	66	65
						34	22	GC	68	
						35	106	GC	70	70
	70					36	106	GC	72	
		AFTER 72 FEET, ABUNDANT IRON OXIDE STAINING				37	75	GC	74	
	74	CHERTY DOLOMITE: 2.5Y 5/2 GY BN, VERY HARD, CONCOIDAL FRACTURES	DOLOMITE			38	173	GC	76	75
	75					39	10	GC	78	
	79					40	16	GC	80	80
	80	DOLOMITIC SANDSTONE: VFG SILICA SD, VERY HARD, 2.5Y 5/2 GY BN, MTX SILTY-CLAYEY DOLOMITE, DK GY BN, MINOR IRON OXIDE STAINING, MINOR CHERTY DOLOMITE INTERBEDS.	DOLO-STONE			41	18	GC	82	
						42	48	GC	84	
	85	SANDSTONE: VFG SILICA, MOD. HARD, CALCAREOUS CEMENT, IRON OXIDE STAINING, SILTY, 2.5Y 6/2 LT BN GY	SS			43	52	GC	86	85
		DOLOMITIC SANDSTONE: VFG SILICA SD, MOD. HD, 2.5Y 4/2 DK GY BN	DOLO-STONE			44	66	GC	88	
	90					45	132	GC	90	90
						46	23	GC	92	
		AFTER 94 FEET ABUNDANT HEMATITE				47	26	GC	94	
	95					48	8	GC	96	95
	96	CHERTY DOLOMITE: HARD, CONCOIDAL FRACTURES, DRY, 10YR 6/2 PALE BN, MINOR IRON OXIDE STAINING	DOLO			49	35	GC	98	
	100					50	19	GC	101	100

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON

BORING NUMBER BH-65

DATE DRILLED 7/1/91 - 7/2/91

DRILLING METHOD AIR ROTARY/WATER CORE

DRILLED BY BOWES

LOGGED BY WEP

CHECKED BY

DRAWN BY:

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BORING RECORD

7/2/91

GROUND SURFACE:

OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 16 18)

REMARKS: BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
AR TO T IN 990	100–110	CHERTY DOLOMITE: 10YR 6/3 PALE BN, VERY HARD, HIGHLY FRACTURED, HORIZONTAL FRACTURES AT 100.2, 100.3, 100.6, 100.8, 101, 101.2, 101.6, 101.8 AN 102 FEET, VERTICAL FRACTURE BETWEEN 100.5 AND 102.3 FEET, IRON OXIDE STAIN, CALCITE AND MINOR MANGANESE OXIDE ALONG FRACTURES. HIGHLY FRACTURED BETWEEN 102.3 AND 104.9 FEET. VERTICAL FRACTURE BETWEEN 104.9 AND 107.3 FEET	DOLO
VERY SIMILAR TO BH-82	110–115	DOLOMITE: 10YR 6/2 LT BN GY, GRADATIONAL CONTACT WITH CHERTY DOLOMITE, SUGARY, VERY HARD, FRACTURES LARGELY REPLACED WITH CALCITE, MINOR CHLORITE, IRON OXIDE, DRY	DOLO
	115–120	DOLOMITIC SANDSTONE: VFG SSU, 10YR 3/1 V DK GY, MODERATELY HARD, DRY, MINOR 10YR 5/2 GY BN DOLOMITE INTERBEDS. AFTER 120 FEET, COLOR CHANGE TO 10YR 4/2 GY BN DOLOMITIC SANDSTONE	DOLO SS
	122–128	DOLOMITE: MICROCRYSTL, 10YR 5/2, GRADATIONAL CONTACT WITH DOLOMITIC SANDSTONE, DRY. MINOR IRON OXIDE STAINING AT 126 FEET	DOLO
	128–130	SANDY DOLOMITE: VFG SD, GRADATIONAL CONTACT WITH DOLOMITE 10YR 5/2 GY BN, HARD, DRY	SDY DOLO
SIMILAR TO THAT SEEN IN BH-80	130–135	DOLOMITIC SANDSTONE: VFG SILTY, VERY HARD, 5Y 6/1 LT GY-GY AFTER 133 FEET, DISCONTINUOUS BANDS OF 10YR 3/1 VERY DARK GRAY COLOR. HORIZONTAL FRACTURES AT 130.2, 130.5, 131.1, 133.1, 134.4, AND 134.9 FEET	DOLO SS

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
S1	9	2.3	101
S2	71		102.3
S3	3.8		104.3
S4	3.2	5.0	106.2
S5	9		107.3
S6	9.2		109.3
S7	2.8	5.0	111.3
S8	30		112.3
S9	30	GC	114
60	70	GC	116
61	161	GC	118
62	365	GC	120
63	64	GC	122
64	71	GC	124
65	61	GC	126
66	76	GC	128
67	53	GC	130
NS	–	5.0	135

REMARKS:
- 102–107: NOTE GREASE FROM CORE SWIVEL LEAKING INTO CORE
- AIR HAMMER 112.3 TO 130
- * NOTE HYDRAUL FLUID IN SAM TO 152 MAY BE RE
- TOO HARD FOR SAMPLE (130–135)
- CORE AFTER 130

CONT. CORE

- CME CONTINUOUS AUGER SAMPLER
- STANDARD PENETRATION TEST
- UNDISTURBED SAMPLE
- WATER TABLE (24 HOURS)
- WATER TABLE (TIME OF BORING)
- LABORATORY TEST LOCATION
- PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER: MARATHON

BORING NUMBER: BH-85

DATE DRILLED: 7/1/91 – 7/2/91 – 7/3/91

DRILLING METHOD: AIR ROTARY/WATER CORE

DRILLED BY: B[illegible]

LOGGED BY: W. [illegible]

CHECKED BY:

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.2, .5, 1.1, 3.1, 4.4, 4.9

1-915-684-3290

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
	135	GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
		DOLOMITE: MICROCRYST. AND SUGARY, GRADATIONAL CONTACT WITH DOLOMITIC SANDSTONE, ABUNDANT FRACTURES LARGELY FILLED WITH CALCITE IRON PYRITE, AND MANGANESE OXIDE, OCCASIONAL VERY THIN INTERBEDS OF DOLOMITIC SANDSTONE,	DOLOMITE			NS	-	4.7	137	TOO HARD TO SAMPLE
	140									140
	141.6	2.5Y 5/2 GY & NAND 5YR 5/2 RED BRN, 10YR 5/1 GY ALONG FRACTURES, FRACTURES @ 135.3, 135.7, 136.1, 136.6 136.9, 137.5, 137.9, 139.2, 140.1, 141, 141.3 AND 141.5 FEET	DOLOMITIC SANDSTONE			NS		33	143.4	
	145	DOLOMITIC SANDSTONE: VF G SD, 2.5Y 5/2, GY BN, MASSIVE, VERY HARD, WELL CEMENTED, HORIZONTAL FRACTURES AT 141.6, 142.3, 143.3, AND 143.8, FRACTURES LARGELY FILLED WITH CALCITE, ABUNDANT VF PYRITE, HIGHLY WEATHERED SILTY SS INTERBED BETWEEN 143.4 AND 143.7 FEET, ABUNDANT IRON OXIDE STAINING AND IRON PYRITE WITHIN INTERBED AFTER 148 FEET 10YR 5/2 GY BN	DOLO. SS			68	3		143.7	
						NS	-		145	145
						69	3.2	GC	148	
	150					70	42	GC	150	150
						71	263	GC	152	
	152	DOLOMITE: MICROCRYST., 10YR 6/2 LT BN GY, VERY HARD, DRY MINOR INTERBEDS OF 10YR 3/1 GRAY VFG SS	DOLOMITE			72	48	GC	154	
	155					73	66	GC	156	155
						74	44	GC	158	
						75	67	GC	160	
	160									160
		MINOR INTERBED OF 2.5Y 7/4 PALE YELLOW SILTY SANDSTONE				76	33	GC	162	
						77	137	GC	164	
	165									
						78	108	GC	166	165
						79	80	GC	168	
	170					80	64	GC	170	170

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON

BORING NUMBER BH-85

DATE DRILLED 7/3/91

DRILLING METHOD AIR HAMMER/WATER CORE

DRILLED BY ROWES

LOGGED BY WEP

CHECKED BY

DRAWN BY:

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BORING RECORD

OLOG. IT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ___ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
										BACKGROUND OVM READING SOIL: ___ PPM AIR: ___ PPM
	170	GROUND SURFACE:	DOLOMITE			81	49	GC	172	170
						82	23	GC	174	
	175					83	127	GC	176	175
						84	10	GC	178	
						85	15	GC	180	
	180	SUGARY WITH MINOR IRON PYRITE AFTER 180 FEET				86	2	GC	182	180
						87	11	GC	184	
	185	AFTER 186 FEET, MINOR IRON OXIDE STAINING				88	6	GC	186	185
						89	2.6	GC	188	
						90	3.5	GC	190	
191	190	DOLOMITIC LIMESTONE: 7.5YR 7/4 PINK, 7.5YR 7/4 PINK-GY, HARD, SATURATION AND STRONG CONDENSATE ODOR AT 191 FEET, AFTER 192 FEET, NO OBVIOUS SATURATION, CHALKY, MICROCRYST.	DOLO. LS			91	66	GC	192	190 SILICA 70 BH-84
191	192		DOLO			92	77	GC	194	
	194	DOLOMITE: 10YR 6/2, LT BN GY, HARD, MICROCRYST., DRY	LIMEST.							
	195	LIMESTONE: 10YR 6/2 LT BN GY, HARD, CHALKY IN CUTTINGS, DRY, STRONG CONDENSATE ODOR				93	519	GC	196	195
						94	277	GC	198	
	200	SATURATION AFTER 700'				95	113	GC	700	200
202		SANDY DOLOMITE: VFG SD, MICRODOL, 10YR 6/2 LT BN GY, SATURATED CONDENSATE ODOR	SDY DOLO			96	342 DUP	GC	702	
	204					97	58	GC	704	
	205	SANDSTONE	SS							205

- CME CONTINUOUS AUGER SAMPLER
- STANDARD PENETRATION TEST
- UNDISTURBED SAMPLE
- WATER TABLE (24 HOURS)
- WATER TABLE (TIME OF BORING)
- L LABORATORY TEST LOCATION
- + PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON

BORING NUMBER BH-85

DATE DRILLED 7-4-91

DRILLING METHOD AIR HAMMER

DRILLED BY BOYLES

LOGGED BY WCP

CHECKED BY

DRAWN BY:

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NORMAN, OKLAHOMA 73072
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BORING RECORD

GEOLOG. INIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM X ____ (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE:								BACKGROUND OVM READING: SOIL: ____ PPM AIR: ____ PPM
	205	SANDSTONE: CARBONATE CEMENT VFG SD, 10 YR 7/3 V PALE BN, CONS, DOR, HARD SATURATED MINOR IRON RX, OG STAINING HIGHLY CEMENTED, AFTER 206 FEET, INTERBEDDED 10 YR 5/1 GRAY SANDSTONE	SS			SS	297	5"	206	205
							144	6"	208	
	210	TD 208 FEET W/L 1 HR AFTER DRILLING 191 FEET 0.9 FEET OF FLOATING PRODUCT								210
	215									215
	220									220
	225									225
	230									230
	235									235

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MARATHON
BORING NUMBER BH 85
DATE DRILLED 7/4/91
DRILLING METHOD AIR HAMMER
DRILLED BY Boyles
LOGGED BY WED
CHECKED BY
DRAWN BY: PAGE OF

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-7895

APPENDIX H

LINE #4 PRODUCED WATER ANALYTICAL RESULTS

RECEIVED 01:51 16-81-60 ... BUSINESS INFORMATION"

SEP 1 2 1991

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CONSERVATION DIV.
SANTA FE

CORE LABORATORIES

ADDITIONAL DATA

LABORATORY TESTS RESULTS
07/09/91

JOB NUMBER: 910906 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.........: 27-98-810 IBGP PIPELINE LEAK
DATE SAMPLED.......: 05/28/91
TIME SAMPLED.......: 16:25
WORK DESCRIPTION...: LINE 4 (WATER/CONDENSATE)

LABORATORY I.D...: 910906-0001
DATE RECEIVED....: 05/30/91
TIME RECEIVED....: 13:46
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	DETECTON LIMITS	UNITS OF MEASURE	TEST METHOD	DATE	TECHNIC
Bicarbonate (Unfilt.)	900	5	mg/L	403 (3)	06/03/91	KJZ
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	06/03/91	KJZ
Chloride (Unfilt.)	12000	1	mg/L	325.3 (1)	05/31/91	PJM
Conductivity (Unfilt.)	32800	1	umhos/cm @25df	120.1 (1)	06/03/91	MW
pH (Unfilt.)	7.43	0.01	pH Units	150.1 (1)	06/03/91	KJZ
Solids, Total Dissolved (TDS)	23900	10	mg/L	160.1 (1)	06/06/91	PJM
Sulfate (Unfilt.)	1960	10	mg/L	375.3 (1)	06/21/91	MW
Aluminum, Total (Al)	0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Antimony, Total (Sb)	<0.1	0.1	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Arsenic, Total (As)	<0.1	0.1	mg/L	206.2 (1)	06/20/91	TLK
Barium, Total (Ba)	0.05	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Beryllium, Total (Be)	<0.005	0.005	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Boron, Total (B)	2.13	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Cadmium, Total (Cd)	<0.005	0.005	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Calcium, Total (Ca)	923	5	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Chromium, Total (Cr)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Cobalt, Total (Co)	<0.03	0.03	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Copper, Total (Cu)	0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Iron, Total (Fe)	0.09	0.03	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Lead, Total (Pb)	<0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Mercury, Total (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	06/20/91	WGL
Magnesium, Total (Mg)	160	0.5	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Manganese, Total (Mn)	0.04	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK

APPROVED BY: David McWhorter

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CORE LABORATORIES

LABORATORY TESTS RESULTS
07/09/91

JOB NUMBER: 910906 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 IBGP PIPELINE LEAK
DATE SAMPLED.....: 05/28/91
TIME SAMPLED.....: 16:25
WORK DESCRIPTION...: LINE 4 (WATER/CONDENSATE)

LABORATORY I.D...: 910906-0001
DATE RECEIVED....: 05/30/91
TIME RECEIVED....: 13:46
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	DETECTON LIMITS	UNITS OF MEASURE	TEST METHOD	DATE	TECHNIC
Molybdenum, Total (Mo)	<0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Nickel, Total (Ni)	<0.04	0.04	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Potassium, Total (K)	97	5	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Selenium, Total (Se)	<0.1	0.1	mg/L	270.2 (1)	06/20/91	WGL
Silver, Total (Ag)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Sodium, Total (Na)	7300	50	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Strontium, Total (Sr)	21.5	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Titanium, Total (Ti)	<0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Vanadium, Total (V)	<0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Zinc, Total (Zn)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK

ADDITIONAL DATA

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LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910906 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 IBGP PIPELINE LEAK
DATE SAMPLED.....: 05/28/91
TIME SAMPLED.....: 16:25
WORK DESCRIPTION...: LINE 4 (WATER/CONDENSATE)

LABORATORY I.D...: 910906-0001
DATE RECEIVED....: 05/30/91
TIME RECEIVED....: 13:46
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	DETECTON LIMITS	UNITS OF MEASURE	TEST METHOD	DATE	TECHNIC
Bicarbonate (Unfilt.)	900	5	mg/L	403 (3)	06/03/91	KJ
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	06/03/91	KJ
Chloride (Unfilt.)	12000	1	mg/L	325.3 (1)	05/31/91	PJ
Conductivity (Unfilt.)	32800	1	umhos/cm @25dF	120.1 (1)	06/03/91	M
pH (Unfilt.)	7.43	0.01	pH Units	150.1 (1)	06/03/91	KJ
Solids, Total Dissolved (TDS)	23900	10	mg/L	160.1 (1)	06/06/91	PJ
Sulfate (Unfilt.)	1960	10	mg/L	375.3 (1)	06/21/91	M
Arsenic, Total (As)	<0.1	0.1	mg/L	206.2 (1)	06/20/91	TL
Calcium, Total (Ca)	923	5	mg/L	200.7/6010 (1,2)	06/11/91	TL
Mercury, Total (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	06/20/91	WG
Magnesium, Total (Mg)	160	0.5	mg/L	200.7/6010 (1,2)	06/11/91	TL
Potassium, Total (K)	97	5	mg/L	200.7/6010 (1,2)	06/11/91	TL
Selenium, Total (Se)	<0.1	0.1	mg/L	270.2 (1)	06/20/91	WG
Sodium, Total (Na)	7300	50	mg/L	200.7/6010 (1,2)	06/11/91	TL

APPROVED BY: Donna McWhorter

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CORE LABORATORIES

ANALYTICAL REPORT
06/21/91

CUSTOMER: Marathon Oil Company

File No..: 910887

CATION/ANION BALANCE

Client Sample I.D..... #1
Remark/Project..... 27-98-810 IBGP Pipeline Leak
Date/Time Sampled..... 05-28-91/1625
Date/Time Received..... 05-30-91/1346
Laboratory Sample I.D..... 910906-1

PARAMETER	RESULT		UNITS
pH	7.43		pH Units
Conductivity at 25 degrees C	32800		umhos/cm
Alkalinity (as CaCO3)	737		mg/L
Total Diss. Solids (measured)	23900		mg/L
Total Diss. Solids (calculated)	22890		mg/L
		meq/Liter	
Calcium (Ca)	923	46.06	mg/L
Magnesium (Mg)	160	13.17	mg/L
Sodium (Na)	7300	317.55	mg/L
Potassium (K)	97	2.48	mg/L
Total Cations meq/Liter		379.26	
		meq/Liter	
Bicarbonate (HCO3)	900	14.75	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	12000	338.52	mg/L
Sulfate (SO4)	1960	40.81	mg/L
Total Anions meq/Liter		394.08	

Cation-Anion Balance (RPD) 3.83 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: David McWhorter

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Results have not yet been received for the ICAP metal constituents. However, they will be forwarded upon receipt.

APPENDIX I

SUMMARY OF MONITORING WELL ANALYTICAL RESULTS

SUMMARY OF MONITORING WELL ANALYTICAL RESULTS

Soil Boring #	Monitor Well #	Date Sampled	Chlorides (mg/L)	TDS (mg/L)
BH-14	MW-1	5/23/91	310	820
BH-33	MW-10	5/23/91	60	1600
BH-34	MW-11	5/22/91	*	*
BH-36	MW-13	5/22/91	*	*
BH-37	MW-14	5/22/91	*	*
BH-39	MW-16	5/22/91	**	**
BH-40	MW-17	---	---	---
BH-41	MW-18	5/23/91	310	1580
BH-42	MW-19	5/22/91	320	1540
BH-44	MW-21	5/23/91	230	1220
BH-49	MW-26	5/21/91	440	1650
BH-55	MW-31	5/22/91	**	**
BH-57	MW-33	5/24/91	**	**
BH-59	MW-35	6/09/91	*	*
BH-60	MW-37	6/09/91	*	*
BH-61	MW-38	5/28/91	60	790
BH-62	MW-39	5/28/91	9.6	---
BH-64	MW-41	6/09/91	*	*
BH-66	MW-43	6/09/91	*	*
BH-67	MW-44	6/09/91	*	*
BH-68	MW-45	6/07/91	451	5440
BH-69	MW-46	6/09/91	*	*
BH-70	MW-47	6/09/91	**	**
BH-72	MW-49	6/09/91	*	*
BH-73	MW-50	6/07/91	376	6070
BH-74	MW-51	6/09/91	*	*
Pit 2		6/09/91	**	**
Pit 4		6/09/91	**	**
Pit 5		6/09/91	**	**
Pit 6		6/09/91	**	**

---No Data Available

*No Sample Obtained due to Pump in Well

**No Fluid Present

SUMMARY OF MONITORING WELL ANALYTICAL RESULTS (CONT'D)

Soil Boring #	Monitor Well #	Date Sampled	Chlorides (mg/L)	TDS (mg/L)
Pit 9		6/09/91	**	**
Pit A9		---	---	---
Pit A10		6/09/91	**	**
Pit 10		5/23/91	3750	8780
Pit A11		---	---	---
Pit 16		---	---	---
Pit 16A		5/22/91	190	876
Pit 16B		---	---	---
Pit 17		---	---	---
Pit 19		---	---	---
Pit 21A		5/23/91	8250	16000

---No Data Available

*No Sample Obtained due to Pump in Well

**No Fluid Present

APPENDIX J

MONITORING WELL LABORATORY ANALYTICAL RESULTS

Western Atlas International
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CORE LABORATORIES

LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910876 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 IBGP PIPELINE LEAK
DATE SAMPLED.....: 05/23/91
TIME SAMPLED.....: 15:05
WORK DESCRIPTION...: MW #1

LABORATORY I.D...: 910876-0002
DATE RECEIVED....: 05/28/91
TIME RECEIVED....: 13:56
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Chloride (Unfilt.)	310	1	mg/L	325.3 (1)	05/30/91	F
Solids, Total Dissolved (TDS)	820	10	mg/L	160.1 (1)	05/29/91	
AROMATIC VOLATILE ORGANICS		*500		8020 (2)	05/28/91	P
Benzene	500	500	ug/L			
Toluene	ND	500	ug/L			
Ethyl Benzene	1000	500	ug/L			
Xylenes	ND	500	ug/L			

APPROVED BY: Daniel McWhorter

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CORE LABORATORIES

LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910876 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 MINERAL ASSAY
DATE SAMPLED.....: 05/23/91
TIME SAMPLED.....: 09:35
WORK DESCRIPTION...: MW #10

LABORATORY I.D...: 910876-0003
DATE RECEIVED....: 05/28/91
TIME RECEIVED....: 13:56
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Chloride (Unfilt.)	60	1	mg/L	325.3 (1)	05/30/91	P
Solids, Total Dissolved (TDS)	1600	10	mg/L	160.1 (1)	05/29/91	
AROMATIC VOLATILE ORGANICS		*500		8020 (2)	05/28/91	M
Benzene	5500	500	ug/L			
Toluene	7000	500	ug/L			
Ethyl Benzene	ND	500	ug/L			
Xylenes	4500	500	ug/L			

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LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910876 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 MINERAL ASSAY
DATE SAMPLED.....: 05/23/91
TIME SAMPLED.....: 16:25
WORK DESCRIPTION...: MW #18

LABORATORY I.D...: 910876-0004
DATE RECEIVED....: 05/28/91
TIME RECEIVED....: 13:56
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TI
Chloride (Unfilt.)	310	1	mg/L	325.3 (1)	05/30/91	
Solids, Total Dissolved (TDS)	1580	10	mg/L	160.1 (1)	05/29/91	

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LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910876 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 MINERAL ASSAY
DATE SAMPLED.....: 05/22/91
TIME SAMPLED.....: 18:00
WORK DESCRIPTION...: MW #19

LABORATORY I.D...: 910876-0005
DATE RECEIVED....: 05/28/91
TIME RECEIVED....: 13:56
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Chloride (Unfilt.)	320	1	mg/L	325.3 (1)	05/30/91	P
Solids, Total Dissolved (TDS)	1540	10	mg/L	160.1 (1)	05/29/91	

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LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910876 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 MINERAL ASSAY
DATE SAMPLED.....: 05/23/91
TIME SAMPLED.....: 16:00
WORK DESCRIPTION...: MW #21

LABORATORY I.D...: 910876-0006
DATE RECEIVED....: 05/28/91
TIME RECEIVED....: 13:56
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Chloride (Unfilt.)	230	1	mg/L	325.3 (1)	05/30/91	P.
Solids, Total Dissolved (TDS)	1220	10	mg/L	160.1 (1)	05/29/91	I
AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/29/91	MI
Benzene	9	1	ug/L			
Toluene	9	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	3	1	ug/L			

APPROVED BY: David McWhorter

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CORE LABORATORIES

LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910876 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 MINERAL ASSAY
DATE SAMPLED.....: 05/21/91
TIME SAMPLED.....: 15:00
WORK DESCRIPTION...: MW #26

LABORATORY I.D...: 910876-0007
DATE RECEIVED....: 05/28/91
TIME RECEIVED....: 13:56
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TI
Chloride (Unfilt.)	440	1	mg/L	325.3 (1)	05/30/91	
Solids, Total Dissolved (TDS)	1650	10	mg/L	160.1 (1)	05/29/91	

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LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910904 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 IBGP PIPELINE LEAK
DATE SAMPLED.....: 05/28/91
TIME SAMPLED.....: 14:45
WORK DESCRIPTION...: MW #38

LABORATORY I.D...: 910904-0001
DATE RECEIVED....: 05/30/91
TIME RECEIVED....: 13:45
REMARKS.....: SEDIMENT IN VOA'S

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Alkalinity, Total (Unfilt.)	738	5	mg/L CaCO3	310.1 (1)	06/03/91	K
Bicarbonate (Unfilt.)	900	5	mg/L	403 (3)	06/03/91	K
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	06/03/91	K
Chloride (Unfilt.)	60	1	mg/L	325.3 (1)	05/31/91	P
Conductivity (Unfilt.)	1270	1	umhos/cm @25dF	120.1 (1)	06/03/91	
Hardness, Total (Unfilt.)	622	1	mg/L(as CaCO3)	314A (3)	06/20/91	T
Nitrogen, Nitrate (Unfilt.)	<0.1	0.1	mg/L (as N)	353.2 (1)	06/21/91	
pH (Unfilt.)	7.60	0.01	pH Units	150.1 (1)	06/03/91	K
Solids, Total Dissolved (TDS)	790	10	mg/L	160.1 (1)	06/06/91	F
Sulfate (Unfilt.)	<10	10	mg/L	375.3 (1)	06/21/91	
Calcium, Total (Ca)	84.2	0.5	mg/L	200.7/6010 (1,2)	06/11/91	T
Iron, Total (Fe)	0.08	0.03	mg/L	200.7/6010 (1,2)	06/11/91	T
Magnesium, Total (Mg)	100	0.5	mg/L	200.7/6010 (1,2)	06/11/91	T
Manganese, Total (Mn)	0.15	0.01	mg/L	200.7/6010 (1,2)	06/11/91	T
Potassium, Total (K)	5.4	0.01	mg/L	258.1 (1)	06/20/91	T
Sodium, Total (Na)	68	1	mg/L	200.7/6010 (1,2)	06/11/91	T
AROMATIC VOLATILE ORGANICS		*250		8020 (2)	05/30/91	M
Benzene	500	250	ug/L			
Toluene	ND	250	ug/L			
Ethyl Benzene	250	250	ug/L			
Xylenes	ND	250	ug/L			

APPROVED BY: David McWhorter

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CORE LABORATORIES

ANALYTICAL REPORT
06/21/91

CUSTOMER: Marathon Oil Company

File No..: 910887

CATION/ANION BALANCE

Client Sample I.D..... #1
Remark/Project..... 27-98-810 Mineral Assay
Date/Time Sampled..... 05-28-91/1445
Date/Time Received..... 05-30-91/1345
Laboratory Sample I.D..... 910904-1

PARAMETER	RESULT		UNITS
pH	7.60		pH Units
Conductivity at 25 degrees C	1270		umhos/cm
Alkalinity (as CaCO3)	738		mg/L
Total Diss. Solids (measured)	790		mg/L
Total Diss. Solids (calculated)	768		mg/L
		meg/Liter	
Calcium (Ca)	84.2	4.20	mg/L
Magnesium (Mg)	100	8.23	mg/L
Sodium (Na)	68	2.96	mg/L
Potassium (K)	5.4	0.14	mg/L
Total Cations meq/Liter		15.53	
		meg/Liter	
Bicarbonate (HCO3)	900	14.75	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	60	1.69	mg/L
Sulfate (SO4)	ND(10)	0.00	mg/L
Total Anions meq/Liter		16.44	

Cation-Anion Balance (RPD) 5.74 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: David M. Chenter

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LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910904 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 IBGP PIPELINE LEAK
DATE SAMPLED.....: 05/28/91
TIME SAMPLED.....: 15:48
WORK DESCRIPTION...: MW #39

LABORATORY I.D...: 910904-0002
DATE RECEIVED....: 05/30/91
TIME RECEIVED....: 13:45
REMARKS.....: SEDIMENT IN VOA'S

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Chloride (Unfilt.)	9.6	0.5	mg/L	325.2 (1)	05/31/91	P
AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/30/91	M
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	11	1	ug/L			
Xylenes	38	1	ug/L			

APPROVED BY: David McWhorter

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06/21/91

JOB NUMBER: 911023 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 IBGP PIPELINE LEAK
DATE SAMPLED.....: 06/07/91
TIME SAMPLED.....: 09:02
WORK DESCRIPTION...: MW #45

LABORATORY I.D...: 911023-0002
DATE RECEIVED....: 06/13/91
TIME RECEIVED....: 16:06
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TI
Chloride (Unfilt.)	451	1	mg/L	325.2 (1)	06/17/91	
Solids, Total Dissolved (TDS)	5440	10	mg/L	160.1 (1)	06/17/91	
AROMATIC VOLATILE ORGANICS		*1		8020 (2)	06/20/91	
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 911023 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 IBGP PIPELINE LEAK
DATE SAMPLED.....: 06/07/91
TIME SAMPLED.....: 10:20
WORK DESCRIPTION...: MW #50

LABORATORY I.D...: 911023-0001
DATE RECEIVED....: 06/13/91
TIME RECEIVED....: 16:06
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TI
Chloride (Unfilt.)	376	1	mg/L	325.2 (1)	06/17/91	
Solids, Total Dissolved (TDS)	6070	10	mg/L	160.1 (1)	06/17/91	I
AROMATIC VOLATILE ORGANICS		*1		8020 (2)	06/20/91	I
Benzene	9	1	ug/L			
Toluene	6	1	ug/L			
Ethyl Benzene	1	1	ug/L			
Xylenes	2	1	ug/L			

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06/21/91

JOB NUMBER: 910876 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 MINERAL ASSAY
DATE SAMPLED.....: 05/23/91
TIME SAMPLED.....: 17:50
WORK DESCRIPTION...: PIT WELL #10

LABORATORY I.D...: 910876-0008
DATE RECEIVED....: 05/28/91
TIME RECEIVED....: 13:56
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Chloride (Unfilt.)	3750	1	mg/L	325.3 (1)	05/30/91	F
Solids, Total Dissolved (TDS)	8780	10	mg/L	160.1 (1)	05/29/91	

APPROVED BY: Donald McWhorter

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LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910876 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 MINERAL ASSAY
DATE SAMPLED.....: 05/22/91
TIME SAMPLED.....: 15:38
WORK DESCRIPTION...: PIT WELL #16A

LABORATORY I.D...: 910876-0009
DATE RECEIVED....: 05/28/91
TIME RECEIVED....: 13:56
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Chloride (Unfilt.)	190	1	mg/L	325.3 (1)	05/30/91	P
Solids, Total Dissolved (TDS)	876	10	mg/L	160.1 (1)	05/29/91	

APPROVED BY: Daniel McWhorter

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LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910876 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 MINERAL ASSAY
DATE SAMPLED.....: 05/23/91
TIME SAMPLED.....: 17:30
WORK DESCRIPTION...: PIT WELL #21A

LABORATORY I.D...: 910876-0010
DATE RECEIVED....: 05/28/91
TIME RECEIVED....: 13:56
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Chloride (Unfilt.)	8250	1	mg/L	325.3 (1)	05/30/91	P
Solids, Total Dissolved (TDS)	16000	10	mg/L	160.1 (1)	05/29/91	

APPROVED BY: Daniel McWhorter

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APPENDIX K

WATER WELL ANALYTICAL DATA

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CORE LABORATORIES

LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910852 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27 98 810 MINERAL ASSAY
DATE SAMPLED.....: 05/20/91
TIME SAMPLED.....: 17:45
WORK DESCRIPTION...: 1

LABORATORY I.D...: 910852-0001
DATE RECEIVED....: 05/22/91
TIME RECEIVED....: 16:30
REMARKS.....: SAMPLE TIME DIFFERS FROM CC

LYMAN WATER WELL

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Alkalinity, Total (Unfilt.)	238	5	mg/L CaCO3	310.1 (1)	05/28/91	K
Bicarbonate (Unfilt.)	290	5	mg/L	403 (3)	05/28/91	K
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	05/28/91	K
Chloride (Unfilt.)	13.2	0.5	mg/L	325.2 (1)	05/24/91	D
Conductivity (Unfilt.)	1300	1	umhos/cm @25dF	120.1 (1)	05/24/91	
Hardness, Total (Unfilt.)	816	1	mg/L(as CaCO3)	314A (3)	06/20/91	-
Nitrogen, Nitrate (Unfilt.)	0.8	0.1	mg/L (as N)	353.2 (1)	06/11/91	D
pH (Unfilt.)	7.50	0.01	pH Units	150.1 (1)	05/28/91	H
Solids, Total Dissolved (TDS)	1060	10	mg/L	160.1 (1)	05/28/91	F
Sulfate (Unfilt.)	629	10	mg/L	375.2 (1)	06/12/91	D
Calcium, Total (Ca)	213	0.5	mg/L	200.7/6010 (1,2)	06/11/91	-
Iron, Total (Fe)	<0.03	0.03	mg/L	200.7/6010 (1,2)	06/11/91	-
Magnesium, Total (Mg)	69.1	0.5	mg/L	200.7/6010 (1,2)	06/11/91	-
Manganese, Total (Mn)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	-
Potassium, Total (K)	1.65	0.01	mg/L	258.1 (1)	06/20/91	T
Sodium, Total (Na)	16	1	mg/L	200.7/6010 (1,2)	06/11/91	T
AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/23/91	M
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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CORE LABORATORIES

ANALYTICAL REPORT
06/21/91

CUSTOMER: Marathon Oil Company

File No..: 9108852

CATION/ANION BALANCE

Client Sample I.D..... #1
Remark/Project..... 27-98-810 Mineral Assay
Date/Time Sampled..... 05-20-91/1745
Date/Time Received..... 05-22-91/1630
Laboratory Sample I.D..... 910852-1

LYMAN WATER WELL

PARAMETER	RESULT		UNITS
pH	7.50		pH Units
Conductivity at 25 degrees C	1300		umhos/cm
Alkalinity (as CaCO3)	238		mg/L
Total Diss. Solids (measured)	1060		mg/L
Total Diss. Solids (calculated)	1083		mg/L
		meq/Liter	
Calcium (Ca)	213	10.63	mg/L
Magnesium (Mg)	69.1	5.69	mg/L
Sodium (Na)	16	0.70	mg/L
Potassium (K)	1.65	0.04	mg/L
Total Cations meq/Liter		17.05	
		meq/Liter	
Bicarbonate (HCO3)	283	4.64	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	13.2	0.37	mg/L
Sulfate (SO4)	629	13.10	mg/L
Total Anions meq/Liter		18.11	

Cation-Anion Balance (RPD) 5.99 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

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CORE LABORATORIES

LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910852 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27 98 810 MINERAL ASSAY
DATE SAMPLED.....: 05/20/91
TIME SAMPLED.....: 14:42
WORK DESCRIPTION...: 4

LABORATORY I.D...: 910852-0004
DATE RECEIVED....: 05/22/91
TIME RECEIVED....: 16:30
REMARKS.....:

BIEBELLE WATER WELL

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TEC
Alkalinity, Total (Unfilt.)	259	5	mg/L CaCO3	310.1 (1)	05/28/91	K.
Bicarbonate (Unfilt.)	316	5	mg/L	403 (3)	05/28/91	K.
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	05/28/91	K.
Chloride (Unfilt.)	11.4	0.5	mg/L	325.2 (1)	05/24/91	D/
Conductivity (Unfilt.)	1220	1	umhos/cm @25dF	120.1 (1)	05/24/91	I
Hardness, Total (Unfilt.)	770	1	mg/L(as CaCO3)	314A (3)	06/20/91	T
Nitrogen, Nitrate (Unfilt.)	0.2	0.1	mg/L (as N)	353.2 (1)	06/11/91	D
pH (Unfilt.)	7.47	0.01	pH Units	150.1 (1)	05/28/91	K.
Solids, Total Dissolved (TDS)	951	10	mg/L	160.1 (1)	05/28/91	P.
Sulfate (Unfilt.)	535	10	mg/L	375.2 (1)	06/12/91	D
Calcium, Total (Ca)	195	0.5	mg/L	200.7/6010 (1,2)	06/11/91	T
Iron, Total (Fe)	0.05	0.03	mg/L	200.7/6010 (1,2)	06/11/91	T
Magnesium, Total (Mg)	68.7	0.5	mg/L	200.7/6010 (1,2)	06/11/91	T
Manganese, Total (Mn)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	T
Potassium, Total (K)	1.59	0.01	mg/L	258.1 (1)	06/20/91	T
Sodium, Total (Na)	14	1	mg/L	200.7/6010 (1,2)	06/11/91	T
AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/23/91	M
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

APPROVED BY: David McWhorter

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CORE LABORATORIES

ANALYTICAL REPORT
06/21/91

CUSTOMER: Marathon Oil Company

File No..: 9108852

CATION/ANION BALANCE

Client Sample I.D..... #2
Remark/Project..... 27-98-810 Mineral Assay
Date/Time Sampled..... 05-20-91/1442
Date/Time Received..... 05-22-91/1630
Laboratory Sample I.D..... 910852-4
LYMAN WATER WELL

PARAMETER	RESULT		UNITS
pH	7.47		pH Units
Conductivity at 25 degrees C	1220		umhos/cm
Alkalinity (as CaCO3)	259		mg/L
Total Diss. Solids (measured)	951		mg/L
Total Diss. Solids (calculated)	984		mg/L
		meq/Liter	
Calcium (Ca)	195	9.73	mg/L
Magnesium (Mg)	68.7	5.65	mg/L
Sodium (Na)	14	0.61	mg/L
Potassium (K)	1.59	0.04	mg/L
Total Cations meq/Liter		16.03	
		meq/Liter	
Bicarbonate (HCO3)	316	5.18	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	11.4	0.32	mg/L
Sulfate (SO4)	535	11.14	mg/L
Total Anions meq/Liter		16.64	

Cation-Anion Balance (RPD) 3.71 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: David McWhorter

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CORE LABORATORIES

LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910852 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27 98 810 MINERAL ASSAY
DATE SAMPLED.....: 05/20/91
TIME SAMPLED.....: 18:50
WORK DESCRIPTION...: 9

LABORATORY I.D...: 910852-0009
DATE RECEIVED....: 05/22/91
TIME RECEIVED....: 16:30
REMARKS.....:

LEE WATER WELL

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Alkalinity, Total (Unfilt.)	239	5	mg/L CaCO3	310.1 (1)	05/28/91	K
Bicarbonate (Unfilt.)	292	5	mg/L	403 (3)	05/28/91	K
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	05/28/91	K
Chloride (Unfilt.)	7.9	0.5	mg/L	325.2 (1)	05/24/91	D
Conductivity (Unfilt.)	655	1	umhos/cm @25dF	120.1 (1)	05/24/91	
Hardness, Total (Unfilt.)	348	1	mg/L(as CaCO3)	314A (3)	06/20/91	T
Nitrogen, Nitrate (Unfilt.)	4.8	0.1	mg/L (as N)	353.2 (1)	06/11/91	D
pH (Unfilt.)	7.71	0.01	pH Units	150.1 (1)	05/28/91	K
Solids, Total Dissolved (TDS)	403	10	mg/L	160.1 (1)	05/28/91	P
Sulfate (Unfilt.)	115	10	mg/L	375.2 (1)	06/12/91	D
Calcium, Total (Ca)	85.7	0.5	mg/L	200.7/6010 (1,2)	06/11/91	T
Iron, Total (Fe)	<0.03	0.03	mg/L	200.7/6010 (1,2)	06/11/91	T
Magnesium, Total (Mg)	32.6	0.1	mg/L	200.7/6010 (1,2)	06/11/91	T
Manganese, Total (Mn)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	T
Potassium, Total (K)	1.51	0.01	mg/L	258.1 (1)	06/20/91	T
Sodium, Total (Na)	11	1	mg/L	200.7/6010 (1,2)	06/11/91	T
AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/23/91	M
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

APPROVED BY: David McWhorter

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CORE LABORATORIES

ANALYTICAL REPORT
06/21/91

CUSTOMER: Marathon Oil Company

File No..: 9108852

CATION/ANION BALANCE

Client Sample I.D..... #3
Remark/Project..... 27-98-810 Mineral Assay
Date/Time Sampled..... 05-20-91/1850
Date/Time Received..... 05-22-91/1630
Laboratory Sample I.D..... 910852-9

PARAMETER	RESULT		UNITS
pH	7.71		pH Units
Conductivity at 25 degrees C	655		umhos/cm
Alkalinity (as CaCO3)	239		mg/L
Total Diss. Solids (measured)	403		mg/L
Total Diss. Solids (calculated)	400		mg/L
		meq/Liter	
Calcium (Ca)	85.7	4.28	mg/L
Magnesium (Mg)	32.6	2.68	mg/L
Sodium (Na)	11	0.48	mg/L
Potassium (K)	1.51	0.04	mg/L
Total Cations meq/Liter		7.48	
		meq/Liter	
Bicarbonate (HCO3)	292	4.79	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	7.9	0.22	mg/L
Sulfate (SO4)	115	2.39	mg/L
Total Anions meq/Liter		7.40	

Cation-Anion Balance (RPD) 0.98 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: David McWhorter

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CORE LABORATORIES

LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910887 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 MINERAL ASSAY
DATE SAMPLED.....: 05/27/91
TIME SAMPLED.....: 11:10
WORK DESCRIPTION...: #7

LABORATORY I.D...: 910887-0007
DATE RECEIVED....: 05/29/91
TIME RECEIVED....: 15:22
REMARKS.....:

IBGP WATER SUPPLY WELL #1

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Alkalinity, Total (Unfilt.)	260	5	mg/L CaCO3	310.1 (1)	06/03/91	K
Bicarbonate (Unfilt.)	318	5	mg/L	403 (3)	06/03/91	K
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	06/03/91	K
Chloride (Unfilt.)	17.0	0.5	mg/L	325.2 (1)	05/30/91	K
Conductivity (Unfilt.)	786	1	umhos/cm @25dF	120.1 (1)	05/30/91	
Hardness, Total (Unfilt.)	432	1	mg/L(as CaCO3)	314A (3)	06/20/91	
Nitrogen, Nitrate (Unfilt.)	2.7	0.1	mg/L (as N)	353.2 (1)	06/13/91	K
pH (Unfilt.)	7.41	0.01	pH Units	150.1 (1)	06/03/91	K
Solids, Total Dissolved (TDS)	580	10	mg/L	160.1 (1)	06/17/91	K
Sulfate (Unfilt.)	162	10	mg/L	375.3 (1)	06/19/91	K
Calcium, Total (Ca)	108	0.5	mg/L	200.7/6010 (1,2)	06/11/91	
Iron, Total (Fe)	0.05	0.03	mg/L	200.7/6010 (1,2)	06/11/91	
Magnesium, Total (Mg)	39.4	0.1	mg/L	200.7/6010 (1,2)	06/11/91	
Manganese, Total (Mn)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	
Potassium, Total (K)	1.50	0.01	mg/L	258.1 (1)	06/20/91	T
Sodium, Total (Na)	11	1	mg/L	200.7/6010 (1,2)	06/11/91	T
AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/29/91	K
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

APPROVED BY: Daniel McWhorter

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CORE LABORATORIES

ANALYTICAL REPORT
06/21/91

CUSTOMER: Marathon Oil Company

File No..: 910887

CATION/ANION BALANCE

Client Sample I.D..... #7
Remark/Project..... 27-98-810 Mineral Assay
Date/Time Sampled..... 05-27-91/1110
Date/Time Received..... 05-29-91/1522
Laboratory Sample I.D..... 910887-7

IBGP WATER SUPPLY WELL #1

PARAMETER	RESULT	meq/Liter	UNITS
pH	7.41		pH Units
Conductivity at 25 degrees C	786		umhos/cm
Alkalinity (as CaCO3)	260		mg/L
Total Diss. Solids (measured)	580		mg/L
Total Diss. Solids (calculated)	498		mg/L
Calcium (Ca)	108	5.39	mg/L
Magnesium (Mg)	39.4	3.24	mg/L
Sodium (Na)	11	0.48	mg/L
Potassium (K)	1.50	0.04	mg/L
Total Cations meq/Liter		9.15	
Bicarbonate (HCO3)	318	5.21	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	17.0	0.48	mg/L
Sulfate (SO4)	162	3.37	mg/L
Total Anions meq/Liter		9.06	

Cation-Anion Balance (RPD) 0.92 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: David McWhorter

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"CONFIDENTIAL BUSINESS INFORMATION"

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Western Atlas International
A Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
06/28/91

JOB NUMBER: 910948 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32.03.144 IBGP PIPELINE LEAK
DATE SAMPLED.....: 06/03/91
TIME SAMPLED.....: 09:45
WORK DESCRIPTION...: #8

LABORATORY I.D...: 910948-0010
DATE RECEIVED....: 06/05/91
TIME RECEIVED....: 16:11
REMARKS.....:

IBGP Well #1A

TEST DESCRIPTION	FINAL RESULT	LIMITS/DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Alkalinity, Total (Unfilt.)	260	5	mg/L CaCO3	310.1 (1)	06/13/91	MRC
Bicarbonate (Unfilt.)	320	5	mg/L	403 (3)	06/13/91	MRC
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	06/13/91	MRC
Chloride (Unfilt.)	25	1	mg/L	325.2 (1)	06/06/91	DTJ
Conductivity (Unfilt.)	866	1	umhos/cm @25dF	120.1 (1)	06/06/91	MW
Hardness, Total (Unfilt.)	508	1	mg/L(as CaCO3)	314A (3)	06/28/91	TLK
Nitrogen, Nitrate (Unfilt.)	2.1	0.1	mg/L (as N)	353.2 (1)	06/19/91	PJM
Unfilt.)	7.36	0.01	pH Units	150.1 (1)	06/13/91	MRC
Solids, Total Dissolved (TDS)	650	10	mg/L	160.1 (1)	06/12/91	MW
Sulfate (Unfilt.)	202	10	mg/L	375.3 (1)	06/26/91	MW
Calcium, Total (Ca)	126	0.5	mg/L	200.7/6010 (1,2)	06/24/91	TLK
Iron, Total (Fe)	0.24	0.03	mg/L	200.7/6010 (1,2)	06/24/91	TLK
Magnesium, Total (Mg)	47.0	0.1	mg/L	200.7/6010 (1,2)	06/24/91	TLK
Manganese, Total (Mn)	0.01	0.01	mg/L	200.7/6010 (1,2)	06/24/91	TLK
Potassium, Total (K)	1.73	0.01	mg/L	258.1 (1)	06/28/91	TLK
Sodium, Total (Na)	14	1	mg/L	200.7/6010 (1,2)	06/24/91	TLK
AROMATIC VOLATILE ORGANICS		*1		8020 (2)	06/06/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

APPROVED BY: Doug McWhorter

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CORE LABORATORIES

ANALYTICAL REPORT
06/28/91

CUSTOMER: Marathon Oil Company File No.: 910948

CATION/ANION BALANCE

Client Sample I.D..... #8
Remark/Project..... 32.03.144
Date/Time Sampled..... 06-03-91/0945
Date/Time Received..... 06-05-91/1611
Laboratory Sample I.D..... 910948-10

PARAMETER	RESULT		UNITS
pH	7.36		pH Units
Conductivity at 25 degrees C	866		umhos/cm
Alkalinity (as CaCO3)	260		mg/L
Total Diss. Solids (measured)	650		mg/L
Total Diss. Solids (calculated)	576		mg/L
		meq/Liter	
Calcium (Ca)	126	6.29	mg/L
Magnesium (Mg)	47	3.87	mg/L
Sodium (Na)	14	0.61	mg/L
Potassium (K)	1.73	0.04	mg/L
Total Cations meq/Liter		10.81	
		meq/Liter	
Bicarbonate (HCO3)	320	5.24	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	25	0.71	mg/L
Sulfate (SO4)	202	4.21	mg/L
Total Anions meq/Liter		10.16	

Cation-Anion Balance (RPD) 6.23 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

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APPENDIX L

ARROYO SPRING WATER ANALYTICAL DATA

Western Atlas International
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CORE LABORATORIES

LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910887 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 MINERAL ASSAY
DATE SAMPLED.....: 05/27/91
TIME SAMPLED.....: 15:20
WORK DESCRIPTION...: #6

LABORATORY I.D...: 910887-0006
DATE RECEIVED....: 05/29/91
TIME RECEIVED....: 15:22
REMARKS.....:

UPPER INDIAN HILLS SPRING-EAST

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TI
Alkalinity, Total (Unfilt.)	251	5	mg/L CaCO3	310.1 (1)	06/03/91	
Bicarbonate (Unfilt.)	306	5	mg/L	403 (3)	06/03/91	
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	06/03/91	
Chloride (Unfilt.)	11.1	0.5	mg/L	325.2 (1)	05/30/91	
Conductivity (Unfilt.)	1190	1	umhos/cm @25dF	120.1 (1)	05/30/91	
Hardness, Total (Unfilt.)	745	1	mg/L(as CaCO3)	314A (3)	06/20/91	
Nitrogen, Nitrate (Unfilt.)	<0.1	0.1	mg/L (as N)	353.2 (1)	06/13/91	
pH (Unfilt.)	7.52	0.01	pH Units	150.1 (1)	06/03/91	
Solids, Total Dissolved (TDS)	991	10	mg/L	160.1 (1)	06/17/91	
Sulfate (Unfilt.)	463	10	mg/L	375.3 (1)	06/19/91	
Calcium, Total (Ca)	190	0.5	mg/L	200.7/6010 (1,2)	06/11/91	
Iron, Total (Fe)	0.07	0.03	mg/L	200.7/6010 (1,2)	06/11/91	
Magnesium, Total (Mg)	65.7	0.5	mg/L	200.7/6010 (1,2)	06/11/91	
Manganese, Total (Mn)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	
Potassium, Total (K)	1.70	0.01	mg/L	258.1 (1)	06/20/91	
Sodium, Total (Na)	13	1	mg/L	200.7/6010 (1,2)	06/11/91	
AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/29/91	
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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CORE LABORATORIES

ANALYTICAL REPORT
06/21/91

CUSTOMER: Marathon Oil Company — File No..: 910887

CATION/ANION BALANCE

Client Sample I.D..... #6
Remark/Project..... 27-98-810 Mineral Assay
Date/Time Sampled..... 05-27-91/1520
Date/Time Received..... 05-29-91/1522
Laboratory Sample I.D..... 910887-6

UPPER INDIAN HILLS SPRING - EAST

PARAMETER	RESULT		UNITS
pH	7.52		pH Units
Conductivity at 25 degrees C	1190		umhos/cm
Alkalinity (as CaCO3)	251		mg/L
Total Diss. Solids (measured)	991		mg/L
Total Diss. Solids (calculated)	898		mg/L
		meq/Liter	
Calcium (Ca)	190	9.48	mg/L
Magnesium (Mg)	65.7	5.41	mg/L
Sodium (Na)	13	0.57	mg/L
Potassium (K)	1.70	0.04	mg/L
Total Cations meq/Liter		15.50	
		meq/Liter	
Bicarbonate (HCO3)	306	5.02	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	11.1	0.31	mg/L
Sulfate (SO4)	463	9.64	mg/L
Total Anions meq/Liter		14.97	
Cation-Anion Balance (RPD)	3.47 Percent		

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

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CORE LABORATORIES

LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910887 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 MINERAL ASSAY
DATE SAMPLED.....: 05/27/91
TIME SAMPLED.....: 15:10
WORK DESCRIPTION...: #2

LABORATORY I.D...: 910887-0002
DATE RECEIVED....: 05/29/91
TIME RECEIVED....: 15:22
REMARKS.....:

UPPER INDIAN HILLS SPRING - WEST

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Alkalinity, Total (Unfilt.)	249	5	mg/L CaCO3	310.1 (1)	06/03/91	K
Bicarbonate (Unfilt.)	304	5	mg/L	403 (3)	06/03/91	K
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	06/03/91	K
Chloride (Unfilt.)	11.7	0.5	mg/L	325.2 (1)	05/30/91	K
Conductivity (Unfilt.)	1190	1	umhos/cm @25dF	120.1 (1)	05/30/91	
Hardness, Total (Unfilt.)	747	1	mg/L(as CaCO3)	314A (3)	06/20/91	T
Nitrogen, Nitrate (Unfilt.)	0.2	0.1	mg/L (as N)	353.2 (1)	06/13/91	F
pH (Unfilt.)	7.55	0.01	pH Units	150.1 (1)	06/03/91	H
Solids, Total Dissolved (TDS)	993	10	mg/L	160.1 (1)	06/06/91	F
Sulfate (Unfilt.)	480	10	mg/L	375.3 (1)	06/19/91	F
Calcium, Total (Ca)	190	0.5	mg/L	200.7/6010 (1,2)	06/11/91	T
Iron, Total (Fe)	0.04	0.03	mg/L	200.7/6010 (1,2)	06/11/91	T
Magnesium, Total (Mg)	66.2	0.5	mg/L	200.7/6010 (1,2)	06/11/91	T
Manganese, Total (Mn)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	T
Potassium, Total (K)	1.74	0.01	mg/L	258.1 (1)	06/20/91	T
Sodium, Total (Na)	13	1	mg/L	200.7/6010 (1,2)	06/11/91	T
AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/29/91	H
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

APPROVED BY: David McWhorter

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CORE LABORATORIES

ANALYTICAL REPORT
06/21/91

CUSTOMER: Marathon Oil Company

File No..: 910887

CATION/ANION BALANCE

Client Sample I.D..... #2
Remark/Project..... 27-98-810 Mineral Assay
Date/Time Sampled..... 05-27-91/1510
Date/Time Received..... 05-29-91/1522
Laboratory Sample I.D..... 910887-2

UPPER INDIAN HILLS SPRING- WEST

PARAMETER	RESULT		UNITS
pH	7.55		pH Units
Conductivity at 25 degrees C	1190		umhos/cm
Alkalinity (as CaCO3)	249		mg/L
Total Diss. Solids (measured)	993		mg/L
Total Diss. Solids (calculated)	915		mg/L
		meq/Liter	
Calcium (Ca)	190	9.48	mg/L
Magnesium (Mg)	66.2	5.45	mg/L
Sodium (Na)	13	0.57	mg/L
Potassium (K)	1.74	0.04	mg/L
Total Cations meq/Liter		15.54	
		meq/Liter	
Bicarbonate (HCO3)	304	4.98	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	11.7	0.33	mg/L
Sulfate (SO4)	480	9.99	mg/L
Total Anions meq/Liter		15.31	
Cation-Anion Balance (RPD)	1.51 Percent		

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: Daniel McWhorter

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CORE LABORATORIES

LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910887 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 MINERAL ASSAY
DATE SAMPLED.....: 05/27/91
TIME SAMPLED.....: 14:30
WORK DESCRIPTION...: #3

LABORATORY I.D...: 910887-0003
DATE RECEIVED....: 05/29/91
TIME RECEIVED....: 15:22
REMARKS.....:

LOWER INDIAN HILLS SPRING

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Alkalinity, Total (Unfilt.)	260	5	mg/L CaCO3	310.1 (1)	06/03/91	K
Bicarbonate (Unfilt.)	318	5	mg/L	403 (3)	06/03/91	K
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	06/03/91	K
Chloride (Unfilt.)	11.2	0.5	mg/L	325.2 (1)	05/30/91	K
Conductivity (Unfilt.)	1190	1	umhos/cm @25dF	120.1 (1)	05/30/91	
Hardness, Total (Unfilt.)	771	1	mg/L(as CaCO3)	314A (3)	06/20/91	T
Nitrogen, Nitrate (Unfilt.)	0.2	0.1	mg/L (as N)	353.2 (1)	06/13/91	P
pH (Unfilt.)	7.57	0.01	pH Units	150.1 (1)	06/03/91	K
Solids, Total Dissolved (TDS)	1010	10	mg/L	160.1 (1)	06/06/91	P
Sulfate (Unfilt.)	467	10	mg/L	375.3 (1)	06/19/91	R
Calcium, Total (Ca)	196	0.5	mg/L	200.7/6010 (1,2)	06/11/91	T
Iron, Total (Fe)	<0.03	0.03	mg/L	200.7/6010 (1,2)	06/11/91	T
Magnesium, Total (Mg)	68.4	0.5	mg/L	200.7/6010 (1,2)	06/11/91	T
Manganese, Total (Mn)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	T
Potassium, Total (K)	1.44	0.01	mg/L	258.1 (1)	06/20/91	T
Sodium, Total (Na)	13	1	mg/L	200.7/6010 (1,2)	06/11/91	T
AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/29/91	M
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

APPROVED BY: Daniel McWhorter

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CORE LABORATORIES

ANALYTICAL REPORT
06/21/91

CUSTOMER: Marathon Oil Company

File No..: 910887

CATION/ANION BALANCE

Client Sample I.D..... #3
Remark/Project..... 27-98-810 Mineral Assay
Date/Time Sampled..... 05-27-91/1430
Date/Time Received..... 05-29-91/1522
Laboratory Sample I.D..... 910887-3
LOWER INDIAN HILLS SPRING

PARAMETER	RESULT		UNITS
pH	7.57		pH Units
Conductivity at 25 degrees C	1190		umhos/cm
Alkalinity (as CaCO3)	260		mg/L
Total Diss. Solids (measured)	1010		mg/L
Total Diss. Solids (calculated)	916		mg/L
		meq/Liter	
Calcium (Ca)	196	9.78	mg/L
Magnesium (Mg)	68.4	5.63	mg/L
Sodium (Na)	13	0.57	mg/L
Potassium (K)	1.44	0.04	mg/L
Total Cations meq/Liter		16.01	
		meq/Liter	
Bicarbonate (HCO3)	318	5.21	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	11.2	0.32	mg/L
Sulfate (SO4)	467	9.72	mg/L
Total Anions meq/Liter		15.25	

Cation-Anion Balance (RPD) 4.87 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: David McWhorter

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CORE LABORATORIES

LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910887 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 MINERAL ASSAY
DATE SAMPLED.....: 05/27/91
TIME SAMPLED.....: 14:00
WORK DESCRIPTION...: #5

LABORATORY I.D...: 910887-0005
DATE RECEIVED....: 05/29/91
TIME RECEIVED....: 15:22
REMARKS.....:

ARROYO SPRING WATER

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TE
Alkalinity, Total (Unfilt.)	264	5	mg/L CaCO3	310.1 (1)	06/03/91	K
Bicarbonate (Unfilt.)	322	5	mg/L	403 (3)	06/03/91	K
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	06/03/91	K
Chloride (Unfilt.)	11.1	0.5	mg/L	325.2 (1)	05/30/91	K
Conductivity (Unfilt.)	1210	1	umhos/cm @25dF	120.1 (1)	05/30/91	
Hardness, Total (Unfilt.)	781	1	mg/L(as CaCO3)	314A (3)	06/20/91	T
Nitrogen, Nitrate (Unfilt.)	<0.1	0.1	mg/L (as N)	353.2 (1)	06/13/91	P
pH (Unfilt.)	7.29	0.01	pH Units	150.1 (1)	06/03/91	K
Solids, Total Dissolved (TDS)	1050	10	mg/L	160.1 (1)	06/13/91	D
Sulfate (Unfilt.)	492	10	mg/L	375.3 (1)	06/19/91	R
Calcium, Total (Ca)	199	0.5	mg/L	200.7/6010 (1,2)	06/11/91	T
Iron, Total (Fe)	<0.03	0.03	mg/L	200.7/6010 (1,2)	06/11/91	T
Magnesium, Total (Mg)	68.9	0.5	mg/L	200.7/6010 (1,2)	06/11/91	T
Manganese, Total (Mn)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	T
Potassium, Total (K)	1.59	0.01	mg/L	258.1 (1)	06/20/91	T
Sodium, Total (Na)	13	1	mg/L	200.7/6010 (1,2)	06/11/91	T
AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/29/91	M
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

APPROVED BY: David McWhorter

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CORE LABORATORIES

ANALYTICAL REPORT
06/21/91

CUSTOMER: Marathon Oil Company

File No..: 910887

CATION/ANION BALANCE

Client Sample I.D..... #5
Remark/Project..... 27-98-810 Mineral Assay
Date/Time Sampled..... 05-27-91/1400
Date/Time Received..... 05-29-91/1522
Laboratory Sample I.D..... 910887-5
ARROYO SPRING WATER

PARAMETER	RESULT		UNITS
pH	7.29		pH Units
Conductivity at 25 degrees C	1210		umhos/cm
Alkalinity (as CaCO3)	264		mg/L
Total Diss. Solids (measured)	1050		mg/L
Total Diss. Solids (calculated)	947		mg/L
		meq/Liter	
Calcium (Ca)	199	9.93	mg/L
Magnesium (Mg)	68.9	5.67	mg/L
Sodium (Na)	13	0.57	mg/L
Potassium (K)	1.59	0.04	mg/L
Total Cations meq/Liter		16.21	
		meq/Liter	
Bicarbonate (HCO3)	322	5.28	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	11.1	0.31	mg/L
Sulfate (SO4)	492	10.24	mg/L
Total Anions meq/Liter		15.83	

Cation-Anion Balance (RPD) 2.32 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: D. Ward McWhorter

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EXHIBIT 1

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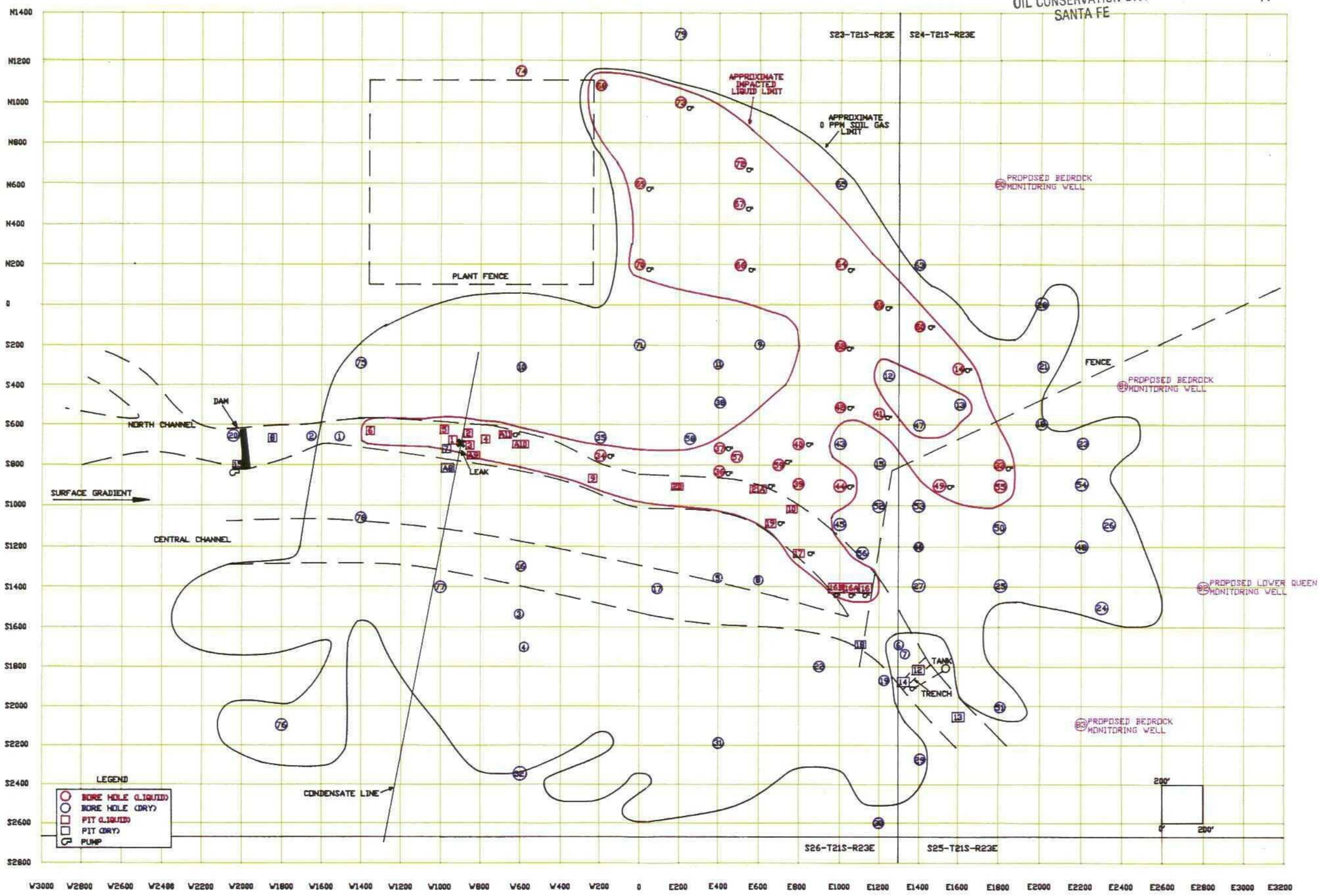
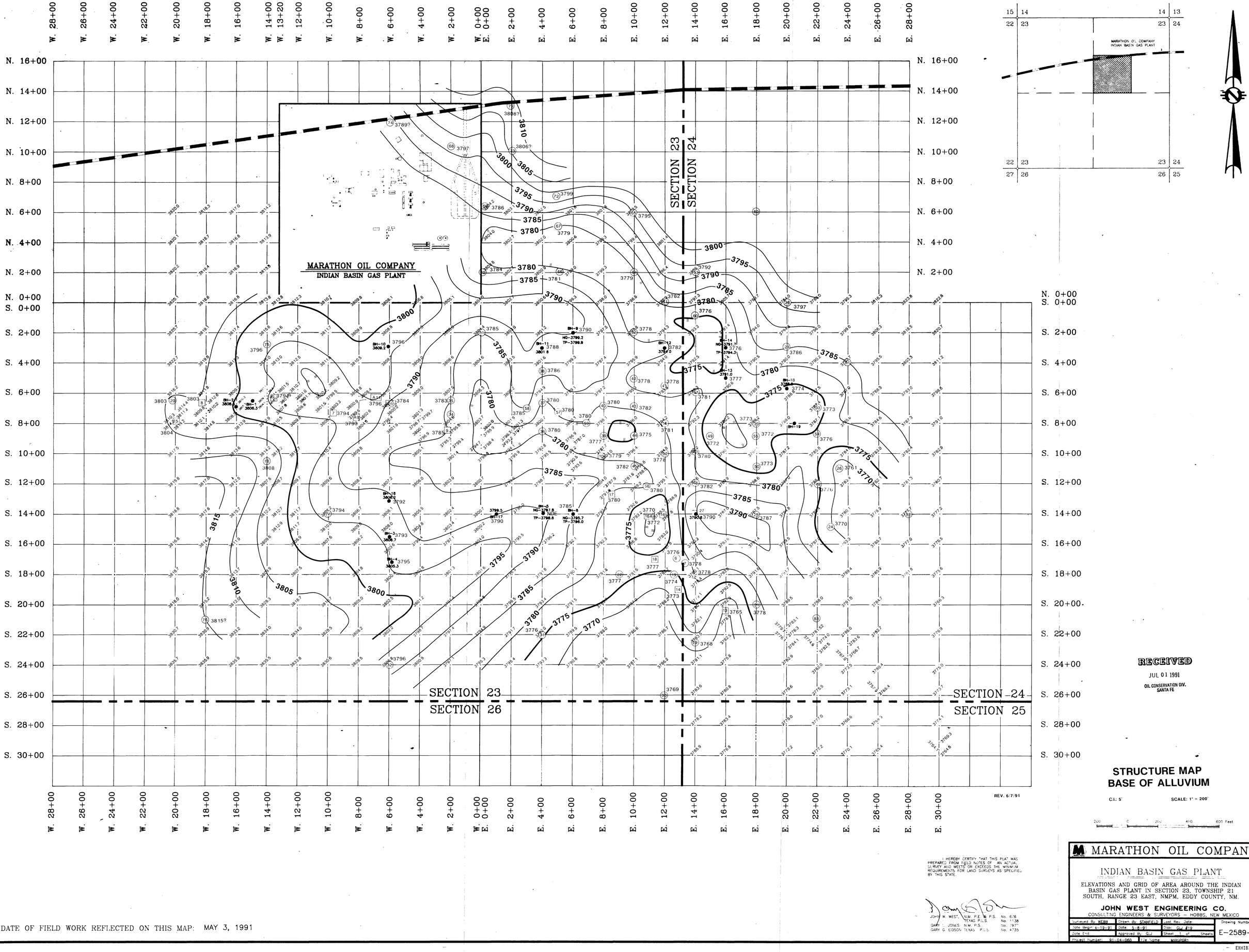
INDIAN BASIN REMEDIATION

JUNE 16, 1991

PRIVILEGED AND CONFIDENTIAL





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SANTA FE

REV. 6/7/91

STRUCTURE MAP
BASE OF ALLUVIUM

C.I.: 5' SCALE: 1" = 200'

200 0 200 400 600 Feet

I HEREBY CERTIFY THAT THIS PLAT WAS PREPARED FROM FIELD NOTES OF AN ACTUAL SURVEY AND MEETS OR EXCEEDS THE MINIMUM REQUIREMENTS FOR LAND SURVEYS AS SPECIFIED BY THIS STATE.

JOHN W. WEST, N.M. P.E. & P.S. No. 676
TEXAS P.L.S. No. 1538
GARY L. JONES N.M. P.S. No. 7977
GARY G. EIDSON TEXAS P.L.S. No. 4735

LAST DATE OF FIELD WORK REFLECTED ON THIS MAP: MAY 3, 1991

MARATHON OIL COMPANY

INDIAN BASIN GAS PLANT

ELEVATIONS AND GRID OF AREA AROUND THE INDIAN BASIN GAS PLANT IN SECTION 23, TOWNSHIP 21 SOUTH, RANGE 23 EAST, NMPM, EDDY COUNTY, NM.

JOHN WEST ENGINEERING CO.
CONSULTING ENGINEERS & SURVEYORS – HOBBS, NEW MEXICO

Surveyed By: WEBB	Drawn By: STANFIELD	Last Rev. Date:	Drawing Number
Date Begin: 4-19-91	Date: 5-8-91	Disk: Gas #19	E-2589-1
Date End:	Approved By: GJJ	Sheet 1 of Sheets	
Project Number: 91-04-060	File Name: MBGPGR1		

EXHIBIT 2

R-23-E

R-24-E

T 20 1/2 S

T 21 S

T 22 S

FROM CONOCO

PLANT SITE

RECEIVED
JUL 01 1991
OIL CONSERVATION DIV.
SANTA FE

Marathon Oil Company — Midland, Texas 79702

PRELIMINARY APP.	DATE	FINAL APP.	DATE

DATE	BY	REVISIONS

INDIAN BASIN GAS GATHERING SYSTEM

SCALE NOT TO SCALE | DATE 1-2-91
DRAWN BY DIANA MATHIS | DWG. NO. IBGP-6
INDIAN BASIN GAS FIELD

DRAPHIX #299181

EXHIBIT 4