AP - 25

STAGE 1 & 2 WORKPLANS

DATE: Feb. 15, 2005

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I. Company Contacts

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II. Purpose

The purpose of this amended abatement plan is to propose additional investigatory work to delineate the extent of possible groundwater contamination at the subject site located at the Yates Scripps battery approximate to Unit letter L, Section 25, Township 18S, Range 26E Eddy County, New Mexico (Figure 1). Possible contamination could have resulted from a pit associated with oil and gas exploration and production activities at the Scripps battery. The pit has since been closed.

III. Background

The New Mexico Oil Conservation Division (NMOCD) has required submittal of an abatement plan (AP-25) for the subject site. A "Preliminary Site Investigation Report" dated June 2003 was submitted to the Division. The report provided information on groundwater elevations, direction of flow and water quality. On October 6, 2004, the OCD responded with a letter stating that a review of the report showed that the extent of groundwater contamination at the site had not been determined. The letter requested that a work plan for further delineation be submitted by December 31, 2004. A 45 day extension to February 15 was requested for submittal of the work plan, which was approved by Ed Martin of the OCD in Santa Fe on December 17, 2004.

IV. Contaminants and Size of Area

The suspected contaminants at the location are inorganic chlorides and total dissolved solids, and dissolved phase hydrocarbons (benzene, toluene, ethylbenzene and xylenes, i.e. BTEX) from produced water and/or other oilfield wastes from the battery which may have been placed in the now-closed pit. These wastes are considered RCRA-exempt oilfield wastes. The former pit occupied an area with exterior dimensions of approximately 180 ft. by 180 ft. or 32,400 sq. ft. (0.74 acres) (Figure 2).

V. Vertical and Horizontal Extent of Contamination

Vertical and horizontal delineation was performed during the preliminary site investigation reported in June 2003. Soil borings drilled during the investigation documented hydrocarbon contamination to a depth of 20 ft. in the boring that penetrated the pit (MW-4). That boring was free of hydrocarbons at 45 ft. Hydrocarbons were absent in all other borings from surface to total depth (Table 1).

Chlorides elevated above the NMOCD guideline of 250 mg/Kg were found in all but two soil samples (MW-1, 30 ft. and MW-2, 25 ft.). Chlorides were highest in samples taken from MW-4 (drilled in the pit). Chloride concentrations averaged 4,000 mg/Kg and were evenly distributed through out the borehole. Analysis of boring samples from MW-2 and MW-3 showed one or more samples exceeding 1,000 mg/Kg chloride.

VI. Groundwater

Groundwater at the site is at a depth of approximately 38-40 ft. below ground surface (bgs) (Table 2). Groundwater flow direction, as mapped in November and December 2004, is generally from east to west. Based on the flow direction from those dates, there are no monitor wells upgradient or downgradient from the pit. Also, water levels from the pit monitor well, MW-4, are slightly lower relative to the other three monitor wells which could indicate a downward vertical gradient. Generally, MW-4 was not plotted on the groundwater elevation maps.

Water quality of the groundwater is poor. Chlorides in the three monitor wells outside the pit that were sampled in November 2004 ranged between 4,000 mg/L (MW-1) and 5,100 mg/L (MW-3). Water quality in these three wells averaged 8,000 mg/L total dissolved solids (TDS). Water quality was worst in the pit well (MW-4) with chloride at 33,000 mg/L and TDS at 44,400 mg/L. However all concentrations greatly exceed water quality standards for human or animal use (Table 3). Benzene and ethylbenzene were detected in MW-4 at a concentration of 0.051 mg/L and 0.005 mg/L, respectively. Benzene exceeds the regulatory standard (0.010 mg/L) while ethylbenzene is well below the standard (0.750 mg/L) and just above the detection level.

Shallow groundwater in bottomland areas immediately west of the Pecos River is known to be brackish. Cooperative studies performed by the NM State Engineer Office and the US Geological Survey document increased sodium chloride mineralization mainly due to natural upward discharge of groundwater followed by evapotranspiration especially by phreatophytes such as salt cedar and mesquite[1].

VII. Action Plan

Based on evaluation of the existing information, elevated chloride and TDS concentrations at this site (except for MW-4) appear to be related to natural mineralization of the soil and groundwater rather than contamination by the pit. Concentrations of chloride and TDS at MW-4 may be due to vertical migration from the pit. To verify that the situation is as depicted here, we propose the following work:

1. Resurvey monitor well elevations.
   No information was provided in the report as to when the survey was performed or who did it. Because of the closeness of the monitor wells and because water levels for MW-4 appear anomalous compared to the other wells, a current elevation survey is necessary to determine more accurately groundwater flow direction.
2. Install two additional monitor wells.
   An additional monitor well will be installed upgradient of the site to determine if background shallow water quality is as poor as indicated by the analytical results for the existing wells. The well will be installed in an area which shows no evidence of disturbance. The most likely location to drill the well will be determined following resurvey of the wells and re-plotting of the water level measurements. A second well will be installed downgradient of the pit as determined by measurements following the resurvey of existing wells. If warranted following installation of that well, additional wells may be drilled to ascertain whether contamination in excess of background

1 Mower, R.W., Hood, J.W., Cushman, R.L., Borton, R.L., and Galloway, S.E., 1964. "An Appraisal of Potential Ground-Water Salvage Along the Pecos River between Acme and Artesia, New Mexico", US Geological Water-Supply Paper 1659, Washington, D.C.

concentrations exists downgradient from the pit. At least three soil samples will be collected during drilling and analyzed for chlorides.

3. Plug monitoring well MW-4.
   This well was drilled through the center of the pit. Water quality in the well is considerably poorer than in the surrounding wells indicating possible downward migration from above. Dissolved BTEX was detected for two constituents, benzene and ethylbenzene during the November 2004 sampling. It is unknown whether drilling of the well provided a vertical pathway for contaminant migration, however it would be best to plug the well and monitor groundwater quality from outside the pit boundaries. We propose to plug the well by injecting pressurized bentonite/cement mix grout down the casing and through the screen. We will remove the steel protection box and cut off the casing below the surface.
4. Measure water levels and monitor groundwater quality.
   Water levels and groundwater quality will be resampled in MW-4 before plugging and in all monitor wells following installation of the new monitor well. Analyses will include BTEX and major cations and anions.
5. Prepare an updated site investigation report.
   This report will be prepared and submitted to the NMOCD within 60 days of completion of the field work. It will present the data collected and summarize the results of the investigation.

VIII. Tables and Figures

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Figure 6. Groundwater Elevation Map, Scripps Pit Site, December 21, 2004 12
Figure 7. Groundwater Elevation Map, Scripps Pit Site, December 30, 2004 13

Table 1. Soil Sampling Results, Scripps Pit Site, August-September 2002

Sample Location, Date	Depth (ft.)	Chloride (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl-benzene (mg/Kg)	Total Xylenes (mg/Kg)	Total BTEX (mg/Kg)	GRO (C6-C12) (mg/Kg)	DRO (>C12-C35) (mg/Kg)	TPH (C6-C35) (mg/Kg)
MW-1	10	993	<0.025	<0.025	<0.025	<0.025	<0.025	<10.0	<10.0	<10.0
09/06/02	20	443	<0.025	<0.025	<0.025	<0.025	<0.025	<10.0	<10.0	<10.0
	30	106	<0.025	<0.025	<0.025	<0.025	<0.025	<10.0	<10.0	<10.0
MW-2	10	1,220	<0.025	<0.025	<0.025	<0.025	<0.025	<10.0	<10.0	<10.0
08/30/02	25	<20.0	<0.025	<0.025	<0.025	<0.025	<0.025	<10.0	<10.0	<10.0
	45	2,980	<0.025	<0.025	<0.025	<0.025	<0.025	<10.0	<10.0	<10.0
MW-3	15	390	<0.025	<0.025	<0.025	<0.025	<0.025	<10.0	<10.0	<10.0
08/30/02	30	2,760	<0.025	<0.025	<0.025	<0.025	<0.025	<10.0	<10.0	<10.0
	45	319	<0.025	<0.025	<0.025	<0.025	<0.025	<10.0	<10.0	<10.0
MW-4	10	4,430	0.269	0.342	0.957	3.44	5.01	321	2,920	3,241
08/30/02	20	3,510	1.74	0.573	9.26	11.8	23.4	591	2,150	2,741
	42	4,080	<0.025	<0.025	<0.025	<0.025	<0.025	<10.0	<10.0	<10.0

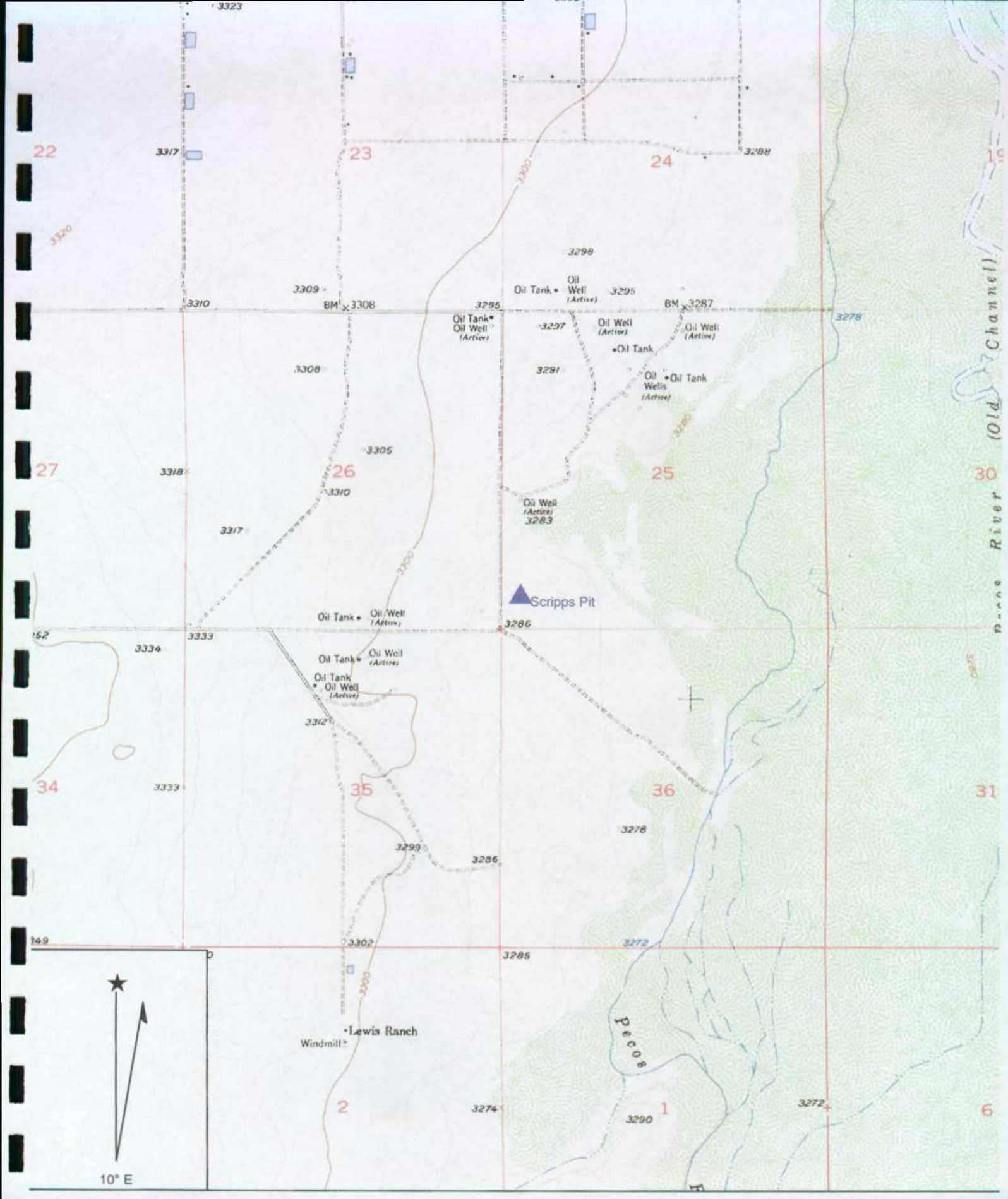
Table 2. Water Level Measurements, Scripps Pit Site, 2002-2004

Monitor Well Name, Total Depth Below TOC (ft.)	Elevation Top of Casing (feet)	Measure-ment Date	Depth to Water Below TOC (feet)	Water Level Elev. (feet)	Water Saturated Thickness (feet)	Water Level Change (ft)
MW-1	3,287.52	09/18/02	41.18	3,246.34	1.2	- -
42.34		09/19/02	41.25	3,246.27	1.1	-0.07
		11/08/04	41.16	3,246.36	1.2	0.09
		12/01/04	41.00	3,246.52	1.3	0.16
		12/15/04	40.91	3,246.61	1.4	0.09
		12/21/04	40.87	3,246.65	1.5	0.04
		12/30/04	40.84	3,246.68.	1.5	0.03
MW-2	3,287.91	09/18/02	41.95	3,245.96	12.5	- -
54.45		09/19/02	41.95	3,245.96	12.5	0.00
		11/08/04	42.00	3,245.91	12.5	-0.05
		12/01/04	41.81	3,246.10	12.6	0.19
		12/15/04	41.73	3,246.18	12.7	0.08
		12/21/04	41.72	3,246.19	12.7	0.01
		12/30/04	41.68	3,246.23	12.8	0.04
MW-3	3,288.79	09/18/02	42.84	3,245.95	10.2	- -
53.08		09/19/02	42.86	3,245.93	10.2	-0.02
		11/08/04	42.90	3,245.89	10.2	-0.04
		12/01/04	42.73	3,246.06	10.4	0.17
		12/15/04	42.65	3,246.14	10.4	0.08
		12/21/04	42.58	3,246.21	10.5	0.07
		12/30/04	42.52	3,246.27	10.6	0.06
MW-4	3,288.25	09/18/02	41.28	3,246.97	14.7	- -
55.99		09/19/02	42.32	3,245.93	13.7	-1.04
		11/08/04	42.37	3,245.88	13.6	-0.05
		12/01/04	42.26	3,245.99	13.7	0.11
		12/15/04	42.15	3,246.10	13.8	0.11
		12/21/04	42.12	3,246.13	13.9	0.03
		12/30/04	42.08	3,246.17	13.9	0.04
(Table updated 01/03/05)						

Table 3. Water Quality Sampling Results, Scripps Pit Site, 2002-2004

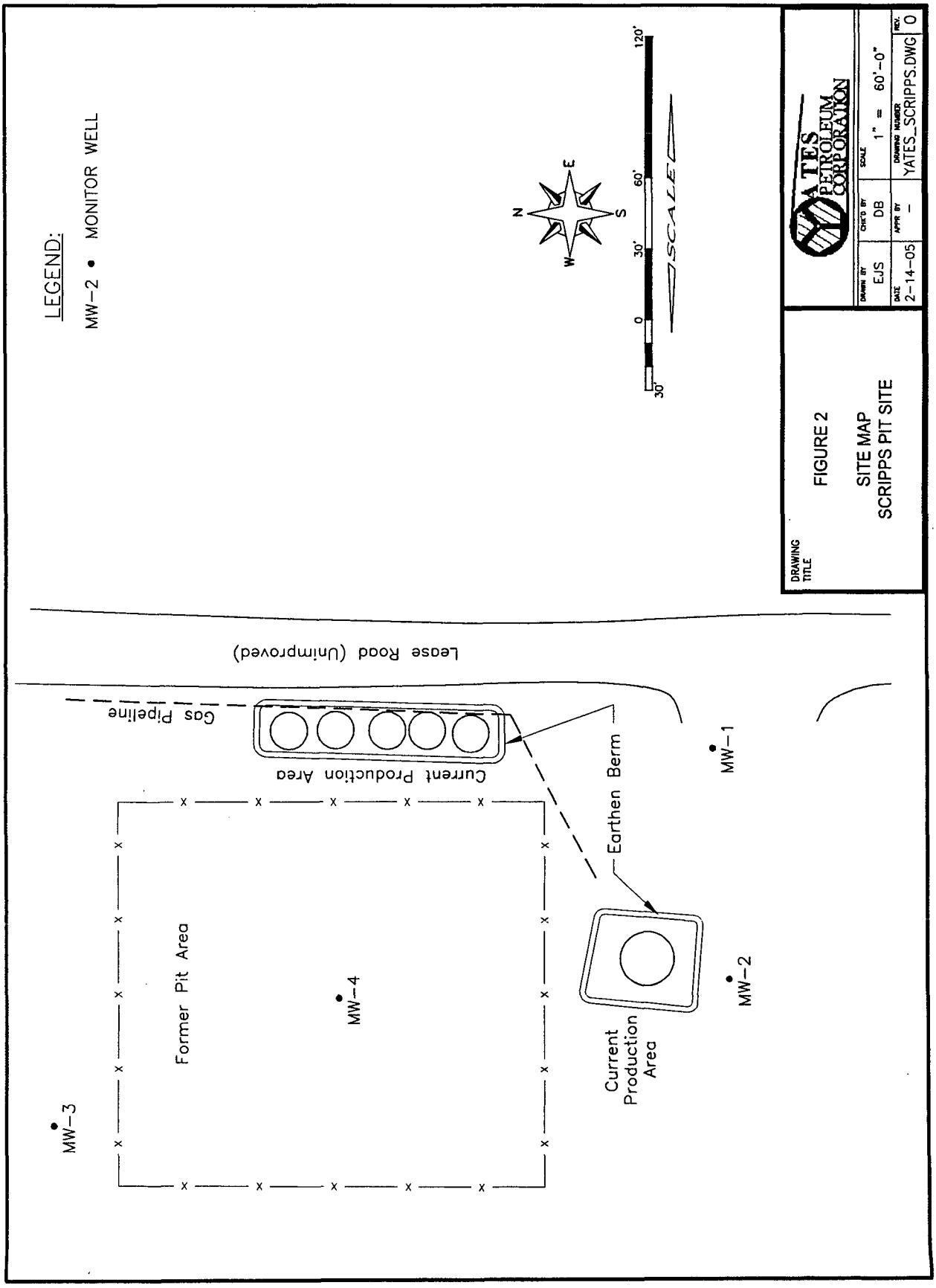
Sample Location	Date	Chloride (mg/L)	TDS (mg/L)	Benzene (mg/L)	Toluene (mg/L)	Ethyl-benzene (mg/L)	Total Xylenes (mg/L)
MW-1	09/19/02	8,150	18,400	<0.001	<0.001	<0.001	<0.001
	11/08/04	3,999	7,800	<0.002	<0.002	<0.002	<0.006
MW-2	09/19/02	6,560	14,800	<0.001	<0.001	<0.001	<0.001
	11/08/04	4,699	9,400	<0.002	<0.002	<0.002	<0.006
MW-3	09/19/02	4,700	10,700	<0.001	<0.001	<0.001	<0.001
	11/08/04	5,098	6,800	0.004	<0.002	<0.002	<0.006
MW-4	09/19/02	38,100	57,400	0.069	0.008	0.010	0.016
	11/08/04	32,990	44,400	0.051	<0.002	0.005	<0.006
NM WQCC Groundwater		250	1,000	0.010	0.750	0.750	0.650

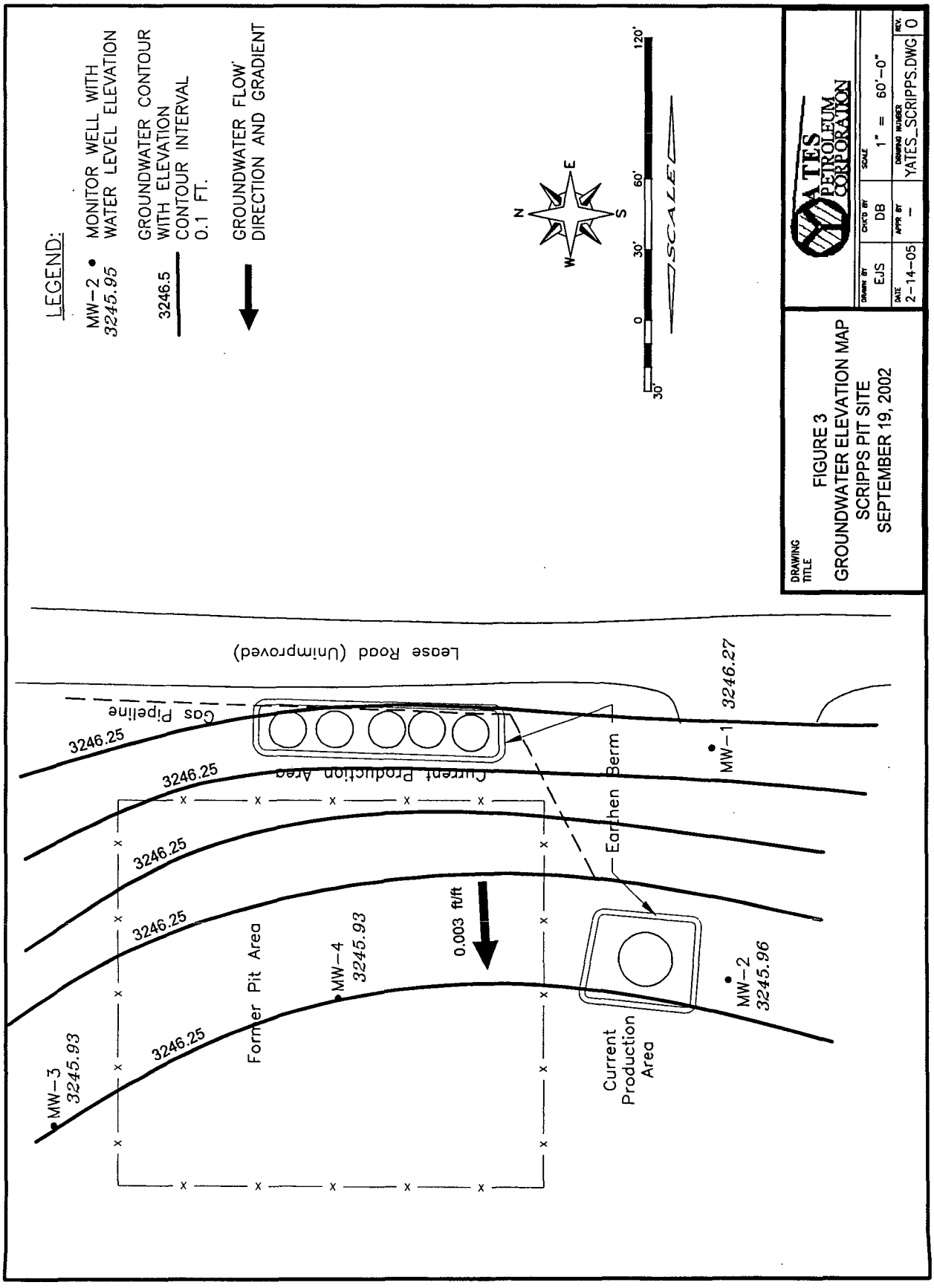
Figure 1. Vicinity Map, Scripps Pit Site

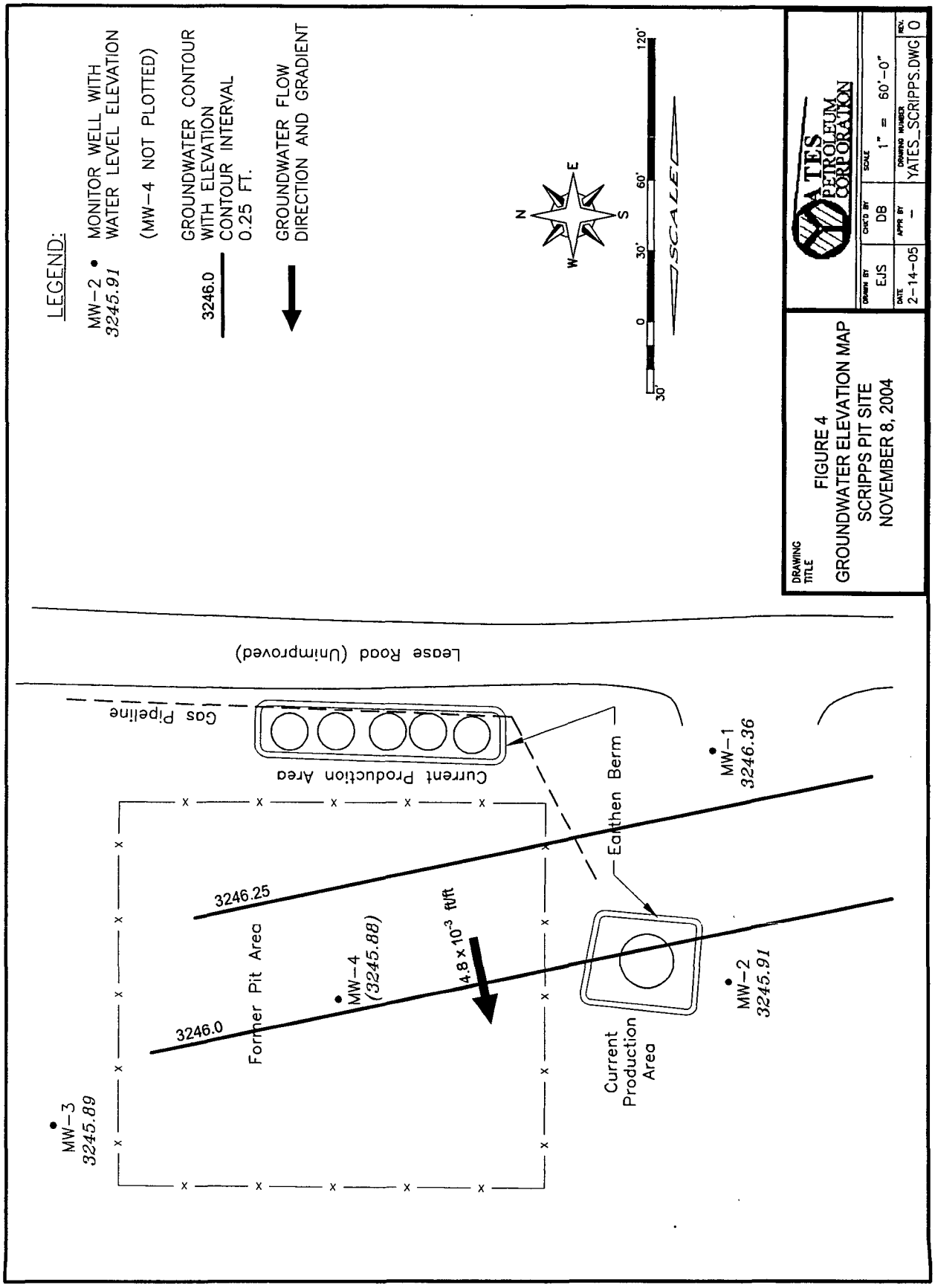


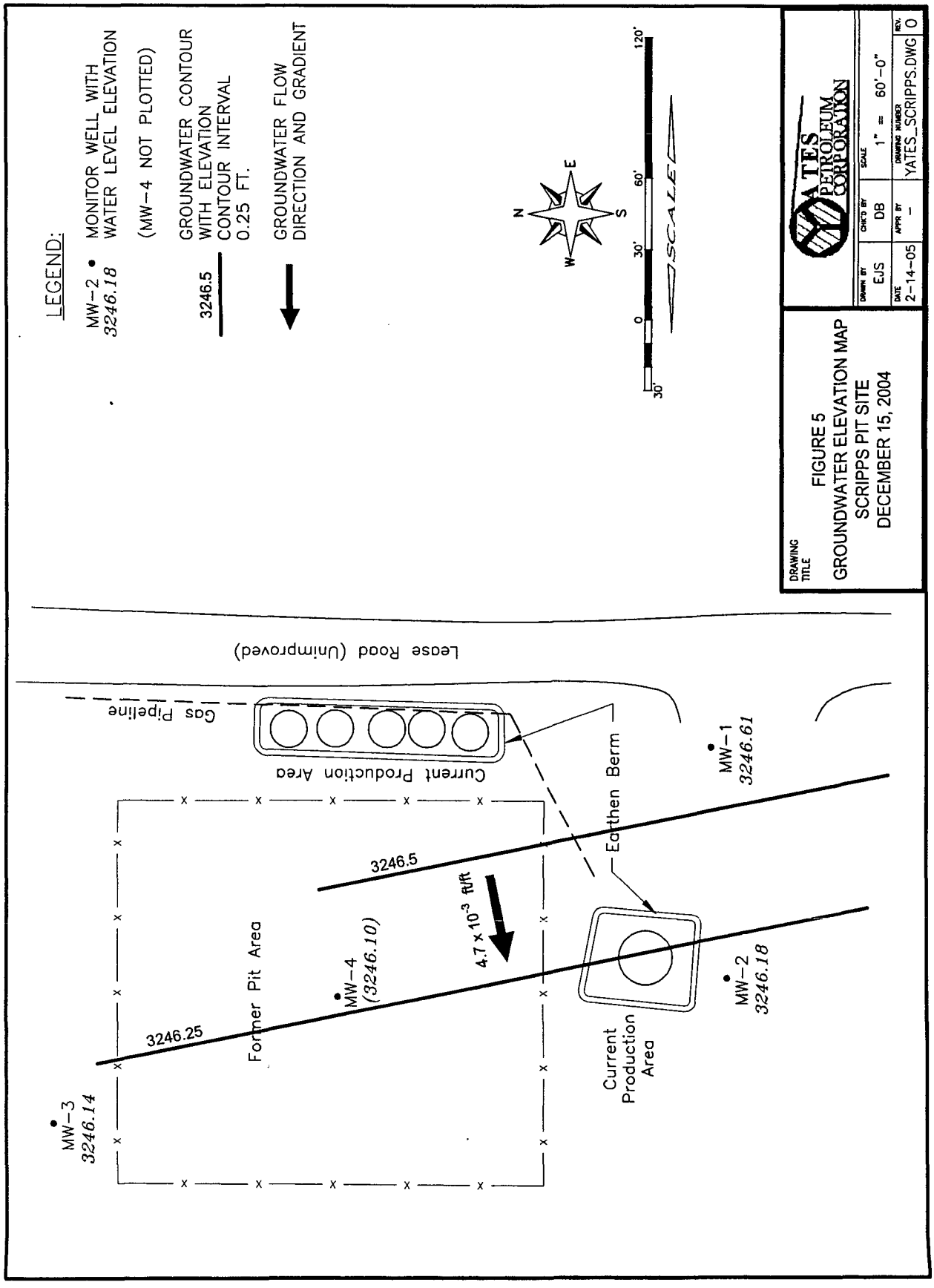
Name: LAKE MC MILLAN NORTH
Date: 1/28/105
Scale: 1 inch equals 2000 feet

Location: 032° 42' 46.9" N 104° 20' 32.8" W
Caption: Yates Petroleum
Sec 25, T18S, R26E
Eddy County, New Mexico


LEGEND:
MW-2 • MONITOR WELL
N
E
S
W
0
30'
60'
120'
SCALE
YATES PETROLEUM CORPORATION
DRAWN BY EJS
CHK'D BY DB
APPR BY -
SCALE 1" = 60'-0"
DRAWING NUMBER YATES_SCRIPPS.DWG
REV. 0
DATE 2-14-05
DRAWING TITLE
FIGURE 2
SITE MAP
SCRIPPS PIT SITE
Lease Road (Unimproved)
Gas Pipeline
Current Production Area
Earthen Berm
MW-1
MW-2
MW-3
MW-4
Former Pit Area
Current Production Area


LEGEND:
MW-2 • 3245.95 MONITOR WELL WITH WATER LEVEL ELEVATION
3246.5 GROUNDWATER CONTOUR WITH ELEVATION CONTOUR INTERVAL 0.1 FT.
GROUNDWATER FLOW DIRECTION AND GRADIENT
N
E
S
W
0
30'
60'
120'
SCALE
YATES PETROLEUM CORPORATION
DRAWN BY EJS
CHK'D BY DB
SCALE 1" = 60'-0"
DATE 2-14-05
APPR BY -
DRAWING NUMBER YATES_SCRIPPS.DWG
REV. 0
DRAWING TITLE
FIGURE 3
GROUNDWATER ELEVATION MAP
SCRIPPS PIT SITE
SEPTEMBER 19, 2002
Lease Road (Unimproved)
Gas Pipeline
Current Production Area
Earthen Berm
MW-1 3246.27
MW-2 3245.96
MW-3 3245.93
MW-4 3245.93
Former Pit Area
Current Production Area
0.003 ft/ft
3246.25
3246.25
3246.25
3246.25


LEGEND:
MW-2 • 3245.91 MONITOR WELL WITH WATER LEVEL ELEVATION
(MW-4 NOT PLOTTED)
3246.0 GROUNDWATER CONTOUR WITH ELEVATION CONTOUR INTERVAL 0.25 FT.
GROUNDWATER FLOW DIRECTION AND GRADIENT
N E S W
0 30' 60' 120'
SCALE
30'
YATES PETROLEUM CORPORATION
DRAWN BY EJS
CHK'D BY DB
SCALE 1" = 60'-0"
DATE 2-14-05
APPR. BY -
DRAWING NUMBER YATES_SCRIPPS.DWG
REV. 0
DRAWING TITLE
FIGURE 4
GROUNDWATER ELEVATION MAP
SCRIPPS PIT SITE
NOVEMBER 8, 2004
Lease Road (Unimproved)
Gas Pipeline
Current Production Area
Earthen Berm
MW-1 3246.36
3246.25
3246.0
Former Pit Area
MW-4 (3245.88)
4.8 x 10^-3 ft/ft
MW-2 3245.91
Current Production Area
MW-3 3245.89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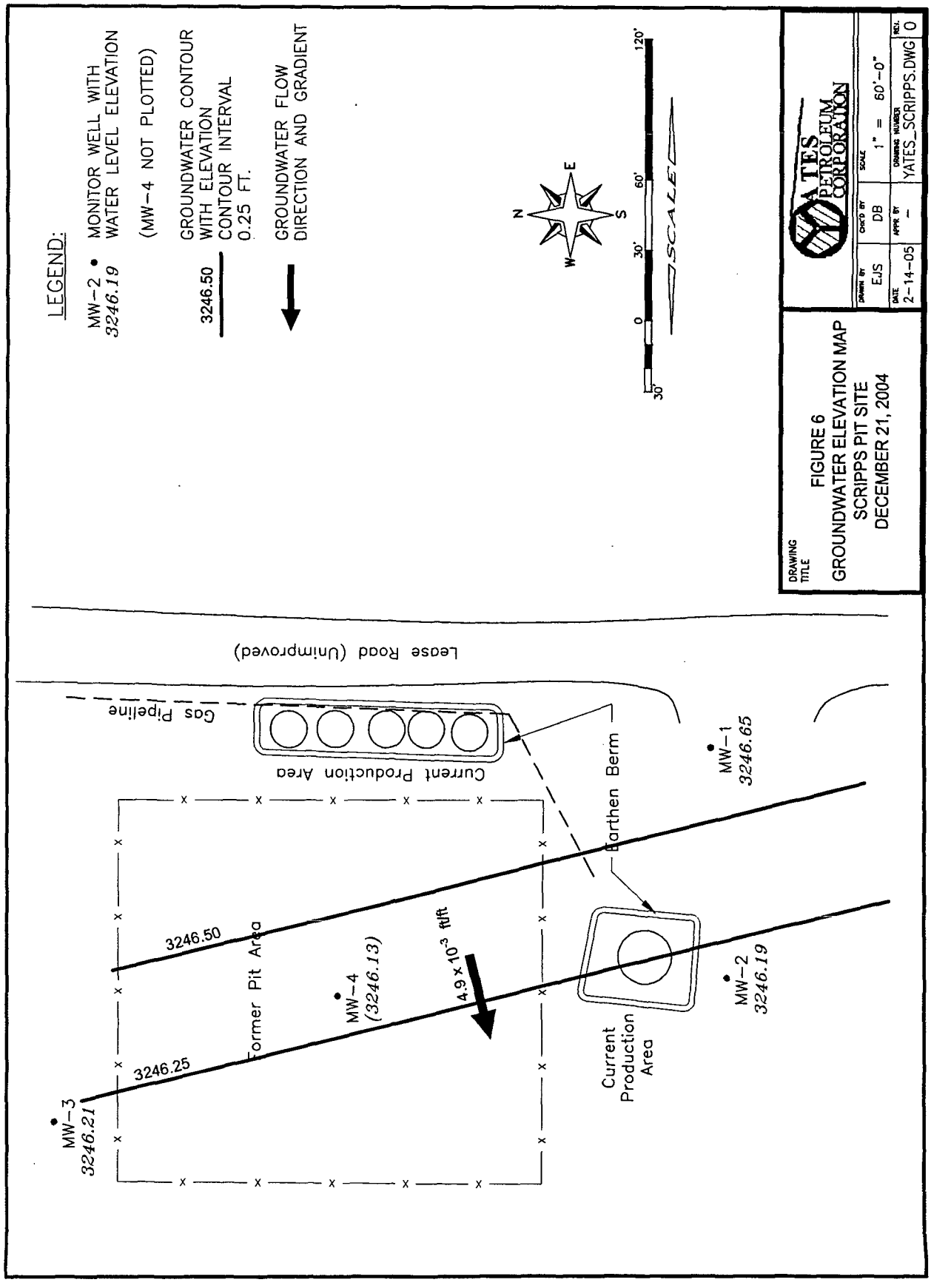
(MW-4 NOT PLOTTED)
3246.5 GROUNDWATER CONTOUR WITH ELEVATION CONTOUR INTERVAL 0.25 FT.
GROUNDWATER FLOW DIRECTION AND GRADIENT
N E S W
0 30' 60' 120'
SCALE
30'
YATES PETROLEUM CORPORATION
DRAWN BY EJS
CHK'D BY DB
APPR BY -
SCALE 1" = 60'-0"
DATE 2-14-05
DRAWING NUMBER YATES_SCRIPPS.DWG
REV. 0
DRAWING TITLE
FIGURE 5
GROUNDWATER ELEVATION MAP
SCRIPPS PIT SITE
DECEMBER 15, 2004
Lease Road (Unimproved)
Gas Pipeline
Current Production Area
Earthen Berm
MW-1 3246.61
3246.5
4.7 x 10-3 ft/ft
Former Pit Area
MW-4 (3246.10)
MW-2 3246.18
3246.25
Current Production Area
MW-3 3246.14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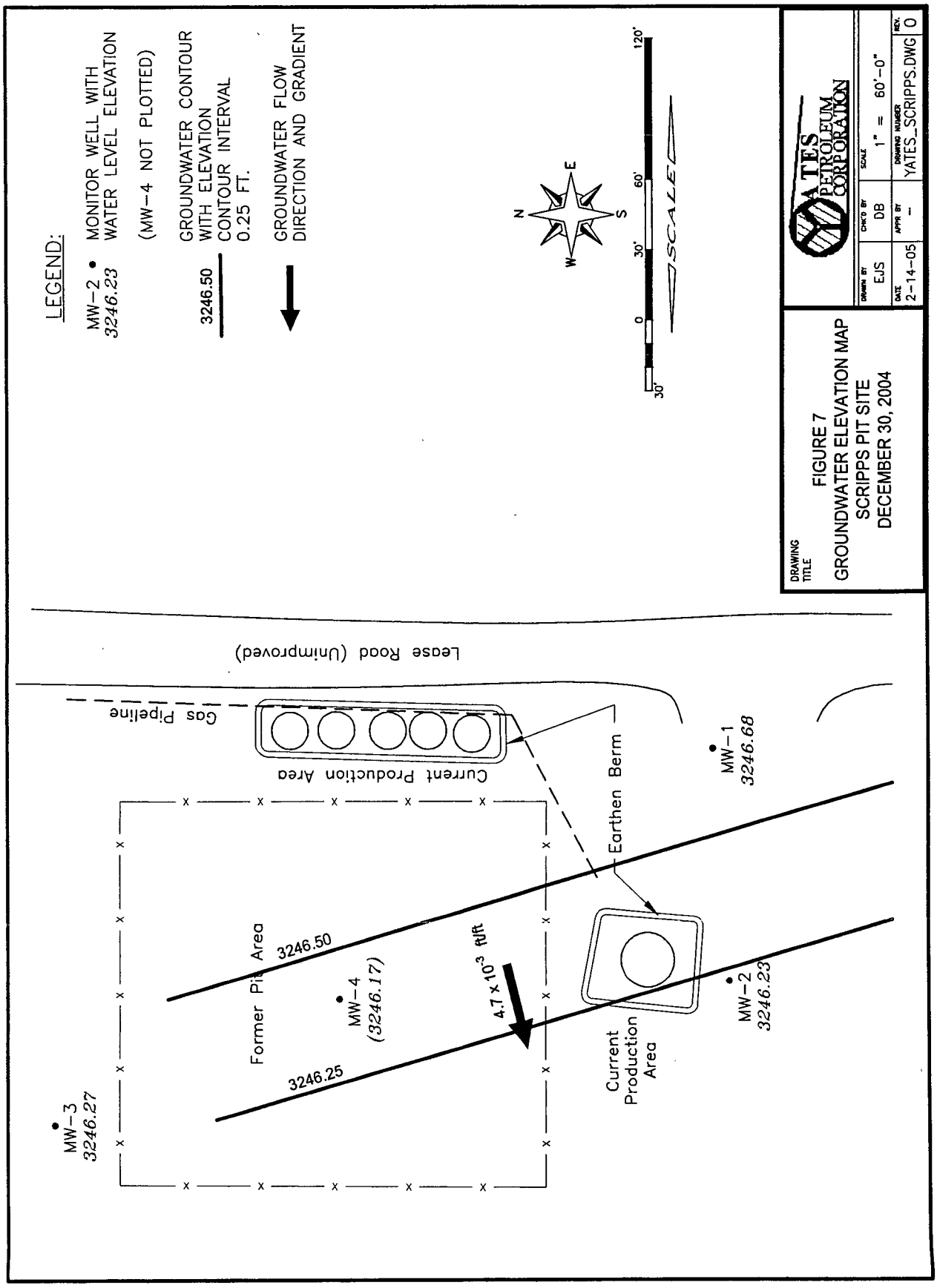
(MW-4 NOT PLOTTED)
3246.50 GROUNDWATER CONTOUR WITH ELEVATION CONTOUR INTERVAL 0.25 FT.
GROUNDWATER FLOW DIRECTION AND GRADIENT
N E S W
0 30' 60' 120'
SCALE
30
YATES PETROLEUM CORPORATION
DRAWN BY EJS
CHK'D BY DB
SCALE 1" = 60'-0"
DATE 2-14-05
APPR BY -
DRAWING NUMBER YATES_SCRIPPS.DWG
REV. 0
DRAWING TITLE
FIGURE 6
GROUNDWATER ELEVATION MAP
SCRIPPS PIT SITE
DECEMBER 21, 2004
Lease Road (Unimproved)
Gas Pipeline
Current Production Area
Earthen Berm
MW-1 3246.65
MW-2 3246.19
MW-3 3246.21
MW-4 (3246.13)
Former Pit Area
3246.50
3246.25
4.9 x 10-3 ft/ft
Current Production Area


LEGEND:
MW-2 • 3246.23 MONITOR WELL WITH WATER LEVEL ELEVATION
(MW-4 NOT PLOTTED)
3246.50 GROUNDWATER CONTOUR WITH ELEVATION CONTOUR INTERVAL 0.25 FT.
GROUNDWATER FLOW DIRECTION AND GRADIENT
N E S W
SCALE
0 30' 60' 120'
30'
YATES PETROLEUM CORPORATION
DRAWN BY EJS
CHK'D BY DB
SCALE 1" = 60'-0"
DATE 2-14-05
APPR BY -
DRAWING NUMBER YATES_SCRIPPS.DWG
REV. 0
DRAWING TITLE
FIGURE 7
GROUNDWATER ELEVATION MAP
SCRIPPS PIT SITE
DECEMBER 30, 2004
Lease Road (Unimproved)
Gas Pipeline
Current Production Area
Earthen Berm
MW-1 3246.68
MW-2 3246.23
MW-3 3246.27
MW-4 (3246.17)
Former Pit Area
3246.50
3246.25
4.7 x 10^-3 ft/ft
Current Production Area