

1R0413

**GENERAL
CORRESPONDENCE**

2005

IR 0413

↳ AP (COMBO STAGE 1, 2)

ConocoPhillips

East Vacuum Glorietta Unit New Mexico East Tank Battery Playa Remediation

CASST OF BUCKEYE, LSA CO.

IR 413

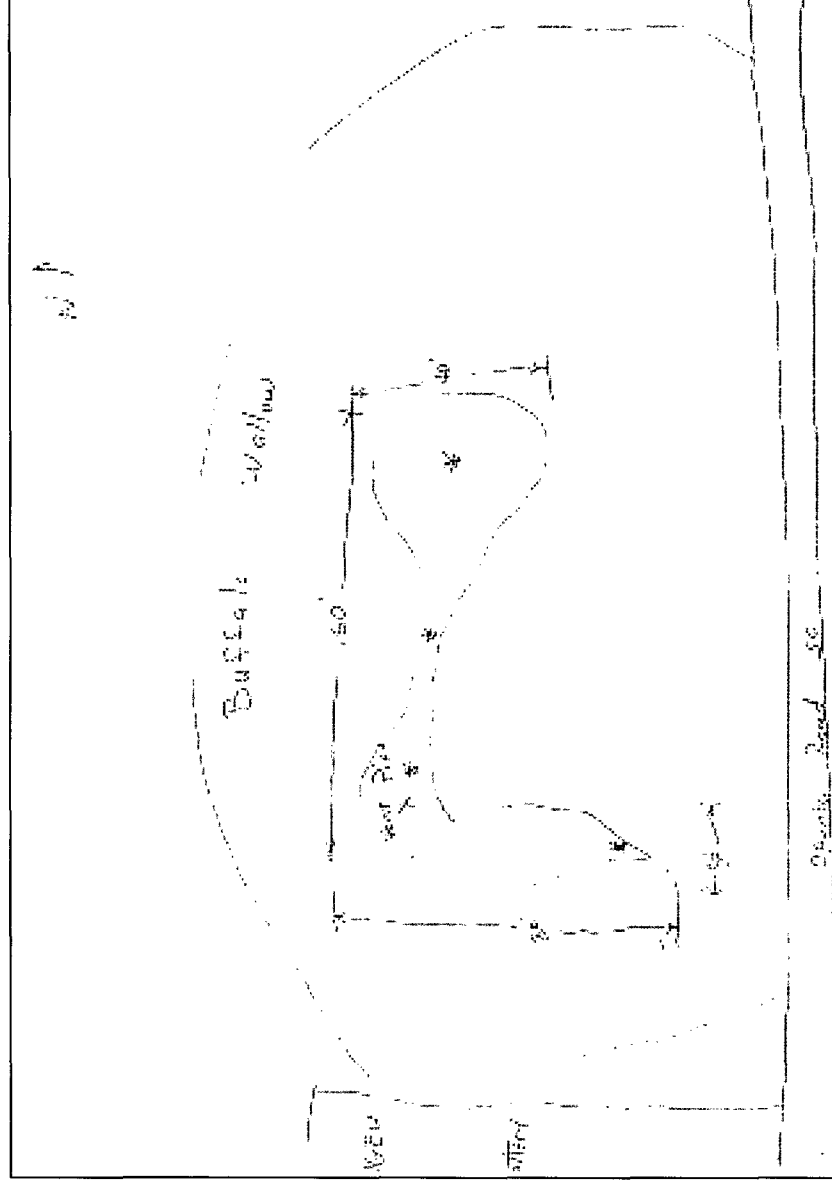


PROJECT HISTORY

- **October 28, 2002** – Loss of air pressure to FWKO tank caused vessel to go out of balance. 80 bbls oil released through vent pipe into playa
- **October 29, 2002** – Release reported to NMOCD
- **November 20, 2002** - B&H Environmental Services delineated the surface extent of the spill and bored one hole to 11 foot depth to delineate vertical extent of affected soil
- **April 7, 2003** - BBC International deepen B&H “vertical” boring to 35 feet in depth to delineate vertical extent of affected soil

PROJECT HISTORY (Continued)

Release Site Drawing



Source: 10/28/2002 NMOCD Form C141 Attachment



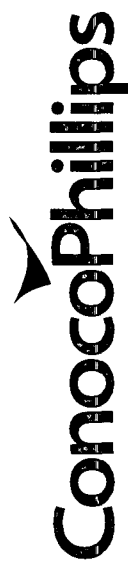
PROJECT HISTORY (Continued)

- **January 4-6, 2004** – Maxim Technologies developed three groundwater monitoring wells (one in the affected area and two outside the playa
- **May 19 – 20, 2004** – Maxim Technologies delineated the vertical and horizontal extent of affected area above the caliche zone
- **July 7, 2004** – Work Plan submitted to NMOCD Santa Fe to excavate affected soil to caliche zone, place a geo-membrane in excavation and backfill
- **July 12, 2004** – NMOCD denied the plan



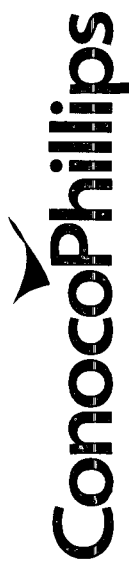
PROJECT HISTORY (Continued)

- **August 5, 2004** – Revised plan submitted to NMOCD Santa Fe that included excavating to the extent practicable, backfilling and surface restoration
 - Excavate to extent practicable = 8 feet deep
(Contractors indicated caliche in the area was very hard)
 - Affected area = 0.25 acres
 - Estimated volume of affected soil to be removed = 4,280 cubic yards
- **August 11, 2004** - Excavation of affected soil was initiated
- **August 13, 2004** - Historic impact encountered, excavation deepened to 20 ft



PROJECT HISTORY (Continued)

- **September 15-16, 2004** – 6 hole intrusive boring program initiated to further delineate lower strata
- **December 8, 2004** - Excavation sidewalls and floor examined to determine statue
- **February 3-4, 2005** - Trenching program to determine lateral extent of TPH contaminants
- **April 4, 2005** - Remediation plan submitted to NMOCD



PROJECT HISTORY (Continued)

- May 12, 2005 – NMOCD requests an Abatement Plan
- June 1, 2005 – Abatement Plan filed with NMOCD



DATA

- Depth to groundwater in January 2004 study was 60 feet below ground surface

Chloride

- Soil boring data indicated chloride concentration above 250 mg/kg down to groundwater
- Soil geo-probe data indicated chloride concentration above NM proposed guideline in central west area (GP-1 thru -7 & -13)
- Groundwater data indicate chloride concentration above NM regulatory limit (250 mg/l) in monitoring well established in playa

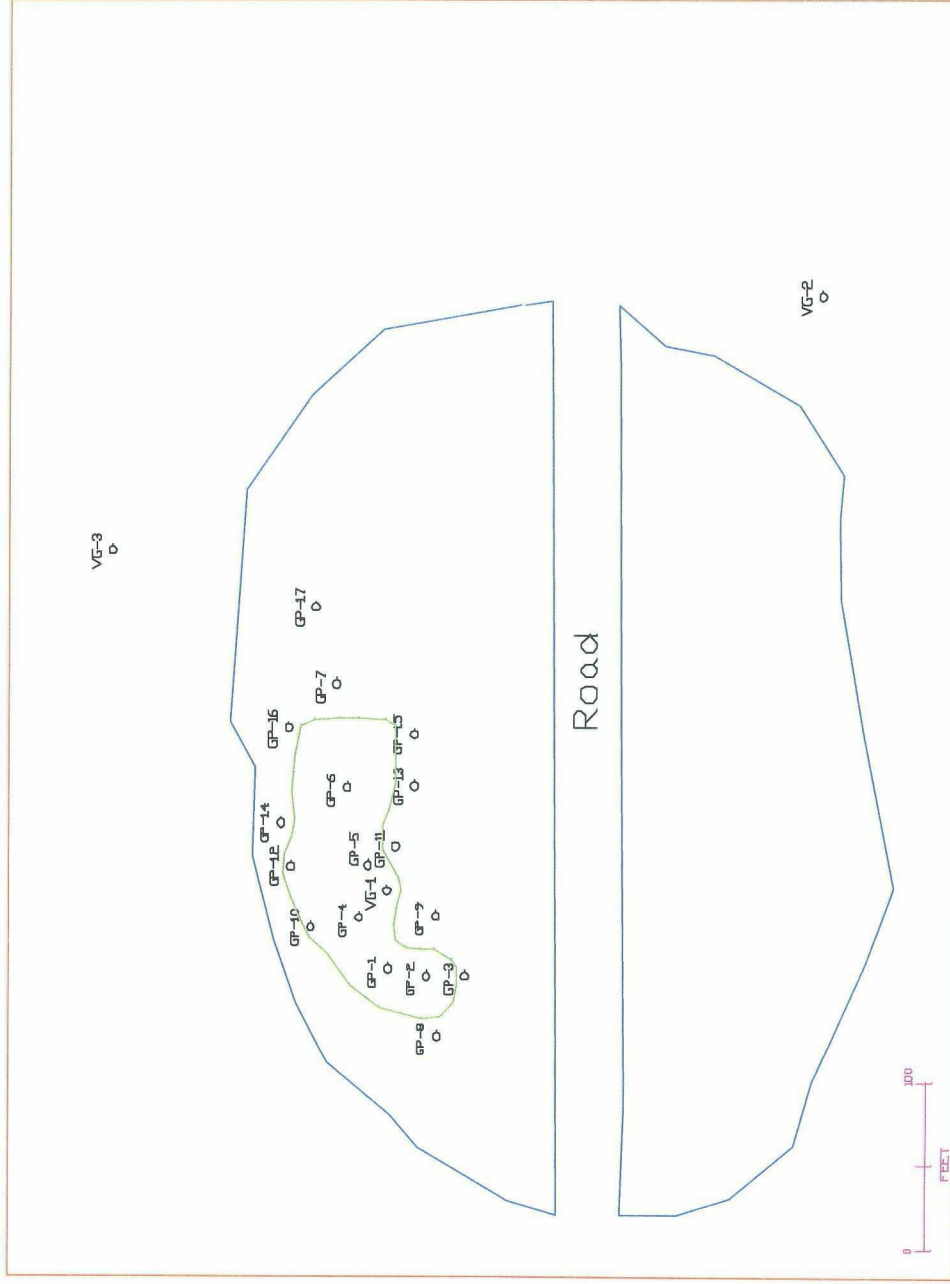


DATA (Continued)

Petroleum Hydrocarbon

- Soil boring data indicated TPH-DRO concentration above NM guideline (100 mg/kg) in the center of release site. SPLP/BTEX analysis of soil 20 – 22 fbgs was below NMWQCC clean up standards at VG-1.
- Soil geo-probe data indicated TPH-DRO above NM guideline in center-east area of release location (GP-5 & -6)
- Groundwater data indicated BTEX concentrations below NM regulatory limits in monitoring well established in playa

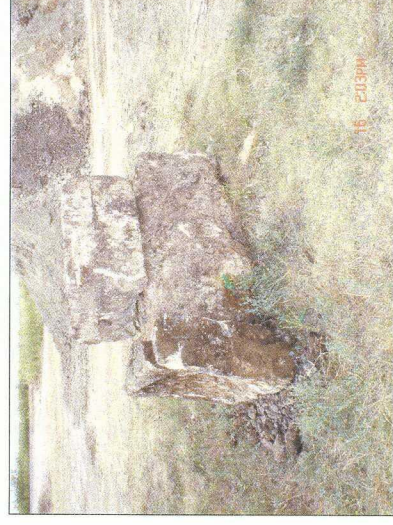
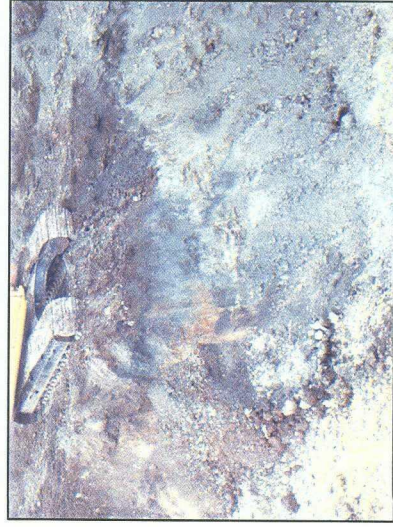
AFFECTED AREA OF PLAYA



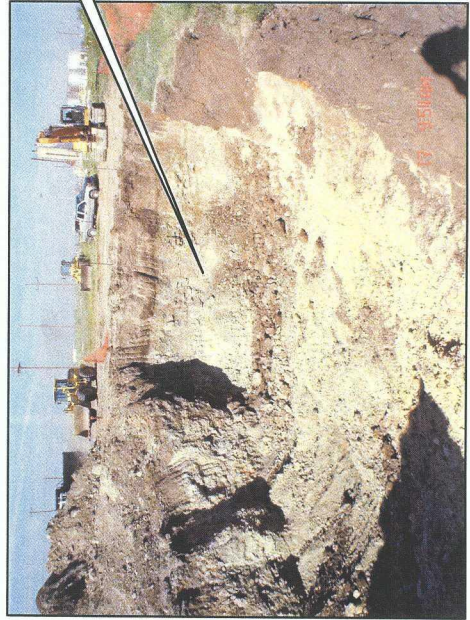
EXCAVATION (Historic Impact)



Historic
Impact



EXCAVATION (Historic Impact)



Historic
Impact

SOIL TESTS

Synthetic Precipitation Leaching Procedure Data

Standard

Chloride	250 ppm (proposed)
Benzene	10 ppm
BTEX	50 ppm

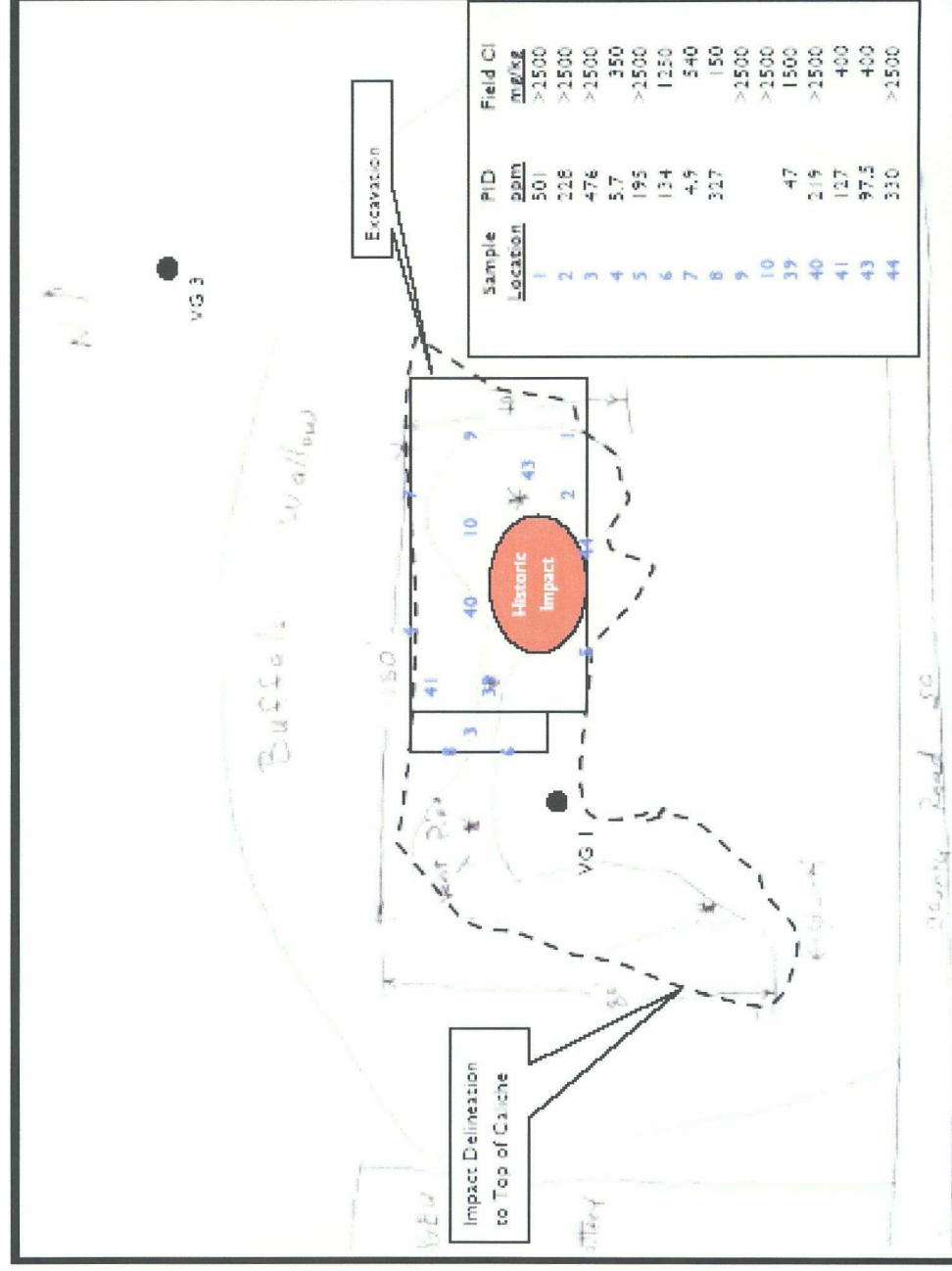


Depth 16 ft
Cl 266 mg/kg
B <0.1 mg/kg
T <0.1 mg/kg
E <0.1 mg/kg
X <0.1 mg/kg

Depth 12 ft
Cl 241 mg/kg
B <0.1 mg/kg
T <0.1 mg/kg
E 0.180 mg/kg
X 0.260 mg/kg

SOIL TESTS (Continued)

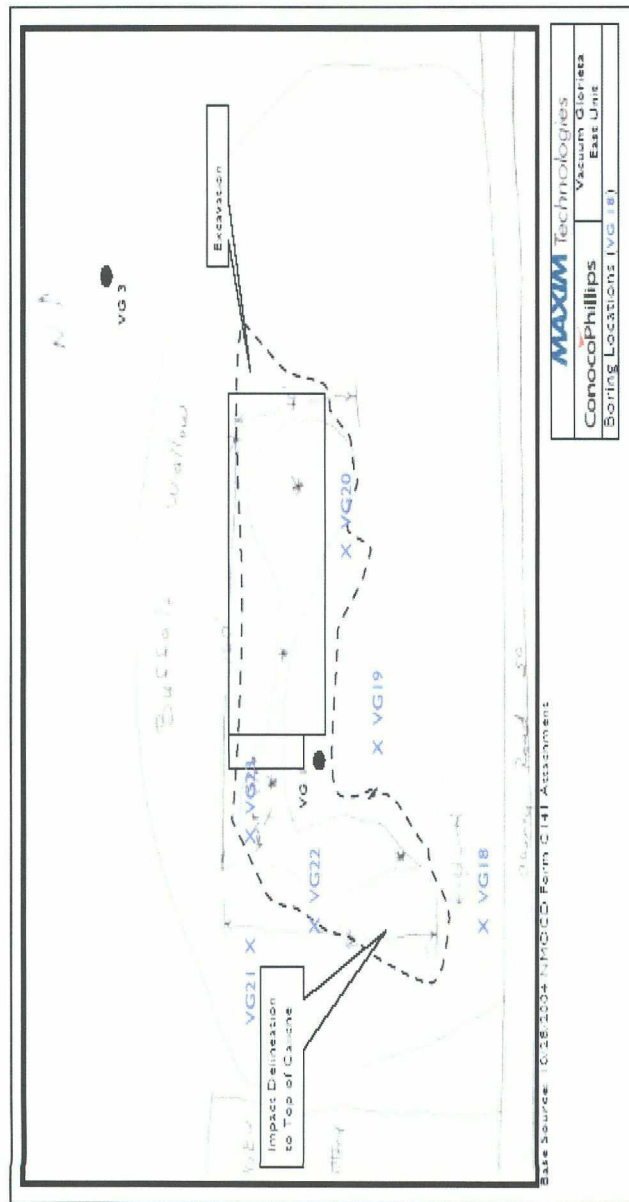
Field Data



Base Source: 10/28/2002 NMCCD Form C141 Attachment

BORING PROGRAM

September 15-16, 2004



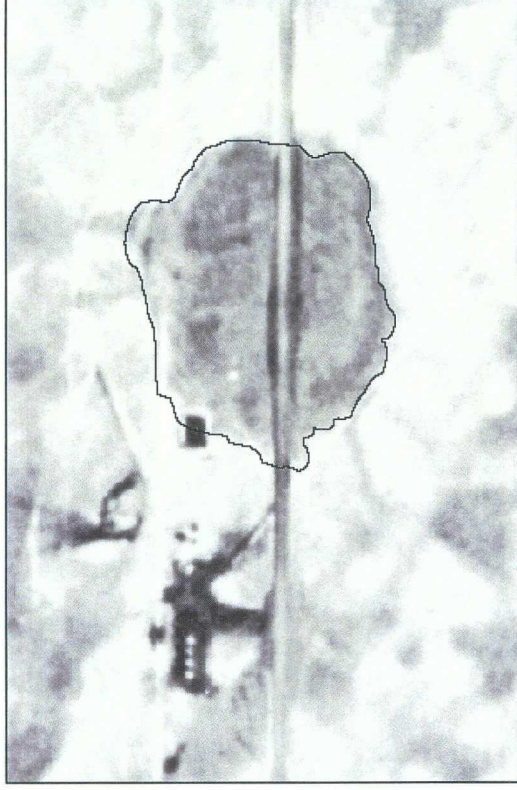
Boring	Sample Interval	TPH		SPLP Chloride	Moisture
		GRO	DRO		
VG-18	0-10	<1.1	68	47.5	8.1
VG-18	10-20	<1.0	<12	18.5	2.8
VG-18	20-30	<1.1	<13	45.4	6.7
VG-18	40-50	<1.0	77	8	2.8
VG-19	0-10	<1.1	110	3.7	6.6
VG-19	10-20	<1.0	<12	8.9	2.2
VG-19	20-30	<1.0	<13	12.8	4.3
VG-19	40-50	<1.0	44	1.9 J	4.4
VG-20	0-10	<1.1	18	4.5	9.1
VG-20	10-20	44	2000	30.5	4.6
VG-20	20-30	340	11000	7.3	6.6
VG-20	40-50	17	1800	2.2	5.2
VG-21	0-10	180	10000	19.2	6.7
VG-21	10-20	170	5300	4.8	4.5
VG-21	20-30	84	3600	10	7.6
VG-21	30-40	NA	NA	19.7	6.2
VG-21	40-50	48	2000	27.7	6
VG-22	0-10	<1.1	720	72.1	9.5
VG-22	10-20	<1.0	70	30.7	2.9
VG-22	30-40	<1.1	16	78	4.8
VG-22	40-50	<1.0	280	83	4.4
VG-23	0-10	<4.3	670	163	7.3
VG-23	10-20	88	4000	209	6.4
VG-23	20-30	110	6500	261	6.8
VG-23	40-50	<1.0	730	222	4.3

SUMMARY

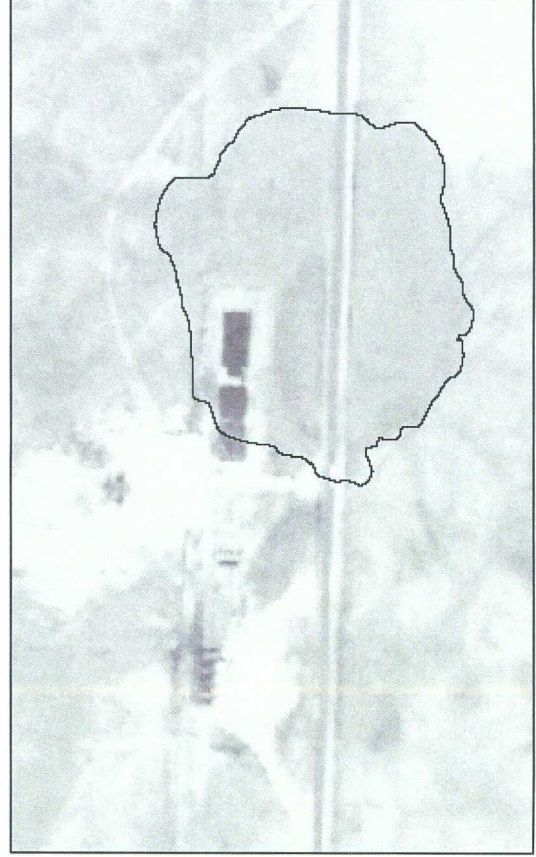
- Data indicated soil was affected down to groundwater
- Initial plan to place set a geo-membrane was denied by NMOCD
- Excavation was initiated to show compliance with NMOCD directive to start work by August 20, 2004
- Historic impact area discovered during excavation
- Caliche zone appears to be structurally fractured around and below historic impact area
- Excavate to 8 ft in revised plan but excavation deepened to 20 ft in area around historic impact area
- 3,240 cubic yards of material hauled to a State regulated disposal facility

SUMMARY (Continued)

1949



1966



PATH FORWARD

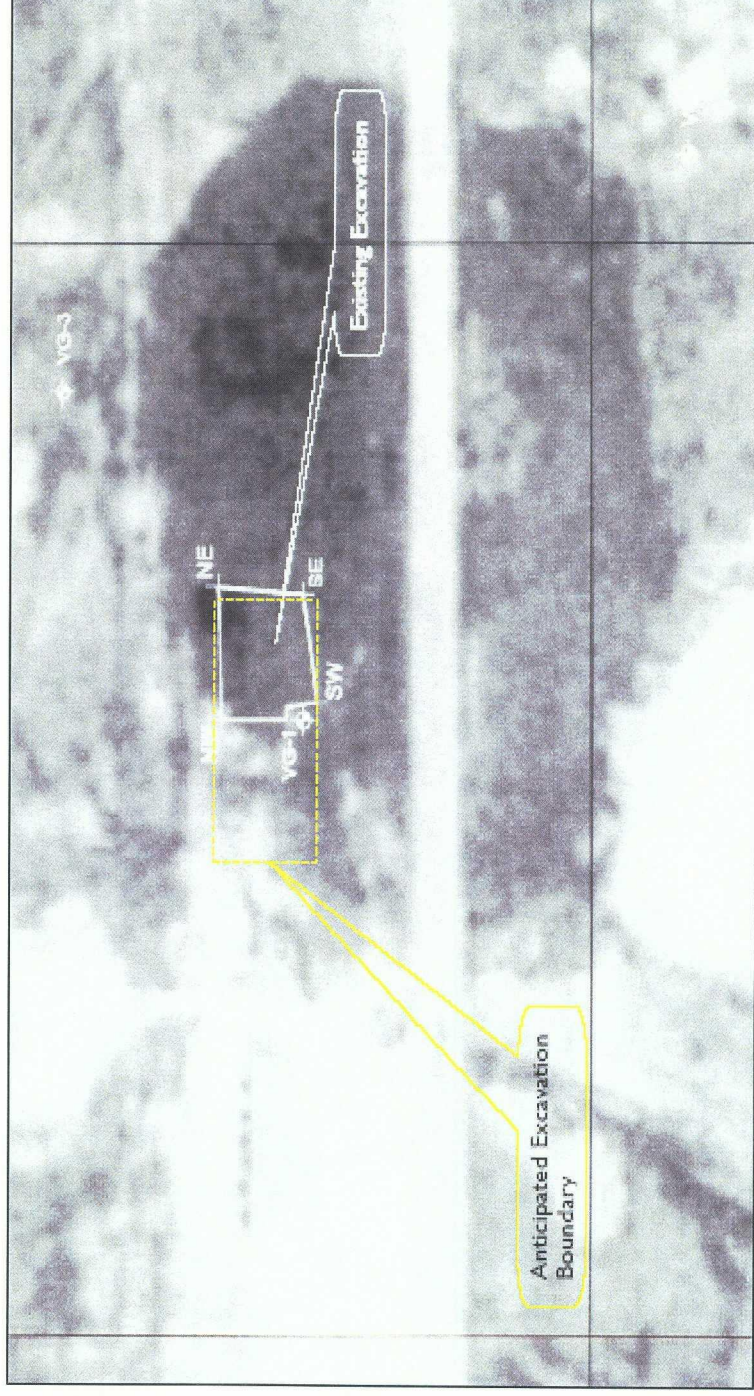
The objective of the abatement plan (Plan) is to remove historical production pit material from the playa, minimize disturbance to the playa's natural soil structure and limit impact to groundwater below the playa.

The Plan includes:

- Removing the remaining historic pit material
- Deploying geo-membrane
- Backfilling excavation with clean material
- Restoring 1 monitoring well after excavation is completed
- Re-establishing vegetation
- Quarterly monitoring groundwater for 8 consecutive sampling events at 3 monitoring wells

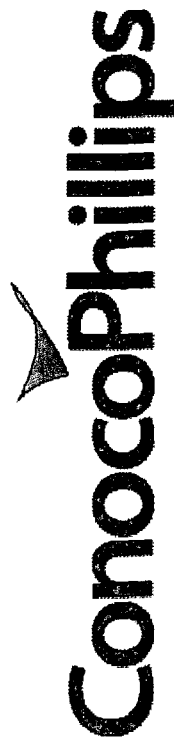
PATH FORWARD (Continued)

- Proposed Excavation



1R0204

MALJAMAR GAS PLANT
GROUNDWATER REMEDIATION SITE
MALJAMAR, LEA COUNTY, NEW MEXICO



Majamar Gas Plant

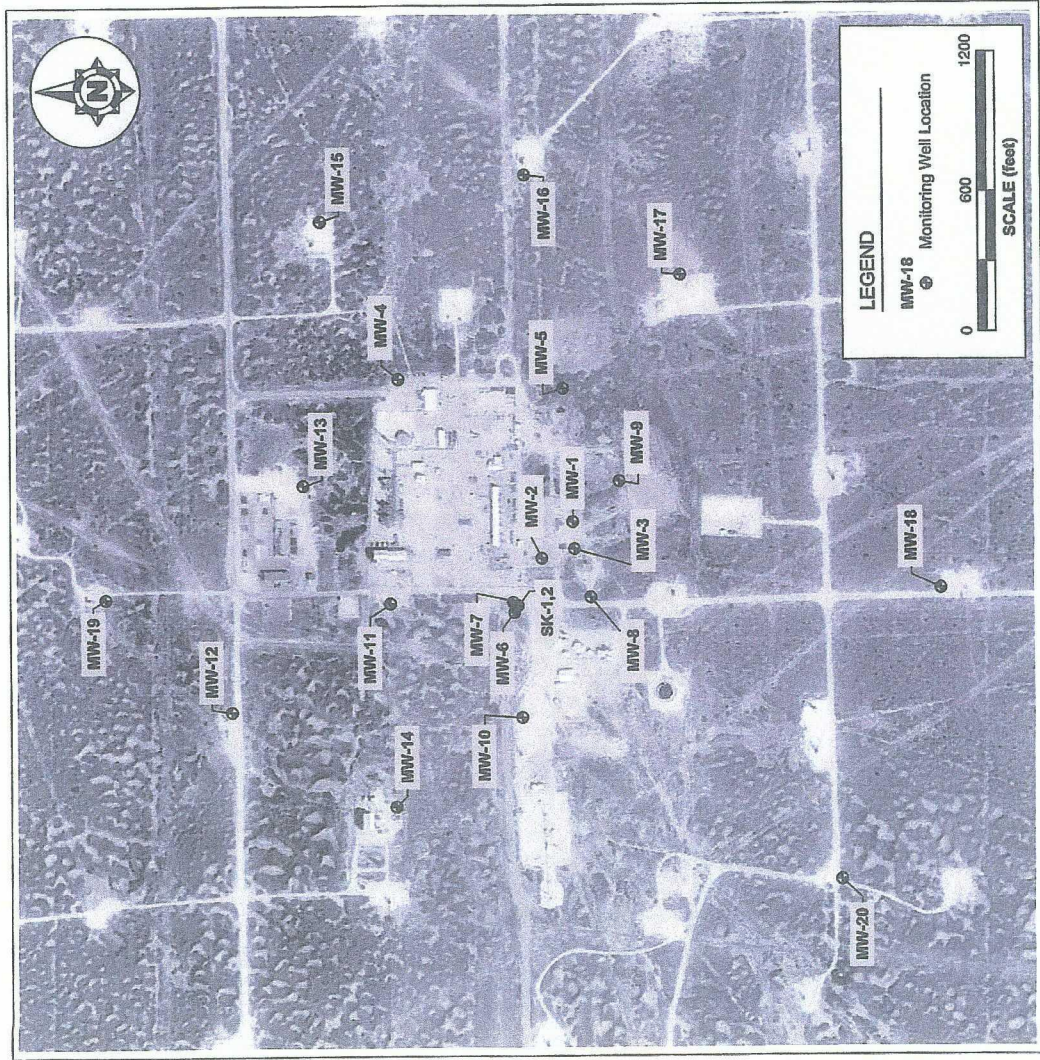
- **History of Site Activities**
 - February 13, 2000: 15 bbl Condensate Release at the Skimmer Basin
 - April, 2000: Field Investigation (6 soil borings)
 - June, 2000: Field Investigation (6 soil borings and MW-1)
 - September, 2000: Field Investigation (MW-2 and MW-3, limited trenching at skimmer basin)
 - May, 2001: Groundwater Investigation (MW-4, 5, 7, 8, and 9)
 - December, 2001: Groundwater Investigation (MW-10, 11, 12, and 13)
 - March, 2002: Well/Boring Installations (MW-14, SK-1, B-1-C & B-2-C)
 - September, 2002: Groundwater Investigation (MW-15, 16, 17, 18, and 19, groundwater mound identified at site)
 - December, 2002: Skimmer Well Installation (SK-2)
 - January, 2003: Surface Geophysical Survey & MCA Well Casing Integrity Testing

Majamar Gas Plant

- **History of Site Activities - continued**
 - March, 2003: Borehole Geophysical Survey (19 MWs)
 - September, 2003: Aquifer Pump Test Performed
 - March 1, 2004: Comprehensive Groundwater Report Submitted to NMOCD
 - March & April, 2004: Extraction Well (MW-6), Pump and Equipment Installation
 - May 10, 2004: Initiation of Groundwater Extraction from MW-6
 - November, 2004: Evaluate Groundwater Model Based on MW-6 Groundwater Extraction Data
 - December 9, 2004: Groundwater Extraction Well Report Submitted to NMOCD
 - December, 2004 – Present: Continued Operation of Groundwater Extraction Well

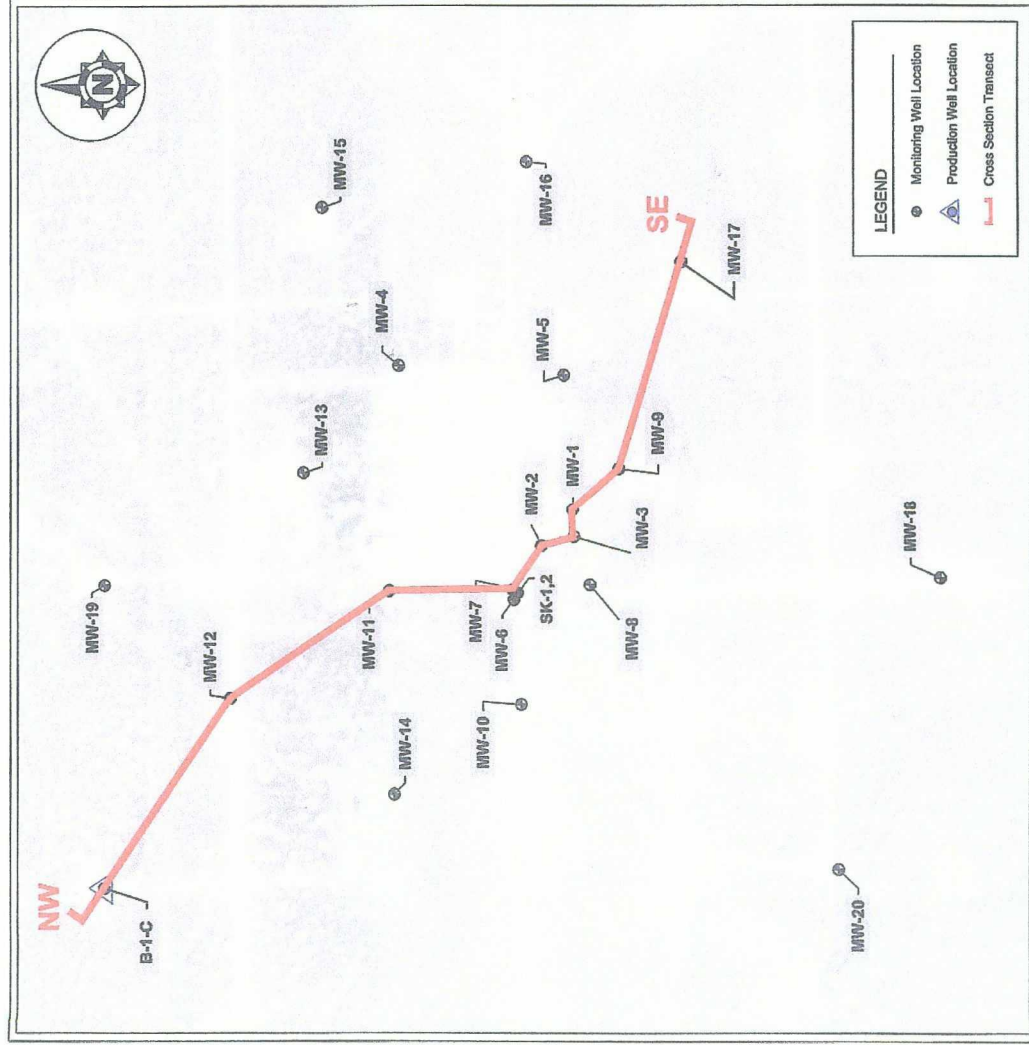
Maljamar Gas Plant Well Locations

- 19 Groundwater Monitoring Wells
- 1 Groundwater Extraction Well
- 2 Condensate Skimmer Wells



Maljamar Gas Plant

Conceptual Model Cross Section Transect

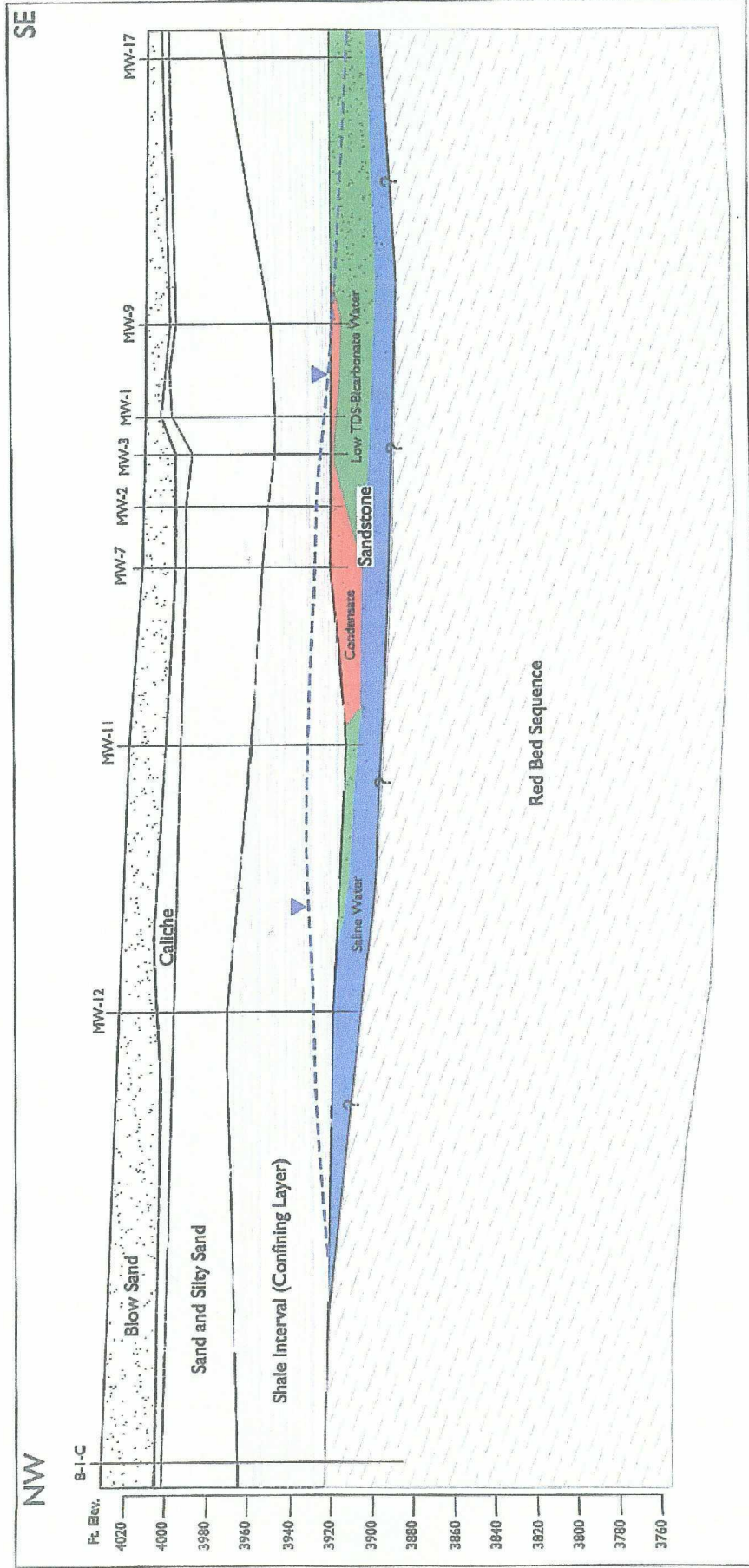


Geology Overview

- Complex Subsurface Stratigraphy
- Overlying Interbedded Sands, Silts & Shales With Minor Caliche
- Confined Sandstone Aquifers With Shale Interbed
- Unconformable Contact With Underlying Triassic Chinle Fm. Redbeds

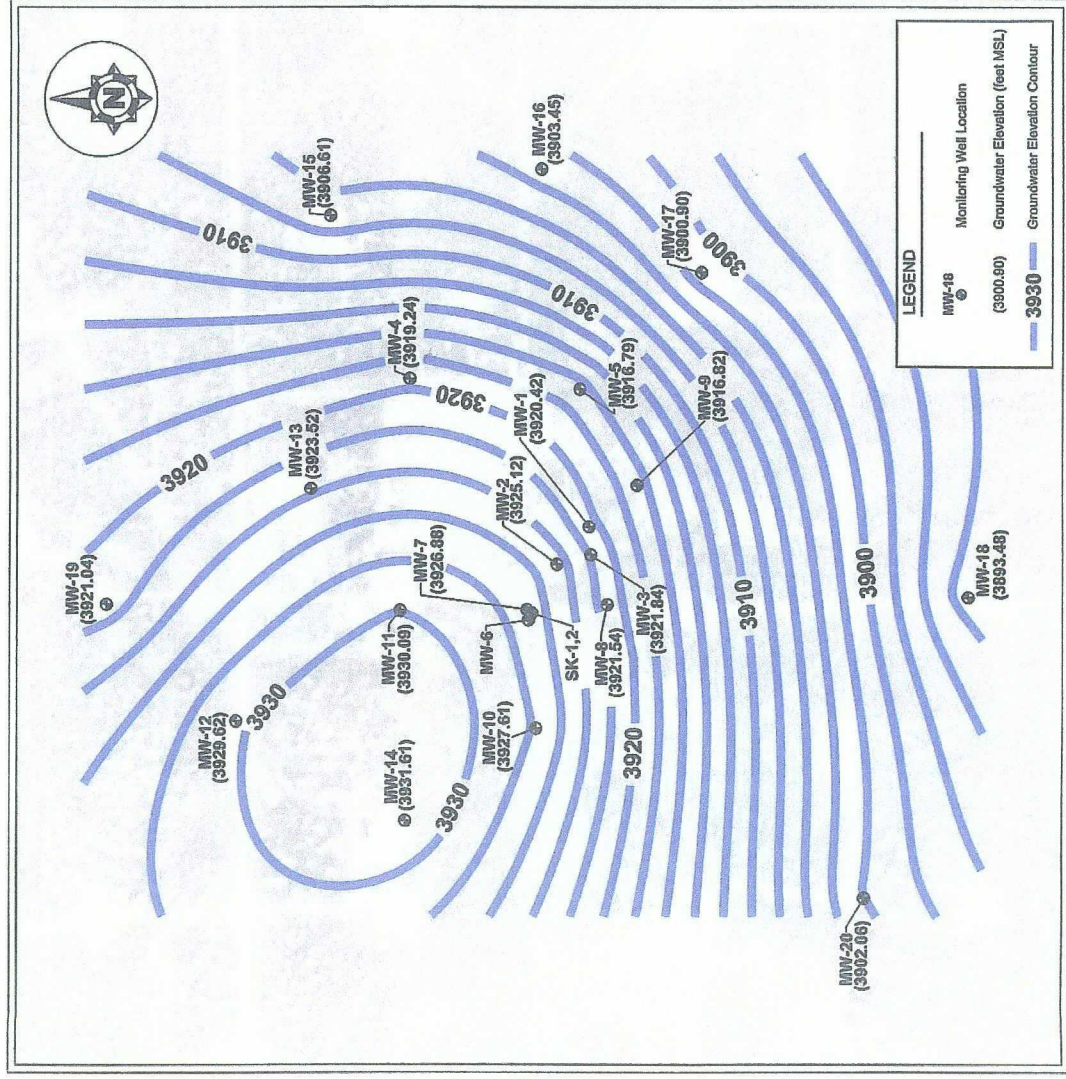
Maljamar Gas Plant

Conceptual Model Cross Section



Maljamar Gas Plant

Potentiometric Surface Map



Groundwater

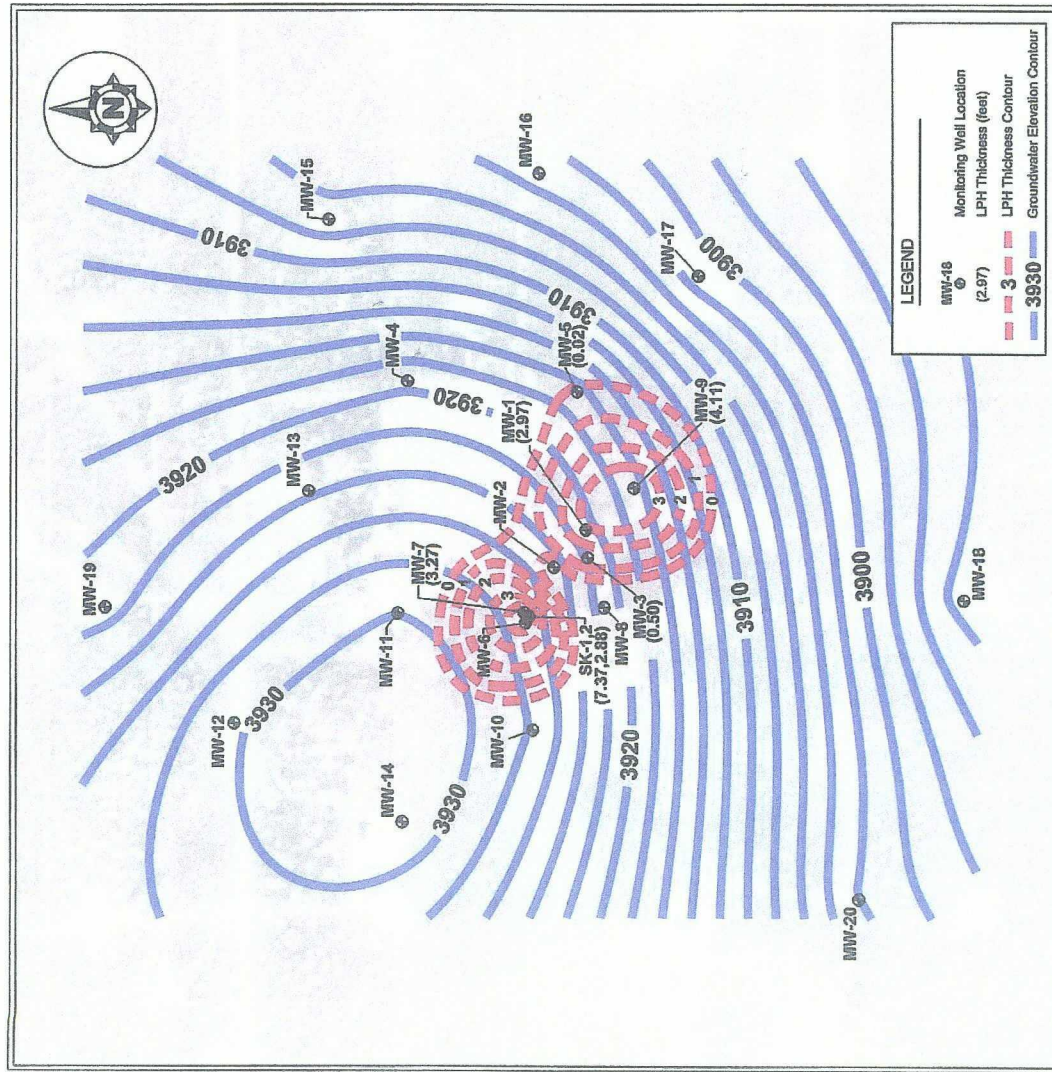
- March 9, 2005 Data
- $i \approx 0.0155$ ft/ft average
- Outward Radial Flow From Mound Centroid
- Confined Conditions in Center Diminish to Unconfined Along Edge of Mound
- GW Boundary due to Pinch-out or Fault to West & Northwest

Maljamar Gas Plant

Condensate Thickness Isopleths

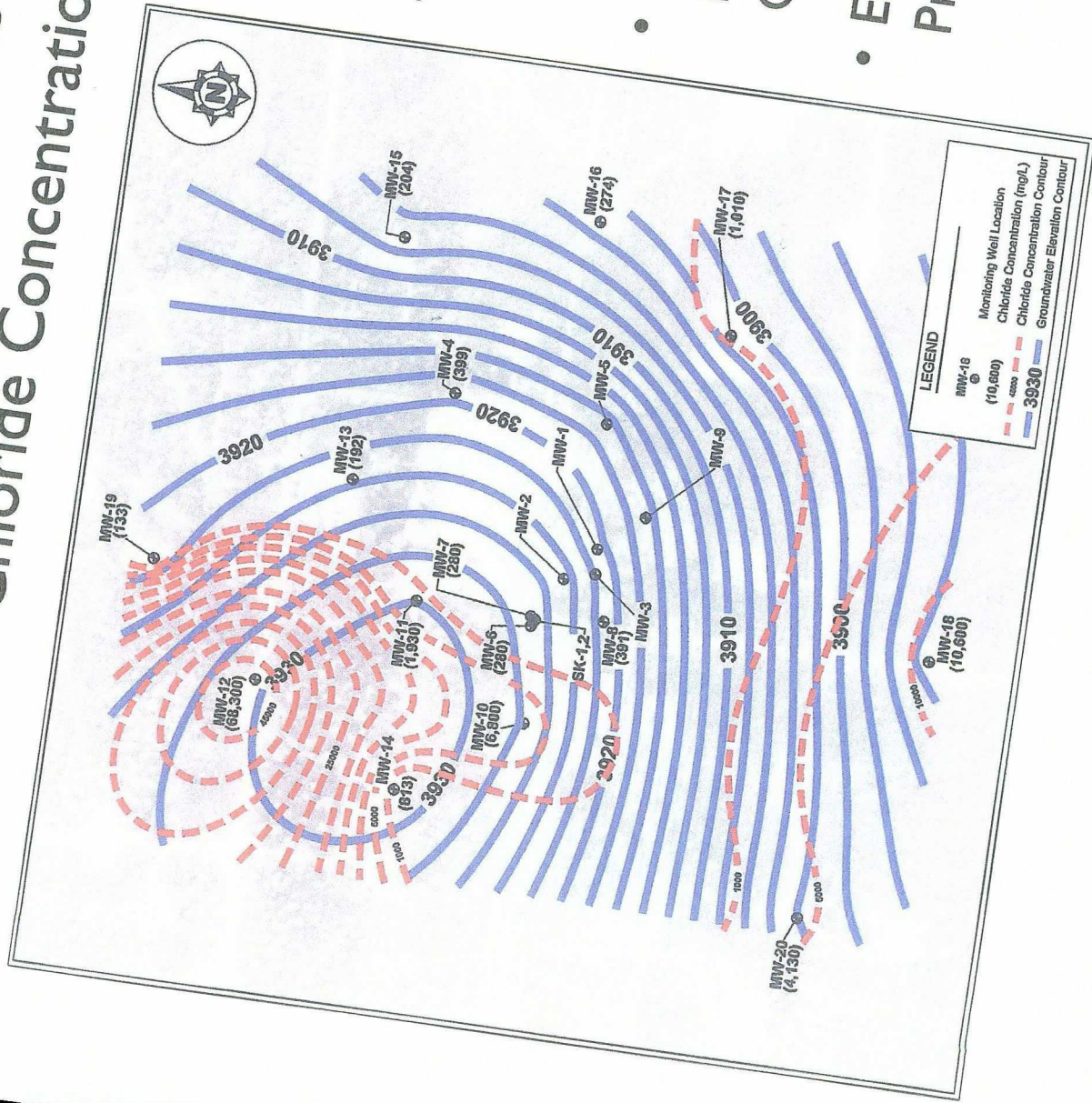
Condensate

- March 9, 2005 Data
- Condensate Centered Downgradient of Mound Centroid
- MW-7 Affected by Pumping of MW-6
- Maximum Thickness of >7 ft in SK-1
- Hydraulic Separation – SK-2 = <3 ft, MW-2 = 0



- May, 2004 Data

- Chlorides Highest in MW-12, Approximate Mound Centroid
- Chlorides Decrease Rapidly Away From Center
- Elevated Chlorides Also Present in MW-18



Maljamar Gas Plant Groundwater Extraction



GW Extraction

- Well Controls Located in “Corral”
- Submersible Electric Pump in MW-6
- Level Probes in MW-6 Regulate Pumping
- >280,000 gallons GW Extracted To Date
- MW-6 Avg. $\approx$ 0.6 gpm

Maljamar Gas Plant

Groundwater Extraction Well MW-6



Well Details

- Well TD = 105 ft
- Well Screened Across Both Aquifers – 30 ft Screened Interval
- 5 ft Sump Section @ Bottom For Sediment Accumulation
- 6-inch Diameter PVC Well Casing

Maljamar Gas Plant

Extraction Well Controls

Well Controls

- 1/2-hp Electric Submersible Pump
- EPG Series 800 Electrical Control Panel
- EPG “F” Series Float Switches For High & Low Level Pump Control
- Controls For Skimmer Pump Systems Also Located in “Corral”

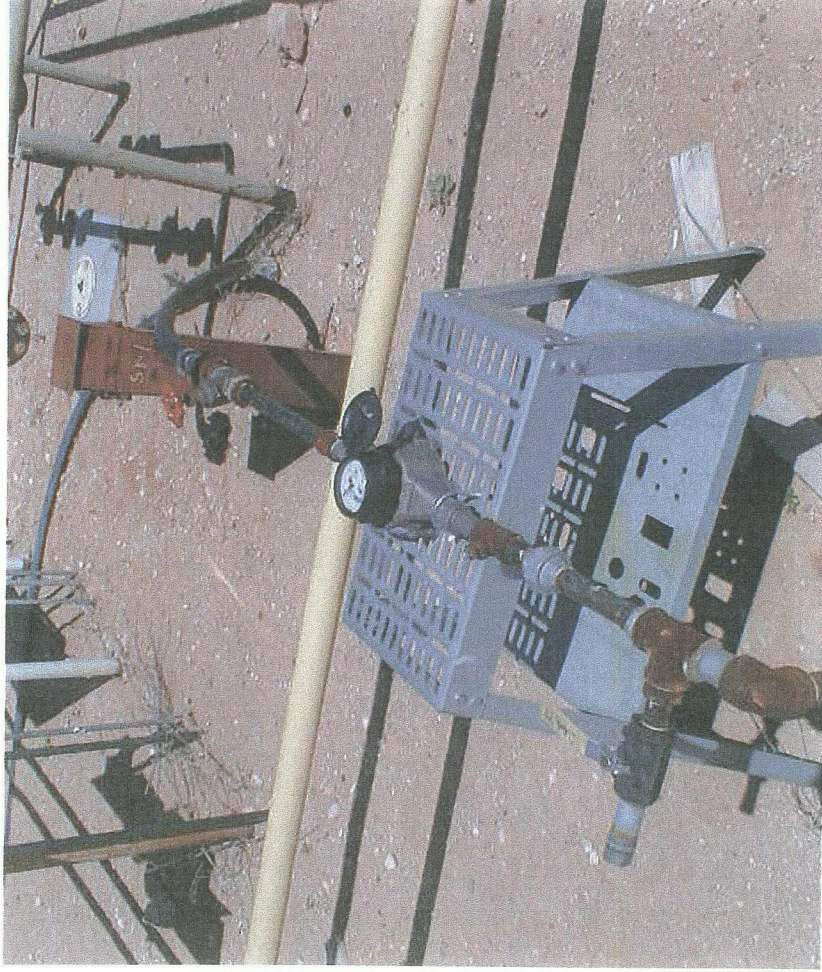


Maljamar Gas Plant

Extraction Well Controls

Flow Controls

- Badger Model 35 RC DL
3/4-inch Totalizing
Flowmeter
- Gate Valve Used For
Flow Rate Control
- Extracted Groundwater
Sampling Port With Ball
Valve
- Check Valve Used To
Prevent Backflow



Maljamar Gas Plant

Extracted Groundwater Disposal



GW Disposal

- Extracted Groundwater Transferred To 210 bbl Storage Tank
- Automated Tank Level Monitoring
- Extracted Groundwater Pumped To MCA Water Flood For Re-injection



Maljamar Gas Plant

Groundwater Model Evaluation

- **Initial Groundwater Model Calibration Parameters and Results**
 - Hydraulic Conductivity = 0.28 ft/day
 - Hydraulic Gradient = 0.0134 ft/ft avg.
 - Specific storage = 3×10^{-4}
 - Specific yield = 0.05
 - Leakage into mound = 2 gpm
 - Extraction well pumping rate = 1-2 gpm
- **Groundwater Model Evaluation Results**
 - Leakage into mound = 0.4 gpm
 - Extraction well pumping rate = 0.6 gpm
 - Greater complexity in groundwater surface observed
 - Hydraulic isolation of MW-2, less than predicted drawdown & absence of condensate observed

Maljamar Gas Plant

Groundwater Quality Evaluation

- **May, 2004 Groundwater Sampling Results**
 - MW-4, benzene = 0.025 mg/L
 - MW-8, benzene = 25 mg/L, toluene = 2.6 mg/L
 - MW-12, chloride = 68,300 mg/L, TDS = 116,000 mg/L

- **MW-6 Groundwater Sampling Results**
 - April 5, 2005 Data
 - Benzene = 4.7 mg/L
 - Toluene = 0.17 mg/L
 - Ethylbenzene = 0.25 mg/L
 - Chloride = 421 mg/L

Maljamar Gas Plant

Path Forward

- **Continue Collecting Monthly Groundwater Level Measurements**
- **Annual Groundwater Sampling During May, 2005**
- **Continue Operation of Groundwater Extraction Well MW-6**
- **Perform Additional Evaluation of Groundwater Model**
- **Perform Condensate Recovery Bail Down Pilot Test**
- **Install New Condensate Skimmer System For MW-7, SK-1 & SK-2**
- **Prepare Annual Groundwater Extraction & Monitoring Report For NMOCD Submittal in August, 2005**