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REPORTS

DATE:

June, 2001

CLOSURE REQUEST REPORT
OHIO "C" GOVERNMENT WELL #3 SITE
SECTION 26, T28N, R11W
SAN JUAN COUNTY, NEW MEXICO

RECEIVED

JUN 29 2001

ENVIRONMENTAL BUREAU
OIL CONSERVATION DIVISION

Prepared for:

Marathon Oil Company
P.O. Box 552
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Prepared by:

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June 2001

1.0 Introduction

1.1 Site Background

The Ohio "C" Government Well #3 site is located in Kutz Canyon, which falls in Section 26, Township 28 North, Range 11 West, San Juan County, New Mexico, approximately 5 miles south-southeast of Bloomfield, New Mexico (Figure 1). The property is operated by Marathon Oil Company (Marathon).

1.2 Site History

Historic drilling activities at the site resulted in hydrocarbon-impacted wastes and drilling fluids being disposed into three unlined pits. El Paso Field Services (EPFS) constructed two of the pits, and one pit was constructed by Marathon Oil. The three pits in aggregate resulted in groundwater contamination.

In 1995, EPFS overexcavated the area of the two pits, removed around 1,200 cubic yards of soil for landfarming, and backfilled the excavation. Soil and groundwater investigations in 1996 confirmed the presence of benzene in groundwater downgradient of the former pits at concentrations exceeding the New Mexico Water Quality Control Commission (NMWQCC) regulatory standard of 10 micrograms per liter (µg/L).

In 1997 monitoring well MW-1 was installed within the footprint of the El Paso Energy pit and groundwater samples were collected quarterly for one year. During all four sampling events, benzene, toluene, ethylbenzene, and xylenes (BTEX) concentrations were reported below laboratory detection limits.

Marathon Oil overexcavated their pit in1998, transported the soil for landfarming, and backfilled the pit with clean soil. Groundwater investigations downgradient of monitoring well MW-1 revealed that dissolved-phase hydrocarbons were present in groundwater.

Monitoring wells MW-2 through MW-5 were installed downgradient of monitoring well MW-1 in 1999 (Figure 2). To determine if natural attenuation was occurring in groundwater, groundwater samples collected in 1999 were analyzed for natural attenuation parameters. Quarterly groundwater sampling of all wells for analysis of BTEX was completed in June, September and December 2000, and March 2001.

1.3 Site Geology

The site geology consists of sands, silts and trace amounts of clays. These sediments appear to overlie sandstone to a depth of at least 20 feet bgs. The site surface drainage and groundwater flow direction is to the north/north-east.

2.0 Groundwater Monitoring Results

Figures 3 through 5 summarize the values of benzene detected at all site wells for the 1999 to 2001 sampling events. MW-4 slightly exceeded NMWQCC cleanup criteria in December 1999. Benzene was present in MW-5 at concentrations exceeding the NMWQCC cleanup criteria in the last four sample events. Sample analytical results and groundwater elevation data collected from 1999 to 2001 are summarized in tables and figures in Appendix A.

The natural attenuation parameter analyses completed for groundwater samples collected in August and December 1999 suggest strong secondary evidence for natural attenuation. Natural attenuation data is summarized in Table B-1 in Appendix B.

3.0 Recommendations

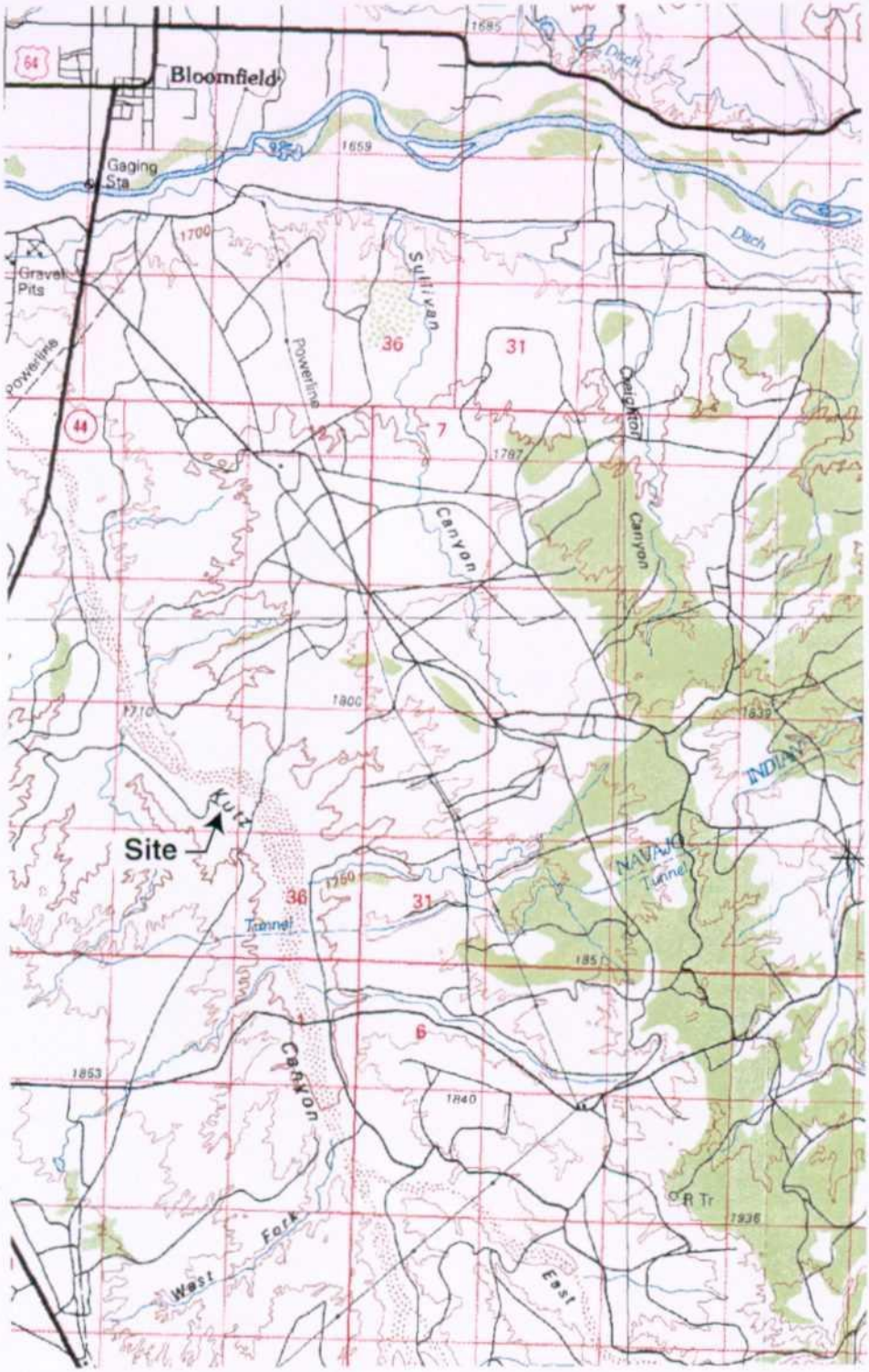
El Paso Energy has requested closure for MW-1 based on non-detect results for all BTEX analytes (El Paso, 2001).

The groundwater contaminant source at the site was removed by 1998. In all wells but MW-5, benzene levels are below the NMWQCC limit. Sampling results at MW-5 show a trend toward the limit over time. Compelling evidence of ongoing dissolved-phase biodegradation is documented in Appendix B of this report. Based on the results of groundwater monitoring activities, IT is recommending site closure.

4.0 References

El Paso Field Services, March 20, 2001, EPFS Groundwater Pits 2000 Annual Groundwater Report, Ohio C Govt #3, Meter/Line 72890.

FIGURES



Topographic base from Navajo Reservoir, NM 1:100,000

IT CORPORATION	DRAWN BY: Z. Carpio — DATE: 6/13/01 CHECKED BY: T. Woodard — DATE: 6/13/01 APPROVED BY: T. Woodard — DATE: 6/13/01 PROJECT MANAGER: — DATE: 6/13/01 SCALE:	Figure 1 Site Location Map Ohio C Government Well #3 - Marathon Oil Company IT PROJECT No. / Drawing No.: 827834.01.00.00.00 A8

06/13/01

Kutz Canyon

5600

LOCATOR MAP

5600

POWER POLE

METER POLE

MW-2

MW-5

MW-4

PRODUCTION WELLHEAD

FORMER PIT (Marathon)

DEHYDRATOR

TANKS

METER HOUSE

SUMP

MW-1

SUMP

ACCESS ROAD

FORMER PIT #1 (El Paso Energy)

FORMER PIT #2 (El Paso Energy)

N

0 100 200 FT

SCALE

LEGEND

Groundwater flow direction

Monitoring well

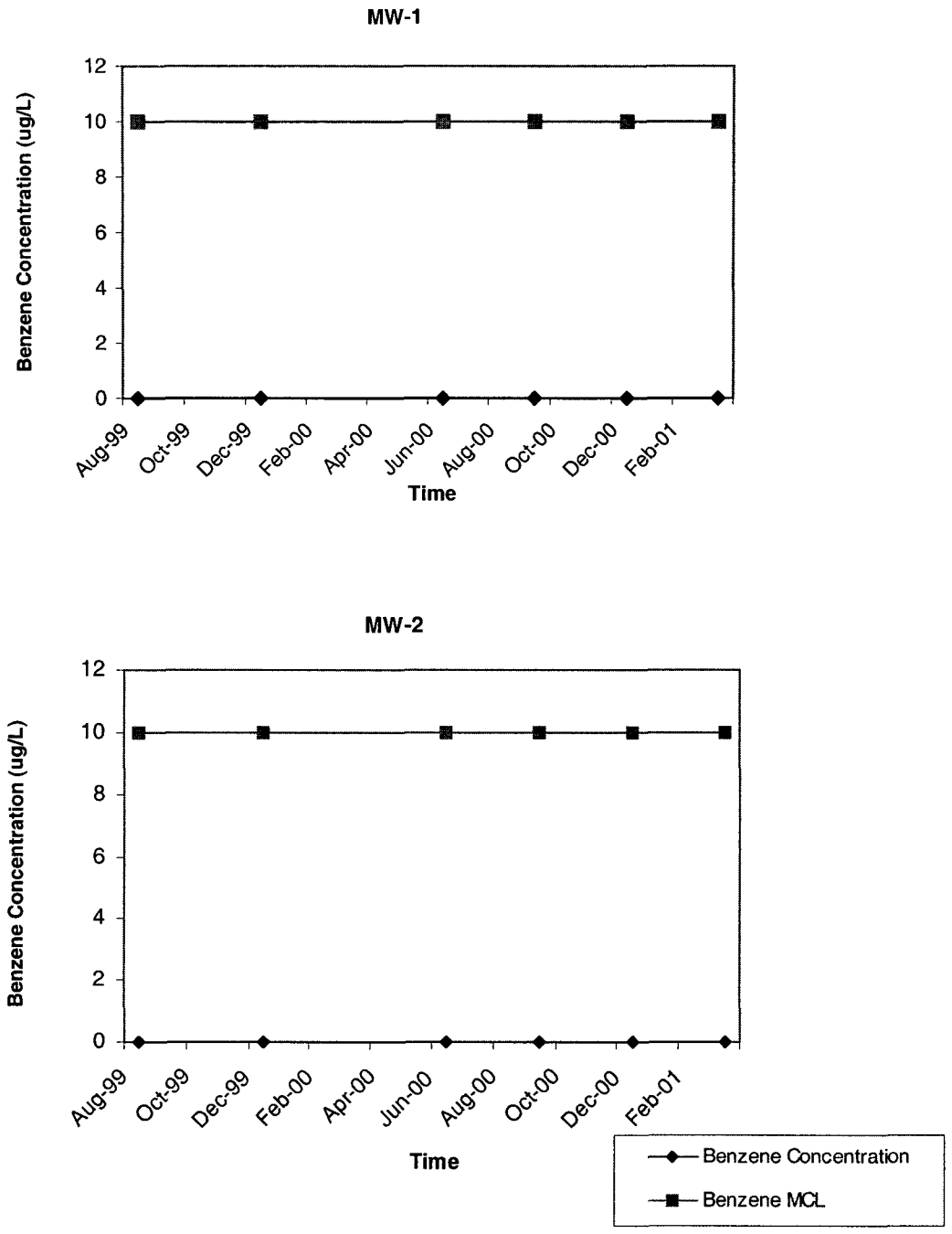
Contour interval = 20 ft.

Topographic base from USGS Bloomfield, NM 7.5 Quad, 1985

06/12/01

IT CORPORATION

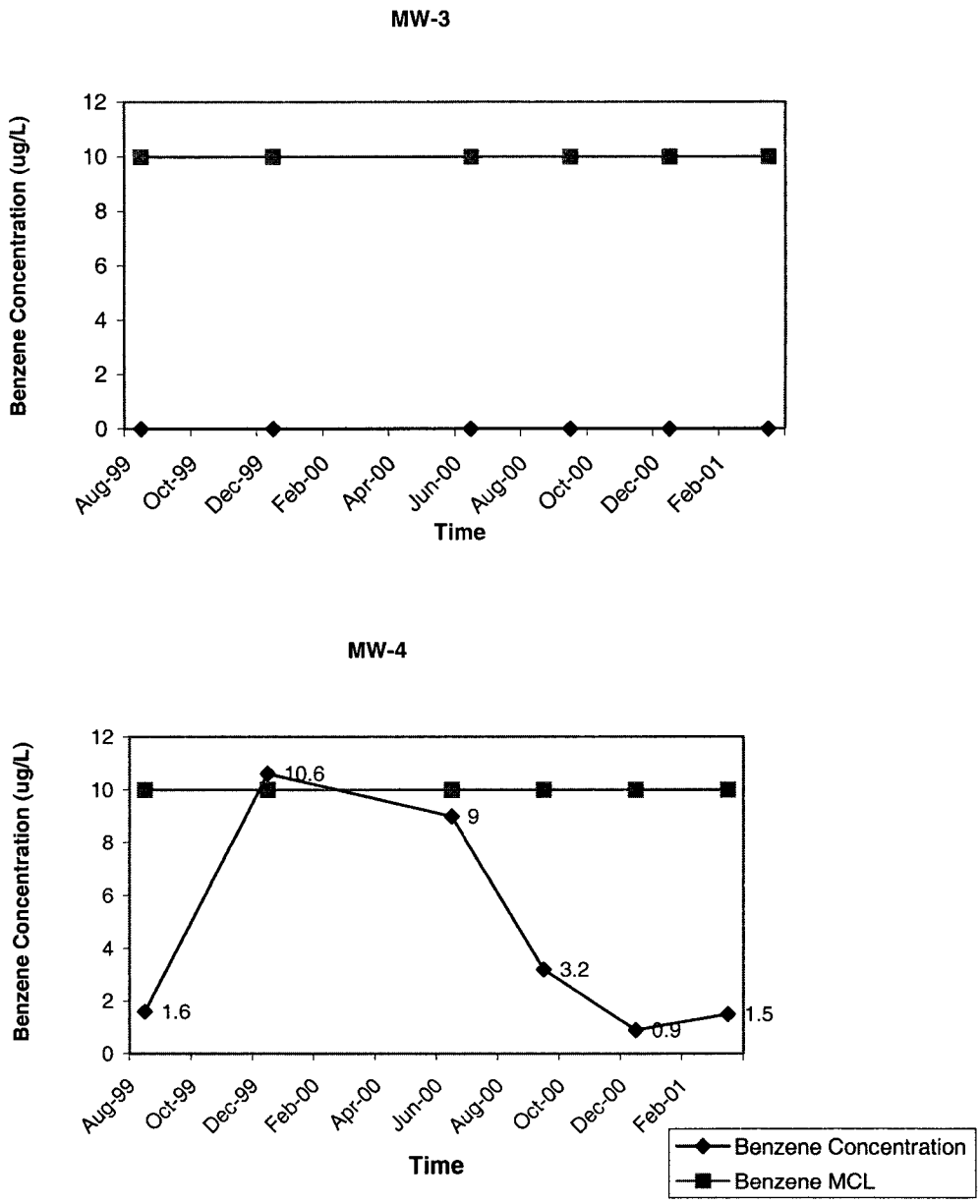
DRAWN BY: Z. Carpio	DATE: 6/11/01	Figure 2 Ohio C Government Well #3 - Remediation Activities Marathon Oil Company
CHECKED BY: T. Woodard	DATE: 6/11/01	
APPROVED BY: T. Woodard	DATE: 6/11/01	
PROJECT MANAGER: —	DATE: 6/11/01	
SCALE: 1" = 200'		IT PROJECT No. / Drawing No.: 827834.01.00.00.00 B1



Note:

1. Benzene concentrations reported below the detection limit were provided the value "0" for plotting

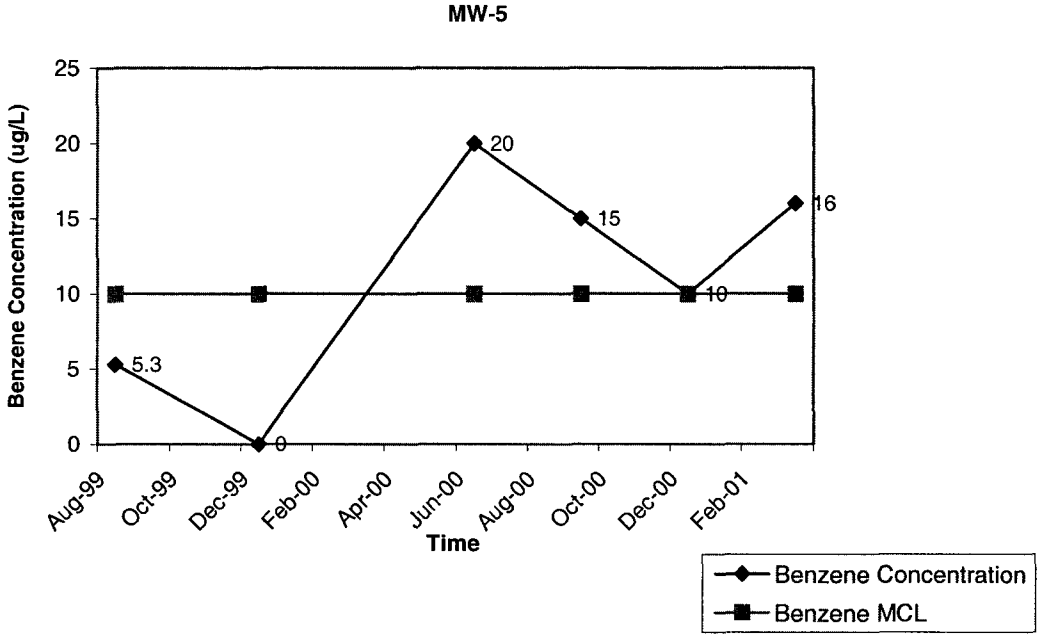
Figure 3
Benzene Concentrations vs Time Plot, MW-1 and MW-2



Note:

1. Benzene concentrations reported below the detection limit were provided the value "0" for plotting

Figure 4
Benzene Concentrations vs Time Plot, MW-3 and MW-4



Note:

1. Benzene concentrations reported below the detection limit were provided the value "0" for plotting

Figure 5
Benzene Concentrations vs Time Plot, MW-5

APPENDIX A
ANALYTICAL AND GROUNDWATER ELEVATION DATA

Table A-1

Summary of Analytical Groundwater Sample Results (1999–2001)

Ohio "C" Government Well #3, Marathon Oil Co., San Juan County, New Mexico

Constituent	NMWQCC Standard	SAMPLE LOCATION AND DATE OF SAMPLING														
		MW-1						MW-2						MW-3		
		8/31/99	12/8/99	6/1/00	9/6/00	12/4/00	3/20/01	8/31/99	12/8/99	6/1/00	9/6/00	12/4/00	3/20/01	8/31/99	12/8/99	6/1/00
BTEX																
Benzene	10	<0.3	<5	<0.5	<0.5	<0.5	<0.5	<0.3	<5	<0.5	<0.5	<0.5	<0.5	<0.3	<5	<0.5
Toluene	750	<0.3	<5	<0.5	<0.5	<0.5	<0.5	<0.3	<5	<0.5	<0.5	<0.5	<0.5	<0.3	<5	<0.5
Ethylbenzene	750	<0.3	<5	<0.5	<0.5	<0.5	<0.5	<0.3	<5	<0.5	<0.5	<0.5	<0.5	<0.3	<5	<0.5
Total Xylenes	620	<0.6	<10	<0.5	<0.5	<0.5	<0.5	<0.6	<10	<0.5	<0.5	<0.5	<0.5	<0.6	<10	<0.5
Total BTEX	NE	NA	NA	NA	NA	NA	NA	<1.5	NA	NA	NA	NA	NA	<1.5	NA	NA
MTBE	100	<10	NA	NA	NA	NA	NA	<10	NA	NA	NA	NA	NA	<10	NA	NA
PAH																
Acenaphthene	NE	<18	<5	NA	NA	NA	NA	<18	<5	NA	NA	NA	NA	<18	<5	NA
Acenapthylene	NE	<23	<5	NA	NA	NA	NA	<23	<5	NA	NA	NA	NA	<23	<5	NA
Anthracene	NE	<6.6	<1	NA	NA	NA	NA	<6.6	<1	NA	NA	NA	NA	<6.6	<1	NA
Benzo(a)anthracene	NE	<.13	<0.1	NA	NA	NA	NA	<0.13	<0.1	NA	NA	NA	NA	<0.13	<0.1	NA
Benzo(a) pyrene	0.7	<0.23	<0.1	NA	NA	NA	NA	<0.23	<0.1	NA	NA	NA	NA	<0.23	<0.1	NA
Benzo(b)fluoranthene	NE	<0.18	<0.1	NA	NA	NA	NA	<0.18	<0.1	NA	NA	NA	NA	<0.18	<0.1	NA
Benzo(g,h,i)perylene	NE	<0.76	<0.1	NA	NA	NA	NA	<0.76	<0.1	NA	NA	NA	NA	<0.76	<0.1	NA
Benzo(k)fluoranthene	NE	<0.17	<0.1	NA	NA	NA	NA	<0.17	<0.1	NA	NA	NA	NA	<0.17	<0.1	NA
Chrysene	NE	<1.5	<1	NA	NA	NA	NA	<1.5	<1	NA	NA	NA	NA	<1.5	<1	NA
Dibenzo(a,h)anthracene	NE	<0.3	<0.1	NA	NA	NA	NA	<0.3	<0.1	NA	NA	NA	NA	<0.3	<0.1	NA
Fluoranthene	NE	<2.1	<1	NA	NA	NA	NA	<2.1	<1	NA	NA	NA	NA	<2.1	<1	NA
Fluorene	NE	<2.1	<1	NA	NA	NA	NA	<2.1	<1	NA	NA	NA	NA	<2.1	<1	NA
Indeno(1,2,3-cd)pyrene	NE	<0.43	<0.1	NA	NA	NA	NA	<0.43	<0.1	NA	NA	NA	NA	<0.43	<0.1	NA
Napthalene	NE	<18	<5	NA	NA	NA	NA	<18	<5	NA	NA	NA	NA	<18	<5	NA
Phenanthrene	NE	<6.4	<1	NA	NA	NA	NA	<6.4	<1	NA	NA	NA	NA	<6.4	<1	NA
Pyrene	NE	<2.7	<1	NA	NA	NA	NA	<2.7	<1	NA	NA	NA	NA	<2.7	<1	NA

Notes:

1. NMWQCC Standard indicates the maximum levels established by the New Mexico Water Quality Control Commission.
2. All concentrations are provided in micrograms per liter (ug/L).
3. NE indicates not established; NA indicates not analyzed.
4. MTBE indicates methyl-tert-butyl-ether; PAH indicates polynucleaur aromatic hydrocarbons.
4. Bolded print indicates that the concentration exceeds the NMWQCC Standard.

Table A-1 *(Continued)*

Summary of Analytical Groundwater Sample Results
(1999–2001)
Ohio "C" Government Well #3, Marathon Oil Co., San Juan County, New Mexico

Constituent	NMWQCC Standard	SAMPLE LOCATION AND DATE OF SAMPLING															
		MW-3			MW-4						MW-5						
		9/6/00	12/4/00	3/20/01	8/31/99	12/8/99	6/1/00	9/6/00	12/4/00	3/20/01	8/31/99	12/8/99	6/1/00	9/6/00	12/4/00	3/20/01
BTEX																	
Benzene	10	<0.5	<0.5	<0.5	1.6	**10.6**	9	3.2	0.9	1.5	5.3	<5	**20**	**15**	**10**	**16**
Toluene	750	<0.5	<0.5	<0.5	<0.3	<5	<0.5	<0.5	<0.5	<0.5	<0.3	<5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	750	<0.5	<0.5	<0.5	5.5	23.4	9.5	9.3	3.3	4.9	1.1	<5	30	24	22	37
Total Xylenes	620	<0.5	<0.5	<0.5	61	67.9	14	12	4.8	8	44	<10	86	78	65	31
Total BTEX	NE	NA	NA	NA	68.1	101.9	32.5	24.5	9	14.4	50.4	NA	136	117	97	84
MTBE	100	NA	NA	NA	<10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAH																	
Acenaphthene	NE	NA	NA	NA	<18	<5	NA	NA	NA	NA	<18	<5	NA	NA	NA	NA
Acenapthylene	NE	NA	NA	NA	<23	<5	NA	NA	NA	NA	<23	<5	NA	NA	NA	NA
Anthracene	NE	NA	NA	NA	<6.6	<1	NA	NA	NA	NA	<6.6	<1	NA	NA	NA	NA
Benzo(a)anthracene	NE	NA	NA	NA	<0.13	<0.1	NA	NA	NA	NA	<0.13	<0.1	NA	NA	NA	NA
Benzo(a) pyrene	0.7	NA	NA	NA	<0.23	<0.1	NA	NA	NA	NA	<0.23	<0.1	NA	NA	NA	NA
Benzo(b)fluoranthene	NE	NA	NA	NA	<0.18	<0.1	NA	NA	NA	NA	<0.18	<0.1	NA	NA	NA	NA
Benzo(g,h,i)perylene	NE	NA	NA	NA	<0.76	<0.1	NA	NA	NA	NA	<0.76	<0.1	NA	NA	NA	NA
Benzo(k)fluoranthene	NE	NA	NA	NA	<0.17	<0.1	NA	NA	NA	NA	<0.17	<0.1	NA	NA	NA	NA
Chrysene	NE	NA	NA	NA	<1.5	<1	NA	NA	NA	NA	<1.5	<1	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NE	NA	NA	NA	<0.3	<0.1	NA	NA	NA	NA	<0.3	<0.1	NA	NA	NA	NA
Fluoranthene	NE	NA	NA	NA	<2.1	<1	NA	NA	NA	NA	<2.1	<1	NA	NA	NA	NA
Fluorene	NE	NA	NA	NA	<2.1	<1	NA	NA	NA	NA	<2.1	204	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NE	NA	NA	NA	<0.43	<0.1	NA	NA	NA	NA	<0.43	<0.1	NA	NA	NA	NA
Napthalene	NE	NA	NA	NA	<18	<5	NA	NA	NA	NA	<18	954	NA	NA	NA	NA
Phenanthrene	NE	NA	NA	NA	<6.4	<1	NA	NA	NA	NA	<6.4	<1	NA	NA	NA	NA
Pyrene	NE	NA	NA	NA	<2.7	<1	NA	NA	NA	NA	<2.7	40.8	NA	NA	NA	NA

Notes:

1. NMWQCC Standard indicates the maximum levels established by the New Mexico Water Quality Control Commission.
2. All concentrations are provided in micrograms per liter (ug/L).
3. NE indicates not established; NA indicates not analyzed.
4. MTBE indicates methyl-tert-butyl-ether; PAH indicates polynucleaur aromatic hydrocarbons.
4. Bolded print indicates that the concentration exceeds the NMWQCC Standard.

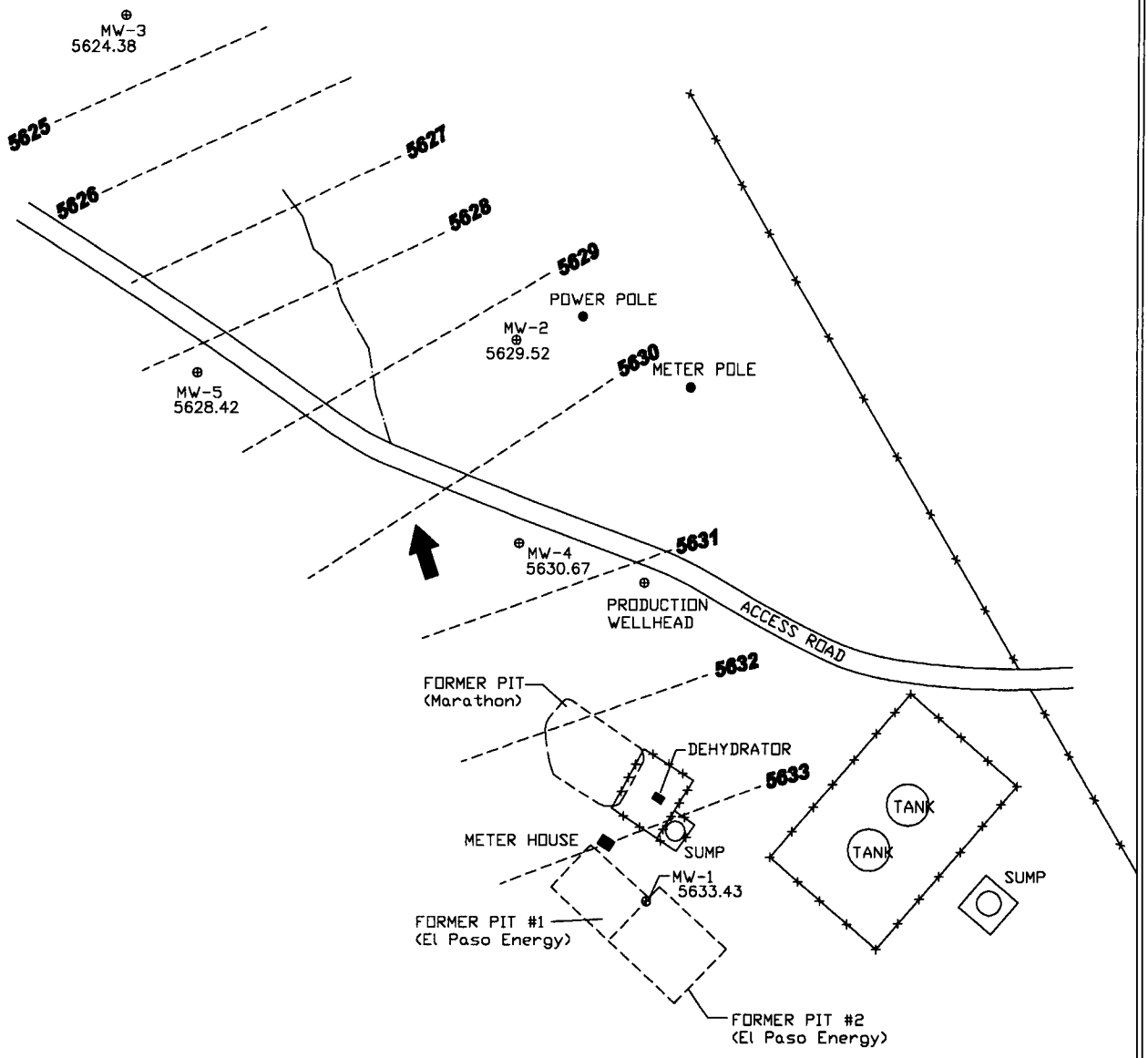
Table A-2

Summary of Groundwater Elevation Data (1999–2001)

Well ID	Depth to Bottom	Ground surface Elevation	TOC Elevation	8/31/99		12/8/99		6/1/00		9/6/00		12/4/00		3/20/01	
				DTW	GW Elev.	DTW	GW Elev.	DTW	GW Elev.	DTW	GW Elev.	DTW	GW Elev.	DTW	GW Elev.
MW-1	21.6	5,643.79	5,646.58	13.15	5,633.43	13.28	5,633.30	12.98	5,633.60	13.09	5,633.49	13	5,633.58	12.9	5,633.68
MW-2	16.64	5,637.91	5,639.94	10.42	5,629.52	10.6	5629.34	10.54	5629.4	10.61	5629.33	10.56	5629.38	10.51	5629.43
MW-3	21.4	5,634.49	5,636.18	14.8	5,621.38	14.48	5621.7	14.08	5622.1	14.18	5622	14.05	5622.13	13.93	5622.25
MW-4	20.3	5,639.31	5,641.14	10.47	5,630.67	10.73	5630.41	10.52	5630.62	10.65	5630.49	10.66	5630.48	10.57	5630.57
MW-5	21.7	5,642.31	5,644.24	15.82	5,628.42	16.02	5628.22	15.99	5628.25	15.98	5628.26	15.9	5628.34	15.88	5628.36

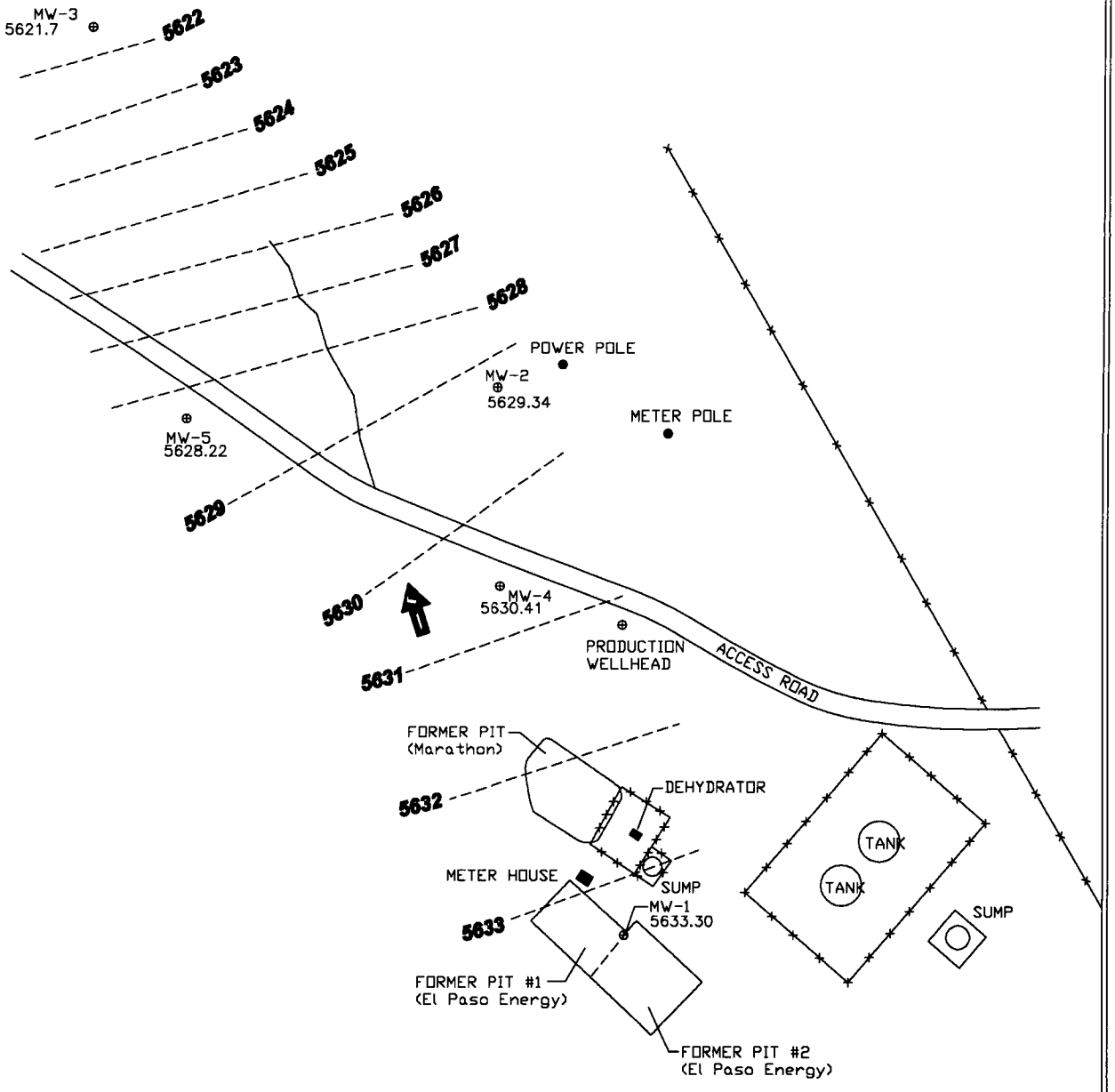
Notes:

1. Ground surface elevations assumed from topographic map.
2. TOC indicates top of casing.
3. GW indicates groundwater elevation relative to top of casing elevation.



IT CORPORATION	DRAWN BY: Z. CARPIO — DATE: 05/21/01 CHECKED BY: T. WOODARD — DATE: 05/21/01 APPROVED BY: T. WOODARD — DATE: 05/21/01 PROJECT MANAGER: — DATE: 05/21/01 SCALE: AS NOTED	**Figure A-1** **Groundwater Elevation Data** **Ohio "C" Government Well #3 Site** **August 31, 1999** **Marathon Oil Company** IT PROJECT No. / Drawing No.: 827834.01.00.00.00/A2

10/06/99



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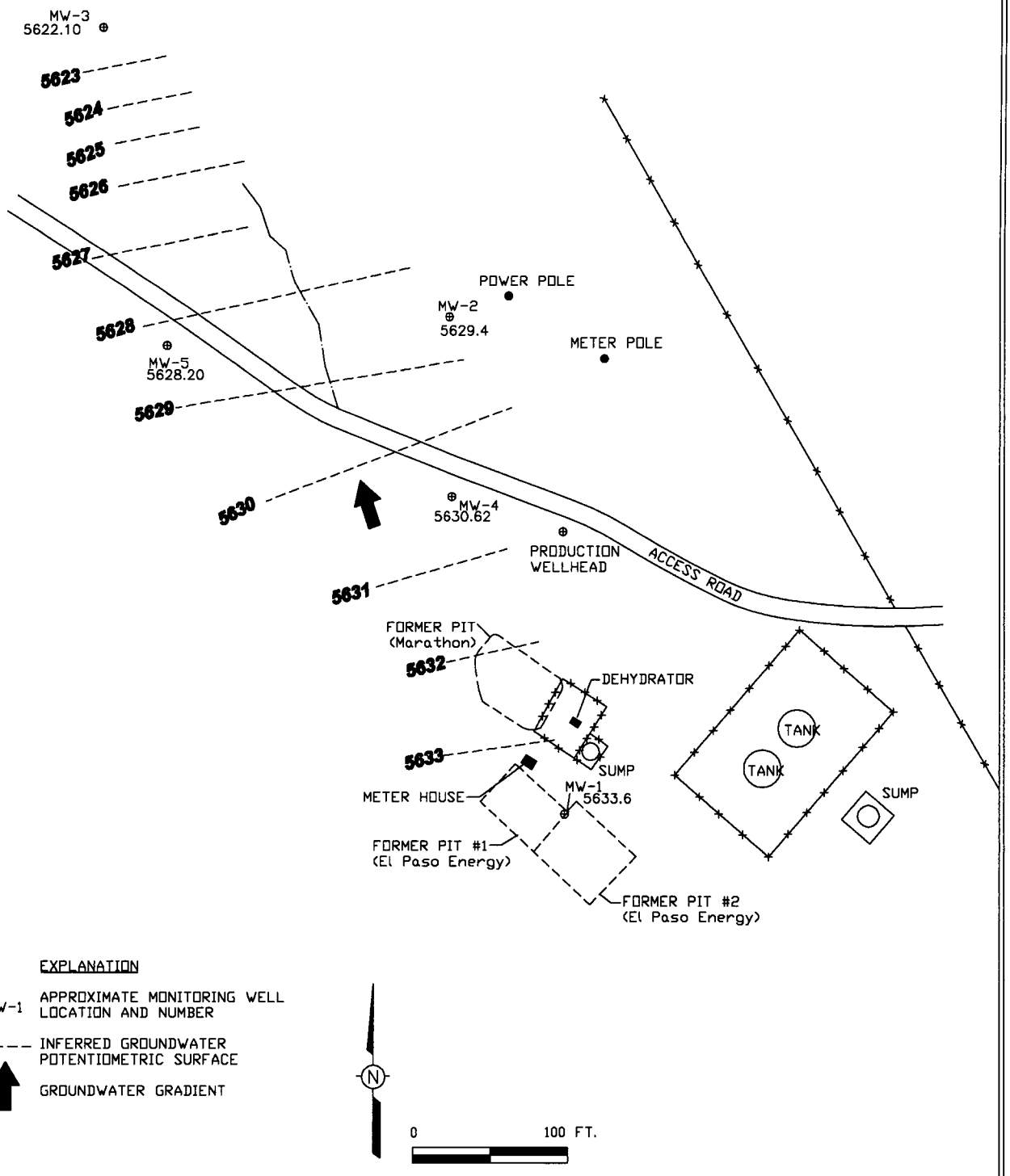
10/06/99



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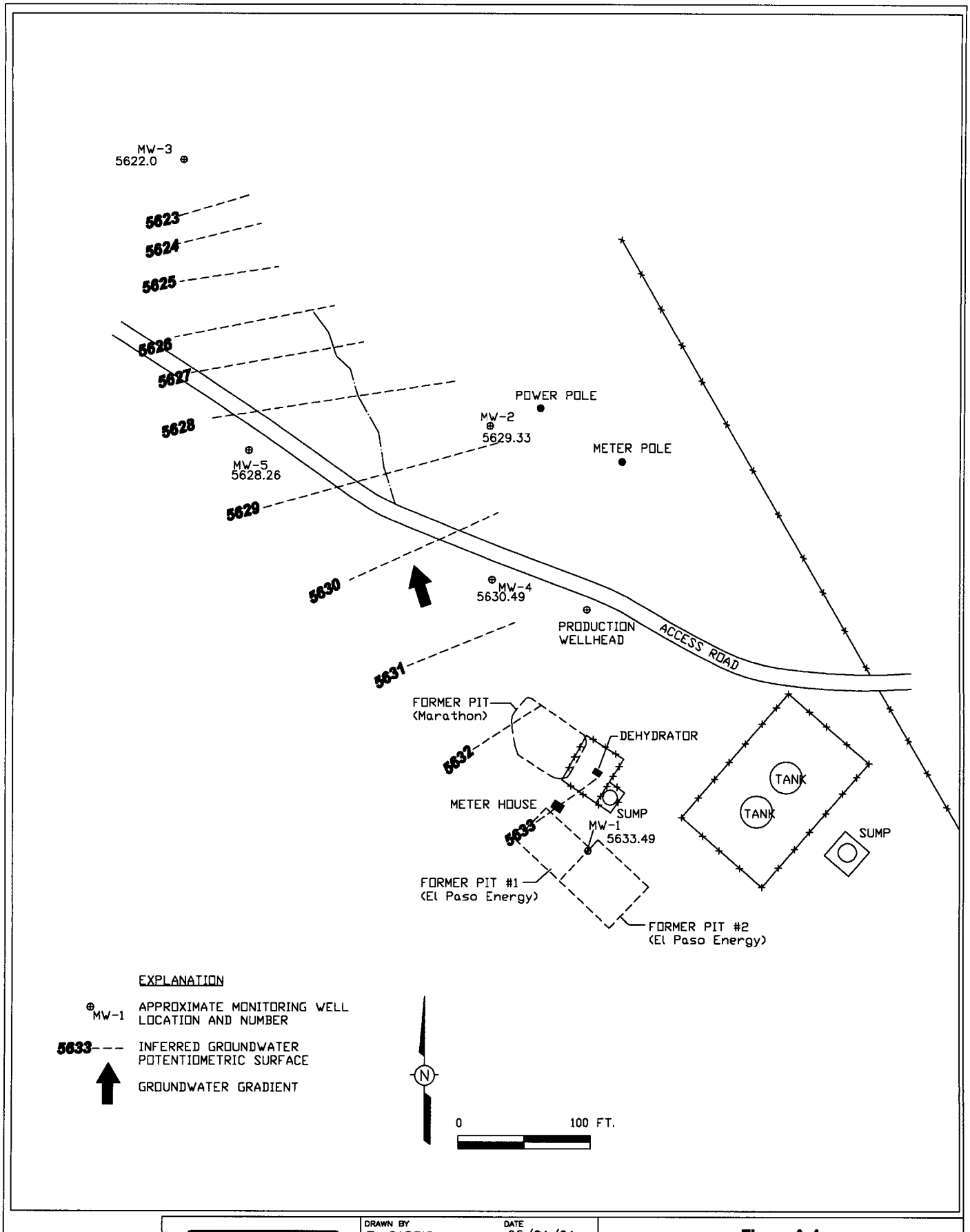
10/06/99



IT CORPORATION	DRAWN BY Z. CARPIO — DATE 05/21/01 CHECKED BY T. WOODARD — DATE 05/21/01 APPROVED BY T. WOODARD — DATE 05/21/01 PROJECT MANAGER — DATE 05/21/01 SCALE AS NOTED	**Figure A-4** **Groundwater Elevation Data** **Ohio "C" Government Well #3 Site** **September 6, 2000** **Marathon Oil Company** IT PROJECT No. / Drawing No. 827834.01.00.00.00/A5

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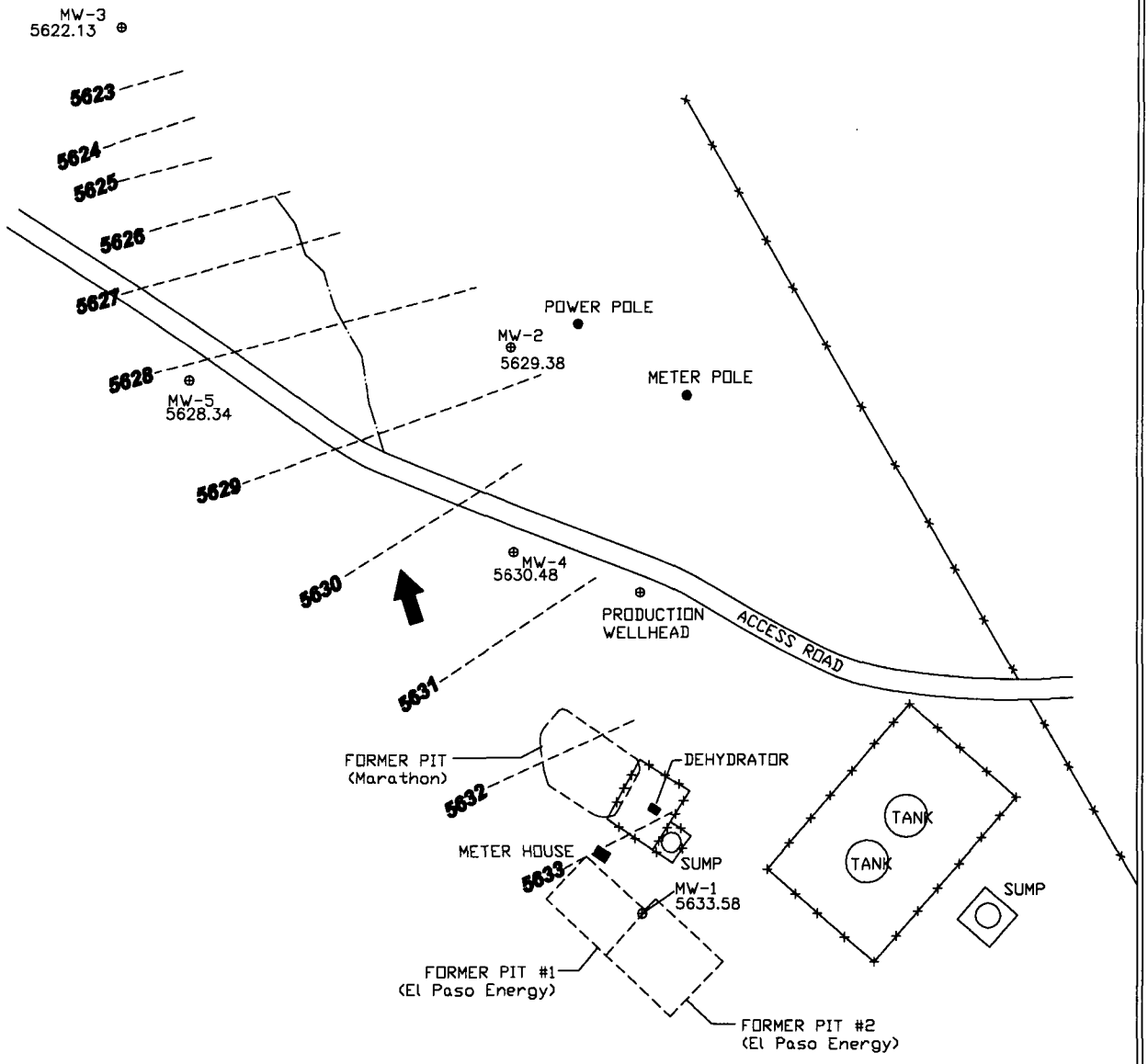
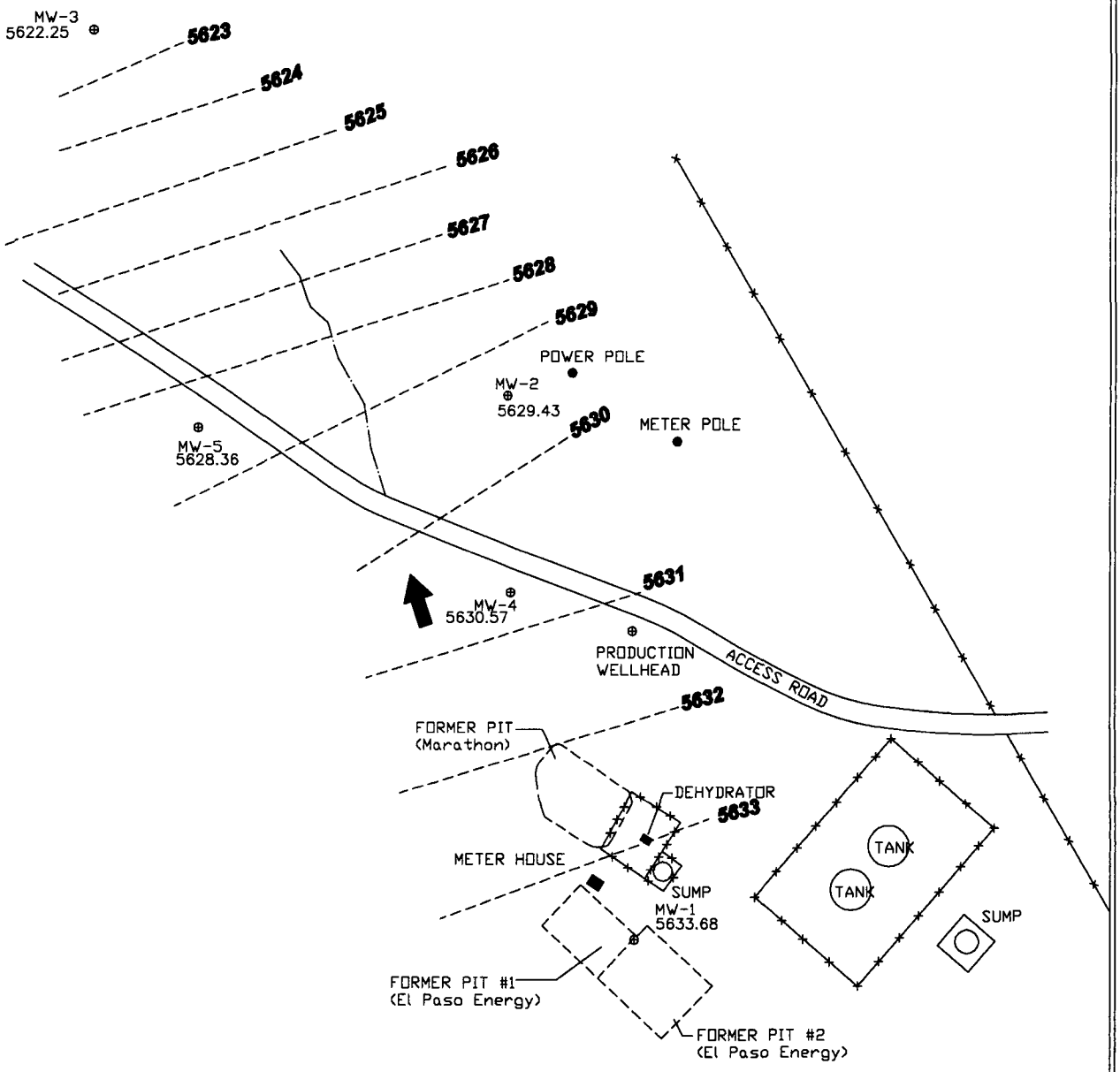


IT CORPORATION	DRAWN BY: Z. CARPIO — DATE: 05/21/01 CHECKED BY: T. WOODARD — DATE: 05/21/01 APPROVED BY: T. WOODARD — DATE: 05/21/01 PROJECT MANAGER: — DATE: 05/21/01 SCALE: AS NOTED	**Figure A-5** **Groundwater Elevation Data** **Ohio "C" Government Well #3 Site** **December 4, 2000** **Marathon Oil Company** IT PROJECT No. / Drawing No.: 827834.01.00.00.00/A6

10/06/99



IT CORPORATION	DRAWN BY: Z. CARPIO — DATE: 05/21/01 CHECKED BY: T. WOODARD — DATE: 05/21/01 APPROVED BY: T. WOODARD — DATE: 05/21/01 PROJECT MANAGER: — DATE: 05/21/01 SCALE: AS NOTED	**Figure A-6** **Groundwater Elevation Data** **Ohio "C" Government Well #3 Site** **March 20, 2001** **Marathon Oil Company** IT PROJECT No. / Drawing No.: 827834.01.00.00.00/A7

10/06/99

APPENDIX B
NATURAL ATTENUATION DOCUMENTATION

Natural attenuation is the term used for the passive remediation of dissolved-contaminant groundwater. Process involved in natural attenuation include biodegradation, dispersion, dilution, volatilization, hydrolysis and sorption. To determine whether indigenous groundwater microbes might be actively containing the migration of the dissolved hydrocarbon contamination at Ohio "C" Government Well #3, groundwater samples from monitoring wells MW-1 through MW-5 were collected for analysis in August and December 1999. Several potential biodegradation processes exist, including both aerobic and anaerobic microbial activity. Indications of such bioactivity can be obtained from site-specific groundwater analyses for dissolved oxygen, carbon dioxide, ferric iron, manganese, methane, nitrate, sulfate and sulfide. Table B-1 presents the results of the natural attenuation parameter and total organic carbon analyses.

Guidance for determining the appropriateness of site remediation by natural attenuation is given in ASTM E 1943-98. Primary evidence of ongoing bioremediation is observed reduction in plume geometry and concentrations of contaminants. Secondary evidence is provided by geochemical evidence of naturally occurring degradation in the vicinity of the contaminant plume. For example, lower dissolved oxygen values inside the plume indicate aerobic microbial degradation, and lower sulfate and/or nitrate values inside the plume indicate the presence of anaerobic sulfate- and/or nitrate-reducing bacteria.

The natural attenuation parameter analyses completed for groundwater samples collected in August and December 1999 suggest strong secondary evidence for natural attenuation. Among the indicators are greatly reduced levels of sulfate and nitrate in downgradient monitoring wells MW-4 and MW-5, compared to the upgradient monitoring well, MW-1, and reduced dissolved oxygen values in the downgradient wells. This evidence documents bioactivity of both aerobes and anaerobes.

Table B-1

Summary of Groundwater Natural Attenuation Parameters (1999)

NA Parameters	NMWQCC Standards	SAMPLE LOCATION AND DATE OF SAMPLING									
		MW-1		MW-2		MW-3		MW-4		MW-5	
		8/31/99	12/8/99	8/31/99	12/8/99	8/31/99	12/8/99	8/31/99	12/8/99	8/31/99	12/8/99
Carbon Dioxide	NE	44,000	294,000	17,600	137,000	21,100	162,000	NA	352,000	88,000	515,000
Dissolved Oxygen	NE	5,020	NA	4,470	3,200	2,550	6,600	4,790	800	5,370	900
Iron (Fe^{2+})	NE	2,200	1,810	1,000	8,480	2,000	7,710	1,600	7,640	2,500	2,870
Manganese (Mn^{2+})	50	3,100	2,790	<500	1,020	<500	3,830	NA	4,720	1,140	3,490
Methane	NE	10	NA	<5	NA	<5	NA	NA	NA	40	NA
Nitrate (NO_3)	10,000	23,700	3,270	6,200	1,940	<10,000	280	<6,250	420	<6,250	560
Organic Carbon, Total	NE	6,500	6,000	800	1,400	1,400	1,600	NA	13,000	36,000	52,000
Sulfate	600,000	2,180,000	2,200,000	2,360,000	2,500,000	2,430,000	2,400,000	1,620,000	1,600,000	1,020,000	870,000
Sulfide	NE	<100	<2,000	<100	<2,000	<100	<2,000	NA	<2,000	<100	<2,000

Notes:

1. NA indicates natural attenuation.
2. NMWQCC indicates New Mexico Water Quality Control Commission.
3. All concentrations are provided in micrograms per liter (ug/L).
4. The dissolved oxygen results from the 12/8/99 sample event were analyzed in the field.
5. The ferric iron and dissolved oxygen results from the 8/31/99 sample event were analyzed in the field.
6. NE indicates not established; NA indicates not analyzed.