3R - 249

GENERAL CORRESPONDENCE

YEAR(S):

1992-1982

El Paso
Natural Gas Company

JAMYE BOONE WARD ATTORNEY AT LAW

OIL CONSER... ..N DIVISION
RE... ..ED

'92 FE... 2... AM 9 20

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-3071

February 21, 1992

Ms. Kathy M. Brown
Geologist
Oil Conservation Division
P.O. Box 2088
Santa Fe, New Mexico 87504

Re: Contamination at Manana - Mary Wheeler No. 1E
<u>Gas Well Site, Flora Vista, New Mexico</u>

Dear Ms. Brown:

Last October, El Paso Natural Gas Company (El Paso) completed nearly every aspect of the remediation of the contaminated ground water at the site named above. In your November 15, 1991, letter you told El Paso that no further remediation of the site was necessary at this time. You also advised us that the OCD has no jurisdiction over the operation of the Water Well S1, which, as part of the pre-approved remediation plan, El Paso was to plug and abandon.

Your recommendation with respect to plugging Well S1 was to "contact both the State Engineer and the Flora Vista Water Users Association (FVWUA) prior to any activities involving Well S1." El Paso did as you recommended. The State Engineer advised Anu Pundari, El Paso's environmental compliance engineer in Farmington, that there are no specific regulations on shallow well abandonment procedures. The State Engineer advised that the FVWUA should complete the bottom portion of the well record form regarding the plugging method. El Paso's preferred plugging method is to weld a steel cap on Well S1.

I contacted the FVWUA, through their attorney, seeking their approval of El Paso's effort to cap Well S1. Mr. Chester Miller, the FVWUA's attorney, informed me yesterday that the FVWUA will not allow El Paso to cap Well S1 until El Paso agrees to several other conditions which are totally unrelated to capping the well.

By way of this letter, I am informing OCD that El Paso, at this time, is not able to plug and abandon Water Well S1 as your agency directed.

Very truly yours,

Jamye Boone Ward

c: Chester Miller III, P.C.
304 South Lake Street
Farmington, New Mexico 87401

OIL CONSERVATION DIVISION RECEIVED

'92 FEB 24 AM 9 20

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-3071

JAMYE BOONE WARD ATTORNEY AT LAW

February 21, 1992

F. Chester Miller III, Esq.
304 South Lake Street
Farmington, New Mexico 87401

Re: Contamination at Manana-Mary Wheeler #1E
<u>Gas Well Site, Flora Vista, New Mexico</u>

Dear Mr. Miller:

El Paso Natural Gas Company ("El Paso") believes that it has made every effort to accommodate the Flora Vista Water Users Association ("FVWUA"). As part of the pre-approved plan to remediate the ground water contamination at the site named above, El Paso was directed to plug and abandon Water Well S1. Please refer to the enclosed copy of the letter to David Boyer, dated March 19, 1991. In the paragraph numbered 22 in Exhibit A to the letter, El Paso agrees to plug and abandon Water Well S1.

Then, at the direction of the New Mexico Oil Conservation Division ("OCD"), El Paso contacted the FVWUA (through you) and the State Engineer's office seeking approval of its efforts to plug Well S1 by welding a metal cap on the well opening. El Paso and the OCD have repeatedly informed the FVWUA that the safe completion of the ground water contamination cleanup requires plugging and abandoning Well S1. Unfortunately, the FVWUA refuses to allow El Paso to plug and abandon Well S1.

Notwithstanding the fact that Well S1 should be plugged and abandoned as a step in the complete remediation of the ground water, El Paso is very concerned that the open and accessible condition of Well S1 raises some serious safety issues. The well may be used for unauthorized disposal or dumping as it now exists. El Paso will not accept any responsibility for the safety or protection of anyone receiving water service from Well S1. El Paso will not be liable for any injury, damage, death, or further contamination arising from the use of Well S1.

If the FVWUA reconsiders its present position and decides to allow El Paso to cap Well S1, please contact me immediately. Thank you for conveying this message to your client.

Very truly yours,

Jamye Boone Ward

Enclosures

c (w/o enclosures):

Kathy M. Brown, OCD

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

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

November 15, 1991

Mr. Thomas D. Hutchins
North Region Compliance Manager
El Paso Natural Gas Company
P.O. Box 1492
El Paso, Texas 79978

RE: Remediation at Manana-Mary Wheeler #1E Gas Well Site, Flora Vista, New Mexico

Dear Mr. Hutchins:

The Oil Conservation Division (OCD) has received your October 11, 1991 summary of remediation activities at the referenced site. In this document El Paso Natural Gas Company (EPNG) has requested permission from the OCD to plug and abandon Well S1. Because Well S1 is a public water supply well, the OCD has no jurisdiction over the operations of this well. The OCD recommends that EPNG contact both the State Engineer and the Flora Vista Water Users Association prior to any activities involving Well S1.

Based on the data submitted to the OCD by EPNG, the OCD requires no further remediation at this time at the Manana-Mary Wheeler #1E Gas Well Site, Flora Vista, New Mexico.

If you have any questions, please contact me at (505) 827-5884.

Sincerely,

Kathy M. Brown

Kathy M. Brown
Geologist

xc: OCD Aztec District Office

Analytical Technologies, Inc. 9830 S. 51st Street Suite B-113 Phoenix, AZ 85044 (602) 496-4400

ATI I.D. 105554

May 16, 1991

El Paso Natural Gas Company
P.O. Box 4990
Farmington, NM 87499

Project Name/Number: Mary Wheeler

Attention: John Lambdin

On 05/03/91, Analytical Technologies, Inc. received a request to analyze soil sample(s). The sample(s) were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

If you have any questions or comments, please do not hesitate to contact us at (602) 496-4400.

Elizabeth Proffitt
Elizabeth Proffitt
Senior Project Manager

Robert V. Woods
Robert V. Woods
Laboratory Manager

RVW:clf
Enclosure

Corporate Offices: 5550 Morehouse Drive San Diego, CA 92121 (619) 458-9141

Analytical Technologies, Inc.

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE RECEIVED	: 05/03/9
PROJECT #	: (NONE)		
PROJECT NAME	: MARY WHEELER	REPORT DATE	: 05/09/9

ATI I.D. : 105554

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTE
01	N10615	SOIL	05/02/91
02	N10616	SOIL	05/02/91
03	N10617	SOIL	05/02/91
04	N10618	SOIL	05/02/91

MAY 1991

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	4

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from th date of this report. If an extended storage period is required, please contac our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 105554

CLIENT : EL PASO NATURAL GAS, NEW MEXICO
PROJECT # : (NONE)
PROJECT NAME : MARY WHEELER

DATE RECEIVED : 05/03/91
REPORT DATE : 05/09/91

PARAMETER	UNITS	01	02	03	04
PETROLEUM HYDROCARBONS, IR	MG/KG	<20	40	74	<20

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10555402

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE SAMPLED	: 05/02/91
PROJECT #	: (NONE)	DATE RECEIVED	: 05/03/91
PROJECT NAME	: MARY WHEELER	DATE EXTRACTED	: 05/03/91
CLIENT I.D.	: N10616	DATE ANALYZED	: 05/06/91
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	109

Harptitler
5-22-94
DJ

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10555401

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE SAMPLED	: 05/02/91
PROJECT #	: (NONE)	DATE RECEIVED	: 05/03/91
PROJECT NAME	: MARY WHEELER	DATE EXTRACTED	: 05/03/91
CLIENT I.D.	: N10615	DATE ANALYZED	: 05/06/91
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-
SURROGATE PERCENT RECOVERIES	
DI-N-OCTYL-PHTHALATE (%)	116

Acceptable!
JS
5-22-91

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10555403

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE SAMPLED	: 05/02/91
PROJECT #	: (NONE)	DATE RECEIVED	: 05/03/91
PROJECT NAME	: MARY WHEELER	DATE EXTRACTED	: 05/03/91
CLIENT I.D.	: N10617	DATE ANALYZED	: 05/06/91
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	118

Acceptable!
5-22-91
JJ

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10555404

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE SAMPLED	: 05/02/91
PROJECT #	: (NONE)	DATE RECEIVED	: 05/03/91
PROJECT NAME	: MARY WHEELER	DATE EXTRACTED	: 05/03/91
CLIENT I.D.	: N10618	DATE ANALYZED	: 05/06/91
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-
SURROGATE PERCENT RECOVERIES	
DI-N-OCTYL-PHTHALATE (%)	141

Accepted 5-22-91 JL

Analytical Technologies, Inc.

COPY

GENERAL CHEMISTRY - QUALITY CONTROL

CLIENT : EL PASO NATURAL GAS, NEW MEXICO
PROJECT # : (NONE)
PROJECT NAME : MARY WHEELER

ATI I.D. : 105554

PARAMETER	UNITS	ATI I.D.	SAMPLE RESULT	DUP. RESULT	RPD	SPIKED SAMPLE	SPIKE CONC	% REC
PETROLEUM HYDROCARBONS	MG/KG	10555402	40	48	18	230	190	100

Acceptable!
J.S. 5-22-91

% Recovery = (Spike Sample Result - Sample Result) / Spike Concentration X 100

RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) / Average Result X 10

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

		ATI I.D.	: 105554
CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE EXTRACTED	: 05/03/91
PROJECT #	: (NONE)	DATE ANALYZED	: 05/03/91
PROJECT NAME	: MARY WHEELER	UNITS	: MG/KG
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	100

Acceptable
5-22-91
[illegible]

Analytical Technologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 105554

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT : EL PASO NATURAL GAS, NEW MEXICO
PROJECT # : (NONE)
PROJECT NAME : MARY WHEELER
REF I.D. : 10599824

DATE ANALYZED : 05/04/91
SAMPLE MATRIX : NON-AQUEOU
UNITS : MG/KG

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS	<5	50	45	90	45	90	0

Accepted
5-22-91
BJ

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

MANANA MARY WHEELER #1E MW.WK3 10-08-91

Analytical Data Summary – Total Petroleum Hy arbon John Lambdin

Field ID	Sample Number	Sample Location	Time	Date (DDMMYY)	Matrix	Modified 8015 (MG/KG)	Carbon Range	FIELD TPH by IR Mod. 418.1 (MG/KG)	Aromatic Hydrocarbons EPA 602/8020 BETX (UG/L) Benzene	Toluene	Ethyl-Benzene	Total Xylenes	MTBE
1	N11667	78N, 36E, 9'	1210	15-8-91	Soil	<5	N/A	42	<0.025	<0.025	<0.025	<0.025	<0.12
2	N11668	85N, 32E, 9'	1215	15-8-91	Soil	<5	N/A	19					
3	N11669	62N, 02W, 9'	1628	15-8-91	Soil	<5	N/A	46					
4	N11670	60N, 24E, 9'	840	16-8-91	Soil	<5	N/A	18					
5	N11671	68N, 08W, 9'	920	16-8-91	Soil	<5	N/A	108					
6	N11672	53N, 22W, 9'	1020	16-8-91	Soil	<5	N/A	22					
7	N11673	39N, 33W, 9'	1140	16-8-91	Soil	<5	N/A	68					
B	N11674	Field Blank, South, 0'	1145	16-8-91	Soil	<5	N/A	4					
C	N11675	Field Blank, North, 0'	1140	16-8-91	Soil	10	(C22-C36)	12					
13	N11676	50N, 16E, 11'	1415	19-8-91	Soil	<5	N/A	89	<0.025	<0.025	<0.025	<0.025	<0.12
14	N11677	41N, 09W, 12'	1437	19-8-91	Soil	<5	N/A	86					
15/16	N11678	40N, 5E/34N, 2W, 10'	848	20-8-91	Soil	<5	N/A	50/111					
17	N11679	Reserve pit, 100S,29E, 6'	1015	20-8-91	Soil	<5	N/A	87					
18	N11680	Reserve pit, 90S,10E, 6'	1025	20-8-91	Soil	<5	N/A	54.5					
19/20/21	N11681	42N,36E/50N,28E/10N,19E, 7'	1140	20-8-91	Soil	<5	N/A	42.5/102/109	<0.025	<0.025	<0.025	<0.025	<0.12
22	N/A	Clay Layer, 90S, 10E, 6'	1411	20-8-91	Soil	Not Run	N/A	286					
23	N11682	32N,31E, 10'	1500	20-8-91	Soil	<5	N/A	49					
24	N11683	30N,15E, 8'	1525	20-8-91	Soil	29	(C10-C23)	130.5					
25	N11684	20N,27E, 10'	1540	20-8-91	Soil	<5	N/A	42.5					
26/27/28	N11685	31N,45E/18N,37E/23N,33E, 8'	750	21-8-91	Soil	<5	N/A	36/75/36	<0.025	<0.025	<0.025	<0.025	<0.12
29	N11686	04N,28E, 8'	1059	21-8-91	Soil	<5	N/A	24	<0.025	<0.025	0.026	0.20	<0.12
30	N11687	Duplicate of #29	1100	21-8-91	Soil	<5	N/A	11	<0.025	<0.025	<0.025	<0.025	<0.12
31	N11688	10N,10E, 8'	1215	21-8-91	Soil	<5	N/A	20					
33/35/37	N11689	20N,35E/10N,50E, 6'	1245	21-8-91	Soil	<5	N/A	15/24/7					
34/36/38	N11690	20N,35E/10N,50E/0N,45E, 7.5'	1250	21-8-91	Soil	<5	N/A	16/15/9					
39	N11691	15S,35E, 7.5'	1320	21-8-91	Soil	<5	N/A	11					
40	N11692	15S,35E, 9'	1325	21-8-91	Soil	<5	N/A	8					
41	N11693	55S,5W, 6'	1425	21-8-91	Soil	<5	N/A	8					
42	N11694	35S,30W, 6'	1430	21-8-91	Soil	<5	N/A	17					
43	N11695	15N,8W, 9'	1501	21-8-91	Soil	<5	N/A	12					
44/45	N11743	10N,15W/10N,30W, 8.5'	820	22-8-91	Soil	<5	N/A	104/88					
46	N11744	20N,0E, 9'	905	22-8-91	Soil	<5	N/A	83.5					
47/48	N11745	5N,25W/0N,15W, 8'	1047	22-8-91	Soil	<5	N/A	99.5/60	<0.025	<0.025	<0.025	<0.025	<0.12
49	N11746	10S,10E, 10'	1110	22-8-91	Soil	<5	N/A	45					
50	N11747	25S,5E, 6'	1145	22-8-91	Soil	<5	N/A	42.5	<0.025	<0.025	<0.025	<0.025	<0.12
51	N11748	8S,40W, 8'	1300	22-8-91	Soil	<5	N/A	50					
52	N11749	30S,5E, 7.5'	1340	22-8-91	Soil	15	(C10-C32)	87					
53	N11750	10S,15E, 8'	1440	22-8-91	Soil	<5	N/A	70					
54	N11751	50S,8E, 7.5'	1500	22-8-91	Soil	<5	N/A	47					
55/56	N11752	30S,5W/40S,5W, 7'	815	23-8-91	Soil	48	(C8-C32)	83/75					
57	N11753	20S,20W, 7.5'	1013	23-8-91	Soil	<5	N/A	48.5	<0.025	<0.025	<0.025	<0.025	<0.12
60	N11754	Clean Cobble, Field Blank, 0'	1300	23-8-91	Soil	<5	N/A	Not Run					
61	N11755	35S,15W, 9'	1310	23-8-91	Soil	6	(C10-C22)	117					
62	N11756	35S,15 (#61 Dup.), 9'	1312	23-8-91	Soil	6	C8	110					
63	N11757	30W, Hay Pile, Field Blank, 0'	1300	23-8-91	Soil	<5	N/A	Not Run					
64	N11758	20S,M.W.#1 Field Blank, 0'	1308	23-8-91	Soil	10	(C10-C24)	Not Run	<0.025	<0.025	<0.025	<0.025	<0.12
65	N11759	Alfalfa Field Edge, Field Blank,	1315	23-8-91	Soil	<5	N/A	Not Run					
66	N11760	50S,5W, 7'	1450	23-8-91	Soil	<5	N/A	113.5					
67	N11761	50S,20W, 8'	800	26-8-91	Soil	<5	N/A	99					
68	N11762	50S,35W, 8'	845	26-8-91	Soil	<5	N/A	28	<0.025	<0.025	<0.025	<0.025	<0.12
69	N11763	58S,38W, 8'	910	26-8-91	Soil	<5	N/A	92.5					
70	N11713	Reserve pit, 3' (Clay Layer)	1010	26-8-91	Soil	47	(C12-C36)	252					
71	N11714	Reserve pit, 4' (Clay Layer)	1020	26-8-91	Soil	26	(C12-C36)	307					
72	N11819	Ballard Clean Fill, 0'	1100	26-8-91	Soil	<5	N/A	Not Run					

NOTE: Field Sample #8 – Location Unknown (TPH=41 Mg/Kg).
Sample #9,10,11,12 were at the same location as #14 but at a shallower depth.
Sample #32 was at the same location as #46 but at a shallower depth.
Sample #58 was at the same location as #61 but at a shallower depth.

Field ID	Sample Number	Sample Location	Time	Date (DDMMYY)	Matrix	Modified 8015 (MG/KG)	Carbon Range	FIELD TPH by IR Mod. 418.1 (MG/KG)	Aromatic Hydrocarbons EPA 602/8020 BETX (UG/L) Benzene	Toluene	Ethyl– Benzene	Total Xylenes	MTBE
73	N11765	Ballard Clean Fill, 0'	1055	26–8–91	Soil	<5	N/A	Not Run					
74	N11820	70S, 30W, 7'	1105	26–8–91	Soil	<5	N/A	75					
75/76	N11821	62S, 8W/62S, 5W, 8'/7'	1310	26–8–91	Soil	6	(C18–C32)	61.5/81.5					
78	N11822	76S, 13W, 6'	1440	26–8–91	Soil	18	(C18–C32)	53					
79	N/A	76S, 18W, 8'	1515	26–8–91	Soil	Not Run	N/A	53.5					
80	N11823	70S, 20W, 7'	1545	26–8–91	Soil	60	(C5–C32)	221	<0.025	<0.025	<0.025	0.16	<0.12
81	N11824	70S, 20W, 8'	800	27–8–91	Soil	<5	N/A	45.5					
82	N11825	67S, 45W, 7'	810	27–8–91	Soil	<5	N/A	61.5					
83	N11826	Duplicate of 82	810	27–8–91	Soil	<5	N/A	87					
84	N11827	80S, 8W, 7'	816	27–8–91	Soil	<5	N/A	37					
85	N11828	Duplicate of 84	816	27–8–91	Soil	<5	N/A	56	<0.025	<0.025	<0.025	<0.025	<0.12
86	N11829	86S, 17W, 7'	930	27–8–91	Soil	<5	N/A	40					
87	N11830	87S, 40W, 7.5'	1155	27–8–91	Soil	<5	N/A	84.5					
88	N11831	Field Blank, 0'	1255	27–8–91	Soil	18	(C18–C36)	72					
89	N11832	92S, 25W, 7'	1315	27–8–91	Soil	<5	N/A	90					
90	N11833	84S, 18W, 6'	1415	27–8–91	Soil	22	(C18–C32)	27	<0.025	<0.025	<0.025	<0.025	<0.12
91	N11834	80S, 50W, 7'	1420	27–8–91	Soil	<5	N/A	94					
92	N11835	87S, 55W, 7'	1500	27–8–91	Soil	<5	N/A	38.5					
93	N11836	Duplicate of 92, 7'	1500	27–8–91	Soil	<5	N/A	69					
94	N11837	100S, 47W, 8'	1520	27–8–91	Soil	<5	N/A	68					
95	N11838	Duplicate of 94, 8'	1520	27–8–91	Soil	<5	N/A	67.5	<0.025	<0.025	<0.025	<0.025	<0.12
96/98	N11839	105S, 56W/110S, 58W, 8'/8'	800	28–8–91	Soil	<5	N/A	41.5/41.5					
97	N11840	1+48S, 0+64W, 5'	910	28–8–91	Soil	<5	N/A	83.5					
99	N11841	108S, 65W, 7'	1045	28–8–91	Soil	<5	N/A	33.5					
100	N11842	Duplicate of 99, 7'	1045	28–8–91	Soil	<5	N/A	73.5					
101	N11843	110S, 38W, 7'	1140	28–8–91	Soil	<5	N/A	82.5	<0.025	<0.025	<0.025	<0.025	<0.12
102	N11844	122S, 34W, 5'	1155	28–8–91	Soil	45	(C18–C32)	73					
103	N11845	180S, 92W, 4'	1255	28–8–91	Soil	<5	N/A	90					
104	N11846	Duplicate of 103, 4'	1255	28–8–91	Soil	<5	N/A	46					
105	N11847	1+255, 0+38W, 5'	1310	28–8–91	Soil	29	(C18–C32)	71					
106	N11848	129S, 52W, 5'	1340	28–8–91	Soil	<5	N/A	72	<0.025	<0.025	<0.025	<0.025	<0.12
107	N11849	1+30S, 0+57W, 6.5'	1425	28–8–91	Soil	<5	N/A	119					
108	N11850	1+52S, 0+73W, 6'	807	29–8–91	Soil	<5	N/A	96					
109	N11851	Duplicate of 109, 6'	807	29–8–91	Soil	<5	N/A	81					
110	N11852	1+60S, 0+75W, 5'	825	29–8–91	Soil	<5	N/A	92					
111	N11853	1+64S, 0+87W, 5'	900	29–8–91	Soil	10	(C20–C32)	71.5	<0.025	<0.025	<0.025	<0.025	<0.12
112	N11854	1+61S, 0+91W, 7'	1035	29–8–91	Soil	<5	N/A	86.5					
113	N11855	1+70S, 0+91W, 5'	1040	29–8–91	Soil	13	(C12–C32)	294					
114	N11856	1+73S, 0+92W, 5'	1120	29–8–91	Soil	<5	N/A	69.5					
115	N11857	1+70S, 1+08W, 5'	1130	29–8–91	Soil	<5	N/A	58					
116	N11858	1+80S, 1+18W, 6'	1325	29–8–91	Soil	<5	N/A	102	<0.025	<0.025	<0.025	<0.025	<0.12
117	N11859	1+66S, 1+12W, 6'	1335	29–8–91	Soil	<5	N/A	88					
118	N11860	Duplicate of 117, 6'	1335	29–8–91	Soil	<5	N/A	88.5					
119	N11861	1+70S, 1+05W, 8'	1400	29–8–91	Soil	<5	N/A	83					
120	N11862	1+85S, 1+40W, 10'	1455	29–8–91	Soil	<5	N/A	86					
121	N11863	1+75S, 1+40W, 10'	1457	29–8–91	Soil	12	(C12–C32)	133	<0.025	<0.025	<0.025	<0.025	<0.12
122	N11864	1+34S, 0+11W, 6'	1525	29–8–91	Soil	<5	N/A	94					
123	N11865	1+95S, 0+00E, 7'	1545	29–8–91	Soil	<5	N/A	122.5					
124	N11866	1+04S, 0+12E, 7'	1555	29–8–91	Soil	<5	N/A	109.5					
125	N11867	1+25S, 0+23W, 6'	815	30–8–91	Soil	<5	N/A	82					
126	N11868	1+10S, 0+00E, 6'	905	30–8–91	Soil	<5	N/A	106	<0.025	<0.025	<0.025	<0.025	<0.12
127	N11869	0+96S, 0+00E, 6'	910	30–8–91	Soil	<5	N/A	85.5					
128	N11870	Duplicate of 127, 6'	910	30–8–91	Soil	<5	N/A	72.5					
N/A	N11912	CDK Clean Fill	1530	03–09–91	Soil	<5	N/A	Not Run					

NOTES: Sample #77 was at the same location as #79 but at a shallower depth.

Analytical Technologies, Inc. 9830 S. 51st Street Suite B-113 Phoenix, AZ 85044 (602) 496-4400

ATI I.D. 108741

August 23, 1991

El Paso Natural Gas Company
P.O. Box 4990
Farmington, NM 87499

Project Name/Number: M. Wheeler 1E

Attention: John Lambdin

On 08/19/91, Analytical Technologies, Inc. received a request to analyze aqueous sample(s). The sample(s) were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

If you have any questions or comments, please do not hesitate to contact us at (602) 496-4400.

Mary H. Tyer
Mary Tyer
Project Manager

E. Proffitt for:
Robert V. Woods
Laboratory Manager

RVW:jat
Enclosure

AnalyticalTechnologies, Inc.

CLIENT : EL PASO NATURAL GAS, NEW MEXICO
PROJECT # : (NONE)
PROJECT NAME : M.WHEELER 1E

DATE RECEIVED : 08/19/91

REPORT DATE : 08/23/91

ATI I.D. : 108741

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	N11636	AQUEOUS	08/15/91

Areation, Observation trench, split sample with OCD,

AUG 1991

----- TOTALS -----

MATRIX	# SAMPLES
AQUEOUS	1

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10874101

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE SAMPLED	: 08/15/91
PROJECT #	: (NONE)	DATE RECEIVED	: 08/19/91
PROJECT NAME	: M.WHEELER 1E	DATE EXTRACTED	: N/A
CLIENT I.D.	: N11636	DATE ANALYZED	: 08/21/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5
METHYL-t-BUTYL ETHER	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	94

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : BTEX & MTBE (EPA METHOD 8020)

		ATI I.D.	: 108741
CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE EXTRACTED	: 08/21/91
PROJECT #	: (NONE)	DATE ANALYZED	: 08/21/91
PROJECT NAME	: M.WHEELER 1E	UNITS	: UG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5
METHYL-t-BUTYL ETHER	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	88

Acceptable
8-26-91
JS

AnalyticalTechnologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 108741

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT : EL PASO NATURAL GAS, NEW MEXICO
PROJECT # : (NONE)
PROJECT NAME : M.WHEELER 1E
REF I.D. : 10899831

DATE ANALYZED : 08/21/91
SAMPLE MATRIX : AQUEOUS
UNITS : UG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.5	10	8.1	81	8.1	81	0
TOLUENE	<0.5	10	7.9	79	7.8	78	1
ETHYLBENZENE	<0.5	10	7.8	78	7.9	79	1
TOTAL XYLENES	<0.5	30	23	77	24	80	4
METHYL-t-BUTYL ETHER	<2.5	20	17	85	17	85	0

Acceptable
8-26-91
DJ.

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

Analytical Technologies, Inc.
Phoenix, Arizona

Chain of Custody

DATE 8/16/91 PAGE 1 OF 1

PROJECT MANAGER:

COMPANY: El Paso Natural Gas Co
ADDRESS: 770 W. Navajo
Farmington, NM 87401

BILL TO: JOHN LAMBDIN
COMPANY: Same As Above
ADDRESS: " " "

Norman Norvelle
SAMPLERS: (Signature)

(505) 599-2144
PHONE NUMBER

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Petroleum Hydrocarbons (418.1)	(MOD 8015) Gas/Diesel	Diesel/Gasoline/BTXE (MOD 8015/8020)	BTXE (8020)	Chlorinated Hydrocarbons (601/8010)	Aromatic Hydrocarbons (602/8020)	MTBE	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	SDWA Primary Standards	SDWA Secondary Standards	SDWA Volatiles (502.1/503.1)	The 13 Priority Pollutant Metals	The 8 EP Tox Metals by EP Tox Prep. (1310)	The 8 EP Tox Metals by Total Digestion	The 8 EP Tox Metals by TCLP (1311)	NUMBER OF CONTAINERS
NII 636	8/15/91	1100	Water	1				X															1

PROJECT INFORMATION	
PROJECT NO:	Mary Wheeler #1E
PROJECT NAME:	Mary Wheeler #1E
P.O. NO.	
SHIPPED VIA:	
SAMPLE DISPOSAL INSTRUCTIONS	☒ ATI ☐ RETURN

SAMPLE RECEIPT	
TOTAL NO. OF CONTAINERS	1
CHAIN OF CUSTODY SEALS	NO
INTACT?	Y
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	108741

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) Yes (RUSH) ☐ 24 ☐ 48 ☐ 72 ☐ 1 WEEK

Comments:
186-59557-01-913-012-51-1250

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: [signature] Time: 1002	Signature: Time:	Signature: Time:
Printed Name: John Lambdin Date 8/16/91	Printed Name: Date	Printed Name: Date
Company: EPNG	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time:	Signature: Time:	Signature: R. Tubeszewski Time: 12:30
Printed Name: Date:	Printed Name: Date:	Printed Name: R. Tubeszewski Date: 8/19
Company:	Company:	Analytical Technologies, Inc.

Analytical Technologies, Inc. 9830 S. 51st Street Suite B-113 Phoenix, AZ 85044 (602) 496-4400

ATI I.D. 109558

September 12, 1991

El Paso Natural Gas Company
P.O. Box 4990
Farmington, NM 87499

Project Name/Number: Mary Wheeler

Attention: John Lambdin

On 09/05/91, Analytical Technologies, Inc. received a request to analyze **aqueous & soil** sample(s). The sample(s) were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

If you have any questions or comments, please do not hesitate to contact us at (602) 496-4400.

Mary H. Tyer
Mary Tyer
Project Manager

Robert V. Woods
Robert V. Woods
Laboratory Manager

RVW:clf
Enclosure

Analytical Technologies, Inc.

CLIENT : EL PASO NATURAL GAS, NEW MEXICO
PROJECT # : (NONE)
PROJECT NAME : MARY WHEELER

DATE RECEIVED : 09/05/91

REPORT DATE : 09/11/91

ATI I.D. : 109558

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	N11911	AQUEOUS	09/03/91
02	N11912	SOIL	09/03/91

SEP 1991

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	1
AQUEOUS	1

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10955802

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE SAMPLED	: 09/03/91
PROJECT #	: (NONE)	DATE RECEIVED	: 09/05/91
PROJECT NAME	: MARY WHEELER	DATE EXTRACTED	: 09/05/91
CLIENT I.D.	: N11912	DATE ANALYZED	: 09/06/91
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	129

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	ATI I.D.	: 109558
PROJECT #	: (NONE)	DATE EXTRACTED	: 09/05/91
PROJECT NAME	: MARY WHEELER	DATE ANALYZED	: 09/06/91
CLIENT I.D.	: REAGENT BLANK	UNITS	: MG/KG
		DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	96

Analytical Technologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 109558

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT : EL PASO NATURAL GAS, NEW MEXICO
PROJECT # : (NONE)
PROJECT NAME : MARY WHEELER
REF I.D. : 10999915

DATE ANALYZED : 09/06/91
SAMPLE MATRIX : NON-AQUEOUS
UNITS : MG/KG

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS	<5	50	53	106	55	110	4

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10955801

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE SAMPLED	: 09/03/91
PROJECT #	: (NONE)	DATE RECEIVED	: 09/05/91
PROJECT NAME	: MARY WHEELER	DATE EXTRACTED	: N/A
CLIENT I.D.	: N11911	DATE ANALYZED	: 09/09/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5
METHYL-t-BUTYL ETHER	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	107

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	ATI I.D.	: 109558
PROJECT #	: (NONE)	DATE EXTRACTED	: 09/09/91
PROJECT NAME	: MARY WHEELER	DATE ANALYZED	: 09/09/91
CLIENT I.D.	: REAGENT BLANK	UNITS	: UG/L
		DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5
METHYL-t-BUTYL ETHER	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	105

Analytical Technologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 109558

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT : EL PASO NATURAL GAS, NEW MEXICO
PROJECT # : (NONE)
PROJECT NAME : MARY WHEELER
REF I.D. : 10999804

DATE ANALYZED : 09/09/91
SAMPLE MATRIX : AQUEOUS
UNITS : UG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.5	10	8.7	87	8.9	89	2
TOLUENE	<0.5	10	8.9	89	8.8	88	1
ETHYLBENZENE	<0.5	10	10	100	9.7	97	3
TOTAL XYLENES	<0.5	30	31	103	30	100	3
METHYL-t-BUTYL ETHER	<2.5	20	18	90	18	90	0

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

Analytical**Technologies**,Inc.
Phoenix, Arizona

Chain of Custody

DATE 9-4-91 PAGE 1 OF 1

PROJECT MANAGER:

COMPANY: EL PASO NATURAL GAS CO.
ADDRESS: P.O. BOX 4990
FARMINGTON N.M. 87499

BILL TO: JOHN LAMBDIN
COMPANY: SAME AS ABOVE
ADDRESS: " " "

Dennis Bird — SAMPLERS: (Signature)
(505) 599-2137 — PHONE NUMBER

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
N11911	9-3-91	15:25	WATER	-1
N11912	9-3-91	15:30	SOIL	-2

SAMPLE ID	Petroleum Hydrocarbons (418.1)	(MOD 8015) Gas/Diesel	Diesel/Gasoline/BTXE (MOD 8015/8020)	BTXE (8020)	Chlorinated Hydrocarbons (601/8010)	Aromatic Hydrocarbons (602/8020)	MTBE	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	SDWA Primary Standards	SDWA Secondary Standards	SDWA Volatiles (502.1/503.1)	The 13 Priority Pollutant Metals	The 8 EP Tox Metals by EP Tox Prep. (1310)	The 8 EP Tox Metals by Total Digestion	The 8 EP Tox Metals by TCLP (1311)	NUMBER OF CONTAINERS
N11911				X															2
N11912		X																	1

PROJECT INFORMATION	
PROJECT NO:	
PROJECT NAME:	MARY WHEELER
P.O. NO.	
SHIPPED VIA:	
SAMPLE DISPOSAL INSTRUCTIONS	☒ ATI ☐ RETURN

SAMPLE RECEIPT	
TOTAL NO. OF CONTAINERS	3
CHAIN OF CUSTODY SEALS	✓
INTACT?	✓
RECEIVED GOOD COND./COLD	✓
LAB NUMBER	109558

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) YES (RUSH) ☐ 24 ☐ 48 ☐ 72 ☐ 1 WEEK

Comments:
CHARGE CODE 136-59557-01-911-013-5-1350

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Dennis Bird Time: 13:55	Signature: Time:	Signature: Time:
Printed Name: DENNIS P. BIRD Date 9-4-91	Printed Name: Date	Printed Name: Date
Company: EL PASO NATURAL GAS	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time:	Signature: Time:	Signature: P. Nicholls Time: 11:25
Printed Name: Date:	Printed Name: Date:	Printed Name: P. Nicholls Date: 9/5/91
Company:	Company:	Analytical Technologies, Inc. Phx

ATI Labs: San Diego (619)458-9141 • Phoenix (602)438-1530 • Seattle (206)228-8335 • Pensacola (904)474-1001 DISTRIBUTION: White, Canary - ANALYTICAL TECHNOLOGIES, INC.• Pink - ORIGINATOR

Analytical **Technologies,** Inc. 9830 S. 51st Street Suite B-113 Phoenix, AZ 85044 (602) 496-4400

ATI I.D. 109619

September 12, 1991

El Paso Natural Gas Company
P.O. Box 4990
Farmington, NM 87499

Project Name/Number: Mary Wheeler

Attention: John Lambdin

On 09/07/91, Analytical Technologies, Inc. received a request to analyze **aqueous** sample(s). The sample(s) were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

If you have any questions or comments, please do not hesitate to contact us at (602) 496-4400.

Mary S. Tyer
Mary Tyer
Project Manager

Robert V. Woods
Robert V. Woods
Laboratory Manager

RVW:clf
Enclosure

Analytical Technologies, Inc.

CLIENT : EL PASO NATURAL GAS, NEW MEXICO
PROJECT # : (NONE)
PROJECT NAME : MARY WHEELER

DATE RECEIVED : 09/07/91
REPORT DATE : 09/12/91

ATI I.D. : 109619

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	N11938	AQUEOUS	09/05/91

SEP 1991

----- TOTALS -----

MATRIX	# SAMPLES
AQUEOUS	1

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10961901

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE SAMPLED	: 09/05/91
PROJECT #	: (NONE)	DATE RECEIVED	: 09/07/91
PROJECT NAME	: MARY WHEELER	DATE EXTRACTED	: N/A
CLIENT I.D.	: N11938	DATE ANALYZED	: 09/10/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5
METHYL-t-BUTYL ETHER	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	99

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	ATI I.D.	: 109619
PROJECT #	: (NONE)	DATE EXTRACTED	: 09/10/91
PROJECT NAME	: MARY WHEELER	DATE ANALYZED	: 09/10/91
CLIENT I.D.	: REAGENT BLANK	UNITS	: UG/L
		DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5
METHYL-t-BUTYL ETHER	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	101

Analytical Technologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 109619

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT : EL PASO NATURAL GAS, NEW MEXICO
PROJECT # : (NONE)
PROJECT NAME : MARY WHEELER
REF I.D. : 10961901

DATE ANALYZED : 09/10/91
SAMPLE MATRIX : AQUEOUS
UNITS : UG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.5	10	9.6	96	9.5	95	1
TOLUENE	<0.5	10	9.5	95	9.2	92	3
ETHYLBENZENE	<0.5	10	10	100	9.9	99	1
TOTAL XYLENES	<0.5	30	30	100	30	100	0
METHYL-t-BUTYL ETHER	<2.5	20	20	100	20	100	0

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

AnalyticalTechnologies,Inc.
Phoenix, Arizona

Chain of Custody

DATE 9-5-91 PAGE 1 OF 1

PROJECT MANAGER:

COMPANY: EL PASO NATURAL GAS CO.
ADDRESS: P.O. BOX 4990
FARMINGTON N.M. 87499

BILL TO: JOHN LAMSON
COMPANY: SAME AS ABOVE
ADDRESS: " " "

Dennis Bird (505) 599-2137
SAMPLERS: (Signature) PHONE NUMBER

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Petroleum Hydrocarbons (418.1)	(MOD 8015) Gas/Diesel	Diesel/Gasoline/BTXE (MOD 8015/8020)	BTXE (8020)	Chlorinated Hydrocarbons (601/8010)	Aromatic Hydrocarbons (602/8020)	MTBE	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	SDWA Primary Standards	SDWA Secondary Standards	SDWA Volatiles (502.1/503.1)	The 13 Priority Pollutant Metals	The 8 EP Tox Metals by EP Tox Prep. (1310)	The 8 EP Tox Metals by Total Digestion	The 8 EP Tox Metals by TCLP (1311)	NUMBER OF CONTAINERS
N 11938	9-5-91	16:10	WATER	1				X															2

PROJECT INFORMATION	
PROJECT NO:	
PROJECT NAME:	MARY WHEELER
P.O. NO.	
SHIPPED VIA:	
SAMPLE DISPOSAL INSTRUCTIONS	☑ ATI ☐ RETURN

SAMPLE RECEIPT	
TOTAL NO. OF CONTAINERS	2
CHAIN OF CUSTODY SEALS	N
INTACT?	Y
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	109619

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) (RUSH) ☐ 24 ☐ 48 ☐ 72 ☐ 1 WEEK

Comments:
CHARGE CODE 186-59557-01-911-02-51-1050

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Dennis Bird Time: 15:00	Signature: Time:	Signature: Time:
Printed Name: DENNIS BIRD Date 9-6-91	Printed Name: Date	Printed Name: Date
Company: EL PASO NATURAL GAS	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time:	Signature: Time:	Signature: [signature] Time:
Printed Name: Date:	Printed Name: Date:	Printed Name: MARGUERITE ODRISCOLL Date:
Company:	Company:	Analytical Technologies, Inc. 9/7/91

El Paso Natural Gas Company

MEMORANDUM

TO: Anu Pundari

DATE: September 12, 1991

FROM: John Lambdin

PLACE: North Engineering Laboratory-Farmington

RE: MANANA MARY WHEELER #1E TESTING

Sample Number:	N11940
Sample Date:	9-5-91
Sampled By:	Dennis Bird
Location:	Mary Wheeler
Sample Point:	Monitor Well S-1
Sample Time:	1545 Hours
Matrix:	Water

The sample was tested for total dissolved solids (TDS) and found to contain 752 mg/L. A duplicate analysis yielded 750 mg/L TDS.

John Lambdin

John Lambdin

cc: Log Book
File

FM-10-0003

El Paso
Natural Gas Company

CHAIN OF CUSTODY RECORD

Project No.	Project Name	Contract Laboratory
	MARY WHEELER	NORTH REGION LABORATORY

Samplers: (Signature)	Date	Receiving Temp. (°F)
Dennis Bird	9-6-91	

Lab ID	Date	Time	Matrix	Sample Number	Total No. of Containers	Chain of Custody Seals	Intact?	Composite or Grab	See Attached	TDS			Remarks
	9-5-91	16:10	WATER	N 11940				G		X			MARY WHEELER MONITOR WELL S-1

Requested Analysis

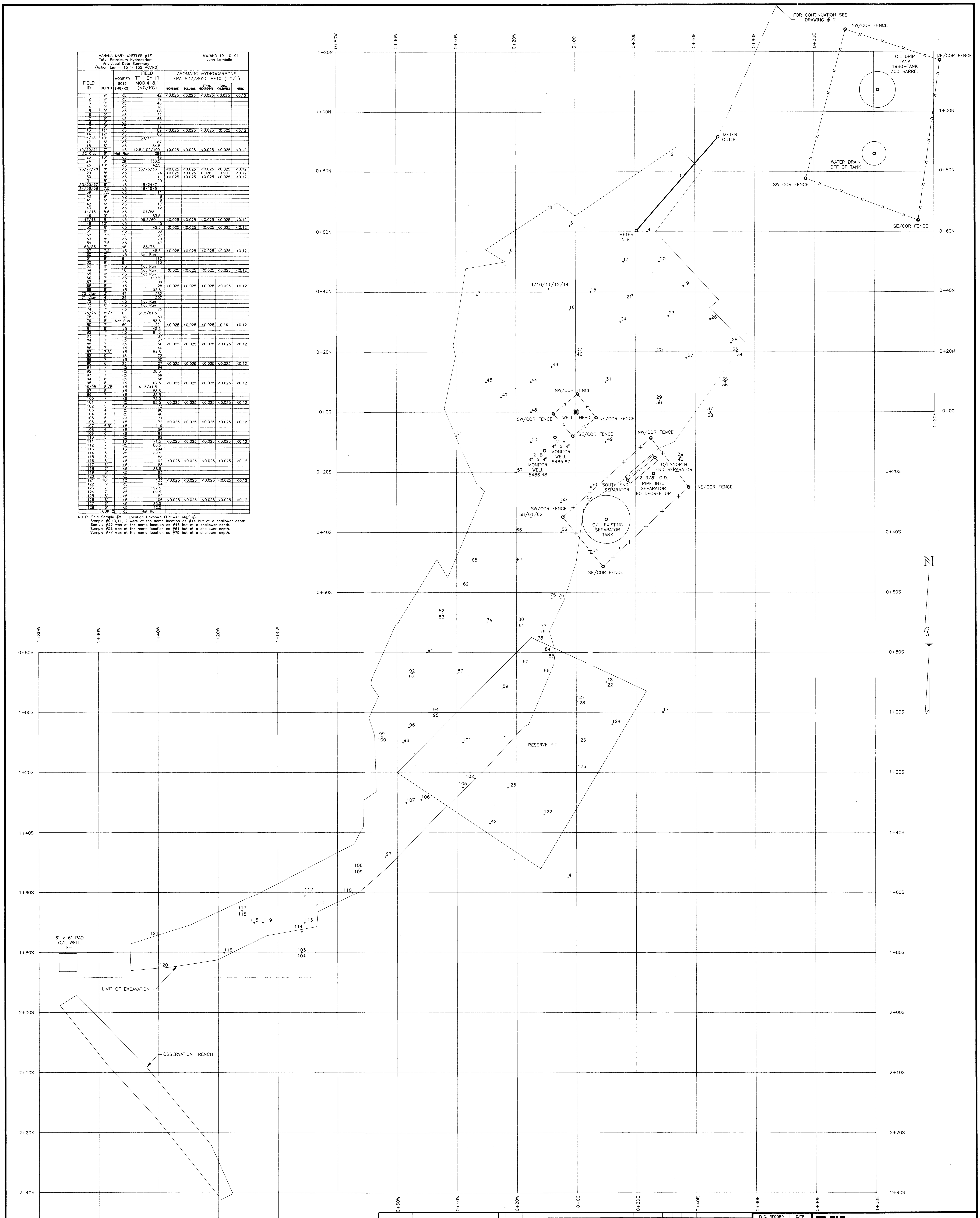
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Dennis Bird	9-6-91 10:20	[signature]			
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks:

Results & Invoices to::	Charge Code	Date Results Reported / by: (Signature)

WHITE-Testing Laboratory YELLOW-EPNG Lab PINK-Field Sampler

san juan repro Form 71-65



MANANA MARY WHEELER #1E
Total Petroleum Hydrocarbon
Analytical Data Summary
(Action Lev = 15 > 135 MG/KG)

MW.WK3 10-10-91
John Lambdin

FIELD ID	DEPTH	MODIFIED 8015 (MG/KG)	FIELD TPH BY IR MOD.418.1 (MG/KG)	AROMATIC HYDROCARBONS EPA 602/8020 BETX (UG/L)				
				BENZENE	TOLUENE	ETHYL BENZENNE	TOTAL XYLENNES	MTBE
1	9'	<5	42	<0.025	<0.025	<0.025	<0.025	<0.12
2	9'	<5	19					
3	9'	<5	46					
4	9'	<5	18					
5	9'	<5	108					
6	9'	<5	22					
7	9'	<5	68					
B	0'	<5	4					
C	0'	10	12					
13	11'	<5	89	<0.025	<0.025	<0.025	<0.025	<0.12
14	12'	<5	86					
15/16	10'	<5	50/111					
17	6'	<5	87					
18	6'	<5	54.5					
19/20/21	7'	<5	42.5/102/109	<0.025	<0.025	<0.025	<0.025	<0.12
22 Clay	6'	Not Run	286					
23	10'	<5	49					
24	8'	29	130.5					
25	10'	<5	42.5					
26/27/28	8'	<5	36/75/36	<0.025	<0.025	<0.025	<0.025	<0.12
29	8'	<5	24	<0.025	<0.025	0.026	0.20	<0.12
30	8'	<5	11	<0.025	<0.025	<0.025	<0.025	<0.12
31	8'	<5	20					
33/35/37	6'	<5	15/24/7					
34/36/38	7.5'	<5	16/15/9					
39	7.5'	<5	11					
40	9'	<5	8					
41	6'	<5	8					
42	6'	<5	17					
43	9'	<5	12					
44/45	8.5'	<5	104/88					
46	9'	<5	83.5					
47/48	8	<5	99.5/60	<0.025	<0.025	<0.025	<0.025	<0.12
49	10'	<5	45					
50	6'	<5	42.5	<0.025	<0.025	<0.025	<0.025	<0.12
51	8'	<5	50					
52	7.5'	15	87					
53	8'	<5	70					
54	7.5'	<5	47					
55/56	7'	48	83/75					
57	7.5'	<5	48.5	<0.025	<0.025	<0.025	<0.025	<0.12
60	0'	<5	Not Run					
61	9'	6	117					
62	9'	6	110					
63	0'	<5	Not Run					
64	0'	10	Not Run	<0.025	<0.025	<0.025	<0.025	<0.12
65	0'	<5	Not Run					
66	7'	<5	113.5					
67	8'	<5	99					
68	8'	<5	28	<0.025	<0.025	<0.025	<0.025	<0.12
69	8'	<5	92.5					
70 Clay	3'	47	252					
71 Clay	4'	26	307					
72	0'	<5	Not Run					
73	0'	<5	Not Run					
74	7'	<5	75					
75/76	8'/7	6	61.5/81.5					
78	6'	18	53					
79	8'	Not Run	53.5					
80	7'	60	221	<0.025	<0.025	<0.025	0.16	<0.12
81	8'	<5	45.5					
82	7'	<5	61.5					
83	7'	<5	87					
84	7'	<5	37					
85	7'	<5	56	<0.025	<0.025	<0.025	<0.025	<0.12
86	7'	<5	40					
87	7.5'	<5	84.5					
88	0'	18	72					
89	7'	<5	90					
90	6'	22	27	<0.025	<0.025	<0.025	<0.025	<0.12
91	7'	<5	94					
92	7'	<5	38.5					
93	7'	<5	69					
94	8'	<5	68					
95	8'	<5	67.5	<0.025	<0.025	<0.025	<0.025	<0.12
96/98	8'/8'	<5	41.5/41.5					
97	5'	<5	83.5					
99	7'	<5	33.5					
100	7'	<5	73.5					
101	7'	<5	82.5	<0.025	<0.025	<0.025	<0.025	<0.12
102	5'	45	73					
103	4'	<5	90					
104	4'	<5	46					
105	5'	29	71					
106	5'	<5	72	<0.025	<0.025	<0.025	<0.025	<0.12
107	6.5'	<5	119					
108	6'	<5	96					
109	6'	<5	81					
110	5'	<5	92					
111	5'	10	71.5	<0.025	<0.025	<0.025	<0.025	<0.12
112	7'	<5	86.5					
113	5'	13	294					
114	5'	<5	69.5					
115	5'	<5	58					
116	6'	<5	102	<0.025	<0.025	<0.025	<0.025	<0.12
117	6'	<5	88					
118	6'	<5	88.5					
119	8'	<5	83					
120	10'	<5	86					
121	10'	12	133	<0.025	<0.025	<0.025	<0.025	<0.12
122	6'	<5	94					
123	7'	<5	122.5					
124	7'	<5	109.5					
125	6'	<5	82					
126	6'	<5	106	<0.025	<0.025	<0.025	<0.025	<0.12
127	6'	<5	85.5					
128	6'	<5	72.5					
	CDK C	<5	Not Run					

NOTE: Field Sample #8 – Location Unknown (TPH=41 Mg/Kg).
Sample #9,10,11,12 were at the same location as #14 but at a shallower depth.
Sample #32 was at the same location as #46 but at a shallower depth.
Sample #58 was at the same location as #61 but at a shallower depth.
Sample #77 was at the same location as #79 but at a shallower depth.

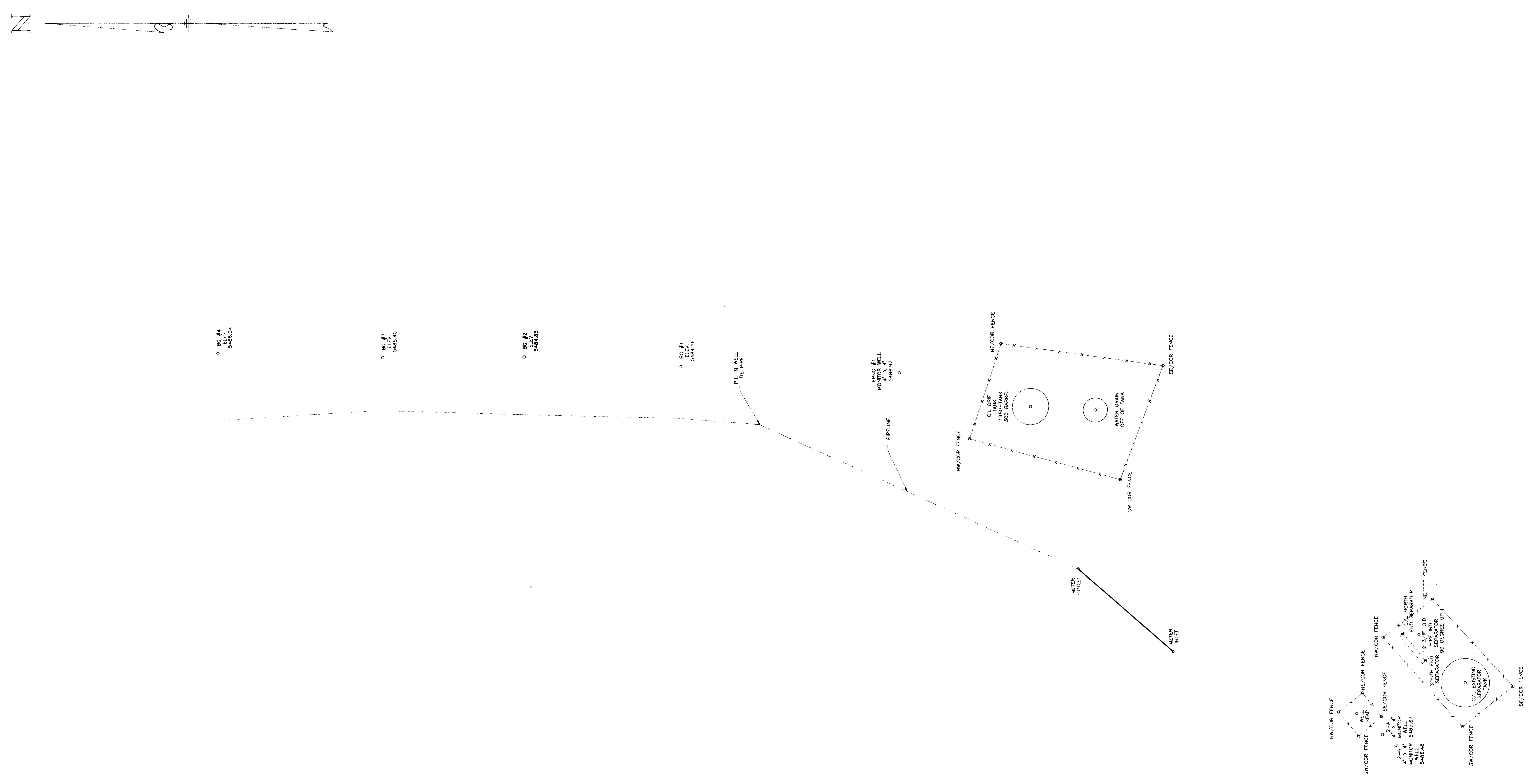
ENG. RECORD		DATE
DRAFTING DESIGN	RAF	10/10/91
COMPUTER GRAPHICS	RAF	10/10/91
CHECKED		
PROJECT APPROVAL		
DESIGN APPROVAL		
COMPUTER SAVE NAME	FLOAD052	

El Paso NATURAL GAS COMPANY

20' GRID AROUND THE
MANANA GAS INC
MARY WHEELER # 1E WELL HEAD
SHOWING EXCAVATED AREA AND SAMPLE LOCATIONS
SW/4SW/4 SEC. 23, T-30-N, R-12-W, N.M.P.M.
SAN JUAN COUNTY, NEW MEXICO

SCALE: 1"=10' W.O.: S-9557 DWG. NO. 1 REV.

DWG. NO.	TITLE	NO.	DATE	BY	DESCRIPTION	W.O.	APP.	PRT.	SEP.	DATE	TO	W.O.
REFERENCE DRAWINGS		REVISIONS						PRINT RECORD				



ENG. RECORD		DATE
DRAFTING DESIGN	RAF	2/12/91
COMPUTER GRAPHICS	RAF	2/12/91
CHECKED		
PROJECT APPROVAL		
DESIGN APPROVAL		
COMPUTER SAVE NAME	FLOADOS1	

El Paso NATURAL GAS COMPANY

PLAT SHOWING LOCATION OF FACILITIES
ON THE MANANA GAS INC
MARY WHEELER # 1E WELL

SW/4SW/4 SEC. 23, T-30-N, R-12-W, N.M.P.M.
SAN JUAN COUNTY, NEW MEXICO

SCALE: 1"=20'
W.O.: S-9557
DWG. NO. 2
REV. 1

NO.	DATE	BY	DESCRIPTION	W.O.	APP.
1	5/13/91	RAF	ADDED BACKGROUND POINTS TO DWG.	S9557	A.P.

REVISIONS

PRT.	SEP.	DATE	TO	W.O.

PRINT RECORD

DWG. NO.	TITLE

REFERENCE DRAWINGS

LEGEND

El Paso
Natural Gas Company

OIL CONSERV... ON DIVISION
REC... VED

'91 OCT 22 AM 8 45

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

October 17, 1991

Mr. David Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, NM 87504

Re: Remediation at Manana-Mary Wheeler #1E
Gas Well Site, Flora Vista, New Mexico

Dear Mr. Boyer:

On October 11, we sent you the Manana-Mary Wheeler #1E Site Remediation package. After mailing, we discovered a line was missing on Page 4. Please replace with the attached. We apologize for the inconvenience.

Very truly yours,

Thomas D. Hutchins

Thomas D. Hutchins
Manager
North Region Compliance Engineering

III. Reserve Pit

During the 1989 K.W. Brown investigation, the reserve pit area was identified. The size of the pit was approximate and based on sizes of similar pits within the San Juan Basin. During remediation, EPNG dug trenches on the north and south edges of the reserve pit. By digging the trenches and locating the clay layer, EPNG determined the size of the reserve pit.

Dave Boyer directed EPNG to remove all clays and drilling mud in the reserve pit. Approximately one half of the reserve pit area was within the plume. In the area outside of the plume, clean overburden and uncontaminated substrate material was excavated and stockpiled for use as clean backfill. The contractor removed the clay zone and soil beneath the clay zone. Field verification samples were obtained at a depth of six feet in the reserve pit area. The clay layer varied in depth but in most cases, it was approximately three feet from grade and one foot thick.

IV. Cleanup and Closure of Observation Trench

Water samples from the observation trench were obtained on August 15 and September 3. The results are under Tab 3. The results were below WQCC standards. During the excavation activities, there was no sign of hydrocarbons in the observation trench. Therefore, on September 3, the fence around the observation trench was removed and the trench was backfilled.

V. Eight Hour Pump Test

Since the observation trench showed no signs of hydrocarbon contamination during the excavation activities, Dave Boyer agreed to an eight hour pump test. Originally, it was planned to pump the water into "frac" tanks, analyze the water and truck the water to EPNG's Kutz lined pond.

However, since the contractor had the 6000 gallon portable water tank at the site, EPNG decided to pump the water directly into the portable tank instead of a "frac" tank. A water truck hauled the water from the portable tank to the Kutz Lined Pond.

On September 5, an eight hour pump test was conducted. Well S1 was pumped at a rate of approximately 66 gallons per minute. During the beginning, middle and end of the test, the water did not show any signs of hydrocarbon contamination. The water was clear and did not have a hydrocarbon odor.

After the pump test, the water was analyzed for BETX and TDS. The results are under Tab 4. The BETX results are below WQCC standards.

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

October 11, 1991

Mr. David Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Re: Remediation at Manana-Mary Wheeler #1E
Gas Well Site, Flora Vista, New Mexico

El Paso Natural Gas Company(EPNG) recently completed remediation activities at the referenced site. Attached is a synopsis of excavation activities, field Total Petroleum analyses results, Modified 8015 analyses results and results from the eight hour pump test.

As noted in Section VI of the synoposis, EPNG requests permission to plug and abandon Well S1. This request is based on the successful soil and groundwater remediation, lack of any visible discolored water appearing in the observation trench, the clear water observed during the pump test and the results of the samples collected during the pump test.

We look forward to your early consideration of this matter.

Sincerely yours,

Thomas D. Hutchins

Thomas D. Hutchins
North Region Compliance Manager

Encl: As stated

MANANA MARY WHEELER #1E SITE REMEDIATION

I. Introduction and Background Information

Manana Gas, Inc. operates a producing natural gas well in Flora Vista, New Mexico. Manana Gas facilities include an aboveground oil storage tank, a separator and below grade separator liquids storage tank. El Paso Natural Gas Company (EPNG) currently has a meter house and meter run at the site. In the 1980's, EPNG also had dehydration facilities at the site. The facilities were removed in 1987. The well is in an area directly adjacent to the Animas River. Hydrocarbons were detected in one water well located hydrologically downgradient of the gas production units. El Paso Natural Gas Company conducted a site investigation of the site in 1989.

Based on OCD's authority to require Manana Gas and EPNG to conduct the necessary cleanup activities, EPNG removed hydrocarbon contaminated soil and drilling muds near the wellsite.

II. Excavation Activities

Diamond D Construction of Kirtland, New Mexico was the project contractor. Manana Gas removed their ancillary production units and shut-in the well prior to excavation.In order to assure worker safety and access to the site, EPNG removed the meter house and meter run prior to excavation activities.

On August 15, 1991, EPNG conducted a pre-excavation safety meeting at the site. First,a temporary trench, located approximately ten feet southwest of Well S1, was constructed to serve as an observation trench. The observation trench allowed natural volatilization of any dissolved hydrocarbons. The observation trench was approximately eighty five feet long,eight feet wide and five feet deep. The contractor initially installed a portable air compressor and slotted PVC pipe to act as a "air stripper" in the trench. Although the air compressor was equipped with a dry element filter, the filter was not sufficient. After discussion with Dave Boyer, EPNG requested the contractor to recirculate the water in the trench with a portable pump. A five foot high fence was installed around the observation trench.

After construction of the observation trench, the contractor began excavation with a Komatsu 200 LC backhoe in an area north of the meter house. During excavation, the top three to five feet of clean overburden was removed and stockpiled adjacent to the excavation area. The clean overburden was used for backfill after all hydrocarbon contaminated soil was removed.

The contractor excavated below the groundwater table. The groundwater table at the site varied from 5 1/2 feet from grade in the northern half of the excavation to 4 feet from grade in the southern half of the excavation. Water infiltrating into the excavation area was pumped into a portable 6000 gallon water tank. From the portable tank the water was transferred into an 80 barrel water truck. The water was discharged into EPNG's Kutz Plant lined pond.

Kutz Plant is located approximately ten miles from the project site. Two absorbent sweeps were stored at Kutz lined pond. The sweeps were on hand to move any freephase hydrocarbons to one side of the pond. If there were hydrocarbons, EPNG planned to collect and recycle the hydrocarbons. Not enough hydrocarbons were detected in the water discharged to require skimming.

Four 20 yard end dumps and one belly dump hauled excavated soil from the job site to EPNG's Ballard Plant. Trucks were allowed to leave the site after most of the water had been drained from the soil, provided the water was not oily. The soil was fully drained prior to leaving the site if oily water was encountered. Belly dump trucks hauled only dry soils. The truck hauling procedures were approved by NMOCD.

Although EPNG constructed a trough to collect water drainage from the end dumps, the trough was not used at the site. During the first three days of the of the project, a twenty four inch diameter PVC pipe was cut in half and was placed underneath the dump truck tailgate. The water collected in the PVC pipe was diverted back to the open excavation trench. Later, a John Deere 544 Loader bucket was used to collect any water drainage from the end dumps. The John Deere 544 Loader returned the water back into the excavation trench.

One hundred oil absorbent pads were stored at the site in case large volumes of hydrocarbons were liberated during excavation. The pads were not used since no significant volumes of hydrocarbons were encountered in the excavation area.

The Farmington Division Laboratory conducted field total petroleum hydrocarbons (TPH) test with a Horiba OCMA-220 Oil Content Analyzer using the 418.1 IR method. Since the background TPH concentration was 35 ppm near the site, an action level of 135 ppm was set by NMOCD. The background sample analytical data is under Tab 1. Figure 2, under Tab 6, shows the location of the background samples. During remediation, the soil was excavated until the field TPH was below 135 ppm. Although every effort was made to obtain samples in a grid , it was difficult since the progress of excavation followed the hydrocarbon contamination.

Each field sample was analyzed twice by the Horiba OCMA-220. The two results were averaged and noted under Field TPH in the Analytical Data Summary table under Tab 2. When the field results were less than 135 ppm, verifications samples were sent to Analytical Technologies Laboratories in Phoenix, Arizona for Modified 8015 verification analysis. Every fifth sample was analyzed for BTEX by Method 8020. Duplicate and blank samples were collected and analyzed for quality assurance/quality control. A summary of the analytical results is presented in the Table under Tab 2. A map of the excavated area showing the sample locations, is under Tab 5.

On the west edge of the excavation, visual and field TPH tests verified the western extent of contamination. When the soil turned from black to gray and the field TPH tests were below 135 ppm, further westward excavation was discontinued. On the east edge of the excavation, the soil remained black. Therefore, excavation continued until the field TPH was below 135 ppm.

The excavated soil was hauled to EPNG's Ballard Plant and spread in a six inch layer. Ballard Plant is located approximately 45 miles from the excavation site. The shallowest useable aquifer is about 440 feet deep at Ballard Plant. The soil was disced twice a week for the duration of the excavation activities. A Caterpillar D-6 with a ripper disced the soil. The entire soil remediation site was bermed to prevent runoff from entering and leaving.

Clean sandy backfill from Ballard Plant and a local contractor, CDK Inc., was used to backfill the site. Below a depth of four feet from grade, riverstone cobble and coarse grained sandy backfill was required. This material was placed to reduce the probability of future settling in the area. Clean, sandy backfill was utilized for the top four feet of the excavated area.

On August 28th, the excavation was at the southern edge of the plume, near the large cottonwood trees. The landowner did not want his large cottonwood trees cut unless it was absolutely necessary. Dave Boyer asked for a representative of Flora Vista Water Users Association to be at the site. The representative, Mr. Leon Knowlton, approved the plan to not cut the large cottonwood trees. EPNG cut down small cottonwoods and Russian olive trees in order to follow the plume to Well S1.

The contractor excavated, hauled and spread 3621.82 tons of contaminated soil. The backfill from Ballard Plant and CDK totalled 1849.45 tons of cobbly backfill and 1474.40 tons of sandy backfill for the site. The contractor transported 2590 barrels of water to Kutz lined pond from the excavation area. In addition, 2590 cubic yards of clean overburden was removed and reinstalled in the excavation area.

After excavation was completed, the excavated area was graded with a A550 Gallion Grader to meet the tenant, Mr. Eli Velasquez, specifications.

III. Reserve Pit

During the 1989 K.W. Brown investigation, the reserve pit area was identified. The size of the pit was approximate and based on sizes of similar pits within the San Juan Basin. During remediation, EPNG dug trenches on the north and south edges of the reserve pit. By digging the trenches and locating the clay layer, EPNG determined the size of the reserve pit.

Dave Boyer directed EPNG to remove all clays and drilling mud in the reserve pit. Approximately one half of the reserve pit area was within the plume. In the area outside of the plume, clean overburden and uncontaminated substrate material was excavated and stockpiled for use as clean backfill. The contractor removed the clay zone and soil beneath the clay zone. Field verification samples were obtained at a depth of six feet in the reserve pit area. The clay layer varied in depth but in most cases, it was approximately three feet from grade and one foot thick.

IV. Cleanup and Closure of Observation Trench

Water samples from the observation trench were obtained on August 15 and September 3. The results are under Tab 3. The results were below WQCC standards. During the excavation activities, there was no sign of hydrocarbons in the observation trench. Therefore, on September 3, the fence around the observation trench was removed and the trench was backfilled.

V. Eight Hour Pump Test

Since the observation trench showed no signs of hydrocarbon contamination during the excavation activities, Dave Boyer agreed to an eight hour pump test. Originally, it was planned to pump the water into "frac" tanks, analyze the water and truck the water to EPNG's Kutz lined pond.

However, since the contractor had the 6000 gallon portable water tank at the site, EPNG decided to pump the water directly into the portable tank instead of a "frac" tank. A water truck hauled the water from the portable tank to the Kutz Lined Pond.

On September 5, an eight hour pump test was conducted. Well S1 was pumped at a rate of approximately 66 gallons per minute. During the beginning, middle and end of the test, the water did not show any signs of hydrocarbon contamination. The water was clear and did not have a hydrocarbon odor.

results are under Tab 4. The BETX results are below WQCC standards.

VI. Future Work At Site

All EPNG and NMOCD monitoring wells within the excavated area were removed during excavation activities. EPNG also removed all NMOCD's monitoring wells located south of the excavated area. Since the BETX results were below WQCC standards after the eight hour pump test, EPNG plans to plug and abandon Well S1.

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

October 11, 1991

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

Mr. Thomas D. Hutchins, Manager
North Region Compliance Engineering
El Paso Natural Gas Company
P.O. Box 1492
El Paso, TX 79978

RE: EPNG FLORA VISTA REMEDIATION
SAN JUAN COUNTY, NEW MEXICO

Dear Mr. Hutchins:

Enclosed please find a copy of a BTEX water analysis for the Flora Vista aeration trench taken on August 15. Please note that the sample was taken after the air compressor had been activated. As you may know, we suspected during this time that the compressor filters were not removing hydrocarbons because a blue haze was observed above the water in the trench. The haze dissipated after the compressor was shut down. It was replaced by a water pump that circulated the water. Because of the circumstances of this incident, I do not believe the low level of benzene is significant and that the value represents failure of the compressor filters and not evidence of other contamination.

If you have any questions regarding this analysis please call Bill Olson at (505) 827-5885 after October 21.

Sincerely,

David G. Boyer

David G. Boyer
Environmental Bureau Chief

enc.

cc: OCD Aztec Office

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

ANALYSIS REQUEST FORM

Contract Lab IML Contract No.

OCD Sample No. 9108151105

Collection Date	Collection Time	Collected by —Person/Agency
910815	1105	Boyer /OCD

SITE INFORMATION

Sample location Flora Vista - Aeration Trench

Collection Site Description

Sample from N. side center 50' Trench Approx 90 minutes after air pump shut off

Township, Range, Section, Tract:

SEND FINAL REPORT TO
ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
PO Box 2088
Santa Fe, NM 87504-2088

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted: 1

- 1 ☒ **NF:** Whole sample (Non-filtered)
- ☐ **F:** Filtered in field with 0.45 μ membrane filter
- ☐ **PF:** Pre-filtered w/45 μ membrane filter

- ☐ **NA:** No acid added
- ☐ **A:** HCL
- ☐ **A:** 2ml H_2SO_4/L added
- ☐ **A:** 5ml conc. HNO_3 added
- ☐ **A:** 4ml fuming HNO_3 added
- 1 ☒ $HgCl_2$

SAMPLING CONDITIONS

☐ Bailed ☐ Pump
☒ Dipped ☐ Tap

pH(00400)	Water level
Water Temp. (00010)	Discharge
	Sample type
	Conductivity (Uncorrected) μmho
	Conductivity at 25° C μmho

FIELD COMMENTS:

LAB ANALYSIS REQUESTED:

ITEM	DESC	METHOD	ITEM	DESC	METHOD	ITEM	DESC	METHOD
☒ 001	VOA	8020	☐ 013	PHENOL	604	☐ 026	Cd	7130
☐ 002	VOA	602	☐ 014	VOC	8240	☐ 027	Pb	7421
☐ 003	VOH	8010	☐ 015	VOC	624	☐ 028	Hg(L)	7470
☐ 004	VOH	601	☐ 016	SVOC	8250	☐ 031	Se	7740
☒ ~~005~~	~~SUITE~~	~~8010-8020~~	☐ 017	SVOC	625	☐ 032	ICAP	6010
☐ 006	SUITE	601-602	☐ 018	VOC	8260	☐ 033	CATIONS/ANIONS	
☐ 007	HEADSPACE		☐ 019	SVOC	8270	☐ 034	N SUITE	
☐ 008	PAH	8100	☐ 020	O&G	9070	☐ 035	NITRATE	
☐ 009	PAH	610	☐ 022	AS	7060	☐ 036	NITRITE	
☐ 010	PCB	8080	☐ 023	Ba	7080	☐ 037	AMMONIA	
☐ 011	PCB	608	☐ 024	Cr	7190	☐ 038	TKN	
☐ 012	PHENOL	8040	☐ 025	Cr6	7198	☐	OTHER	

Inter·Mountain Laboratories, Inc.

2506 West Main Street
Farmington, New Mexico 87401
Tel. (505) 326-4737

VOLATILE AROMATIC HYDROCARBONS

Client:	NMOCD	Report Date:	09-26-91
Sample ID:	Flora Vista Trench	Date Sampled:	08-15-91
Laboratory Number:	6949	Date Received:	08-16-91
Analysis Requested:	8020	Date Analyzed:	08-28-91
Sample Matrix:	Water	Preservative:	Cool & HgCl2
Condition:	Cool & Intact		

Parameter	Concentration (ug/L)	Det. Limit (ug/L)
Benzene	1.4	0.5
Toluene	ND	0.5
Chlorobenzene	ND	0.5
Ethylbenzene	ND	0.5
p,m-Xylene	ND	0.5
o-Xylene	ND	0.5
1,3-Dichlorobenzene	ND	0.5
1,4-Dichlorobenzene	ND	0.5
1,2-Dichlorobenzene	ND	0.5

SURROGATE RECOVERIES:

Parameter	Percent Recovery
4-Bromofluorobenzene	93.2 %

Method: Method 8020, Aromatic Volatile Organics, SW-846, USEPA, (Sept. 1986).
ND - Parameter not detected at the stated detection limit.

Comments:

Tony Tristano
Analyst

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

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

August 21, 1991

CERTIFIED MAIL -
RETURN RECEIPT NO. P-756-666-155

rcd Nancy K. Prince 8/21/91

Mr. Thomas D. Hutchins, Manager
North Region Compliance Engineering
El Paso Natural Gas Company
P. O. Box 1492
El Paso, Texas 79978

RE: Remediation of Manana
Mary Wheeler #1E Gas Well Site
Flora Vista, New Mexico

Dear Mr. Hutchins:

The Oil Conservation Division (OCD) has approved additional changes or clarifications to EPNG's work plan for remediation at the above site. These changes were requested in a phone call on August 20 to OCD from Anu Pundari and John Lambdin of EPNG's Farmington Office.

Based on the information provided in that phone conversation, I approved the following modifications to the site work plan:

1. Three trench samples, each one taken every ten feet, can be composited to be tested for method 8015 verification.

2. Excavation of deep contaminated material exceeding 135 ppm TPH is to be continued until the depth limitation of on-site equipment is reached. At that point, a soil verification sample should be obtained, along with a water sample for BTEX testing. The apparent aeral extent of the unreclaimed material and grid location should be noted and the area backfilled. Further evaluation will be made after test results are received.

3. Removal of clays, and material exceeding the 135 ppm TPH limit, is required at the drilling mud/reserve pit. Removal of clean overburden or uncontaminated substrate material is not necessary. However, trenching below the obvious clay zone should be performed periodically to confirm the absence of mixed material at depth.

Copies of this letter and yesterday's (8-20) letter are being faxed to Ms. Pundari in Farmington. If you have any questions please contact me at (505) 827-5812.

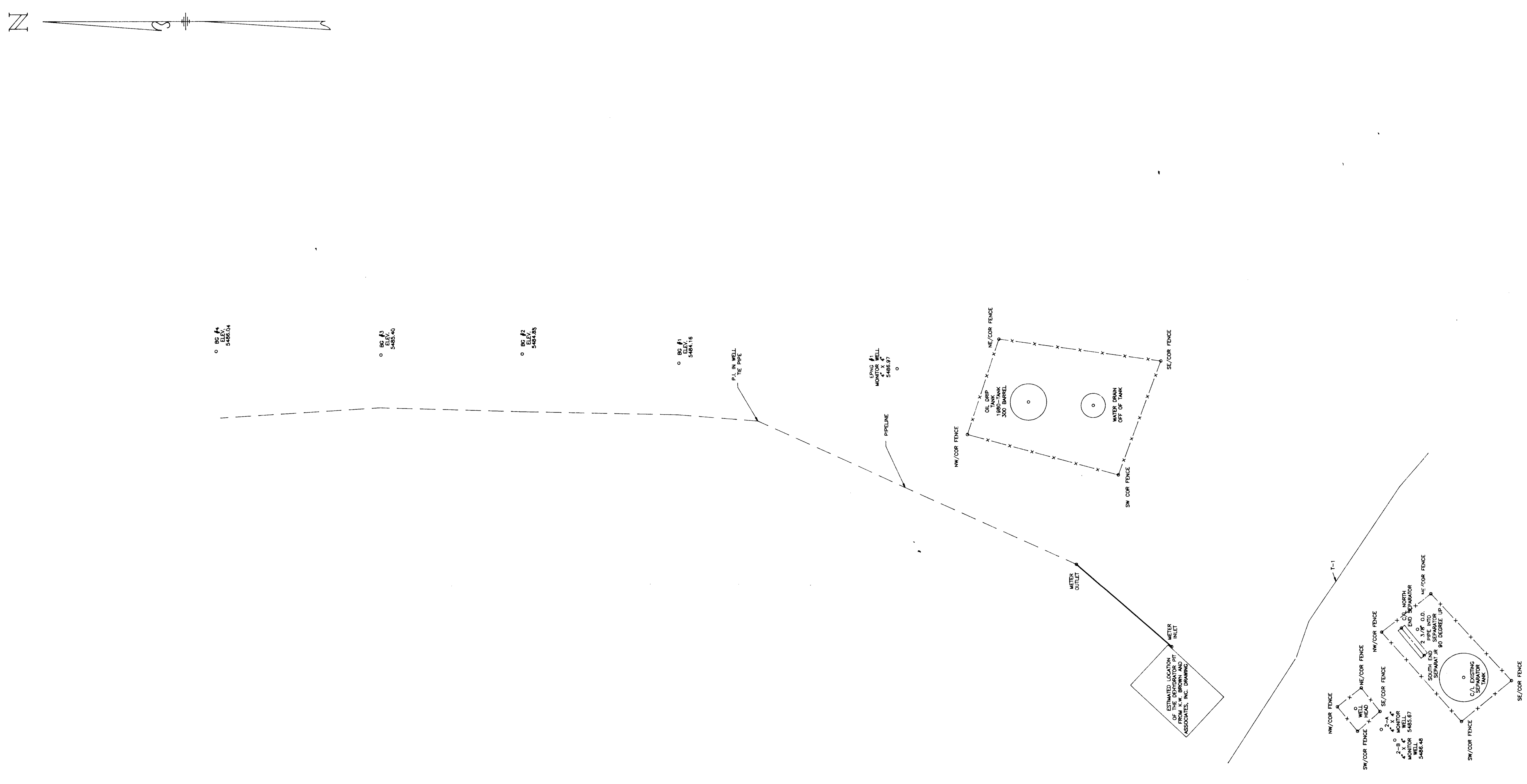
Sincerely,

David G. Boyer

David G. Boyer, Hydrogeologist
Environmental Bureau Chief

DGB/sl

cc: OCD Aztec Office
Anu Pundari, EPNG, Farmington



RECEIVED
AUG 13 1991
OIL CONSERVATION DIV.
SANTA FE

NOTE
PRELIMINARY DRAWING
FOR APPROVAL ONLY
FINISH DRAWING AND
DRAWING NUMBER TO
BE FURNISHED BY MAIN OFFICE

LEGEND

REFERENCE DRAWINGS

DWG. NO.	TITLE

REVISIONS

NO.	DATE	BY	DESCRIPTION	W.O.	APP.
1	5/13/91	RAF	ADDED BACKGROUND POINTS TO DWG.	S9557	A.P.

PRINT RECORD

PRT.	SEP.	DATE	TO	W.O.

ENG. RECORD		DATE
DRAFTING DESIGN	RAF	2/12/91
COMPUTER GRAPHICS	RAF	2/12/91
CHECKED		
PROJECT APPROVAL		
DESIGN APPROVAL		
COMPUTER SAVE NAME	FLOADDS1	

El Paso
NATURAL GAS COMPANY

PLAT SHOWING LOCATION OF FACILITIES
ON THE MANANA GAS INC
MARY WHEELER # 1E WELL

SW/4SW/4 SEC. 23, T-30-N, R-12-W, N.M.P.M.
SAN JUAN COUNTY, NEW MEXICO

SCALE: 1"=20'
W.O.: S-9557
DWG. NO.
REV. 1

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

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

August 20, 1991

CERTIFIED MAIL -
RETURN RECEIPT NO. P-756-666-150

Mr. Thomas D. Hutchins, Manager
North Region Compliance Engineering
El Paso Natural Gas Company
P. O. Box 1492
El Paso, Texas 79978

RE: Remediation of Manana
Mary Wheeler #1E Gas Well Site
Flora Vista, New Mexico

Dear Mr. Hutchins:

Your letter of August 9, 1991, containing the results of the background tests for Total Petroleum Hydrocarbons (TPH) using the 418.1 IR method has been received. I have reviewed the data and concur with EPNG's request to use a TPH of 35 ppm as a background value using this method.

Additionally, in a conversation on August 13, Ms. Anu Pundari requested that the number of verification samples for BTEX be reduced. Because of the expected large number of samples (in excess of 60) and because BTEX at the site was not a major contributor to the contamination, I concurred with her request. We agreed that only every fifth (5) sample is to be analyzed for BTEX.

I was at the site on Thursday and Friday of last week and verbally approved a number of further changes in the work plan:

1. Composites of four soil samples were approved for method 8015 verification tests.

2. Trucks were allowed to leave the site after most water had been drained from the dirt load provided the water was not oily. Full draining is required for oily water. Belly-dump trucks for dry soils were approved Monday morning (8-19) after a conversation with Nancy Prince.

3. A water pump was approved for use in the aeration trench. It replaced an air compressor which was imparting a blue haze to the trench indicating that the air filters were not completely effective.

I was very impressed with the portable laboratory which Norman Norvelle has set up. It worked very well showing that much forethought was put into its construction and operation. It's operation will greatly speed up excavation work.

Kathy Brown of this office will be on site Thursday and Friday of this week to observe excavation of the soils. I expect to return for several days during the week of August 26.

Sincerely,

David G. Boyer

David G. Boyer, Hydrogeologist
Environmental Bureau Chief

DGB/sl

cc: OCD Aztec Office
Anu Pundari, EPNG

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

August 9, 1991

RECEIVED

AUG 13 1991

OIL CONSERVATION DIV.
SANTA FE

Mr. David Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
P.O. Box 2088
Land Office Building
Santa Fe, New Mexico 87504-2088

RE: Remediation of Manana-Mary Wheeler #1E Gas Well Site, Flora Vista, New Mexico

Dear David:

In accordance with the plan approved by the New Mexico Oil Conservation Division (NMOCD), attached is a copy of Anu Pundari's memo concerning the sampling to determine a background Total Petroleum Hydrocarbon level at the Mary Wheeler #1E well site.

The El Paso lab will perform the 418.1 IR Method and an outside lab will perform the analysis by the Modified 8015 Method. Based on the attached results, El Paso proposes the following background levels be used for the remediation at Mary Wheeler #1E:

418.1 IR Method - (20+40+74+20)/4 = 38.5 ppm, **Use 35 ppm.**
Therefore, when the results from the field detection unit are less than 135 ppm, a verification sample will be caught and the area backfilled.

Modified 8015 Method - The background level will be zero (0).
The results should not exceed 100 ppm.

I will be out of the office August 12 - 15. Therefore, please contact Anu Pundari, at (505) 599-2176 if you have any questions or need additional information.

Sincerely,

T. D. Hutchins, gb

Thomas D. Hutchins
Manager, North Region Compliance

Attachments: As stated
c: Anu Pundari

FLORA VISTA CONTAMINATION
MANANA-MARY WHEELER

TESTING

1. Using the portable IR (infrared) spectrophotometer for field screening of TPH in the soils (418.1). Pick up additional organics so determined a background level. Background level determined is 35 ppm. Soils must be below the UST standard of 100 ppm. Therefore, the remediation level is 135 ppm TPH. Anything below this level can be left in place.

2. Use modified 8015 for TPH and 8020 for BTEX.
Composite samples are taken from each area = to the backhoe swing width x 50' or the length of the excavation (smaller). OCD requires 1 sample per 10 feet are to be composited for 8015 verification

2. Highest contamination is TPH. BTEX is not a major contamination contributor. The reserve pit is the major source of the contamination.

3. The excavation will begin in the area farthest up gradient. Any clean (nonstained) overburden soils can be stockpiled and used for backfill. Any excavated soils less than 135 ppm TPH can be used for backfill. For soils over 135 ppm TPH (field analyzed) must have a lab verification. If excavations proceed to a depth of 8 feet, need to stop operations and assess the need for further excavations.

EL PASO NATURAL GAS COMPANY MEMORANDUM

To: Tom Hutchins

From: A.N. Pundari

Date: June 4, 1991

Place: North Region Engineering

Re: Mary Wheeler #1E Background Samples

In order to determine the background TPH level, four soil samples were collected in an area no less than 100 feet up gradient from the beginning of the excavation area. At each of the four locations, soil was collected at the surface, at a depth of 12 inches and at a depth of 24 inches. The soil was composited into a single sample for analysis by 418.1 IR and Modified 8015 Methods.

The results are noted below:

	418.1 IR Method (mg/l)	Modified 8015 Method (mg/l)
Sample #1	<20	<5
Sample #2	40	<5
Sample #3	74	<5
Sample #4	<20	<5

The average of the four sample results will be used for the background TPH level, if approved by NMOCD. A map showing the area and location of each sample is attached. In addition, a copy of the analytical results are also attached.

A. N. Pundari

A.N. Pundari

cc: S.Miller/File 5216-Mary Wheeler #1E

Analytical Technologies, Inc. 9830 S. 51st Street Suite B-113 Phoenix, AZ 85044 (602) 496-4400

ATI I.D. 105554

May 16, 1991

El Paso Natural Gas Company
P.O. Box 4990
Farmington, NM 87499

Project Name/Number: Mary Wheeler

Attention: John Lambdin

On 05/03/91, Analytical Technologies, Inc. received a request to analyze soil sample(s). The sample(s) were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

If you have any questions or comments, please do not hesitate to contact us at (602) 496-4400.

Elizabeth Proffitt
Elizabeth Proffitt
Senior Project Manager

Robert V. Woods
Robert V. Woods
Laboratory Manager

RVW:clf
Enclosure

Analytical Technologies, Inc.

CLIENT : EL PASO NATURAL GAS, NEW MEXICO DATE RECEIVED : 05/03/91
PROJECT # : (NONE)
PROJECT NAME : MARY WHEELER REPORT DATE : 05/09/91

ATI I.D. : 105554

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	N10615	SOIL	05/02/91
02	N10616	SOIL	05/02/91
03	N10617	SOIL	05/02/91
04	N10618	SOIL	05/02/91

MAY 1991

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	4

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from th date of this report. If an extended storage period is required, please contac our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 105554

CLIENT : EL PASO NATURAL GAS, NEW MEXICO
PROJECT # : (NONE)
PROJECT NAME : MARY WHEELER

DATE RECEIVED : 05/03/91
REPORT DATE : 05/09/91

PARAMETER	UNITS	01	02	03	04
PETROLEUM HYDROCARBONS, IR	MG/KG	<20	40	74	<20

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10555401

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE SAMPLED	: 05/02/91
PROJECT #	: (NONE)	DATE RECEIVED	: 05/03/91
PROJECT NAME	: MARY WHEELER	DATE EXTRACTED	: 05/03/91
CLIENT I.D.	: N10615	DATE ANALYZED	: 05/06/91
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	116

Acceptable!
JJ
5-22-91

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10555402

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE SAMPLED	: 05/02/91
PROJECT #	: (NONE)	DATE RECEIVED	: 05/03/91
PROJECT NAME	: MARY WHEELER	DATE EXTRACTED	: 05/03/91
CLIENT I.D.	: N10616	DATE ANALYZED	: 05/06/91
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-
SURROGATE PERCENT RECOVERIES	
DI-N-OCTYL-PHTHALATE (%)	109

5-22-91

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10555403

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE SAMPLED	: 05/02/91
PROJECT #	: (NONE)	DATE RECEIVED	: 05/03/91
PROJECT NAME	: MARY WHEELER	DATE EXTRACTED	: 05/03/91
CLIENT I.D.	: N10617	DATE ANALYZED	: 05/06/91
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	118

Acceptable!
5-22-91
JJ

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10555404

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE SAMPLED	: 05/02/91
PROJECT #	: (NONE)	DATE RECEIVED	: 05/03/91
PROJECT NAME	: MARY WHEELER	DATE EXTRACTED	: 05/03/91
CLIENT I.D.	: N10618	DATE ANALYZED	: 05/06/91
SAMPLE MATRIX	: SOIL	UNITS	: MG/KG
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	141

Accepted
5-22-91
JF

AnalyticalTechnologies, Inc.

COPY

GENERAL CHEMISTRY - QUALITY CONTROL

CLIENT : EL PASO NATURAL GAS, NEW MEXICO
PROJECT # : (NONE)
PROJECT NAME : MARY WHEELER

ATI I.D. : 105554

PARAMETER	UNITS	ATI I.D.	SAMPLE RESULT	DUP. RESULT	RPD	SPIKED SAMPLE	SPIKE CONC	% REC
PETROLEUM HYDROCARBONS	MG/KG	10555402	40	48	18	230	190	100

Acceptable!
D.J.
5-22-91

% Recovery = (Spike Sample Result - Sample Result) / Spike Concentration X 100

RPD (Relative Percent Difference) = (Sample Result - Duplicate Result) / Average Result X 10

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

		ATI I.D.	: 105554
CLIENT	: EL PASO NATURAL GAS, NEW MEXICO	DATE EXTRACTED	: 05/03/91
PROJECT #	: (NONE)	DATE ANALYZED	: 05/03/91
PROJECT NAME	: MARY WHEELER	UNITS	: MG/KG
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	100

Acceptable
5-22-91
[illegible]

Analytical Technologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 105554

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT : EL PASO NATURAL GAS, NEW MEXICO
PROJECT # : (NONE)
PROJECT NAME : MARY WHEELER
REF I.D. : 10599824

DATE ANALYZED : 05/04/91
SAMPLE MATRIX : NON-AQUEOU:
UNITS : MG/KG

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS	<5	50	45	90	45	90	0

Accepted 5-22-91 [illegible]

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

July 24, 1991

Mr. David Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
P.O. Box 2088
Land Office Building
Santa Fe, New Mexico 87504-2088

RE: Remediation at Manana-Mary Wheeler #1E Gas Well Site, Flora Vista, New Mexico

Dear Mr. Boyer

This letter is to provide you an update on the status of the subject project. On July 18, 1991, a job showing was held with contractors to advise them of the Scope of Work and allow an opportunity to get any clarifications needed prior to submitting bids for the work. We anticipate the contract for the remediation project will be awarded on July 29, with work commencing on or about August 5, 1991.

Attached for your files are the following:

1. A copy of the Bid Package provided to the potential contractors;

2. A copy of a June 10, 1991 letter to the landowner outlining the agreement needed between the landowner and EPNG;

3. A copy of a July 12, 1991 memorandum from an EPNG Right of Way representative advising that Mr. Velasquez, son-in-law of the landowner, has agreed to the requests outlined in EPNG's June 10, 1991 letter to Mr. Thurstonson;

4. A copy of a July 17, 1991 letter to Mr. Ed Hartman, President of Manana Gas, Inc. advising him of the timeframe for removing Manana's facilities; and,

5. A copy of a July 17, 1991 letter to Mr. William F. Carr, attorney for Manana Gas, Inc.

If you have any questions or need additional information please advise.

Very truly yours,

Thomas D. Hutchins

Thomas D. Hutchins, Manager
North Region Compliance Engineering

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

OIL CONSERVATION DIVISION
RECEIVED

'91 JUL 22 AM 10 14

July 15, 1991

BID INVITATION

Re: Remediation at Manana Mary Wheeler #1E at Flora Vista, New Mexico

Gentlemen:

El Paso Natural Gas Company invites you to submit your proposal for work as referenced above and more particularly described in Exhibit "A" of the proposal Contract, two (2) copies of which are attached.

Contractors are asked to meet at 9:00 A.M. (MDT) on Thursday, July 18, 1991 at Company's Farmington Office located at 614 Reilly, Farmington, New Mexico.

Your bid is to be prepared in accordance with the proposed Contract Specification and Drawings. With the exception of the executed date, you are to fill in all blanks including Cost Schedule in Exhibit "B" in the Contract. Please properly execute, sign and witness the Contract in the places and return both complete originals.

Contractors are asked to bring and wear a hard hat, safety glasses with sideshields and a "fire retardant" suit for the job showing. El Paso Natural Gas Company will not supply these items!

Project start Date August 5, 1991 and Completion Date August 30, 1991.

All bidders must be licensed and authorized to transact business in the State (if applicable) where the work is to be performed. **ALL APPLICABLE TAXES ARE NOT TO BE INCLUDED ON THE PROPOSAL.**

Your two (2) executed copies fo the Contract must be received by the undersigned no later than 2:00 P.M. (MDT) on Thursday, July 25, 1991. Proposals not received by that time will not receive consideration.

Please clearly mark the envelope: "BID PROPOSAL -REMEDIATION AT MANANA MARY WHEELER #1E".

Mail Bids to: El Paso Natural Gas Company
Attention: Mr. Joe A. Fierro, Jr.
Contracting
304 Texas Avenue
El Paso, Texas 79901

After receiving your proposal, the Company will review the prices and, upon management review and concurrence, enter into a Contract with the successful bidder, if any.

A preconstruction safety meeting will be held with the successful Contractor prior to move-in.

If you have any questions concerning the document, contact the undersigned. Questions concerning the "Scope of Work" should be directed to Anu Pundari, Compliance Engineer, at (505) 599-2176, Farmington, New Mexico.

Yours very truly,

Joe A. Fierro, Jr.
Analyst, Contracting
(915) 541-5298
FAX (915) 541-3390

JAF:gh
Attachment

cc: M. L. Ayoub
G. E. Bauer
M. L. Gallegos
A. E. Gilmore
T. L. Hutchins
D. M. Kelsey
A. Pundari
H. A. Shaffer
K. L. Steelhammer (w/o attachment)
L. B. Tinker

File

1 2 3 4 5 6 7 8 9

7-15-91 MAT205 Flint Engineering & Construction Co. Attention: Mr. Bobby J. Brown 2 County Road 5569 Farmington, New Mexico 87401 505 325-5081 2 Bid Invitation-Remediation at Manana Mary Wheeler #1E at Flora Vista, New Mexico

OVERNIGHT

7-15-91 MAT544 Diamond D Construction, Inc. Attention: Mr. Dennis Fieldsted 36 County Rd. 6500 Kirkland, New Mexico 87417 505 598-5836 2 Bid Invitation-Remediation at Manana Mary Wheeler #1E at Flora Vista, New Mexico

OVERNIGHT

7-15-91 MAT600 Taft Construction Attention: Mr. Wesley Taft #32 Road 5219 B Bloomfield, New Mexico 87413 505 632-8822 2 Bid Invitation-Remediation at Manana Mary Wheeler #1E at Flora Vista, New Mexico

-OVERNIGHT-

7-15-91 MAT025 Four-Four, Inc. Attention: Mr. B. N. Strunk 3000 E. Bloomfield Highway Farmington, NM 87401 505 327-3500 2 Bid Invitation-Remediation at Manana Mary Wheeler #1E at Flora Vista, New Mexico

OVERNIGHT

7-15-91 MAT028 Foutz & Bursum Construction Attention: Mr. Rob Mitchell 3620 E. Main Farmington, NM 87401 505 325-3712 2 Bid Invitation-Remediation at Manana Mary Wheeler #1E at Flora Vista, New Mexico

OVERNIGHT

7-15-91 MAT718 Yucca Welding & Excavating Attention: Henry B. Armenta 1901 W. Blanco Blvd. Bloomfield, NM 87413 (505) 632-3728 2 Bid Invitation-Remediation at Manana Mary Wheeler #1E at Flora Vista, New Mexico

OVERNIGHT

7-15-91 MAT119 CDK Contracting Company Attention: Bill Etie 800 S. Hutton Road Farmington,NM 87401 505 326-4722 2 Bid Invitation-Remediation at Manana Mary Wheeler #1E at Flora Vista, New Mexico

OVERNIGHT

7-15-91 MAT796 ADD TO LIST Envirotech Inc. Attention: Morris D. Young 5796 U. S. Highway 64-3014 Farmington, New Mexico 87401 (505) 632-0615 2 Bid Invitation-Remediation at Manana Mary Wheeler #1E at Flora Vist, New Mexico

OVERNIGHT

CONSTRUCTION CONTRACT
REMEDIATION AT MANANA MARY WHEELER
AT FLORA VIST, NEW MEXICO

INDEX TO

REMEDIATION AT MANANA MARY WHEELER
AT
FLORA VISTA, NEW MEXICO

PART I

DESCRIPTION OF WORK, PRICE AND SPECIAL PROVISIONS

PART II

GENERAL CONDITIONS

EXHIBITS

Contract No. ______
W/O No. S-9557

CONSTRUCTION CONTRACT

EXCAVATING AND BUCKFILLING
AT
MANANA MARY WHEELER #1E WELL

THIS CONTRACT, made and entered into this _____ day of __________, 1991, by and between EL PASO NATURAL GAS COMPANY, a Delaware Corporation, whose address is Post Office Box 1492, El Paso, Texas 79978, hereinafter referred to as "Company," and ______________________________, whose address is ______________________________, and who is authorized and licensed to do business in the State of Texas hereinafter referred to as "Contractor";

W I T N E S S E T H:

That for and in consideration of payments, covenants and agreements hereinafter set forth, Company and Contractor do hereby contract, covenant and agree with each other as follows:

PART I

DESCRIPTION OF WORK, PRICE AND SPECIAL PROVISIONS

ARTICLE I. STATEMENT OF WORK

Contractor shall excavate and transport contaminated soils to Envirotech's Disposal Site or to Company's facility for disposal. Company will select one of the two sites as the disposal location.

Site of the work is Manana Mary Wheeler #1E Well Site located in Flora Vista, New Mexico.

All such work is more particularly described in Exhibit "A" attached hereto and made a part hereof, and Company and Contractor desire that Contractor shall perform all such work in accordance with drawing and

Company's specifications, all of which Company has furnished to Contractor or will furnish to Contractor in sufficient time to enable Contractor to perform work, and all of which hereinafter referred to as the "Work".

ARTICLE II. SCOPE OF WORK

To complete the work, Contractor shall furnish the following:

A. Construction

(1) Personnel

Contractor shall furnish all necessary superintendents, supervisors, foremen, skilled and unskilled labor, and all other persons.

(2) Construction Equipment, Tools and Supplies

Contractor shall furnish construction tools and equipment, small tools and consumable and expendable supplies necessary to perform the Work in accordance with the diagrams, drawings and Company's Manual of Engineering Standards ("MES") and shall arrange for transportation to the site of the Work of all such items.

ARTICLE III. COMPENSATION

In full consideration of the undertakings of Contractor pursuant to the terms of this Contract, Company shall pay Contractor the sum of the following:

Section 1.

As full compensation for the performance of the Work, inclusive of all taxes and other charges, Contractor shall be paid the according with cost schedule in Exhibit "B":

Work Order No. S-9557 * $________

*See Cost Schedule Referenced Above

Section 2. Compensation for Delays in Performance of Work

A. By Contractor

All delays in the performance of the Work resulting from causes other than those attributable to Company shall be at the cost and expense of Contractor where the Work involves coordination of schedules with other contractors on the site. Contractor shall use its best efforts to minimize delay to the Work, provided, however, that where delay occurs through no fault of the Contractor, such delay shall be either compensable or excused or both, as the case may warrant.

B. By Company

For delays in the performance of the Work attributable to Company, it is agreed that the compensation and/or amounts due Contractor in full and complete settlement of such delays shall be as follows:

(1) A lump sum settlement, inclusive of all taxes, mutually agreed upon by Company and Contractor; or

(2) Reimbursement at the hourly rates contained in Exhibit "D" hereof, or if no specific rate is listed in Exhibit "D", at rental rates prevailing in the area in which the work is being performed for all construction equipment and tools owned by Contractor which are placed in "stand-by" status as a result of such delays; and/or

(3) Reimbursement at actual costs for all construction equipment and tools rented from third parties, inclusive of taxes, which are placed in a "stand-by" status as a result of such delays; provided, however, such actual costs shall not exceed the current rates prevailing in the area where the Work is being performed; and, provided further, that a copy of all such rental agreements are furnished Company; and/or

(4) Reimbursement in accordance with the wage rates shown in the attached Exhibit "C" for Contractor's labor placed in a "stand-by" status as a result of such delays; and/or

(5) Reimbursement of costs and expenses, inclusive of all taxes, incurred by Contractor for subcontractors placed in a "stand-by" status as a result of such delays; and/or

(6) Reimbursement of actual costs, exclusive of all taxes, incurred by Contractor as a result of such delays for which Contractor is not reimbursed by the terms of (2) through (5) above.

Company shall have the right to mitigate the amount of compensation payable by it for delays in the performance of the Work by requiring Contractor to dismiss from the Work such labor, construction equipment and tools, and subcontractors as Company may in its discretion deem necessary.

ARTICLE IV. COMMENCEMENT AND COMPLETION OF WORK

The move-in and completion dates for the Work are as follows:

MOVE-IN DATE:	August 5, 1991
COMPLETION DATE:	August 30, 1991

"Move-In" is the date which Contractor is approved to move onto the project, and "Completion" is the date that all Work is completed to the satisfaction of Company and Contractor moves off the site. ANY DELAYS IN THE PERFORMANCE OF THE WORK attributable to Company shall be added to the term hereof.

Notwithstanding any provisions of this Article IV., as to the Move-In date, it is the understanding of Company and Contractor that Contractor shall not enter upon the premises where the Work is to be performed without the written or oral permission of Company first having been obtained; provided, however, that Contractor shall be reimbursed on a lump sum basis pursuant to Section 2.B (1) of Article III. hereof for any delay by Company which prevents Contractor from moving in on the above said Move-In date.

ARTICLE V. COMPANY'S RESPONSIBILITY

Company shall, at its own expense and at such times as may be required for the successful and continuous prosecution of the Work, furnish the following:

(1) All materials, equipment, and apparatus described in Exhibit "A" attached hereto.

(2) All drawings and specifications.

(3) An area immediately adjacent to the site of the Work sufficient in size to accommodate Contractor's temporary facilities (including office, warehouse, shop building, materials storage, and employee parking). Improvements of the site required to adapt the same to Contractor's use shall be at the expense of Contractor.

In the event of conflict between the terms and provisions of Part I. and II. of this Contract, the terms and provisions of Part I. shall govern.

PART II

GENERAL CONDITIONS

ARTICLE VI. METHOD OF PAYMENT

A. Cost Reimbursement

On or after the first day of each month during the performance of the Work, Contractor shall submit to Company a statement of the costs incurred by Contractor in the performance of the Work for the previous month. Costs incurred in the construction of the Work shall be submitted in accordance with instructions of and on forms requested by Company's Accounting Department. Such statement shall be addressed as follows: El Paso Natural Gas Company, Post Office Box 4990, Farmington, New Mexico 87499, Attention: Anu Pundari, North Region Engineering. Company shall pay such statement amount within twenty (20) days following receipt by Company's South Region Engineering of Contractor's statement. (Separate invoices shall be prepared by Contractor and submitted to Company to cover Changes in Scope of Work items.) Upon approval of such statement by Company's representative, Company shall promptly pay Contractor the statement amount in full until the sum of such payments equals ninety percent (90%) of the lump sum price set out in Article III. hereof. Thereafter Company shall retain an amount equal to ten percent (10%) of such lump price, in addition to retainage, if any being withheld with respect to compensation for Changes in Scope of Work items.

The unpaid balance of the lump price set in Article III, hereof, shall be paid to Contractor when all the following conditions have been met:

(1) Satisfactory completion of all performance tests described in Article IX. hereof;

(2) Acceptance of Work by Company as provided in Article X. hereof; and

(3) Receipt of acceptable evidence by Company, including Contractor's affidavit, that all bills for labor, supplies, and equipment and other claims incurred by Contractor in the performance of the Work have been paid.

B. <u>Record Keeping and Company's Audit Rights</u>

Contractor shall maintain books and records of all costs and expenditures incurred by in such detail that all such costs and expenditures may be readily computed and audited. Company shall have the right to inspect and audit such books and records of Contractor for the purpose of determining the accuracy of such costs and expenditures charged to Company for the purpose of answering any inquiries or requirements made by a regulatory authority to Company.

ARTICLE VII. PERFORMANCE OF WORK

Contractor is an independent contractor having full power and authority to select the mode, means, methods and manner of performing the Work, including the selection of sufficient, competent employees, suitable construction equipment and tools, and qualified subcontractors, and shall follow the desires of Company only as to the results to be achieved; subject, however, to the following terms and conditions:

A. Company shall have the right, subject to applicable laws, regulations and agreements in effect at the time, to require the removal from the Work of any employee of Contractor, or its subcontractors, who in Company's opinion is incompetent, careless, unqualified, insubordinate, or guilty of improper conduct. Contractor agrees to indemnify and hold harmless Company against any liens filed by or other claims of any employee of Contractor so removed.

B. Contractor shall be responsible for the selection and maintenance of all construction tools and equipment necessary for the proper performance of the Work. Such equipment shall be serviceable, kept in a first-class operating condition and must be satisfactory to Company's Representative. Any equipment that is not satisfactory shall be removed and satisfactory equipment substituted therefor.

C. Company may perform work not covered by this Contract, perform changes provided for in Article VIII. hereof, perform Work uncompleted in the event of termination of the Contract, and award contracts to others for any part thereof. Contractor shall fully cooperate with Company or with such other contractors and carefully fit its own Work with the work of Company and such other contractors as may be directed by Company. Contractor shall not commit any act which will interfere with the performance of the Work by Company or by any of its subcontractors.

D. Contractor represents that it has had an opportunity to examine, and has carefully examined, all of the Contract documents and has fully acquainted itself with the Scope of Work, the general topography, soil structure, substructure conditions, obstructions, and all other conditions pertaining to the Work, the site of the Work and its surroundings; that it has made all investigations essential to a full understanding of the difficulties which may be encountered in performing the Work; and that anything in any of the Contract documents or in any representations, statements or information made or furnished by Company or its representatives notwithstanding, Contractor will regardless of any such conditions pertaining to the Work, the site of the Work or its surroundings, complete the Work for the compensation **stated** in this Contract, and pursuant to the extent of Contractor's **liability** under this contract, assume full and complete responsibility for any such conditions pertaining to the Work, the site of the Work or its surroundings, and all risks in connection therewith. In addition thereto, Contractor represents that it is fully qualified to do the Work in accordance with the terms of this Contract within the time specified.

E. Contractor shall comply with all state and federal laws and regulations pertaining to the hours of employment and rates of pay applicable to the employees of Contractor and all governmental regulations and orders pertaining hereto, in performing the Work covered hereby, and shall comply with any agreements, stipulations orrestrictions applicable to the site of the Work when copies thereof are furnished to Contractor by Company.

F. Contractor shall properly protect the property of Company and others at the site of or adjacent to the Work. Contractor shall take all necessary precautions for the safety of the employees on the Work and shall comply with all applicable provisions of federal, state, and municipal safety laws to prevent accidents or injuries to persons or damage to property on, or about, or adjacent to the premises where the Work is being performed. Hard hats and safety glasses shall be worn at all times in designated areas. Firearms, alcohol and drugs, and the use thereof, shall be prohibited from any job site.

G. Contractor specifically agrees to comply, in all respects, to the Drug Testing Regulations adopted by the U.S. Department of Transportation that appear at 49 CFR Part 199. Contractor, in addition, understands and agrees that Company shall have the right to audit Contractor's records to verify compliance with these regulations and Contractor acknowledges that Company has retained a Consultant to conduct these audits as requested by Company. Contractor agrees to, upon request by Company, provide access to Contractor's records as required by the Consultant to verify Contractor's compliance with the DOT Regulations. If Contractor's policy and practices do not, in the opinion of the Consultant, comply with the DOT Regulations and if, after reasonable opportunity to correct such deficiencies, Contractor does not comply with such Regulations this Contract may be terminated by Company.

ARTICLE VIII. CHANGES IN SCOPE OF WORK

A. As defined herein, "Change in Scope of Work" shall mean the addition to or elimination from the Work described in Article I., hereof. A "Change of Scope of Work" can only be made following the issuance of a "Contract Change Order," which shall be in writing, signed by Company's Authorized Representative, and delivered to Contractor's Authorized Representative, who shall acknowledge receipt therefor in writing.

Company may at any time by such Change in Scope of Work, without notice to sureties, if any, issued additional instructions, make changes in the specifications and drawings, omit certain Work and require other Work to be performed by Contractor. In any event, Company shall specify the amount and kind of Work to be done or omitted, the materials to be used and the equipment to be furnished.

Where a Change in Scope of Work is authorized, Contractor shall make every effort to provide such additional personnel and equipment to complete said Work within the time specified herein, it being agreed that the date for the completion of the Work shall not be extended unless approved in writing by Company.

Contractor shall make no additions, alterations or omissions, perform no extra work nor supply or use extra materials or equipment of any kind except upon a prior "Contract Change Order" of Company.

B. If any of the additions, changes, alterations or omissions due to a change in Scope of Work shall increase or decrease the Contract Compensation, such increase or decrease shall be subject to Company's right to retain 10% of billed amounts and shall be in accordance with one or more of the following methods acceptable to Company:

(1) Referencing Article III., Section 1., a proposal acceptable to Company excluding of all applicable taxes.

(2) Charges for direct labor costs, including applicable insurance, all taxes, overhead and profit based on the schedule of wage rates which is attached as Exhibit "C". Company will not reimburse Contractor for superintendent's time under this item unless such superintendent is on the project solely for the purpose of supervising work which is a result of a "Contract Change Order".

(3) Charges for the use of equipment based on a schedule of equipment rental rates which is attached as Exhibit "D". The rental rates shown thereon shall be on a fully maintained basis, exclusive of all operating labor, and shall be considered to expressly include all gasoline, oil, supplies, repair parts, repair labor, all taxes,

license fees, rentals, supervision, overhead and profit and any and all other costs incidental to the use of such equipment and applicable to the extra work involved.

(4) The actual costs, less all discount, plus fifteen percent (15%) for Contractor's overhead, profit and taxes, of materials, supplies and outside services (with the exception of materials, supplies and services included in "Equipment Rates" as set forth in Exhibit "D") furnished by Contractor in connection with extra work performed in accordance with items (2) and/or (3) above.

Charges made for the foregoing terms are to be supported by reports thereof (forms to be furnished by Company) signed by representatives of Contractor and Company and shall be subject to audit by Company.

Company reserves the right to check the labor and equipment time devoted to the charges provided for hereunder by the use of time checkers and equipment checks as Company may deem necessary. In the event Company exercises this right, Contractor shall furnish and make available to such time checkers or equipment checkers complete information and records relating to such labor and equipment time.

ARTICLE IX. ACCEPTANCE OF WORK

When Contractor deems that is has completed all Work hereunder, it shall notify Company in writing that the Work is ready for final inspection and acceptance. Company shall make such inspection within ten (10) days after receipt of such notice. When Company's final inspection has been completed and all defects, if any, have been remedied. Company shall promptly execute and cause to be delivered to Contractor a letter of acceptance stating that, subject to continuing obligations under Articles IX. and XVII. hereof, Contractor has fully performed all its obligations under the terms of this Contract, and that the Work is accepted by Company as being completed in accordance with the terms and conditions hereof. When accepted, care, custody, and control of the Work shall pass to Company.

ARTICLE X. SUBCONTRACTORS

Contractor shall procure Company's written approval of all subcontractors used by Contractor and of all subcontracts let. Such approval shall not relieve Contractor from any of the obligations of this Contract to Company. No subcontract shall bind or purport to bind Company but shall contain certain provisions permitting the assignment thereof from Contractor to Company. Contractor shall check subcontractor's work and keep such records and furnish reports and information relative to subcontractor as Company may request.

Notwithstanding any of the provisions set forth above, Company agrees that Contractor may subcontract those items set forth in Exhibit "F" attached hereto and made a part hereof.

ARTICLE XI. REPRESENTATIVES OF COMPANY AND CONTRACTOR

Company hereby designates Mr. L. R. Tarver, Vice President of El Paso Natural Gas Company, its "Representative" for the purpose of exercising Company's rights hereunder. In addition to Company's Inspector for the Work, who is hereby designated to act as substitute for Representative, Representative may appoint from time to time another substitute or other substitutes to act in his stead or delegate portions of Company's supervision of the Work to third persons for exercise. Such substitute or delegation shall be made in writing by Representative to Contractor detailing the rights which may be exercised by the substitute or delegates and shall continue in effect until expiration by the terms of the writing or revocation by the Representative.

Representative shall be the sole, exclusive judge of the interpretation and meaning of the diagrams, plans, drawings, and specifications furnished by Company hereunder when there is doubt as to their meaning, and shall have the right to make reasonable changes in said drawings, plans, diagrams, and specifications, providing that such changes are in writing and are for the purpose of correcting errors therein, including minor design errors.

Representative shall have the right of ingress and egress with respect to the site of the Work and full privileges of inspection and testing for the purpose of insuring that the Work is being performed in accordance with the terms and conditions of this Contract. Representative may require Contractor to conform strictly with the terms and conditions hereof and to make any change or alteration as may become necessary to constitute compliance herewith. Upon Representative's request, Contractor at any time before acceptance of the Work shall remove or uncover such portions of the finished Work as may be directed. After examination, Contractor shall restore said portions of the Work to the standards required by the specifications.

All instructions, requests, and decisions made by Representative, his substitute or delegates in the performance of their duties shall be binding upon Company.

Contractor at all times shall have a designated representative and a superintendent as its agents on the Work. Such representatives and superintendent shall have full authority to execute the orders or directions of the Company's Representative without delay; shall supply promptly such materials, tools, equipment, and labor as may be required; and shall be furnished by Contractor irrespective of the amount of Work sublet. Contractor's Superintendent shall not be removed from the Work or replaced without written permission by Company.

ARTICLE XII. REPORTS AND ACCOUNTING PROCEDURES

As soon as practicable, Contractor shall prepare and submit to Company a monthly cost estimate and revisions and a completion schedule of all Work it shall perform hereunder. Contractor shall also prepare and submit to Company a monthly progress report showing the status of all construction to be performed by Contractor. In addition, Contractor shall make such other reports and furnish such other information as the Company shall request on forms prescribed by Company. In the preparation and submissions of the foregoing reports and information, Company's procedures shall be followed.

ARTICLE XIII. ACCOUNTING

A. Record Keeping

All record keeping shall be performed by Contractor in accordance with procedures set forth in Company's Field Accounting Procedures for lump sum Contract Plant Construction (copies of which shall be provided to Contractor). All billings from Contractor to Company shall be prepared by Contractor at the site of the Work, itemized, in accordance with Company's Gas Plant Catalog and Plant Accounting Manual. Contractor shall present its billings to Company's Field Auditor, or if no Field Auditor has been assigned to the Work, to Company's Inspector, who shall secure Company's necessary field approval to same and shall forward such billings to Company for payment.

B. Deficiencies

If at any time during the performance of the Work it becomes the opinion of Company's Field Auditor and Material Inspector that Contractor's record keeping to be performed pursuant to this Article XIV. has become deficient to a critical point, Company's Representative shall give written notice of such deficiencies to Contractor's Representative designated in Article XXII. hereof. If after fifteen (15) days Contractor has not taken immediate steps to correct such deficiencies, Contractor hereby consents and agrees that payments to Contractor of Fixed Fee installments pursuant to Article VI. hereof may be suspended by Company until, in the opinion of Company's Representative, proper action has been taken by Contractor to remedy such deficiencies.

ARTICLE XIV. INSURANCE

A. Contractor and each of its subcontractors hereunder, if any, shall, each at its own expense, obtain insurance as provided below from reliable insurance companies acceptable to Company and authorized to do business in the state in which the Work is to be performed. Each policy shall provide for a waiver of subrogation rights against Company. Company shall be designated as additional insured on each policy required by this contract provision except Workers' Compensation and Employer's Liability policies. Contractor and its subcontractors shall maintain in force during the entire period of this Contract, the following insurance:

(1) Statutory Workers' Compensation and Employer's Liability Insurance with a limit of not less that $100,000.

(2) Comprehensive General Public Liability policy, including crossliability endorsement, covering premises and operations, contractual liability, contractor's protective liability, products and completed operations and, if an exposure exists, elevator liability and/or water craft liability, with Bodily Injury limits of not less than $500,000 per occurrence, and Broad Form Property Damage Liability Coverage with limits of not less than $500,000 per occurrence, including, where the exposure exists, coverage for blasting and explosions, collapse, and underground property damage.

(3) Comprehensive Automobile Liability Insurance including hired cars and nonowner coverages, with Personal Injury limits of not less than $300,000 per person and not less than $500,000 per occurrence and Automobile Property Damage with limits of not less than $500,000 per occurrence.

(4) If using an owned or nonowned aircraft or employing or borrowing an aircraft in connection with the Work performed under this Contract, a combined single limit Bodily Injury and Property Damage Liability coverage shall be maintained, with a limit of liability of not less than $5,000,000 per occurrence, and Voluntary Settlement Coverage of not less than $500,000 per passenger seat.

(5) Such additional insurance as may be required by Company, the cost of which shall be reimbursed by Company.

B. Before Work is commenced, Certificates evidencing that satisfactory coverage of the type and limits set forth above in Paragraph A. with respect to Contractor are in effect shall be furnished to Company. Such certificates shall be in a form acceptable to Company and shall contain provisions that no reductions, cancellations, or material changes in the policies shall become effective except upon thirty (30) days' written notice to Company; provided, however, that no such reduction, cancellation, or material changes in any policy shall relieve Contractor of its obligations to maintain coverages in accordance with Paragraph A. above.

C. Irrespective of the requirements as to insurance to be carried by Contractor as provided herein, insolvency, bankruptcy, or failure of any insurance company to pay all claims accruing, shall not be held to relieve Contractor of any obligations hereunder.

ARTICLE XV. PERMITS

Permits and licenses necessary for the performance of the Work shall be secured and paid by Contractor. Permits, licenses and easements for permanent structures or authorization of permanent modification thereof shall be secured and paid by Company.

ARTICLE XVI. INDEMNITY

A. Without excluding or limiting in any way Company's right to indemnity and/or contribution for any loss arising from any cause whatsoever growing out of or in connection with the Work, as such right may exist under applicable laws, Contractor agrees to indemnify and hold harmless Company, its parent, subsidiaries and affiliates and all their respective officers, agents and employees (all hereinafter collectively referred to as the "Indemnitee"), from all and every kind and character of liability, damages losses, costs, expenses, demands, claims, suits, actions and causes of action on account of illness, personal injury or death to employees or any other persons, damage to property of Company or others or other loss or liability arising from any cause whatsoever growing out of or in connection with Contractor's negligent performance of the Work. Further, Contractor, at its own expense, shall defend any demand, claim, suit, action or cause of action brought against the Indemnitee where such demand, claim, suit, action or cause of action arises from any cause for which the Indemnitee may be entitled to be indemnified and held harmless pursuant to this Article XVII., and Contractor shall pay all damages, losses, costs and expenses (including attorneys' fees), growing out of or in connection with such demand, claim, suit, action or cause of action; provided, however, that the Indemnitee shall be entitled to participate in such defense at the Indemnitee's own expense. Notwithstanding the fore going, in no event shall Contractor be liable to indemnify and hold harmless the Indemnitee from any liability, damages, losses, costs, expenses, demands, claims, suits, actions or causes of action arising out of the sole negligence of the Indemnitee.

B. Contractor further agrees that each of its subcontractors performing activities in connection with the Work shall enter into a written contract containing the indemnification and hold harmless clauses in this Article XVII. in favor of the Indemnitee, such contract to be entered into by the subcontractor prior to the performance of any work by the subcontractor.

ARTICLE XVII. TERMINATION

A. Should Contractor at any time refuse or neglect to supply a sufficiency of properly skilled workmen or materials of the proper quality or quantity, fail in any respect to prosecute the Work or any portion thereof in an efficient, workmanlike, skillful and careful manner or fail to prosecute the Work with such speed as in the judgment of Company is necessary to complete the same within the time herein specified, fail to comply with any of the terms of this Contract, perform in bad faith, or become insolvent, then in any such event Company may give written notice to Contractor stating the event and, if pertinent, the respect or respects in which Contractor is failing to comply with the terms of this Contract. If Contractor does not remedy such event or failure to proceed with such speed as is required by Company with five (5) days after such notice is given, then Company shall have the right to provide any such labor or materials as may be required and to deduct the cost thereof from any money due or thereafter to become due Contractor under this Contract. Additionally, Company may terminate Contractor's right to proceed with the Work or any part thereof regardless of its stage of completion and without prejudice to any claim that Company may have hereunder. In such case Contractor shall not be entitled to receive any further payment until the Work is finished.

If the unpaid balance of the amount to be paid on the Contract shall exceed the expense of finishing the Work, compensation for additional managerial or administrative services and such other costs and damages as Company may suffer, such excess shall be paid to

Contractor. If such expenses, compensation, costs, and damages shall exceed such unpaid balance, Contractor and it sureties, if any, shall be liable for and shall pay the difference to Company.

B. If by reason of labor disputes, strikes, lock-outs, or any similar reason, a shutdown or cessation of Work should occur and continue for as long as fourteen (14) days, then Company at its option, may give Contractor written notice of Company's desire to terminate the Contract and to take over the Work and perform or cause the contracted Work to be performed and completed. If Contractor has failed to resume full performance of the Work within five (5) days after such notice, then Company, at its option, may terminate the Contract insofar as future Work is concerned and take over the Work and itself perform or cause the contracted Work to be performed by others. Company will not interfere with Contractor in fulfilling its obligations, if any, with labor unions.

C. Should conditions arise, which in the opinion of Company make it advisable or necessary to cease Work under this Contract, Company may terminate this Contract upon twenty-four (24) hours' written notice to Contractor, and all amounts due Contractor in full and complete settlement of this Contract shall be the sum of the following:

(1) Pro rata compensation for the portion of the Contract already performed, adjusted for the amount of any changes which may have been authorized, approved and performed under Article VIII. of these General Conditions prior to the date of termination:

(2) The net cost of material for which Contractor has made firm contracts it being understood that Company shall be entitled to and receive such material, and

(3) An allowance for the unabsorbed portion of Contractor's moving in and moving out costs. The unabsorbed portion of such costs shall be determined based on the ratio of the Contract Compensation for Work not competed to the total Contract Compensation. Moving costs shall be limited to equipment only and for actual distance moved but in no case for a greater distance than from the Work to Contractor's General Offices.

Upon determination of the compensation above specified, Company shall promptly pay the amount thereof to Contractor upon delivery by it of the evidence required by Section A. (3) of Article VI. of the Contract.

ARTICLE XVIII. FORCE MAJEURE

A. Neither party hereto shall be liable for any failure to perform the terms of this Contract when such failure is due to "force majeure" as hereinafter defined. The term "force majeure" as used in this Contract shall mean any delay or default in performance hereunder due to any cause beyond the control of the parties and without their fault or negligence, including but not restricted to acts of God or the public, civil disturbances, arrests and restraints by rulers and people, acts, requests or interruptions of the federal, state or local government or any agency thereof, or of any federal, state or local officer purporting to act under duly constituted authority, court orders, present and future valid orders of any governmental authority, or any officer, agency or any instrumentality thereof, floods, fires, acts of the public enemy, wars, storms, strikes, lockouts, or industrial disturbances, interruption of transportation, freight embargoes or failures, exhaustion or unavailability or delays in delivery equipment or service necessary to the performance of any provision hereof, including inability to secure materials as a result of allocations promulgated by authorized governmental agencies, riots, rebellions, blockade, insurrections, sabotage, inability to secure right-of-way, labor shortages, epidemics, invasions, landslides, lightning, earthquakes, quarantine, restrictions, washouts, explosions, breakage or accident to machinery or lines of pipe, or any other cause, whether of the kind herein enumerated or otherwise, not reasonably within the control of the party claiming "force majeure." Nothing herein contained, however, shall be construed to require either party to settle a labor dispute against its will.

B. In the event either party is unable, wholly or in part, to carry out its obligation under this contract when caused by force majeure, other than the obligation to make payment of money due hereunder, the party claiming a suspension which, by the exercise of due diligence, such party shall not be able to overcome or avoid, then, upon such party's giving notice and full particulars of such cause in writing to the other party as soon as possible after the occurrence of the cause relied on, the obligation of the party giving such notice, so far as it is affected by the cause specified in such notice, shall be suspended during the continuance of any inability so caused by for no longer period, and such cause shall, as far as possible, be remedied with all reasonable dispatch; provided, however, that nothing herein contained shall be construed to limit Company's rights as set forth in Article XVIII. (Termination) hereof.

ARTICLE XIX. PERFORMANCE BONDS

If requested by Company, Contractor shall obtain, at Company's expense, and furnish Company within fifteen (15) days after execution of this Contract and prior to commencing work, a performance and payment bond in form and amount satisfactory to Company with surety approved by Company and payable to Company, its successors and assigns, conditioned that Contractor will faithfully perform promptly and with due diligence all of the terms, covenants, and conditions of this Contract on its part to be performed, including all of the undertakings, obligations, and liabilities of Contractor or subcontractors, protect Company against loss by reason of breach of or default in the performance of any obligations Contractor or such subcontractors may have incurred, and protect Company against all claims for the payment of labor and materialbills incurred in the Work by Contractor, respectively. Failure of Contractor to furnish such bond within the time provided shall entitle Company at its option to cancel and terminate this Contract.

ARTICLE XX. LIENS

Contractor shall indemnify and hold Company harmless from all costs, damages, or expenses arising out of any charge or encumbrance in the nature of a laborer's, mechanic's, or materialman's lien in connection with the Work as performed by Contractor or its subcontractors.

ARTICLE XXI NOTICES

All notices, orders, statements, reports, or other correspondence required or made necessary by the terms of this Contract shall be in writing and shall be considered as having been given (a) to Company if delivered personally to its designated Representative at the site of the Work with authority to act for it and if mailed by registered mail, postage prepaid, to Mr. L. R. Tarver, Vice President, El Paso Natural Gas Company, Post Office Box 1492, El Paso, Texas 79978, or (b) to Contractor if delivered personally to its designated Representative at the site of the Work and if mailed by registered mail, postage prepaid, to:

____

of ____.

ARTICLE XXII. NON-WAIVER OF TERMS OR CONDITIONS

Any failure by Company at any time or from time to time, to enforce or require the strict keeping and performance of any of the terms or conditions of this Contract shall not constitute a waiver of such terms or conditions and shall not affect or impair such terms or conditions in any way or the right of Company at any time to avail itself of such remedies as it may have for any breach or breaches of such terms or conditions.

ARTICLE XXIII. CONFLICTS

In the event of conflict between the terms of this Contract and the Exhibits attached hereto, such conflict shall be resolved by applying the following priorities:

(1) Exhibit "A"

(2) Exhibit "B"

(3) Exhibit "C"

((4) Exhibit "?") "G"

(5) The body of the Contract.

(6) The remaining Exhibits.

ARTICLE XXIV. DISPUTES

If, at any time, there is a difference of opinion between the parties hereto in regard to their respective rights, duties, and obligations, under such provisions of this Contract, the question or questions in dispute shall be referred to Mr. L. R. Tarver, Vice President of El Paso Natural Gas Company, whose decision shall be binding upon Company.

ARTICLE XXV. GOVERNMENTAL AUTHORITY

In the performance of the Work, Contractor shall comply with all federal and state laws and all rules, regulations, and orders of federal and state agencies having jurisdiction in the premises.

ARTICLE XXVII. ASSIGNMENT

All covenants and agreements herein contained shall be extended to and be binding upon the successors and assigns of Contract and Company. Contractor shall not assign this Contract or any moneys to become due hereunder without prior written consent of Company; provided, however, that no conveyance or transfer of any interest of Contractor shall be binding upon Company until Company has been furnished with written notice and true copy of such conveyance and transfer. Company shall at all times have the right to assign all or any part of its interest in this Contract.

ARTICLE XXVII. TITLE

The title to all Work completed and in the course of construction at the site of the Work and of all materials furnished by Company, irrespective of the location thereof, as between Company and Contractor or Contractor's subcontractor, shall be in Company.

ARTICLE XXVIII. SURPLUS MATERIALS

In the performance of work of this nature, there will be certain overages of materials. All such overages will belong to Company. Contractor, if requested by Company, will dispose of any such overages and will credit the proceeds of any such sales to the Work.

ARTICLE XXIX. NONDISCRIMINATION

Contractor agrees as follows:

(1) In the event that the amount of this Contract equals or exceeds $10,000, Contractor agrees that, unless this Contract or the Work performed hereunder is exempt under Executive Order 11246, as amended, or under the rules and regulations issued thereunder, there are hereby incorporated by reference the provisions of Section 202 of Executive Order 11246, as amended, codified in 41 C.F.R. Section 60-1.4.

(2) In the event that the amount of this Contract equals or exceeds $50,000, and Contractor has fifty (50) or more employees, Contractor agrees that, unless this Contract or the Work performed hereunder is exempt pursuant to Executive Order 11246, as amended, or under the rules and regulations issued thereunder, the following terms and conditions shall be applicable during the performance of this Contract:

(a) Contractor acknowledges that it is required to file Standard Form 100 (EEO-1), pursuant to 41 C.F.R. Section 60-1.7, within thirty (30) days after the Contract award, unless such a report has been filed by Contractor within 12 months preceding the date of the award, and to otherwise comply with or file such compliance reports as may be required under Executive Order 11246, as amended, or under the rules and regulations issued thereunder.

(b) Contractor further acknowledges that it is required to develop a written affirmative action compliance program, pursuant to 41 C.F.R. Section 60-1.40.

(3) In the event that the amount of this Contract equals or exceeds $10,000, Contractor further agrees that, unless this Contract or the Work performed hereunder is exempt under 41 C.F.R. Part 60-1 or 41 C.F.R. Part 60-250, as appropriate, the following terms and conditions shall be applicable:

(a) During the performance of this Contract, Contractor certifies that it does not and will not maintain any facilities it provides for its employees in a segregated manner, or permit its employees to perform their services at any location, under its control, where segregated facilities are maintained; and that it will obtain a similar certification in the form approved by the Director of the OFCCP, prior to the award of any nonexempt subcontract.

(b) There are hereby incorporated by reference the provisions of 41 C.F.R. Section 60-250.4, pertaining to affirmative action for veterans.

(4) In the event that the amount of this Contract equals or exceeds $2,500, Contractor further agrees that, unless this Contract or the Work performed hereunder is exempt under 41 C.F.R. Part 60-741, there are hereby incorporated by reference the provisions of 41 C.F.R. Section 60-741.4, pertaining to affirmative action for handicapped persons.

(5) Upon the request of the Company, Contractor shall provide the Company with copies of any or all plans and programs which Contractor uses to satisfy the requirements of the preceding paragraphs.

ARTICLE XXX. GOVERNING LAWS

Contractor and Company agree that the laws of the State of Texas shall govern the interpretation and application of this Contract and the rights and obligations of the parties hereunder.

ARTICLE XXXI. SEVERABILITY OF PROVISIONS

Contractor and Company agree that, in the event any provision (or portion thereof) of this Contract is determined to be invalid for any reason, such invalidity shall not affect the validity of any remaining language which can be given effect without the invalid provision.

IN WITNESS WHEREOF, the parties hereto have executed this Contract in several counterpart originals as of the day and year first above written.

WITNESS: EL PASO NATURAL GAS COMPANY

_______________________________ By _______________________________
Vice President

WITNESS:

_______________________________ By _______________________________

Title_______________________________

EXHIBIT "A"

SCOPE OF WORK

FOR REMEDIATION PROJECT AT

MANANA MARY WHEELER #1E WELL SITE

LOCATED IN FLORA VISTA, NEW MEXICO

1.0 BACKGROUND

Manana Gas operates a producing natural gas well, Mary Wheeler #1E, in Flora Vista, New Mexico. The alluvial aquifer became contaminated with hydrocarbon liquids. Figure 1 is a map of the site.

The water table at the site is approximately five to six feet from grade. Due to the shallow water table, hydrocarbons migrated with the water and contaminated an area approximately 100 feet by 260 feet. The New Mexico Oil Conservation Division (NMOCD) requested EPNG to implement a plan to remediate the site. The approximate area to be remediated is indicated on Figure 1.

2.0 INTRODUCTION

EPNG desires to contract for the excavation of contaminated soils and transportation of the excavated soils. EPNG would like the contractor to bid on transportation of excavated soils to: (1) Envirotech's disposal site; or (2) to EPNG's facility for disposal. After reviewing the costs for both sites, EPNG will select one of the two sites as the disposal location.

2.1 Ingress and Egress to the Work Site

The well, Mary Wheeler #1E is located in Flora Vista, New Mexico. The site may be reached by going east from Farmington on Highway 550. Then, take a right at the Flora Vista stop light onto County Road 3500. After approximately 3/4 mile, take a left onto Road 3490. The turnoff from County Road 3500 is before the Animas River Bridge. Road 3490, a 1/2 mile dirt road, leads to the site.

3.0 REMEDIATION SCOPE OF WORK

The Scope of Work describes the work necessary to remediate the site. This section is comprised of the following :

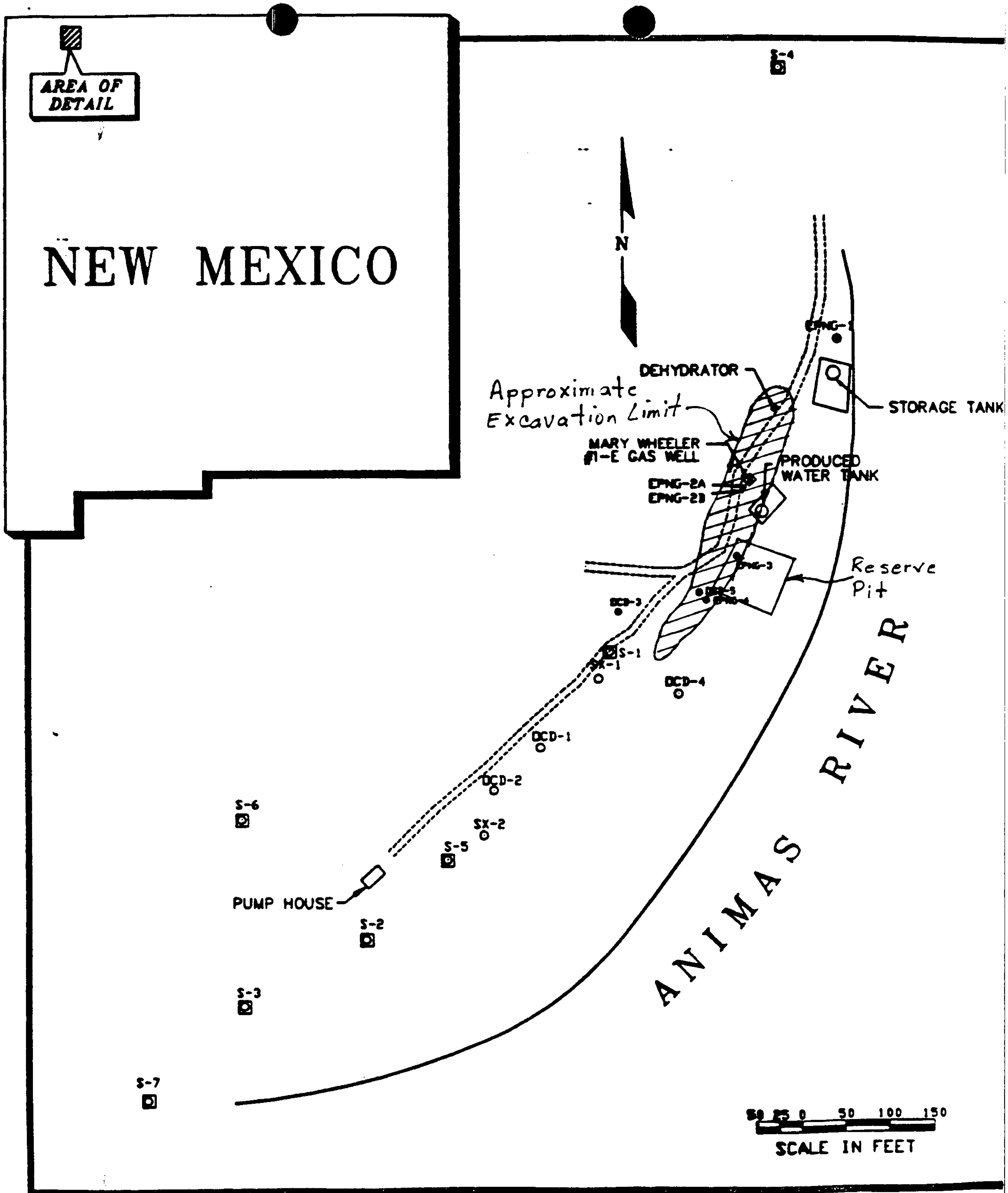


Figure 1

MANANA-MARY WHEELER #1-E WELL SITE

3.1. EXCAVATION

3.1.1 Clean Overburden Excavation and Stockpiling

A "strip mining" approach will be used for the project, whereby the top three to four feet of clean overburden is removed and stockpiled adjacent to the area prior to excavation of the visibly stained underlying sediments. The clean overburden shall be used for backfill. In the reserve pit area, the top four feet is not considered "clean" and must be excavated and disposed.

Only clean overburden shall be stockpiled for backfill. Any stained soil encountered during excavation must be taken to the disposal location.

3.1.2 Contaminated Soil Excavation

The site can be subdivided into three different excavation areas.

Area I - Reserve Pit

The first area is the reserve pit, an area approximately 70 feet by 70 feet. The reserve pit should be excavated from grade to a depth of approximately six feet.

Area II - "Highly" Contaminated Area

The second area is the highly contaminated area approximately 100 feet by 50 feet. The depth of excavation may range from six to eight feet. Results from field laboratory analyses, discussed in Section 3.1.4, will determine the final excavation depth.

The contaminated soil must be transported to the selected disposal site, EPNG's Ballard Plant or to Envirotech's facility. It is estimated that approximately two to four feet of contaminated soil will be excavated. Water may collect in the excavation trench. A portable pump to be furnished by contractor will be needed during soil excavation to pump any water encountered from the excavation trench into water trucks or "frac" storage tanks furnished by contractor.

Area III - "Less" Contaminated Area

The third area is the "less" contaminated area of approximately 15,700 square feet. This area will most likely be excavated to a depth of six feet. A final excavation depth will be determined by field soil analyses during the excavation.

The contaminated soil must be transported to the selected disposal site. It is estimated that approximately two feet of contaminated soil will be excavated. Water may collect in the excavation trench. A portable pump to be furnished by the contractor will be needed during soil excavation to pump any water encountered from the excavation trench into the contractors water trucks or "frac" storage tanks.

3.1.3 Saturated/Wet Soil

If groundwater is encountered during excavation, wet soil must be placed into the dump trucks. Oil and water drainage from the excavated soil must be intercepted prior to the discharge onto the ground. Wet soil loaded directly into the trucks must be drained prior to the soil being transported to the disposal location. Oil and water must not discharge on-site or enroute to the disposal location.

To collect oil and water drainage, EPNG will provide troughs which will be placed underneath the trucks. The truck's tailgate will be pinned and the bed tilted over the trough until all residual water is removed from the soils. This is estimated to take approximately 15 minutes. The contractor will be responsible for pumping collected liquids from the troughs to frac tanks or water trucks.

The contractor may offer other options for removing the water prior to transportation of the soil.

3.1.4 - Laboratory Support

NMOCD requires EPNG to collect soil samples at the bottom of the excavation area. EPNG will conduct field total petroleum hydrocarbon (TPH) analysis. Although a specific sampling plan has not been determined, if a 50 foot long, 3 to 5 foot wide trench is excavated, approximately four to five samples will be needed. On average, it will take approximately 45 minutes to analyze the four to five samples. The contractor **must assist EPNG** by providing the use of the backhoe for collection of soil samples.

The contractor **will not** be allowed to backfill the site until the TPH is below the limits set by NMOCD. The contractor will be required to excavate until the TPH is below NMOCD limits or to a depth of eight feet. If the TPH is above NMOCD limits **and** the excavation depth is at eight feet, EPNG will require the contractor to keep the excavation open until clearance for closure is given by NMOCD. The NMOCD may be at the site and request excavation beyond the eight foot depth at some locations.

3.1.5 Backfill and Compaction

Two different types of backfill are required at the site. Riverstone cobble and coarse grained sandy backfill (Type I) is required for all areas below a depth of four feet from grade. The reason for the cobble backfill, similar to the existing soil, is to decrease the probability of future settling in the area. Clean, sandy backfill (Type II) is required for the top four feet of the entire excavated area.

Area I - Reserve Pit - 70 foot by 70 foot by 6 foot depth

The contractor is responsible for furnishing riverstone cobble and coarse grained sandy (Type I) backfill for the bottom two feet of the reserve pit area. The top four feet of the excavated area should be clean sandy backfill (Type II).

Area II - "Highly" Contaminated Area - 5,000 square foot by 8 foot depth

The top four feet of the excavation area can be reused as clean backfill. Assuming a four foot contaminated soil depth, the contractor is responsible for furnishing four additional feet of riverstone cobble and coarse grained sandy (Type I) backfill in the excavation area.

Area III - "Less" Contaminated Area - 15,700 square foot by 6 foot depth

The top four feet of the excavation area can be reused as clean backfill. The contractor is responsible for furnishing two feet of clean sandy backfill (Type II) for the top two feet of the excavation area.

EPNG will provide a borrow site near Ballard Plant for clean sandy backfill if Ballard is chosen as the disposal site. The contractor will be responsible for loading, transporting and placing backfill in the excavated area.

If Envirotech's site is chosen, Envirotech has agreed to provide and load clean sandy backfill at a cost of $1.98 per cubic yard to be paid by the contractor. The contractor will be responsible for transporting and placing backfill in the excavated area.

The contractor is responsible for providing the cobble, coarse grained sandy backfill. The contractor must provide a representative sample and identify the borrow source of the riverstone cobble backfill. The top two feet of Area I,II and III must be machine compacted.

3.1.6 Trench South of Contaminated Soil Excavation Area

A temporary trench must be constructed approximately 20 feet downgradient of the southwestern most area of excavation to serve as an observation trench. The trench would provide visual verification that no floating hydrocarbons escaped the excavation. It will also allow natural volatilization of any remaining dissolved hydrocarbons. The trench will be approximately 75 feet in length, three feet wide and five feet in depth or until groundwater is reached. The trench will be kept open for a minimum of 60 but not more than 120 days.

The contractor is responsible for excavating the trench and providing and installing a temporary six foot high fence around the trench with a three foot wide locked gate. In addition, the contractor is responsible for installing and operating an agitator device in the trench. The agitator and fence can be removed after completion of the project.

The agitator will be a small portable air compressor attached to a perforated hose. The agitator will assist in volatilization of any hydrocarbons. The air compressor must be equipped with a dry element filter that prevents any oil, water or combustion by products from entering the air discharge stream.

3.1.7 Contaminated Soil Transport to Disposal Site

The contractor will transport the contaminated soil to the selected disposal site. EPNG will consider the following two disposal sites. The first disposal site is an area immediately east of EPNG's Ballard Plant, located approximately 45 miles from the excavation site. To get to the plant, the contractor must go south on Highway 44 and turn east just before Huerfano Mesa on County Road 7425. An approximately nine mile dirt road, County Road 7425, leads to the plant.

The second site is Envirotech's facility near Bloomfield. The facility is approximately 26 miles, of paved road, from the remediation site. Envirotech has quoted a price of $12.80 per cubic yard for contaminated soil disposal. Envirotech would be responsible for discing the soil.

If the Ballard site is chosen, the contractor must be spread out at the disposal site in six inch lifts. In addition, the contractor must disced the soil two times per week for the duration of the remediation project.

3.2 GROUNDWATER DISPOSAL

The excavation site is near the Animas River. The Animas River may be at a "low level" this year. Therefore, the water table may be deeper than six feet from grade and the contractor may not have to dispose of any groundwater.

However, if the water table is higher than the excavation depth, the contractor must pump the water from the excavation trench into waiting water trucks and/or "frac" storage tanks. The amount of water that will need to be pumped out is difficult to accurately determine due to unknown aquifer characteristics.

The best estimates of groundwater disposal ranges from 300,000 to 500,000 gallons of water for the project. The actual groundwater disposal quantities may be greater or less than the estimates.

The contractor is responsible for assuring that the water trucks and "frac" storage tanks are adequately steam cleaned prior to project use. The contractor is also responsible for obtaining pumps for groundwater pumping during excavation.

The contractor must haul water to the lined pond at EPNG's Kutz Plant. Kutz Plant is approximately ten miles from the project site. If the Kutz lined pond is filled to capacity, the contractor must truck the water to Southwest Disposal, approximately 20 miles from the project site.

Although it is not anticipated that large volumes of hydrocarbons will be liberated during excavation, the contractor must have absorbent pads on site. The pads will be used to capture any free-phase hydrocarbons that may be in the excavation trench. EPNG will provide drums for the used absorbent pads. In addition, EPNG will dispose of the pads.

In addition, the contractor must have an absorbent "sweep" at the Kutz lined pond. The "sweep" will be used to move, capture in the pond, remove any freephase hydrocarbons from the surface of the pond. The hydrocarbons phase must be trucked to EPNG's Blanco Plant near Bloomfield. At the end of each working day, the contractor is responsible for assuring that the pond surface is free of any oil.

The "sweep" and pads are available from Moore Engineering and Sales, Inc. of Englewood, Colorado. Two absorbent 3M "sweeps" or equivalent, T-126, which is 17" X 100' X 3/8" is adequate for the project. One "sweep" costs $86.40 plus shipping. One bale of absorbent 3M pads or equivalent, T-156, which is 17"X 19"X 3/8" is adequate for the project. One bale, 100 pads, costs $68.55 plus shipping.

3.3 OTHER ISSUES

Prior to project startup, EPNG and Manana Gas will remove the well from service. The meter house, meter run, separator, fiberglass storage tank and fencing around the separator area will be removed.

Contractor working hours are limited to Monday through Friday from 7 a.m. to 5 p.m. All efforts should be made to close all excavations by the end of the working day. If excavations are left open overnight, contractor shall install as a minimum, appropriate safety barriers i.e. saw horse with lights, red tape, temporary fence, around the open excavation.

The project site is on private property. The landowner lives in a house near the project site. The existing road to the house is in the excavation area. The contractor will be responsible for constructing and maintaining a temporary road (approximately 400 feet) around the project area to provide access for the owner.

In order to allow access to the site, an alternate route, adjacent to County Road 3490, will be utilized. A section of wooden fence(approximately 15 feet) must be removed and reinstalled by the contractor to allow access to the site along the alternate route. In addition, the contractor is responsible for assuring the integrity of an existing six inch irrigation pipe underneath the access road and preventing damage due to heavy vehicular traffic.

The contractor must exercise extreme care to ensure that private property is not damaged during the execution of this project. EPNG will not compensate the contractor for any property damage due to contractor negligence.

The contractor must purchase/rent good quality pipe, fittings, pumps and other water handling hardware. The contractor must utilize good housekeeping practices so that contaminated water does not leak or spill onto clean soil. If the contractor is negligent and allows contaminated water to discharge onto clean soil, the contractor is responsible for the cleanup of contaminated soil at the contractors expense. The discharge of any water into the Animas River is strictly prohibited. The contractor shall provide general cleanup after completion of the project.

All trucks with contaminated soil and clean backfill must be weighed at Doug Foutz Construction's scale near Crouch Mesa Road or an alternate scale approved by EPNG's Project Engineer. The turnoff from Crouch Mesa Road to the scale is approximately 3-1/2 miles from the site. An additional 3-1/2 mile road leads to the scale. The scale is on the way to either Ballard Plant or Envirotech. Mr. Doug Foutz has agreed to a $3.00 fee to weigh each truck. The fee in the contractor's bid shall be included.

The contractor is required to follow New Mexico Motor Transportation Division and Department of Transportation rules regarding truck weight limitations and other applicable transportation rules.

All work performed by the contractor shall conform to applicable industry codes and standards and the EPNG Manual of Engineering Standards. The EPNG project engineer will have sole authorization to make changes in the material or specified procedures. Field and approved by the project engineer. All excavation activities must be in accordance with applicable OSHA and EPNG standards. No changes shall be made without the written approval of the Project Engineer.

The contractor shall be responsible for providing the required protection or security for equipment or materials on the job site. EPNG will not assume any liability for losses of materials or equipment.

The contractor must provide a list of all subcontractors with the bid. The contractor must receive written approval from EPNG before using subcontractors for any portion of the work. Such approval will not relieve the contractor of any obligations with EPNG.

4.0 COST SCHEDULE

The contractor must provide costs as required by Figure 2.

EXHIBIT "B"

FIGURE 2

COST SCHEDULE

1.	Soil Excavation (Includes a temporary fencing and assistance in sampling)	________/ton
2.	Soil Hauling,Spreading and Discing at Ballard Plant (Include $3 scale fee.)	________/ton
3.	Soil Hauling and Disposal at Envirotech (Include $12.80/cubic yard Envirotech fee) (Include $3 scale fee)	________/ton
4.	Clean Riverstone Cobble Backfill (Includes cost of material,loading,transportation, $3 scale fee and placement.)	________/ton
5.	Clean Sandy Backfill from Ballard Plant (Includes cost of loading,transportation $3 scale fee and placement.)	________/ton
6.	Clean Sandy Backfill from Envirotech (Include $1.98/cubic yard material and loading fee, transportation $3 scale fee and placement. Envirotech will load the oil.)	________/ton
7.	South Trench Excavation & Agitator(Lump Sum) (Includes fencing)	________
8.	Haul Water to Kutz Lined Pond(per barrel)	________
9.	Haul Hydrocarbon Liquids to Blanco Plant(per barrel)	________
10.	Haul Water to Southwest Disposal(per barrel)	________
11.	Two Oil Absorbent "Sweeps"(Lump Sum)	________
12.	100 Oil Absorbent Pads(Lump Sum)	________
13.	Temporary Road Construction (Lump Sum)	________
14.	Fence Removal and Reinstallation (Lump Sum)	________

Please Note: One barrel is equivalent to 42 gallons
: It is difficult to accurately determine the weight of the excavated soil but the following are our best estimates.
: Clean Backfill is approximately 1.35 tons/cubic yard
: Moist/Wet Cobble Backfill is approximately 1.75 tons/cubic yard
: Dry Cobble Backfill is approximately 1.50 tons/cubic yard

EXHIBIT "C"

RATE SCHEDULE

EXHIBIT "D"

EQUIPMENT RATE SCHEDULE

* Equipment rates shall be on a fully maintained basis, inclusive of all taxes, exclusive of operating labor, in accordance with Exhibit "B".

EXHIBIT "E"

SAFETY MANUAL

EXHIBIT "F"

LIST OF SUBCONTRACTOR

EXHIBIT "G"

PROJECT SHOWING NOTES

THE FOLLOWING CHANGES, ADDITIONS. OR CORRECTIONS WERE MADE AT THE SHOWING. ALL CONTRACTOR'S, INSPECTORS AND INTERESTED EPNG PERSONNEL WERE MADE AWARE OF THE CHANGES AT THE SHOWING. THIS DOCUMENT IS TO BE MADE PART OF THE CONTRACT.

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

July 22, 1991

Re: Project Showing Notes - REMEDIATION AT MANANA MARY WHEELER #1E AT FLORA VISTA, NEW MEXICO

Gentlemen:

Enclosed are "Project Showing Notes" for the reference project. These notes are to be placed under Exhibit "G" and will become a part of the Contract.

If you have any questions, please call the undersigned at (915) 541-5298.

Sincerely,

Joe A. Fierro, Jr.
Analyst, Contracting

JAF:gh
Attachment

cc: Messrs.: M. L. Ayoub
G. E. Bauer
M. L. Gallegos
A. E. Gilmore
T. L. Hutchins
D. M. Kelsey
A. Pundari
H. A. Shaffer
K. L. Steelhammer (w/o attachment)
L. B. Tinker
Ms.: M. L. Gallegos

File

EXHIBIT "G"

PROJECT SHOWING NOTES

THE FOLLOWING CHANGES, ADDITIONS, OR CORRECTIONS WERE MADE AT THE SHOWING. ALL CONTRACTOR'S, INSPECTORS AND INTERESTED COMPANY PERSONNEL WERE MADE AWARE OF THE CHANGES AT THE SHOWING. THIS DOCUMENT IS TO BE MADE PART OF THE CONTRACT.

Re: Soil remediation at Manana Mary Wheeler #1E at Flora Vista, New Mexico

1. Section 3.1.6. - Trench south of contaminated soil excavation area

The trench must be kept open for 60 days. The agitator must be operating from 7 A. M. till one hour after excavation. (example: excavation ends at 4 P. M. each day, the agitator must be running until 5 P. M. each day)

2. Section 3.1.7. - Contaminated soil transport to disposal site

Company will obtain a separate contract with Envirotech if their disposal site is selected.

If the Ballard Plant site is chosen, Contractor will be responsible for utilizing proper equipment in order to aerate the soil two times per week for the duration of the remediation project (i.e. duration of excavation and project cleanup activities). The contaminated soil contains various sizes of riverstone cobbles.

3. Section 3.3 - Other issues

A) Company has sent a letter to Manana Gas, Inc. asking them to remove all underground piping in the excavation area. If Manana does not remove the piping, Contractor must take every precaution to protect the integrity of their lines.

B) The landowner has agreed to allow trucks and vehicles to travel in an area which is approximately 60 feet west of the meter house. This will allow additional area for vehicle traffic.

C) The temporary road around the project area should be immediately west of the 60 - foot easement mentioned above. The road should be smooth and free of riverstone cobbles. There should be a small, approximately six to twelve inches depth, trench on the west side of the road to allow water drainage from the landowner's irrigation system. In addition, the Contractor shall provide and place a small section (approximately 10 - foot) of four inch PVC pipe to allow drainage from the west side of the temporary road to the east side.

D) If the four inch PVC drainage pipe on the existing road to the landowner's house is damaged, Contractor will be responsible for replacing the section of pipe.

E) Contractor is not required to excavate within the small fenced area around the wellhead.

F) Contractor must assure that dust from the roads is not a nuisance to nearby property owners and must follow the guidelines of the on-site Company inspector or at a maximum, water the roads three times per day.

4. Figure 2 - Cost Schedule

Item 1. Temporary fencing means any fencing around open excavations

Item 3. Do not include the $12.80/cubic yard Envirotech fee, if their disposal site is elected Company will negotiate a separate Contract with Envirotech.

ADD:

Item 15. Portable Scale for project (Lump sum)______________
(If a portable scale is not used, include the $3.00 scale fee in your cost estimate.)

10019

El Paso
Natural Gas Company

P. O. BOX 4990
FARMINGTON, NEW MEXICO 87499
PHONE: 505-325-2841

June 10, 1991

Mr. Richard G. Thurstonson
P.O. Box 400
Flora Vista, New Mexico 87415

Re: R/W 89320 Soil Contamination:
Manana Gas-Mary Wheeler No. 1E
San Juan, Co., New Mexico

Dear Mr. Thurstonson:

El Paso Natural Gas Company(EPNG) is working closely with New Mexico Oil Conservation Division(NMOCD) to remediate the Mary Wheeler No. 1E site. Work on this site is scheduled to begin in late July or early August of this year and should be completed with as little inconvenience to you as possible.

Last year, EPNG discussed the project with your son-in-law, Mr. Eli Velasquez. We discussed the extent of excavation,access to the site, discharge of water onto the field and other project topics. Due to unforeseen problems, the project had to be delayed until this year.

EPNG needs to reach an agreement with you and your son-in-law regarding access to the site, discharge of water and other project topics. A contractor will be hired to excavate and remove contaminated soil. The contractor working hours will be limited to Monday through Friday from 7 a.m. to 5 p.m.. All efforts will be made to close all excavations by the end of the working day. If excavations are left open overnight, the contractor will install appropriate safety barriers around the excavation.

Since the existing road to your son-in-law's house is within the excavation area, the contractor will be responsible for constructing and maintaining a temporary road around the project area. The location of the road will be based on your judgment and approval. As discussed with Mr. Eli Velasquez, in order to allow access to the site, a section of wooden fence on the west side of the property will need to be removed and later replaced after project completion.

After soil remediation activities, NMOCD requested EPNG to pump groundwater from Well S-1. If approved by you, EPNG wants to temporarily place frac tanks for groundwater storage near Well S-1. Then,the water will be analyzed. If the sample results are less than Water Quality Control Commission(WQCC) limits for benzene, ethylbenzene, toluene, xylene(BETX) and 1000 ppm for Total Dissolved Solids, EPNG asks your permission to discharge the water onto your property either to the west or south of the remediation site.

Attached is a detailed explanation of the project.I will work with you to reach an agreement on this project. If you have any questions, please call me at 599-2253.

Very Truly Yours,

Leonard I Lord

Leonard I. Lord
Senior Right of Way Negotiator

cc: Mr. Eli Velasquez

bc: Gail Bauer
Tom Hutchins
Anu Pundari
Jamye B. Ward
S. D. Miller/File 5216-Mary Wheeler #1E

REMEDIATION PLAN FOR
MANANA - MARY WHEELER #1E

The following outlines the procedures and plan for the remediation activities at the subject well site.

1.The reserve pit and the area of soil visibly stained by hydrocarbon will be excavated . The area was delineated during the site investigation study. A "strip mining" approach will be used, in which clean overburden is removed and stockpiled prior to excavation of the underlying stained soil.

2.The excavation will begin up gradient. Overburden to a depth of four to five feet, or until hydrocarbon stained soil is encountered, will be removed and stockpiled for reuse as final backfill after the remediation is completed. Only clean overburden will be stockpiled and used for backfill. Any soil mixed with stained soil will not be used for backfill.

3. Before commencing the excavation activities, El Paso will remove all of its ancillary equipment from the site. After the remediation is complete, El Paso will reinstall its equipment.

4. In order to assure worker safety, access to the site and a thorough and final cleanup, Manana Oil will perform the following:

a. Shut-in the well for the duration of the excavation activities;

b. remove their ancillary production units (e.g., the separator and storage tank) prior to excavation activities

5. Any above or below ground tanks installed by Manana Oil after the remediation is complete will be equipped with OCD approved leak detection equipment.

6. To augment the clean overburden that will be placed back into the excavation area, a borrow site will be located where clean, coarse-grained sand can be obtained.

7. A small amount of groundwater will probably be encountered. All water observed to have a hydrocarbon sheen will be removed during excavation. A portable pump or vacuum truck will be used to pump the water from the excavation area during soil removal.

8.In the event it is necessary to excavate below the water table, the saturated soils will be placed into dump trucks. Each dump truck tailgate will be pinned and the bed tilted over a trough designed to collect and separate the hydrocarbon/water mixtures that drain from the saturated soil. This procedure will result in effective drainage of the wet soils and avoidance of any leakage during transport. The collected water will be trucked to the lined pond at Kutz Plant or a permitted disposal site.

9. It is not anticipated that large volumes of hydrocarbons will be liberated. However, absorbent pads will be available on site to facilitate the capture of any free-phase hydrocarbons.

10. The water from the excavation area will be pumped into water trucks and hauled to the Kutz lined pond or a permitted disposal site.

11. Hydrocarbon contaminated soil will be removed and spread in six inch lifts on EPNG property approved by NMOCD.

12. A temporary trench will be constructed just down gradient of the excavation area to serve as an observation trench. An agitator will be installed in the trench to act as a final treatment "air stripper" and aeration system. The agitator will be kept in use for a short period (60 - 90 days) after soil remediation is complete to allow flushing of the replacement soil. Water samples will be collected at the beginning of the excavation, at seven day intervals during excavation or if a hydrocarbon sheen is observed and at thirty day intervals after remediation until the trench is closed.

13. All former NMOCD monitoring wells will be removed. In addition, all EPNG monitoring wells in the excavation area will be removed.

14. After remediation, well S-1 will be pumped at a constant rate of about 65 gallons per minute (gpm) for 24 hours and sampled. Visual observations of the color, odor, and turbidity of the water will be noted at the beginning and end of the 24 hour period. The samples will be analyzed for BETX and TDS. The water discharged during the 24 hour pumping will be contained in tanks until the sample results are received. If the sample results are less that the WQCC limits for BETX and 1000 ppm for TDS and EPNG receives approval from the landowner, the water will be discharged on to either the west or south of the remediation site. If the results of the samples exceed the WQCC limits and/or TDS limits, the water will be treated prior to discharge or disposed at the Kutz lined pond.

15. Following item 14 above, water well S-1 will be pumped for 48 hours at a constant rate of about 65 gpm and sampled at the beginning and end of the 48 hour period. Visual observations will be noted at the beginning, middle and end of the 48 hour period. If the results from the 24 hour pumping were less than the above limits and no visual problems are noted, the water will be discharged as discussed in Item 14. Otherwise, the water will be contained in tanks and either treated prior to discharge to the landowner's property or disposed of at the Kutz lined pond.

16. Every thirty(30) days thereafter for a period of six(6) months, water well S-1 will be pumped for 48 hours at a constant rate of about 65 gpm. Samples will be collected at the beginning and end of the 48 hour period and analyzed for the NMOCD recommended constituents. Visual observations will be noted at the beginning, middle and end of the 48 hour period. If the results of the previous sampling are below the WQCC limits and no visual problems are noted and EPNG receives approval from the landowner, water will be discharged onto the landowner's property. Otherwise, the water will be stored in tanks for treatment prior to discharge to the property or disposed at the Kutz Plant lined pond. If the sample results at the end of the six month period are satisfactory, no additional monitoring will be performed.

17. After remediation is complete and the groundwater is demonstrated to be clean, water well S-1 will be plugged and abandoned.

El Paso Natural Gas Company

MEMORANDUM

TO: Tom Hutchins

DATE: July 12, 1991

FROM: Leonard I. Lord

PLACE: Right of Way Dept.
Farmington Division

RE: R/W 890320
Manana Gas Company -
Mary Wheeler #1E
San Juan County, New Mexico

On July 10, 1991 Anu Pundari, Henry Bluejacket and I met with Mr. Eli Velasquez, son-in-law of Richard G. Thurstonson and occupant of the subject land, to discuss our June 10, 1991 letter.

We discussed the contents of the June 10th letter as well as some of the construction activities that are proposed during this project. Mr. Velasquez had no objections to our proposed project and offerred any assistance that he may be to the project.

Mr. Velasquez was invited to the "Contractor's Showing" that is to be held the week of July 15th.

The settlement of surface damage for this project will be after construction is completed. Mr. Velasquez was in agreement with this manner of settlement.

Leonard I. Lord

Leonard I. Lord

LIL/sj

cc: Anu Pundari
Glen E. Orr

FM-10-0003A

El Paso Natural Gas Company

P. O. BOX 4990
FARMINGTON, NEW MEXICO 87499
PHONE: 505-325-2841

July 17, 1991

Mr. Ed Hartman
Manana Gas, Inc.
P.O. Box 14069
Albuquerque, NM 87191-4069

Re: Manana Mary Wheeler #1E Gas Well Site, Flora Vista,NM

Dear Mr. Hartman:

El Paso Natural Gas Company has prepared a Scope of Work for the remediation project and plans to conduct a Bid Showing on July 18, 1991.

The project start date is August 5, 1991 and excavation should be completed by August 30. Please shut-in the gas well and remove your ancillary production units(e.g., the separator and storage tank) during the week of July 29th. In addition, it would be helpful if you could remove all of the underground piping connecting to and from the production units in the excavation area.

EPNG will remove our facilities during the week of July 29th. You may want to coordinate the removal of facilities with our Kutz Pipeline Superintendent, Walt Mosley or Lead Technician, Glen Zimmerman .Both Mr. Mosley and Mr. Zimmerman can be reached at 632-2470 or 632-1180.

Since worker safety and access are important to this project, the shut-in of the well and removal of the production facilities will help to assure a safe working environment.

We will notify you after project completion. If you have any questions regarding the project, please call me at (505) 599-2176 or Mr. Tom Hutchins at (915) 541-3531.

Sincerely,

A.N. Pundari

A.N. Pundari

cc: Mr. Tom Hutchins

bc: Jamye Boone Ward
Walt Mosley
Glen Zimmerman
S. Miller/R. Duarte/File 5216-Mary Wheeler #1E

MW

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-3071

JAMYE BOONE WARD ATTORNEY AT LAW

July 17, 1991

William F. Carr
Campbell & Black, P.A.
P.O. Box 2208
Santa Fe, New Mexico 87504-2208

Re: Contamination at Manana-Mary Wheeler #1E
Gas Well Site, Flora Vista, New Mexico

Dear Bill:

Tomorrow, July 18, 1991, El Paso Natural Gas Company ("EPNG") will have a bid showing, the first step in hiring a contractor to remediate the ground water contamination at the Manana-Mary Wheeler #1E gas well site. Anu Pundari, EPNG's engineer overseeing the project, is notifying Mr. Hartman of EPNG's proposed remediation schedule. Actual remediation activities are scheduled to begin August 5, 1991. In order to complete the remediation as scheduled, Mr. Hartman should shut in the well and remove the production equipment no sooner than July 29, 1991, and no later than August 4, 1991.

EPNG appreciates Mr. Hartman's cooperation in this matter, but must emphasize once more that EPNG is not responsible for the contamination and is not acting as a volunteer. You attended several meetings during which the New Mexico Oil Conservation Division discussed the ground water contamination near the Manana-Mary Wheeler #1E well site. During those meetings and by written notice, OCD directed EPNG and Manana Gas, Inc., jointly, to remediate the contamination at the site.

Unfortunately, the only way to legally determine responsibility for the contamination as between the two companies is to allow OCD to take the matter to public hearing. EPNG believes that taking this matter to a public hearing is unwise and against the best interests of both companies. Therefore, EPNG is left with no choice but to conduct the remediation.

Very truly yours,

Jamye Boone Ward

c: L. R. Tarver
Vice President
El Paso Natural Gas Company

W. P. Pearce--Montgomery & Andrews

bc: G. E. Bauer
T. D. Hutchins
G. J. Odegard
A. Pundari

WPPENV32:27

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

OIL CONSER. ... N DIVISION
REC ... ED
'91 MAY 23 AM 9 06

May 17, 1991

Mr. David Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
P.O. Box 2088
Land Office Building
Santa Fe, New Mexico 87504-2088

RE: Contamination at Manana-Mary Wheeler #1E Gas Well Site, Flora Vista, New Mexico

Dear David:

In accordance with the schedule provided by my letter dated April 24, 1991, attached is a copy of a letter from Bill Carr, the attorney for Manana Gas, Inc., acknowledging that Manana will cooperate with EPNG's request to shut in the well and remove the production equipment prior to EPNG's remediation of the site. Manana has advised that they are not willing to provide substitute gas service to the house adjacent to the well. However, they will notify the property owner of the service interruption.

The negotiations with the landowner for the right-of-way required to perform the cleanup and authorization to dispose of the water from the pump test is continuing. We anticipate the negotiations and agreement to be complete by May 31, 1991. A copy of the agreement will be provided for your files.

Also, the equipment needed to establish the background Total Petroleum Hydrocarbon (TPH) levels has not been received. Therefore, the background TPH will not be established until sometime in June. You will be provided a report when the work is completed.

Please let me know if you have any questions.

Thomas D. Hutchins

Thomas D. Hutchins
Manager
North Region Compliance Eng.

CAMPBELL & BLACK, P.A.
LAWYERS

JACK M. CAMPBELL
BRUCE D. BLACK
MICHAEL B. CAMPBELL
WILLIAM F. CARR
BRADFORD C. BERGE
MARK F. SHERIDAN
WILLIAM P. SLATTERY
ANNIE-LAURIE COOGAN

JEFFERSON PLACE
SUITE 1 - 110 NORTH GUADALUPE
POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

MAY 9 1991
JBW

May 7, 1991

Jamye Boone Ward
Attorney at Law
El Paso Natural Gas Company
Post Office Box 1492
El Paso, Texas 79978

Re: **Contamination at Manana-Mary Wheeler No. 1E Gas Well Site, Flora Vista, New Mexico**

Dear Jamye:

I have reviewed your letter of April 25, 1991 concerning the above referenced matter with Mr. Ed Hartman and can advise that Manana will cooperate with El Paso Natural Gas Company in its efforts to clean up the contamination at the above referenced well site.

Manana will shut in the Mary Wheeler No. 1E Gas Well during the excavation activities and will remove the production equipment and the storage tank for produced water at the well site. Manana does not believe it is its responsibility to provide substitute gas service to the house presently receiving gas from the Manana Mary Wheeler No. 1E Well but will advise the owner of this residence of the interuption in gas supply that will occur during your clean up operation. El Paso should coordinate its efforts at this well site directly with Mr. Hartman at Manana Gas, Inc.

Manana is willing to assist El Paso in these remediation efforts but this assistance should not be considered a change in its position on this matter. Manana Gas, Inc. continues to believe that it is not responsible for the contamination at this well site and it is its position that in proceeding with the proposed clean up operation, El Paso is acting as a volunteer.

Very truly yours,

William F. Carr

WILLIAM F. CARR
ATTORNEY FOR MANANA GAS, INC.

WFC:ys
cc: Mr. Ed Hartman
Mr. W. Perry Pearce.

OIL CONSERV N DIVISION
REC ED
'91 APR 29 AM 9 28

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

April 24, 1991

Mr. David Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
P.O. Box 2088
Land Office Building
Santa Fe, New Mexico 87504-2088

RE: Contamination at Manana-Mary Wheeler #1E Gas Well Site, Flora Vista, New Mexico

Dear David:

El Paso Natural Gas Company (EPNG) has received Mr. Morrow's letter dated, March 26, 1991, approving El Paso Natural Gas Company's remediation plan for the Mary Wheeler #1E site. Your assistance and your staff's was most helpful in finalizing the plan.

I would like to provide the remediation schedule for performing the work outlined in the plan as follows:

1. Reach agreement with Manana Oil, Inc., Item 7. - Begin on April 8, estimated completion by May 10;
2. Obtain Right-of-Way agreement with adjacent landowner, Item 20. - Begin April 15, estimated completion by May 17;
3. Determine background Total Petroleum Hydrocarbon level, Item 2. - Begin April 29, estimated completion by May 31;
4. Select a borrow site, Item 9. - Begin April 29, estimated completion by May 31;
5. Perform soil excavation, groundwater disposal and backfilling - Begin July 29, estimated completion by August 30;
6. Sample Water Well S-1 - Begin September 3, estimated completion by February 1992.

We will provide you data on Nos. 1, 2, 3 and 4, as soon as possible and notify you of any schedule changes in advance.

Sincerely yours,

Thomas D. Hutchins

Thomas D. Hutchins
Manager
North Region Compliance Eng.

El Paso
Natural Gas Company

JAMYE BOONE WARD ATTORNEY AT LAW

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-3071

OIL CONSER... ON DIVISION
REC... VED
'91 APR 29 AM 9 58

April 25, 1991

William F. Carr
Campbell & Black, P.A.
P.O. Box 2208
Santa Fe, New Mexico 87504-2208

Re: Contamination at Manana-Mary Wheeler #1E
Gas Well Site, Flora Vista, New Mexico

Dear Bill:

Enclosed is a copy of the remediation plan El Paso Natural Gas Company submitted to the New Mexico Oil Conservation Division by letter dated March 19, 1991. Jim Morrow sent you and Mr. Hartman copies of his letter dated March 26, 1991, in which OCD accepts and approves the plan as submitted. El Paso intends to begin soil excavation in late July 1991, and complete it by August 30, 1991. Due to potential weather related complications, it is very important that El Paso begin the cleanup as scheduled. In preparation of the soil excavation and total remediation of the site, El Paso is seeking the cooperation and assistance of Manana Gas, Inc.

Please refer to the paragraph numbered 7 in the attached letter. El Paso cannot begin the cleanup of the contamination at Manana-Mary Wheeler #1E until Manana takes its wellhead out of service, removes its ancillary production units from the well site, and provides the adjacent house with an alternate source of natural gas. As soon as El Paso completes the cleanup of the site, Manana may replace its production equipment and resume gas production and delivery to the adjacent house.

You will receive a copy of the remediation schedule submitted to OCD. Manana's cooperation through completion of the three items listed above is crucial to the proposed remediation schedule. Within a week from El Paso's submission of its proposed schedule to OCD, I will contact you for assurance of Manana's cooperation.

Feel free to contact me or Perry Pearce if you have any questions regarding this matter. Thank you in advance for your cooperation.

Very truly yours,

Jamey Ward

Enclosure

c (w/enclosure):

J. F. Eichelmann--Burlington Resources Inc.

W. P. Pearce--Montgomery & Andrews

Dave Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, NM 87504

El Paso
Natural Gas Company

March 19, 1991

Mr. David Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Re: Contamination at Manana-Mary Wheeler #1E
Gas Well Site, Flora Vista, New Mexico

Dear David:

El Paso Natural Gas Company ("El Paso") recognizes that the New Mexico Oil Conservation Division ("OCD") has the jurisdiction necessary to demand that El Paso and all other responsible parties remediate the site of the Manana-Mary Wheeler #1E gas well located in Unit M (SW/4, SW/4) Section 23, Township 30 North, Range 12 West, NMPM, San Juan County, New Mexico. Further, El Paso recognizes that OCD has the power to enforce such a requirement through a properly issued order.

Based on OCD's authority to require El Paso to conduct the necessary cleanup activities, El Paso is prepared to do so. El Paso will provide a schedule for the cleanup activities as soon as El Paso receives OCD's written acknowledgement that El Paso's remediation plan, contained herein, is sufficient and adequate to accomplish the required remediation.

In response to your demands that remediation be conducted at this site, El Paso will cleanup the contamination at the Manana-Mary Wheeler #1E gas well near Flora Vista, New Mexico according to the following procedures set forth in Exhibit A, attached hereto and incorporated herein.

El Paso's actions taken in response to your demands to remediate the Manana-Mary Wheeler #1E gas well site should not be construed as a waiver of its rights to contribution from other responsible parties.

If you have any questions with regard to this plan, please feel free to contact me or Jamye Boone Ward.

Very truly yours,

Thomas D. Hutchins

Thomas D. Hutchins
Manager, North Region
Engineering

EXHIBIT A

The outline below includes the plan and procedures which El Paso Natural Gas Company will follow pursuant to the clean up of the groundwater contamination at the Manana-Mary Wheeler #1E Gas Well Site near Flora Vista, New Mexico:

1. The reserve pit and the area of soil visibly stained by hydrocarbon will be excavated until the field detection unit, Miran 1FF Analyzer, indicates a TPH level less than 100 ppm above background level. Said area was delineated during the site investigation study. A "strip mining" approach will be used, in which clean overburden soil is removed and stockpiled prior to excavation of the underlying stained soil.

2. In order to determine the background TPH level, four (4) soil samples will be collected in an area no less than 100 feet up gradient from the beginning of the excavation area. At each of the four (4) locations, soil will be collected at the surface, at a depth of 12 inches, and at a depth of 24 inches. The soil will be composited into a single sample for analysis by the 418.1 IR and Modified 8015 Methods. The average of the four sample results will be used for the background TPH level, if approved by OCD. A map showing the area and location of each sample will be provided to OCD along with the sample results.

3. The excavation will begin up gradient. Overburden to a depth of four to five feet, or until hydrocarbon stained soil is encountered, will be removed and stockpiled for reuse as final backfill after the remediation is complete. Only clean overburden soil will be stockpiled and used for backfill. Any clean soil mixed with stained soil will not be used for backfill.

4. Composite samples will be collected in each excavation zone. An excavation zone is defined as the backhoe swing width by a maximum length of 50 feet or the length of the excavation, whichever is less. The number of samples collected for each composite will be determined

in accordance with the SW846 field sampling protocol. The soil samples will be analyzed for BETX, EPA 8020 Method and TPH, Modified 8015 Method.

5. The zones will be backfilled when the field detection results for TPH are less than 100 ppm above background. If the field results are close to, but slightly greater than, 100 ppm above background, the zone may be sampled for laboratory verification, left open until results are received, and then backfilled if the lab verification results are acceptable. In no case will a zone be backfilled before composite verification samples are collected. If the excavation depths reach eight feet and the field and lab sample results are greater than 100 ppm above background, excavation will cease until El Paso and OCD assess the need for additional excavation.

6. Before commencing the excavation activities, El Paso will remove all its ancillary equipment from the site. After the remediation is complete, El Paso will reinstall its ancillary equipment.

7. In order to assure worker safety and access to the site, the operator must perform the following:

   a. shut-in the gas well for the duration of the excavation activities;

   b. remove the operator's ancillary production units (e.g., the separator and storage tank) prior to excavation activities;

   c. assure that the house located near the well which presently receives gas directly from the Manana-Mary Wheeler #1E well is provided substitute gas service during the shut-in period.

   El Paso will seek to reach agreement with the operator for its cooperation in attaining items a, b, and c, above. A copy of such agreement will be provided to OCD. However, if El Paso and the operator are unable to reach agreement, OCD will be notified as soon as possible.

8. Any above or below ground tanks installed after the remediation is complete will be equipped with OCD approved leak detection systems.

9. To augment the clean overburden which will be placed back into the excavated area, a borrow site with coarse-grained sand will be designated. Most likely, the borrow site will be near Ballard Plant, which is also the disposal site for the contaminated soil. Once a borrow site is designated, El Paso will notify OCD as to the site's location and a representative sample of the borrow material will be provided.

10. A small amount of ground water will probably be encountered. All water observed to have a hydrocarbon sheen will be removed during excavation. A portable pump or vacuum truck will be used to pump the water from the excavation area during soil removal.

11. In the event it becomes necessary to excavate below the water table, the saturated soil will be placed in dump trucks. Each dump truck tailgate will be pinned and the bed tilted over a trough designed to collect and separate the hydrocarbon/water mixtures draining from the saturated soil. This procedure will result in effective drainage of the wet soil and avoidance of any leakage during transport.

12. Absorbent pads will be available on site to facilitate the capture of any free-phase hydrocarbons.

13. The collected water from the excavation area will be pumped into water trucks and hauled to the Kutz Plant lined pond or some other legally permitted disposal site. In accordance with OCD recommendations the Kutz Plant pond liner was inspected for leaks, tears, etc. and none were found.

    A containment "sweep" will be available at the Kutz pond. If necessary, the sweep will be used to move and capture any free-phase hydrocarbons to one side of the pond. The hydrocarbons will then be collected in a pump truck and transported to the Blanco Plant for recycling.

14. Hydrocarbon contaminated soil will be removed to Ballard Station and spread in six inch lifts. The soil will be disced twice a week for the duration of the excavation activities. After excavation is complete, random samples of the disced soil will be collected and analyzed for TPH and BETX to ensure successful aeration. If the TPH, BETX or benzene exceed 100 ppm, 50 ppm, or 10 ppm, respectively, the soil will be disced until the sample results do not exceed the above limits.

15. A temporary trench will be constructed down gradient of the excavation area to serve as an observation trench. The observation trench will provide visual verification that floating hydrocarbons are removed during the excavation process. In addition, the trench will allow natural volatilization of any remaining dissolved hydrocarbons. An agitator will be installed in the trench to act as a final treatment "air stripper" and aeration system. The agitator will be kept in use for a short period (60 - 90 days) after soil remediation is complete to allow flushing of the replacement soil. A fence will be placed around the trench for the period it is open. The fence will be removed and the area returned to its original grade after the 60 - 90 day period is over. Water samples will be collected at the beginning of the excavation activities, at seven day intervals during excavation activities or more often if a hydrocarbon sheen is observed, and at thirty day intervals once remediation is complete. The samples will be analyzed for BETX and TPH by the 8020 and Modified 8015 Methods, respectively.

16. All existing OCD monitoring wells will be removed. In addition, all El Paso monitoring wells in the excavation area will be removed.

17. After remediation is complete, well S-1 will be pumped at a constant rate of about 65 gallons per minute (gpm) for 24 hours and sampled. Visual observations of the color, odor, and turbidity of the water will be noted at the beginning and end of the 24 hour period. The samples will be analyzed for BETX and TDS. The water discharged during the 24 hour pumping

will be contained in tanks until the sample results are received. If the sample results are less than WQCC limits for BETX and 1000 ppm for TDS, the water will be discharged to the farmer's field west of the remediation site. If the results of the samples exceed the WQCC and/or TDS limits, the water will be treated prior to discharge to the field or disposed of at the Kutz Plant lined pond.

18. Following item 17 above, water well S-1 will be pumped for 48 hours at a constant rate of about 65 gpm and sampled at the beginning and end of the 48 hour period. Visual observations will be noted at the beginning, middle and end of the 48 hour period. If the results from the 24 hour pumping were less than the above limits and no visual problems are noted, the water will be discharged directly onto the farmer's field. Otherwise, the water will be contained in tanks and either treated prior to discharge to the farmer's field or disposed of at the Kutz Plant lined pond. The samples collected during the 48 hour pumping will be analyzed for BETX, TPC, EC, sodium, calcium, potassium, magnesium, chloride, sulfate, nitrate, carbonate, and bicarbonate.

19. Every thirty (30) days thereafter for a period of six (6) months, water well S-1 will be pumped for 48 hours at a constant rate of about 65 gpm. Samples will be collected at the beginning and end of the 48 hour period and analyzed for the constituents listed in item 18 above. Visual observations will be noted at the beginning, middle and end of the 48 hour period. If the results of the previous sampling are below the WQCC limits and no visual problems are noted, the water will be discharged directly to the farmer's field. Otherwise, the water will be stored in tanks for treatment prior to discharge to the field or disposed of at the Kutz Plant lined pond. If the sample results at the end of the six month period are satisfactory, no additional monitoring will be performed.

20. The approval of the landowner and OCD will be obtained prior to any discharge to the farmer's field. El Paso will provide OCD a copy of the

agreement with the landowner, noting approval for discharge onto the field.

21. The necessity for additional monitoring wells will be assessed with OCD after remediation activities are complete and sample results received. OCD will be provided a summary report on the remediation activities, sampling, and sample results.

22. After remediation is complete and the groundwater is demonstrated to be clean, water well S-1 will be plugged and abandoned.

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

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

March 26, 1991

CERTIFIED MAIL -
RETURN RECEIPT NO. P-327-278-089

Mr. Thomas D. Hutchins, Manager
North Region Compliance Engineering
El Paso Natural Gas Company
P. O. Box 1492
El Paso, Texas 79978

RE: Contamination at Manana-Mary Wheeler #1E Gas Well Site, Flora Vista, New Mexico

Dear Mr. Hutchins:

The Oil Conservation Division (OCD) has received your letter, dated March 19, 1991, to Mr. David Boyer together with the proposed remediation plan (attached as your Exhibit A) for the Mary Wheeler #1E site. This remediation plan has been reviewed by Mr. Boyer and other OCD staff.

Based on information previously provided OCD as part of the site investigation study and information provided in the plan, we believe the plan to be sufficient and adequate to accomplish the required remediation and hereby approve the plan.

You are requested to provide OCD with the proposed schedule for conducting the cleanup and notify OCD 14-days prior to beginning soil removal to allow OCD viewing of this procedure.

Please be advised that OCD approval does not relieve you from taking additional measures should the approved plan fail to remediate petroleum contaminated ground water at this site. In addition, OCD approval does not relieve you of responsibility for compliance with other city, county, state and federal laws and/or regulations.

We appreciate El Paso Natural Gas Company's cooperation in undertaking this remediation activity and believe that voluntary compliance with our agency's regulatory requirements provides the fastest and most efficient use of agency and company time and resources. We look forward to working with you as groundwater cleanup and site remediation proceeds. If you have any questions, contact Mr. David Boyer of my staff at (505) 827-5812.

Sincerely,

Jim Morrow
Deputy Director

JM/DGB

cc: OCD Aztec Office
William Carr - Campbell & Black
Perry Pearce - Montgomery & Andrews
John Eichelmann - Burlington Resources
Ed Hartman - Manana Oil

El Paso
Natural Gas Company

OIL CONSERVATION DIVISION
RECEIVED

'91 MAR 21 AM 9 15

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

March 19, 1991

Mr. David Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Re: Contamination at Manana-Mary Wheeler #1E
Gas Well Site, Flora Vista, New Mexico

Dear David:

El Paso Natural Gas Company ("El Paso") recognizes that the New Mexico Oil Conservation Division ("OCD") has the jurisdiction necessary to demand that El Paso and all other responsible parties remediate the site of the Manana-Mary Wheeler #1E gas well located in Unit M (SW/4, SW/4) Section 23, Township 30 North, Range 12 West, NMPM, San Juan County, New Mexico. Further, El Paso recognizes that OCD has the power to enforce such a requirement through a properly issued order.

Based on OCD's authority to require El Paso to conduct the necessary cleanup activities, El Paso is prepared to do so. El Paso will provide a schedule for the cleanup activities as soon as El Paso receives OCD's written acknowledgement that El Paso's remediation plan, contained herein, is sufficient and adequate to accomplish the required remediation.

In response to your demands that remediation be conducted at this site, El Paso will cleanup the contamination at the Manana-Mary Wheeler #1E gas well near Flora Vista, New Mexico according to the following procedures set forth in Exhibit A, attached hereto and incorporated herein.

El Paso's actions taken in response to your demands to remediate the Manana-Mary Wheeler #1E gas well site should not be construed as a waiver of its rights to contribution from other responsible parties.

If you have any questions with regard to this plan, please feel free to contact me or Jamye Boone Ward.

Very truly yours,

Thomas D. Hutchins

Thomas D. Hutchins
Manager, North Region
Engineering

EXHIBIT A

The outline below includes the plan and procedures which El Paso Natural Gas Company will follow pursuant to the clean up of the groundwater contamination at the Manana-Mary Wheeler #1E Gas Well Site near Flora Vista, New Mexico:

1. The reserve pit and the area of soil visibly stained by hydrocarbon will be excavated until the field detection unit, Miran 1FF Analyzer, indicates a TPH level less than 100 ppm above background level. Said area was delineated during the site investigation study. A "strip mining" approach will be used, in which clean overburden soil is removed and stockpiled prior to excavation of the underlying stained soil.

2. In order to determine the background TPH level, four (4) soil samples will be collected in an area no less than 100 feet up gradient from the beginning of the excavation area. At each of the four (4) locations, soil will be collected at the surface, at a depth of 12 inches, and at a depth of 24 inches. The soil will be composited into a single sample for analysis by the 418.1 IR and Modified 8015 Methods. The average of the four sample results will be used for the background TPH level, if approved by OCD. A map showing the area and location of each sample will be provided to OCD along with the sample results.

3. The excavation will begin up gradient. Overburden to a depth of four to five feet, or until hydrocarbon stained soil is encountered, will be removed and stockpiled for reuse as final backfill after the remediation is complete. Only clean overburden soil will be stockpiled and used for backfill. Any clean soil mixed with stained soil will not be used for backfill.

4. Composite samples will be collected in each excavation zone. An excavation zone is defined as the backhoe swing width by a maximum length of 50 feet or the length of the excavation, whichever is less. The number of samples collected for each composite will be determined

in accordance with the SW846 field sampling protocol. The soil samples will be analyzed for BETX, EPA 8020 Method and TPH, Modified 8015 Method.

5. The zones will be backfilled when the field detection results for TPH are less than 100 ppm above background. If the field results are close to, but slightly greater than, 100 ppm above background, the zone may be sampled for laboratory verification, left open until results are received, and then backfilled if the lab verification results are acceptable. In no case will a zone be backfilled before composite verification samples are collected. If the excavation depths reach eight feet and the field and lab sample results are greater than 100 ppm above background, excavation will cease until El Paso and OCD assess the need for additional excavation.

6. Before commencing the excavation activities, El Paso will remove all its ancillary equipment from the site. After the remediation is complete, El Paso will reinstall its ancillary equipment.

7. In order to assure worker safety and access to the site, the operator must perform the following:

   a. shut-in the gas well for the duration of the excavation activities;

   b. remove the operator's ancillary production units (e.g., the separator and storage tank) prior to excavation activities;

   c. assure that the house located near the well which presently receives gas directly from the Manana-Mary Wheeler #1E well is provided substitute gas service during the shut-in period.

   El Paso will seek to reach agreement with the operator for its cooperation in attaining items a, b, and c, above. A copy of such agreement will be provided to OCD. However, if El Paso and the operator are unable to reach agreement, OCD will be notified as soon as possible.

8. Any above or below ground tanks installed after the remediation is complete will be equipped with OCD approved leak detection systems.

9. To augment the clean overburden which will be placed back into the excavated area, a borrow site with coarse-grained sand will be designated. Most likely, the borrow site will be near Ballard Plant, which is also the disposal site for the contaminated soil. Once a borrow site is designated, El Paso will notify OCD as to the site's location and a representative sample of the borrow material will be provided.

10. A small amount of ground water will probably be encountered. All water observed to have a hydrocarbon sheen will be removed during excavation. A portable pump or vacuum truck will be used to pump the water from the excavation area during soil removal.

11. In the event it becomes necessary to excavate below the water table, the saturated soil will be placed in dump trucks. Each dump truck tailgate will be pinned and the bed tilted over a trough designed to collect and separate the hydrocarbon/water mixtures draining from the saturated soil. This procedure will result in effective drainage of the wet soil and avoidance of any leakage during transport.

12. Absorbent pads will be available on site to facilitate the capture of any free-phase hydrocarbons.

13. The collected water from the excavation area will be pumped into water trucks and hauled to the Kutz Plant lined pond or some other legally permitted disposal site. In accordance with OCD recommendations the Kutz Plant pond liner was inspected for leaks, tears, etc. and none were found.

    A containment "sweep" will be available at the Kutz pond. If necessary, the sweep will be used to move and capture any free-phase hydrocarbons to one side of the pond. The hydrocarbons will then be collected in a pump truck and transported to the Blanco Plant for recycling.

14. Hydrocarbon contaminated soil will be removed to Ballard Station and spread in six inch lifts. The soil will be disced twice a week for the duration of the excavation activities. After excavation is complete, random samples of the disced soil will be collected and analyzed for TPH and BETX to ensure successful aeration. If the TPH, BETX or benzene exceed 100 ppm, 50 ppm, or 10 ppm, respectively, the soil will be disced until the sample results do not exceed the above limits.

15. A temporary trench will be constructed down gradient of the excavation area to serve as an observation trench. The observation trench will provide visual verification that floating hydrocarbons are removed during the excavation process. In addition, the trench will allow natural volatilization of any remaining dissolved hydrocarbons. An agitator will be installed in the trench to act as a final treatment "air stripper" and aeration system. The agitator will be kept in use for a short period (60 - 90 days) after soil remediation is complete to allow flushing of the replacement soil. A fence will be placed around the trench for the period it is open. The fence will be removed and the area returned to its original grade after the 60 - 90 day period is over. Water samples will be collected at the beginning of the excavation activities, at seven day intervals during excavation activities or more often if a hydrocarbon sheen is observed, and at thirty day intervals once remediation is complete. The samples will be analyzed for BETX and TPH by the 8020 and Modified 8015 Methods, respectively.

16. All existing OCD monitoring wells will be removed. In addition, all El Paso monitoring wells in the excavation area will be removed.

17. After remediation is complete, well S-1 will be pumped at a constant rate of about 65 gallons per minute (gpm) for 24 hours and sampled. Visual observations of the color, odor, and turbidity of the water will be noted at the beginning and end of the 24 hour period. The samples will be analyzed for BETX and TDS. The water discharged during the 24 hour pumping

will be contained in tanks until the sample results are received. If the sample results are less than WQCC limits for BETX and 1000 ppm for TDS, the water will be discharged to the farmer's field west of the remediation site. If the results of the samples exceed the WQCC and/or TDS limits, the water will be treated prior to discharge to the field or disposed of at the Kutz Plant lined pond.

18. Following item 17 above, water well S-1 will be pumped for 48 hours at a constant rate of about 65 gpm and sampled at the beginning and end of the 48 hour period. Visual observations will be noted at the beginning, middle and end of the 48 hour period. If the results from the 24 hour pumping were less than the above limits and no visual problems are noted, the water will be discharged directly onto the farmer's field. Otherwise, the water will be contained in tanks and either treated prior to discharge to the farmer's field or disposed of at the Kutz Plant lined pond. The samples collected during the 48 hour pumping will be analyzed for BETX, TPC, EC, sodium, calcium, potassium, magnesium, chloride, sulfate, nitrate, carbonate, and bicarbonate.

19. Every thirty (30) days thereafter for a period of six (6) months, water well S-1 will be pumped for 48 hours at a constant rate of about 65 gpm. Samples will be collected at the beginning and end of the 48 hour period and analyzed for the constituents listed in item 18 above. Visual observations will be noted at the beginning, middle and end of the 48 hour period. If the results of the previous sampling are below the WQCC limits and no visual problems are noted, the water will be discharged directly to the farmer's field. Otherwise, the water will be stored in tanks for treatment prior to discharge to the field or disposed of at the Kutz Plant lined pond. If the sample results at the end of the six month period are satisfactory, no additional monitoring will be performed.

20. The approval of the landowner and OCD will be obtained prior to any discharge to the farmer's field. El Paso will provide OCD a copy of the

agreement with the landowner, noting approval for discharge onto the field.

21. The necessity for additional monitoring wells will be assessed with OCD after remediation activities are complete and sample results received. OCD will be provided a summary report on the remediation activities, sampling, and sample results.

22. After remediation is complete and the groundwater is demonstrated to be clean, water well S-1 will be plugged and abandoned.

OK w/Phone Changes. RGB 3/18/91 (Letter to follow from TH)

Revised 3/15/91
TDH

SUBJECT: Site Remediation for the Manana - Mary Wheeler #1E Gas Well Site in Flora Vista, New Mexico

The following outlines the procedures and plan for the remediation activities at the subject well site.

1. The reserve pit and the area of soil visibly stained by hydrocarbon will be excavated until the field detection unit, Miran 1FF Analyzer, indicates a TPH level less than 100 ppm above background. The area was delineated during the site investigation study. A "strip mining" approach will be used, in which clean overburden is removed and stockpiled prior to excavation of the underlying stained soil.

2. To determine the background TPH level, four soil samples will be collected in an area a minimum of 100 feet up gradient from the beginning of the excavation area. At each of the four locations, soil will be collected at the surface, a depth of 12 inches and a depth of 24 inches. The soil will be composited into a single sample for analysis by the 418.1 IR and Modified 8015 Methods. The average of the four sample results will be used for the background TPH level, if approved by OCD. A map showing the area and location of each sample will be provided to OCD along with the sample results.

3. The excavation will begin up gradient. Overburden to a depth of four to five feet, or until hydrocarbon stained soil is encountered, will be removed and stockpiled for reuse as final backfill after the remediation is complete. Only clean overburden will be stockpiled and used for backfill. Any soil mixed with stained soil will not be used for backfill.

4. Composite samples will be collected in each excavation zone. An excavation zone is defined as the backhoe swing width by a maximum length of 50 feet or the length of the excavation, whichever is less. The number of samples collected for each composite will be determined in accordance with the SW846 field sampling protocol. The soil samples will be analyzed for BETX, EPA 8020 Method and TPH, Modified 8015 Method.

5. The zones will be backfilled when the field detection results for TPH are less than 100 ppm above background. If the field results are close to but slightly greater than 100 ppm above background, the zone may be sampled for laboratory verification, left open until results are received and then backfilled if the lab verification results are acceptable. In no case will a zone be backfilled before composite verification samples are collected. If the excavation depths reach eight feet and the field and

lab sample results are greater than 100 ppm above background, excavation will cease until El Paso and OCD assess the need for additional excavation.

6. Before commencing the excavation activities, El Paso will remove all of it's ancillary equipment from the site. After the remediation is complete, El Paso will reinstall it's equipment.

7. In order to assure worker safety, access to the site and a thorough and final cleanup, the operator must perform the following:

a. Shut-in the well for the duration of the excavation activities;
b. remove the operator's ancillary production units prior to excavation activities;
c. assure that the house located near the well, which presently receives gas directly from the Manana-Mary Wheeler #1E well, is provided substitute gas service during the shut in period.

El Paso will seek to reach an agreement with the operator for the above items and a copy of the agreement will be provided to OCD. However, if El Paso is unable to reach an agreement with the operator, OCD will be notified as soon as possible.

8. Any above or below ground tanks installed after the remediation is complete must be installed with leak detection equipment that is approved by OCD.

9. To augment the clean overburden that will be placed into the excavation area, a borrow site with coarse-grained sand will be designated. Most likely the borrow site will be near Ballard Plant, which is also the disposal site for the contaminated soil. Once a borrow site is located, OCD will be notified of the location and a representative sample of the borrow material will be provided.

10. A small amount of ground water will be encountered. Any water observed during excavation with a hydrocarbon sheen will be removed. A portable pump or vacuum truck will be used to remove the water from the excavation area during excavation. ~~The water will be discharged taken to the lined pond at Kutz~~.

11. In the event it is necessary to excavate below the water table, the saturated soils will be placed into dump trucks. The dump truck tailgate will be pinned and the bed tilted over a trough designed to collect and separate the hydrocarbon/water mixtures that drain from the saturated soil. This procedure will result in effective drainage of the wet soils and avoidance of any leakage during transport. ~~The collected water will be trucked to the lined pond at Kutz Plant or another permitted disposal site~~.

12. Absorbent pads will be available on site to facilitate the

capture of any free-phase hydrocarbons.

13. The collected water from the excavation area will be pumped into water trucks and hauled to the Kutz lined pond or another permitted disposal site. In accordance with OCD recommendations the Kutz pond liner was inspected for leaks, tears, etc. and none were found.
A containment "sweep" will be on site at the Kutz pond. The sweep will be used to move and capture any free-phase hydrocarbons to one side of the pond. The hydrocarbons will be collected in a pump truck and transported to the Blanco Plant for recycling.

14. Hydrocarbon contaminated soil will be removed to Ballard Station and spread in six inch lifts. The soil will be disced twice a week for the duration of the excavation activities. After excavation is complete, random samples will be collected and analyzed for TPH and BETX to ensure aeration was successful. If the TPH, BETX or benzene results exceed 100 ppm, 50 ppm or 10 ppm, respectively, the soil will be disced until the results do not exceed these limits.

15. A temporary trench will be constructed just down gradient of the excavation area to serve as an observation trench. It will provide visual verification that no floating hydrocarbons escaped during the excavation process. It will also allow natural volatilization of any remaining dissolved hydrocarbons. An agitator will be installed in the trench to act as a final treatment "air stripper" and aeration system. It will be kept in use for a short period (60 - 90 days) after soil remediation is complete to allow flushing of the replacement soil. A fence will be placed around the trench for the period it is open. The fence will be removed and the area returned to it's original grade after the 60 - 90 day period. Water samples will be collected at the beginning of the excavation, at seven day intervals during excavation or if a hydrocarbon sheen is observed and at thirty day intervals after remediation until the trench is closed. The samples will be analyzed for BETX and TPH by the 8020 and Modified 8015 Methods, respectively.

16. All former OCD monitoring wells will be removed. In addition, all EPNG monitoring wells in the excavation area will be removed.

17. After remediation, well S-1 will be pumped at a constant rate of about 65 gallons per minute (gpm) for 24 hours and sampled. Visual observations of the color, odor and turbidity of the water will be noted at the beginning and end of the 24 hour period. The sample will be analyzed for BETX and TDS. The water discharged during the 24 hour pumping will be contained in tanks until the sample results are received. If the sample results are less than WQCC limits for BETX and 1000 ppm for TDS the water will be discharged to the farmers field. If the results exceed the WQCC and/or TDS limits the water will be treated prior to discharge to the field or disposed of at the Kutz lined pond.

18. Well S-1 will then be pumped for 48 hours at a constant rate of about 65 gpm and sampled at the beginning and end of the 48 hour period. Visual observations will be noted at the beginning, middle and end of the 48 hour period. If the results from the 24 hour pumping were less than the above limits and no visual problems are noted, the water will be discharged directly onto the farmer's field. Otherwise, the water will be contained in tanks and either treated prior to discharge to the farmer's field or disposed of at the Kutz lined pond. The samples collected during the 48 hour pumping will be analyzed for BETX, TPH, EC, sodium, calcium, potassium, magnesium, chloride, sulfate, nitrate, carbonate and bicarbonate.

and analyzed as in 18. above.

19. Every thirty days thereafter for a period of six months, well S-1 will be pumped for 48 hours at a constant rate of about 65 gpm. Samples will be collected at the beginning and end of the 48 hour period. Visual observations will be noted at the beginning, middle and end of the 48 hour period. If the results of the previous sampling were below the WQCC limits and no visual problems are noted, the water will be discharged directly to the farmer's field. Otherwise, the water will be stored in tanks for treatment prior to discharge to the field or disposed of at the Kutz pond. If the sample results at the end of the six month period are satisfactory, no additional monitoring will be performed.

20. The approval of the landowner and OCD will be obtained prior to any discharge to the farmer's field. El Paso will provide OCD a copy of the agreement with the landowner, noting approval for discharge on the field.

21. The necessity for additional monitoring wells will be assessed with OCD after remediation activities are completed and sample results are received. OCD will be provided a summary report on the remediation activities, sampling and sample results.

22. After remediation is complete and the groundwater is shown to be clean, well S-1 will be plugged and abandoned.

EPNG - OCD Flora Vista Meeting 3/11/91 - 1000 hrs

personnel - Dave Boyer - OCD
- Bill Olson - OCD
- Henry Van - EPNG
- Anan Pundari - EPNG
- Tom Hutchins EPNG

TH Hand out paper on site remediation addressing OCD comments

DB. Is Manana cooperating in remediation

T.H. So far, will move forward until obstacles are approached

D.B. OCD will send letter to Manana if trouble with cooperation arises

T.H. item 14 need commitment from landowner to discharge and OCD approval prior to discharge not included

D.B. These need to be included as well as discharge color turbidity, odor & taste during discharge as in OCD letter 1/11/91 item 13. These observations needed at least once per day

D.B. Need letter on file btw landowner and EPNG on discharge
Item 16 can omit reference to ~~the~~ replacement water well and state that an agreement will be reached with Flora Vista on fate of S-1 ie capping and abandonment

D Will Manana be responsible for removing their own equipment?

T.H. Yes but may be done by EPNG.

D.B. Change item 3 to reflect removal of all ancillary equipment including Manana's

J.H. already covered in item 4

D.B. otherwise ~~the~~ items 2-16 ok
Move to item 1

~~T.H.~~
D.B. Oily soils in reserve pit area still remain

A Originally this area analyzed for oil & grease later done with FID/GC method for TPH Showed not good correlation between methods (see copy of results)

A | We have field 418.1 equipment that can be used for field confirmation

~~D.B. Consider~~

T.H. | What level TPH used in field

W.O., D.B. | 100 ppm is action level

D.B. | Consider taking ~~an~~ upgradient sample for field 418.1 method then subtract out from normal samples to take out ~~at~~ natural effects

T.H. | Could leave open while confirmation ~~dig~~ being done.

A. | Dig to eight feet or TPH field reading whichever applies

D.B. | Don't expect to reach ~~rai~~ 8' depth
But need confirmation of actual contaminants remaining

W.O. | Keep close communication with OCD during excavation to make determination of amount removal required

H.V. | Will do

T.H. | May consider dewatering for excavation and discharge to river

D.B. | Needs NPDES permit, don't want that
Will check on discharge to swamp instead of river

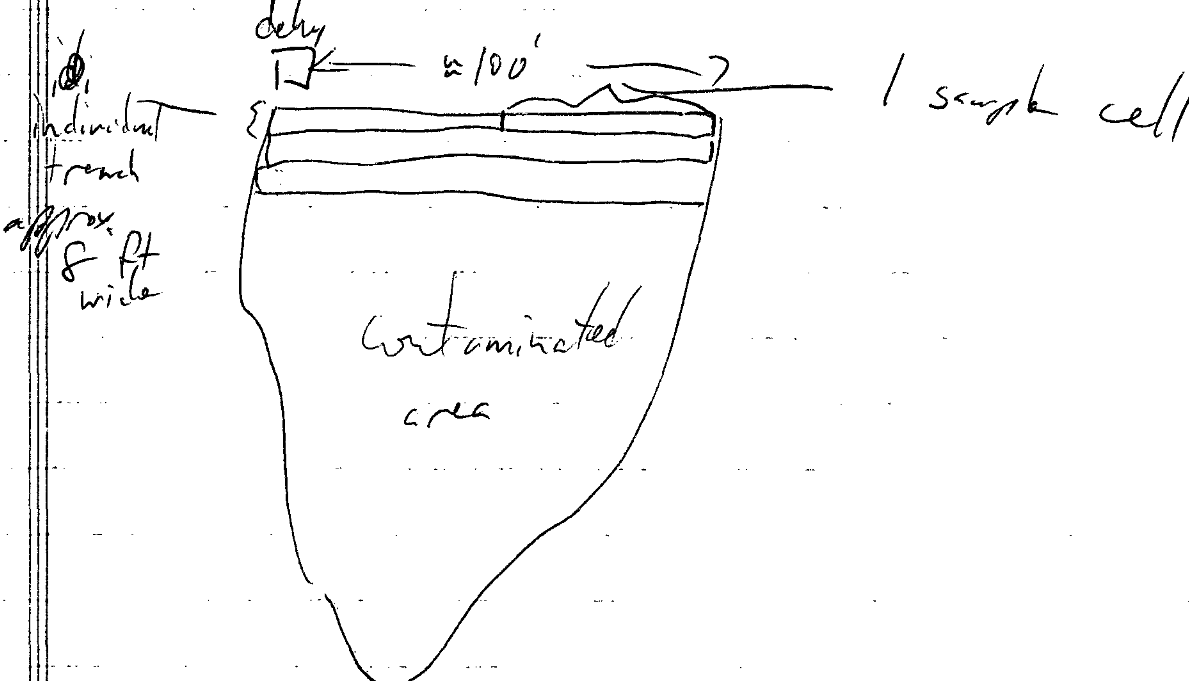
A.P. What # of confirmation samples needed and type of analysis

D.B. TPH + BTEX for analysis
Isolate into cells and get samples from each cell ~~on~~

W.O. Sample as per SW 846 compositing techniques

W.O. Try doing field confirmation as tool for determining backfilling, i.e., if clean with field method

D.B. Want to break each trench in 50' cell with composite from each cell as below



Form 7-1 (Rev 9-77)

ENGINEERING CALCULATION

Date: 3/11/91
By: H. Van
File: EPNG

MW		gals/mol
16.04	C_1	6.4
30.07	C_2	10.12
44.10	C_3	10.42
58.12	iC_4	12.38
58.12	nC_4	11.93
72.15	iC_5	13.85
72.15	nC_5	13.71
86.18	iC_6	15.50
86.18	C_6	15.57
100.21	iC_7	17.2
100.21	C_7	17.46
114.23	C_8	19.39
28.05	$C_2^=$	9.64
42.08	$C_3^=$	9.67

MISC.

MW		gals/mol
32.00	O_2	3.37
28.01	CO	4.19
44.01	CO_2	6.38
64.06	SO_2	5.50
34.08	H_2S	5.17
28.01	N_2	4.16
2.02	H_2	3.38

MEETING ON MARY Wheeler #1E Gas Well Site in Floravista, N.M.

- Participants
  - David Boyer – OCD
  - Bill Olsen – OCD
  - Tom Hutchins – EPNG
  - Anu Pundari – "
  - Henry Van – "
- Purpose of Meeting
  - To review draft remediation workplan
- Discussion Highlights
  - Manana should be notified about the temporary movement of the equipment. Send the owners approval to OCD to procure approval for W/W disposal.
  - Item 14
    - Notify the owner and receive authorization from OCD should be ~~[illegible]~~ stipulated
    - Physical Parameters should be included as visual observation.
      - Turbidity
      - Color
      - Odor

      } once per day, at least
  - Item 16
    - The agreement is between EPNG & Floravista.
  - Item 3
    - Insert about EPNG will attempt to

Mary Wheeler #1-E (Floravista)
Remediation Proposal

MW		gals/mol
16.04	C_1	6.4
30.07	C_2	10.12
44.10	C_3	10.42
58.12	iC_4	12.38
58.12	nC_4	11.93
72.15	iC_5	13.85
72.15	nC_5	13.71
86.18	iC_6	15.50
86.18	C_6	15.57
100.21	iC_7	17.2
100.21	C_7	17.46
114.23	C_8	19.39
28.05	$C_2^{=}$	9.64
42.08	$C_3^{=}$	9.67

MISC.

MW		gals/mol
32.00	O_2	3.37
28.01	CO	4.19
44.01	CO_2	6.38
64.06	SO_2	5.50
34.08	H_2S	5.17
28.01	N_2	4.16
2.02	H_2	3.38

reach agreement with Manana to remove their equipment to allow remediation and EPNG will notify OCD if Manana does not agree. If agreement is reached copy of the agreement should be sent to OCD.

Items: # 5 & 6, 7 are OK

7 word "small"

8 OK

9 OK

10 OK

11 OK

12 OK

13 OK

15 OK

Item # 1:

- The KW Brown indicates very low values of what we can measure.
- What was left was Hydrocarbon characterization
- Need to send Ann Pundari's 1990 testing which show no correlation

MW		gals/mol
16.04	C_1	6.4
30.07	C_2	10.12
44.10	C_3	10.42
58.12	iC_4	12.38
58.12	nC_4	11.93
72.15	iC_5	13.85
72.15	nC_5	13.71
86.18	iC_6	15.50
86.18	C_6	15.57
100.21	iC_7	17.2
100.21	C_7	17.46
114.23	C_8	19.39
28.05	$C_2^{=}$	9.64
42.08	$C_3^{=}$	9.67

MISC.

MW		gals/mol
32.00	O_2	3.37
28.01	CO	4.19
44.01	CO_2	6.38
64.06	SO_2	5.50
34.08	H_2S	5.17
28.01	N_2	4.16
2.02	H_2	3.38

Mary Wheeler #1-E (Floravista)
Remediation Proposal

between the Method FID (418) ~~[illegible]~~
for TPH and Oil & Grease.

- We could use Field TPH "MIRAN" 1 FF and 1 ACVF. Remediation TPH levels to guide remediation could be:

Proposed Cleanup Level - Take samples of background TPH ≃ 100 minus background.

1) Analyze in the lab for verification (Use the 418 FID method) Leave open for about two weeks while testing
2) 2 ft below
3) Take samples → ∠ 26
4) Review results
5) Take more confirmation

- OCD believes that the excavation may not have to be beyond 8 feet. If results are over the cleanup level these should be discussed at that point.

Mary Wheeler #1-E (Flaravista)
Remediation Proposal

MW		gals/mol
16.04	C_1	6.4
30.07	C_2	10.12
44.10	C_3	10.42
58.12	iC_4	12.38
58.12	nC_4	11.93
72.15	iC_5	13.85
72.15	nC_5	13.71
86.18	iC_6	15.50
86.18	C_6	15.57
100.21	iC_7	17.2
100.21	C_7	17.46
114.23	C_8	19.39
28.05	$C_2^=$	9.64
42.08	$C_3^=$	9.67

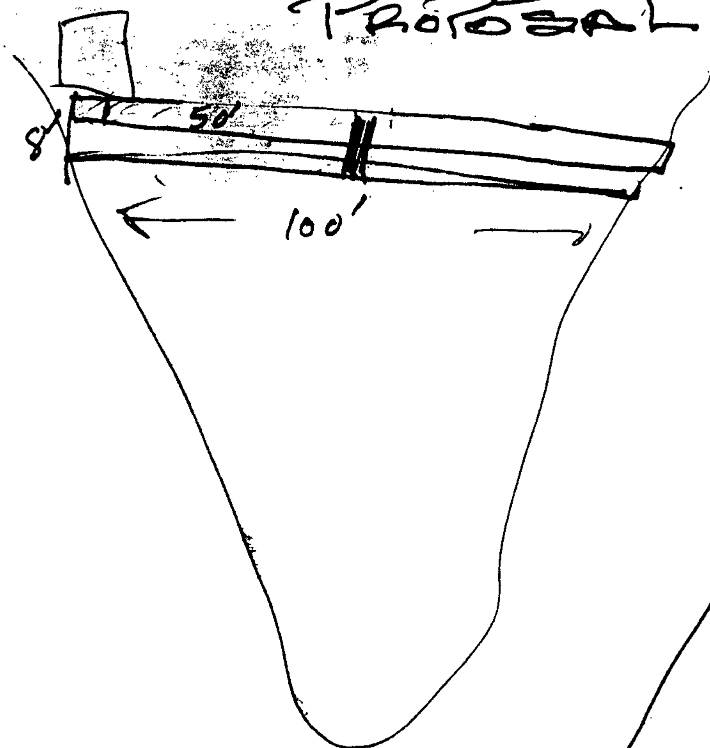
MISC.

MW		gals/mol
32.00	O_2	3.37
28.01	CO	4.19
44.01	CO_2	6.38
64.06	SO_2	5.50
34.08	H_2S	5.17
28.01	N_2	4.16
2.02	H_2	3.38

- OCD will advice about disposal of background water if analysis shows to be free of contamination.
- VERIFICATION
  - → TPH & BTX
  - → No. of Samples
  - → Diking could be use to isolate remediation cells to avoid contamination.
  - → Take a composite of cells no longer than 50 feet. The composites will depend on the width of the cell. The width of the trench will depend on the reach of the backhoe. (Page 4a shows figure)
- Disposal of backgrd. water will be evaluated.
  - (1) river discharge is not recommended.

Mary Wheeler #1-E
Floravista
3/11/91
EPNG

REMEDIATION PROPOSAL

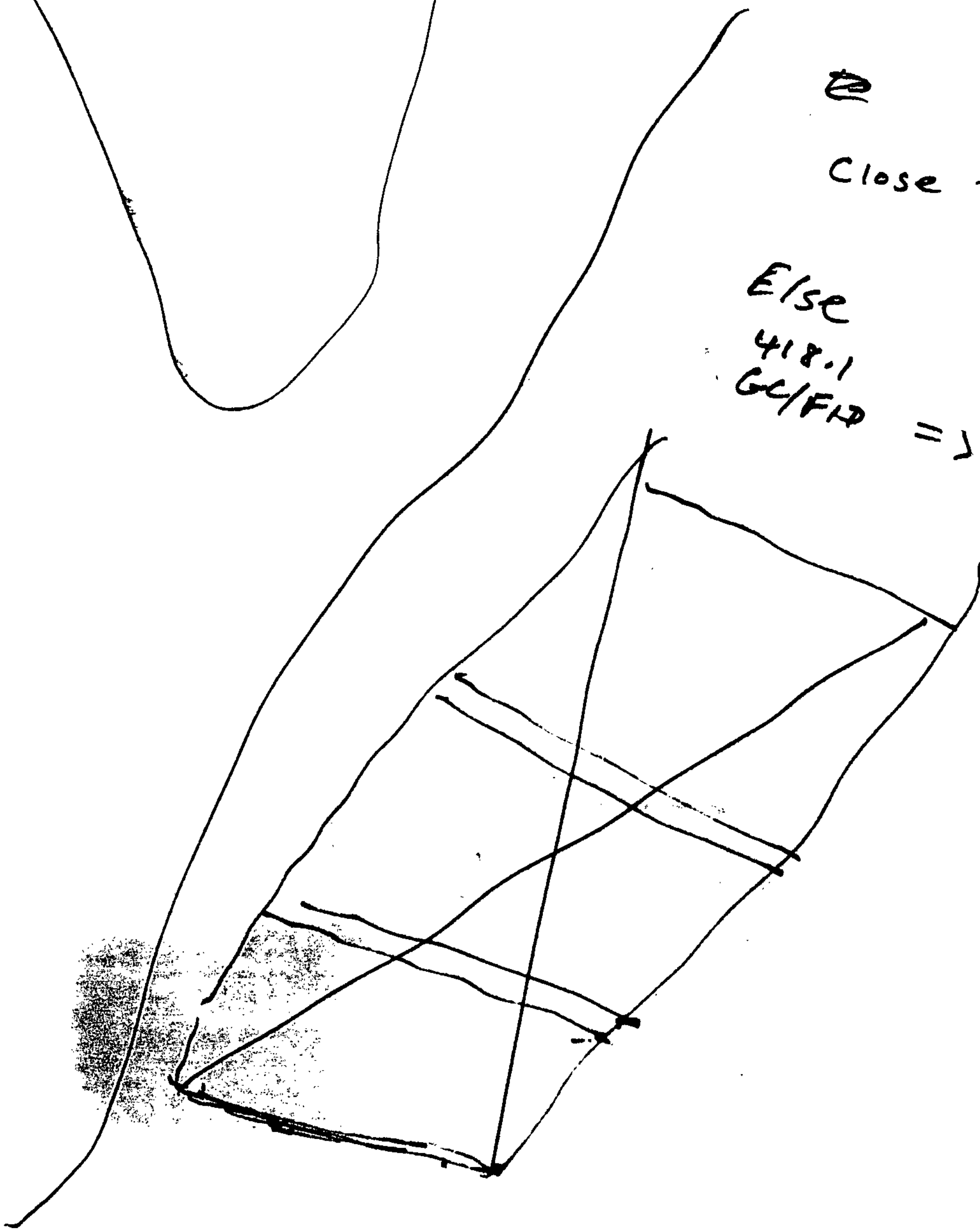


4 ft good soil

@

Close - Field TPH < 100 + Background

Else
418.1
GC/FID => Results



3/11/91

SUBJECT: Site Remediation for the Manana = Mary Wheeler #1E Gas Well Site in Flora Vista, New Mexico

The following outlines the procedures and plan for the remediation activities at the subject well site.

1. The reserve pit and the area of soil visibly stained by hydrocarbon will be excavated to a depth that is two feet below groundwater. The area was delineated during the site investigation study. A "strip mining" approach will be used, in which clean overburden is removed and stockpiled prior to excavation of the underlying stained soil.

2. The excavation will begin up gradient. Overburden to a depth of four to five feet, or until hydrocarbon stained soil is encountered, will be removed and stockpiled for reuse as final backfill after the remediation is completed. Only clean overburden will be stockpiled and used for backfill. Any soil mixed with stained soil will not be used for backfill.

3. Before commencing the excavation activities, El Paso will remove all of it's ancillary equipment from the site. After the remediation is complete, El Paso reinstall it's equipment.

4. In order to assure worker safety, access to the site and a thorough and final cleanup, the operator must perform the following:

   a. Shut-in the well for the duration of the excavation activities;

   b. remove the operator's ancillary production units prior to excavation activities;

c. assure that the house located near the well, which presently receives gas directly from the Manana-Mary Wheeler #1E well, is provided substitute gas service during the shut in period.

5. Any tanks installed after the remediation is complete must be installed with leak detection equipment that is approved by NMOCD.

6. To augment the clean overburden that will be placed back into the excavation area, a borrow site with coarse-grained sand will be designated. Most likely the borrow site will be near Ballard Plant, which is also the disposal site for the contaminated soil. Once a borrow site is located, OCD will be notified of the location and a representative sample of the borrow material will be provided.

7. A small amount of ground water will be encountered. However, any water observed with a hydrocarbon sheen will be filtered and water with soluble hydrocarbons will be removed during excavation. A portable pump will be used to pump the water from the excavation area during soil removal. The water will be discharged into tank trucks and taken to the lined pond at Kutz.

8. In the event it is necessary to excavate below the water table, the saturated soils will be placed into dump trucks. The dump truck tailgate will be pinned and the bed tilted over a trough designed to collect and separate the hydrocarbon/water mixtures that drain from the saturated soil. This procedure will result in effective drainage of the wet soils and avoidance of

any leakage during transport. The collected water will be trucked to the lined pond at Kutz Plant or a permitted disposal site.

9. Absorbent pads will be available on site to facilitate the capture of any free-phase hydrocarbons.

10. The water from the excavation area will be pumped into water trucks and hauled to the Kutz lined pond or a permitted disposal site. In accordance with OCD recommendations the Kutz pond liner was inspected for leaks, tears, etc. and none were found.

A containment "sweep" will be on site at the Kutz pond. The sweep will be used to move and capture any free-phase hydrocarbons to one side of the pond. The hydrocarbons will be collected in a pump truck and transported to the Blanco Plant for recycling.

11. Hydrocarbon contaminated soil will be removed to Ballard Station and spread in six inch lifts. The soil will be disced twice a week for the duration of the excavation activities. After excavation is completed, random samples will be collected and analyzed for TPH and BETX to ensure aeration was successful. If the TPH, BETX or benzene results exceed 100 ppm, 50 ppm or 10 ppm, respectively, the soil will be disced until the results do not exceed these limits.

12. A temporary trench will be constructed just down gradient of the excavation area to serve as an observation trench. It will provide visual verification that no floating hydrocarbons escaped during the excavation process. It will also allow natural volat-

ilization of any remaining dissolved hydrocarbons. An agitator will be installed in the trench to act as a final treatment "air stripper" and aeration system. It will be kept in use for a short period (60 - 90 days) after soil remediation is completed to allow flushing of the replacement soil. Water samples will be collected at the beginning of the excavation, at seven day intervals during excavation or if a hydrocarbon sheen is observed and at thirty day intervals after remediation until the trench is closed. The samples will be analyzed for BETX.

13. All former NMOCD monitoring wells will be removed. In addition, all EPNG monitoring wells in the excavation area will be removed.

14. After remediation, well S-1 will be pumped for 72 hours and sampled. Every thirty days thereafter, S-1 will be pumped for 72 hours and sampled. This will continue for a period of six months. The samples will be analyzed for BETX, TPH, EC, sodium, calcium, potassium, magnesium, chloride, sulfate, nitrate, carbonate and bicarbonate. If the sample results are satisfactory, no additional sampling will be performed. The water from S-1 will be discharged into the field west of the location.

15. The necessity for additional monitoring wells will be assessed with NMOCD after remediation activities are completed and sample results are received.

16. A replacement water well will be provided for Flora Vista to replace S-1. S-1 will be capped and abandoned and the replacement well located downstream of the existing well field.

El Paso
Natural Gas Company

MEMORANDUM

TO: Tom Hutchins

DATE: March 6, 1991

FROM: John Lambdin

PLACE: North Engineering Laboratory-Farmington

RE: TOTAL PETROLEUM HYDROCARBON METHOD AND EQUIPMENT FOR FIELD TESTING

Please find enclosed the reference material for the Method and equipment which I have found to be suitable for our application at Manana Mary Wheeler.

The cost of the unit described is approximately $4,000. To set up in the field, we will need approximately an additional $1,000 worth of equipment. We would need approximately two (2) weeks to get set up to perform this analysis. The unit would be a nice addition to our capabilities and would pay for itself in about 50 analyses.

Let me know, if you want us to set this up and how we can pay for it.

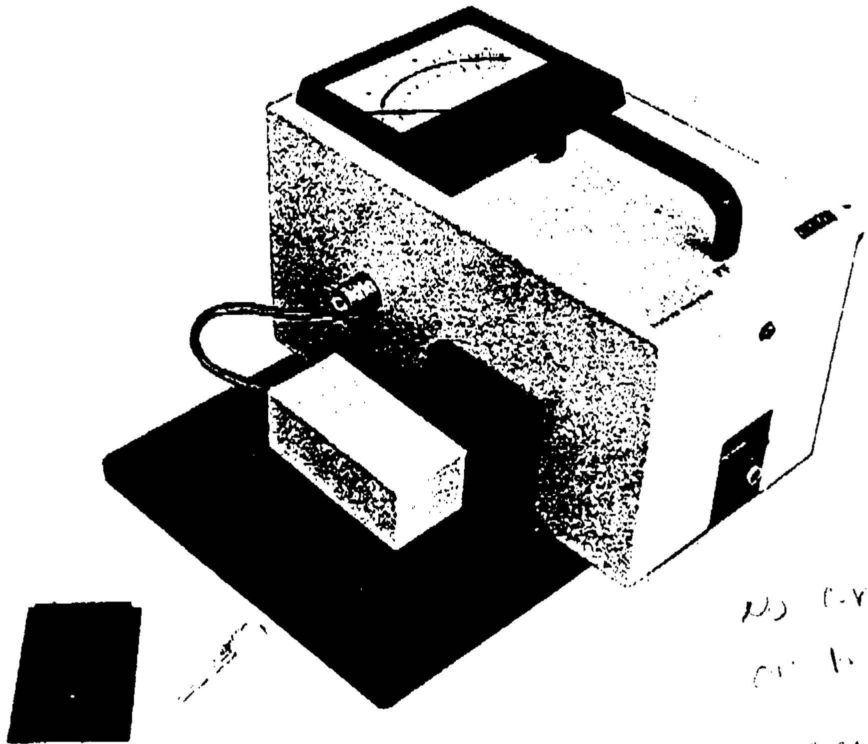
John Lambdin

John Lambdin

Attachment

cc: Anu Pundari
File

FM 10 0003



MIRAN™ 1FF AND 1ACVF LABORATORY ANALYZERS

Field Screening Method for Total Petroleum Hydrocarbons (TPH) in Soil

INTRODUCTION

Contaminated soil is present at many industrial and commercial sites. It is the job of regulatory agencies, plant personnel, environmental consultants, and hazardous materials personnel to assess the degree of contamination in an accurate and efficient manner.

Screening methods have generally involved headspace or vapor analysis. The problem with using vapor analysis as a screening method arises when dealing with severely weathered samples, or samples that are not sufficiently volatile. Another method of assessing contamination involves sampling suspected contaminated areas, and transporting these samples to a laboratory. The problem with this method is slow response, and more importantly, a potential waste of money by sending samples that are uncontaminated.

Foxboro has equipment designed for portable use which makes it easy to perform field screening analysis for petroleum hydrocarbons. In general, the method involves a modification of EPA Method 418.1. The modification was developed by Mobil Oil Corporation and appeared in the American Petroleum Institute Publication Number 4449.

FOXBORO
A SIEBE COMPANY

INSTRUMENT DESCRIPTION

For professionals who want real time answers to soil contaminated with hydrocarbons, the portable in-field solution is the MIRAN 1FF (front page) or the MIRAN 1ACVF (Figure 1) Laboratory Analyzer. These instruments can be set up to run in the field when connected to a 12 V dc inverter. This allows the unit to be effectively and accurately switched from ac to dc current. The inverter can be operated from a vehicle's 12-volt battery.

The MIRAN 1FF is a single beam spectrophotometer with direct meter readout in Absorbance Units (AU) or percent transmission (%T). The MIRAN 1ACVF comes equipped with a circular variable filter which is user selectable in the range of 2.5 to 14.1 micrometres.

FIELD USE

Both the MIRAN 1FF and 1ACVF infrared spectrophotometers are relatively small and rugged. Each unit has an optional carrying case for use in the field. Because these instruments weigh approximately 5.4 kg (12 lb) and are approximately 140 x 140 x 250 mm (5.5 x 5.5 x 10 in) in size, they can be easily operated from a van or the trunk of a car. Each unit has a sturdy steel base platform which allows the unit to be placed on the floor of a van or on another flat surface. When the MIRAN 1FF or 1ACVF is taken into the field, the 110 V ac needed is supplied by a power inverter connected to a dc source such as a car or truck battery. These inverters are lightweight and small.

This screening method was designed specifically for field use. Therefore, the amount of equipment required is limited. All sample extraction is done in the sample container. No separatory funnels or elaborate extraction apparatus are needed. The Freon 113 and hydrocarbon extract is separated from the soil and mixed with silica gel. The extract is then placed in a cuvette for analysis. Most importantly, however, is the fact that this analysis is easily and accurately performed by technicians with no chemistry background. The entire analysis time is approximately 15 to 20 minutes per sample.

The information derived from this method will aid the user in determining the presence of any petroleum hydrocarbons. Chiefly however, this method will aid the user in determining the presence of nonvolatile constituents in soil or sludge. Users of this method, we believe, will have already screened the areas for the presence of volatile organics with an instrument such as the Organic Vapor Analyzer (OVA) manufactured by The Foxboro Company. If high readings are generated by an OVA, then there would be no reason to continue; the sample would be collected and sent to the laboratory.

The MIRAN 1FF and 1ACVF will, according to the following laboratory documentation, accurately detect the presence of nonvolatile and volatile hydrocarbons. With this information the users can systematically and cost effectively screen soil samples for determination of additional laboratory testing.

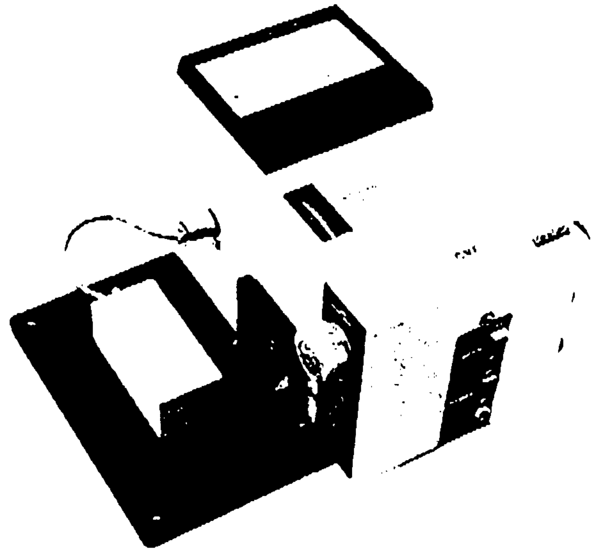


Figure 1. MIRAN 1ACVF

CALIBRATION STANDARDS

Several calibration standards were prepared by diluting stock solutions and bringing to volume with Freon 113. The formula is:

(Eq. 1) $(C1)(V1) = (C2)(V2)$

where, C1 = Stock Concentration (ppm)
V1 = Stock Volume Pipetted (mL)
C2 = Prepared Concentration (ppm)
V2 = Final Standard Volume (mL)

Experimental data has shown that the parts per million divided by Absorbance Unit (ppm/AU) relationship is linear. We recommend, therefore, that users generate a one point calibration curve at 500 ppm oil in Freon. Calibration curves were then generated by measuring the absorbance (1A range), on our MIRAN 1FF at room temperature, and plotting it versus the prepared concentrations in ppm (mg hydrocarbon/kg Freon 113). The calibration curves for various hydrocarbons have been generated and are shown in Figures 2, 3, and 4.

Equipment Required

1. Reaction vessels: 8 oz or 16 oz french square bottles with teflon lined caps (1/analysis)
2. Scale: Accurate to ± 0.1 g and having a minimum capacity of 50 g
3. Ring Stand Assembly with clamps
4. Glass Funnel: 10 cm top diameter
5. Whatman #41 Filter Circles: 15 cm
6. Glass Wool
7. Volumetric Container: 50 mL (1/analysis)
8. ptfe Tape: One roll of 1/2 in wide (teflon)

DISCUSSION

The differing recovery rates shown in Table 1 for sand versus soil matrices is primarily due to the porosity of the matrix. The sandy mixtures will provide a greater degree of extraction capability. In rough terms, the Freon 113 comes in contact with the particles of sand more easily, thereby allowing the hydrocarbons to be extracted by the Freon 113 solvent more efficiently. Recovery rates and analytical data are presented in Tables 2, 3, and 4 for a variety of compounds.

Table 1.
Hydrocarbon Recovery Data for Sand vs Soil Matrices

Hydrocarbon Type	Matrix Type	Percent Recovered (%)	Standard Deviation
Used No. 2 Fuel Oil	Sand Soil	88.4% 63.7%	0.30 1.20
Used 10W-40 Mobil Oil	Sand Soil	78.2% 74.2%	1.12 0.66
Weathered Gas (50%)	Sand Soil	85.8% 71.8%	2.38 1.40

Table 2.
50% Weathered Unleaded Gasoline Data for Sand and Soil Matrices

Prepared Standard (ppm)	Sand Matrix			Soil Matrix		
	Absorbance 1 A	ppm from Calibration Curve	Percent Recovered (%)	Absorbance 1 A	ppm from Calibration Curve	Percent Recovered (%)
102	0.0780	88	86.3%	0.0660	74	72.5%
205	0.164	182	88.8%	0.124	139	67.8%
409	0.314	348	85.1%	0.256	285	69.7%
512	0.384	425	83%	0.358	396	77.3%
			Avg: 85.8%			Avg: 71.8%

Table 3.
10W-40 Mobil Motor Oil Data for Sand and Soil Matrices

Prepared Standard (ppm)	Sand Matrix			Soil Matrix		
	Absorbance 1 A	ppm from Calibration Curve	Percent Recovered (%)	Absorbance 1 A	ppm from Calibration Curve	Percent Recovered (%)
52	0.0552	42	80.8%	0.0532	39	75.0%
105	0.108	80	76.2%	0.104	76	72.4%
315	0.341	248	78.7%	0.316	234	74.3%
525	0.553	405	77.1%	0.540	395	75.2%
			Avg: 78.2%			Avg: 74.2%

Table 4.
No. 2 Fuel Oil Data for Sand and Soil Matrices

Prepared Standard (ppm)	Sand Matrix			Soil Matrix		
	Absorbance 1 A	ppm from Calibration Curve	Percent Recovered (%)	Absorbance 1 A	ppm from Calibration Curve	Percent Recovered (%)
26	---	---	---	0.0220	16	61.5%
51	0.0580	45	88.2%	0.0440	33	64.7%
77	---	---	---	0.0600	46	59.7%
102	---	---	---	0.0880	66	64.7%
128	---	---	---	0.116	69	61.8%
153	0.172	135	88.2%	---	---	---
256	0.296	228	89.1%	0.216	166	64.8%
512	0.586	450	87.9%	0.456	351	68.5%
			Avg: 88.4%			Avg: 63.7%

Note

The calibration curve that was generated for (mg oil)/(kg Freon) is linear. This allows the user to set up a one point calibration curve. We suggest a calibration point representing 500 ppm oil in Freon. This curve, although only a single point, will provide a very accurate calibration which will be the basis for back-calculating the milligrams of hydrocarbon in the soil.

One observation not noted in the analytical charts is the additional percent recovery achieved by performing a secondary extraction of the soil. The second extraction step requires shaking for five additional minutes. Although this step does increase the recovery rate, the significance of the second extraction may not be necessary if the user suspects the sample to be highly contaminated.

Finally, the volatility of the petroleum hydrocarbons was compared. The results indicate that each of the three hydrocarbons contains only a small fraction of volatile components. This suggests that to analyze the sample properly, an extraction procedure must be carried out.

CONCLUSION

The MIRAN 1FF and MIRAN IACVF Portable Spectrophotometers are effective tools for screening soil samples for TPH. An extraction technique is a cost effective method of detection for identifying the presence of nonvolatile hydrocarbons. With the ever increasing need for fast and reliable analytical information, the analysis of samples at the site not only provides fast and reliable information, but will immediately save the client and consultant money by making more efficient use of excavation equipment and personnel. The screening method described in this document will provide that information.

REFERENCES

D. DeAngelis, Mobil Oil Corporation;
Manual of Sampling and Analytical Methods
for Petroleum Hydrocarbons in Ground Water and Soil;

American Petroleum Institute Publication No. 4449
Health and Environmental Sciences Department.

PORTABLE IR SPECTROPHOTOMETERS FOR FIELD SCREENING OF TOTAL PETROLEUM HYDROCARBONS IN SOIL

Mark T. Grant,
Jay E. Godleski,
W. Douglas Stakem
The Foxboro Company, Foxboro, Massachusetts

ABSTRACT

Field screening for non-volatile organic compounds is a much needed tool for hazardous waste site investigators. It not only delivers real time answers which can help to develop a remediation scheme in a more timely fashion, but it also saves a great deal of money for the owners of the site in the way of consulting costs, unnecessary removal of soil, and downtime. The method presented here is not meant to replace the valuable tool of organic vapor analyzers, but instead is meant to provide a method to enhance the entire process. The method is designed for use by unskilled technicians as well as highly technical experts and it is meant to be performed in a field vehicle. The method is a solid-liquid extraction using Freon 113. The extracted solution of Freon 113 and hydrocarbon is analyzed by a small portable infrared spectrophotometer. The amount of equipment is limited and the run time of a single analysis is about 20 minutes. Sample time can be significantly reduced by employing a mechanical shaker. Analytical results have been achieved which produce a recovery rate of between 64% and 88% depending on the matrix and hydrocarbon of interest. Analysis of the costs associated with the screening method indicates that the costs of start-up and labor are covered after the analysis of as few as 45 samples.

INTRODUCTION

Contaminated soil is present at many industrial and commercial sites. It is the job of regulatory agencies, plant personnel, environmental consultants, and hazardous materials (HAZMAT) personnel to assess the sites in an accurate and efficient manner.

To accurately evaluate samples that have been substantially weathered or samples that contain a significant portion of non-volatile hydrocarbons a method other than headspace evaluation needs to be instituted.

The other issue that is at the top of the list of all the concerned parties is the timeliness. Sending samples to analytical labs generally takes 2 weeks. There is always the option of priority testing but the costs are generally doubled.

A method has been devised which employs the basic techniques of EPA Method 418.1 (Petroleum Hydrocarbons, Total Recoverable) which is a Freon 113 extraction from a liquid sample followed by infrared analysis.

The method that will be discussed here represents a Freon 113 extraction of soil followed by infrared analysis. The method is designed for use by personnel with little or no chemistry background and uses a limited number of supplies. The analytical methodology requires the use of a small portable infrared spectrophotometer. The MIRAN 1FF from The Foxboro Company, Foxboro, Massachusetts was used for the experiments discussed within this paper. The Miran 1FF can be powered by a DC inverter. Inverters are lightweight and inexpensive.

FIELD ANALYSIS

The percent recovery for each hydrocarbon is dependent upon the matrix, Lot No. of Freon 113, and the extraction time. Test samples were prepared using various concentrations of each hydrocarbon in sand and in soil matrices. The procedure used to extract the hydrocarbons with Freon 113 varies slightly depending on the condition of the matrix. A damp or wet matrix requires 3 to 5 grams of anhydrous sodium sulfate to be added to the filter system or reaction vessel. Additional anhydrous sodium sulfate may be needed for the wet matrices. If there is a distinct water layer in the sample, then the pH should be checked and adjusted to a pH of 2 or lower by using hydrochloric acid (50% by volume). Non-petroleum hydrocarbons (decaying vegetation, for example) may be present in the samples. These more polar hydrocarbons can be separated by adding 3 to 5 grams of silica gel to the extract solution just prior to measuring its absorbance. For the purposes of this report, dry soil and sand samples were used and negligible interferences were encountered from non-petroleum hydrocarbons. All joints/seals involved in the extraction process should have 1 to 2 wraps of 1/2 inch teflon tape to reduce sample loss error. All glassware, glass wool, and filter paper should be rinsed with clean solvent prior to their use in a particular step. The following is a list of equipment needed.

EQUIPMENT French square bottles

1. Reaction vessels
   8 oz. or 16 oz. bottles with teflon lined caps (1/analysis)
2. Scale: accurate to +/- 0.1 grams and having minimum capacity of 500 grams
3. Ring stand with clamps
4. Nalgene funnel 10 cm
5. Whatman #41 filter circles: 15cm
6. Glass wool
7. Graduated cylinder: 100ml
8. Teflon tape
9. Silical gel: Grade 922 - 200 mesh (3-5g/analysis)
10. Anhydrous sodium sulfate: (3-5g/analysis)
11. Hydrochloric acid: 50% by volume (0.5ml/analysis)
12. Portable infrared spectrophotometer

PROCEDURE

1. Collect a 20 gram sample of the contaminated soil/sand in a reaction vessel and add 20 ml of Freon 113. Mix for 15 seconds and vent the vessel, then continue mixing for 10 minutes.

2. Slowly decant the extract, through the larger filter paper and glass wool plug into a volumetric container.

3. Add 20 ml additional solvent to the vessel, mix for 5 minutes, and then slowly decant as in step 2 above. Combine

the extracts.

4. Wash the funnel system by pouring two aliquots of clean solvent (5-10 ml) through the filter paper and glass wool. Collect the washings in the same volumetric as the extract and then bring to final volume by adding clean solvent directly to the volumetric container.

5. Measure the absorbance of this solution using an infrared spectrophotometer.

6. From the calibration curve, determine the correspopnding ppm reading (mg hydrocarbons/kg Freon 113) of the sample.

7. Convert the reading from the calibration curve to the actual concentration of petroleum hydrocarbons in the soil from the site. Use Equation 1.

CALCULATION

The final analysis of TPH is made in Freon 113. The calibration data from the calibration curve is central to calculating the concentration of TPH in the soil. The user will be essentially back calculating the TPH in soil concentration form the calibration curve.

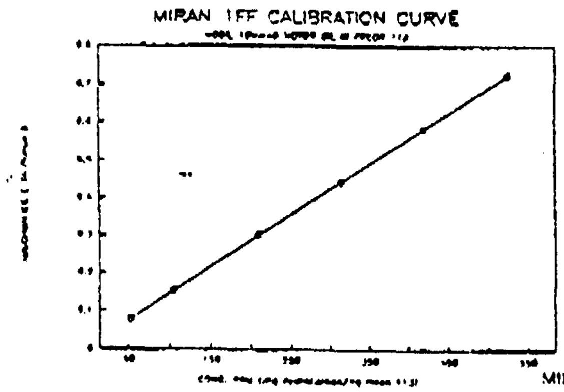
There are several variables involved in the sample formula. The formula is as follows:

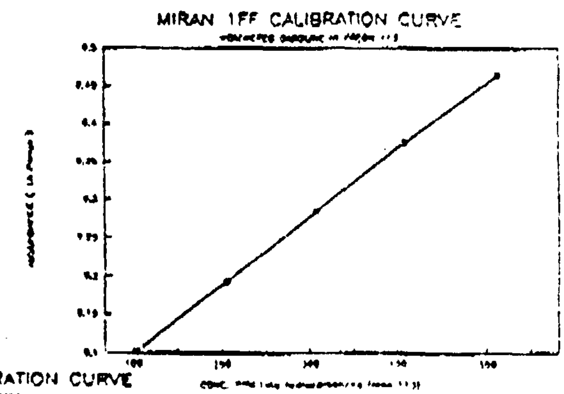
TABLE 1
CALIBRATION CURVE DATA

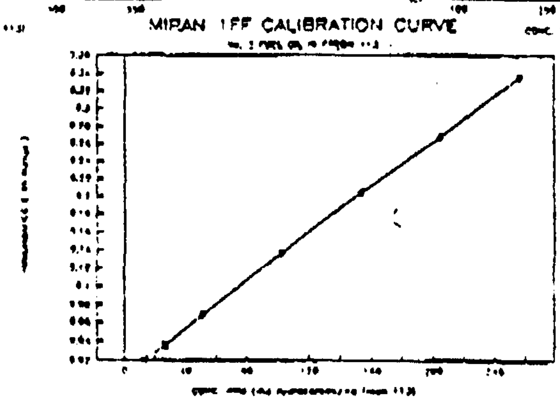
Used 10W-40 Mobil Motor Oil		50% Weathered Unleaded Gasoline		Filtered No. 2 Fuel Oil	
Prepared Standard (PPM)	Measured Absorb. (1A)	Prepared Standard (PPM)	Measured Absorb. (1A)	Prepared Standard (PPM)	Measured Absorb. (1A)
-	-	-	-	13	.005
52	.076	-	-	26	.009
105	.152	102	.100	51	.017
210	.300	205	.192	102	.034
315	.444	307	.284	153	.051
420	.584	409	.376	204	.067
525	.724	512	.464	256	.084

x4

The above chart represents the analytical information generated when creating the calibration curves for the three types of hydrocarbons. The graphical representations are shown below. The MIRAN 1FF was operated in the 1A range setting.







$$\text{TPHppm (mgTPH/kgsoil)} = \frac{C * V * D}{W} \qquad [1]$$

C = Concentration of TPH from the curve (mgTPH/kgFreon)
V = Volume of Freon used (ml)
D = Density of Freon 113 (1.564 g/ml)
W = Weight of the soil (g)

From the formula it is shown that the user must accurately record the weight of the soil used and the final volume of the Freon 113 used.

TABLE 2

HYDROCARBON RECOVERY DATA

Hydro-carbon Type	Matrix	Average Percent Recovery	Standard Deviation
No. 2 Fuel Oil	Sand	88.4%	0.30
	Soil	63.7%	1.20
Used 10W-40 Mobil Oil	Sand	78.2%	1.117
	Soil	74.2%	0.66
Weathered Gas (50%)	Sand	85.8%	2.38
	Soil	71.8%	1.40

This chart represents average recovery rates for various matrices. The recovery rates were generated with the MIRAN 1FF and were analyzed via the described screening method.

DISCUSSION

The differing recovery rates for sand versus soil matrices is primarily due to the porosity of the matrix. The sandy mixtures will provide a greater degree of extraction capability. In rough terms, the Freon 113 comes in contact with the particles of sand more easily, thereby allowing the hydrocarbons to be extracted by the Freon 113 solvent.

It should also be noted that the calibration curve that was generated for mg oil per mg Freon is linear. This allows the user to set up a one point calibration curve. We suggest a calibration point representing 500ppm hydrocarbon in Freon. This curve, although only a single point, will provide a very accurate calibration which will be the basis for back-calculating the concentration of hydrocarbons in the soil.

One observation not noted in the analytical charts is the additional gain achieved by performing a secondary extraction of the soil. The second extraction step requires shaking for 5 additional minutes. Although this step does increase the recovery rate, the significance of the secondary shaking is questionable. Obviously for a user who believes the soil to be highly contaminated, a secondary extraction is not necessary. The extraction with the first volume will put the TPH concentration over the limit.

EQUIPMENT PRICES

The user will need only a few limited non-disposable items The disposable items generally are inexpensive and should provide the users a long period of use before replenishing the supply.

NON-DISPOSABLES

1. A portable infrared spectrophotometer complete with sturdy base, cuvette holder, and cuvette. A system

similar to the **MIRAN 1FF** or **MIRAN 1ACVF** from The Foxboro Company, Foxboro, MA is suitable. The price for the unit is approximately $4,300.

2. A beam balance that can measure accurately to 0.1g with a range up to 500g is suitable. The price for a unit in this range is approximately $100.

3. An inverter to change the DC power source of a vehicle battery to the required AC power of the MIRAN spectrophotometer. The price for a unit in this range is approximately $60.

4. <u>OPTIONAL</u>: Mechanical shaker - that holds up to 4 flasks for more efficient use of the time will cost approximately $550.

5. Graduated cylinder will be needed for measuring Freon 113. A 100 ml Nalgene graduated cylinder will cost approximately $8.

6. Beakers will be needed for mixing the silica gel. A box of twelve 100 ml beakers will cost approximately $25.

7. Supports and clamps for holding funnels. A support and a ring stand will cost approximately $30.

8. Funnels for pouring and filtering solutions will be needed. A package of 6 funnels will cost approximately $10.

DISPOSABLES

1. Sample jars with teflon lined lids. The volume of the jars should be preferably 500ml (250ml will also work). These jars are reusable if the user washes them and then bakes them to drive off residual hydrocarbons. The price for a case of 250ml bottles (48 bottles per case) is approximately $70.

2. Freon 113 is used in a quantity of approximately 80-100ml per run. A 4 liter jug will provide enough sample for 40-50 analyses. This includes using Freon for blanks and rinses. The price for a 4 liter jug is approximately $100.

3. Silica gel is used to remove polar hydrocarbons (mostly biological hydrocarbon such as fats, waxes, vegetable oils). The substance is a powder and 250 grams costs about $50. This should be enough to last for approximately 80 analyses.

4. Sodium sulfate-anhydrous is a reagent used to remove trace amounts of water. The substance is a powder and

250 grams costs about $20.

5. Filter paper is required to filter the liquid from the soil and for filtering the solvent through the anhydrous sodium sulfate. A case of 1000 sheets will cost approximately $20.

COSTS

As with any new procedure or piece of equipment, the costs need to be compared to the benefits that are to be realized from the change. This section of the report will attempt to show all the costs associated with performing the analysis described in this paper.

DISPOSABLE COSTS

The cost for items that will wear out or chemicals that will be consumed is approximately $260. This initial outlay will cover the analysis of 40-50 analyses. For an additional $170 the user will have enough supply to double the number of samples to analyze. The disposable cost breaks down to $6.50 per sample.

NON-DISPOSABLE COSTS

The cost for all non-disposable items, items that can be reused, is approximately $4,600. If the user chooses to purchase a mechanical shaker which can be used to shake up to

4 flasks at a time, the efficiency of performing analyses in the field will be dramatically increased. The cost will increase to $5,200.

LABOR COSTS

Generally environmental consulting firms like to have each member of their staff approach a billable rate of $75 per hour. Therefore, this will be the associated labor cost that will be applied to the overall cost analysis.

Each analysis takes approximately 20 minutes if the analysis is being done one at a time. That is, the user is carrying out the entire analysis of one sample prior to starting another. This breaks the labor cost down to approximately $25 per sample.

Under most circumstances the user will be analyzing multiple samples and will, therefore, be using an automatic shaker. By using an automatic shaker the analytical time is reduced to approximately 12 minutes per analysis. The labor rate is, therefore, reduced to $15/sample. The total variable cost (labor plus materials) is $21.50 per sample.

BREAK-EVEN ANALYSIS

The goal of this method is to avoid taking samples to a lab that are over the state defined action limit or well below the action limit. Therefore, any analysis that is done needs to be based on the savings that are generated from not taking samples to a laboratory. A typical environmental lab will charge \$80-\$100 for Method 9073 or Method 418.1 (TPH analysis in soil via IR). The price of \$80 will be the base price used for the analysis. The Break-Even Volume is calculated as follows:

$$\frac{FC + TVC\,(X)}{S} = X \qquad [2]$$

FC = Fixed Cost: \$5,200
TVC = Total Variable Cost/Sample (labor & materials) \$21.50
X = Break-Even Volume
S = Savings generated (labcost-TVC): \$58.50

For our example:

$$\frac{\$5200 + \$21.5\,X}{\$58.50} = X \qquad X = 141 \text{ samples}$$

In many cases lab analyses are required on a priority basis. Although most labs provide a sliding scale, 48 hour turnaround generally carries a 100% surcharge. In these cases the Break-Even Volume is significantly decreased. Using the above formula the Break-Even Volume is:

$$\frac{\$5200 + \$21.5\ X}{(\$160-\$21.50)} = X \qquad X = 45 \text{ samples}$$

The user can also calculate the Break Even Volume based on a combination of priority cases and normal turnaround cases. In this example we will assume 25% require priority treatment of 48 hours and 75% require normal treatment. The Break-Even Volume equation now becomes:

$$\frac{\$5,200 + \$21.50\ X}{.25(\$160-\$21.50) + .75(\$80-\$21.50)} = X \qquad X = 92 \text{ samples}$$

CONCLUSION

The use of a portable spectrophotometer for field analytical screening of Total Petroleum Hydrocarbons is an extremely valuable tool for identifying sources of non-volatile hydrocarbons at contaminated sites. The method of solid-liquid extraction is the only true means of identifying high boiling or non-volatile organics.

The equipment required to perform the analysis of TPH in soils is limited, making the analysis all the more easily performed in a field vehicle. The analytical time required to perform the analysis can be significantly reduced by using a portable shaker. Actually the time associated with each analysis can be significantly reduced by decreasing the shaking time for each sample. Analytical work has been done which indicates

FOXBORO The Foxboro Company

Environmental Monitoring Operations

P.O. Box 500
600 North Bedford Street
East Bridgewater, MA 02333

Telephone: (508) 378-5400

Fax No: (508) 378-5505

Message No. 525-MTG

Date 3/6/91 Company El Paso Natural Gas Company

To John Lambdin Signed Mark Grant

Fax No. 505-599-2261 This telefax consists of 21 pages -- including this page.

MESSAGE

If you have any questions please. If you need info on the 418.1 or 413.2 write-ups please call me.

Mark Grant

The Foxboro Company

MARK T. GRANT
Marketing Specialist

P.O. Box 500
600 N. Bedford St.
East Bridgewater, MA 02333
Telephone 508-378-5546
Fax 508-378-5505

SIEBE

FOXBORO

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

February 21, 1991

Mr. David Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Re: Contamination at Manana-Mary Wheeler #1E
Gas Well Site, Flora Vista, New Mexico

Dear David:

El Paso Natural Gas Company ("El Paso") recognizes that the New Mexico Oil Conservation Division ("OCD") has the jurisdiction necessary to demand that El Paso and all other responsible parties remediate the site of the Manana-Mary Wheeler #1E gas well located in Unit M (SW/4, SW/4) Section 23, Township 30 North, Range 12 West, NMPM, San Juan County, New Mexico. Further, El Paso recognizes that OCD has the power to enforce such a requirement through a properly issued order.

Based on OCD's authority to require El Paso to conduct the necessary cleanup activities, El Paso is prepared to do so. Weather permitting, El Paso will begin cleanup activities less than one month from the time El Paso receives OCD's written acknowledgement that El Paso's remediation plan, contained herein, is sufficient and adequate to accomplish the required remediation.

In response to your demands that remediation be conducted at this site, El Paso will cleanup the contamination at the Manana-Mary Wheeler #1E gas well near Flora Vista, New Mexico according to the following procedures:

1. The reserve pit and the area of soil visibly stained by hydrocarbon will be excavated until all of the visibly stained soil is removed or to one foot below groundwater, whichever is most efficient. Said area was delineated during the site investigation study. A "strip mining" approach will be used, in which clean

overburden soil is removed and stockpiled prior to excavation of the underlying stained soil.

2. The excavation will begin up gradient. Overburden to a depth of four to five feet, or until hydrocarbon stained soil is encountered, will be removed and stockpiled for reuse as final backfill after the remediation is complete. Only clean overburden soil will be stockpiled and used for backfill. Any clean soil mixed with stained soil will not be used for backfill.

3. Before commencing the excavation activities, El Paso will remove all its ancillary equipment from the site. After the remediation is complete, El Paso will reinstall its ancillary equipment.

4. In order to assure worker safety and access to the site, the operator must perform the following:

   a. shut-in the gas well for the duration of the excavation activities;

   b. remove the operator's ancillary production units (e.g., the separator and storage tank) prior to excavation activities;

   c. assure that the house located near the well which presently receives gas directly from the Manana-Mary Wheeler #1E well is provided substitute gas service during the shut-in period.

   If the operator refuses to perform the above activities, El Paso may seek OCD's assistance to achieve the above.

   Once the excavated area has been backfilled, the operator may return its ancillary units and metering equipment to the appropriate locations and place the gas well back in service.

5. El Paso understands that buried tanks installed after the remediation is complete must be equipped with leak detection monitors and all above ground tanks must be set on concrete pads with curbing.

6. To augment the clean overburden which will be placed back into the excavated area, a borrow site with coarse-grained sand will be designated. Most likely, the borrow site will be near Ballard Plant, which is also the disposal site for the contaminated soil. Once a borrow site is designated, El Paso will notify OCD as to the site's location and a representative sample of the borrow material will be provided.

7. A small amount of ground water will probably be encountered. However, any water observed to have a hydrocarbon sheen will be removed during excavation. A portable pump will be used to pump the water from the excavation area during soil removal. The water will be discharged into tank trucks and taken to the lined pond at El Paso's Kutz Plant.

8. In the event it becomes necessary to excavate below the water table, the saturated soil will be placed in dump trucks. The dump truck tailgates will be pinned and the beds tilted over troughs designed to collect and separate the hydrocarbon/water mixtures draining from the saturated soil. This procedure will result in effective drainage of the wet soil and avoidance of any leakage during transport. The collected water will be trucked to the lined pond at Kutz Plant or some other legally permitted disposal site.

9. Absorbent pads will be available on site to facilitate the capture of any free-phase hydrocarbons.

10. The water from the excavated area will be pumped into water trucks and hauled to the Kutz lined pond or some other legally permitted disposal site. In accordance with OCD recommendations the Kutz pond liner was inspected for leaks, tears, etc. and none were found.

    A containment "sweep" will be available at the Kutz pond. If necessary, the sweep will be used to move and capture any free-phase hydrocarbons in the pond. The hydrocarbons will then be collected in a pump truck and transported to the Blanco Plant for recycling.

11. Hydrocarbon stained soil will be removed to Ballard Station and spread in six inch lifts. The soil will be disced twice a week for the duration of the excavation activities. After excavation is complete, random samples of the disced soil will be collected and analyzed for TPH and BETX to ensure aeration. If the TPH, BETX or benzene exceed 100 ppm, 50 ppm or 10 ppm, respectively, the soil will be disced until the sample results do not exceed the above limits.

12. A temporary trench will be constructed down gradient of the excavation area to serve as an observation trench. The observation trench will provide visual verification that floating hydrocarbons are removed during the excavation process. In addition, the trench will allow natural volatilization of any remaining dissolved hydrocarbons. An agitator will be installed in the trench to act as a final treatment "air stripper" and aeration system. The agitator will be kept in use for a short period (60 - 90 days) after soil remediation is complete to allow flushing of the replacement soil. While the trench is open, water samples will be collected at seven day intervals during excavation and more often if a hydrocarbon sheen is observed and at thirty day intervals once remediation is complete. The samples will be analyzed for BETX.

13. All OCD monitoring wells will be removed. In addition, all El Paso monitoring wells in the excavation area will be removed.

14. After remediation is complete, well S-1 will be pumped for 72 hours and sampled. Every thirty days thereafter, S-1 will be pumped for 72 hours and sampled. This will continue for a period of six months. If the sample results are satisfactory, no additional sampling will be performed. The water from S-1 will be discharged into the field west of the location.

15. The necessity for additional monitoring wells will be evaluated mutually by El Paso and OCD after remediation activities are complete and sample results received.

16. Either an alternate source of water or a replacement water well will be provided for the community of Flora Vista. Water Well S-1 will be capped and abandoned and any replacement well will be located downstream of the last well in the existing well field.

El Paso's actions taken in response to your demands to remediate the Manana-Mary Wheeler #1E gas well site should not be construed as a waiver of its rights to contribution from other responsible parties.

If you have any questions with regard to this plan, please feel free to contact me or Jamye Boone Ward.

Very truly yours,

Thomas D. Hutchins

Thomas D. Hutchins
Manager, North Region
Engineering

WPPENV32:3

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

January 11, 1991

BRUCE KING
GOVERNOR

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

<u>CERTIFIED MAIL</u>
<u>RETURN RECEIPT NO. P918-402-436</u>

Mr. Thomas D. Hutchins, Manager
North Region Compliance Engineering
El Paso Natural Gas Company
P.O. Box 1492
El Paso, TX 79978

Re: Site Investigation/Remediation for the
Manana-Mary Wheeler #1E Gas Well
Flora Vista, New Mexico

Dear Mr. Hutchins:

On December 27, 1990, I met with you and other representatives of EPNG, and Mr. William Carr representing Manana Oil, to discuss remediation at the above site. At that time an undated draft document entitled "**Replacement Water Well Option**" was presented to OCD for review and comment. The draft proposal was discussed with me during the meeting and has also been reviewed by other staff members. This letter transmits our agency's comments and requirements on the proposal. Comments are numbered as presented in the draft proposal.

1. The lower boundary depth of six feet is approximate. The actual depth to which evacuation will be performed is dependent on the presence of hydrocarbon; at some locations it may exceed six feet. Likewise, hydrocarbons may be present for some distance beneath the water table and be released during excavation. If hydrocarbons do exist beneath the water table, soil and hydrocarbons need to be excavated as discussed in Item **#7**.

2. As discussed at the meeting, it is necessary to remove the reserve pit. Also, due to previous investigative digging and trenching, overburden may not be clean since the trenches were not backfilled in any particular sequence.

3. Leak detection will be required on all condensate or produced water storage tanks installed below or partially below grade. Above grade tanks should be placed on a pad such that bottom leaks are detected at the edge of the pad. Submit plans and specifications for all storage units to OCD prior to reinstallation.

4. Propose a procedure if the random samples show high **TPH** or **BTEX**. Are the pits to remain open to await receipt of the test results? If they are closed and results are high, what action is proposed? (A possible solution is portable onsite sampling/detection equipment calibrated for the known constituents. Laboratory testing would only be used for final confirmation of field tests.)

5-9. Acceptable.

10. At the conclusion of discing, hydrocarbon levels of the random soil samples analyzed for **TPH**, total **BTEX** and **Benzene**, should not exceed 100 ppm, 50 ppm and 10 ppm, respectively (UST standards).

11. OCD requests that the observation trench be sampled only for **BTEX** and conductivity at the beginning of the excavation and at seven day intervals during active site work, or if floating hydrocarbons or hydrocarbon sheens are observed. Upon completion of work, samples will be taken at thirty day intervals until closure.

12. Accepted.

13. During the 30-day period of testing Well S-1, how will the water be disposed? Disposal into a water course or surface water body requires an **NPDES** permit. Although I believe that quality will not be a problem, EPNG should perform some physical observation of the pumped water and note color, turbidity, odor, and taste. If any significant deterioration is observed, pumping should cease and OCD notified.

14. It is likely that some monitoring wells will be necessary to monitor at least one complete seasonal cycle. However, long term use of these wells will be necessary if water wells continue to supply the water system, but sampling would be infrequent. Final decisions on numbers, locations and sampling can await completion of remedial actions.

15. This item is dependent on separate negotiations between the parties and not part of OCD's required remediation.

Based on these comments, you are requested to present a revised proposal to OCD within thirty (30) days of receipt of this letter. Review of final plans and approval of remediation procedures will allow the cleanup to begin in late winter this year as planned.

If you have any questions on this letter, please contact me at (505) 827-5812.

Sincerely,

David G. Boyer

DAVID G. BOYER, Hydrogeologist
Environmental Bureau Chief

DGB/dp

cc: David Catanach - OCD
OCD District Office - Aztec
John Eichelmann, EPNG
William Carr, Campbell & Black
Perry Pearce - Montgomery & Andrews

EPNG Meeting 12/27/90

EL Paso Natural Gas:
John Eichelmann
Tom Wright
Tom Hutchins
Jayme Ward

Manana Oil:
Bill Carr

Meeting to discuss ~~replacement~~ status of remediation efforts at Flora Vista. EPNG required to present site investigation/remediation for review, and to prevent OCD from scheduling a hearing requiring parties to show cause why enforcement action should not be taken to require cleanup (removal of soils, groundwater treatment)

EPNG presented plans for remediation, with a replacement well option for the community, but stated that the actual replacement option had not ~~had~~ been decided because of stalled negotiations with adjacent communities. Since the actual physical cleanup does not depend on the type of replacement water supply, EPNG proposed to move ahead without an agreement from the community

Boyer gave his first-cut opinion of the proposal and stated that, ~~as~~ although some changes would be necessary and other staff need to review it, the basic structure was sound. OCS will comment within two weeks.

EPNG said they expect to be able to start work in February after receiving OCS approval.

(Notes of R Boyer)

REPLACEMENT WATER WELL OPTION

Mr. David Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Recieved OCD 12/27/90

SUBJECT: Site Investigation/Remediation for the Manana - Mary Wheeler #1E Gas Well Site in Flora Vista, New Mexico

Dear Mr. Boyer:

The following outlines the proposed procedures and plan for the remediation activities at the subject well site.

1. A 15,000 square foot area of visibly hydrocarbon stained soil will be excavated to a depth of about six feet. The area was delineated during the site investigation study.

   A "strip mining" approach will be adopted, whereby clean overburden is removed and stockpiled prior to excavation of the underlying hydrocarbon stained soil. The upper boundary of the hydrocarbon zone should be coincident with the high water level. The lower boundary of the zone is expected to be approximately six feet below grade as discussed with your staff.

2. The excavation will begin up gradient. Overburden to a depth of four to five feet, or until hydrocarbon stained soil is encountered, will be removed and stockpiled for reuse as final backfill after the remediation is completed.

3. For safety and access measures, the gas well will be shut-in for the duration of the excavation portion of the remediation effort. All ancillary production units, such as the separator and fiberglass storage tank will be removed prior to initiating excavation operations. The meter house and meter run will also be removed. Once the excavated area has been backfilled, these units will be returned to their locations and the gas well will be returned to service.

4. Soil from the bottom of the excavation will be randomly sampled for TPH and BETX. The excavation will take approximately twenty working days.

5. To augment the clean overburden that will be placed back into the excavation area, a borrow site will be located where clean, coarse-grained sand can be obtained. We would like to identify a borrow site near Ballard Plant, the disposal site for the contaminated soil. Once a borrow site

is located, OCD will be notified of the location and a representative sample of the borrow material will be provided.

6. Since the excavation depth is estimated to be about six feet, we anticipate a small amount of water will be encountered. A portable pump will be used to pump the water from the excavation area during soil removal.

7. If it is possible to excavate the entire hydrocarbon zone without reaching the water table, the problem of water handling and disposal will not be an issue.

   However, in the event it is necessary to excavate below the water table, the saturated soils will be placed into waiting dump trucks. The dump truck tailgate will be pinned and the bed tilted over a trough designed to collect and separate the hydrocarbon/water mixtures that drain from the saturated soil. This procedure will result in effective drainage of the wet soils and avoidance of any leakage during transport. The collected hydrocarbon contaminated water will be trucked to the lined pond at Kutz Plant or a permitted disposal site.

8. It is not anticipated that large volumes of hydrocarbons will be liberated. However, absorbent pads will be available on site to facilitate the capture of any free-phase hydrocarbons.

9. The water from the excavation area will be pumped into water trucks and hauled to the lined pond or a permitted disposal site. In accordance with OCD recommendations the Kutz pond liner was inspected for leaks, tears, etc. and none were found.

   A containment "sweep" will be on site at the Kutz pond. The sweep will be used to move and capture any free-phase hydrocarbons to one side of the pond. The hydrocarbons will be collected in a pump truck and transported to the Blanco Plant for recycling.

10. Hydrocarbon contaminated soil will be removed to Ballard Station and spread in six inch lifts. The soil will be disced twice a week for the duration of the excavation activities. Random samples will be collected and analyzed for TPH and BETX to ensure aeration was successful.

11. A temporary trench will be constructed just down gradient of the excavation area to serve as an observation trench. It will provide visual verification that no floating hydrocarbons escaped during the excavation process. It will also allow natural volatilization of any remaining dissolved

hydrocarbons. An agitator will be installed in the trench to act as a final treatment "air stripper" and aeration system. It will be kept in use for a short period (60 - 90 days) after soil remediation is completed to allow flushing of the replacement soil.

12. All former NMOCD monitoring wells will be removed. In addition, all EPNG monitoring wells in the excavation area will be removed.

13. After remediation, well S-1 will be sampled. The well will then be pumped at rates representative of those used during the time when the well was used as a water production well. S-1 will be pumped for 30 days and then sampled immediately. The well will then be shut in for a period of two weeks and again sampled. The groundwater samples will be analyzed for BETX, TPH, pH, EC, sodium, calcium, potassium, magnesium, chloride, sulfate, nitrate, carbonate and bicarbonate.

14. The necessity for additional monitoring wells will be assessed with NMOCD after completion of the remediation project.

15. A replacement water well will be provided for Flora Vista to replace S-1. We will provide the Flora Vista Municipal Water Users Association funds to drill, complete and tie in a well and leave it to their discretion to locate the well.

We believe that the remediation plan outlined above will result in successful site remediation. Most of the remediation requirements discussed with your staff and stated in Mr. Catanach's letter dated July 18, 1990 will be met after completion of the project.

Since groundwater in much of the San Juan basin is known to exceed inorganic WQCC and/or USEPA standards regardless of the public water well's proximity to a natural gas production facility, we believe that the requirement for meeting WQCC or USEPA drinking water standards for inorganic contaminants is beyond the scope of this project.

We hope the remediation plan outlined above meets with your approval. If you have any questions regarding the remediation project, please call me at (915) 541-3531.

Sincerely,

Thomas D. Hutchins
North Region Compliance Manager

CAMPBELL & BLACK, P.A.
LAWYERS

JACK M. CAMPBELL
BRUCE D. BLACK
MICHAEL B. CAMPBELL
WILLIAM F. CARR
BRADFORD C. BERGE
MARK F. SHERIDAN
WILLIAM P. SLATTERY

JEFFERSON PLACE
SUITE I - 110 NORTH GUADALUPE
POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

November 8, 1990

HAND-DELIVERED

RECEIVED

NOV 8 1990

OIL CONSERVATION DIV.
SANTA FE

Mr. David G. Boyer, Chief
Environmental Bureau
New Mexico Oil Conservation Division
Energy, Minerals and Natural
Resources Department
State Land Office Building
Santa Fe, New Mexico 87503

Re: Contamination at Mary Wheeler No. 1-E Gas Well Site, Flora Vista, New Mexico

Dear Mr. Boyer:

This letter confirms our conversations of November 5, 1990 in which Perry Pearce and I advised you that negotiations were continuing between representatives of Manana Gas Inc. and El Paso Natural Gas Company concerning the above-referenced matter. It is our belief that progress is being made toward an agreement whereby action can be undertaken to remedy this situation, subject to OCD approval.

The parties are reviewing information concerning the details of a proposed clean-up action and hope to meet again during the week of November 19, 1990 to conclude their negotiations and to finalize a proposal for your consideration.

I will keep you advised of all further developments.

Very truly yours,

WILLIAM F. CARR
ATTORNEY FOR MANANA GAS INC.
WFC:mlh
cc: Robert G. Stovall, Esq.
W. Perry Pearce, Esq.
Jayme Boone Ward, Esq.

CAMPBELL & BLACK, P.A.
LAWYERS

JACK M. CAMPBELL
BRUCE D. BLACK
MICHAEL B. CAMPBELL
WILLIAM F. CARR
BRADFORD C. BERGE
MARK F. SHERIDAN
WILLIAM P. SLATTERY
PATRICIA A. MATTHEWS

RECEIVED

AUG 16 1990

OIL CONSERVATION DIV.
SANTA FE

JEFFERSON PLACE
SUITE 1 - 110 NORTH GUADALUPE
POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

August 16, 1990

HAND-DELIVERED

Mr. David R. Catanach
Deputy Director
Oil Conservation Division
New Mexico Department of Energy,
Minerals and Natural Resources
State Land Office Building
Santa Fe, New Mexico 87503

Re: Contamination at Manana-Mary Wheeler No. 1E Gas Well Site, Flora Vista, New Mexico

Dear Mr. Catanach:

This letter confirms conversations which I had on this date with Mr. David Boyer and Mr. Bob Stovall of the Oil Conservation Division staff concerning the above-referenced matter.

I have been retained to represent Manana Gas Inc. in this case and have been in negotiations with W. Perry Pearce, attorney for El Paso Natural Gas Company, concerning the clean-up of the above-referenced well site. We have scheduled a meeting between El Paso and Manana representatives on September 7, 1990 to review the plans that have been developed between the Oil Conservation Division and El Paso Natural Gas Company and discuss those actions necessary for a successful clean-up of this site. This meeting is scheduled on this date since certain key individuals are out of town until that time. Therefore, we will be unable to respond to your July 18th letter until after that date.

Mr. David R. Catanach
Deputy Director
Oil Conservation Division
New Mexico Department of Energy,
Minerals and Natural Resources
August 16, 1990
Page Two

Accordingly we request an extension until September 12, 1990 to respond to the Oil Conservation Division with an outline for a remediation plan.

Very truly yours,

William F. Carr

WILLIAM F. CARR
WFC:mlh
cc: Mr. Ed Hartman, President
Manana Gas, Inc.
Post Office Box 14069
Albuquerque, New Mexico 87191

W. Perry Pearce, Esq. — Hand-Delivered
Montgomery & Andrews, PA
325 Paseo de Peralta
Santa Fe, New Mexico 87501

✓ David Boyer — Hand-Delivered
Environmental Bureau Chief
State Land Office Building
Santa Fe, New Mexico 87503

Robert G. Stovall, Esq. — Hand-Delivered
General Counsel
Oil Conservation Division
State Land Office Building
Santa Fe, New Mexico 87503

Oil Conservation Division
District III Office
1000 Rio Brazos Road
Aztec, New Mexico 87410
Attn: Frank Chavez

CAMPBELL & BLACK, P.A.
LAWYERS

JACK M. CAMPBELL
BRUCE D. BLACK
MICHAEL B. CAMPBELL
WILLIAM F. CARR
BRADFORD C. BERGE
MARK F. SHERIDAN
WILLIAM P. SLATTERY
PATRICIA A. MATTHEWS

JEFFERSON PLACE
SUITE 1 - 110 NORTH GUADALUPE
POST OFFICE BOX 2208
SANTA FE, NEW MEXICO 87504-2208
TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

August 16, 1990

HAND-DELIVERED

RECEIVED
AUG 16 1990
OIL CONSERVATION DIVISION

Mr. David R. Catanach
Deputy Director
Oil Conservation Division
New Mexico Department of Energy,
Minerals and Natural Resources
State Land Office Building
Santa Fe, New Mexico 87503

Re: Contamination at Manana-Mary Wheeler No. 1E Gas Well Site, Flora Vista, New Mexico

Dear Mr. Catanach:

This letter confirms conversations which I had on this date with Mr. David Boyer and Mr. Bob Stovall of the Oil Conservation Division staff concerning the above-referenced matter.

I have been retained to represent Manana Gas Inc. in this case and have been in negotiations with W. Perry Pearce, attorney for El Paso Natural Gas Company, concerning the clean-up of the above-referenced well site. We have scheduled a meeting between El Paso and Manana representatives on September 7, 1990 to review the plans that have been developed between the Oil Conservation Division and El Paso Natural Gas Company and discuss those actions necessary for a successful clean-up of this site. This meeting is scheduled on this date since certain key individuals are out of town until that time. Therefore, we will be unable to respond to your July 18th letter until after that date.

Mr. David R. Catanach
Deputy Director
Oil Conservation Division
New Mexico Department of Energy,
Minerals and Natural Resources
August 16, 1990
Page Two

Accordingly we request an extension until September 12, 1990 to respond to the Oil Conservation Division with an outline for a remediation plan.

Very truly yours,

William F. Carr

WILLIAM F. CARR
WFC:mlh
cc: Mr. Ed Hartman, President
Manana Gas, Inc.
Post Office Box 14069
Albuquerque, New Mexico 87191

W. Perry Pearce, Esq. — Hand-Delivered
Montgomery & Andrews, PA
325 Paseo de Peralta
Santa Fe, New Mexico 87501

David Boyer — Hand-Delivered
Environmental Bureau Chief
State Land Office Building
Santa Fe, New Mexico 87503

Robert G. Stovall, Esq. — Hand-Delivered
General Counsel
Oil Conservation Division
State Land Office Building
Santa Fe, New Mexico 87503

Oil Conservation Division
District III Office
1000 Rio Brazos Road
Aztec, New Mexico 87410
Attn: Frank Chavez

El Paso
Natural Gas Company

JAMYE BOONE WARD ATTORNEY AT LAW

OIL CONSERV ON DIVISION
RECEIVED

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-3071

'90 AUG 17 AM 9 00

August 15, 1990

Mr. David Catanach
Deputy Director
Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87504

Re: Contamination at Manana - Mary Wheeler No. 1E
Gas Well Site, Flora Vista, New Mexico

Dear Mr. Catanach:

We are in receipt of your letter to Kenneth E. Beasley dated July 18, 1990, dealing with the contamination at the Mary Wheeler No. 1E Well Site situated in SW/4, SW/4, Section 23, Township 30 North, Range 12 West, NMPM, San Juan County, New Mexico which is in the vicinity of community of Flora Vista.

As you know, El Paso Natural Gas Company has performed extensive study of the area surrounding the well site but at this time is not prepared to submit a remediation plan. If you or other members of the Oil Conservation Division staff would like to discuss this matter with us, we will be happy to meet at your convenience.

If you have any questions about this matter, please do not hesitate to contact me or Perry Pearce at 505/986-2506.

Sincerely,

Jamye Boone Ward

c: W. Perry Pearce, Montgomery & Andrews
Kenneth E. Beasley, III, No. Region Engineering
Thomas L. Wright, Office of General Counsel

WPPENV14:17

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

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

July 18, 1990

CERTIFIED MAIL
RETURN RECEIPT NOS. P-918-402-294
P-918-402-296

Mr. Kenneth E. Beasley, Manager
North Region Compliance Engineering
EL PASO NATURAL GAS COMPANY
P. O. Box 1492
El Paso, Texas 79978

Mr. Ed Hartman, President
Manana Gas, Inc.
P. O. Box 14069
Albuquerque, New Mexico 87191-4069

RE: Contamination at Manana - Mary Wheeler #1E Gas Well Site, Flora Vista, New Mexico

Dear Mr. Beasley:

This letter is to notify you that the New Mexico Oil Conservation Division (OCD) is initiating enforcement action to require removal of oil, drilling muds, contaminated soil and other materials that has caused and continues to cause ground water contamination at the Manana - Mary Wheeler #1E gas well site located in Unit M (SW/4, SW/4) Section 23, Township 30 North, Range 12 West, NMPM, San Juan County, New Mexico.

Information in OCD files shows contamination first reported in 1983 requiring shut down of a Flora Vista public water supply well because of floating oil and odors. Subsequent investigation by OCD and others in 1986, 1987 and 1989 determined the following water contaminants were present in soils and ground water:

1. In water: Benzene, ethylbenzene, toluene, xylene and polynuclear aromatic hydrocarbons. Benzene exceeded the federal drinking water standard in some samples.

2. In soil: Benzene, toluene, xylene, polynuclear aromatic hydrocarbons (including naphalene), chromium, and sodium chloride.

3. In water and soil: Oily hydrocarbons that impart a taste and odor to the water.

The presence of these contaminants in soils and ground water is due to activities at the lease by Manana and El Paso Natural Gas that include but are not limited to spills and/or disposal of drilling muds and additives, oil and grease, condensate, produced water, glycol and/or other contaminants into unlined drilling/reserve pits, dehydration pits, condensate tank drain pits, and onto the surface of the ground. The remediation requirements that must be met for successful cleanup at the site are shown in Attachment A. An outline for a remediation plan must be presented to OCD within thirty (30) days from receipt of this letter. The plan outline should consider various alternative remediation schemes in the event one or more of the Flora Vista water wells will not be used as a public water supply in the future.

This enforcement action is taken under authority granted to the OCD under the Oil and Gas Act (70-2-1 to 38 NMSA 1978), the Water Quality Act (74-6-1 to 12, NMSA 1978) and under authority to abate the public nuisance of polluting water (30-8-1, 30-8-2 and 30-8-8, NMSA, 1978). Failure to comply with this directive may result in additional enforcement action.

If you have any questions regarding the remediation measures contact David Boyer at 827-5812; please direct other questions to Robert Stovall, General Counsel, at 827-5805.

Sincerely,

David Catanach

David Catanach
Deputy Director

Attachment

DC/DGB/sl

cc: OCD Aztec Office

Attachment A

Remediation Requirements

Successful site remediation must meet the following criteria:

1. Dissolved, emulsified, and free-floating petroleum, and other organic and inorganic water contaminants, must be removed from the groundwater such that:

   a) the water quality standards of Section 3-103 of the New Mexico Water Quality Control Commission Regulations (as amended through December 24, 1987) are met; and

   b) the USEPA drinking water standards for public water supplies in effect as of June 15, 1988; and

   c) undesirable odors attributable to loss of petroleum or other fluids from the site are not present in ground water.

2. The unsaturated (vadose) zone in the vicinity of the contamination shall not contain drilling muds, inorganic salts, heavy metals, or hydrocarbons in quantities sufficient to recontaminate ground water. Contamination shall be deemed to occur if State or Federal numerical standards are exceeded, or if there is continued presence or reappearance of oil or grease, or undesirable odors in the water supply. Such recontamination shall not be allowed to occur as a result of seasonal rises in the water table, drainage, recharge events, or in any other manner. Soils contaminated with drilling muds, salts, heavy metals, or hydrocarbons, and needing to be removed to prevent continued or future contamination of groundwater, shall be excavated and disposed in locations approved in advance by OCD. Clean fill material may need to be provided to replace contaminated soils. Pumping of the affected water supply well for some length of time may be necessary to verify successful clean-up.

El Paso
Natural Gas Company

P. O. BOX 4990
FARMINGTON, NEW MEXICO 87499

'90 JUN 11 AM 9 29

June 6, 1990

Mr. David G. Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
P.O. Box 2088
Santa Fe, New Mexico 87504

Re: Remedial Action Plan for the Manana -Mary Wheeler #1E Gas Well Site, Flora Vista, New Mexico

Dear Mr. Boyer:

This letter confirms our conversation regarding dewatering and disposition of groundwater at the Manana- Mary Wheeler #1E Site. El Paso Natural Gas Company (EPNG) plans to construct a slurry wall or trench around the remediation site in order to restrict groundwater flow into the excavation area. At the beginning of the project, groundwater will be pumped out of the remediation area. Later, pumps will be strategically placed to remove groundwater flow into the remediation area.

We do not expect large amounts of oil to be liberated during excavation. The groundwater will be pumped into "frac" tanks and allowed to settle for an appropriate amount of time until any oil separates.

Presently, we are investigating groundwater disposal options. A disposal option is to irrigate an adjacent field. At this time, Mr. Eli Velasquez, the tenant, is considering our watering proposal.

If we obtain approval from him, we will follow your guidelines set forth during our phone conversation on June 5, 1990. This was a conference call with you, Mr. Eli Velasquez, Mr. Leonard Lord (EPNG Right-of-Way Department) and I.

The guidelines set on June 5, 1990 are listed below:

1. Prior to groundwater discharge onto the alfalfa fields, the groundwater will be analyzed for Benzene(B), Ethylbenzene(E), Toluene(T), Xylene(X) and Electrical Conductivity(EC). EC will be used as an indicator of Total Dissolved Solids.

2. The benzene limit is 10 micrograms per liter. The ethylbenzene limit is 750 micrograms per liter. The Toluene limit is 750 micrograms per liter. The Xylene limit is 620 micrograms per liter. The EC limit is 2250 micromhos per cm (Corrected to 25 ^{o}C). The EC limit was set by considering the existing Total Dissolved Solids level of the background well.

3. Groundwater will not be discharged onto the fields unless it meets the requirements set above.

4. EPNG will conduct additional tests every five "frac" tank volumes. In addition to the previously mentioned constituents, as you requested, we will analyze the water for Chlorides, Sulfates, Total Dissolved Solids, Chromium, Cadmium and Barium.

If you have any questions, please contact me at (505) 599-2176.

Sincerely,

A. N. Pundari

A. N. Pundari
Compliance Engineer

cc: Mr. Kenneth E. Beasley
Mr. Leonard Lord
Mr. Eli Velasquez

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

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

May 29, 1990

CERTIFIED MAIL
RETURN RECEIPT NO. P-918-402-255

Mr. Kenneth E. Beasley, Manager
North Region Compliance Engineering
EL PASO NATURAL GAS COMPANY
P. O. Box 1492
El Paso, Texas 79978

RE: Finalization of Site Investigation Report/Remedial Action Plan for the Manana - Mary Wheeler #1E Gas Well Site, Flora Vista, New Mexico.

Dear Mr. Beasley:

The staff of the Oil Conservation Division (OCD) Environmental Bureau have reviewed the May 16, 1990 response document that was presented and discussed at our meeting in Santa Fe on May 17th. Unless otherwise discussed herein, the responses in that document are accepted and become part of the Report and Remedial Plan.

1. Section 6.1, Reclamation Technologies: When final decisions are made regarding dewatering of fluids, soil excavation and reserve pit removal, provide the following information for OCD review and concurrence prior to beginning site excavation:

    a. Specifics on the method and planned depth of dewatering and soil excavation (e.g. one or two feet below river bottom elevation at the site?), slurry wall installation (if chosen), water treatment, batch testing, and disposal. If land application of the treated water is chosen, a discharge plan is <u>not</u> necessary if the length of time of the discharge does not exceed 120 days. If a slurry wall is installed, it must be breached upon completion of restoration.

    b. Specifics on disposal of soil removal from the excavation including disposal location, land application and treatment procedures (depth of lifts, frequency of discing), testing parameters (TPH) and proposed limits.

    c. Additional specifics on encapsulation if that method of treatment is chosen.

2. Resampling of S-5 should include analysis of all volatile aromatics (i.e. BTEX).

3. At the conclusion of the first month's test pumping of S-1 after cleanup, a sample should be taken for the specified parameters at the time the well is shut-in.

4. If removal of some existing OCD monitoring wells is necessary as part of the excavation, OCD would prefer that all be removed since they were installed hastily and do not meet current monitoring well criteria.

5. OCD requests that EPNG perform random sampling of soils from the bottom of the excavations for TPH and BTEX prior to backfilling, in lieu of the sampling originally proposed to determine clean levels.

As stated at our meeting OCD will separately notify Manana of your planned activities, request cooperation in removing equipment, and notify them of deficiencies with the wastewater collection system(s). I will send you copies of our correspondence.

Thank you for your prompt and complete response to my letter and comments of March 30th. EPNG and K.W. Brown have obviously put a lot of thought and effort into this planned remediation and I look forward to its being implemented by mid-summer.

If you have any questions, please contact me at (505) 827-5812.

Sincerely,

David G. Boyer

David G. Boyer, Hydrogeologist
Environmental Bureau Chief

DGB/sl

cc: OCD Aztec Office
J. Eichelmann, Burlington Northern Resources
S. Johnson, K.W. Brown

OCD-EI... , Flora Vista Remedi...on Meeting
5/17/90 10:00 am

Handed out Response to Comments on Flora Vista Investigation Report (OCD comments)

Slurry wall to limit G.W.
6" lift for soil disposal at at Bolland Plant

what TPH level should be obtained to determine clean levels in saturated zone?
6. 1-2 feet below W.T. then take confirmation samples? One foot below level at river then take confirmation.

3. pg 62 - will use compressor to blow air into bottom at trench as stripper.

4 pg 62 - sample will be taken immediately after shutting down pump instead of after 2 weeks.

Project start date June 15, 1990

Look at ~~reserve~~ reserve pit exemption from Haz-Waste?

File Copy

RESPONSES TO COMMENTS ON THE SITE INVESTIGATION OF THE MANANA - MARY WHEELER #1-E WELL SITE NEAR FLORA VISTA, NEW MEXICO

I. Comments on Site Investigation Report

1. p.41, Table 3-4. The values for Benzo(b)fluoranthene and Indeno(1,2,3-cd)pyrene should be shown as 2 and 6 μg/l (instead of 0.002 and 0.006 μg/l). The correct values for WQCC standards for Ethylbenzene, Toluene and Xylenes (total) are 750, 750 and 620 mg/l, respectively.

> ***Response:*** *The table has been corrected with the appropriate values. A corrected Table 3-4 is enclosed in Attachment 1.*

2. p.45. A discussion of oil and grease concentrations found in soil samples taken from trenches 6 and 7 is presented. Additional investigation is necessary to verify the actual presence of a "slug" of oil in this area, especially if analytical techniques may have contributed to false positive readings (ref. "A Comparison of Methods of Measuring Total Petroleum Hydrocarbons in Soil," 1989 NWWA/API Proceedings of the Conference on Petroleum Hydrocarbons and Organic Chemicals in Ground Water). Present a plan to perform the necessary verification.

> ***Response:*** *Additional soil samples will be collected in the area to provide more control with respect to delineating the impacted area. The soil samples will be collected by excavating pits, not trenches. Proposed locations are illustrated on Figure 1 (see Attachment 2). Sampling methods will involve the use of a backhoe and standard sampling equipment as described in the September, 1989, report.*
>
> *With respect to analytical techniques, it is proposed that both oil and grease, and total petroleum hydrocarbons (TPH) analyses be performed. To reduce the likelihood that matrix interference is occurring, the GC analytical technique will be specified.*

3. p.48. Please provide a copy of the referenced 1983 paper on risk assessment by Crouch ("The Risk of Drinking Water").

> ***Response:*** *The requested reference is included in Attachment 3.*

4. p.48, Comment on Section 4.0 Risk Assessment. As stated in this section, risk assessment techniques are used to estimate chronic toxic potential from contaminants dissolved in ground water. In addition to dissolved contaminants, we have an oil phase that imparts visual and hydrocarbon odor characteristics to the water. The assessment technique would seem more appropriate if used after the cleanup to evaluate the risk of any remaining dissolved constituents.

> ***Response:*** *The goal of presenting the risk assessment prior to cleanup activities was to illustrate the current risk. It was never intended that the risk assessment would not be performed following remedial activities. The intent was to secure baseline data for comparison purposes (i.e., pre-remediation versus post-remediation).*

5. p.52, Table 4.2. The contaminant concentrations listed in Table 4.2 are 1,000 times greater that actually observed (e.g., benzene concentration in EPNG-2A is 8.1 ppb not 8,100 ppb). I suspect these are transcription errors. Please verify that the risk calculations shown are for the actual concentrations and not those shown in the table.

Response: *The presented risk assessment calculations were based on the water contaminant concentrations listed in the original Table 4-2. Thus, the risk factors presented in the original report are in error. The source for the error was hand-written drafts which preceded the final plates included in the report. The hand-written notation for µg/l was mistakenly read as mg/l and then converted to µg/l; hence, the 1,000 factor error.*

The contaminant levels have been corrected and are presented as a revised Table 4-2. Also, the risk assessment has been re-run, with a commensurate decrease in risk as depicted in the table. Hence, the discussion included in Section 4.2 of the report needs to be revised. Attached are revised text and tables for Section 4.2. which should be inserted into the report (Attachment 4).

6. p.57. In New Mexico, buried reserve pits commonly contain waste debris from drilling operations. It would not surprise me to find concrete fragments and scrap pipe in the pit.

Response: *None.*

II. Remedial Action Plan

A. Section 6.1.1. Contaminated Soil

1. p.59. Describe further the procedure for visual inspection verification of removal of contaminated soil, especially since contamination extends to sands and gravels beneath the water table. Is temporary dewatering proposed as part of the soil removal process?

Response: *It is envisioned that a "strip mining" approach will be adopted, whereby clean overburden is removed and stock-piled prior to excavation of the oily/stained underlying sediments. Identifying the upper boundary of the oily zone should not pose a problem since it should be coincident with the high water level.*

Identification of the lower boundary of the oily/stained zone, on the other hand, may prove to be more difficult. To aid in discerning the lower boundary, excavation operations should be undertaken during the summer when the Animas River is at its lowest stage level.

Due to an exceptionally dry summer in 1989, and low winter precipitation receipts in the mountainous region to the north of the Flora Vista area, it is anticipated that the Animas River will be at a low stage during the upcoming summer months, a condition favoring excavation efforts.

In lieu of a dewatering program, EPNG intends to construct a slurry wall around the lateral and upgradient portions of the area to be excavated in an effort to limit the volume of water to be handled during the remedial effort.

2. p.59. Removal of hydrocarbon stained soil should extend to the vicinity of well S-1 since staining was noted in that location during the 1987 excavation (See the discussion on page 2 of Dr. Blair's 1987 report).

Response: *KWB&A Plate 6 illustrates the distribution of oil and grease in the sediments at the site. Comparing this plate with Blair's sketch indicates a reasonable correlation between the observed oil staining. It is anticipated that excavation will extend to the vicinity of S-1.*

3. p.59. What procedures are proposed to determine the extent and the necessity for soil removal under lease structures (eg. oil/water separator, produced water tank, meter house).

Response: *For safety and access measures, the gas well will be shut-in for the duration of the excavation portion of the remediation effort. All ancillary production units, such as the produced water and oil storage tanks, will be removed from the area prior to initiating excavation operations. Once the excavated area has been back-filled, these units will be returned to the production location, and the gas well will be placed back into service.*

4. p.59. Describe the type and source of the material that will be deposited in the excavation to replace the contaminated soil.

Response: *Much of the soil excavated from the site will not be contaminated, and will therefore be returned to the excavated area. To augment those clean sediments that are placed back into the excavations, a borrow site will be located where clean, coarse-grained sand can be obtained. This material is specified since it is easy to handle, and closely resembles those materials to be removed from the site.*

At this time, a borrow pit or quarry has not been identified. Once such a facility has been located, OCD will be notified of its location and the type of materials to be procured for use at the Manana - Mary Wheeler #1-E Well Site. In addition, EPNG will acquire a representative sample of this material which will be submitted to OCD for inspection.

5. p. 60. If the contaminated soil is stored on-site prior to offsite removal, it must be stored such that oil and water drainage is intercepted prior to discharge to the bare ground. Likewise, saturated soil cannot be loaded directly into trucks such that oily water will discharge on-site or en route to the disposal location.

Response: *All of the contaminated soil above the water table (i.e., in the unsaturated zone) will be excavated first, thereby minimizing drainage problems during the initial phases of the excavation effort. Moreover, if it is possible to excavate the entire oily zone without reaching the water table, the problem of drainage water will not be an issue.*

In the event that it is necessary to excavate below the water table, saturated soils will be placed into waiting dump trucks. At this point, the truck bed tailgate will be pinned and the bed tilted over a trough designed to collect and separate the oil/water mixtures that drain from the saturated, contaminated soils. This procedure will result in effective drainage of the wet soils and avoidance of any leakage during transport. The collected fluids will be disposed at a location agreed upon by OCD and EPNG.

B. Section 6.1.2 Contaminated Groundwater

1. p.60. Explain the impacts to the area adjacent to well S-5. Is the reference to the oil and grease analyses or the low levels of dissolved hydrocarbons found during the 1989 investigation sampling?

> ***Response:*** *The reference to groundwater being impacted in the area adjacent to S-5 stems from the fact that low levels of dissolved hydrocarbons were detected in a groundwater sample taken from that well. As Plate 3 of the report indicates, 0.26 $\mu g/l$ benzene and 0.32 $\mu g/l$ toluene were found in a sample of groundwater taken from S-5 on June 16/17, 1989.*

2. p.60. Additional sampling of S-5 is necessary to verify if benzene and toluene are present at trace levels shown in the 1989 site sampling. (1986 sampling also detected these at about the same levels.)

> ***Response:*** *Resampling of S-5 will be conducted at a date to be arranged prior to the remediation of the site. The requested analysis will be limited to benzene and toluene.*

3. p.60. During the excavation, water will be made turbid with the disturbance and residual oil may be freed from the soil and float on top of the water. Equipment should be available on site during the excavation to skim and remove floating oil.

> ***Response:*** *It is not anticipated that large volumes of oil will be liberated during excavation. Arrangements will be made to have an oil-containment boom and/or absorbent pads as necessary to facilitate the capture of any free-phase oils that may develop. A holding tank will be made available on-site during excavation to accommodate the collection of any oil (see the response to comment A.5. above).*

C. Section 6.3 Monitoring Soil

1. p.61. Soil. Explain how representative samples are to be collected from the bottom of the excavation if the excavation is not dewatered.

> ***Response:*** *It is presupposed that the bottom of the excavation will be accessible to samplers since either: (1) the Animas River will be at a sufficiently low stage that the contaminated soil can be fully excavated without encountering saturated conditions, or (2) the slurry wall will provide a sufficient level of groundwater containment to permit ready access to the bottom of the excavation.*
>
> *It is anticipated that the sidewalls of the excavation will be separated a sufficiently large distance apart to permit the sampling team to walk out onto the floor of the excavation without incurring the risk of sidewall failure. Thus, representative soil samples will be collected with decontaminated augers or stainless-steel utensils. If sidewall stability becomes an issue, a backhoe or other piece of heavy equipment may be employed to acquire a sample of soil from the bottom of the excavation. From this, a sub-sample will be taken in a safe area, such as the original grade level on the banks of the excavation.*

2. p.61. Groundwater. The December, 1989 EID/OCD sampling of well S-1 detected acetone. Pre-cleanup sampling should verify the presence or absence of that contaminant.

> ***Response:*** *In January, 1990, S-1 was purged and samples were collected for volatile analysis. The laboratory results do not confirm the presence of acetone. Attached are the lab results for this sampling event (see Attachment 5).*

3. p.62. In addition to replacement monitoring wells, I would like to discuss digging a temporary trench just downgradient of the southwestern-most area of excavation to serve as an observation trench. It would provide visual verification (absence of product or sheens) that no floating hydrocarbons escaped the excavation. More importantly, with ground water flow at 2 to 3 feet per day, it would allow natural volatilization of any remaining dissolved hydrocarbons. With a minimum of agitation and circulation the trench could act as a final treatment "air stripper" and aeration system. It could be kept in use for a short period of time (90-120 days) after excavation and soil replacement has been completed to allow flushing of the replacement soil.

Response: *EPNG is agreeable to a discussion on the use of a temporary observation trench. If used, all necessary safety and monitoring protocols will be formulated and observed.*

4. p.62. Suggest a schedule for short and long term pumping and testing of well S-1 after completion of the excavation.

Response: *It is recommended that S-1 be pumped at rates considered to be representative of those used during the time when that well was used as a water-production well (e.g., 50 GPM). S-1 should begin pumping no sooner than the date when all remediation activities have been completed. This approach will insure that no false positives are generated in response to the potential mobilization of contaminants due to excavation activities.*

As for a pumping schedule, it is proposed that S-1 be pumped continuously for the first month. At the end of this period, it is additionally proposed that a water sample be taken and analyzed for the list of parameters specified in the response to comment C.6. below.

After the first month of pumping, to allow for the diffusion of any residual-level contaminants from clayey subsurface deposits, it is suggested that S-1 be shut in for a period of two weeks, with a sample taken at the end of this dormant period using an appropriate sampling methodology.

Once it has been demonstrated that the detected contaminant levels are below WQCC section 3-103 standards, S-1 will then be turned over to the Flora Vista Water Users Association for re-introduction into its water-distribution network.

5. p.62. Provide the number and location of the proposed monitoring wells.

Response: *At this time, EPNG feels it to be inappropriate to specify the exact number and location of post-remediation groundwater monitoring wells. OCD can be assured, however, that a sufficient number of wells will be used or installed that will provide the necessary groundwater quality data to monitor conditions at the Manana - Mary Wheeler #1-E Well Site. The number and location of these wells will be established through joint communications between OCD and EPNG prior to entering into the field to implement the post-remediation monitoring program.*

6. p.62. Analytical Parameters. In addition to the proposed sampling constituents, analyses of water should include major cations and anions. Soil analyses should include chromium and those PAH's detected and shown in Table 3.5 (p. 43).

Response: *The following tables indicate the proposed suite of analytical parameters to be employed during the remedial activities:*

Analytical Parameters for Water Samples to be Taken During Remedial Activities.

VOLATILE AROMATICS:	CATIONS:
Benzene Toluene Ethylbenzene Total Xylene	Sodium Calcium Potassium Magnesium
INDICATORS:	**ANIONS:**
pH EC	Chloride Sulfate Nitrate Carbonate Bicarbonate

Analytical Parameters for Soil Samples to be Taken During Remedial Activities.

VOLATILE AROMATICS:	PAHs:
Benzene Toluene Ethylbenzene Total Xylene	Acenapthene Fluoranthene Napthalene
INDICATORS:	**METALS:**
pH TPH[1]	Chromium (TCLP)

7. p.63. Sampling Frequency. Monitor wells shall be removed, or properly plugged and abandoned at the conclusion of their use. This will be no later than at the time of decommissioning of the gas well, or an earlier time as approved by OCD.

> ***Response:*** *During excavation, several of the existing OCD- and EPNG-series monitoring wells will have to be removed since they lie in the affected area. Otherwise, the monitoring wells will be maintained, or plugged, as prescribed in the report.*

D. Additional Comments

Provide a proposed timetable for the start and completion of the remedial action, including the time expected to be required for the excavation phase.

> *Response: EPNG continues to assemble information on project costs and available resources. It is expected that sufficient information will be available to provide NMOCD with a project start date on June 15, 1990.*

[1] Total Petroleum Hydrocarbons to be determined via Gas Chromatography.

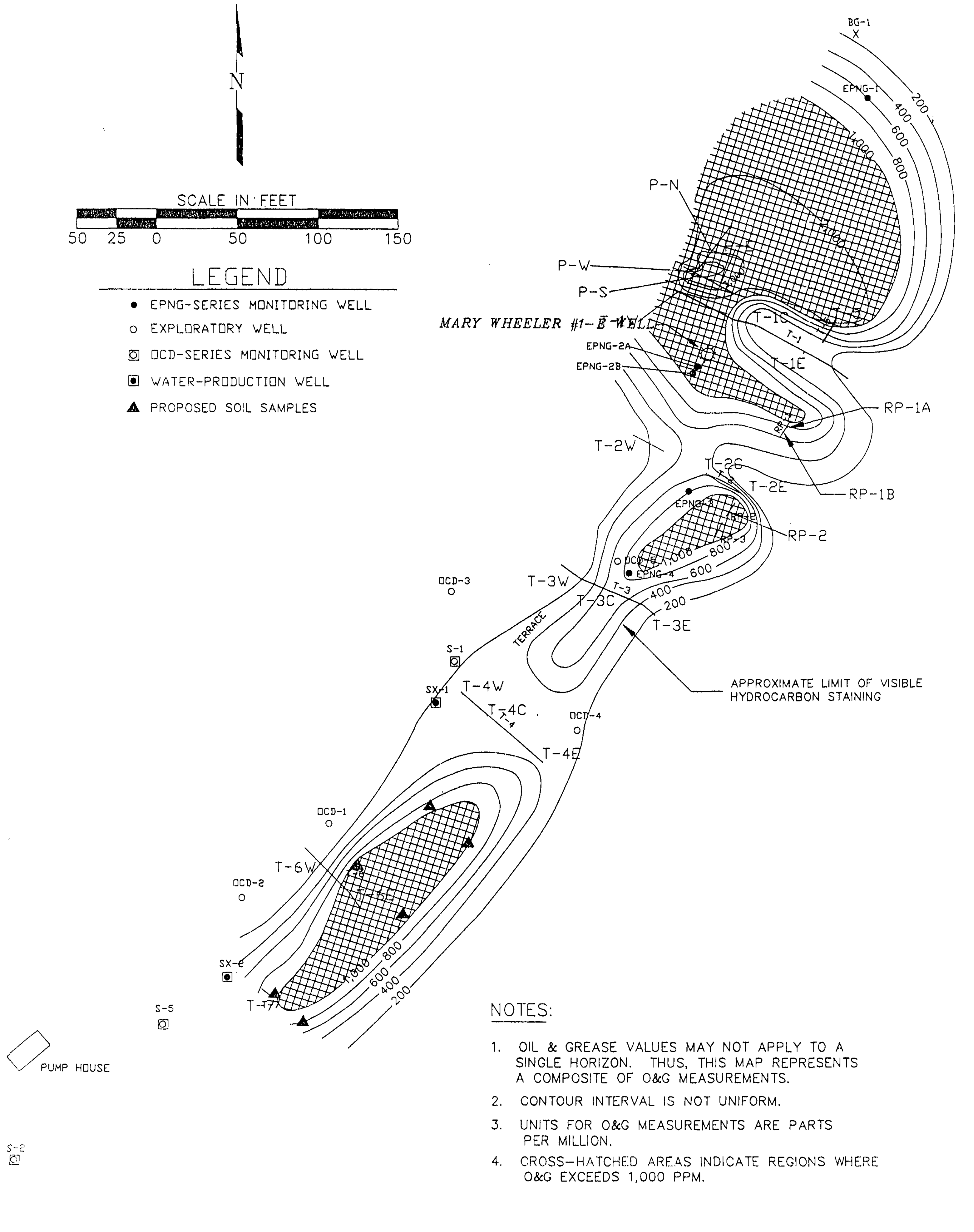
Table 3-4. Analytical Results for Groundwater Samples.

Constituent	NM WQCC Standard (ug/l)	Concentration (ug/l)											
		EPNG-1	EPNG-2A	EPNG-2B	EPNG-3	EPNG-4	OCD-1	OCD-2	OCD-3	OCD-4	OCD-5	S-1	S-5
Aromatic Volatile Organics:													
Benzene	10	ND	8.1	1.6	0.4	0.95	ND	ND	NS	NS	NS	ND	0.26
Ethylbenzene	750	ND	37.4	1.2	4.3	ND	ND	ND	NS	NS	NS	ND	ND
Methylene Chloride	100	2.1	ND	ND	ND	ND	1.3	ND	NS	NS	NS	1.6	1.2
Toluene	750	ND	ND	ND	0.33	ND	ND	ND	NS	NS	NS	ND	0.32
Xylene (total)	620	0.34	192.4	12.1	13.54	ND	ND	ND	NS	NS	NS	ND	ND
Polynuclear Aromatic Hydrocarbons:													
Benzo(b)fluoranthene	see note 3	ND	ND	ND	ND	2	ND	ND	NS	NS	NS	ND	ND
Indeno(1,2,3-cd)pyrene	"	ND	ND	ND	ND	6	ND	ND	NS	NS	NS	ND	ND

Notes:

1. WQCC standard, Section 3-103, as amended through December 24, 1987
2. ND - not detected, NS - well not sampled
3. PAHs: total napthalene plus monomethylnapthalenes = 30 ug/l

Note: This table revised 4/26/90.



NOTES:

1. OIL & GREASE VALUES MAY NOT APPLY TO A SINGLE HORIZON. THUS, THIS MAP REPRESENTS A COMPOSITE OF O&G MEASUREMENTS.
2. CONTOUR INTERVAL IS NOT UNIFORM.
3. UNITS FOR O&G MEASUREMENTS ARE PARTS PER MILLION.
4. CROSS-HATCHED AREAS INDICATE REGIONS WHERE O&G EXCEEDS 1,000 PPM.

El Paso Natural Gas Company			ISOPLETH MAP OF OIL & GREASE CONCENTRATION IN SOIL SAMPLES TAKEN AT THE MANANA-MARY WHEELER #1-E WELL SITE		
PROJECT: EPNG 63712 (EPSLSAMP)			LOCATION: FLORA VISTA, NEW MEXICO		
K.W. BROWN & ASSOCIATES, INC.					DATE: 05/01/90
APPR:			DRAWN BY:	RMM	SCALE: AS SHOWN
DATE:			DATE:	05/01/90	FIGURE: 1

WATER RESOURCES

WATER RESOURCES RESEARCH, VOL. 19, NO. 6, PAGES 1359-1375, DECEMBER 1983

The Risks of Drinking Water

E. A. C. CROUCH,[1] R. WILSON,[1] AND L. ZEISE[2]

Energy and Environmental Policy Center, Harvard University

Exposures to the low levels of organic compounds found in drinking water might cause a variety of health effects, cancer being one of great concern. The estimation of cancer risk is uncertain, which may in part explain why cancer risk is not properly considered in establishing drinking water standards. Current standards for a given chemical or class of chemicals do not account for the presence of other pollutants, chemicals which have not been tested in long term oral bioassays are generally ignored, and the uncertainties of risk calculations are not explicitly considered. To better quantify risks from drinking waters, we apply procedures which incorporate measures of uncertainty into the risk calculation and consider all chemicals included in a water analysis. This procedure is demonstrated by calculating risks for several U.S. water supplies. Our results show that some might pose moderately high risks.

INTRODUCTION

Current drinking water standards are not directly related to health risks posed. Usually it is cancer risk which is of greatest concern in the setting of guidelines for low levels of organic compounds, and almost always estimates of cancer risk are made in an atmosphere of uncertainty. Over a period of years we have developed procedures which account for the uncertainties involved in risk calculations so that such risks can be more accurately determined. We illustrate these methods by calculating risks for some U.S. water supplies.

We begin by discussing how to estimate the cancer risk from chemicals in cases in which there is no unequivocal evidence of adverse response on people and outline the procedure that we use for this purpose. Then we compare this procedure to that used by the Carcinogen Assessment Group (CAG) of the Environmental Protection Agency (EPA), emphasizing some of the assumptions in both procedures. Our method, which treats uncertainties more consistently, results in a probability distribution rather than a single value for risk. Upper and lower bounds as well as the mean risk can be derived from the distribution. Thirdly, we uncover inconsistencies within the proposed regulations for volatile organic chemicals [*Federal Register*, 1982] and the final regulations for halomethanes [*Federal Register*, 1979]; we note that if the acceptable risk level is rigidly set at 10^{-6}/life for a conservatively calculated risk, one of the possibilities suggested in the proposed regulations, the EPA would be forced to ban as unfit for human consumption most of the drinking water supplies measured by EPA in the National Organics Monitoring Survey of 1977 [*EPA*, 1977]. We then suggest that drinking water risks be considered in light of societal behavior toward better known risks. Public attitudes indicate that risks of one in a million per year (risks averaged over a lifetime) and under might be small enough to be ignored. Finally, we note that many of the U.S. water supplies may impose much higher risks, usually because low levels of halomethanes are present. This suggests caution until risks of these chemicals can be more accurately evaluated through animal bioassay and other experiments.

[1] Also with the Department of Physics, Harvard University.
[2] Also with the Division of Applied Sciences, Harvard University.

Paper number 3W1490.
0043-1397/83/003W-1490$05.00

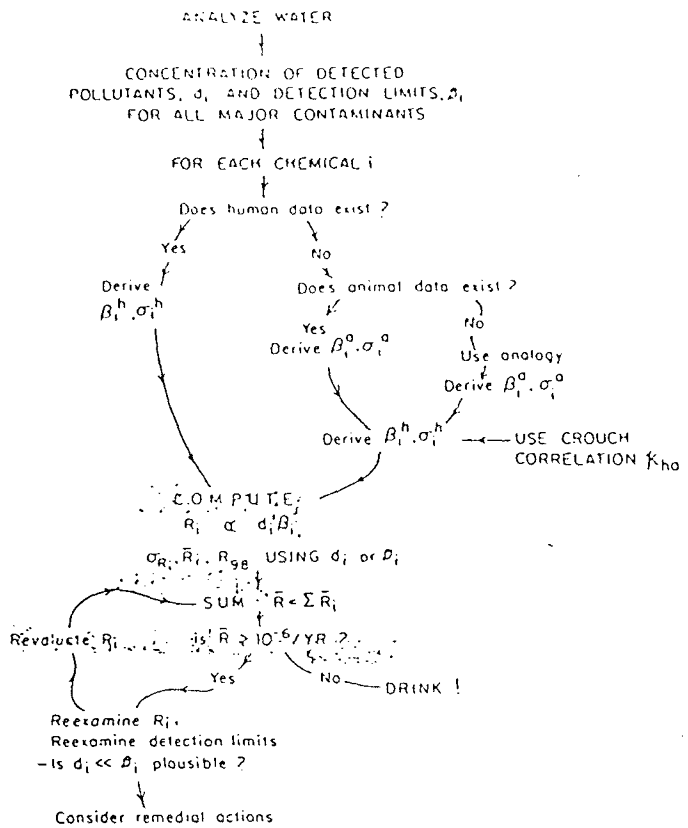
CANCER RISK

The risks addressed will be risks of cancer and not of other toxic effects. The reason for this restriction is that most chemical toxicity is characterized by a sharp threshold in dose or dose rate, so that for the low doses discussed here, toxic effects are very small. For carcinogenic effects for some chemicals and/or types of cancer there may be no thresholds, so that for public policy purposes it is prudent to assume that there are none. It is possible that teratogenic effects are also important, but information is limited. To the extent that teratogens are carcinogens, this is not a huge omission.

The word risk in itself implies uncertainty. The uncertainties dealt with here are of two types: first, those of the carcinogenic process which is, at least in part, a stochastic process, and second, uncertainties in the estimating the parameters of the mathematical models assumed.

It should be recognized that the cancer risks calculated differ from some of the other risks of everyday life. Since cancer risk from a single chemical is usually small and the latency period for cancer is large, and since a variety of circumstances and chemicals prevalent in the environment could have caused cancer of a particular type, causality is usually difficult if not impossible to establish. Often, even when it is possible to link an exposure with human cancer, quantification of the relationship remains elusive. For most of the drinking water contaminants there are no epidemiological studies which demonstrate a direct association with human cancer. However, it would be unethical to ignore the possibility. Many of the contaminants are known animal carcinogens, and since the exposure is so widespread, thousands of human cancers may have already been caused and many more may be caused in the future. The public health should be protected, but the cost of reducing the chemicals to the lowest levels possible in all water supplies would be enormous. We must find a way to determine when a water supply is reasonably safe. This first involves estimating the risk as well as is possible, which is the main purpose of this paper. Such risk can then be compared with other risks that society endures, some of which are readily accepted, others avoided, and some reduced through public expenditures.

The procedure is to use all relevant and available data to estimate the lifetime cancer risk for drinking water with various levels of contamination. Measures of risk for the individual constituents are developed, then combined to establish the overall risk of the supply. For a very few chemicals there are human data which can be used to evaluate cancer risk



d_i Concentration of i^{th} Chemical
$\mathcal{D}_i$ Detection Limit for i^{th} Chemical
β_i^a Carcinogenic Potency in Animals
β_i^h Carcinogenic Potency in Humans
K_{ha} Interspecies Conversion Factor (Animal to Human)
R Human Cancer Risk
σ Standard Deviation

Fig. 1. Scheme for assessing drinking water risks.

Usually, the most relevant data available are from studies on animals. Without exception the 30 or so materials or processes known to be carcinogenic in man have also been found to be carcinogenic in animals, so that this can be taken as a general rule. The converse of this general rule has been used for public policy purposes to proscribe any chemical found to be carcinogenic in animals (a good example is the Delaney Clause). However, there are so many animal carcinogens present in such small but detectable amounts that such a "zero risk" approach is unworkable.

Since the zero risk option is not feasible, the next step is to recognize that chemicals differ widely in their ability to cause cancer. If it is noted that chemicals are usually acutely toxic in animals and man at similar relative values, the question arises as to whether the qualitative agreement in carcinogenicity between species can be made into a quantitative statement: that a chemical which is potent in one species is likely to be potent in man and that a chemical which has a low potency in an animal has a low potency in man. Most attempts to estimate carcinogenic risks rest on the assumption that this is to some extent true.

Animal carcinogenesis studies have not been run on all the chemicals of concern. To estimate risk when this is the case, we propose the use of mutagenicity and toxicity information as well as carcinogenesis data from studies in animals of chemicals with like structure. We call this method of risk assessment "risk by analogy." The general scheme for assessing risks of drinking water is illustrated in Figure 1.

METHODOLOGY

We are concerned with estimating in humans the carcinogenic effects of a chemical at low concentrations. To do this we usually use data on animals exposed to much higher levels of the chemical, so a two-fold extrapolation is required: from high to low dose and from animal to human. Logically, the two orders of extrapolation might give different results, but in practice the assumptions made assure their equivalence.

The usual approach for extrapolation between doses has been to use a mathematical dose response model:

$$R = F(d, x, y, z, \cdots; a, b, c, \cdots) \qquad (1)$$

Here R is a measure of response which is presumably related to the risk of interest and which can be observed in the animal experiments. The functional form F is usually chosen by guesswork, or on the basis of some hypothesis, or to fit various constraints. The response is expected to be a function of dose d measured in some way and also of various other variables $(x, y, z, \cdots)$, for example, age. Included in the model are a set of parameters $(a, b, c, \cdots)$ which measure how strongly the response R depends upon the variables $(d, x, y, z, \cdots)$. The dose response model may be fitted to experimental animal results to give estimates of the parameters $(a, b, c, \cdots)$, one of which (or some combination of which) may be considered a potency of the material under test. With such estimates of the parameters the dose response model allows extrapolation to low doses.

The next problem is extrapolation to another species, in this case humans. Once again a dose response model

$$Z = G(d, x, y, z, \cdots ; \alpha, \beta, \gamma, \cdots) \tag{2}$$

is specified. Here G, Z, $(\alpha, \beta, \gamma, \cdots)$ have the same general interpretations as F, R, $(a, b, c, \cdots)$. However, the response Z may be a response different in nature from R, and the functional forms F and G are not necessarily identical. For example, R may represent the incidence of liver cancer in mice with F chosen to be an S-shaped dose response function, and Z may represent bladder cancer in humans caused by the same carcinogen, with a linear form for G.

The interspecies extrapolation is specified by relations between the parameters $(a, b, c, \cdots)$ and $(\alpha, \beta, \gamma, \cdots)$:

$$\begin{aligned} g_1(a, b, c, \cdots ; \alpha, \beta, \gamma, \cdots) &= 0 \\ g_2(a, b, c, \cdots ; \alpha, \beta, \gamma, \cdots) &= 0 \\ &\vdots \end{aligned} \tag{3}$$

Given these relationships, information about the response in one species, contained in the parameters $\alpha, \beta, \gamma, \cdots$ can be used to obtain information in the second species through the parameters $a, b, c, \cdots$.

In practice the same functional form in the assumed dose response functions is being used for animals and humans ($F = G$). This is the origin of the logical equivalence between the two routes of extrapolation mentioned above. Some go so far as to suggest that the numerical values of the parameters are identical, so that the set of relations $(g_1 = 0, g_2 = 0, \cdots)$ becomes

$$a = \alpha \qquad b = \beta \qquad c = \gamma \qquad \text{etc.} \tag{4}$$

The CAG adopts this approach.

The above summary has been written with considerable generality to emphasize the following separate elements of the extrapolation: (1) a dose response function F in one species; (2) a logically separate dose response function G in another species, for a logically separate response, and (3) relations $(g_1 = 0, g_2 = 0, \cdots)$ between the parameters of such dose response functions. It is easy to become confused in the practical cases where the same symbols are used to represent parameters or variables referring to different species, and the same mathematical dose response function is used to model dose response in both species of interest.

Risk Calculation

For both animals and humans, *Crouch and Wilson* [1979, 1981] use as a dose-response model a formula which can, inter alia, be derived from a one-hit model:

$$R = 1 - (1 - \alpha) \exp - [\beta D/(1 - \alpha)] \tag{5}$$

Here R is the probability of dying with a tumor induced by a dose D; α and β are the parameters of this model, and both are taken to be constant. By expanding the exponential we see that the right-hand side of (5) reduces to $\alpha + \beta D$ at low doses, to the spontaneous tumor rate α at $D = 0$, and tends to unity at high doses. The parameter β is called the carcinogenic "potency," since it is the ratio of the excess lifetime cancer incidence in a population caused by the carcinogen to the average daily dose received by the population (provided all individual doses are small enough; this is assumed from here on). Dose is the lifetime average daily intake per unit bodyweight, measured in milligrams per kilogram day; hence potency is expressed in kilogram days per milligram. For an individual the product of potency and dose will be the lifetime probability of cancer, or "risk," imposed by the carcinogen. It is found that a chemical's potency, as defined above, is roughly independent of species [*Crouch and Wilson*, 1979].

We can use the carcinogenic potency in a risk calculation in the following way. The risk is the product of potency and dose ($R = \beta D$). For example, if the amount of pollutant in the water is 1 μg/l and the daily water intake is 2 liters, then the intake is 2 μg/day. For a 70-kg man the dose, in the required units, is

$$\begin{aligned} 2\ \mu\text{g/day}/(70\ \text{kg bodyweight}) &\sim 3 \times 10^{-2}\ \mu\text{g}/(\text{kg day}) \\ &= 3 \times 10^{-5}\ \text{mg}/(\text{kg day}) \end{aligned}$$

And the cancer risk, that is, the probability of developing a cancer in a lifetime, is $\beta \times 3 \times 10^{-5}$ for an intake of 2 l/day for life of water contaminated with 1 μg/l.

For convenience in making comparisons, we define the "average annual cancer risk" R to be the lifetime probability of cancer divided by the life expectancy, which is approximately 70 years. (We do not mean to imply that the risk is equally spread over age; it probably is not, even if ingestion of the carcinogen occurs at a constant rate or in a single dose. Hence average annual cancer risk is only a convenient way of expressing lifetime risk; it is a nominal risk and not a true probability.) So average annual cancer risk R for a lifetime intake of 2 l/day of water contaminated with d μg/l of pollutant is

$$\begin{aligned} \mathrm{R} &= [3 \times 10^{-5} (\beta\ d)]/70 \\ &= 4 \times 10^{-7} (\beta\ d) \end{aligned} \tag{6}$$

For a mixture of chemicals we calculate the quantity

$$\mathrm{R} = 4 \times 10^{-7} \left[\sum_i (\beta_i\ d_i) \right] \tag{7}$$

where d_i is the concentration of chemical i in units of microgram per liter and β_i is the potency of that chemical in humans. If there are uncertainties in any of the values in (7), as is always the case, the procedure is a little more complicated. Before detailing that procedure, four elements of uncertainty plaguing most risk calculations are discussed.

Uncertainties

Uncertainties in measuring potency in animal experiments, σ_A. In fitting the dose response curve (equation (5)) to experimental results, the potency β cannot be found exactly but is subject to uncertainty. This uncertainty can be approximately modelled by a lognormal distribution, so that if

$$x = \log_e (\beta) \tag{8}$$

then the probability distribution for x is given by

$$p(x)\, dx = \frac{1}{\sigma_A (2\pi)^{1/2}} \exp\left[- \frac{(x - \bar{x})^2}{2\sigma_A^2} \right] dx \tag{9}$$

where σ_x is usually about 0.35 for the ingestion bioassays reported on in the National Cancer Institute's Carcinogenesis Technical Report Series [*Zeise et al.*, 1982] and $\bar{x}$ is the median value of $\log_e(\beta)$, corresponding to the point estimates given by *Crouch and Wilson* [1979]. When the only studies available are insensitive and the carcinogenic potency β differs *insignificantly from zero, the distribution of β is not lognormal*. For these cases we obtain upper confidence bounds on potency using techniques described by *Crouch* [1983].

Uncertainties in extrapolating from animals to humans, σ_y. We estimate that the potency in people is the same as the potency in animals, when expressed in units of kilogram days per milligram, although this statement of equality must be tempered by the uncertainty associated with this interspecies extrapolation. The most systematic study of this uncertainty was begun by *Crouch and Wilson* [1979] and extended by *Crouch* [1983], wherein they compared the carcinogenic potency of several chemicals in rats and mice, and where data was available, in people also. They found about the same proportion of cancers would be induced in different species of animals fed the same daily dose, expressed as lifetime average daily intake as fraction of bodyweight. The animals studied had been treated for an appreciable proportion of their lifespans. Crouch and Wilson express this formally by assigning an interspecies sensitivity factor K to convert from potency in one species to potency in another:

$$\beta_h = K_{ha}\beta_a \qquad (10)$$

where β_a and β_h are the potencies in species a and h, respectively. They find that K fits a lognormal distribution. If

$$y = \log_e(K) \qquad (11)$$

then the probability distribution $p(y)$ is

$$p(y)\,dy = \frac{1}{\sigma_y(2\pi)^{1/2}} \exp -\frac{(y-\bar{y})^2}{2\sigma_y^{\,2}}\,dy \qquad (12)$$

For comparisons of rats and mice, they found that $\sigma_y \approx 1.5$, corresponding to the factor 4.5, since $\exp(1.5) \approx 4.5$ and $\bar{y} \approx 0$ [*Crouch*, 1983]. We assume that potency in humans is, on average, the same as in mice or rats and that the error in extrapolating from rodents to humans is the same as extrapolating from mice to rats or vice versa. The available data on human cancers indicates that this is not an unreasonable assumption [*Crouch and Wilson*, 1979].

Uncertainties in exposure, σ_z. Estimates of the dose d are derived from drinking water analyses and information on drinking water habits. We assume that the doses to the population are lognormally distributed, as is often the case for *environmental contaminants*, so that for

$$z = \log_e(d) \qquad p(z)\,dz = \frac{1}{\sigma_z(2\pi)^{1/2}} \exp -\frac{(z-\bar{z})^2}{2\sigma_z^{\,2}}\,dz \qquad (13)$$

where $\bar{z}$ is the median.

Uncertainties in high to low dose extrapolation, E. The dose response curve (equation (5)), here used in making estimates of potency, incorporates an assumption of linear extrapolation from high to low doses. All the estimates of potency have been made at high dose, and other dose response models which may differ drastically in their low dose behavior would give similar estimates of high-dose potency and similar results for estimate errors. The work on interspecies extrapolation quoted above has little bearing on the correct extrapolation to low dose.

The data on dose response is equivocal. We do not go into detail here but note that there is evidence for certain chemicals and types of cancer that the dose response relationship is linear; for others a threshold response is more plausible. For most chemicals the data to distinguish the forms are inadequate. Therefore the matter of high to low dose extrapolation *is one of public policy, at least for the purposes of risk assessment*, rather than of science. It has been conventional to assume that the dose response relationship is linear. The FDA in its ruling on saccharin implicitly assumed linearity, while the EPA now consistently allows for sublinear response at low doses. Because the cost of being wrong is so great, we contend that unless the data strongly indicates otherwise, linear extrapolation should be used. However, we formally account for those who disagree by introducing an extrapolation factor E, which can be assigned a probability distribution based on prior belief.

The distribution for E is subjectively derived. Those who believe in a threshold assume that E is near zero, a few believe that at low doses the response is greater than linear ($E > 1$), and those who, like ourselves, believe in linearity set E to one. Indeed, if decisions are based on average risk and if the chance that there is no threshold exceeds, say, 1 in 3, the risk will be greater than $\frac{1}{3}$ of that calculated under the linear assumption and there will be little difference in any policy implications.

The Probability Distribution for Risk

Provided the doses are small enough, the excess annual risk due to a carcinogen is thus

$$R = 4 \times 10^{-7}\,(\beta\ K\ d\ E) \qquad (14)$$

where

- β potency;
- K interspecies factor;
- d contaminant concentration;
- E dose extrapolation factor.

The uncertainties in each of the factors in (14) must be taken into account in the Crouch-Wilson procedure. As noted above, this may be done by assuming a probability distribution for each factor in R. For simplicity we take the extrapolation factor $E = 1$, corresponding to no threshold. For reasons discussed above the effect on any decisions using our risk estimation procedure is likely to be small, although it unavoidably introduces a small coupling between the risk assessment and risk decisions, which is generally considered undesirable. Since E is assumed to be equal to 1 with certainty, and since the factors β, K, and d are independent and lognormally distributed, R also obeys a lognormal distribution, with a standard deviation σ given by

$$\sigma^2 = \sigma_x^{\,2} + \sigma_y^{\,2} + \sigma_z^{\,2} \qquad (15)$$

so that for

$$r = \log_e(R) \qquad p(r)\,dr = \frac{1}{\sigma(2\pi)^{1/2}} \exp -\frac{(r-\bar{r})^2}{2\sigma^2}\,dr \qquad (16)$$

where $\bar{r}$ is the median value, the probability distribution for the annual risk R is

$$p(R)\,dR = \frac{1}{\sigma R(2\pi)^{1/2}} \exp -\frac{(\log_e R - \bar{r})^2}{2\sigma^2}\,dR \qquad (17)$$

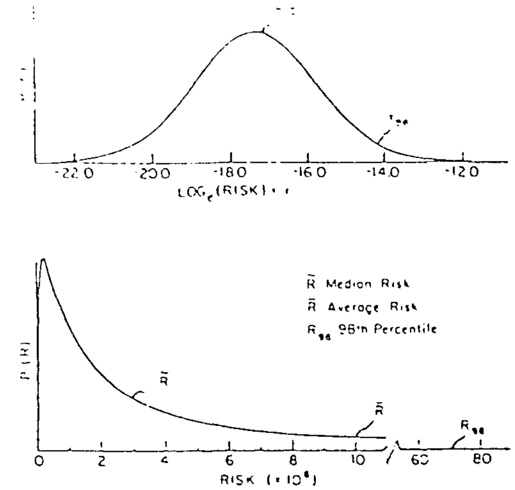


Fig. 2. Lognormal risk distribution (average annual cancer risk from 100 μg/l trichloroethylene in drinking water).

The distributions for r and R are illustrated in Figure 2. Note that the average, or mean value, of R is not the same as the median but larger by a factor of exp $(\sigma^2/2)$. This is because a lognormal distribution is skewed to the right.

Since risk is represented by a distribution, rather than one value, a summary statistic must be derived. It is a matter of judgment what measure of the probability distribution is selected, and the choice may depend on the type of action considered. One of us argues that an individual cannot distinguish between the different types of uncertainty: first, the stochastic variability arising since R itself expresses only a probability of harm or second, the uncertainties in β, K, or d. For him the parameter of interest is an average value of R, $\bar{R}$. This is given by

$$\bar{R} = (4 \times 10^{-7})\, \bar{\beta}\, \bar{K}\, \bar{d}\, \bar{E}$$

$$= (4 \times 10^{-7})\, \tilde{\beta}\, \tilde{K}\, \tilde{d}\, \tilde{E} \exp(\sigma^2/2) \tag{18}$$

where $\tilde{\beta} = \exp(\bar{x})$, $\tilde{K} = \exp(\bar{y})$, $\tilde{d} = \exp(\bar{z})$. A risk-averse person may instead decide on the basis of an upper quantile of the distribution, say the 98th percentile.

For public policy decisions, where one must be conservative, it may also be appropriate to use an upper limit on the risk; here the stochastic nature of the risk is averaged out by the large population but the uncertainties in β, K, and dose remain. In a population of size N, the upper 98th percentile on the annual number of cancers is $NR_{98} = (4 \times 10^{-7})\, N\, \tilde{\beta}\, \tilde{K}\, \tilde{d}\, \tilde{E} \exp(2\sigma)$ and the mean estimate is $N\bar{R} = (4 \times 10^{-7})\, N\, \tilde{\beta}\, \tilde{K}\, \tilde{d}\, \tilde{E} \exp(\sigma^2/2)$. Using an upper limit corresponds in intent to the CAG procedure of taking the 95th percentile of the various terms before multiplying them but accounts more correctly and completely for the uncertainty.

This procedure is slightly more complicated when the effect of a mixture of chemicals is to be determined. In that case, as indicated in (7), the overall risk is obtained by summing several variables, each with a lognormal distribution. The mean value is simply the sum of the means, but in order to obtain the percentage points $\tilde{R}$ and R_{98}, the distribution of the sum must be determined.

An Example: Risk Calculated for Trichloroethylene

Using the National Cancer Institute (NCI) ingestion bioassay results, Crouch and Wilson evaluated the carcinogenic potency of trichloroethylene [*Crouch and Wilson*, 1979]. The value of potency used is the highest significant value calculated for any site among the four experiments (rats and mice of both sexes). Since a chemical may cause cancer in more than one organ, this method may underestimate potency, as it does when applied to cigarette smoking in humans, where the potency is understated by a factor of 2, since it is that of lung cancer and the effects of smoking on other organs are omitted. Underestimation is somewhat compensated for by taking the highest value in the four experiments.

The model fits the trichloroethylene data well, and the median estimate for β is 7.3×10^{-4} kg day/mg and for σ_x is 0.22. As discussed above, for the interspecies comparison factor K we assume that the uncertainty is measured by the spread of the points in the comparison of *Crouch* [1983] and obtain $\sigma_y = 1.5$, while for the dose measure we assume for illustrative purposes that $\sigma_z = 1/2$.

The overall uncertainty in the risk is then $\sigma^2 = \sigma_x^2 + \sigma_y^2 + \sigma_z^2 = 2.6$, and so the average risk $\bar{R}$ is then greater than $\tilde{R}$ by a factor of 3.6 ($\exp \sigma^2/2 = \exp(1.3) = 3.6$) and the 98th percentile of the distribution differs from $\tilde{R}$ by 25 ($\exp(2\sigma) = \exp(3.2) = 25$). The median estimate of annual risk of drinking 2 liters of water a day containing trichlorethylene at a level of 100 μg/l is then (see (6))

$$\tilde{R} = 4 \times 10^{-7} \times 100 \times 7.3 \times 10^{-4}$$

$$= 2.9 \times 10^{-8} \tag{19}$$

so that the mean estimate of risk is

$$\bar{R} = \exp(\sigma^2/2) \times \tilde{R} = 1 \times 10^{-7} \tag{20}$$

and the upper 98th percentile is

$$R_{98} = \exp(2\sigma) \times \tilde{R} = 7 \times 10^{-7} \tag{21}$$

These values as well as the risk distribution for trichloroethylene are illustrated in Figure 2.

Comparison with CAG Methodology

The Carcinogen Assessment Group follows a procedure similar to that discussed [*EPA*, 1981], but although they often derive upper bound estimates of risk similar to our own, there are important differences in the details. The CAG uses a procedure developed by K. Crump, in which the dose response relationship is a "modified multistage model" in that lifetime probability of tumor, R, is related to dose D by:

$$R = 1 - \exp[-(a + bD + cD^2 + \cdots)] \tag{22}$$

Dose is measured in a different way from that discussed above. The parameter b is very similar to the potency β described above, and the CAG use an estimate, from the animal experiments, of the 95% upper confidence limit on this parameter, b_{95}, as an estimator to be used in deriving an upper limit on risk. In practice, b_{95} and β_{95} usually differ little when account is taken of the differences in definition of dose.

Whereas the CAG chooses the 95% confidence bound on potency for use in the risk calculation, with the intention of obtaining a conservative estimate of risk, we instead strive to estimate risk and its distribution as precisely as possible in order to reliably estimate the upper bounds of risk. Indeed, the CAG is much less conservative in these important respects.

1. Insignificant findings in animal experiments are used to imply zero risk.

2. The modified multistage model can result in estimates of b_{95} which are substantially smaller than of β_{95}.

TABLE 1a. Lifetime Average Annual Risk of 100 μg/l Trichloroethylene

	Value
$\bar{R}$, average risk	1×10^{-7}
R_{98}, 98th percentile	7×10^{-7}
CAG risk estimate	3.6×10^{-7}

Assumes 2 l/day of water consumption.

3. The CAG does not attempt to estimate the risk for chemicals on which neither human epidemiological studies nor animal bioassays exist and, in general, ignore the potential risk from these chemicals.

4. Estimates of the parameters of the multistage model corresponding to experiments with several dose groups are unstable; therefore extracting the single parameter b for use in estimating risk can produce widely varying estimates of risk for similar experimental results.

The CAG have not yet discussed in detail the relationship between carcinogenicity in animals and carcinogenicity in man, which is accounted for by our factor K. Implicit in their methodology are the assumptions that the dose response relationships are functionally identical in man and experimental animal and that the values of the parameters are numerically identical in the two relationships. They thus effectively assume K to be a fixed exact value. Thus animals and men are considered to respond identically when dosed at an equal amount per unit surface area (not per unit weight), which is equivalent to taking $K \approx 5$ for rat to man comparisons and $K \approx 13$ for mouse to man comparisons. Although the data do not suggest these values, CAG justify them as being conservative.

Despite the many dissimilarities in computation, our method and that used by the CAG often produce similar results. In Table 1a, CAG estimates of risk are compared with the risk calculated above for a lifetime intake of 2 l/day of water contaminated with 100 μg/l of trichloroethylene (TCE). (The number quoted in Table 1a for the CAG estimate of risk differs slightly from that derived from Table 3 of the Federal Register notice, which is reproduced as Table 7. From the first line, the lifetime risk of TCE is 10^{-4} at 280 μg/l, or $10^{-4}/2.8$ at 100 μg/l. The annual risk is $10^{-4}/(2.8 \times 70)$ at 100 μg/l or 5×10^{-7}. We do not know the reason for the discrepancy, except that the Federal Register may use a different version of the CAG report.) For some compounds tested in the NCI *Carcinogenesis Technical Report Series* (numbers 2–239, National Cancer Institute, Bethesda, Md.) the two methods produce different results, as evidenced in Table 1b.

RISKS FROM VARIOUS U.S. WATER SUPPLIES

The methods described above may be used to estimate risks from carcinogens in the various water supplies monitored by the EPA in the National Organic Monitoring Survey of 1976–1977 [*EPA*, 1977]. Table 2 lists the 27 chemicals monitored, together with our estimators of potency and their uncertainty. For estimates of exposure we assume that an individual drinks 2 liters daily of the polluted water for life and that the water remains contaminated at the maximum levels found in the 1976–1977 survey (Table 3).

In most cases we derive values of potency from bioassay data and in one case from a human epidemiological study. However, such data is not available for all chemicals or is so poor as to be of no use. We estimate these potencies by "analogy," deriving a value based on the carcinogenicity of related chemicals. For example, the potency of bromoform may be estimated by comparing the carcinogenicity of brominated alkanes to their chlorinated analogues [*Wilson and Fiering*, 1983]. In most cases the brominated compounds are more carcinogenic. The only direct evidence for the carcinogenicity of bromoform comes from a comparatively short and insensitive study using intraperitoneal injection to induce pulmonary tumors in A/St mice [*Theiss et al.*, 1977]. Although many compounds were tested, only bromoform induced a significant number of tumors. This test included chloroform, which was shown to be carcinogenic in the more sensitive NCI tests. However, the bromoform results are considered inconclusive because the significant result was in the middose group and insignificant numbers of tumors were induced in mice with the same survival rate but receiving a higher dose. In another short term study of alkyl halides using intraperitoneal injection, this time into A/He mice, butyl bromides were slightly more potent than or as potent as their butyl chloride analogues [*Poirer et al.*, 1975]. We also note that 1,2-dibromoethane has a carcinogenic potency which is 10 to 200 times as large as 1,2-dichloroethane, and that the only other brominated alkane tested in the NCI series, 1,2-dibromo-3-chloropropane, was highly carcinogenic, with potency greater than that found for any of the other halogenated alkanes in these tests. (Other halopropanes were not tested.) In addition, bromoform and dibromochloromethane are mutagenic in salmonella typhimurium under conditions in which chloroform is not mutagenic [*Simmon et al.*, 1978]. These facts suggest that brominated hydrocarbons may be substantially more potent than their chlorinated analogues.

For bromoform, which has three bromine atoms, it would be prudent to assume it is at least a hundred times more potent than chloroform. For dibromochloromethane (two bromine atoms) we assume that the potency is 20 times that of chloroform and for dichlorobromomethane (one bromine atom) 5 times. The uncertainties in these estimates have to include the uncertainty in extrapolation from animals to humans and the uncertainties in the animal experiments, as well as the uncertainty due to the use of analogy. As a crude estimate we add an extra 0.3 to σ for each bromine substituted for chlorine, leading to the values shown in Table 2 for bromodichloromethane, dibromochloromethane, and bromoform. The upper bound on the carcinogenic potency of iodoform derived from the NCI bioassay is less than the potency measured for chloroform, so we assume that dichloroiodomethane is less carcinogenic than chloroform. Notice that the order of carcinogenicity of the brominated, chlorinated, and iodinated alkanes may be the same as the order of electronegativity of the halogen ions.

Using analogy, potencies were derived for several of the other chemicals listed in Table 2. The analyses and assumptions made for these chemicals are discussed in the appendix.

Some people have suggested that 1,1,1-trichloroethane is

TABLE 1b. Lifetime Average Risk from Water Contaminated With 100 μg/l

	Clonitralid	Lead Dimethyldithiocarbamate
$\bar{R}$, median risk	1×10^{-8}	0
R_{98}, 98th percentile	2×10^{-7}	2×10^{-5}
CAG risk estimate	0	0

Assumes 2 l/day of water consumption.

TABLE 2. Carcinogenic Potency of Drinking Water Contaminants Monitored by the EPA in the 1976–1977 National Organic Monitoring Survey

i	Chemical	Potency, kg day/mg	σ_e	Total σ Assumed	Reference
1	Chloroform	1.1×10^{-2}	0.14	1.51	(NCI)*
2	Bromodichloromethane	5.5×10^{-2}	···	1.8	text
3	Dibromochloromethane	2.2×10^{-1}	···	2.1	text
4	Bromoform	1.1×10^{0}	···	2.4	text
5	Dichloroiodomethane	2.2×10^{-3}	···	1.8	text
6	1,2-Dichloroethane	9.4×10^{-3}	0.27	1.53	(NCI)*
7	Carbon tetrachloride	4.0×10^{-3}	0.22	1.52	(NCI)*
8	Methylene chloride	2.5×10^{-3}	2.1	2.5	text (app.)†
9	Vinyl chloride	2.0×10^{-2}	···	1.55	(Maltoni)‡
10	Trichloroethylene	7.3×10^{-4}	0.22	1.52	(NCI)
11	Tetrachloroethylene	1.6×10^{-3}	0.16	1.51	(NCI)
12	1,1,1-Trichloroethane	1.7×10^{-5}	0.75	1.68	(NCI)
13	Bis-(2-chloroethyl)-ether	4.2×10^{-2}	0.34	1.68	(Innis)§
14	Bis-(2-chloroisopropyl)-ether	$<6.7 \times 10^{-4}$	NA‖	(1.5)	(NCI)*
15	Benzene	1.0×10^{-3}	···	1.5	CW (human)**
16	*p*-Dichlorobenzene	1.4×10^{-3}	1.9	2.3	text (app.)†
17	*m*-Dichlorobenzene	$<8.8 \times 10^{-2}$	2.0	2.5	text (app.)†
18	*o*-Dichlorobenzene	6.9×10^{-3}	1.7	2.3	text (app.)†
19	1,2,4-Trichlorobenzene	4.4×10^{-3}	1.5	2.1	text (app.)†
20	2,4-Dichlorophenol	1.7×10^{-3}	1.7	2.2	text (app.)†
21	Pentachlorophenol	4.0×10^{-2}	1.7	2.1	text (app.)†
22	Polychlorinated biphenyls	5.3×10^{-2}††	0.57	1.6	(NCI)*
23	Fluoranthene	3.1×10^{-2}	2.5	2.9	text (app.)†
24	Benzofluoranthene	9.3×10^{-2}	1.8	2.0	text (app.)†
25	1,12-Benzperylene	1.9×10^{-2}	2.5	2.9	text (app.)†
26	3,4-Benzopyrene	9.3×10^{-1}	0.87	1.7	text (app.)†
27	Indeno (1,2,3-cd) pyrene	9.3×10^{-2}	2.5	2.9	text (app.)†

*(NCI): Analysis of NCI Carcinogenesis Technical Report Series data (Numbers 2–239, 1976–1982, National Cancer Institute, Bethesda, Md.).

†text (app.): Analysis appears in the appendix of this paper.

‡(Maltoni): Analysis of Maltoni's ingestion data [*Maltoni et al.*, 1979].

§(Innis): Analysis of data from *Innis et al.* [1969].

‖NA: Not applicable.

**CW (human): Analysis of human data [*Crouch and Wilson*, 1979].

††The potency is of the PCB Arochlor 1254.

not carcinogenic. This statement is inaccurate; a more correct statement would be that it has not been found to be carcinogenic, for the simple reason that the tests may have not been sensitive enough. The NCI test was considered inconclusive, in part because toxic effects killed the treated animals early, before carcinogenic effects might be manifest. However, we still can estimate a potency figure, with uncertainty, from the 1,1,1 trichloroethane data.

Table 4 shows the risk calculated for the selected cities. To arrive at these values, contributions for each of the chemicals are calculated separately (Tables 5*a*–5*c*) and then combined. In Tables 5*a*–5*c* we have only tabulated risk values for chemicals which have been detected and significantly contribute to the risk and not for all of the chemicals listed in Table 2. The value of $\bar{R}$, the mean estimate, can be obtained simply by arithmetically summing the individual Table 5*a* entries which are the mean annual risks for each of the chemicals:

$$\bar{R} = \sum_i \tilde{R}_i \,[\exp(\sigma_i^2/2)]$$
$$= 4 \times 10^{-7}\left[\sum_i \tilde{\beta}_i d_i \exp(\sigma_i^2/2)\right] \quad (23)$$

where $\sum_i$ represents the summation over all chemicals i. However, to obtain the median and the 98th percentile estimates of risk, it is necessary to determine the probability distribution of the sum expressed in (7). This has been done, using a Monte Carlo technique, to arrive at the entries $\tilde{R}$ and R_{98} in Table 4. In most cases the median of the sum is approximately twice the sum of the medians, while the 98th percentile of the sum is approximately 10–20% less than the sum of the 98th percentiles.

Table 4 shows that all cities have average risks greater than 10^{-6} per year and that several have values of 10^{-5} and above. The value d_i used is the highest concentration measured for the chemical in the appropriate city, and so these estimates of risk may be a bit pessimistic. However, most of the large estimates are dominated by large concentrations of bromoform, where the carcinogenic potency is very uncertain since it has not been directly measured. Notice especially the cities of Brownsville (Texas), Fort Worth (Texas), Melbourne (Florida), Topeka (Kansas), and Dayton (Ohio), where bromoform concentrations are particularly high so that, since for bromoform the value of β is moderately high and of σ is very high, the 98th percentile risk is very high indeed (Table 5*c*). This indicates a need for caution while awaiting the results of the ongoing NCI bioassay on bromoform. In Tables 4 and 5*a*–5*c*, entries greater than 10^{-3} are not precise and slightly overestimate the risk, because the expression in (5) is not linear at these levels. Appropriately alarming, though not precisely calculated, these large numbers indicate unacceptably high risks by most standards.

Although we have tried to be systematic and logical in estimating risks for drinking water, we have not been entirely complete. We have not discussed how two pollutants added to the water can produce a multiplicative synergistic effect such as follows, for example, exposure to both asbestos and tobac-

TABLE 3. Maximum Concentrations of Pollutants Measured in the EPA National Organics Monitoring Survey of 1977

	Chloroform	Bromodichloromethane	Dibromochloromethane	Bromoform	Dichloroiodomethane	1,2-dichloroethane	Carbon tetrachloride	Methylene chloride	Vinyl chloride*	Trichloroethylene	Tetrachloroethylene	1,1,1-trichloroethane	Bis(2-chloroethyl)ether	Bis(2-chloroisopropyl)ether	Benzene	*p*-dichlorobenzene	*m*-dichlorobenzene	*o*-dichlorobenzene	1,2,4-trichlorobenzene	2,4-dichlorophenol	Pentachlorophenol	Polychlorinated biphenyls*	Fluoranthene	3,4-benzofluoranthene†	1,12-benzperylene‡	3,4-benzopyrene†	Indeno(1,2,3-cd)pyrene‡
Annandale, Va.	330	16	1.1	(0.3)	N§	(1.0)	0.2	2.0		(0.03)	P‖	(0.2)	(0.01)	(0.01)	(0.1)	(0.005)	(0.005)	(0.005)	(0.005)	0.17	0.18		(0.01)				
Atlanta, Ga.	95	17	5.2	(0.3)	P	(0.5)	(0.2)	(2.0)		(0.06)	P	(0.2)	(0.01)	(0.01)	(0.1)	(0.005)	(0.005)	(0.005)	(0.005)	0.02	0.23		(0.01)				
Baltimore, Md.	67	15	5.8	(0.3)	P	(0.5)	(0.2)	(1.0)		(0.03)	0.26	(0.2)	(0.01)	(0.01)	(0.1)	(0.005)	(0.005)	(0.005)	(0.005)	0.09	0.08		(0.01)				
Billings, Mont.	14	5.2	2.2	(0.3)	P	(0.05)	(0.2)	(1.0)		(0.03)	(0.2)	(0.2)	(0.01)	(0.01)	(0.1)	(0.005)	(0.005)	(0.005)	(0.005)	lost¶	lost		(0.01)				
Birmingham, Ala.	96	16	2.9	(0.3)	P	(1.0)	(0.2)	(1.0)		(0.03)	lost	lost	(0.01)	(0.01)	(0.2)	(0.005)	(0.005)	(0.005)	(0.005)	0.03	0.02		(0.01)				
Brownsville, Tex.	35	120	290	280	P	(0.5)	(0.2)	(1.0)		(0.03)	(0.2)	(0.4)	(0.01)	(0.01)	(0.1)	(0.005)	(0.005)	(0.005)	(0.005)	0.18	(0.01)		(0.01)				
Cape Girardeau, Mo.	220	53	16	0.69	P	(1.0)	28	(2.0)		0.21	0.82	P	0.19	(0.01)	1.5	0.22	0.03	0.18	10	(0.01)	0.04		(0.01)				
Columbus, Ohio	220	48	13	(0.3)	P	(1.0)	P	(2.0)		(0.06)	(0.2)	P	0.05	0.08	(0.1)	0.02	(0.005)	(0.005)	(0.005)	0.13	(0.01)		(0.01)				
Dayton, Ohio	25	16	22	12	P	(0.1)	(0.2)	(1.0)		2.1	1.1	1.3	(0.01)	(0.01)	(0.1)	(0.005)	(0.005)	(0.005)	(0.005)	(0.01)	0.01		(0.01)				
Elizabeth, N. J.	150	28	8.8	(0.3)	P	(0.5)	(0.2)	(2.0)		(0.03)	P	(0.2)	(0.01)	(0.01)	(0.1)	(0.005)	(0.005)	(0.005)	(0.005)	0.04	0.04		(0.01)				
Fort Worth, Tex.	4.5	29	37	29	P	(0.05)	0.24	(1.0)		(0.03)	(0.2)	(0.2)	(0.01)	(0.01)	(0.2)	(0.005)	(0.005)	(0.005)	(0.005)	0.05	(0.01)		0.02				
Huntington, W. Va.	130	57	37	5	P	1.3	30	(1.0)		0.34	0.25	P	(0.01)	(0.01)	0.1	1.0	0.18	9.1	0.03	(0.01)	0.08		(0.01)				
Jackson, Miss.	300	26	4.2	(0.3)	P	(1.0)	(0.2)	1.5		0.26	(0.2)	(0.4)	(0.01)	(0.01)	(0.1)	(0.005)	(0.005)	(0.005)	(0.005)	0.10	0.12		(0.01)				
Jersey City, N. J.	65	15	3.8	(0.3)	P	(0.5)	P	(1.0)		0.23	(0.2)	P	(0.01)	(0.01)	(0.2)	(0.005)	(0.005)	(0.005)	(0.005)	0.15	0.70		0.02				
Kansas City, Mo.	43	6.8	2.6	(0.3)	P	(0.5)	(0.2)	(2.0)		(0.03)	P	(0.2)	(0.01)	(0.01)	(0.2)	0.02	(0.005)	0.03	(0.005)	(0.01)	0.08		(0.01)				
Lincoln, Neb.	9.6	11	9.7	9	P	(0.05)	(0.2)	(1.0)		(0.03)	(0.2)	(0.2)	0.011	(0.01)	(0.1)	(0.005)	(0.005)	(0.005)	(0.005)	(0.01)	0.01		(0.01)				
Los Angeles, Calif.	49	13	6.7	(0.3)	P	(0.5)	(0.2)	(1.0)		(0.03)	(0.2)	(0.4)	(0.01)	(0.01)	(0.1)	(0.005)	(0.005)	(0.005)	(0.005)	(0.01)	0.05		(0.01)				
Manchester, N. H.	70	18	0.91	(0.3)	P	(1.0)	(0.2)	1.6		(0.03)	(0.2)	P	(0.01)	(0.01)	(0.1)	(0.005)	(0.005)	(0.005)	(0.005)	0.05	0.04		(0.01)				
Melbourne, Fla.	540	183	120	14	P	(1.0)	(0.2)	(1.7)		(0.3)	P	(0.2)	(0.01)	(0.01)	(0.1)	(0.005)	(0.005)	(0.005)	(0.005)	0.02	0.11		(0.01)				
Montgomery, Ala.	190	17	2.3	(0.3)	P	(1.0)	(0.2)	(3.0)		0.22	(0.2)	(0.4)	(0.01)	(0.01)	(0.1)	(0.005)	(0.005)	(0.005)	(0.005)	0.07	0.04		(0.01)				
Newport, R. I.	220	66	26	1.9	P	(1.0)	(0.2)	lost		(0.03)	P	(0.2)	(0.01)	(0.01)	(0.2)	(0.005)	(0.005)	(0.005)	(0.005)	0.05	0.05		0.01				
Norfolk, Va.	210	59	5	(0.3)	P	(1.0)	(0.2)	(1.0)		(0.03)	P	(0.4)	(0.01)	(0.01)	(0.1)	(0.005)	(0.005)	(0.005)	(0.005)	0.04	0.02		(0.01)				
Passaic Valley, N. J.	130	28	7.1	(0.3)	N	(0.5)	1.8	(2.0)		1.4	1.0	1.2	(0.01)	(0.01)	(0.1)	0.05	(0.005)	(0.005)	0.03	(0.01)	0.07		(0.01)				
Sacramento, Calif.	39	7.1	1.3	(0.3)	P	(0.5)	(0.2)	(1.0)		0.43	(0.2)	(0.4)	(0.01)	(0.01)	(0.2)	(0.005)	(0.005)	(0.005)	(0.005)	(0.01)	0.06		(0.01)				
Topeka, Kan.	140	62	50	12	P	(1.0)	7.1	(2.0)		(0.03)	(0.2)	(0.4)	(0.01)	(0.01)	(0.2)	(0.005)	(0.005)	(0.005)	(0.005)	0.05	0.03		(0.01)				

Parentheses indicate that the chemical was not detected. The number inside the parentheses is the detection limit. All values are in micrograms per liter.
*None detected: detection limit 0.10.
†None detected: detection limit 0.03.
‡None detected: detection limit 0.05.
§N Not detected present: detection limits not given.
‖P Presence detected but not quantified.
¶Sample taken for survey was lost.

TABLE 4. Mean, Median and 98th Percentile Estimates of Annual Risk from Organic Chemicals in Drinking Water from Selected U.S. Cities

City	R, Average	$\tilde{R}$, Median	R_{98}, 98th Percentile
Annandale, Va.	7.0E − 06	3.2E − 06	4.2E − 05
Atlanta, Ga.	7.5E − 06	2.6E − 06	4.5E − 05
Baltimore, Md.	7.4E − 06	2.4E − 06	5.3E − 05
Billings, Mont.	2.6E − 06	7.5E − 07	1.9E − 05
Birmingham, Ala.	5.5E − 06	2.1E − 06	3.2E − 05
Brownsville, Tex.	2.5E − 03*	2.8E − 04	1.9E − 02*
Cape Girardeau, Mo.	2.9E − 05	1.1E − 05	1.5E − 04
Columbus, Ohio.	1.9E − 05	6.7E − 06	1.2E − 04
Dayton, Ohio	1.2E − 04	1.6E − 05	7.5E − 04
Elizabeth, N. J.	1.2E − 05	4.5E − 06	7.8E − 05
Fort Worth, Tex.	2.7E − 04	3.2E − 05	2.0E − 03*
Huntington, W. Va	7.9E − 05	2.0E − 05	5.5E − 04
Jackson, Miss.	1.1E − 05	4.5E − 06	6.2E − 05
Jersey City, N. J.	5.8E − 06	2.1E − 06	3.1E − 05
Kansas City, Kan.	3.5E − 06	1.2E − 06	2.0E − 05
Lincoln, Neb.	8.1E − 05	9.8E − 06	6.6E − 04
Los Angeles, Calif.	7.6E − 06	2.2E − 06	5.3E − 05
Manchester, N. H.	3.8E − 06	1.6E − 06	2.5E − 05
Melbourne, Fla.	2.4E − 04	5.9E − 05	1.6E − 03*
Montgomery, Ala.	6.5E − 06	2.9E − 06	3.9E − 05
Newport, R. I.	4.7E − 05	1.4E − 05	3.0E − 04
Norfolk, Va.	1.4E − 05	5.5E − 06	8.6E − 05
Passaic Valley, N. J.	1.1E − 05	3.9E − 06	6.9E − 05
Sacramento, Calif.	2.4E − 06	9.6E − 07	1.7E − 05
Topeka, Kan.	1.5E − 04	2.9E − 05	1.1E − 03*

1.0E − 06 means 1.0×10^{-6} in ordinary scientific notation.
*Entries greater than 1.0E − 03 (10^{-3}) are not precise: see text.

co smoke. However, in most cases we are concerned with small doses of one pollutant added to a "sea" of many pollutants. For these small doses, a multiplicative effect is not expected. In addition, we have included only the 27 chemicals analyzed by the EPA in its organics survey and have not accounted for inorganic chemicals.

This analysis has been extended to include risks for those chemicals not detected at any site. We assume that the chemicals which were not detected were present at the detection limits and rederived the risk distribution using the same methods described above. In doing this it was found that at the very most, average annual risks were doubled. The cases of doubling were those where we would least expect undetected contaminants to be at concentrations near the detection limits: the least polluted water supplies with average risks of 2×10^{-6} and less. For the more polluted water supplies the values of risks were unchanged.

Selection of an Acceptable Level of Risk

Once the risk distributions are derived, the obvious next step is to question whether or not the waters are safe to drink. The EPA has solicited public opinion as regards an acceptable level of risk [*Federal Register*, 1982]. All told, there has been much written on this subject, wherein most agree on one point: there are no simple answers. There is also a general consensus that judgements on public safety have no place in a risk assessment, especially since risk perception and public acceptance cannot be exactly predicted from actuarial statistics, benefits, costs of risk reduction, and the degree to which the risk is voluntary. It is without the intention of suggesting a risk level to be used as a strict safety standard that we make the following remarks. First, an acceptable level cannot be determined in vacuo: an assessed risk is only meaningful in relation to like risks, similarly determined, and the risks and costs of the other options under consideration. Second, some general statements can be made about public behavior toward known cancer risks (e.g., X rays, smoking) and other noncataclysmic risks of death (e.g., car accidents and bee stings; not reactor meltdowns and nuclear war). Some risks are so small that people tend to ignore them and regulations are not developed to reduce them. There are other, larger risks that the public attends to through regulations, public expenditures, and individual action. *Pochin* [1976] and the *United Kingdom Royal Commission on Environmental Pollution* [1976] point out that many risks of 10^{-6}/year are familiar and casually accepted. This is not surprising when we consider that a person exposed to a risk of 1 in 10^6 per year has life expectancy reduced by only one day [*Crouch and Wilson*, 1982].

Risks of cancer from drinking water can be compared to a number of risks indicated in Table 6 taken from *Crouch and Wilson* [1982]. Data on hazards other than cancer were derived from annual death rates on exposed populations. The cancer risks shown are calculated in the same way as drinking water risks in this paper, and so the same caveats and uncertainties apply. Table 6 gives further evidence that risks of 1 in 10^6 and less are generally ignored, while risks above 10^{-6}/year are of concern. Dangerous occupations, in which workers are somewhat compensated for risks assumed, carry risks of 10^{-4} and greater (Table 6); while many popular sports, several considered risky, carry risks of 10^{-5} and more [*Crouch and Wilson*, 1982]. Cancer risks from air pollution are approximately 10^{-5}/year, and the total fatality risk from air pollution is 10^{-4}/year [*Crouch and Wilson*, 1982].

With these remarks in mind we note that, except for the very polluted water supplies indicated in Table 4, drinking water risks are comparable to other risks society puts up with but tries to control. The mean and median estimates are moderate but less than 10^{-4}/year, apart from the five extreme cases. The 98th percentiles of the distributions are high, however, especially where there is bromoform present, and the uncertainty is large. Given that this is the case, none of the risks for drinking water supplies we calculated should be ignored. More careful experiments and the attendant risk analyses, as well as further regulatory action, should be considered.

EPA's Drinking Water Standards

Although cancer risk is an important consideration to the EPA in the setting of standards, it is not entirely consistent in its use of risk estimates. The federal standard for the total concentration of trihalomethanes is 100 μg/l [*Federal Register*, 1979]. The EPA defines total trihalomethanes as the sum of concentrations of the four halomethanes chloroform, bromoform, dibromomethane, and bromodichloromethane. The mean value of the risk for 100 μg/l of chloroform is 1.4×10^{-6}/year or 1×10^{-4}/lifetime. The 98th percentile is 6×10^{-4}/lifetime. We calculate the 98th percentile risk from 100 μg/l of bromoform as 600 times greater, partly because of the extreme uncertainty, and so a supply just meeting the standard and contaminated solely with chloroform poses much less risk than if it were just meeting the standard but contaminated mostly with bromoform. Bromoform is likely to be more carcinogenic than chloroform, which is 10 to 100 times as carcinogenic as trichloroethylene in animals. The EPA should put the allowed maximum contaminant levels (MCL's) in this order. Yet the proposed standards are not

TABLE 5a. R, The Average Risk of Drinking Water of Selected U.S. Cities

	Chloro-form	Bromodi-chloro-methane	Dibromo-chloro-methane	Bromo-form	1,2-Di-chloro-ethane	Carbon tetra-chloride	Methyl-ene chloride	Benzene	*m*-Di-chloro-benzene	*o*-Di-chloro-benzene	1,2,4 tri-chloro-benzene	Penta-chloro-phenol	Fluor-anthene	1,12-Benz-perylene	3,4-Ben-zopyrene	Indeno-(1,2,3-cd) pyrene
Annandale, Va.	4E−06	2E−06	9E−07	(2E−06)	(1E−08)	1E−09	5E−08	(4E−08)	(4E−09)	(2E−10)	(8E−11)	3E−08	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Atlanta, Ga.	1E−06	2E−06	4E−06	(2E−06)	(6E−09)	(1E−09)	(5E−08)	(4E−08)	(4E−09)	(2E−10)	(8E−11)	3E−08	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Baltimore, Md.	9E−07	2E−06	5E−06	(2E−06)	(6E−09)	(1E−09)	(2E−08)	(4E−08)	(4E−09)	(2E−10)	(8E−11)	1E−08	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Billings, Mont.	2E−07	6E−07	2E−06	(2E−06)	(6E−10)	(1E−09)	(2E−08)	(4E−08)	(4E−09)	(2E−10)	(8E−11)	*P*	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Birmingham, Ala.	1E−06	2E−06	2E−06	(2E−06)	(1E−08)	(1E−09)	(2E−08)	(8E−08)	(4E−09)	(2E−10)	(8E−11)	3E−09	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Brownsville, Tex.	5E−07	1E−05	2E−04	2E−03	(6E−09)	(1E−09)	(2E−08)	(4E−08)	(4E−09)	(2E−10)	(8E−11)	(1E−09)	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Cape Girardeau, Mo.	3E−06	6E−06	1E−05	6E−06	(1E−08)	1E−07	(5E−08)	6E−07	2E−08	7E−09	2E−07	6E−09	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Columbus, Ohio	3E−06	5E−06	1E−05	(2E−06)	(1E−08)	*P**	(5E−08)	(4E−08)	(4E−09)	(2E−10)	(8E−11)	(1E−09)	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Dayton, Ohio	4E−07	2E−06	2E−05	1E−04	(1E−09)	(1E−09)	(2E−08)	(4E−08)	(4E−09)	(2E−10)	(8E−11)	1E−09	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Elizabeth, N. J.	2E−06	3E−06	7E−06	(2E−06)	(6E−09)	(1E−09)	(5E−08)	(4E−08)	(4E−09)	(2E−10)	(8E−11)	6E−09	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Fort Worth, Tex.	6E−08	3E−06	3E−05	2E−04	(6E−10)	1E−09	(2E−08)	(8E−08)	(4E−09)	(2E−10)	(8E−11)	(1E−09)	2E−08	(3E−08)	(5E−08)	(1E−07)
Huntington, W. Va.	2E−06	6E−06	3E−05	4E−05	2E−08	2E−07	(2E−08)	4E−08	1E−07	4E−07	5E−10	1E−08	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Jackson, Miss.	4E−06	3E−06	3E−06	(2E−06)	(1E−08)	*P*	3E−08	(4E−08)	(4E−09)	(2E−10)	(8E−11)	2E−08	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Jersey City, N. J.	9E−07	2E−06	3E−06	(2E−06)	(6E−09)	(1E−09)	(2E−08)	(8E−08)	(4E−09)	(2E−10)	(8E−11)	1E−07	2E−08	(3E−08)	(5E−08)	(1E−07)
Kansas City, Mo.	6E−07	8E−07	2E−06	(2E−06)	(6E−09)	(1E−09)	(5E−08)	(8E−08)	(4E−09)	1E−09	(8E−11)	1E−08	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Lincoln, Neb.	1E−07	1E−06	8E−06	7E−05	(6E−10)	(1E−09)	(2E−08)	(4E−08)	(4E−09)	(2E−10)	(8E−11)	1E−09	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Los Angeles, Calif.	7E−07	1E−06	5E−06	(2E−06)	(6E−09)	(1E−09)	(2E−08)	(4E−08)	(4E−09)	(2E−10)	(8E−11)	7E−09	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Manchester, N. H.	1E−06	2E−06	7E−07	(2E−06)	(1E−08)	(1E−09)	4E−08	(4E−08)	(4E−09)	(2E−10)	(8E−11)	6E−09	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Melbourne, Fla.	8E−06	2E−05	1E−04	1E−04	(1E−08)	(1E−09)	(4E−08)	(4E−08)	(4E−09)	(2E−10)	(8E−11)	2E−08	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Montgomery, Ala.	3E−06	2E−06	2E−06	(2E−06)	(1E−08)	(1E−09)	(7E−08)	(4E−08)	(4E−09)	(2E−10)	(8E−11)	6E−09	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Newport, R. I.	3E−06	7E−06	2E−05	2E−05	(1E−08)	(1E−09)	*P*	(8E−08)	(4E−09)	(2E−10)	(8E−11)	7E−09	8E−09	(3E−08)	(5E−08)	(1E−07)
Norfolk, Va.	3E−06	7E−06	4E−06	(2E−06)	(1E−08)	(1E−09)	(2E−08)	(4E−08)	(4E−09)	(2E−10)	(8E−11)	3E−09	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Passaic Valley, N. J.	2E−06	3E−06	6E−06	(2E−06)	(6E−09)	9E−09	(5E−08)	(4E−08)	(4E−09)	(2E−10)	5E−10	1E−08	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Sacramento, Calif.	5E−07	8E−07	1E−06	(2E−06)	(6E−09)	(1E−09)	(2E−08)	(8E−08)	(4E−09)	(2E−10)	(8E−11)	9E−09	(8E−09)	(3E−08)	(5E−08)	(1E−07)
Topeka, Kan.	2E−06	7E−06	4E−05	1E−04	(1E−08)	4E−08	(5E−08)	(8E−08)	(4E−09)	(2E−10)	(8E−11)	4E−09	(8E−09)	(3E−08)	(5E−08)	(1E−07)

1E−06 represents 1×10^{-6} in ordinary scientific notation. Chemicals listed are those for which the average risk exceeds 1E−08 in at least one city. Parentheses indicate that the chemical was not detected; inside the parentheses is the average risk for exposure at the detection limit.

* *P* indicates that the chemical was detected but that the quantity present was not given.

TABLE 5b. R̂, The Median Risk of Drinking Water of Selected U.S. Cities

	Chloroform	Bromodichloromethane	Dibromochloromethane	Bromoform	1,2-Dichloroethane	Carbon tetrachloride	Methylene chloride	Bis(2-chloroethyl)ether	Benzene	m-Dichlorobenzene	o-Dichlorobenzene	1,2,4 trichlorobenzene	Pentachlorophenol	3,4 Benzofluoranthene	3,4-Benzopyrene	Indeno-(1,2,3-cd) pyrene
Annandale, Va.	1E−06	4E−07	1E−07	(1E−07)	(4E−09)	3E−10	2E−09	(2E−10)	(4E−08)	(2E−10)	(1E−11)	(9E−12)	3E−09	(1E−09)	(1E−08)	(2E−09)
Atlanta, Ga.	4E−07	4E−07	5E−07	(1E−07)	(2E−09)	(3E−10)	(2E−09)	(2E−10)	(4E−08)	(2E−10)	(1E−11)	(9E−12)	4E−09	(1E−09)	(1E−08)	(2E−09)
Baltimore, Md.	3E−07	3E−07	5E−07	(1E−07)	(2E−09)	(3E−10)	(1E−09)	(2E−10)	(4E−08)	(2E−10)	(1E−11)	(9E−12)	1E−09	(1E−09)	(1E−08)	(2E−09)
Billings, Mont.	6E−08	1E−07	2E−07	(1E−07)	(2E−10)	(3E−10)	(1E−09)	(2E−10)	(4E−08)	(2E−10)	(1E−11)	(9E−12)	P	(1E−09)	(1E−08)	(2E−09)
Birmingham, Ala.	4E−07	4E−07	3E−07	(1E−07)	(4E−09)	(3E−10)	(1E−09)	(2E−10)	(8E−08)	(2E−10)	(1E−11)	(9E−12)	3E−10	(1E−09)	(1E−08)	(2E−09)
Brownsville, Tex.	2E−07	3E−06	3E−05	1E−04	(2E−09)	(3E−10)	(1E−09)	(2E−10)	(4E−08)	(2E−10)	(1E−11)	(9E−12)	(2E−10)	(1E−09)	(1E−08)	(2E−09)
Cape Girardeau, Mo.	1E−06	1E−06	1E−06	3E−07	(4E−09)	5E−08	(2E−09)	3E−09	6E−07	1E−09	5E−10	2E−08	7E−10	(1E−09)	(1E−08)	(2E−09)
Columbus, Ohio	1E−06	1E−06	1E−06	(1E−07)	(4E−09)	P*	(2E−09)	9E−10	(4E−08)	(2E−10)	(1E−11)	(9E−12)	(2E−10)	(1E−09)	(1E−08)	(2E−09)
Dayton, Ohio	1E−07	4E−07	2E−06	5E−06	(4E−10)	(3E−10)	(1E−09)	(2E−10)	(4E−08)	(2E−10)	(1E−11)	(9E−12)	2E−10	(1E−09)	(1E−08)	(2E−09)
Elizabeth, N. J.	7E−07	6E−07	8E−07	(1E−07)	(2E−09)	(3E−10)	(2E−09)	(2E−10)	(4E−08)	(2E−10)	(1E−11)	(9E−12)	7E−10	(1E−09)	(1E−08)	(2E−09)
Fort Worth, Tex.	2E−08	7E−07	3E−06	1E−05	(2E−10)	4E−10	(1E−09)	(2E−10)	(8E−08)	(2E−10)	(1E−11)	(9E−12)	(2E−10)	(1E−09)	(1E−08)	(2E−09)
Huntington, W. Va.	6E−07	1E−06	3E−06	2E−06	5E−09	5E−08	(1E−09)	(2E−10)	4E−08	6E−09	3E−08	5E−11	1E−09	(1E−09)	(1E−08)	(2E−09)
Jackson, Miss.	1E−06	6E−07	4E−07	(1E−07)	(4E−09)	P	2E−09	(2E−10)	(4E−08)	(2E−10)	(1E−11)	(9E−12)	2E−09	(1E−09)	(1E−08)	(2E−09)
Jersey City, N. J.	3E−07	3E−07	3E−07	(1E−07)	(2E−09)	(3E−10)	(1E−09)	(2E−10)	(8E−08)	(2E−10)	(1E−11)	(9E−12)	1E−08	(1E−09)	(1E−08)	(2E−09)
Kansas City, Kan.	2E−07	2E−07	2E−07	(1E−07)	(2E−09)	(3E−10)	(2E−09)	(2E−10)	(8E−08)	(2E−10)	8E−11	(9E−12)	1E−09	(1E−09)	(1E−08)	(2E−09)
Lincoln, Neb.	4E−08	2E−07	9E−07	4E−06	(2E−10)	(3E−10)	(1E−09)	2E−10	(4E−08)	(2E−10)	(1E−11)	(9E−12)	2E−10	(1E−09)	(1E−08)	(2E−09)
Los Angeles, Calif.	2E−07	3E−07	6E−07	(1E−07)	(2E−09)	(3E−10)	(1E−09)	(2E−10)	(4E−08)	(2E−10)	(1E−11)	(9E−12)	8E−10	(1E−09)	(1E−08)	(2E−09)
Manchester, N. H.	3E−07	4E−07	8E−08	(1E−07)	(4E−09)	(3E−10)	2E−09	(2E−10)	(4E−08)	(2E−10)	(1E−11)	(9E−12)	7E−10	(1E−09)	(1E−08)	(2E−09)
Melbourne, Fla.	2E−06	4E−06	1E−05	6E−06	(4E−09)	(3E−10)	(2E−09)	(2E−10)	(4E−08)	(2E−10)	(1E−11)	(9E−12)	2E−09	(1E−09)	(1E−08)	(2E−09)
Montgomery, Ala.	9E−07	4E−07	2E−07	(1E−07)	(4E−09)	(3E−10)	(3E−09)	(2E−10)	(4E−08)	(2E−10)	(1E−11)	(9E−12)	7E−10	(1E−09)	(1E−08)	(2E−09)
Newport, R. I.	1E−06	1E−06	2E−06	9E−07	(4E−09)	(3E−10)	P	(2E−10)	(8E−08)	(2E−10)	(1E−11)	(9E−12)	8E−10	(1E−09)	(1E−08)	(2E−09)
Norfolk, Va.	9E−07	1E−06	4E−07	(1E−07)	(4E−09)	(3E−10)	(1E−09)	(2E−10)	(4E−08)	(2E−10)	(1E−11)	(9E−12)	3E−10	(1E−09)	(1E−08)	(2E−09)
Passaic Valley, N. J.	6E−07	6E−07	6E−07	(1E−07)	(2E−09)	3E−09	(2E−09)	(2E−10)	(4E−08)	(2E−10)	(1E−11)	5E−11	1E−09	(1E−09)	(1E−08)	(2E−09)
Sacramento, Calif.	2E−07	2E−07	1E−07	(1E−07)	(2E−09)	(3E−10)	(1E−09)	(2E−10)	(8E−08)	(2E−10)	(1E−11)	(9E−12)	1E−09	(1E−09)	(1E−08)	(2E−09)
Topeka, Kan.	6E−07	1E−06	4E−06	5E−06	(4E−09)	1E−08	(2E−09)	(2E−10)	(8E−08)	(2E−10)	(1E−11)	(9E−12)	5E−10	(1E−09)	(1E−08)	(2E−09)

Note that the median of the sum of the entries for a given city is about twice the sum of the medians. See Table 4 for the median of the sum. 1E−06 represents 1×10^{-6} in ordinary scientific notation. Chemicals listed are those for which the median risk exceeds 1E−09 in at least one city. Parentheses indicate that the chemical was not detected; inside the parentheses is the median risk for exposure at the detection limit.

*P indicates that the chemical was present but that the quantity was not given.

TABLE 5c. R_{98}, 98th Percentile of the Distribution for Annual Risk of Drinking Water of Selected Cities

	Chloroform	Bromodichloromethane	Dibromochloromethane	Bromoform	1,2-Dichloroethane	Carbon tetrachloride	Methylene chloride	Benzene	*m*-Dichlorobenzene	*o*-Dichlorobenzene	1,2,4 trichlorobenzene	Pentachlorophenol	Fluoranthene	1,12-Benzperylene	3,4 Benzopyrene	Indeno-(1,2,3-cd) pyrene
Annandale, Va.	3E−05	1E−05	7E−06	(2E−05)	(8E−08)	7E−09	3E−07	(4E−08)	(3E−08)	(1E−09)	(6E−10)	2E−07	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Atlanta, Ga.	9E−06	1E−05	3E−05	(2E−05)	(4E−08)	(7E−09)	(3E−07)	(4E−08)	(3E−08)	(1E−09)	(6E−10)	3E−07	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Baltimore, Md.	6E−06	1E−05	3E−05	(2E−05)	(4E−08)	(7E−09)	(2E−07)	(4E−08)	(3E−08)	(1E−09)	(6E−10)	9E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Billings, Mont.	1E−06	4E−06	1E−05	(2E−05)	(4E−09)	(7E−09)	(2E−07)	(4E−08)	(3E−08)	(1E−09)	(6E−10)	*P*	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Birmingham, Ala.	9E−06	1E−05	2E−05	(2E−05)	(8E−08)	(7E−09)	(2E−07)	(8E−08)	(3E−08)	(1E−09)	(6E−10)	2E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Brownsville, Tex.	3E−06	1E−04	2E−03	2E−02	(4E−08)	(7E−09)	(2E−07)	(4E−08)	(3E−08)	(1E−09)	(6E−10)	(1E−08)	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Cape Girardeau, Mo.	2E−05	4E−05	1E−04	4E−05	(8E−08)	1E−06	(3E−07)	6E−07	2E−07	5E−08	1E−06	4E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Columbus, Ohio	2E−05	4E−05	8E−05	(2E−05)	(8E−08)	*P**	(3E−07)	(4E−08)	(3E−08)	(1E−09)	(6E−10)	(1E−08)	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Dayton, Ohio	2E−06	1E−05	1E−04	7E−04	(8E−09)	(7E−09)	(2E−07)	(4E−08)	(3E−08)	(1E−09)	(6E−10)	1E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Elizabeth, N. J.	1E−05	2E−05	5E−05	(2E−05)	(4E−08)	(7E−09)	(3E−07)	(4E−08)	(3E−08)	(1E−09)	(6E−10)	4E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Fort Worth, Tex.	4E−07	2E−05	2E−04	2E−03	(4E−09)	8E−09	(2E−07)	(8E−08)	(3E−08)	(1E−09)	(6E−10)	(1E−08)	8E−08	(1E−07)	(3E−07)	(6E−07)
Huntington, W. Va.	1E−05	5E−05	2E−04	3E−04	1E−07	1E−06	(2E−07)	4E−08	1E−06	3E−06	4E−09	9E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Jackson, Miss.	3E−05	2E−05	3E−05	(2E−05)	(8E−08)	*P*	2E−07	(4E−08)	(3E−08)	(1E−09)	(6E−10)	1E−07	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Jersey City, N. J.	6E−06	1E−05	2E−05	(2E−05)	(4E−08)	(7E−09)	(2E−07)	(8E−08)	(3E−08)	(1E−09)	(6E−10)	8E−07	8E−08	(1E−07)	(3E−07)	(6E−07)
Kansas City, Kan.	4E−06	6E−06	2E−05	(2E−05)	(4E−08)	(7E−09)	(3E−07)	(8E−08)	(3E−08)	8E−09	(6E−10)	9E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Lincoln, Neb.	9E−07	9E−06	6E−05	5E−04	(4E−09)	(7E−09)	(2E−07)	(4E−08)	(3E−08)	(1E−09)	(6E−10)	1E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Los Angeles, Calif.	5E−06	1E−05	4E−05	(2E−05)	(4E−08)	(7E−09)	(2E−07)	(4E−08)	(3E−08)	(1E−09)	(6E−10)	5E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Manchester, N. H.	6E−06	1E−05	5E−06	(2E−05)	(8E−08)	(7E−09)	2E−07	(4E−08)	(3E−08)	(1E−09)	(6E−10)	4E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Melbourne, Fla.	5E−05	2E−04	7E−04	8E−04	(8E−08)	(7E−09)	(3E−07)	(4E−08)	(3E−08)	(1E−09)	(6E−10)	1E−07	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Montgomery, Ala.	2E−05	1E−05	1E−05	(2E−05)	(8E−08)	(7E−09)	(5E−07)	(4E−08)	(3E−08)	(1E−09)	(6E−10)	4E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Newport, R. I.	2E−05	5E−05	2E−04	1E−04	(8E−08)	(7E−09)	*P*	(8E−08)	(3E−08)	(1E−09)	(6E−10)	5E−08	4E−08	(1E−07)	(3E−07)	(6E−07)
Norfolk, Va.	2E−05	5E−05	3E−05	(2E−05)	(8E−08)	(7E−09)	(2E−07)	(4E−08)	(3E−08)	(1E−09)	(6E−10)	2E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Passaic Valley, N. J.	1E−05	2E−05	4E−05	(2E−05)	(4E−08)	6E−08	(3E−07)	(4E−08)	(3E−08)	(1E−09)	4E−09	8E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Sacramento, Calif.	4E−06	6E−06	8E−06	(2E−05)	(4E−08)	(7E−09)	(2E−07)	(8E−08)	(3E−08)	(1E−09)	(6E−10)	7E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)
Topeka, Kan.	1E−05	5E−05	3E−04	7E−04	(8E−08)	2E−07	(3E−07)	(8E−08)	(3E−08)	(1E−09)	(6E−10)	3E−08	(4E−08)	(1E−07)	(3E−07)	(6E−07)

1E−06 represents 1×10^{-6} in ordinary scientific notation. Chemicals listed are those for which the 98th percentile risk exceeds 1E−07 in at least one city. Parentheses indicate that the chemical was not detected; inside the parentheses is the 98th percentile risk from exposure at the detection limit.

* *P* indicates that the chemical was present but not quantified.

TABLE 6. Risks of Other Activities

Everyday Risks	Time to Accumulate a One in a Million Risk of Death	Average Annual Risk per Capita
Living in the United States		
Motor vehicle accident	1.5 days	2×10^{-4}
Falls	6 days	6×10^{-5}
Drowning	10 days	4×10^{-5}
Fires	13 days	3×10^{-5}
Firearms	36 days	1×10^{-5}
Electrocution	2 months	5×10^{-6}
Tornados	20 months	6×10^{-7}
Floods	20 months	6×10^{-7}
Lightning	2 years	5×10^{-7}
Animal bite or sting	4 years	2×10^{-7}
Occupational Risks		
General		
manufacturing	4.5 days	8×10^{-5}
trade	7 days	5×10^{-5}
service and government	3.5 days	1×10^{-4}
transport and public utilities	1 day	4×10^{-4}
agriculture	15 hours	6×10^{-4}
construction	14 hours	6×10^{-4}
mining and quarrying	9 hours	1×10^{-3}
Specific		
coal mining (accidents)	14 hours	6×10^{-4}
police duty	1.5 days	2×10^{-4}
railroad employment	1.5 days	2×10^{-4}
fire fighting	11 hours	8×10^{-4}

Other One in a Million Risks

Source of Risk	Type and Amount of Exposure: Examples
Cosmic rays	one transcontinental round trip by air
	living 1.5 months in Colorado compared to New York
	camping at 15,000 feet for 6 days compared to sea level
Other radiation	20 days of sea level natural background radiation
	2.5 months in masonry rather than wood building
	⅐ of a chest X ray using modern equipment
Eating and drinking	40 diet sodas (saccharin)
	6 pounds of peanut butter (aflatoxin)
	180 pints of milk (aflatoxin)
	200 gallons of drinking water from Miami or New Orleans
	90 pounds of broiled steak (cancer risk only)
Smoking	2 cigarettes

From *Crouch and Wilson* [1982].

exactly related to probable risk, as they should be (compare Table 7 and Table 8).

For individual contaminants, a 10^{-6} risk per year leads to the concentrations shown in Table 7. We note that the concentrations of chloroform giving an average risk of 10^{-6}/year is 30% less than the federal standard [*Federal Register*, 1979]. Also, rarely is only one important contaminant, such as chloroform, present in drinking water, and so the risk from drinking water in compliance with federal regulations may be substantially higher. For mixtures the calculation should be adjusted to limit the total risk to 10^{-6} per year, by using the techniques described above.

If the EPA wish to be inconsistent in the setting of risk-based standards, they should state why. Among possible reasons are that halomethanes are costly to reduce and enter water supplies as byproducts of a desirable technology, e.g., chlorination of water supplies to prevent disease. Trichloroethylene and tetrachloroethylene usually enter the supplies as industrial pollution, which might more easily and cost effectively be controlled. According to this idea, different risk-based standards may be in order; for example, use of 10^{-5}/year for the mixture produced through chlorination and

TABLE 7. Contaminant Concentration for $R = 10^{-6}$/year

	R_{98}	$\hat{R}$	$\bar{R}$	EPA Potential MCL's*
Trichloroethylene	165	1100	3400	5 to 500
Tetrachloroethylene	75	500	1500	5 to 500
Carbon Tetrachloride	30	200	625	5 to 500
1,1,1-Trichloroethane	5000	36,000	145,000	1000
1,2-Dichloroethane	10	80	250	1 to 100
Vinyl Chloride	5	35	125	1 to 100

Values in μg/l.

*From Table 8 of *Federal Register* [1982]. MCL is the maximum contaminant level permissible.

TABLE 8. Projected Upper Limit Lifetime Cancer Risk for Indicated Drinking Water Concentrations by Two Concentrations by Two Cancer Risk Calculations

	Projected Upper Limit Excess Lifetime Cancer Risk	Concentrations in Drinking Water, μg/l	
		CAG	NAS
Trichloroethylene	10^{-6}	280	450
	10^{-5}	28	45
	10^{-4}	2.8	4.5
Tetrachloroethlyene	10^{-6}	90	350
	10^{-5}	9	35
	10^{-4}	0.9	3.5
Carbon Tetrachloride	10^{-6}	40	450
	10^{-5}	4	45
	10^{-4}	0.4	4.5
1,2-Dichloroethane	10^{-6}	95	70
	10^{-5}	9.5	7
	10^{-4}	0.95	0.7
Vinyl Chloride	10^{-6}	200	100
	10^{-5}	20	10
	10^{-4}	2	1

Assumes: Lifetime exposure (70 years) by 70-kg adult. Consumption of 2 liters of water per day. Nonthreshold toxicity mechanism is operative at low doses in humans. Assimilation in humans at low doses is the same as animals at experimental doses. Interspecies (animal/human) dose scaling is proportional to body surface area. Note: CAG is the EPA Carcinogen Assessment Group. NAS is the National Academy of Sciences Safe Drinking Water Committee. Copied verbatim from *Federal Register* [1982, Table 3].

10^{-6}/year for all industrial chemicals. Other reasons for choosing different risk levels for different types of chemicals may be to account for persistence or the use of certain chemicals as surrogates for others, possibilities not included in the scheme here propounded.

APPENDIX: ORAL POTENCIES FOR PAH AND SOME OF THE CHLORINATED HYDROCARBONS LISTED IN TABLE 2

Risk estimates are conventionally obtained from human data or from lifetime experiments on animals in which the animals are exposed to the test chemical in the same manner as humans would be. When lifetime animal results or human data are not available, it has usually been maintained that risks cannot be estimated, as was the case when the National Academy of Sciences chose not to estimate the risks of 3,4-benzopyrene in drinking water [*NAS*, 1977]. However, we believe that the available data are adequate for risk estimation in many cases where human or lifetime animal studies cannot be found.

For all of the chemicals listed in Table 2 we believe there is sufficient data for risk estimation. The chemicals listed in Table 2 for which we have yet to derive values of potency are all either chlorinated hydrocarbons or polycyclic aromatic hydrocarbons (PAH).

Polycyclic Aromatic Hydrocarbons (PAH)

The potencies of these compounds are derived from animal carcinogenesis studies. Cancer has been induced in laboratory animals with the PAH 3,4-benzopyrene in numerous experiments. In several of these experiments, 3,4-benzopyrene was given orally and the experiment lasted for a long period of time, albeit not for the entire lifetime of the animals (Table A1). We obtain a potency for 3,4-benzopyrene from these experiments by applying a factor to correct for the length of the experiment. For the rest of the PAH listed in Table 2, we use results from mouse skin tests, which were performed to compare the carcinogenic activities of the various PAH. The potency of a particular PAH is extrapolated from the potency of 3,4-benzopyrene by comparing its skin activity with that of 3,4-benzopyrene.

When given orally, 3,4-benzopyrene consistently induces tumor growth. R. H. Rigdon and coworkers have extensively studied its induction of leukemias and lymphomas, as well as cancers of the stomach and lung, in laboratory mice [*Rigdon et al.*, 1967, 1969; *Rigdon and Neal*, 1966]. Unfortunately, their experiments were too short to be of use in potency calculations. There are, however, several rodent experiments lasting a year or longer, and we are much more comfortable using these long experiments for potency estimation. J. Borneff (*Borneff* [1963], as reported by *U.S. Department of Health, Education and Welfare* [1973*a*], and *Borneff et al.* [1968], as reported by *U.S. Department of Health, Education and Welfare* [1973*b*]) induced lung adenomas and stomach papillomas and carcinomas with 3,4-benzopyrene in experiments that lasted 500 days (see Table A1). He was able to affect the activity at a particular site by adding mineral oil or detergents to the feed or drinking water and administering the chemical either in the drinking water or feed. However, the potency, which we define as the highest significant value for any site in a particular experiment, did not vary by more than a factor of 4 in the Borneff experiments (Table A1).

Several other investigators also induced cancer of the forestomach in long-term experiments. All of the experiments we know of which lasted a year or longer where 3,4-benzopyrene was administered orally are listed in Table A1. We have estimated potencies from these experiments, using methods described in the body of the text. The values obtained are listed in the first column of Table A1. None of the experiments used were run for the lifetime of the animals, and so the potencies listed in the first column are underestimates; had the experiment run for the lifetime of the animals, more cancers probably would have been observed.

To take this into account, potency values are multiplied by a compensating factor f:

$$\beta_{\text{corrected}} = \beta_{\text{uncorrected}} f \tag{A1}$$

Armitage and Doll [1954] have observed that for many human tumors, incidence R by a given age t is proportional to t^{λ}, where λ is characteristic of a tumor:

$$R \sim t^{\lambda} \tag{A2}$$

Hence the potency from a short experiment is underestimated by a factor

$$f = \left(\frac{t_l}{t_e}\right)^{\lambda} \tag{A3}$$

where t_l is the natural lifetime of the animal and t_e is the age of the animal at the end of the experiment. For rodents, t_l is approximately 2 years. For human tumors of the type listed in Table A1, λ is approximately 5.6. In rodents, we assume that it is the same and so correct the values in Table A1 by computing:

$$\beta_{\text{corrected}} = \beta_{\text{uncorrected}} \left(\frac{24 \text{ months}}{t_e}\right)^{5.6} \tag{A4}$$

TABLE A1. Animal Potency of 3,4-Benzopyrene, Oral Route, Derived From Animal Bioassays Longer Than One Year

$\beta_{uncorrected}$	Tumor Type	Method of BAP Administration	Remarks	Duration of	Animal Age at the End of Experiment	f	$\beta_{corrected}$
			Chouroulinkov et al. [1967]				
0.123	forestomach papilloma	feed	...	14 months	496 days	8.7	1.07
			Borneff et al. [1968]				
0.130	stomach papilloma	drinking water	surfactants added to water	(500 days)*	(556 days)	(4.6)	0.60
0.245	stomach carcinoma						1.13
0.182	stomach papilloma	drinking water	surfactants and potassium chromate added to water	(500 days)*	(556 days)	(4.6)	0.84
0.219	stomach carcinoma						1.01
			Borneff [1963]				
0.367	lung adenoma	feed	mineral oil and detergent added to drinking water	500 days	(556 days)‡	(4.6)	1.68
0.16	stomach pap. + ker.†						0.74
0.159	stomach carcinoma	drinking water	detergent added to water	500 days	(556 days)	(4.6)	0.73
0.274	stomach papilloma						1.26
0.066	lung adenoma	drinking water	mineral oil and detergent added to drinking water	500 days	(556 days)	(4.6)	0.30
0.546	stomach papilloma						2.51
0.138	lung adenoma	feed	mineral oil added to feed	500 days	(556 days)	(4.6)	0.63
0.021	stomach papilloma						0.10
0.143	lung adenoma	drinking water	mineral oil added to feed; detergent added to water	500 days	(556 days)	(4.6)	0.66
0.123	stomach papilloma						0.56
			Fedorenko et al. [1967]				
0.149	stomach carcinoma	gavage: 10 times	to fasting mice	19 months	21–22 months	1.9	0.28
0.807	stomach papilloma						1.49
			Gibel [1964]				
0.015	esophagus and forestomach papilloma	daily gavage for 1 year	to Sprague Dawley rats	12 months	67 weeks	11.7	0.17
			Biancinifiori et al. [1967]				
0.27	stomach carcinoma	gavage, 30 times	....	65 weeks	73 weeks	7.3	1.96

Except for the Gibel experiment, all experiments were performed on mice, of a variety of strains.
*It was assumed that the 1968 Borneff experiment was run under the same protocol as the 1963 Borneff experiment.
†For stomach papillomas and keratosis combined.
‡It was assumed that the experiment began when the animals were 8 weeks of age.

where t_e is expressed in months. The corrected potencies are listed in the last column of Table A1. The values of potency obtained are surprisingly consistent, considering the variety of strains and experimental conditions, with the largest only a factor of 15 from the smallest value. To obtain a single value for 3,4-benzopyrene, we took a geometric mean. Using a single value of potency for each of the references, the geometric mean was found to be 0.93 with a logarithmic standard deviation of 0.87.

No long-term oral bioassays were found for any of the other PAH listed in Table 2, although mouse skin-painting experiments were available on all of them. In one skin-painting experiment, in which both 3,4-benzofluoranthene (B(b)F) and 3,4-benzopyrene were repeatedly applied, B(b)F was less potent by about a factor of 10 [*Wynder and Hoffman*, 1959]. In an initiation experiment, B(b)F was about 1/40th as powerful as 3,4-benzopyrene [*Van Duuren et al.*, 1966]. We assume that B(b)F would be about 1/10th as potent as 3,4-benzopyrene in an oral study. In applying this assumption, we note that we may be underestimating the relative potency of B(b)F by a factor of 5 or more ($\beta = 9 \times 10^{-2}$, but $\sigma_x{}^2 = [\ln (5)]^2 + (0.87)^2 = 1.83^2$).

Hoffman and Wynder [1966], as reported by *International Agency for Research on Cancer* [1973], topically applied indeno(1,2,3-cd)pyrene (IP) as well as 3,4-benzopyrene thrice weekly for 1 year. In this experiment, 3,4-benzopyrene was at least 20 times as active as IP. We assume that IP is less than 1/10th as potent as 3,4-benzopyrene through the oral route, but to account for the looseness of the extrapolation, assume a large uncertainty ($\beta = 0.09$, $\sigma_x{}^2 = [\ln (10)]^2 + (0.87)^2 = 2.46^2$).

In an 80-week skin painting experiment, *Horton and Christian* [1974] tested the complete and cocarcinogenic properties of several PAH, including 3,4-benzopyrene and fluoranthene. In this experiment 3,4-benzopyrene was at least 40 times more potent than fluoranthene as a cocarcinogen and 30 times more potent as a complete carcinogen. Hence we assume a potency of 3×10^{-2} for fluoranthene, with large uncertainty ($\sigma_x = 2.5$).

In one skin painting experiment, 1,12-benzperylene was not active at doses in which other PAH were highly active [*Lijinsky and Saffiotti*, 1965]. From the *Van Duuren et al.* [1966, 1970] experiments we can deduce that 1,12-benzperylene may be less potent than 3,4-benzopyrene in initiation by a factor of 250; however, 1,12-benzperylene can also act as a cocarcinogen and was found to be half as potent as pyrene in cocarcinogenic activity [*Van Duuren et al.*, 1973]. Pyrene was about 1/20th as potent as benzpyrene as a cocarcinogen in the *Horton and Christian* [1974] experiment. These facts indicate that, orally, 1,12-benzperylene may be less than 1/50th as potent as 3,4-benzopyrene ($\beta = 0.02$, $\sigma_x = 2.5$).

Chlorinated Hydrocarbons

A number of chlorinated hydrocarbons tested in the standard NCI bioassays have produced noncarcinogenic effects, such as liver and kidney toxicity, as well as liver cancers or leukemia in mice and kidney and/or endocrine cancer in rats. In fact, acute oral toxicity was found to be strongly correlated with carcinogenic potency for those chlorinated hydrocarbons

TABLE A2 Potency β Estimated from LD_{50} Values for Some Chlorinated Hydrocarbons

Chemical	LD_{50}	σ_2	β, mg kg day	σ_x	LD_{50} References
Methylene Chloride	1270	1.36	2.5×10^{-3}	2.13	*Kimura et al.* [1971]; *NIOSH* [1980]
p-Dichlorobenzene	2132	1.00	1.4×10^{-3}	1.88	*Spencer* [1973]
o-Dichlorobenzene	500	0.36*	6.9×10^{-3}	1.70	*NIOSH* [1980]
m-Dichlorobenzene	> 50	...	$< 8.8 \times 10^{-2}$	(2.00)	we assume that the meta isomer is no more than 10 times as toxic as the *p*- and *o*- isomers
1,2,4-trichlorobenzene	761	0.36*	4.4×10^{-3}	1.70	*Brown et al.* [1969]
2,4-dichlorophenol	1765	0.73	1.7×10^{-3}	1.72	*Kobayuski et al.* [1972]; *NIOSH* [1980]; *Vernot et al.* [1972]
pentachlorophenol	102.5	0.68	4.0×10^{-2}	1.69	*NIOSH* [1980]; *Deichmann et al.* [1942]; *Gaines* [1969]; *Stohlman* [1951]; *McGaveck et al.* [1941]

*Since only one LD_{50} value was found, we assume that the uncertainty in the LD_{50} is the same as that for an arbitrary LD_{50} found in the literature [*Zeise et al.*, 1982].

tested by the NCI [*Zeise et al*, 1983]. The relationship derived is used to predict carcinogenic activity for the untested chlorinated hydrocarbons in Table 2 given their acute toxicity. The relationship is

$$\tilde{\beta} = 6.5(LD_{50})^{-1.1} \tag{A5}$$

where β is lognormally distributed with median $\log_e(\tilde{\beta})$ and standard deviation (σ_1) 1.52. Uncertainty measures on potency (σ_x) must include both the uncertainty from using the relationship (σ_1) and the uncertainty in the value of the LD_{50} used (σ_2):

$$\sigma_x^2 = \sigma_1^2 + (1.1^2)\sigma_2^2 \tag{A6}$$

The potency values derived, together with the LD_{50} values, their references, and the uncertainties, are listed in Table A2.

Notation

- b EPA Carcinogen Assessment Group's estimate of potency.
- d_i average concentration of chemical i in drinking water, μg/l.
- D average daily dose, mg/kg of bodyweight/day.
- E high to low dose extrapolation factor.
- K_{ba} interspecies extrapolation factor, from species a to species b.
- $P(\ )$ probability density function.
- R lifetime cancer risk.
- $\bar{R}$ average annual cancer risk.
- $\tilde{w}$ median value of w.
- $\bar{w}$ average value of w.
- w^{98} 98th percentile of w.
- α backround lifetime tumor incidence.
- β carcinogenic potency.
- σ standard deviation of $\log_e(R)$.
- σ_x standard deviation of $\log_e(\beta)$.
- σ_k standard deviation of $\log_e(K)$.
- σ_d standard deviation of $\log_e(d)$.

References

Armitage, P., and R. Doll, The age distribution of cancer and a multistage theory of carcinogenesis, *Br. J. Cancer, 8*, 1–12, 1954.

Berenblum, I., *Carcinogenesis as a Biological Problem*, North-Holland, Amsterdam, 1974.

Biancifiori, C., F. Caschera, F. E. Giornelli-Santilli, and E. Buccarelli, The action of oestrone and four carcinogens in intact and ovarectomised BALB/C/C_8/SE mice, *Br. J. Cancer, 21*, 452–459, 1967.

Borneff, J., *Arch. Hyg. Bakteriol., 147*(1), 28–40, 1963.

Borneff, J., K. Englehart, W. Griem, H. Kunte, and J. Reichart, 3,4-benzpyrene and potassium chromate ingestion in mice, *Arch. Hyg. Bakteriol., 152*, 45–53, 1968.

Brown, V. K. H., C. Muir, and E. Thorpe, The acute toxicity and skin irritant properties of 1,2,4-trichlorobenzene, *Ann. Occup. Hyg., 12*, 209–212, 1969.

Chouroulinkov, I., A. Gentil, and M. Guerin, Etude de l'activité carcinogène du 9,10-dimethyl-benzanthracène et du 3,4-benzopyrène administrés par voie digestive, *Bull. Cancer, 54*(1), 67–78, 1967.

Crouch, E. A. C., Uncertainties in interspecies extrapolation of carcinogenic potency, *EHP Environ. Health Perspect., 50*, 321–327, 1983.

Crouch, E. A. C., and R. Wilson, Interspecies comparison of carcinogenic potency, *J. Toxicol. Environ. Health, 5*, 1095–1118, 1979.

Crouch, E. A. C., and R. Wilson, Regulation of carcinogens, *Risk Anal., 1*, 47–57, 1981.

Crouch, E. A. C., and R. Wilson, *Risk/Benefit Analysis*, Ballinger, Cambridge, Mass., 1982.

Deichmann, W., W. Machle, K. V. Kitzmiller, and G. Thomas, Acute and chronic effects of pentachlorophenol and sodium pentachlorophenate upon experimental animals, *J. Pharmacol. Exp. Ther., 76*, 104–117, 1942.

Environmental Protection Agency (EPA), The national organics monitoring survey, report, Office of Water Supply, Tech. Support Div., Washington, D. C., 1977.

Environmental Protection Agency (EPA), Draft criteria document for trichloroethylene, report, Office of Drinking Water, Criteria and Standards Div., Washington, D. C., November 1981.

Federal Register, National interim primary regulations, Control of trihalomethane in drinking water: Final rule, *44*, 68624, 1979.

Federal Register, National revised primary drinking water regulations, Volatile synthetic organic chemicals in drinking water, Advanced notice of primary rulemaking, *47*, 9350–9358, 1982.

Fedorenko, Z. P., and N. Y. Yanysheva, Experimental reproduction of tumours of the central part of the stomach of mice by administration of various doses of 3,4-benzopyrene, *Hyg. Sanit.*, *32*(5), 168–173, 1967.

Gaines, T. B., Acute toxicity of pesticides, *Toxicol. Appl. Pharmacol.*, *14*, 515–534, 1969.

Gibel, V. W., Experimenteller Beitrag Zur Synkarzinogenese beim Speiserohrenkarzinom, *Krebsarzt*, *19*, 268–272, 1974.

Hoffmann, D., and E. L. Wynder, Beitrag Zur carcinogen Wirkung von Dibenzopyrenen, *Z. Krebsforsch.*, *68*, 137, 1966.

Hoston, A. W., and G. M. Christian, Cocarcinogenic versus incomplete carcinogenic activity among aromatic hydrocarbons: Contrasts between chrysene and benz(b)triphenylene, *J. Natl. Cancer Inst. U.S.*, *53*, 1017–1020, 1974.

Innes, J. R. M., et al., Bioassay of pesticides and industrial chemicals for tumorigenicity in mice: A preliminary report, *J. Natl. Cancer Inst. U.S.*, *42*, 1101–1114, 1969.

International Agency for Research on Cancer (IARC), *Certain Polycyclic Aromatic Hydrocarbons and Heterocyclic Compounds*, vol. 3, *IARC Monogr. Eval. Carcinogenic Risk Chem. Man*, Lyon, France, 1973.

Kimura, E. T., D. M. Ebert, and P. W. Dodge, Acute toxicity and limits of solvent residue for sixteen organic solvents, *Toxicol. Appl. Pharmacol.*, *19*, 699–704, 1971.

Kobayashi, S., S. Toida, H. Kawamura, H. S. Chang, T. Fukuda, and K. Kawaguchi, Chronic toxicity of 2,4-dichlorophenol in mice, *J. Med. Soc. Toho Univ.*, *19*, 356–362, 1972.

Lijinsky, W., and U. Saffiotti, Relation between structure and skin tumorigenic activity among hydrogenated derivatives of several polycyclic aromatic hydrocarbons, *Ann. Ital. Dermatol. Clin. Sper.*, *19*(1), 34–44, 1965.

Maltoni, C., G. Lefemine, A. Ciliberti, G. Cotti, and Carretti, Vinyl chloride carcinogenicity bioassays (BT project) as an experimental model for risk identification and assessment in environmental and occupational carcinogenesis, in *Epidemiologie Animale et Epidemiologie Humaine: le Cas du Chlorure de Vinyle Monomere*, pp. 15–112, Club de Carcerogenese Chimique, Paris, 1979.

McGavack, T. H., L. J. Boyd, F. V. Piccione, and R. Terranova, Acute and chronic intoxications with sodium pentachlorophenate in rabbits, *J. Ind. Hyg. Toxicol.*, *23*, 239–251, 1941.

National Academy of Sciences (NAS), *Drinking and Health*, p. 692, National Research Council, Safe Drinking Water Committee, National Academy of Sciences, Washington, D. C., 1977.

National Institute for Occupational Safety and Health (NIOSH), Registry of toxic effects of chemical substances, *Publ. DHHS (NIOSH) 80-111*, U.S. Dep. of Health and Human Serv., Cincinnati, Ohio, 1980.

Pochin, E. E., Acceptance of risk, *Br. Med. Bull.*, *31*(3), 184–190, 1975.

Poirier, L. A., G. D. Stoner, and M. B. Shimkin, Bioassay of alkyl halides and nucleotide base analogs by pulmonary tumor response in Strain A mice, *Cancer Res.*, *35*, 1411–1415, 1975.

Rigdon, R. H., and J. Neal, Gastric carcinomas and pulmonary adenomas in mice fed benzo(a)pyrene, *Tex. Rep. Biol. Med.*, *24*(2), 195–207, 1966.

Rigdon, R. H., J. Neal, and J. Mack, Leukemia in mice fed benzo(a)pyrene, *Tex. Rep. Biol. Med.*, *25*(3), 422–436, 1967.

Rigdon, R. H., M. C. Benge, H. Kirchoff, J. Mack, and J. Neal, Leukemia in mice fed benzo(a)pyrene: A clinical, pathologic and hematologic study, *Tex. Rep. Biol. Med.*, *27*(3), 803–820, 1969.

Simmon, V. F., K. Kauhanen and R. G. Tardiff, in *Progress in Genetic Toxicology, Proceedings of the 2nd International Conference on Environmental Mutagens*, edited by D. Scott, B. A. Bridges, and F. H. Sobels, pp. 249–264, Elsevier North-Holland, New York, 1978.

Spencer, E. Y., Guide to chemicals used in crop protection, *Publ. 1093*, Res. Branch, Agric. Can., Ottawa, 1973.

Stohlman, E. F., Acute toxicity of pesticides, *Toxicol. Appl. Pharmacol.*, *14*, 515–524, 1969.

Theiss, J. C., G. D. Stoner, M. B. Shimkin and E. K. Weisburger, Test for carcinogenicity of organic contaminants of United States drinking water by pulmonary response in Strain A mice, *Cancer Res.*, *37*, 2717–2720, 1977.

United Kingdom Royal Commission on Environmental Pollution, Sixth report: Nuclear power and the environment, *Cmnd. 6618*, Her Majesty's Stationery Office, London, England, 1976.

U.S. Department of Health, Education and Welfare, Survey of compounds which have been tested for carcinogenic activity: 1961–1967 volume, section II, *DHEW Publ. (NIH) 73-35*, U.S. Publ. Health Serv., Washington, D. C., 1973*a*.

U.S. Department of Health, Education and Welfare, Survey of compounds which have been tested for carcinogenic activity: 1968–1969 supplement, *DHEW Publ. (NIH) 73-453*, U.S. Publ. Health Serv., Washington, D. C., 1973*b*.

Van Duuren, B. L., A. Sivak, A. Segal, L. Orris, and L. Langseth, Tumor promoting agents of tobacco leaf and tobacco smoke condensate, *J. Natl. Cancer Inst. U.S.*, *37*, 519–526, 1966.

Van Duuren, B. L., A. Sivak, B. M. Goldschmidt, C. Katz, and S. Melchionne, Initiating activity of aromatic hydrocarbons in two stage carcinogenesis, *J. Natl. Cancer Inst. U.S.*, *44*, 1167–1173, 1970.

Van Duuren, B. L., C. Katz, and B. M. Goldschmidt, Cocarcinogenic agents in tobacco smoke, *J. Natl. Cancer Inst. U.S.*, *51*, 703–705, 1973.

Vernot, E. H., J. D. MacEwen, C. C. Haun and E. R. Kinkead, Acute toxicity and skin corrosion data for some organic and inorganic compounds and aqueous solutions, *Toxicol. Appl. Pharmacol.*, *42*, 417–423, 1977.

Wilson, R., and M. Fiering, Attempts to establish a risk by analogy, *Risk Anal.*, in press, 1983.

Wynder, E. L., and D. Hoffman, The carcinogenicity of benzofluoranthenes, *Cancer*, *12*, 1194, 1959.

Zeise, L., R. Wilson, E. A. C. Crouch, and M. Fiering, Use of acute toxicity to estimate carcinogenic potency, in Health and Environmental Effects Document: Non-Regulatory and Cost Effective Control of Carcinogenic Hazard, report, Dep. of Energy, Health and Assessment Div., Office of Energy Res., Energy and Environ. Policy Ctr., Harvard Univ., Cambridge, Mass., September 1982.

Zeise, L., R. Wilson, and E. Crouch, Use of acute toxicity to estimate carcinogenic risk, *Risk Anal.*, in press, 1983.

E. Crouch, R. Wilson, and L. Zeise, Energy and Environmental Policy Center, Jefferson Physical Laboratory, Harvard University, Cambridge, MA 02138.

(Received May 6, 1983;
revised September 9, 1983;
accepted September 13, 1983.)

4.0 RISK ASSESSMENT

In establishing priorities for remediation or monitoring, it is important to consider the health risk associated with a specific sample or location. In most cases, relatively high concentrations of contaminants must be present to constitute an acute health hazard. However, extremely low dose levels of chronic toxicants can present a significant risk if exposure occurs over the lifetime of the organism. The chemical constituents and concentrations of soil and water samples have been reviewed in order to estimate their chronic toxic potential. The lifetime cancer risk associated with consumption of the various chemicals detected in soil and groundwater samples at the Manana - Mary Wheeler #1-E well site has been estimated using the procedures of Crouch et al. (1983). This procedure can be used to estimate the risk of individual chemicals, as was done for the soil samples; or, the procedure can be used to estimate the cumulative cancer risk for mixtures of chemicals, as was done for the groundwater samples. The risk equation takes into account the carcinogenic potential of each chemical, the variability of the data used to estimate carcinogenic potential, and the concentration of the chemical. The major limitations of this equation are that extrapolations must be made from the high dose used in animal testing to the low dose which occurs in most environmental samples; and, extrapolations must be made from the animal species in which toxicity testing was conducted and humans for which the risk is being estimated.

For groundwater, the risk equation assumes that a 70 kg human will consume 2 liters of water per day for an entire lifetime. The equation can be used to estimate the mean, median, and 98th percentile risk. The mean risk is typically used to assess the hazard of individual chemicals or mixtures in most groundwater samples. The median risk is usually less than the mean risk, and should only be used if the risk of human exposure is extremely low; while, the 98th percentile risk is a conservative estimate and can be used if potable water wells are believed to be within the plume of contaminated groundwater. For the purposes of this review, the mean risk will be used.

4.1 SOIL

The results from the estimation of risk for individual chemicals detected in the soil are provided in Table 4-1. The oral rat lethal dose or tumorigenic dose for chrysene and acenaphthene could not be located in the literature. However, chrysene is described as a potential carcinogen (Lewis and Tatken, 1984). Thus, the carcinogenic potential for chrysene should be comparable to that for fluoranthene. In addition, a comparison based on chemical structure suggests that the carcinogenic potential of acenaphthene should be comparable to naphthalene. The adsorptive properties of soil should prevent a significant amount of these chemicals from reaching groundwater. However, in order to provide a higher level of security, soil samples will be considered to present a potential risk to human health if the soil concentration incurs an estimated risk of greater than 10 in a million.

Three soil samples contained a concentration of chemical with an estimated risk above a mean of 100 in a million. Soil sample P-N contained 178 ppb fluoranthene which incurs an estimated risk of 148 in a million (Table 4-1). The risk associated with chrysene is likely equal to that for fluoranthene in this soil sample. The estimated risk associated with fluoranthene in soil sample T-1W is 137 in a million; this sample also contained xylene at a concentration which incurs an estimated risk of 1 in

Table 4-1. Risk Factors for Soil Samples Collected at the Manana - Mary Wheeler #1-E Well Site.

Sample I.D.	Constituent	Conc. (ppm)	Mean R	Median R	98th Percentile R98
P-N	Fluoranthene	0.178	1.48E-04	2.21E-06	7.29E-04
	Chrysene	0.118			
T-1W	Fluoranthene	0.165	1.37E-04	2.05E-06	6.76E-04
T-2E	Napthalene	3.901	2.79E-05	2.65E-06	2.04E-04
	Acenapthene	3.584			
BG-1	1,2-Dichloropropane	0.61	7.07E-06	1.03E-07	3.45E-05
P-N	Toluene	1.2	1.61E-06	4.23E-07	1.10E-05
	Xylene	17.8	2.54E-05	7.05E-06	1.73E-04
P-W	Benzene	2.6	3.20E-06	1.04E-06	2.09E-05
	Toluene	34.3	4.59E-05	1.24E-05	3.15E-04
	Xylene	177.2	2.52E-04	7.02E-05	1.72E-03
P-S	Chlorobenzene	0.37	3.37E-06	1.48E-07	2.20E-05
	Xylene	0.76	1.08E-06	3.01E-07	7.38E-06
P-E	Xylene	2.1	2.99E-06	8.32E-07	2.04E-05
T-1W	Xylene	0.73	1.04E-06	2.89E-07	7.09E-06
T-1C	Toluene	0.16	2.14E-07	5.76E-08	1.47E-06
T-1E	Xylene	0.98	1.40E-06	3.88E-07	9.52E-06
RP-1B	Vinyl chloride	4.3	1.14E-04	3.44E-05	7.64E-04
T-2C	Toluene	0.26	3.48E-07	9.36E-08	2.39E-06
	Xylene	0.94	1.40E-06	3.72E-07	9.13E-06
T-2E	Benzene	0.22	2.71E-07	8.80E-08	1.77E-06
	Toluene	0.35	4.68E-07	1.26E-07	3.47E-06
T-3C	Chlorobenzene	0.19	1.73E-06	7.60E-08	1.13E-05

Note: This table revised 4/17/90.

a million (Table 4-1). The maximum risk associated with a soil sample at the Manana - Mary Wheeler #1-E well site was 252 in a million for xylene in soil sample P-W. This sample also had a relatively high risk for toluene (45.9 in a million). The concentration of vinyl chloride in soil sample RP-1B incurs an estimated risk of 114 in a million (Table 4-1). This soil may present the greatest risk of those investigated, as vinyl chloride is a suspected human carcinogen with a high vapor pressure. Thus, the potential for exposure via either air or groundwater exists.

Other soil samples with chemicals at a concentration which incurs an estimated risk of greater than 10 in a million include T-2E (naphthalene's risk is 28 in a million), P-N (xylene's risk is 25 in a million), and P-W (toluene's risk is 46 in a million). Thus, the soil sampling locations for which chemical concentrations suggest the greatest estimated carcinogenic risk appear to be P-N, T-1W, P-W and RP-1B (Table 4-1).

4.2 GROUNDWATER

The presence of toxic chemicals in groundwater presents a more imminent risk to human health than does their presence in soil. Thus, any groundwater sample with a mean risk of greater than 1 in a million may indicate the need for continued monitoring at a minimum. At the conclusion of the risk assessment, it was noted that the maximum carcinogenic risk estimated for groundwater at the Mary Wheeler #1-E site is no greater than that estimated for drinking water from several large cities. The concentration of indeno(1,2,3-c,d)pyrene in sample EPNG-4 incurs the maximum estimated risk of 15 in a million. Methylene chloride, which has been suggested to have been introduced by the analytical laboratory, incurs an estimated risk of .009 in a million at a concentration of 2.1 ppb in water sample EPNG-1 (Table 4-2). The maximum estimated risk for a water

Table 4-2. Risk Factors for Individual Chemicals in Water Samples Collected at the Manana - Mary Wheeler #1-E Well Site.

Sample I.D.	Constituent	Conc. (ppb)	Mean R	Median R	98th Percentile R98
EPNG-1	Methylene chloride	2.1	9.34E-09	1.85E-09	6.76E-08
	Xylene	0.34	4.84E-10	1.35E-10	3.30E-09
EPNG-2A	Benzene	8.1	9.98E-09	3.24E-09	6.51E-08
	Ethylbenzene	37.4	1.89E-08	5.09E-09	1.30E-07
	Xylene	192.4	2.74E-07	7.62E-08	1.87E-06
EPNG-2B	Benzene	1.6	1.97E-09	6.40E-10	1.29E-08
	Ethylbenzene	1.2	6.06E-10	1.63E-10	4.17E-09
	Xylene	12.1	1.72E-08	4.79E-09	1.18E-07
EPNG-3	Benzene	0.4	4.93E-10	1.60E-10	3.21E-09
	Ethylbenzene	4.3	2.17E-09	5.85E-10	1.49E-08
	Xylene	13.54	1.62E-07	4.50E-08	1.10E-06
	Toluene	0.33	4.41E-10	1.19E-10	3.03E-09
EPNG-4	Benzene	0.95	1.17E-09	3.80E-10	7.63E-09
	Benzo(b)fluoranthene	2	5.50E-07	7.44E-08	4.06E-06
	Indeno(1,2,3-cd)pyrene	6	1.50E-05	2.23E-07	7.37E-05
S-5	Benzene	0.24	2.96E-10	9.60E-11	1.93E-09
	Toluene	0.32	4.28E-10	1.15E-10	2.94E-09

Note: This table revised 4/17/90.

sample was incurred by sample EPNG-2A. For this sample, the concentration of xylene yields an estimated cancer risk of .27 in a million, (Table 4-2). Xylene in samples EPNG-2B and EPNG-3 is present at concentrations which incur estimated risks of .017 in a million and 0.162 in a million, respectively.

The mean estimated cumulative cancer risk for the mixtures of chemicals in the groundwater samples (see Table 4-3) ranged from a low of .0007 in a million for sample S-5 to the high of 15 in a million for the mixture of chemicals in sample EPNG-4. Except for sample EPNG-4, all groundwater samples had an estimated risk of less than one in ten million. Crouch et al. (1983) suggest that a person exposed to a risk of 1 in a million per year has a life expectancy reduced by only one day. In addition, their review of drinking water quality from cities in the United States indicates that the mean annual cancer risk was greater than one in a million for all 25 cities investigated (Crouch et al., 1983).

Only one groundwater sample incurred an estimated risk which was appreciably greater than 1 in a million. For each of the other groundwater samples, the estimated carcinogenic risk was less than one in ten million. These data indicate that only one well at the Manana - Mary Wheeler #1-E well site may present a threat to human health if the plume of contamination reaches wells used for the production of drinking water. In addition, drinking water from 5 of 25 cities reviewed by Crouch et al. (1983) had estimated cancer risks of greater than 100 in a million.

Table 4-3. Estimated Cumulative Cancer Risk of Drinking Groundwater from Selected Wells at the Manana - Mary Wheeler #1-E Well Site.

Well I.D.	Risk (x 10^6)*		
	Mean	Median	98th Percentile
EPNG-1	0.01	0.002	0.07
EPNG-2A	0.04	0.02	0.2
EPNG-2B	0.02	0.008	0.13
EPNG-3	0.02	0.008	0.14
EPNG-4	15	0.6	87
OCD-1			
S-1			
S-5	0.0007	0.0003	0.004

*** Carcinogenic risk estimated using procedures of Crouch et al. (1983) based on a 70-kg human consuming 2 liters of water per day for 70 years.**

Note: This table revised 4/17/90.

CDS LABORATORIES
P O BOX 2605
DURANGO, CO 81302

(303) 247-4220

El Paso Natural Gas
P O Box 4990
Farmington, NM 87499

January 30, 1990

METHOD 8240

CDS ID: 2035
SAMPLE ID: F90013 Flora Vista, NM Water Well FV-1
DATE TAKEN: 01/10/90
TIME TAKEN: 1050
DATE REC'D: 01/11/90
COC: Yes

Volatile Organics	Results ppm	Detection Limit
Acetone	< .100	.100
Acrolein	< .010	.010
Acrylonitrile	< .010	.010
Benzene	< .005	.005
Bromoform	< .005	.005
Bromomethane	< .010	.010
Carbon tetrachloride	< .005	.005
Chlorobenzene	< .005	.005
Chloroethane	< .010	.010
Chloroform	< .005	.005
Chloromethane	< .010	.010
cis-1,3-Dichloropropene	< .005	.005
Dibromochloromethane	< .005	.005
Dichlorobromomethane	< .005	.005
Dichlorodifluoromethane	< .010	.010
Ethyl Benzene	< .005	.005
Methylene chloride	< .005	.005
Tetrachloroethylene	< .005	.005

Volatile Organics (Cont.)	Results ppm	Detection Limit
Toluene	< .005	.005
trans-1,2-Dichloroethylene	< .005	.005
trans-1,3-Dichloropropene	< .005	.005
Trichloroethylene	< .005	.005
Trichlorofluoromethane	< .010	.010
Vinyl chloride	< .010	.010
1,1,1-Trichloroethane	< .005	.005

Approved by: Joe Bowden Checked by: SKD

Dr. Joe Bowden, Director

EL PASO NATURAL GAS COMPANY

ENVIRONMENTAL SAMPLING DATA

\# 2035

Facility No. 5216 Sample Matrix WATER Sample No. F90013 Time 1050 24 Hr. Clk.

Sample Location FLORA VISTA, NM Charge

Sampling Site Description WATER WELL FV-1

Date of Collection (MMDDYY) 071090 Collection Method X Grab ☐ Comp. ____ hrs.

Sample Collected By KEN BEASLEY / NORMAN NORVELLE Phone 505-599-2182

Laboratory Conducting Analysis CDS LABS, DURANGO, CO.

ANALYSIS REQUESTED *(check appropriate blocks)*

	GROUP A		Hardness		Residue, Nonfilterable		GROUP T
	Ammonia		Iron		Residue, Settleable		Benzene
	Chemical Oxygen Demand		Lead		Residue, Volatile		Benzo-a-pyrene
	Kjeldahl Nitrogen		Magnesium		Silica		Bromoform
	Nitrate		Manganese		Sulfate		Bromodichloromethane
	Nitrite		Mercury		Sulfite		Carbon Tetrachloride
	Oil & Grease		Molybdenum		Surfactants-MBAS		Chloroform
	Organic Carbon		Nickel				Chloromethane
	Orthophosphate		Potassium		GROUP H		Dibromochloromethane
	Phosphorus, Total		Selenium		BHC Isomers		1,1-Dichloroethane (DCE)
			Silver		Chlordane		1,2-Dichloroethane (EDC)
	GROUP D		Sodium		DDT Isomers		1,1-Dichloroethylene (1,1-DCE)
	Cyanide, Total		Thallium		Dieldrin		Ethylbenzene
			Zinc		Endrin		Ethylene Dibromide
	GROUP E				Heptachlor		Methylene Chloride
	Phenols		GROUP G		Heptachlor Epoxide		Monomethylnapthalenes
			Acidity, Total		Lindane		Naphthalene, Total
	GROUP F		Alkalinity, Total		Methoxychlor		PAH
	Aluminum		Alkalinity, Bicarbonate		Toxaphene		PCBs
	Arsenic		Bromide		2,4-D		1,1,2,2Tetrachloroethane(PCE)
	Barium		Carbon Dioxide		2,4,5-TP-Silvex		1,1,1-Trichloroethane
	Beryllium		Chloride		2,4,5-T		1,1,2 Trichloroethane
	Boron		Color				1,1,2 Trichloroethylene (TCE)
	Cadmium		Fluoride		GROUP J		Trihalomethanes
	Calcium		Iodide		Sulfides		TOX
	Chromium, Total		Odor				Toluene
	Cobalt		Residue, Total		Asbestos		Vinyl Chloride
	Copper		Residue, Filterable (TDS)		Ignitability		Xylenes, Total

COMMENTS/SPECIAL INSTRUCTIONS PLEASE PERFORM VOLATILE ORGANICS BY EPA METHOD 8240 (especially include ACETONE)

RELINQUISHED BY 1.	RELINQUISHED BY 2.	RELINQUISHED BY 3.	ON SITE ANALYSES	
[signature] 12:19	[signature] 501pm		Turbidity	NTU
(Signature) (Time)	(Signature) (Time)	(Signature) (Time)		
NORMAN NORVELLE 01-11-90	1-10-90 9/10/90		Flow	mgd
(Print Name) (Date)	(Print Name) (Date)	(Print Name) (Date)		
EL PASO NATURAL GAS CO. P.O. BOX 4990 FARMINGTON N.M. 87499			Chlorine, Total	mg/1
(Company)	(Company)	(Company)		
RECEIVED BY 1.	RECEIVED BY 2.	RECEIVED BY 3.	Dissolved, Oxygen	mg/1
[signature] 12:19				
(Signature) (Time)	(Signature) (Time)	(Signature) (Time)	pH	units
JOE BOWDEN 9-11-90				
(Print Name) (Date)	(Print Name) (Date)	(Print Name) (Date)	Temperature	°C
CDS LABS				umhos/cm
(Company)	(Company)	(Company)	EC	

SP2983

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

May 16, 1990

Mr. David G. Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

SUBJECT: Site Investigation/Remediation for the Manana-Mary Wheeler #1E Gas Well Site at Flora Vista, New Mexico

Dear Mr. Boyer:

Enclosed for your review are two copies of EPNG's responses to your March 30, 1990 comments on the Site Investigation/Remedial Action Plan. We are looking forward to discussing these and any other pertinent issues tomorrow in Santa Fe.

Sincerely yours,

Kenneth E. Beasley, Manager
North Region Compliance Engineering

File Copy

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

March 30, ~~1989~~ 90

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

CERTIFIED MAIL
RETURN RECEIPT NO. P-918-402-154

Mr. Kenneth E. Beasley, Manager
North Region Compliance Engineering
EL PASO NATURAL GAS COMPANY
P. O. Box 1492
El Paso, Texas 79978

RE: Site Investigation Report/Remedial Action Plan for the Manana-Mary Wheeler #1E Gas Well Site, Flora Vista, New Mexico

Dear Mr. Beasley:

Attached are my comments on the above report. After review by you and your consultant, K.W. Brown and Associates, I would like to schedule a conference call or meeting in mid to late April to discuss my comments, your reply, and a schedule to commence work in late spring/early summer. The goal should be to accomplish physical removal of soils and complete cleanup by the end of the summer.

Two other issues, not mentioned previously in correspondence, but which I believe are critical to future protection of ground water, are the placement of proper well seals and locks on Flora Vista's water wells, and replacement of Manana's produced water tank. The issue of the unused but open, unsealed water wells has been mentioned numerous times, including as recommendations in my 1986 reports. Wells S-1, S-4, and S-5 and any other unused production wells should be sealed but with locking caps so that water level and sampling can be conducted as necessary. Exploratory wells SX-1 and SX-2 should have their caps examined and welded shut, if not already done so.

Secondly, Manana's fiber-glass tank sits partially below grade and has a buckled side. It should be replaced by an above ground metal stock tank, probably at the time of excavation. Without these additional precautions the cleanup could be undone in the event of vandalism or accident and charges could be made that EPNG was negligent in cleanup. OCD will contact Manana regarding the produced water tank, but EPNG may wish to assume responsibility for sealing unused wells to avoid any further future liability.

Along with my comments, I have also enclosed a copy of a map showing the Flora Vista numbering of water wells. Please send a copy of EPNG's December's Flora Vista analyses; I ended up with results of some other EPNG sampling.

On a personal note, with the rehiring of Bill Olson, we're finally digging ourselves out of the remedial action hole we were in (Pardon the expression!). We have at least a dozen projects needing attention similar to this one. My apologies for taking so long to get these comments out.

Sincerely,

Dave

David G. Boyer, Hydrogeologist
Environmental Bureau Chief

DGB/sl

Enclosures

cc: W. J. LeMay, Director OCD
OCD Aztec Office
J. Eichelmann, Burlington Northern
S. Johnson, KW Brown & Associates

COMMENTS ON SITE INVESTIGATION/REMEDIAL ACTION PLAN AT MANANA MARY WHEELER #1E GAS WELL FLORA VISTA, NEW MEXICO

Prepared by
David G. Boyer, Hydrogeologist
March, 1990

I. Comments on Site Investigation Report

1. p.41, Table 3-4. The values for Benzo(b) fluoranthene and Indeno (1, 2, 3-cd) pyrene should be shown as 2 and 6 ug/l (instead of 0.002 and 0.006 ug/l). The correct values for WQCC standards for Ethylbenzene, Toluene and Xylenes (total) are 750, 750 and 620 mg/l, respectively.

2. p.45. A discussion of oil and grease concentrations found in soil samples taken from trenches 6 and 7 is presented. Additional investigation is necessary to verify the actual presence of a "slug" of oil in this area, especially if analytical techniques may have contributed to false positive readings (ref. "A Comparison of Methods of Measuring Total Petroleum Hydrocarbons in Soil," 1989 NWWA/API Proceedings of the Conference on Petroleum Hydrocarbons and Organic Chemicals in Ground Water) present a plan to perform the necessary verification.

3. p. 48. Please provide a copy of the referenced 1983 paper on risk assessment by Crouch ("The Risk of Drinking Water").

4. p.48, Comment on Section 4.0, Risk Assessment. As stated in this section, risk assessment techniques are used to estimate chronic toxic potential from contaminants dissolved in ground water. In addition to dissolved contaminants we have an oil phase that imparts visual and hydrocarbon odor characteristics to the water. The assessment technique would seem more appropriate if used after the cleanup to evaluate the risk of any remaining dissolved constituents.

5. p.52, Table 4.2. The contaminant concentrations listed in Table 4.2 are 1000 times greater than actually observed (eg. Benzene concentration in EPNG-2A is 8.1 ppb not 8,100 ppb). I suspect these are transcription errors. Please verify that the risk calculations shown are for the actual concentrations and not those shown in the table.

6. p. 57. In New Mexico, buried reserve pits commonly contain waste debris from drilling operations. It would not surprise me to find concrete fragments and scrap pipe in the pit.

II. Remedial Action Plan

A. Section 6.1.1. Contaminated Soil

1. p.59. Describe further the procedure for visual inspection verification of removal of contaminated soil, especially since contamination extends to sands and gravels beneath the water table. Is temporary dewatering proposed as part of the soil removal process?

2. p.59. Removal of hydrocarbon stained soil should extend to the vicinity of well S-1 since staining was noted in that location during the 1987 excavation (See the discussion on page 2 of Dr. Blair's 1987 report).

3. p.59. What procedures are proposed to determine the extent and the necessity for soil removal under lease structures (eg. oil/water separator, produced water tank, meter house).

4. p.59. Describe the type and source of the material that will be deposited in the excavation to replace the contaminated soil.

5. p.60. If the contaminated soil is stored on site prior to offsite removal, it must be stored such that oil and water drainage is intercepted prior to discharge to the bare ground. Likewise, saturated soil cannot be loaded directly into trucks such that oily water will discharge onsite or enroute to the disposal location.

B. Section 6.1.2. Contaminated Groundwater

1. p.60. Explain the impacts to the area adjacent to well S-5. Is the reference to the oil and grease analyses or the low levels of dissolved hydrocarbons found during the 1989 site investigation sampling?

2. p.60. Additional sampling of S-5 is necessary to verify if benzene and toluene are present at trace levels as shown in the 1989 site sampling. (1986 sampling also detected these at about the same levels).

3. p.60. During excavation, water will be made turbid with the disturbance and residual oil may be freed from the soil and float on top of the water. Equipment should be available on site during excavation to skim and remove floating oil.

C. Section 6.3. Monitoring Soil

1. p.61. Soil. Explain how representative samples are to be collected from the bottom of the excavation if the excavation is not dewatered.

2. p.61. Groundwater. The December, 1989 EID/OCD sampling of well S-1 detected acetone. Pre-cleanup sampling should verify the presence or absence of that contaminant.

3. p.62. In addition to replacement monitor wells, I would like to discuss digging a temporary trench just downgradient of the southwestern-most area of excavation to serve as an observation trench. It would provide visual verification (absence of product or sheens) that no floating hydrocarbons escaped excavation. More importantly, with ground water flow at 2 to 3 feet per day, it would allow natural volitization of any remaining dissolved hydrocarbons. With a minimum of agitation and circulation the trench could act as a final treatment "air stripper" and aeration system. It could be kept in use for a short period of time (90-120 days) after excavation and soil replacement has been completed to allow flushing of the replacement soil.

4. p.62. Suggest a schedule for short and long term pumping and testing of well S-1 after completion of the excavation.

5. p.62. Provide the number and location of the proposed monitoring wells.

6. p.62. Analytical Parameters. In addition to the proposed sampling constituents, analyses of water should include major cations and anions. Soil analyses should include chromium and those PAH's detected and shown in Table 3.5 (p. 43).

7. p.63. Sampling Frequency. Monitor wells shall be removed, or properly plugged and abandoned at the conclusion of their use. This will be no later than at the time of decommissioning of the gas well, or an earlier time as approved by OCD after consultation with other involved parties (i.e. Flora Vista Water Users, EID, EPNG, Manana).

D. Additional Comments

Provide a proposed timetable for the start and completion of the remedial action, including the time expected to be required for the excavation phase.

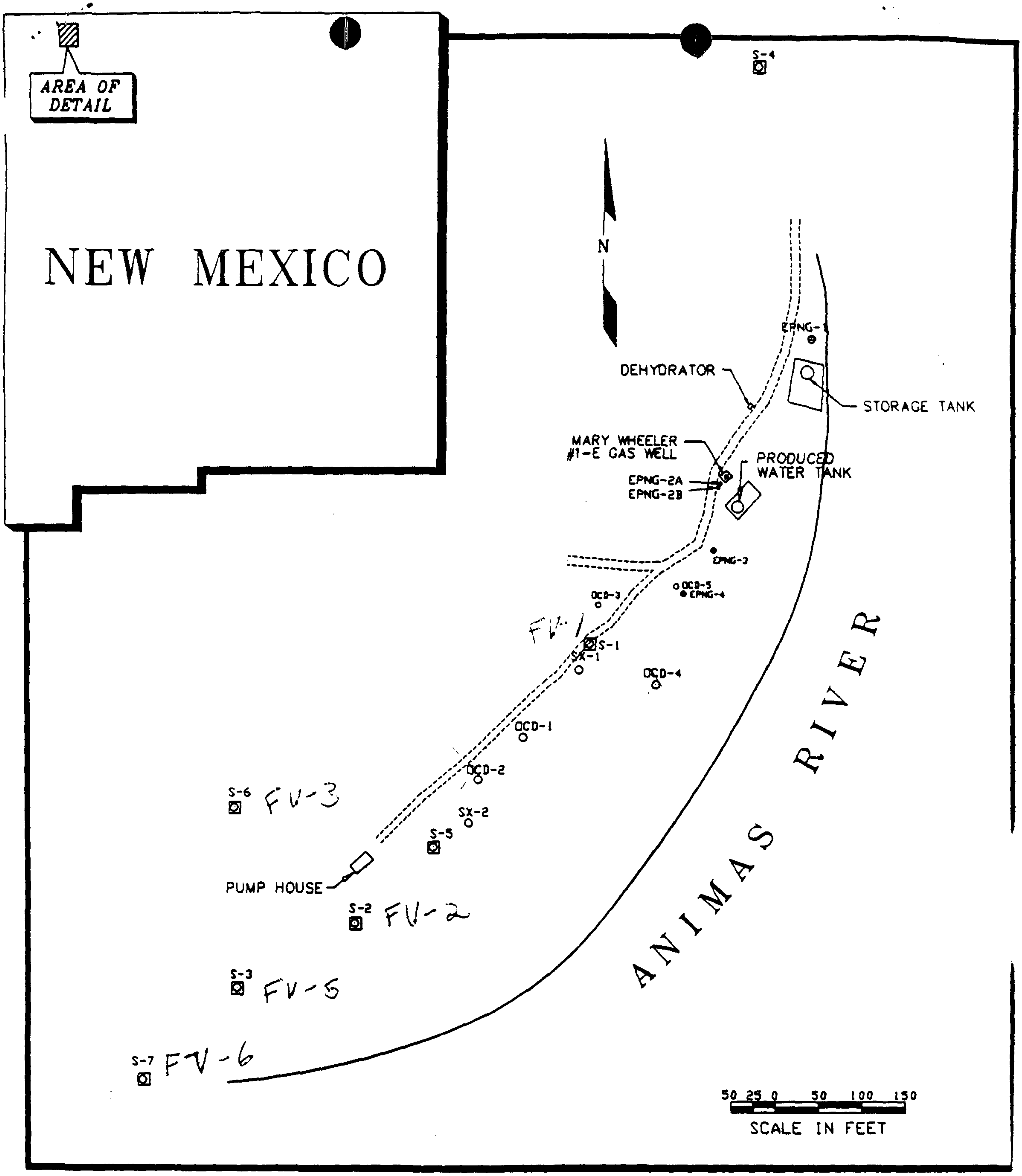


FIGURE 2-1. MAP SHOWING LOCATION OF THE MAÑANA – MARY WHEELER #1-E WELL SITE.

New Mexico Health and Environment Department

GROUND WATER BUREAU
DRINKING WATER SECTION

March 2, 1990

Mr. Bert Barnes, President
Flora Vista Water Users Association
Box 171
Flora Vista, NM 87415

SUMMARY

The sheen observed on the water surface of the Flora Vista public water supply wells in December, 1989 was not caused by petroleum contamination. However, the entire well field remains highly vulnerable to documented contamination which remains in the soil near the El Paso Natural Gas facility adjacent to the well field. At least once a year each of the public water supply wells should be sampled for volatile organic compounds as a precautionary measure until the required site cleanup is complete.

Dear Mr. Barnes;

This letter is to transmit the results of the sampling that was performed by EID and OCD personnel on the Flora Vista WUA wells on December 27 & 28, 1989 and to summarize EID's conclusions and recommendations. EID and OCD personnel investigated the reported contamination of the well field at the request of the Flora Vista WUA.

A visible iridescent sheen was observed on the surface of wells 2, 5, and 6. All wells had been shut off by the WUA on December 21, 1989 when the sheen was observed during a routine pump replacement at well No. 5. There was some speculation that the sheen may have been caused by contamination from a nearby natural gas well owned by El Paso Natural Gas. This well and related facilities have been shown to be the source of contamination which required the Association to abandon well No. 1 in 1983.

Samples were taken from well Nos. 1, 2, 5, and 6. All wells except No. 1 were sampled on December 27, 1989 under static conditions with the well pumps off and again on December 28, 1989 after purging the wells by pumping them for at least one hour. All pumped waters during this test were discharged to waste on site rather than pumping to distribution.

The samples were analyzed by the State Scientific Laboratory for:

— ENVIRONMENTAL IMPROVEMENT DIVISION —
Harold Runnels Building
1190 St. Francis Dr.
Santa Fe, New Mexico 87503

Volatile organic compounds
Base/Neutral Extractibles
Heavy Metals
Secondary Standards

Copies of the laboratory results are attached. The results indicate that no detectible organics were present in wells 2, 5 & 6 after they were purged. Before purging, well No. 2 contained 8.8 ug/l of methylene chloride. There is no drinking water MCL for methylene chloride but the WQCC regulations set a groundwater MCL value of 100 ug/l. Methylene chloride is occasionally found to be a laboratory contaminant.

Well No. 1, which has not been in service since petroleum contamination was observed in 1983, did contain a very high concentration, 8,800 ug/l, of acetone. We have no ready explanation for this result which the SLD confirmed by use of mass spectroscopy. Acetone is not commonly associated with petroleum contamination. It is a common laboratory solvent and could possibly be a lab contaminant. Well No. 1 did not have a proper seal. The casing was covered with a loose piece of sheet steel and a rock.

Heavy metal concentrations were all below detection limits. Secondary (aesthetic) standards for iron and manganese were exceeded in well Nos. 2 & 6. The Water Users Association is aware of the problems with iron and manganese and uses a sequestering agent to control the resulting taste and staining problems.

CONCLUSIONS

1. The observed sheen on wells No. 2, 5 & 6 was not due to petroleum contamination. It may have been due to iron bacteria or some other source.

2. No violations of the Maximum Contaminant Levels for chemicals listed in the Regulations Governing Water Supplies was noted for wells No. 2, 5 & 6. Well No. 1 contained a high concentration of acetone.

3. The Flora Vista well field is obviously very vulnerable to contamination from the gas well and related facilities as well as the existing contamination in soil around these facilities.

RECOMMENDATIONS

1. The remedial cleanup of the EPNG gas well site which has been required by OCD should take place as soon as possible to remove contamination resulting from operations at that site.

2. Flora Vista WUA should continue to refrain from using well No. 1 until remedial cleanup is complete and EID and OCD determine that no significant threat of contamination remains. A lockable cap should be provided for the well head to

prevent accidental or deliberate contamination of well No. 1. The cap must be able to be removed for sampling, though.

3. Well No. 1 should be re-sampled to confirm or deny the apparent acetone contamination.

4. Since the entire well field is highly vulnerable to contamination from the EPNG site, VOC monitoring frequencies should be increased beyond the minimum requirements for compliance with the regulations. EID strongly advises that all the wells be sampled for volatile organic compounds at least once a year.
Mr. Oscar Simpson of our Albuquerque office, at 841-6570, can assist with coordination of sample submittals with the state Scientific Laboratory Division.

Sincerely,

Stuart P. Castle

Stuart P. Castle, Chief
Groundwater Bureau

SPC/NW

cc: Jon Thompson, Deputy Director
Dan Vigil, Acting Dist. I Manager
Dave Tomko, EID Farmington
Stuart Castle, GWB Chief
Oscar Simpson, DWS
Rep. Richard Cheney (w/encl.)
Kenneth Beasley, El Paso Natural Gas Co. (w/encl)
David Boyer, OCD (w/encl.)

Associ Flora Vista Water Users

Bert Barns Pres {334-9132 (H) / 325 7577 (O)}

Ray Penrod Mgr 632-2459 (H) (O) 334-6045

Dick Thurstonson V.P. Farmers Agent

Have backhoe 334-9060

9AM Thursday, March 21

Rick Lougee Attorney

108 Orchard 327-5281

Farmington

Lawrence Brewer & Assoc } 327-3303

Bruce Thompson

Civerolo Law Firm

219 Central NW

Suite 401

ALB. 87102

ED HARTMAN

1002 Tramway Lane NE 87122

President	P.O. Box 14069
Mañana Gas, Inc.	Albuquerque, New Mexico 87191-4069
Realtor	TELE: (505) 275-8817
Certified Public Accountant	(505) 275-8816

FAX TRANSMISSION COVER SHEET

To: Individual DAVE BOYER

Company NMOCD

From: BOBBY SPEAKE

Date: 12-22-89

Time: 16:45 CST

Fax Number: (505) 827-5741

Project Number: 63712

Number of Pages: 1 cover sheet + 8 pages of text

If you do not receive all of the pages, please call (409) 690-9280.

Fax Operator: BOBBY SPEAKE

K.W. Brown & Associates, Inc.
6 Graham Road
College Station, TX 77840
(409) 690-9280
(409) 690-7310 (FAX Number)

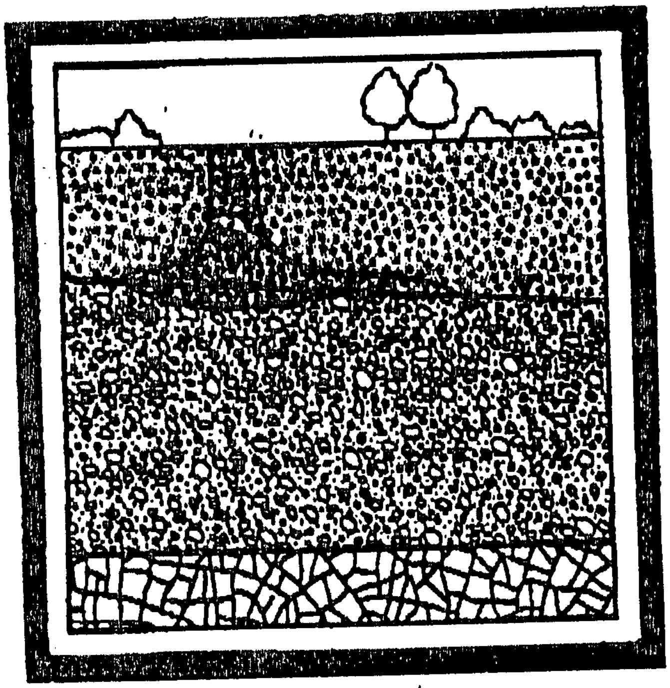
NOTES:

MERRY X-MAS!

THE PROCEEDINGS OF THE

Petroleum Hydrocarbons and Organic Chemicals in Ground Water:

Prevention, Detection and Restoration



A Conference and Exposition

November 15-17, 1989
The Westin Galleria
Houston, Texas

Presented by
The Association of Ground Water
Scientists and Engineers,
division of NWWA; and
The American Petroleum Institute

A COMPARISON OF METHODS

FOR MEASURING TOTAL PETROLEUM HYDROCARBONS IN SOIL

by

Nan Thomey, David Bratberg
Applied Earth Sciences, Inc.
Houston, Texas
and
Catha Kalisz
Star Enterprise
Irving, Texas

ABSTRACT

Two analytical methods are used to measure total petroleum hydrocarbon concentration in soil samples. One method is a modification of EPA Method 418.1 which utilizes a freon extraction followed by infrared spectroscopy. The second method uses the same extraction method, but is followed by gas chromatography/flame ionization detector analysis.

Soil samples collected during investigations of petroleum product releases from underground storage tanks were submitted to the laboratory and analyzed by both methods. Specific controls were specified for the analyses to eliminate sampling bias from the results.

The data obtained by the two methods were compared and different results were observed. In certain soil matrices, a positive interference was documented in the results from Method 418.1. This positive interference could lead to unwarranted remediation activities if the results are used as cleanup guidelines. The results of the study and potential explanation for the differences are presented.

INTRODUCTION

During the course of subsurface investigations of petroleum product releases from underground storage tanks, soil samples may be collected in order to document the veritcal and horizontal extent of subsurface contamination. In addition, soil samples are collected during remediation activities to measure the effectiveness of the technique utilized and to determine the proper disposal location for excavated material.

Current regulations and technical guidelines in many states require that these soil samples be analyzed for the common gasoline constituents benzene, toluene, ethylbenzene and total xylenes (BTEX). These analyses are performed using EPA Method 8020 as described in SW-846, Test Methods for Evaluating Solid Waste-Physical/Chemical Methods. This is a gas chromatography technique utilizing a photo-ionization detector. In addition, many states require measurement of total petroleum hydrocarbons (TPH) to determine the presence of non-gasoline hydrocarbons such as diesel or kerosene, and extremely weathered gasoline products. Currently, there is not an EPA approved method for TPH analysis in soil. The method which has been commonly used and referenced is EPA Method 418.1, described in Methods for Chemical Analysis of Water and Wastes. This method is for measurement of TPH by infrared spectroscopy (IR) in water and wastewater. The extraction procedure must be modified for soil analysis. The state of California, among others, specified a gas chromatography (GC) with flame ionization detection (FID) to determine TPH concentrations in both soil and water. This method is designed to provide product identification as well as quantification. The so called "California Method" is not approved by the state of Texas. This is because a headspace injection technique is used for gasoline analysis. The state of Texas does not accept this injection method because the EPA considers this technique suitable for screening purposes only.

During environmental assessments, anomolies were noticed in the 418.1 TPH data. The data obtained were inconsistent with known site information. One type of situation involved soil samples which were collected from service station sites which had never dispensed any products except gasoline. Analytical results indicated that the samples contained no measurable BTEX constituents and the soils exhibited no hydrocarbon odors. However, TPH results indicated the presence of 100-200 mg/kg of petroleum hydrocarbons. These results were inconsistent with the composition of gasoline. A second type of situation involved samples which were collected in conjunction with remodeling activities at sites with no suspected or known product releases. Soil borings were performed and several intervals were sampled and analyzed for each boring. BTEX concentrations were below the analytical detection limits. The TPH results ranged from 100-250 mg/kg for all of the samples which were collected.

Based upon this information, a potential problem was suspected with the 418.1 TPH analyses. The BTEX chromatograms were examined and in most cases, there was no evidence of the presence of petroleum hydrocarbons. A positive interference in the IR method was suspected. The IR methodology was focused upon because the method used for soil analyses is actually a technique developed for water analyses. The method did not appear to be directly applicable to the analysis of soils. Through discussions with the Texas Water Commission and other states, a method for TPH analysis by Gas Chromatograph (GC) utilizing a flame ionization detector (FID) was proposed and was approved by the State for use in the underground storage tank program.

To satisfy our own curiosity, we decided to conduct a method comparison study. We submitted a number of soil samples for TPH analysis. The samples were analyzed by IR and GC/FID. The data obtained by the two methods are presented and compared below.

The state of Texas has approved the use of a GC/FID analysis for TPH. The method approved specifies the extraction solvent, type of column, and injection technique to be used.

DESCRIPTION OF METHODS

Approximately 60 samples were submitted for analysis during the course of the study. All soils were classified by the same hydrogeologist to assure consistency.

Two methods were used for the analysis of the samples. One method was the EPA modified 418.1 procedure for infrared spectroscopy. The second method was a GC/FID capillary column analysis, based upon ASTM 3328. This is the GC method which is approved by the State of Texas. ATSM 3328 is a procedure for the comparison of waterborne oils. There is no mechanism in this method for quantification.

Both methods utilize the same extraction procedure. A known portion of the sample was dried with anhydrous sodium sulfate, and ground to form a free-flowing powder. The dried samples were then extracted by sonication. The solvent which was used was fluorocarbon-113. The extract was treated with 60-200 mesh silica gel. The silica gel treatment is to remove polar hydrocarbons which include animal fats and other non-petroleum hydrocarbons.

The treated extract was then analysed by Infrared spectroscopy and GC/FID. Both analyses were performed on the same extract. This eliminated any bias from the sampling and extraction processes. The IR analysis measures carbon-hydrogen bonds. The GC/FID analysis utilizes flame ionization to measure hydrocarbons. The IR analysis cannot identify specific hydrocarbons. GC/FID is a common analytical technique which is frequently used to identify and quantify specific hydrocarbons.

In the IR method, TPH is calculated by comparing the IR absorbance of the samples at about 2950 cm^{-1}, to the response of a reference oil standard. The reference oil standard utilized in 418.1 is composed of n-hexadecane (C16), isoctane (C8), and chlorobenzene (C6). In the GC/FID method, the total area response of the sample is compared to the total area response of a specific fuel or mixture of fuels such as gasoline or diesel. These standards are in the range of approximately C-5 to C-22. Copies of standard chromatograms for gasoline and diesel are shown in Figure 1. A known 418.1 reference oil standard was analyzed by GC and the result calculated based upon the GC standard. A known GC gasoline standard was analyzed by IR and the result calculated from the 418.1 reference oil. This was done to determine the potential affects of utilising different standards.

RESULTS

The analytical results are presented by soil type in Table 1. Significantly different results by the two methods were observed. The IR results were higher than the GC/FID results for certain types of soil. The predominant samples exhibiting this effect were the soils whose major constituents were weathered limestone, silt, or clay.

All of the samples composed predominantly of weathered limestone had IR results which were higher than the GC/FID results. Some of these differences were quite significant. For example, on one sample which was submitted, the results were 760 and 67 mg/kg by IR and GC/FID, respectively. In a second case, the results were 3,100 and 1,000 mg/kg by IR and GC/FID, respectively.

TABLE 1

Summary of Results
TPH Method Comparison

SOIL TYPE	TPH IR	TPC/GC
Weathered limestone, sandy clay	760	67
	31	ND
	3,100	1,000
Sand	130	230
Sand	120	170
Sand	150	150
Sand	100	130
Sand, medium	ND	ND
Sand, medium	ND	ND
Sand, medium	ND	ND
Sand, some clay	ND	ND
Sand, medium	ND	ND
Sand, medium	ND	ND
Sand, clay mixture	ND	ND
Silty sand	30	ND
Silty sand	ND	ND
Silty sand	ND	ND
Clayey sand	ND	ND
Silty clay	16	ND
Silty clay	ND	ND
Silty clay	ND	ND
Silty clay	ND	ND
Silty clay, weathered limestone	ND	ND
Silty clay, silty clay	366	<25
Sandy clay, dry	ND	ND
Clay, brown, dry	ND	ND
Clay, yellow brown, dry	ND	ND
Clay, weathered limestone	ND	ND
Clay, yellow brown, dense, dry	250	ND
Clay, dark gray, dense, stiff	ND	ND
Clay, dark gray, stiff	120	ND
Clay, dark gray, stiff	ND	ND
Clay, gray, stiff	160	ND
Clay, some silt, dense	ND	ND

TABLE 1 (Continued)

Summary of Results
TPH Method Comparison

SOIL TYPE	TPH IR	TPH/GC
Clay, light brown, manganese concretions	ND	ND
Clay, dark gray	30	ND
Clay, light brown	ND	ND
Clay, black	ND	ND
Clay, dark gray, some grass roots	323	87
Clay, dark gray	ND	63
Clay, light brown	ND	ND
Clay, dark brown, stiff	ND	ND
Clayey silt	796	70
Clayey silt	ND	ND
Clayey silt	ND	ND
Clayey silt	ND	ND
Clayey silt, silty clay	ND	ND
Silt, weathered limestone, wet	ND	ND
Silt, gray, loose	90	ND
Silt, medium sand	ND	ND
Sandy, silt, wet	106	ND
Clayey gravel	9,700	350

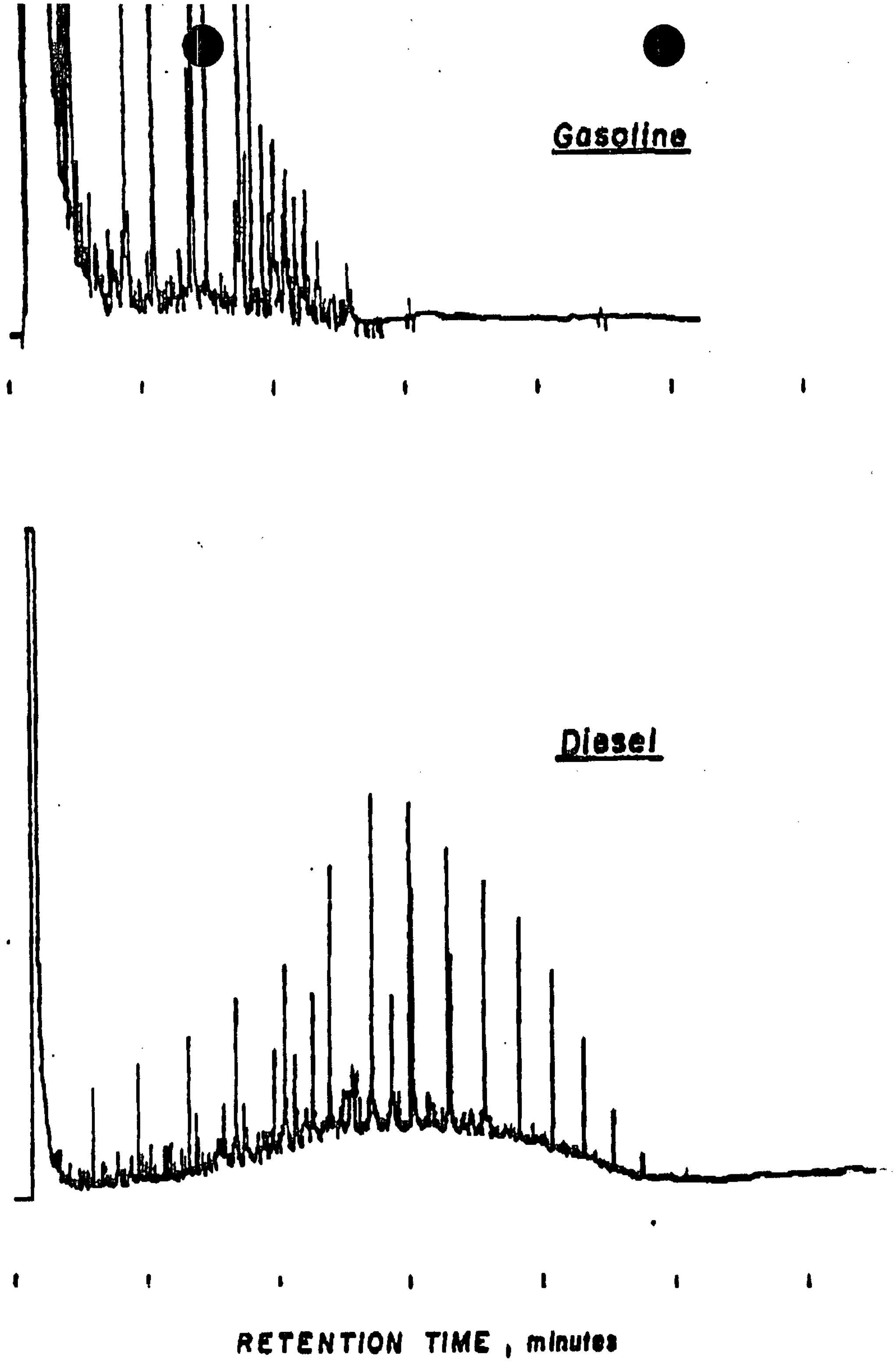


Figure I.- STANDARD CHROMATOGRAMS

CONCLUSION

Based upon the results of this study, it is apparent that EPA Method 418.1 is not an appropriate technique for measuring TPH concentration in certain types of soils. These types of soils can be categorized as weathered limestone, clays, and silts. One of the more frequent arguments for using this method is that it is a relatively inexpensive test. We believe this study demonstrates how thousands of dollars can be spent on unnecessary remediation and disposal costs because of actions taken on the basis of a laboratory analysis costing less than fifty dollars. It is our opinion that the GC/FID technique provides a more adequate representation of the degree of hydrocarbon contamination in soil.

If EPA modified Method 418.1 is used for TPH analysis in soils, positive results should be confirmed through GC/FID analysis. Otherwise, the parameter of TPH should not be used to establish cleanup guidelines or to assign waste classfications.

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

August 28, 1989

Mr. David G. Boyer
Environmental Bureau Chief
New Mexico Oil Conservation Division
310 Old Santa Fe Trail
Suite 206
Santa Fe, New Mexico 87504

Subject: Investigation Report of the Manana - Mary Wheeler Site

Dear David:

Enclosed are two copies of the report by K.W. Brown and Associates on the site near Flora Vista. After you have had a chance to review it, we will be happy to get together with you and discuss the remediation. Henry Van or I will be happy to answer any questions you might have on the report in the interim.

Sincerely yours,

Kenneth E. Beasley
Manager of Compliance
Engineering, North Region

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

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

May 17, 1989

Mr. Kenneth Beasley
Manager, North Region
Compliance Engineering
EL PASO NATURAL GAS COMPANY
P. O. Box 1492
El Paso, Texas 79978

RE: Flora Vista - Manana Mary Wheeler
#1E Investigation

Dear Mr. Beasley:

The Oil Conservation Division (OCD) has received the revised investigation plan submitted to us with your April 10, 1989, letter. Comments were made by telephone, and changes were incorporated in the copy provided to us by the Farmington EPNG Office. The final copy of Table 2 was telefaxed to us on May 8, 1989.

EPNG's revised investigation plan, with the agreed-to changes, is hereby approved. I understand that a contractor will be chosen shortly and that Task 1, Review of Existing Information, should start within 30-days. Please notify us when the contractor is selected and of the anticipated starting date.

If you need further information, please contact me at (505) 827-5812. Please note that we have resumed use of our old P. O. box number, and correspondence should be directed to that address.

Sincerely,

David G. Boyer

David G. Boyer, Hydrogeologist
Environmental Bureau Chief

DGB/sl

CC: OCD Aztec Office

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

May 8, 1989

RECEIVED

MAY 10 1989

OIL CONSERVATION DIV.
SANTA FE

Mr. David G. Boyer
Environmental Bureau Chief
Energy and Minerals Department
Oil Conservation Division
310 Old Santa Fe Trail
Santa Fe, New Mexico 87504

Subject: Flora Vista - Manana Mary Wheeler #1E Investigation

Dear Mr. Boyer:

Enclosed is the revised investigation plan for the Flora Vista site. I have incorporated your final comments which were received telephonically. As discussed today, this proposal now addresses all of our mutual concerns and we will begin implementation. Thank you again for your input. We will keep you posted on planned activities.

Sincerely Yours,

Kenneth E. Beasley
Manager, North Region
Compliance Engineering

bc:
S.D. Aragon
W.H. Healy, Jr. (w/o att)
D.W. Hill (w/o att)
A.N. Pundari
H.A. Shaffer (w/o att)
L.R. Tarver (w/o att)
H. Van
file 24322

A PROPOSAL

FOR

INVESTIGATING THE MANANA - MARY WHEELER #1E

WELL SITE

NEAR FLORA VISTA, NEW MEXICO

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

El Paso Natural Gas Company (EPNG) has prepared this proposal for a soil/groundwater investigation of the Manana - Mary Wheeler #1E gas well site near Flora Vista, New Mexico. The proposal describes tasks involved in the site investigation including a review of existing information concerning the site, further characterization and topographic survey of the area, and interpretation of the collective observations and results. These efforts will culminate in a risk assessment of possible contamination from the inactive pit, and recommendations for treatment or removal of the contamination, if deemed necessary. The objective is to allow the continued use of existing water wells adjacent to the site.

2.0 REVIEW OF EXISTING INFORMATION

EPNG will collect and review existing information on conditions at the site, specifically on the area between the inactive pit and nearby water wells. This review will include information in NMOCD files such as field reports, aquifer tests, water quality data and topographic details. EPNG will review this information to determine the preexisting conditions at the site for comparison with findings of the EPNG field investigation. From this comparison, conclusions will be made concerning the likelihood of migration and/or degradation of contaminants from the pit. This information will be used to aid in designing the hydrologic investigation.

3.0 AREA TOPOGRAPHIC SURVEY

A topographic survey of the area will be conducted to provide relative elevations of points of interest at the site. The survey will provide a grid, with points of known elevations, for siting the location of pits for soil sampling. The data will also be used in the description of the contaminant plume, if any, as well as the piezometric surface of the immediate area. Data generated during this task will be used to generate base maps which illustrate the locations of all relevant features and will establish baseline elevations for all aspects of the investigation.

4.0 HYDROLOGIC INVESTIGATION

A hydrogeologic investigation will be performed to define the hydrologic setting and aquifer characteristics, such as groundwater flow direction and velocity, transmissivity, and storage coefficient. Additionally, the behavior of free oil and/or dissolved hydrocarbons, if present, will be evaluated in light of the physical characteristics of the saturated alluvial sediments. The extent of the investigation will encompass the area immediately surrounding the well site (including the reserve pit as well as other pits), and the area down gradient from the well which could potentially be affected by past operations.

The intent of the hydrologic investigation will be to illustrate, to the fullest degree possible, the lateral and vertical extent to which the site has been affected. To assess the magnitude of migration, organic constituents associated with hydrocarbons will be measured (e.g., benzene, toluene, xylene, and oil and grease) as will inorganic constituents (e.g., metals) and indicator parameters such as pH and electrical conductivity (EC).

To achieve the objectives of the hydrologic investigation, piezometers will be installed to determine the horizontal and vertical gradients, trenches will be dug to visually assess the dimensions of the plume (if any) using stained soil/sediments as evidence, and pump tests will be performed using the local water wells and piezometers to define aquifer characteristics.

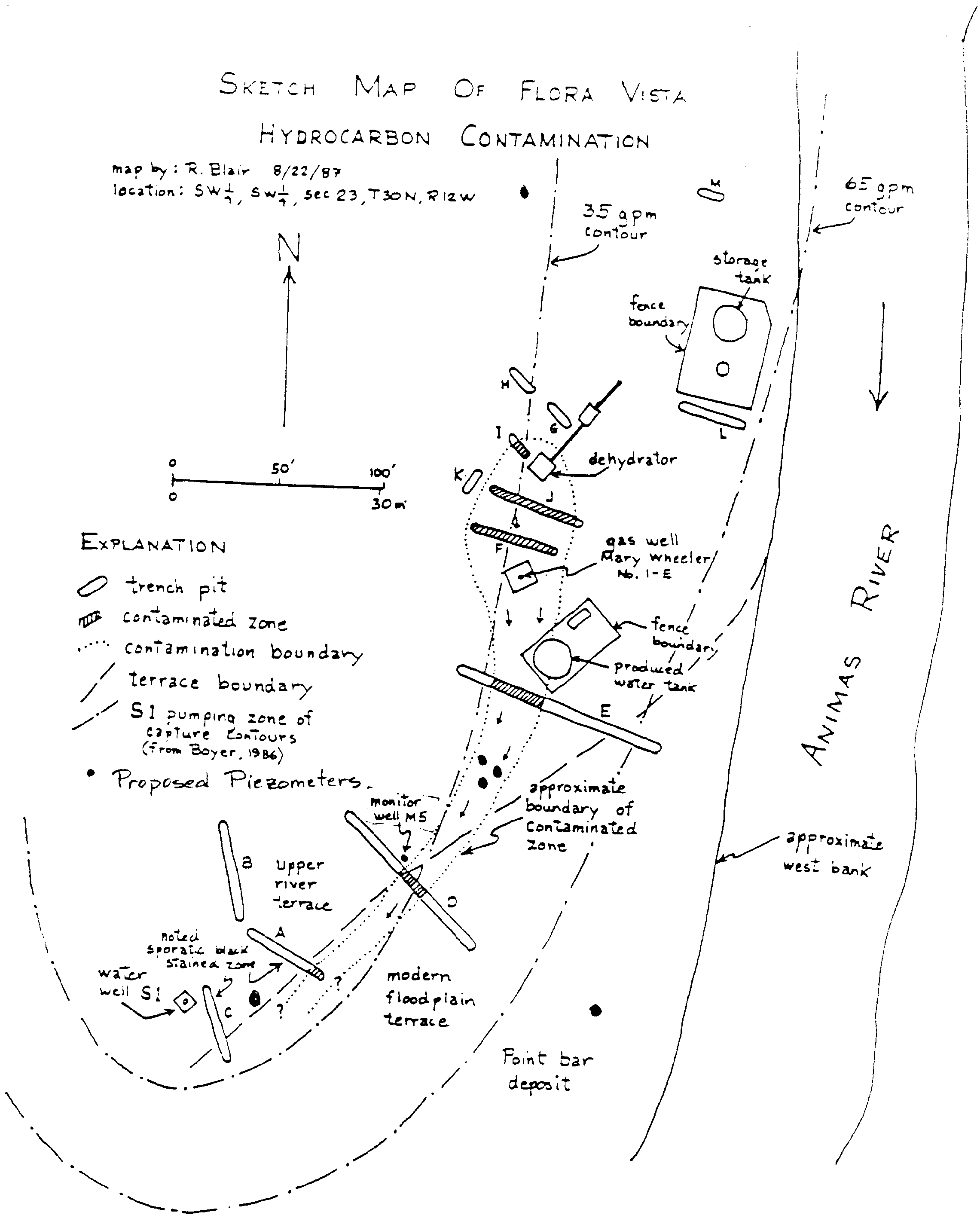
Piezometers

Approximately four sites will be selected for the installation of new piezometers, one of which will be installed upgradient to establish background concentrations for parameters measured at downgradient locations. Figure 1 shows possible piezometer locations superimposed on a site sketch. Of the remaining piezometer locations, one will be selected for a nested piezometer to determine the vertical gradient. Each piezometer will be installed using construction details, which are tailored to the site, to allow representative groundwater samples to be collected. Figure 2 shows a typical piezometer installation guide. Before installation of piezometers, EPNG will sample piezometers previously installed by NMOCD after determining that they are suitable and cleaning them of sediment. It is expected that these piezometers will also assist in mapping the water table. Piezometers will be installed with a rotary rig if possible. A last resort will be by excavating with a backhoe to the desired depth and setting the casing.

In addition to defining the vertical gradient, the piezometer nest will aid in the determination of the vertical extent of constituents in the groundwater. In conjunction with the installation of the piezometers, soil samples may be collected for laboratory analysis.

Trenches

To define the extent and shape of affected soil/sediments, it is proposed that trenches be dug perpendicular to the direction of groundwater flow. The purpose of the



SKETCH MAP OF FLORA VISTA
HYDROCARBON CONTAMINATION
map by: R. Blair 8/22/87
location: SW1/4, SW1/4, sec 23, T30N, R12W
N
0
50'
100'
0
30m
EXPLANATION
trench pit
contaminated zone
contamination boundary
terrace boundary
S1 pumping zone of capture contours (from Boyer, 1986)
• Proposed Piezometers
35 gpm contour
65 gpm contour
M
storage tank
fence boundary
H
G
I
dehydrator
K
J
L
F
gas well Mary Wheeler No. 1-E
fence boundary
produced water tank
E
approximate boundary of contaminated zone
monitor well MS
B
upper river terrace
D
A
noted sporatic black stained zone
water well S1
C
modern flood plain terrace
Point bar deposit
approximate west bank
ANIMAS RIVER

Figure 1

MONITORING WELL REPORT

PROJECT: ____________________

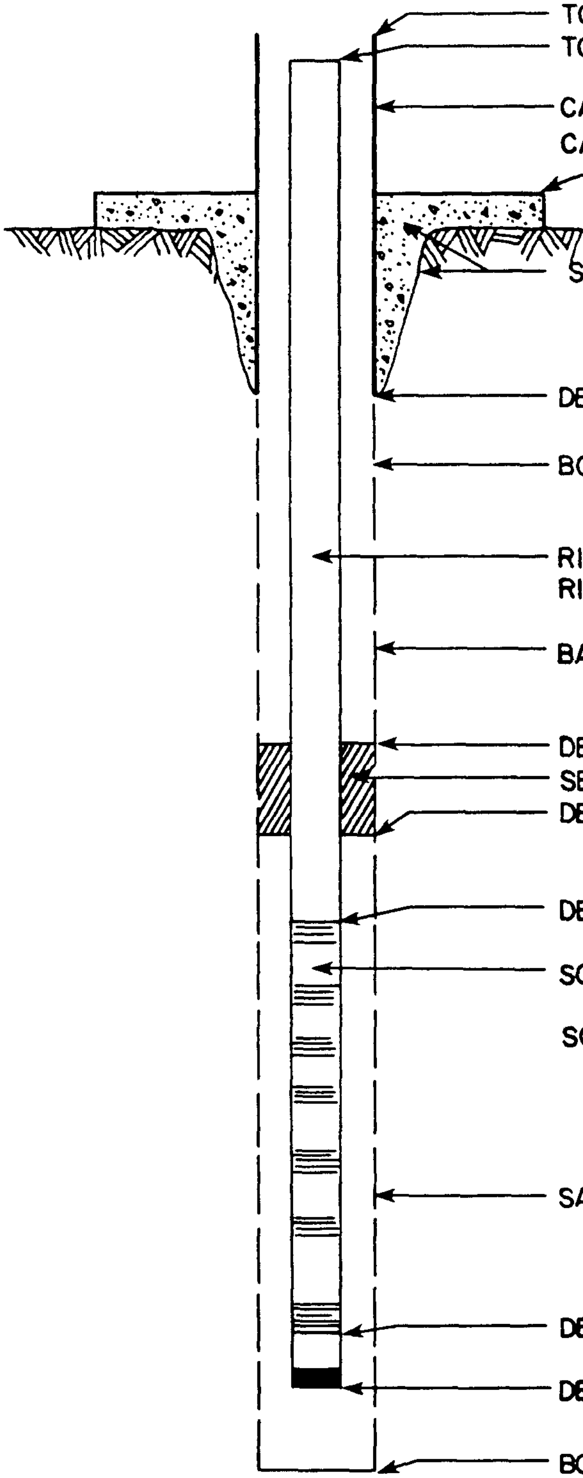
LOCATION: ____________________

____

WELL NO: ____________________ DRILLED BY: ____________________

DATE COMPLETED: ____________________ LOGGED BY: ____________________

SCREENED INTERVAL: ____________________ INSPECTED BY: ____________________



TOP OF CASING ELEVATION: ____________________

TOP OF RISER PIPE ELEVATION: ____________________

CASING TYPE: ____________________

CASING I.D.: ____________________

PLATFORM ELEVATION: ____________________

GROUND SURFACE ELEVATION: ____________________

SURFACE SEAL: ____________________

DEPTH OF CASING BELOW GROUND: ____________________

BOREHOLE DIAMETER: ____________________

RISER PIPE TYPE: ____________________

RISER PIPE I.D.: ____________________

BACKFILL TYPE: ____________________

DEPTH AT TOP OF SEAL: ____________________

SEAL TYPE: ____________________

DEPTH AT BASE OF SEAL / TOP OF SAND PACK: ____________________

DEPTH AT TOP OF SCREENED SECTION: ____________________

SCREEN TYPE: ____________________

SCREEN OPENINGS: ____________________

SAND PACK TYPE: ____________________

DEPTH AT BASE OF SCREENED SECTION: ____________________

DEPTH AT BASE OF PLUG: ____________________

BOREHOLE DEPTH: ____________________

trenches will be to allow visual inspection of the shallow soil profile for evidence of migrating hydrocarbons. Additionally, soil samples can be collected for the profile at points where there is evidence of affected soils. Initially the trenches would be dug at 100-foot intervals to define the lateral extent of the plume. If it is determined that the 100-foot spacing is too coarse, then additional trenches will be dug as needed to define the extent and magnitude of the plume.

In addition to excavating trenches in downgradient locations, one trench or pit will be situated in an upgradient position to allow the collection of background soils samples. Where hydrocarbons are suspected, water sampling of the trenches will be conducted.

Pump Tests

In order to evaluate the potential impact oil field constituents could have on the local water wells, it will be necessary to determine the aquifer characteristics. To this end, if there is a need to expand on data from previous pump tests, it is proposed that the nearest water well, S-1, be pumped and the piezometers (and other wells) be monitored. At this time it is believed that only the S-5 well will need to be pumped to monitor for contaminants. This would be a short duration test, possibly 15 to 30 minutes. The results of the pump tests, along with the soils data, will numerically define the potential for migration of the oil field constituents prior to cleanup activities as well as subsequent to remedial efforts.

5.0 COLLECTION AND ANALYSIS OF SOIL/GROUNDWATER SAMPLES

Soil samples will be collected during the excavation of the trenches described in Section 2. Sample locations within the trenches will be based on visual evidence and the need to define the lateral as well as the vertical extent of any plume which may be detected. Collection of the samples will be from the face of the trenches using stainless steel utensils. Samples will be collected from the former pit areas, including the reserve pit, to determine the potential for leaching and migration of wastes. All soil samples will be placed in glass jars and preserved in the field using ice to maintain the temperature of the samples at or near 4° C.

Groundwater samples will be collected for each of the piezometers installed during the investigation, from the piezometers currently present at the site, and from the local water wells. Sample collection will be accomplished using either dedicated PVC bailers, a Teflon bailer(s), dedicated pump, or a bladder sample pump. If dedicated equipment is not employed, then EPA-approved decontamination procedures will be implemented between samples. Once collected, all groundwater samples will be filtered using 0.45 micron membranes (for metals only), placed in appropriate containers, preserved as needed, and stored in the field on ice at or near 4° C.

Both field analysis and laboratory analysis will be performed as samples are collected. Analysis of groundwater and soil samples will be conducted according to methods and procedures presented in SW-846, Third Edition (EPA, 1986) or an equivalent approved procedure. Parameters selected for groundwater analysis, as it pertains to groundwater standards, will be selected from Section 3-301 of the WQCC Regulations. The selection of specific parameters from Section 3-301 will be based on discussions between OCD and EPNG. Soil and groundwater samples will generally be analyzed for the parameters listed in Table 1. Soil and groundwater samples collected for screening purposes may be analyzed for selected constituents on the list.

Table 1. Analytical Parameters for Soil and Groundwater

Indicators	Organics	Inorganics	
pH	Benzene	Barium	Chlorides
EC	Toluene	Calcium	Sulfur Compounds
TDS	Xylenes	Magnesium	Selenium
Oil and Grease	Ethylbenzene	Sodium	Cadmium
	Chlorinated, Aliphatic hydrocarbons	Potassium	Chromium
	Glycol	Carbonate/ Bicarbonate	
	PNA's		

6.0 DATA INTERPRETATION AND RISK ASSESSMENT

The information gathered from previous investigations and the hydrologic investigation will be collectively reviewed to evaluate the existence, spatial distribution, and possible effects of contamination from the inactive pit and surrounding area. Utilizing these data, a risk assessment will be conducted to evaluate possible contamination to the nearby water wells and surrounding environment. The assessment will be based upon a comparison of the collective data to establish health and environmental criteria and potential for future migration.

7.0 REMEDIAL ACTION PLAN

The purpose of remedial action is to leave the site such that the existing Flora Vista water wells can be operated without exceeding current WQCC standards. The plan will contain details on the methodology to demonstrate that current USEPA drinking water standards are not violated or that no undesirable odors exist due to dissolved, emulsified and free-floating petroleum or other organic and inorganic contaminants. Further, the plan will demonstrate that the vadose zone does not contain materials such as drilling muds, inorganic salts, heavy metals or hydrocarbons in quantities sufficient to recontaminate ground water as the result of seasonal rises in water table, drainage, recharge or similar events. The remediation will consider all or portions of the reserve pit area depending on the results of the site assessment. Table 2 is a time line showing the activities leading to the completion of the remedial action plan. A proposed schedule for completion of remedial activities will be submitted with the plan.

Given the relatively small size of the inactive dehydration pit, it is suggested that the contaminated soil from the pit be removed as part of remediation. Since the pit is considered to be the major source of potential contamination at the site removal of the source is considered a cost-effective measure. In the extreme case where risk assessment suggests a hazard to water quality, total removal of all affected soils downgradient from the gas well area is proposed as a worst case remediation plan. The removal of this material will prevent future leaching of constituents to the groundwater.

It is anticipated that removal can be accomplished by excavation with a backhoe and a dump truck. The proper disposal method and disposal site will be defined prior to initiation of this task. Once the affected soils/sediments have been excavated, the area will be recontoured using clean borrow soil.

Table 2. Time–line for Completion of Activities at the Manana Well Site*.

Weeks 1–2	Weeks 3–4	Weeks 5–8	Weeks 8–11	Weeks 11–13	Weeks 13–16
Review of Existing Information *Task 2*	Initiation & Completion of Field Work *Tasks 3–5*	Sample Analysis** *Task 5* & Begin Draft Report Preparation *Task 6*	Data Inter–pretation, Risk Assessment, & Finalize Draft Report *Task 6*	Remedial Action Plan *Task 7*	Final Report Preparation

* *Task numbers correlate with main heading numbers in proposal*

** *A turn–around time of three weeks will be requested from the lab, actual analysis time may require more than 3 weeks*

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

April 10, 1989

Mr. David G. Boyer
Environmental Bureau Chief
Energy and Minerals Department
Oil Conservation Division
310 Old Santa Fe Trail
Santa Fe, New Mexico 87504

Subject: Flora Vista - Manana Mary Wheeler #1E Investigation

Dear Mr. Boyer:

Enclosed is the revised investigation plan for the Flora Vista site. I have incorporated comments from your February 14, 1989 memorandum, our February 16 meeting and your June 15, 1988 letter. We at El Paso Natural Gas feel that this proposal now addresses all of your concerns and are eager to begin implementation. In order to perform the investigation and complete any necessary remediation while weather is in our favor we will need to proceed as soon as possible. Thank you for your input and consideration in this manner.

Sincerely Yours,

Kenneth E. Beasley
Manager, North Region
Compliance Engineering

Draft (4/10/89)

A PROPOSAL

FOR

INVESTIGATING THE MANANA - MARY WHEELER #1E

WELL SITE

NEAR FLORA VISTA, NEW MEXICO

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

El Paso Natural Gas Company (EPNG) has prepared this proposal for a soil/groundwater investigation of the Manana - Mary Wheeler #1E gas well site near Flora Vista, New Mexico. The proposal describes tasks involved in the site investigation including a review of existing information concerning the site, further characterization and topographic survey of the area, and interpretation of the collective observations and results. These efforts will culminate in a risk assessment of possible contamination from the inactive pit, and recommendations for treatment or removal of the contamination, if deemed necessary. The objective is to allow the continued use of existing water wells adjacent to the site.

2.0 REVIEW OF EXISTING INFORMATION

EPNG will collect and review existing information on conditions at the site, specifically on the area between the inactive pit and nearby water wells. This review will include information in NMOCD files such as field reports, aquifer tests, water quality data and topographic details. EPNG will review this information to determine the preexisting conditions at the site for comparison with findings of the EPNG field investigation. From this comparison, conclusions will be made concerning the likelihood of migration and/or degradation of contaminants from the pit. This information will be used to aid in designing the hydrologic investigation.

3.0 AREA TOPOGRAPHIC SURVEY

A topographic survey of the area will be conducted to provide relative elevations of points of interest at the site. The survey will provide a grid, with points of known elevations, for siting the location of pits for soil sampling. The data will also be used in the description of the contaminant plume, if any, as well as the piezometric surface of the immediate area. Data generated during this task will be used to generate base maps which illustrate the locations of all relevant features and will establish baseline elevations for all aspects of the investigation.

4.0 HYDROLOGIC INVESTIGATION

A hydrogeologic investigation will be performed to define the hydrologic setting and aquifer characteristics, such as groundwater flow direction and velocity, transmissivity, and storage coefficient. Additionally, the behavior of free oil and/or dissolved hydrocarbons, if present, will be evaluated in light of the physical characteristics of the saturated alluvial sediments. The extent of the investigation will encompass the area immediately surrounding the well site (including the reserve pit as well as other pits), and the area down gradient from the well which could potentially be affected by past operations.

The intent of the hydrologic investigation will be to illustrate, to the fullest degree possible, the lateral and vertical extent to which the site has been affected. To assess the magnitude of migration, organic constituents associated with hydrocarbons will be measured (e.g., benzene, toluene, xylene, and oil and grease) as will inorganic constituents (e.g., metals) and indicator parameters such as pH and electrical conductivity (EC).

To achieve the objectives of the hydrologic investigation, piezometers will be installed to determine the horizontal and vertical gradients, trenches will be dug to visually assess the dimensions of the plume (if any) using stained soil/sediments as evidence, and pump tests will be performed using the local water wells and piezometers to define aquifer characteristics.

Piezometers

Approximately four sites will be selected for the installation of new piezometers, one of which will be installed upgradient to establish background concentrations for parameters measured at downgradient locations. Figure 1 shows possible piezometer locations superimposed on a site sketch. Of the remaining piezometer locations, one will be selected for a nested piezometer to determine the vertical gradient. Each piezometer will be installed using construction details, which are tailored to the site, to allow representative groundwater samples to be collected. Figure 2 shows a typical piezometer installation guide. Before installation of piezometers, EPNG will sample piezometers previously installed by NMOCD after determining that they are suitable and cleaning them of sediment. It is expected that these piezometers will also assist in mapping the water table. Piezometers will be installed with a rotary rig if possible. A last resort will be by excavating with a backhoe to the desired depth and setting the casing.

In addition to defining the vertical gradient, the piezometer nest will aid in the determination of the vertical extent of constituents in the groundwater. In conjunction with the installation of the piezometers, soil samples may be collected for laboratory analysis.

Trenches

To define the extent and shape of affected soil/sediments, it is proposed that trenches be dug perpendicular to the direction of groundwater flow. The purpose of the

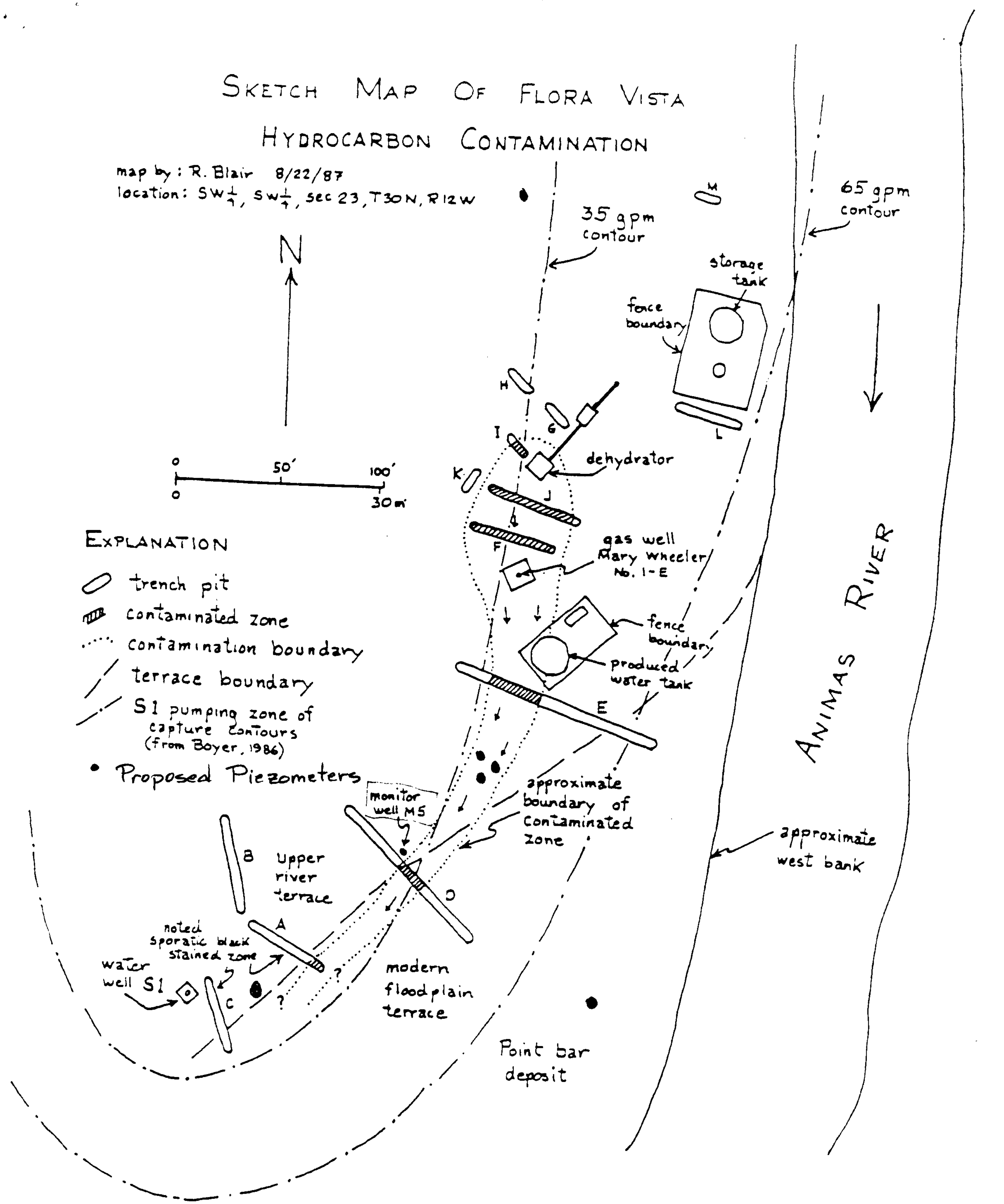

SKETCH MAP OF FLORA VISTA
HYDROCARBON CONTAMINATION
map by: R. Blair 8/22/87
location: SW$\frac{1}{4}$, SW$\frac{1}{4}$, sec 23, T30N, R12W
N
0 50′ 100′
0 30m
EXPLANATION
trench pit
contaminated zone
contamination boundary
terrace boundary
S1 pumping zone of capture contours (from Boyer, 1986)
• Proposed Piezometers
35 gpm contour
65 gpm contour
storage tank
fence boundary
dehydrator
gas well Mary Wheeler No. 1-E
fence boundary
produced water tank
ANIMAS RIVER
approximate boundary of contaminated zone
approximate west bank
monitor well M5
Upper river terrace
noted sporatic black stained zone
water well S1
modern flood plain terrace
Point bar deposit
A
B
C
D
E
F
G
H
I
J
K
L
M
?
?

Figure 1

MONITORING WELL REPORT

PROJECT: ______________________________

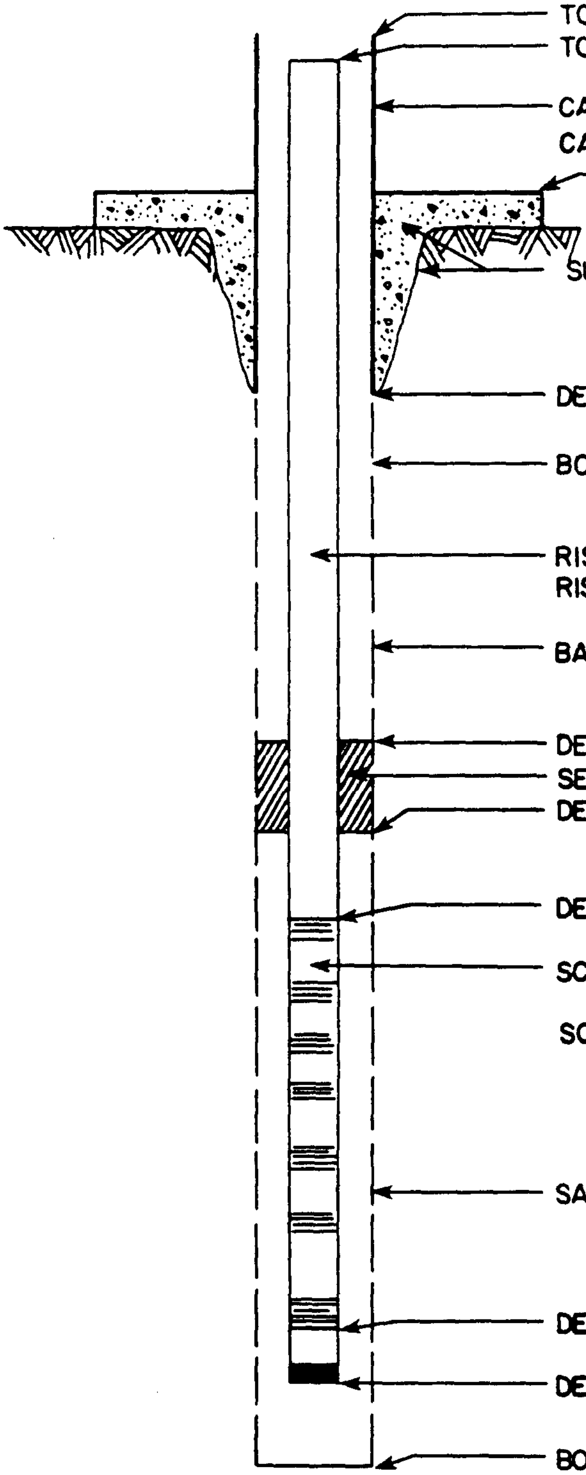
LOCATION: ______________________________

____

WELL NO: ______________________ DRILLED BY: ______________________

DATE COMPLETED: ______________________ LOGGED BY: ______________________

SCREENED INTERVAL: ______________________ INSPECTED BY: ______________________



TOP OF CASING ELEVATION: ______________________

TOP OF RISER PIPE ELEVATION: ______________________

CASING TYPE: ______________________

CASING I.D.: __________

PLATFORM ELEVATION: ______________________

GROUND SURFACE ELEVATION: ______________________

SURFACE SEAL: ______________________

DEPTH OF CASING BELOW GROUND: __________

BOREHOLE DIAMETER: __________

RISER PIPE TYPE: ______________________

RISER PIPE I.D.: __________

BACKFILL TYPE: ______________________

DEPTH AT TOP OF SEAL: __________

SEAL TYPE: ______________________

DEPTH AT BASE OF SEAL / TOP OF SAND PACK: __________

DEPTH AT TOP OF SCREENED SECTION: ______________________

SCREEN TYPE: ______________________

SCREEN OPENINGS: ______________________

SAND PACK TYPE: ______________________

DEPTH AT BASE OF SCREENED SECTION: __________

DEPTH AT BASE OF PLUG: __________

BOREHOLE DEPTH: __________

Figure 2

trenches will be to allow visual inspection of the shallow soil profile for evidence of migrating hydrocarbons. Additionally, soil samples can be collected for the profile at points where there is evidence of affected soils. Initially the trenches would be dug at 100-foot intervals to define the lateral extent of the plume. If it is determined that the 100-foot spacing is too coarse, then additional trenches will be dug as needed to define the extent and magnitude of the plume.

In addition to excavating trenches in downgradient locations, one trench or pit will be situated in an upgradient position to allow the collection of background soils samples. Where hydrocarbons are suspected, water sampling of the trenches will be conducted.

Pump Tests

In order to evaluate the potential impact oil field constituents could have on the local water wells, it will be necessary to determine the aquifer characteristics. To this end, it is proposed that the nearest water well be pumped and the piezometers (and other wells) be monitored. At this time it is believed that only the S-5 well will need to be pumped to monitor for contaminants. The results of the pump test, along with the soils data, will numerically define the potential for migration of the oil field constituents prior to cleanup activities as well as subsequent to remedial efforts.

5.0 COLLECTION AND ANALYSIS OF SOIL/GROUNDWATER SAMPLES

Soil samples will be collected during the excavation of the trenches described in Section 2. Sample locations within the trenches will be based on visual evidence and the need to define the lateral as well as the vertical extent of any plume which may be detected. Collection of the samples will be from the face of the trenches using stainless steel utensils. Samples will be collected from the former pit areas, including the reserve pit, to determine the potential for leaching and migration of wastes. All soil samples will be placed in glass jars and preserved in the field using ice to maintain the temperature of the samples at or near 4° C.

Groundwater samples will be collected for each of the piezometers installed during the investigation, from the piezometers currently present at the site, and from the local water wells. Sample collection will be accomplished using either dedicated PVC bailers, a Teflon bailer(s), dedicated pump, or a bladder sample pump. If dedicated equipment is not employed, then EPA approved decontamination procedures will be implemented between samples. Constituents to be analyzed for are expected to include some metals, PNA's, glycol, and both aliphatic and chlorinated hydrocarbons. Once collected, all groundwater samples will be filtered using 0.45 micron membranes (for metals only), placed in appropriate containers, preserved as needed, and stored in the field on ice at or near 4° C.

Both field analysis and laboratory analysis will be performed as samples are collected. Analysis of groundwater and soil samples will be conducted according to methods and procedures presented in SW-846, Third Edition (EPA, 1986) or an equivalent approved procedure. Parameters selected for groundwater analysis, as it pertains to the public water supply, will be selected from Section 3-301 of the WQCC Regulations. The selection of specific parameters from Section 3-301 will be based on discussions between OCD and EPNG. Soil samples and some groundwater samples collected for screening purposes will be analyzed for some, if not all of the parameters listed in Table 1.

Table 1. Analytical Parameters for Screening Purposes.

Indicators	Organics	Inorganics	
pH	Benzene	Barium	Chloride
EC	Toluene	Calcium	Sulfides
TDS	Xylenes	Magnesium	Selenium
Oil & Grease		Sodium	Cadmium
		Carbonate (and Bicarbonate)	Chromium

6.0 DATA INTERPRETATION AND RISK ASSESSMENT

The information gathered from previous investigations and the hydrologic investigation will be collectively reviewed to evaluate the existence, spatial distribution, and possible effects of contamination from the inactive pit and surrounding area. Utilizing these data, a risk assessment will be conducted to evaluate possible contamination to the nearby water wells and surrounding environment. The assessment will be based upon a comparison of the collective data to establish health and environmental criteria and potential for future migration.

7.0 REMEDIAL ACTION PLAN

The purpose of remedial action is to leave the site such that the existing Flora Vista water wells can be operated without exceeding current WQCC standards. The plan will contain details on the methodology to demonstrate that current USEPA drinking water standards are not violated or undesirable odors exist due to dissolved, emulsified and free-floating petroleum or other organic and inorganic contaminants. Further, the plan will demonstrate that the vadose zone does not contain materials such as drilling muds, inorganic salts, heavy metals or hydrocarbons in quantities sufficient to recontaminate ground water as the result of seasonal rises in water table, drainage, recharge or similar events. The remediation will consider all or portions of the reserve pit area depending on the results of the site assessment. Table 2 is a time line showing the activities leading to the completion of the remedial action plan.

Given the relatively small size of the inactive dehydration pit, it is suggested that the contaminated soil from the pit be removed. Since the pit is considered to be the major source of potential contamination at the site removal of the source is considered a cost-effective measure. In the extreme case where risk assessment suggests a hazard to water quality, total removal of all affected soils downgradient from the gas well area is proposed as a worst case remediation plan. The removal of this material will prevent future leaching of constituents to the groundwater.

It is anticipated that removal can be accomplished by excavation with a backhoe and a dump truck. The proper disposal method and disposal site will be defined prior to initiation of this task. Once the affected soils/sediments have been excavated, the area will be recontoured using clean borrow soil.

Table 2. Time–line for Completion of Activities at the Manana Well Site*.

Weeks 1–2	Weeks 3–4	Weeks 5–11	Weeks 12–16	Weeks 16–20	Weeks 21–24
Review of Existing Information *Task 2*	Initiation & Completion of Field Work *Tasks 3–5*	Sample Analysis *Task 5*	Data Inter–pretation, Risk Assessment, & Draft Report Preparation *Task 6*	Remedial Action Plan *Task 7*	Final Report Preparation

** Task numbers correlate with main heading numbers in proposal*

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

February 14, 1989

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

M E M O R A N D U M

TO: FLORA VISTA FILE

FROM: DAVID G. BOYER, Hydrogeologist

SUBJECT: EPNG MANANA WELL SITE INVESTIGATION PROPOSAL

The following are my comments on the above proposal dated January 27, 1989.

Section 2.0. Review of Existing Information

OCD files contain much significant information on the site including two reports of work, results of an aquifer test, water quality data, topographic survey, etc. These should be thoroughly reviewed by EPNG and consultants prior to the investigation to determine which information is adequate and which needs additional work or updating.

Section 4.0. Hydrologic Investigation

Piezometers - Before installation of new piezometers, use of existing OCD piezometers should be considered. However, OCD wells will need to be cleaned of sediment before use. If new wells are used, construction procedures must be submitted to OCD prior to construction.

Trenches

Trenching is the method preferred by OCD for defining the extent and magnitude of oil contamination water sampling of the trenches should be conducted where hydrocarbons are suspected.

Pump Tests

OCD believes that only well S-5 need be pumped to monitor for contaminants as it has not previously been pumped and tested.

Section 5.0. Collection and Analysis of Soil/Ground Water Samples

Analysis of the soil samples shall include analyses of the materials in the various pits, including the reserve pit, to determined the potential for leaching and migration of the wastes.

Some water samples should include analyses for PNA's, glycol, aliphatic and chlorinated hydrocarbons.

6.0. Data Interpretation and Risk Assessment

No comments.

7.0. Remedial Action Plan

More than just the inactive dehydration pit may need to be removed depending on test results. Remedial action should conform with and satisfy the criteria listed in my memo of June 15, 1988

Form 7-1 (Rev. 9-77)

ENGINEERING CALCULATION

Sheet: 1 of
Date: 2/16/89
By: H. Van
File:

MW		gals/mol
16.04	C_1	6.4
30.07	C_2	10.12
44.10	C_3	10.42
58.12	iC_4	12.38
58.12	nC_4	11.93
72.15	iC_5	13.85
72.15	nC_5	13.71
86.18	iC_6	15.50
86.18	C_6	15.57
100.21	iC_7	17.2
100.21	C_7	17.46
114.23	C_8	19.39
28.05	$C_2^=$	9.64
42.08	$C_3^=$	9.67

MISC.

MW		gals/mol
32.00	O_2	3.37
28.01	CO	4.19
44.01	CO_2	6.38
64.06	SO_2	5.50
34.08	H_2S	5.17
28.01	N_2	4.16
2.02	H_2	3.38

— FLORAVISTA —

K.E. Beasley, H. Van of EPNG   D. Boyer (OCD)

- Sample the existing OCD). (D. Boyer ~~[illegible]~~ will be on site when sampling).
- PIEZOMETERS
  - One up
  - Two downgradient
  - Use the other OCD piezometers
  Include location and construction procedures
- Need a location map
- TRENCHING
  Seems OK as indicated on proposal.
- PUMP TESTS
  - as Memo Feb. 14, 89.
- Section 5.0
  - Chlorinated hydrocarbons (because solvents might have been used)
- – We (EPNG) will include analysis of the soil samples.

* – Aliphatic HC, Hydrocarbon (look at the Lee Acres for parameters), Sulfate, Sulfite, Arsenic, Lead

- Scientific reasoning that no leaching will

Form 7-1 (Rev. 9-77)

ENGINEERING CALCULATION

Sheet: 2 of
Date: 2/16/89
By: H. Van
File:

FLORAVISTA

MW		gals/mol
16.04	C_1	6.4
30.07	C_2	10.12
44.10	C_3	10.42
58.12	iC_4	12.38
58.12	nC_4	11.93
72.15	iC_5	13.85
72.15	nC_5	13.71
86.18	iC_6	15.50
86.18	C_6	15.57
100.21	iC_7	17.2
100.21	C_7	17.46
114.23	C_8	19.39
28.05	$C_2^=$	9.64
42.08	$C_3^=$	9.67

MISC.

MW		gals/mol
32.00	O_2	3.37
28.01	CO	4.19
44.01	CO_2	6.38
64.06	SO_2	5.50
34.08	H_2S	5.17
28.01	N_2	4.16
2.02	H_2	3.38

occur to assure non-leachability:

1) Coring
2) Chem. Analysis
3) Removal

In other words:

a) Delineate reserve pit
b) Find out what is in there
c) Remove
d) Determine that no problem will continue to exist

- When removal the contaminated soil pump the G.W. to depress the G.W. level to allow removal of all the contaminated soil. The water can be pumped to the swampy area.
- The Domestic Water Well will be placed back in operation or at least have the capability.
- EPNG will include a schedule of Remedial Action Tasks in the revised proposal.

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978
PHONE: 915-541-2600

January 27, 1989

Mr. David Boyer, Chief
Environmental Bureau
Energy and Mineral Department
New Mexico Oil Conservation Division
310 Old Santa Fe Trail, 206
Sante Fe, New Mexico 87504

Reference: **Flora Vista**

Dear Mr. Boyer:

Enclosed for your review and consideration is our proposal for investigating the Manana Well Site near Flora Vista, New Mexico.

At your convenience, after you review this proposal, we would like to set up a meeting to discuss questions you may have and the project schedule.

If you have questions, please contact me at 915/541-2146 or Henry Van at 915/541-2832.

Very ~~truly~~ yours,

K. E. Beasley, P.E.
Manager of Compliance Engineering
North Region

KEB:cds

Enclosures

cc: J. F. Eichelmann III (w/ encl)
H. Van (w/ encl)

A PROPOSAL

FOR

INVESTIGATING THE MANANA WELL SITE

NEAR FLORA VISTA, NEW MEXICO

TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

El Paso Natural Gas Company (EPNG) has prepared this proposal for a soil/groundwater investigation of the Manana well site near Flora Vista, New Mexico. The proposal includes a description of tasks involved in the site investigation. The proposed investigation includes a review of existing information concerning the site, further characterization and topographic survey of the area, and interpretation of the collective observations and results. These efforts will culminate in a risk assessment of possible contamination from the inactive pit, and recommendations for treatment or removal of the contamination, if deemed necessary.

2.0 REVIEW OF EXISTING INFORMATION

EPNG will collect and review existing information on conditions at the site, specifically on the area between the inactive pit and nearby water wells. EPNG will review this information to determine the pre- existing conditions at the site for comparison with findings of the EPNG field investigation. From this comparison, conclusions will be made concerning the likelihood of migration and/or degradation of contaminants from the pit. This information will be used to aid in designing the hydrologic investigation.

3.0 AREA TOPOGRAPHIC SURVEY

A topographic survey of the area will be conducted to provide relative elevations of points of interest at the site. The survey will provide a grid, with points of known elevations, for siting the location of pits for soil sampling. The data will also be used in the description of the contaminant plume, if any, as well as the piezometric surface of the immediate area. Data generated during this task will be used to generate base maps which illustrate the locations of all relevant features and will establish baseline elevations for all aspects of the investigation.

4.0 HYDROLOGIC INVESTIGATION

A hydrogeologic investigation will be performed to define the hydrologic setting and aquifer characteristics, such a groundwater flow direction and velocity, transmissivity, and storage coefficient. Additionally, the behavior of free oil and/or dissolved hydrocarbons, if present, will be evaluated in light of the physical characteristics of the saturated alluvial sediments. The extent of the investigation will encompass the area immediately surrounding the well site (including all pits), as well as the area down gradient from the well which could potentially be affected by past well operations.

The intent of the hydrologic investigation will be to illustrate, to the fullest degree possible, the lateral and vertical extent to which the site has been affected. To assess the magnitude of migration, organic constituents associated with hydrocarbons will be measured (e.g., benzene, toluene, xylene, and oil and grease) as will inorganic constituents (e.g., metals) and indicators parameters such as pH and electrical conductivity (EC).

To achieve the objectives of the hydrologic investigation, piezometers will be installed to determine the horizontal and vertical gradients, trenches will be dug to visually assess the dimensions of the plume (if any) using stained soil/sediments as evidence, and pump tests will be performed using the local water wells and piezometers to define aquifer characteristics.

<u>Piezometers</u>

Four sites will be selected for the installation of new piezometers, one of which will serve to establish background concentrations for parameters measured at downgradient locations. Of the three remaining piezometer locations, one will be selected for a nested piezometer to determine the vertical gradient. Each piezometer will be installed using construction details, which are tailored to the site, to allow representative groundwater samples to be collected.

In addition to defining the vertical gradient, the piezometer nest will aid in the determination of the vertical extent of constituents in the groundwater. In conjunction with the installation of the piezometers, soil samples may be collected for laboratory analysis.

<u>Trenches</u>

To define the extent and shape of affected soil/sediments, it is proposed that trenches be dug perpendicular to the direction of groundwater flow. The purpose of the trenches will be to allow visual inspection of the shallow soil profile for evidence of migrating hydrocarbons. Additionally, soil samples can be collected for the profile at points where there is evidence of affected soils. Initially the trenches would be dug at 100-foot intervals to define the lateral extent of the plume. If it is determined that the 100-foot spacing is too coarse, then additional trenches will be dug as needed to define the extent and magnitude of the plume.

In addition to excavating trenches in downgradient locations, one trench or pit will be situated in an upgradient position to allow the collection of background soils samples.

<u>Pump Tests</u>

In order to evaluate the potential impact oil field constituents could have on the local water wells, it will be necessary to determine the aquifer characteristics. To this end, it is proposed that the nearest water well be pumped and the piezometers (and other wells) be monitored. The results of the pump test, along with the soils data, will numerically define the potential for migration of the oil field constituents prior to cleanup activities as well as subsequent to remedial efforts.

5.0 COLLECTION AND ANALYSIS OF SOIL/GROUNDWATER SAMPLES

Soil samples will be collected during the excavation of the trenches described in Section 2. Sample locations within the trenches will be based on visual evidence and the need to define the lateral as well as the vertical extent of any plume which may be detected. Collection of the samples will be from the face of the trenches using stainless steel utensils. All soil samples will be placed in glass jars and preserved in the field using ice to maintain the temperature of the samples at or near 4° C.

Groundwater samples will be collected for each of the piezometers installed during the investigation, from the piezometers currently present at the site, and from the local water wells. Sample collection will be accomplished using either dedicated PVC bailers, a Teflon bailer(s), dedicated pump, or a bladder sample pump. If dedicated equipment is not employed, then EPA approved decontamination procedures will be implemented between samples. Once collected, all groundwater samples will be filtered using 0.45 micron (for metals only), placed in appropriate containers, preserved with appropriate acids as needed, and stored in the field on ice at or near 4° C.

Both field analysis and laboratory analysis will be performed as samples are collected. Analysis of groundwater and soil samples will be conducted according to methods and procedures presented in SW-846, Third Edition (EPA, 1986) or an equivalent approved procedure. Parameters selected for groundwater analysis, as it pertains to the public water supply, will be selected from Section 3-301 of the WQCC Regulations. The selection of specific parameters from Section 3-301 will be based on discussions between OCD and EPNG. Soil samples and some groundwater samples collected for screening purposes will be analyzed for some, if not all of the parameters listed in Table 1.

Table 1. Analytical Parameters for Screening Purposes.

Indicators	Organics	Inorganics	
pH	Benzene	Barium	Chloride
EC	Toluene	Calcium	Sulfides
TDS	Xylenes	Magnesium	Selenium
Oil & Grease		Sodium	Cadmium
		Carbonate (and Bicarbonate)	Chromium

6.0 DATA INTERPRETATION AND RISK ASSESSMENT

The information gathered from previous investigations and the hydrologic investigation will be collectively reviewed to evaluate the existence, spatial distribution, and possible effects of contamination from the inactive pit and surrounding area. Utilizing these data, a risk assessment will be conducted to evaluate possible contamination to the nearby water wells and surrounding environment. The assessment will be based upon a comparison of the collective data to establish health and environmental criteria and potential for future migration.

7.0 REMEDIAL ACTION PLAN

Given the relatively small size of the inactive pit, it is suggested that the contaminated soil from the pit be removed. The pit is considered to be the major source of potential contamination at the site; therefore, removal of the source is considered a cost-effective measure. Furthermore, in the extreme case where risk assessment suggests a hazardous to water quality, total removal of all tainted soils downgradient for the well area is proposed as a worst case remediation plan. The removal of this material will prevent future leaching of constituents to the groundwater. It is anticipated that removal can be accomplished by excavation with a backhoe and a dump truck. The proper disposal method and disposal site will be defined prior to initiation of this task. Once the affected soils/sediments have been excavated, the area will be recontoured using clean borrow soil.

ZIA REPORTERS
500 OAK STREET, N.E., P.O. BOX 27457
ALBUQUERQUE, NEW MEXICO 87125
(505) 242-5544

JUL 19 1988
OIL CONSERV. SANTA

July 18, 1988

Mr. David G. Boyer
P.O. Box 2088
Santa Fe, New Mexico 87501

Re: Flora Vista vs. Manana Gas, Inc., et al.
San Juan County District Court Cause No. CV 86-00154-4

Dear Mr. Boyer:

Your deposition in the above-captioned cause that was taken on June 23, 1988, has been transcribed and is available for you to read and sign at our office. The office is open from 8:00 a.m. until 5:00 p.m., Monday through Friday. Please call before you come in.

If your deposition has not been signed by you within 30 days from today's date, the unsigned original transcript of your deposition will be forwarded to Mr. Byron Caton's office at that time.

Yours very truly,

ZIA REPORTERS

Louise R. Williams

Louise R. Williams

cc: Robert G. Stovall

265-2030 Rick Lougee

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

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

June 15, 1988

M E M O R A N D U M

TO: INTERESTED PARTIES

FROM: DAVID. G. BOYER, Hydrogeologist DGB
Environmental Bureau Chief

SUBJECT: REQUIREMENTS FOR FLORA VISTA CONTAMINATION INVESTIGATION AND REMEDIAL ACTION PLAN

- -

Attached are the technical requirements I believe necessary to perform a complete hydrologic investigation of the Flora Vista contamination site, and the clean-up criteria required to be met at completion of the remedial action plan. Also attached is a copy of the El Paso Natural Gas Company letter of December 23, 1987, that provides some suggestions for further study of the contamination. I will be happy to discuss the technical requirements, and provide clarification and additional information if needed.

REQUIREMENTS FOR FLORA VISTA
CONTAMINATION INVESTIGATION AND REMEDIAL ACTION PLAN

The Oil Conservation Division (OCD) believes that the most methodical approach for cleanup at the Flora Vista site is to conduct a hydrogeologic investigation and prepare a remedial action plan. A hydrologic investigation report must be prepared for OCD review and approval that includes the items detailed below. The report can also incorporate those items suggested for investigation in the El Paso Natural Gas Company (EPNG) letter of December 23, 1987. Concurrent with submittal of the hydrologic investigation report, is the submittal of a reclamation plan that provides for the removal of dissolved, emulsified and free-floating product from the aquifer and soils; and for the removal of actual and potential organic and inorganic ground water contaminants from site locations including the reserve and other pit locations. Actual reclamation will begin after OCD approval of the report and reclamation plan. All on-site locations will need to be examined to determine the totality of actual or potential contamination. Due to the proximity of the public water supply well, a successful reclamation action must include all possible contaminant sources. A timetable for completion of the investigation and agency reviews is suggested.

A. The hydrologic investigation report should provide the following:

1.a. Definition of the horizontal and vertical extent and magnitude of petroleum and other fluid contamination both on and off-site in water and soil. Constituent investigation must include oil, glycol, emulsified and dissolved oil, salts, heavy metals, and chlorinated hydrocarbon contaminants. The investigation area must include the dehydration pit, other pit locations (i.e. tank drain, blowdown, etc.) the area between the contaminated water supply well and the Mary Wheeler #1E site, and the area between the contaminated water well and the other supply wells. It also will be necessary to pump and test well S-5 for possible contaminants.

1.b. Definition of the horizontal and vertical extent of the drilling mud pit (aka. "reserve" or "slush" pit) and a determination of the type and concentration of drilling mud, inorganic salts, heavy metals, and hydrocarbons in pit sediments, and determination of the type and amount of any other material deposited in the pit prior to closure.

2. Information on the rate and direction of oil and dissolved constituent migration;

3. Monitoring well or excavated pit data including field observations of odors, soil discoloration, reports of petroleum encountered, and results of all chemical or physical analyses of water, soil or petroleum. If monitoring wells are installed, construction procedures must be submitted to OCD prior to construction;

4. Water table elevation map(s);

5. Map(s) showing locations of all known past pits, of trenches or pits excavated for the current investigation, and locations of samples taken for soil, water or petroleum analyses;

6. Map(s) showing petroleum contamination locations and thickness, and concentration of dissolved constituents;

7. A discussion of the potential for contamination of the other public water supply wells; and

8. Other technical information necessary or requested by OCD to determine the extent or magnitude of contamination.

An evaluation of existing information as outlined in the EPNG letter of December 23 would be useful in determining circumstances relating to the loss of petroleum and other fluids on site. However, it can not substitute for the detailed geohydrologic investigation required prior to remedial action commencement. Likewise, though pits could be useful, trenching as performed in August 1987 would seem to be the most expeditious procedure to use to locate the path the oil has followed to the well, and possibly beyond.

B. Coincident with submittal of the hydrologic investigation report (see schedule below), a reclamation proposal for site remedial action shall be submitted that will include specific detail on technology or methodology to meet the following clean-up criteria:

1. Dissolved, emulsified and free-floating petroleum, and other organic and inorganic water contaminants, must be removed from the ground water such that:

   a) the water quality standards of Section 3-103 of the NM Water Quality Control Commission Regulations (as amended through December 24, 1987) are met; and

   b) the USEPA drinking water standards for public water supplies in effect as of the date of this agreement are met; and

   c) undesirable odors attributable to loss of petroleum or other fluids from the site are not present in ground water.

2. The unsaturated (vadose) zone in the vicinity of the contamination shall not contain drilling muds, inorganic salts, heavy metals or hydrocarbons in quantities sufficient to recontaminate ground water. Contamination shall be deemed to occur if State of Federal numerical standards are exceeded, or through continued presence or reappearance of oil or grease, or undesirable odors in the water supply. Such recontamination shall not be allowed to occur as a result of seasonal rises in the water table, drainage, recharge events, or in any other manner. Soils contaminated with drilling muds, salts, heavy metals or hydrocarbons, and needing to be removed to prevent continued or

future contamination of ground water, shall be excavated and disposed of in locations approved in advance by OCD. Clean fill material may need to be provided to replace contaminated soils. Pumping of the affected water supply well for some length of time may be necessary to verify successful cleanup.

The remedial action plan should include an estimated schedule for completion of the various remedial action tasks.

C. The following schedule is proposed for investigation and remedial action:

Within 120 days after parties agree to the study and remedial action requirements - submittal of hydrogeologic investigation report and proposed reclamation plan.

Within 30 days of OCD receipt of report and plan - OCD completes review and provides comments.

Within 15 days of receipt of OCD comments - response to OCD comments.

Within 15 days of receipt of response - OCD decision on approval of reclamation plan.

Within 15 days of OCD approval - begin remedial action.

El Paso
Natural Gas Company

DEC 28 1987

P. O. BOX 4990
FARMINGTON, NEW MEXICO 87499
PHONE: 505-325-2841

December 23, 1987

Mr. David G. Boyer
Hydrogeologist/Environmental Bureau Chief
Energy and Minerals Department
New Mexico Oil Conservation Division
P.O. Box 2088
Santa Fe, New Mexico 87501-2088

Subject: Flora Vista Contamination Study

Dear Mr. Boyer:

On September 17, 1987 El Paso Natural Gas representatives met with your staff and held an informal discussion on the recent events at the Manana-Mary Wheeler #1E site. You requested additional information on the dehydrator operation at that time and we provided a chronology to you on October 28. At the meeting you also offered some suggestions on investigation and remediation at the site. Those recommendations were duly noted reviewed in the interim.

After some independent study as well as consideration of your suggestions we have put together some steps which we feel appropriate entities could implement to satisfy all concerned that the Flora Vista water supply is adequately protected from any possible contamination at the well site. Your views on the viability of this plan would be appreciated. The plan is, of course, conceptual and some details would need to be worked out later. However, we believe that the objectives and basic steps required to achieve them are spelled out clearly enough to allow NMOCD to evaluate them.

First, a detailed evaluation of existing information on site conditions would be required. This evaluation would include a review of all data and reports which have been generated in the years since problems at the Flora Vista Water Users well field were first identified. This review would help determine pre-existing conditions which can be compared with field investigations to be conducted later.

A topographic survey should then be conducted of the area to provide key elevations and allow the establishment of a grid. This grid would be used for siting pits for soil sampling. The elevation information also would be a tool for determining the piezometric surface in the immediate area.

Several pits would be necessary to locate and define a contaminant plume should one exist. Additional piezometers might also be required at this time. Analyses for samples collected from pits and all piezometers should include benzene, toluene and xylene although other constituents could conceivably be identified during the investigation.

A risk assessment should then be conducted to evaluate the existence and possible effects of contamination at the well site. This assessment would be based on field information, previously collected data, and a comparison with established health and environmental criteria.

Finally, the plan should include excavation of contaminated soil from the pit area. This material should be removed from the area to an acceptable site.

In summary, the steps outlined above would allow concerned parties to identify and delineate any contamination in the area of the Manana-Mary Wheeler #1E well site and the Flora Vista Water Users well field. In addition, this type of plan would provide guidance for any necessary remediation and the subsequent assurance that the Flora Vista water supply will not be adversely affected by any contamination at the above-mentioned gas well location. El Paso is interested in any comments that you might have on the plan and thanks you in advance for your views.

Sincerely Yours,

Kenneth E. Beasley III
Compliance Engineer

Mail to:

Bryon Calon
333 East Main Street
Farmington, NM 87401

~~Richard~~
Chester F Miller, III
Richard Lougee
406 Airport Road
Farmington, NM 87401

Bruce Thompson
P.O. Drawer 887
Albuquerque, NM 87102

Interagency Stuart Castle
EID Water Supply
Runnels Bldg.
Santa Fe

Dennis McQuillan
EID Ground Water
Runnels Bldg.
Santa Fe

Bill Olson
EID Ground Water
Runnels Bldg
Santa Fe

Sent 6/15/88
DAB

Sent Ken Beasley
Henry Van
6/17/88

ANALYSIS OF HYDROLOGIC AND ENVIRONMENTAL EFFECTS
OF DRILLING MUD PITS AND PRODUCED WATER IMPOUNDMENTS

VOLUME I:

Executive Summary and Report

For

THE AMERICAN PETROLEUM INSTITUTE

Reviewed for use
in preparation
of June 15, 1988,
Remedial Action
Memorandum and
June 23, 1988 Deposition.
[illegible]

Prepared by
DAMES & MOORE
HOUSTON, TEXAS

October 1982

ACKNOWLEDGEMENTS

The authors express sincere appreciation to the American Petroleum Institute and to the Task Force on Mud Pits and Produced Water Impoundments for their cooperation, effort, lively discussion, and support in the successful completion of this study. The American Petroleum Institute and Dames & Moore Consultants in Environmental and Earth Sciences acknowledge Hall Environmental Services for invaluable assistance in data management and analysis, and IHI-KEMRON and SPECTRIX CORPORATION for chemical analysis of the multitude of water, soil, and vegetation samples performed for this study. Special thanks are given to G. Henderson, J. Woodrow, C. Wills, V. Keys, T. Westbrook, J. Slikas, A. Laramee, J. Salinas, E. Aguilar, C. Johnson, T. Mellini, and D. Bartlett for their efforts in sampling and installation of monitoring wells. Appreciation is given to C. Wills and Dr. N. Fotheringham for their dilligence and effort in the implementation of data analysis and G. Henderson for interpretation. We would also like to thank R. Orosco, S. Edwards, and G. A. Smalley for their guidance and assistance on the program. Special thanks to S. Jackson and J. Knowles of Triad Drafting Services for technical illustration, and R. Fisher, D. Szuba, J. Campbell, E. Cook, and others for word processing and patience. Deep appreciation is expressed to the personnel at all sites visited for their cooperation, help and guidance in the study, and to the owner companies and regional offices for information and assistance throughout.

The committee members of the Task Force on the Mud Pits and Produced Water Impoundments Study are:

J. W. Collins, Cities Service Company, Chairman
J. Greer, API staff
Dr. G. H. Holliday, Shell Oil Company
A. B. "Bud" Parker, ARCO Oil & Gas Company
H. R. Moseley, ERCO Petroleum Services
R. Abbott, CONOCO, Inc.

1.0 EXECUTIVE SUMMARY

1.1 BACKGROUND

In the proposed hazardous waste management regulations of December 18, 1978, the Environmental Protection Agency (EPA) classified oil and gas drilling muds and oil production brines (produced water) as "special wastes" (43 FR 58949-58968). As the result of a Congressional amendment, these wastes were exempted from the Resource Conservation and Recovery Act (RCRA) in the May 19, 1980 regulations. EPA was mandated by Congress to conduct studies to evaluate the effects of onshore disposal of drilling muds and produced waters because the effects of these wastes on human health and the environment were not well documented. The American Petroleum Institute (API) sponsored the independent study reported herein to provide data on the effects of these oil and gas field waste management and disposal activities.

1.2 PURPOSE OF THE API STUDY

The purpose of the API Study was to investigate the leaching potential of possible hazardous constituents from selected oil and gas field drilling mud reserve pits and emergency produced water impoundments. The objectives were:

1. To evaluate whether constituents leach in sufficient quantity to present a significant hazard to human or the environment; and
2. To investigate the possible transport pathways of leached constituents.

1.3 PARAMETERS STUDIED

Parameters selected for chemical analysis in ground water, subsurface and surface soils and/or vegetation at these sites included arsenic (As), barium Ba), cadmium (Cd), hexavalent chromium (hCr), total chromium (tCr), lead (Pb), mercury (Hg), zinc (Zn), sodium (Na), chloride (Cl), bromide (Br) (one site only), total alkalinity (Alk), specific conductivity (SC), pH and temperature (T°C) (ground water only). The seven heavy metals As, Ba, Cd, tCr, Pb, Hg and Zn were chosen because 1) they can occur as trace contaminants of clays or barite, both of which are major components of many drilling fluids; and 2) current regulations have set standards for acceptable concentration limits of these elements in drinking water and/or ground waters downgradient of disposal facilities. The other parameters--Na, Cl, Alk, SC, pH and TC--were measured primarily to provide supplemental information on ground water quality and chemical characteristics of water and sediments.

1.4 TYPES OF FACILITIES INVESTIGATED

1.4.1 Drilling Mud Reserve Pits

Mud pits are usually in operation only during the drilling of an oil or gas well, a period of time ranging from a few weeks to about a year, depending upon the depth of the well. Mud pits are used for onsite emergency reserve drilling mud storage during drilling and, at the completion of the well, to contain waste drilling fluids, cuttings, and site runoff. The type of drilling mud used (i.e., the "mud system") is generally a function of the depth to, and the intervening lithology of, the strata between the surface and the oil or gas producing formation. The majority of the wells drilled in the United States are advanced to depths of less than 5,000 feet and therefore require relatively small amounts of drilling fluids. For this study, deeper wells were selected because of the larger, more complex mud systems involved. Four of the six mud systems contained chromium lignosulfonate additives.

1.4.2 Produced Water Impoundments

Produced water impoundments are usually in operation for relatively long periods of time (10 to 30 years). The impoundments investigated in this study are used to contain produced water and small amounts of oils collected during emergency conditions. A given produced water impoundment generally services several wells. Produced water is directed to such impoundments when an emergency situation occurs (such as failure in the injection equipment or disposal well resulting in overfilling of the produced water storage tank). Produced water impoundments are constructed either from natural clay sediments--or are artifically lined--to provide very low permeability.

1.5 SITES STUDIED

The eight sites selected for the American Petroleum Institute Mud Pit Produced Water Impoundment Study (API Study) represented current industry practices for operation, maintenance and/or closure of mud pits and produced water impoundments. The eight sites are from three major hydrogeologic regions, each with different potentials for leachate migration and detection. These regions were:

1. Northern, semi-arid sites on consolidated sedimentary facies. The three sites located in this region were two mud pit sites in the Wyoming Overthrust Belt region and one mud pit site in the Williston Basin of North Dakota.

2. Southern, transitional climate sites on semi-consolidated sedimentary facies. The two sites in this region were located in Northeast Texas (a mud pit site) and in Southwestern Arkansas (a produced water impoundment site) on opposite sides of the Sabine Uplift.

3. Southern, coastal sites on unconsolidated sedimentary facies. Three sites were located in this region, one mud pit and one produced water impoundment site, both in Southern Louisiana, plus one mud pit site in the middle of the Gulf Coastal bend in Southern Texas.

The sites in Region 1 have high leaching potential based on subsurface lithogic conditions but low potential based on annual precipitation rates and patterns. The sites in Region 2 have high leaching potential based on both subsurface lithology and annual rainfall. Sites in Region 3 had either low or high leaching potential rates based on lithology (depending upon presence or absence of heavy clay layers near-surface) and high potential leaching rate based on annual rainfall. These three regions are considered representative of the majority of the regions where oil and gas drilling and producing operations occur.

1.6 CONTAMINATION PATHWAYS

In the planning phase of the study, three generic pathways were identified: a) leaching and subsurface movement of constituents downward and laterally through subsurface soils to ground water via infiltration, percolation and ground water flow; b) surface movement to downslope soils and/or downstream drainage basins via erosion and runoff; and, c) in situ uptake by vegetation on or adjacent to disposal areas and subsequent incorporation into the general food web via herbivores.

1.7 RESULTS AND CONCLUSIONS

Results of chemical analyses of ground water, subsurface soil and surface soil, and vegetation samples at the sites indicate the most motile ions found to leach from both mud pits and produced water impoundments were Na and Cl. Levels of Cl return to levels below Secondary Drinking Water Standards within a matter of several hundred feet at most facilities, and do not constitute either a health hazard or a water potability problem for public and industrial ground water uses. Probable migration rates of heavy metals from both mud pits and produced water impoundments to ground water appear to be very slow and the observed concentrations measured in ground waters at the sites are low and do not indicate a hazard to human health. Subsurface soils, surface soil and vegetation samples at all sites showed elevated levels of heavy metals, Na and Cl in pit and/or downgradient locations. However, apparent rates of migration are slow, based on the observation that "contaminated" subsurface layers, when they exist, are found in relatively narrow, shallow bands close to the point of origin. Moreover, although the study indicates elevated levels of some heavy metals in plants growing on some reclaimed mud pits and bordering some impoundments, the small size of the area of affected plants does not represent a significant portion of the available forage resources of the areas studied, and is unlikely to constitute a significant environmental or health hazard.

? See conclusion #4

5.0 CONCLUSIONS AND RECOMMENDATIONS

The observations made and the data collected during the API Study led to a number of conclusions regarding both the effects of mud pit and production impoundments and the efficacy of the methods used to evaluate such effects for these and other disposal facilities.

These conclusions, along with recommendations for changes in certain methods, are summarized in this section. In general, results of chemical analyses of ground water, subsurface soil and surface soil, and vegetation samples at the sites indicate the most motile ions found to leach from both mud pits and produced water impoundments were Na and Cl. Levels of Cl in ground water return to levels below Secondary Drinking Water Standards within a matter of several hundred feet at most facilities, and do not constitute either a health hazard or a water potability problem for public and industrial ground water uses. Probable migration rates of heavy metals from both mud pits and produced water impoundments to ground water appear to be very slow and the observed concentrations measured in ground waters at the sites do not indicate a hazard to human health.

Subsurface soils, surface soil and vegetation samples at all sites showed elevated levels of heavy metals, Na and Cl in pit and/or downgradient locations. However, apparent rates of migration are slow, based on the observation that "contaminated" subsurface layers, when they exist, are found in relatively narrow, shallow bands close to the point of origin. Moreover, although the results indicate elevated levels of some heavy metals in plants growing on some reclaimed mud pits and bordering some impoundments, the small size of the area of affected plants does not represent a significant portion of the available forage resources of the areas studied, and is unlikely to constitute a significant environmental or health hazard at any of the sites studied.

Specific conclusions and recommendations include the following:

1. None of the extract mg/l concentrations for any samples at any of the sites exceed RCRA guidelines of 100 X PDWS. Therefore, samples of mud pit mixtures and soils near produced water impoundments analyzed in the API Study are not hazardous waste mixtures.

2. The data presented here, in conjunction with the reported inconsistency and unpredictability of the extraction methods as routinely run by reputable analytical laboratories, indicate a more reliable method for setting performance standards to regulate solid waste facilities under RCRA must be developed.

3. Location rankings indicate elevated uptake of heavy metals by plants may occur on soils with elevated heavy metal concentrations, and that heavy metals in drilling mud mixtures may be available for plant uptake. However, due to the small area of affected plants, the impact of disposal-derived heavy metal concentrations on the forage resources of the areas studied is insignificant and should not constitute a threat to human health or the environment.

4. Even though parameter concentrations in downgradient wells tend to be higher than those in upgradient or background control wells, the mean concentrations in downgradient wells for most heavy metals at most sites are below Primary and Secondary DWS limits. Some metals did exceed PDWS in downgradient and/or control wells during the period of study, particularly As, Ba and Cd. Mean Cl concentrations exceeded SDWS at all the study sites except DND and VLA. With the exception of KTX, all Cl exceedances were confined to downgradient wells.

5. All sites show significant differences in direction of ground water flow with season. In several sites, the direction change appears to be reflected in the relative concentrations of certain parameters,

especially Cl. These data indicate that changes in flow direction must be taken into account when monitoring wells are placed onsite, and must be incorporated into data analysis and interpretation.

6. Overall mean concentrations in ground water for most parameters are low at all sites. However, high levels of three or four metals are apparent at each site, and high Cl levels are apparent at four sites.

7. Comparison of the distribution of the number and magnitude of exceedances of DWS in up- and downgradient wells indicate that the percent exceedance is generally not very different among wells for most sites. However, the magnitude by which DWS limits are exceeded is almost always less in control wells than elsewhere.

8. Statistical tests indicate well location affects the concentrations of many of the measured parameters, particularly Ba, Na, Cl and Alk. Season affects most parameters at most sites, particularly concentrations of Ba, Cd, Hg, Zn and Cl. Treatment did not significantly affect most parameters at most sites, indicating that, in general, filtering ground water samples does not affect concentrations of most measured parameters.

9. With one exception (DND), rankings of mean concentrations indicate ground water samples collected from downgradient or pit area locations are higher for most parameters than are samples collected from control well locations.

10. Four extract methods were used for chemical analyses of soil samples. Data for these extracts were converted to mg/kg oven dry weight concentrations and were ranked to examine relative extract "strength" for each parameter. In general, concentrations in EPA extracts are higher than those in TDWR extracts at all sites except DND, where the rankings are reversed. At all sites (except DND), Cl concentrations

are higher in TDWR extracts than in EPA extracts, but Na is reversed, being always higher in EPA extracts than in TDWR extracts.

11. Concentrations found in different extracts for the same soil samples were regressed for each parameter. The results of the regression analyses indicate that the concentrations found in one extract had very little, if any, relationship to concentrations in other extracts, except for Na and Cl in TDWR versus EPA extracts.

12. Levels of heavy metals, Na and Cl tend to be elevated in subsurface soil locations in or near pits or impoundments at all sites. However, as evidenced by ground water data, most parameters do not appear to migrate any appreciable distance away from these disposal and storage facilities. The only parameters which showed definite evidence of vertical migration downward through subsurface soils were the mobile ions Na and Cl. High SC was also characteristic of contaminated zones.

13. No statistically significant relationship between soil and vegetation concentrations was evident for most of the measured parameters at the study sites. One of the reasons for the apparent lack of correlation between measured concentrations in soils and vegetation was the evident variability in extraction "success". As a result of these extraction problems, all surface soil and vegetation results should be evaluated only in relation to each other at each site and not in relation to absolute levels determined at other sites or in other studies.

14. The QA program results for soils and vegetation extracts indicate that all extraction methods investigated for the API Study had severe problems with both recovery and replication reliability. Given these results, all data presented in this report for soils and vegetation should be viewed as indicative of <u>relative concentrations</u> of the various ions within each site, but are suitable neither to rigorous

statistical treatment nor to in-depth visual inspection and comparison of exact values between sites. It should be emphasized that these reservations are applicable only to soils and vegetation extraction results and are not relevant to ground water results.

STATE OF NEW MEXICO
COUNTY OF SAN JUAN
IN THE DISTRICT COURT

FLORA VISTA WATER USERS ASSOCIATION,

Plaintiff,

vs.

MANANA GAS, INC., CV 86-00154-4

Defendant/Third Party Plaintiff,

vs.

EL PASO NATURAL GAS COMPANY,

Third Party Defendant.

NOTICE OF DEPOSITION

NOTICE IS HEREBY GIVEN that Defendant/Third Party Plaintiff, Manana Gas, Inc., will take the deposition of David Boyer, upon oral interrogatories, before a Certified Court Reporter and Notary Public from Zia Reporting Service, at the hour of 10:00 o'clock a.m. on Thursday, June 23, 1988, at the offices of Zia Reporting Service, 500 Oak Street, N.E., Albuquerque, New Mexico.

RECEIVED
JUN 14 1988
DIVISION

BRIONES, ODENWALD & CATON, P.A.
333 East Main Street
Farmington, NM 87401
(505) 325-0258

Byron Caton
Attorney for Defendant/
Third Party Plaintiff

FILING OF DOCUMENTS DATE June 13, 1988

RE: FLORA VISTA v. MANANA

The following document(s) are enclosed for filing with your office:

NOTICE OF DEPOSITION of DAVID BOYER

PLEASE RETURN FILE - STAMPED COPY TO OUR OFFICE.

TO
11th Judicial District Court Clerk
920 Municipal Drive, Suite 2
Farmington, NM 87401

BRIONES & PITTARD, P. A.
333 East Main Street
Farmington, New Mexico 87401
(505) 325 - 0258

cc: all counsel
Zia Reporting Service
David Boyer

I hereby certify that
a copy of the foregoing
was mailed to opposing
counsel of record this
13th day of June, 1988.

Byron Caton

El Paso
Natural Gas Company

P. O. BOX 4990
FARMINGTON, NEW MEXICO 87499
PHONE: 505-325-2841

December 23, 1987

Mr. David G. Boyer
Hydrogeologist/Environmental Bureau Chief
Energy and Minerals Department
New Mexico Oil Conservation Division
P.O. Box 2088
Santa Fe, New Mexico 87501-2088

Subject: Flora Vista Contamination Study

Dear Mr. Boyer:

On September 17, 1987 El Paso Natural Gas representatives met with your staff and held an informal discussion on the recent events at the Manana-Mary Wheeler #1E site. You requested additional information on the dehydrator operation at that time and we provided a chronology to you on October 28. At the meeting you also offered some suggestions on investigation and remediation at the site. Those recommendations were duly noted reviewed in the interim.

After some independent study as well as consideration of your suggestions we have put together some steps which we feel appropriate entities could implement to satisfy all concerned that the Flora Vista water supply is adequately protected from any possible contamination at the well site. Your views on the viability of this plan would be appreciated. The plan is, of course, conceptual and some details would need to be worked out later. However, we believe that the objectives and basic steps required to achieve them are spelled out clearly enough to allow NMOCD to evaluate them.

First, a detailed evaluation of existing information on site conditions would be required. This evaluation would include a review of all data and reports which have been generated in the years since problems at the Flora Vista Water Users well field were first identified. This review would help determine pre-existing conditions which can be compared with field investigations to be conducted later.

A topographic survey should then be conducted of the area to provide key elevations and allow the establishment of a grid. This grid would be used for siting pits for soil sampling. The elevation information also would be a tool for determining the piezometric surface in the immediate area.

Several pits would be necessary to locate and define a contaminant plume should one exist. Additional piezometers might also be required at this time. Analyses for samples collected from pits and all piezometers should include benzene, toluene and xylene although other constituents could conceivably be identified during the investigation.

A risk assessment should then be conducted to evaluate the existence and possible effects of contamination at the well site. This assessment would be based on field information, previously collected data, and a comparison with established health and environmental criteria.

Finally, the plan should include excavation of contaminated soil from the pit area. This material should be removed from the area to an acceptable site.

In summary, the steps outlined above would allow concerned parties to identify and delineate any contamination in the area of the Manana-Mary Wheeler #1E well site and the Flora Vista Water Users well field. In addition, this type of plan would provide guidance for any necessary remediation and the subsequent assurance that the Flora Vista water supply will not be adversely affected by any contamination at the above-mentioned gas well location. El Paso is interested in any comments that you might have on the plan and thanks you in advance for your views.

Sincerely Yours,

Kenneth E. Beasley III
Compliance Engineer

Form 7-M Rev 9-77

ENGINEERING CALCULATION

Sheet: 1 of
Date: 9/16/87
By:
File:

		gals/mol
04	C_1	6.4
07	C_2	10.12
10	C_3	10.42
12	iC_4	12.38
12	nC_4	11.93
15	iC_5	13.85
15	nC_5	13.71
18	iC_6	15.50
18	C_6	15.57
21	iC_7	17.2
21	C_7	17.46
23	C_8	19.39
05	$C_2^=$	9.64
08	$C_3^=$	9.67

MISC.

	gals/mol
O_2	3.37
CO	4.19
CO_2	6.38
SO_2	5.50
H_2S	5.17
N_2	4.16
H_2	3.66

K.E. Beasley – EPNG
H. Van – EPNG

MARY WHEELER #1E Well

- K.E. Beasley showed a diagram of the Dehydrator
- KEB indicated that there are no operational records exist for the two-phase separator.
- There has been oil discharges into the pit – This is what OCD has heard.
- K.E. Beasley provided some historical background of the Glycol Dehydrator Unit. This info. was provided from conversations with operations personnel.
- Request from NMOCD
  - Chronological History of the Dehydrator
  - Diagrams showing what was taken out of service.
  - Explanations to the best of EPNG's recollection

Form ? 1 Rev. 9-77

ENGINEERING CALCULATION

Sheet: 2 of
Date: 9/16/87
By:
File:

MARY WHEELER #1E Well

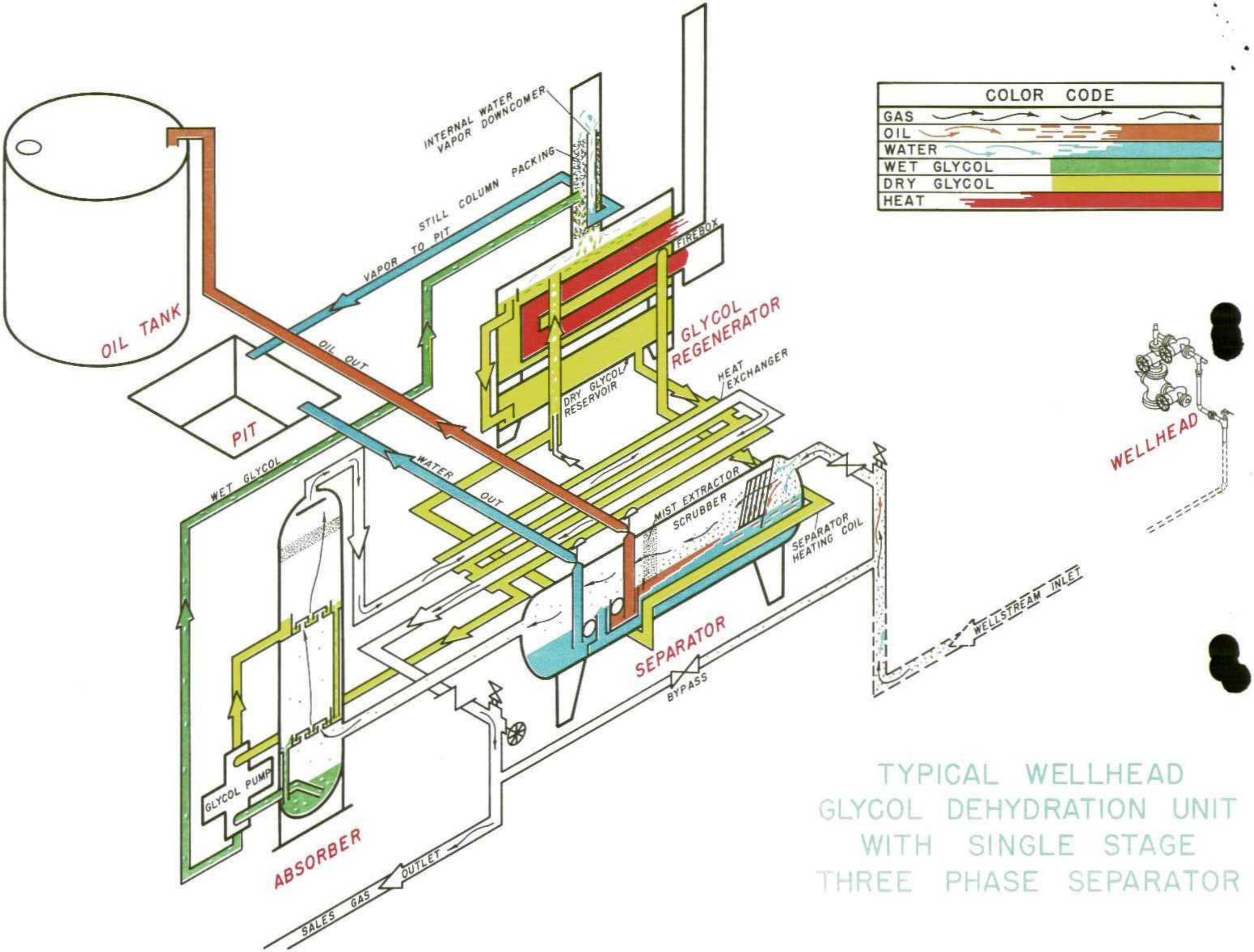
		gals/mol
.04	C_1	6.4
.07	C_2	10.12
.10	C_3	10.42
.12	iC_4	12.38
.12	nC_4	11.93
.15	iC_5	13.85
.15	nC_5	13.71
.18	iC_6	15.50
.18	C_6	15.57
.21	iC_7	17.2
.21	C_7	17.46
.23	C_8	19.39
.05	C_2'	9.64
.08	C_3'	9.67

- Manana has file a motion that due to Manana's poor operation of the primary separator the EPNG glycol dehydrator unit failed causing the contamination problem.

- Proposed Remedial Work
  - Excavation of Contaminated Soils
  - Trenching for Exploratory Purposes
  - Pumping & Sampling
  - VOC's Monitoring

MISC.

	gals/mol
O_2	3.37
CO	4.19
CO_2	6.38
SO_2	5.50
H_2S	5.17
N_2	4.16
H_2	3.38



TYPICAL WELLHEAD
GLYCOL DEHYDRATION UNIT
WITH SINGLE STAGE
THREE PHASE SEPARATOR

El Paso
Natural Gas Company

P. O. BOX 4990
FARMINGTON, NEW MEXICO 87499
PHONE: 505-325-2841

October 28, 1987

Mr. David G. Boyer
Hydrogeologist/Environmental Bureau Chief
Energy and Minerals Department
New Mexico Oil Conservation Division
P.O. Box 2088
Santa Fe, New Mexico 87501-2088

Subject: Flora Vista Contamination Study

On Wednesday September 17, 1987 in a meeting with your staff we briefly discussed the Manana Mary Wheeler #1E location and dehydrator operation. At that time a need for further information on the dehydrator was identified and you requested a chronology of operation and modifications to the unit. Written records are essentially non-existent and some of the individuals involved in the well's operation during the time in question are no longer available for comment. The following summarizes the dehydrator operation as best as can be recollected by location personnel.

The Manana-Mary Wheeler #1E was first delivered on July 16, 1980. El Paso Natural Gas installed a four million BS&B two phase dehydrator with the El Paso Natural Gas number 2303 at the location. The vapor line from the still column, the glycol storage vent and the liquid phase dump all were routed to an unlined pit immediately south of the dehydrator. (See Sketch #1) No records relating to the operation of the unit or condition of the associated pit are available from first delivery until 1983.

In the summer of 1983 the 1" liquid dump line was re-routed and connected to the 2" pipeline leading to the producer's tank. The top was removed from a 55 gallon drum and the drum placed in the pit to catch any liquid which might drip from the vapor line from the still column on the dehydrator's glycol regenerator. (See Sketch #2) This action was taken since the Flora Vista Water Users had expressed concern about contamination of their water wells adjacent to the location. The pit was dry at this time with no sign of liquids in the pit from the liquid dump, glycol storage vent or still column vapor line. Operating personnel checked this pit regularly from the summer of 1983 to December 1986. No glycol leaks or fluids in the pit were ever in evidence during that time.

In addition, El Paso installed a sensing element in 1983 that would shut in the well should slugs of liquid enter the dehydrator and cause an excessive signal to be transmitted to the liquid dump valve. (See Sketch #2) This shut-off device must be reset manually to allow the well to begin producing again once it has tripped. In the years since its installation the valve has been found in the shut position on various occasions.

In December of 1986 operating personnel turned the dehydrator off, disconnected the vapor line from the still column and the vent on the glycol storage and plugged all vents. There was no evidence of discharges to the unlined pit at this time. This action was taken as part of El Paso's program to insure compliance with NMOCD regulations prohibiting discharge to certain unlined pits in the vulnerable groundwater area.

Shutting down the dehydrator was actually unnecessary since discharge from the still column was being collected in the 55 gallon drum installed for that purpose. For this reason, the dehydrator was returned to service in early spring of 1987. The vent lines were re-installed and routed to the 55 gallon drum.

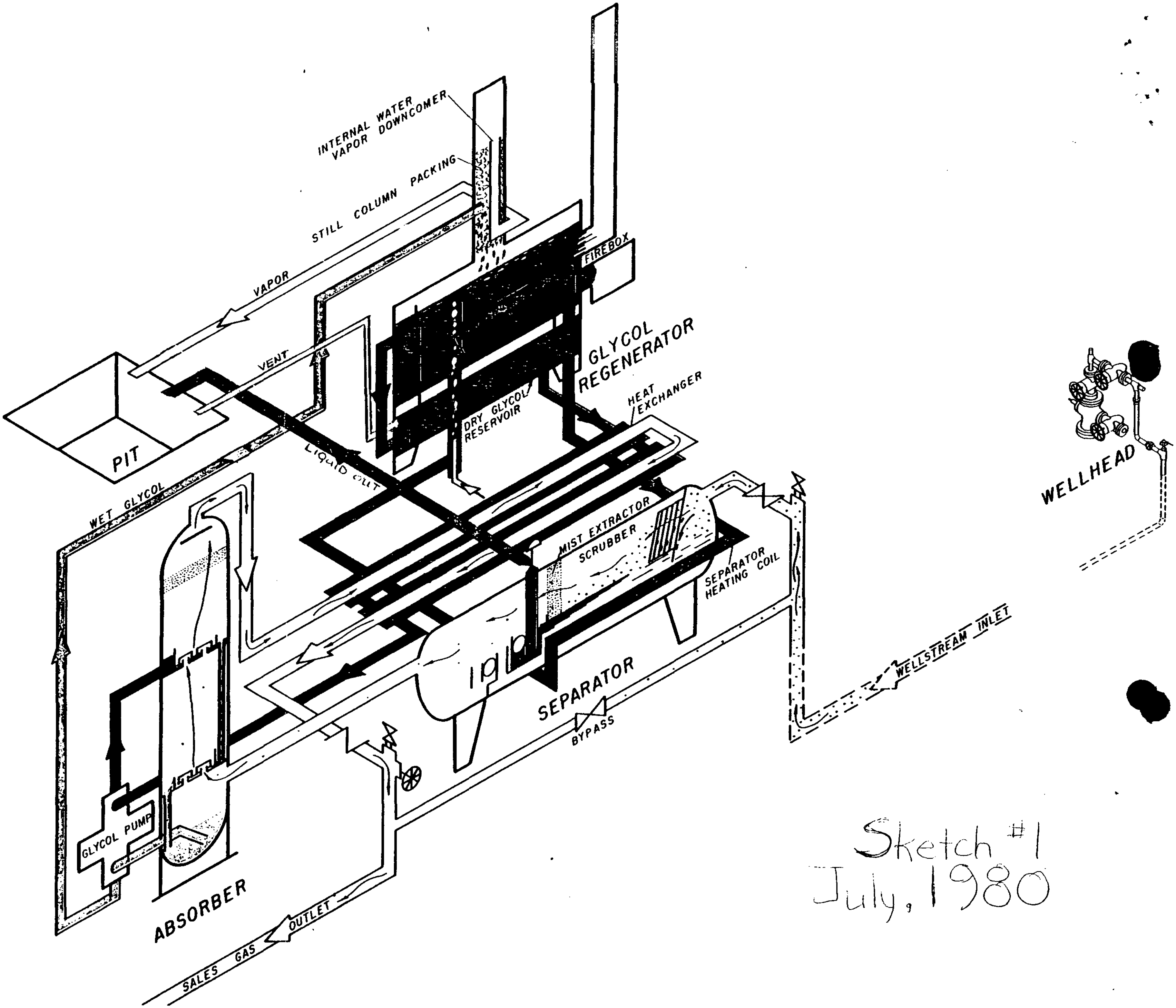
In June of 1987 the pit immediately south of the dehydrator was closed since its use was no longer required. The dehydrator was turned off and remains out of service.

The above is the most complete summary available of dehydrator operations and modifications from 1980 to present. The absence of written records precludes greater detail but it is believed that this chronology will nevertheless provide some insight into the operation of the dehydration unit and related site conditions. El Paso has no direct knowledge of the operation of any primary separation equipment.

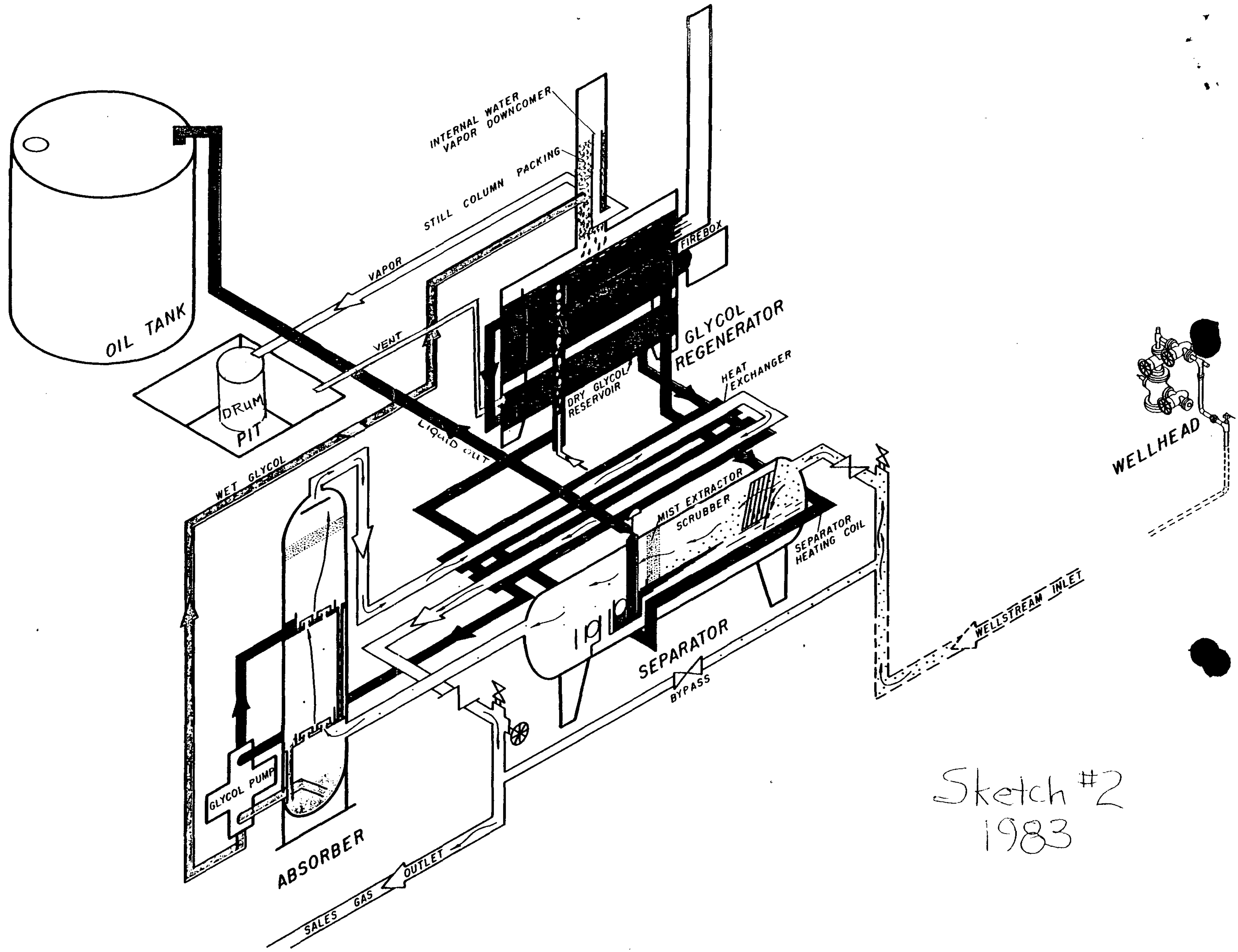
EL Paso is evaluating possible remedial measures to be taken at the site. NMOCD will be kept apprised of activities in this area. Please feel free to contact me for further questions.

Sincerely yours,

Kenneth E. Beasley III
Compliance Engineer



Sketch #1
July, 1980



Sketch #2
1983

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

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

September 8, 1987

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Dr. Henry Van
Environmental Affairs Department
El Paso Natural Gas Company
P.O. Box 1492
El Paso, TX 79978

RE: Flora Vista Contamination Study

Dear Mr. Van:

As you know, since March, 1985, the OCD has been investigating the source of oil contamination at the Flora Vista Municipal Well contaminated in 1983. We have maintained that the source of the contamination was from one or more of the production facilities at the Manana Gas Mary Wheeler #1-E gas well located southeast of Flora Vista in Unit M (SW/4, SW/4) of Section 23, Township 30 North, Range 12 West. Such facilities include well separator, separator tank, condensate tank, condensate water tank, the now-closed reserve pit and the El Paso Natural Gas dehydrator/separator and now-closed dehydrator pit.

On April 22, 1986 an aquifer (pumping) test was conducted at the water well to determine hydrologic characteristics, and to ascertain whether oil was still present in the subsurface adjacent to the well. Oil was drawn into the well five hours after the test commenced, and continued to be captured for the duration of the test (48 hours). On Monday, August 17, 1987, Manana Gas and the Flora Vista Water Users Association began a joint investigation of the site using a backhoe to dig a series of trenches, beginning at the water well and continuing up gradient until the source(s) were located. Trenching completed on August 17 indicated that the major source of contamination was at the site of the now-closed EPNG dehydrator pit. Further trenching on August 18 confirmed this. Kenneth Beasley, compliance engineer for El Paso Natural Gas in Farmington was notified of the situation at approximately 6 p.m. on August 17 and El Paso staff were on site for trenching on August 18.

Pollution of fresh surface or ground waters is prohibited by the New Mexico Oil and Gas Act, the New Mexico Water Quality Act, and the New Mexico Public Nuisance statutes. The New Mexico Oil Conservation Division is authorized to administer and enforce regulations for the former two statutes, and enforce the public nuisance statutes. Accordingly, this Division requests your cooperation in further defining the extent of contamination, its cause, and in developing a remedial action plan to contain, remove, and otherwise mitigate and abate the contamination at this location. At a meeting previously scheduled for 9:00 a.m., Wednesday, September 16, 1987, the OCD will initiate preliminary discussion with EPNG that hopefully will lead to voluntary remedial action by EPNG, either singularly or with Manana, to alleviate the problem. For this meeting, it would be helpful if EPNG could provide any diagrams of the dehydrator/separator unit originally at the site, any modifications subsequently made, and copies of any spill reports made to this agency or other regulatory agencies. OCD will provide suggestions for additional investigation, and possible regulatory mechanisms to define and facilitate remedial actions.

As this will be a preliminary meeting on this matter, and because other unrelated matters involving EPNG will be discussed, I do not intend to involve other parties or agencies in this meeting. However, I expect that other meetings that will include all interested parties will be scheduled as action on this issue develops. If you have any questions, please contact me at (505) 827-5812.

Sincerely,

David G. Boyer
Hydrogeologist/
Environmental Bureau Chief

cc: Kenneth E. Beasley, EPNG Farmington
OCD - Aztec
Jeff Taylor, OCD

BREWER
ASSOCIATES, INC.

ENGINEERS • SURVEYORS

P. O. BOX 2079 • FARMINGTON, NM 87499 • (505) 327-3303
CLOVIS, NM • (505) 763-4255

September 3, 1987

Mr. Bert Barns
Flora Vista Water Users' Association
113 East Ute
Farmington, NM 87401

Re: Well Polution

Dear Bert:

Transmitted herewith is a copy of a report prepared by Dr. R.W. Blair, Jr. regarding the trenches and the geology in the vicinity of the Flora Vista Water Users Association water wells and the Manana Oil & Gas Company gas well, Mary Wheeler #1E. The dates of observation noted should be August 17, 18, and 19, rather than August 18 and 19. Dr. Blair is submitting a corrected page number one for this report. I am, however, transmitting copies of the report for your review. I believe that they are self explanatory. If you have questions regarding the report, please feel free to contact me or Dr. Blair at your convenience.

Sincerely yours,

BREWER ASSOCIATES, INCORPORATED

Richard P. Cheney, P.E., L.S.
President

RPC:tm L1087/F-331

Enclosure

cc: Mr.Rick Lougee

RECEIVED
SEP 11 1987
OIL CONSERVATION DIVISION
SANTA FE

SEP 11 1987

FLORA VISTA CONTAMINATION STUDY
SUMMARY OF TRENCHING ACTIVITIES
8/18 TO 8/19 1987

by R. W. Blair, Jr.
consulting geologist

SITUATION

Systematic trenching with a backhoe was commenced on August 18th and 19th, 1987 between the Flora Vista Water Users Association's water well S1 and Manana Oil and Gas well, Mary Wheeler no. 1-E. The objective was to trace and isolate the source of hydrocarbon contamination to the S1 water well. Present during trenching on the 18th were Ed Hartman, President of Manana Gas, Inc.; David Boyer, hydrologist with New Mexico Oil Conservation Division; R. W. Blair, Jr., consulting geologist representing Brewer Associates; Ray Penrod, representing the Flora Vista Water Users Association and the backhoe operator. Present during trenching on the 19th were Ed Hartman, R. W. Blair, Jr., Ray Penrod, Frank Chavez, district supervisor, N.M. Oil Conservation Division, Ken Beasley and six other El Paso Natural Gas Company employees,and the backhoe operator.

TECHNIQUES AND METHODS

1. Thirteen trenches, seven to eight feet deep were dug in all, six (A thru F) on the 18th and seven (G thru M) on the 19th (see attached map). Trench location on the first day was determined by David Boyer. On the second day Mr. Ed Hartman, and myself (Blair) determined trench location.

2. All trenches were documented as to location, orientation and hydrocarbon contamination.

3. The trenches were dug in such a manner that: a) they intersected the existing water table, b) berms were placed every 8 to 10 feet at bottom of trench to minimize groundwater mixing, c) they were generally oriented perpendicular to the direction of groundwater flow direction, and d) they were positioned to maximize information concerning location and source of contamination.

4. Mr. Ed Hartman with my assistance obtained water samples from all contaminated trenches and a few of the uncontaminated trenches which are to be analyzed for hydrocarbons. David Boyer took water samples only from the six trenches excavated on August 18th. These are to be analyzed for specific organic pollutants such as benzene and toluene.

5. A map was constructed using standard pace and compass techniques of the trenches, well sites, and associated gas

SEP 11 1987

production structures (see attached map).

DISCUSSION

The water and gas well are located upon a point bar deposit (sand and gravel deposited from a meandering river). Two flat depositional surfaces are evident (see attached map). The lower surface represents the modern floodplain and is found adjacent to the Animas River and the upper surface or terrace (18 to 24 inches higher) is an older floodplain. The point bar deposit consists of sand and gravel with cobbles commonly 12 inches in diameter. The upper 12 to 18 inches of both surfaces consists of a sandy loam soil.

The water table is measured in the trenches at 5 to 6 feet below the upper terrace surface. Uncontaminated water is slightly muddy with some natural organic foam or scum present on the surface. Contaminated water displays an iridescent oil film along with a strong hydrocarbon smell. The contaminated zones are recognized in the gravel deposits from a black stain which coats the sand and cobble surfaces and from strong noxious organic odors emanating from the stained horizon. The contaminated zone is found to coinside with the water table flux zone, because the hydrocarbons tend to float and be carried along at the top of the water table surface. Thus, only rarely is the contaminated zone found within the upper five feet. The smelly black organic stain is noted in the contaminated trenches and is marked on the attached map with cross hatching. The contaminated zones vary in thickness from a few inches to several feet (the thickest zone is found just south of the dehydrator).

In trenches A and C a thin discontinuous black stained zone is noted, but it is not associated with any hydrocarbon odor. This zone may have been contaminated during the producing periods of the water well S1, because the cone of depression would have captured the contaminated flow documented to the west of the well. Upon cessation of pumping, fresh, clean ground water probably flushed and leached out the volatiles, but still left an insoluble organic black stain.

As noted from the map, the contaminated zone appears to be confined to a narrow band and is shaped like a giant comma, trending south. Ground water flow is to the south, as recorded by David Boyer (1986); thus, the source of hydrocarbon contamination is found in the vicinity of the dehydrator and specifically from an area immediately south of the dehydrator (old dehydrator pit). If liquid hydrocarbon waste was dumped into the gravels south of the dehydrator near the surface and above the water table, they would spread laterally in all directions; and therefore, could conceivably contaminate an area immediately north of the dehydrator as indicated in trench I. Once the waste fed into the water table it would be carried in the direction of ground water flow. The slight westward trend of the contamin-

ation plume as it trends south may be due to natural flow along a highly permeable zone which corresponds closely with the upper and lower terrace boundary or it may reflect ground water capture due to the pumping of S1 and its associated cone of depression.

CONCLUSIONS

1. Contamination of the S1 water well was due to capture of the hydrocarbon plume identified from trenching and shown on the attached map.

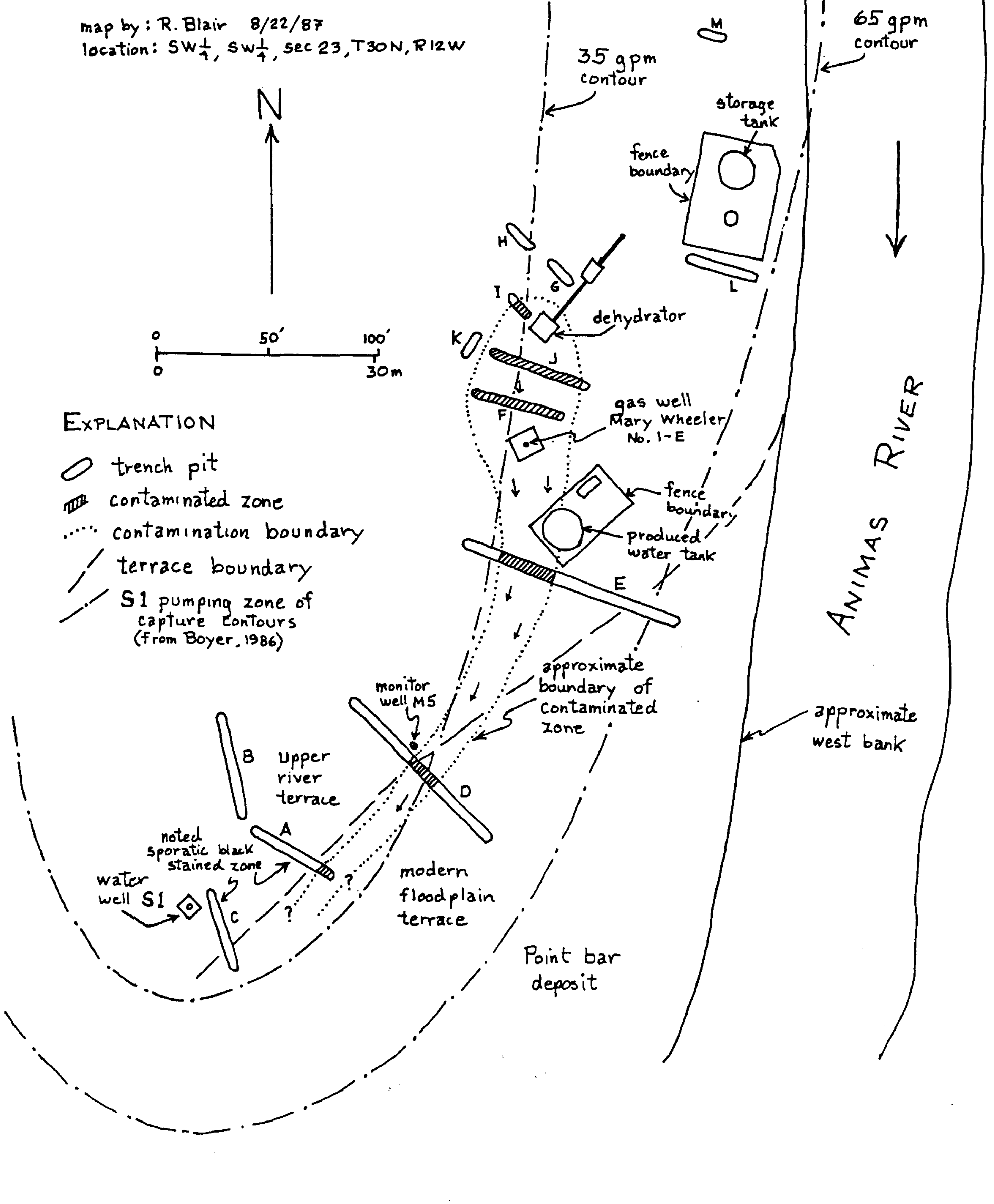
2. The source of the hydrocarbon plume appears to be a circular zone located immediately south of the present location of a dehydrator owned by El Paso Natural Gas Company.

REFERENCES

Boyer, David G., 1986, Final report on Flora Vista Contamination Study, October 1986: Sante Fe, N.M., Environmental Bureau, New Mexico Oil Conservation Division, 55p.

SEP 11 1987

SKETCH MAP OF FLORA VISTA HYDROCARBON CONTAMINATION



OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
1000 RIO BRAZOS RD. - AZTEC
87410

DIRECTOR
JOE D. RAMEY

LAND COMMISSIONER
PHIL R. LUCERO

STATE GEOLOGIST
EMERY C. ARNOLD

November 3, 1976

Monsanto Company
1330 Midland National Bank Tower
Midland, Texas 79701

Re: Monsanto Company, NWP #1 K-23-30N-12W San Juan County

Gentlemen:

The attached Inspection Ticket shows that the subject well is venting gas at the wellhead. The gas surges to where a bull plug has been removed, which may indicate it to be coming through water.

Waste of gas cannot be tolerated.

Initiate action to repair or to plug this well.

If there are questions, please contact us.

Yours very truly,

Original Signed by A. R. Kendrick

A. R. Kendrick
Supervisor District #3

Enclosures: Memo # 3-70, Inspection Ticket

xc: OCC, Santa Fe

ARK:no

3/18/88 -
No info when received by ENV. Bureau - Possibly May/June '87 prior to Manana trenching in August '87. Probably came from Ed Hartman.
AYB

RECEIVED
NOV -4
Oil Conservation Comm.
Santa Fe

NO. OF COPIES RECEIVED	4	
DISTRIBUTION		
SANTA FE	/	
FILE	/	
U.S.G.S.		
LAND OFFICE		
OPERATOR	1	

NEW MEXICO OIL CONSERVATION COMMISSION

Form C-103
Supersedes Old
C-102 and C-103
Effective 1-1-65

5c7

5a. Indicate Type of Lease
State [ ] Fee [X]

5. State Oil & Gas Lease No.

SUNDRY NOTICES AND REPORTS ON WELLS

(DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR. USE "APPLICATION FOR PERMIT –" (FORM C-101) FOR SUCH PROPOSALS.)

1. OIL WELL [ ] GAS WELL [X] OTHER-

7. Unit Agreement Name

2. Name of Operator
Monsanto Chemical Company

8. Farm or Lease Name
NWP Unit

3. Address of Operator
321 West Texas, Midland Texas 79701

9. Well No.
1

4. Location of Well
UNIT LETTER K, 2075 FEET FROM THE South LINE AND 1850 FEET FROM THE West LINE, SECTION 23 TOWNSHIP 30N RANGE 12W NMPM.

10. Field and Pool, or Wildcat
Basin Dakota, Blanco M.V.

15. Elevation *(Show whether DF, RT, GR, etc.)*
5491 GR

12. County
San Juan

16. Check Appropriate Box To Indicate Nature of Notice, Report or Other Data

NOTICE OF INTENTION TO:

- PERFORM REMEDIAL WORK [ ]
- PLUG AND ABANDON [ ]
- TEMPORARILY ABANDON [ ]
- PULL OR ALTER CASING [ ]
- CHANGE PLANS [ ]
- OTHER [ ]

SUBSEQUENT REPORT OF:

- REMEDIAL WORK [ ]
- ALTERING CASING [ ]
- COMMENCE DRILLING OPNS. [ ]
- PLUG AND ABANDONMENT [X]
- CASING TEST AND CEMENT JOB [ ]
- OTHER [ ]

17. Describe Proposed or Completed Operations *(Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work)* SEE RULE 1103.

January 13, 1977
This well was plugged and abandoned in the following manner.

Set cement plugs in 5½" casing

6100-6485	1650-1750(Inside & outside)
3275-3425	225-275(Inside & outside)
2800-2850	10 sxs in surf. with dry hole marker.

RECEIVED
JAN 25 1977
OIL CON. COM.
DIST. 3

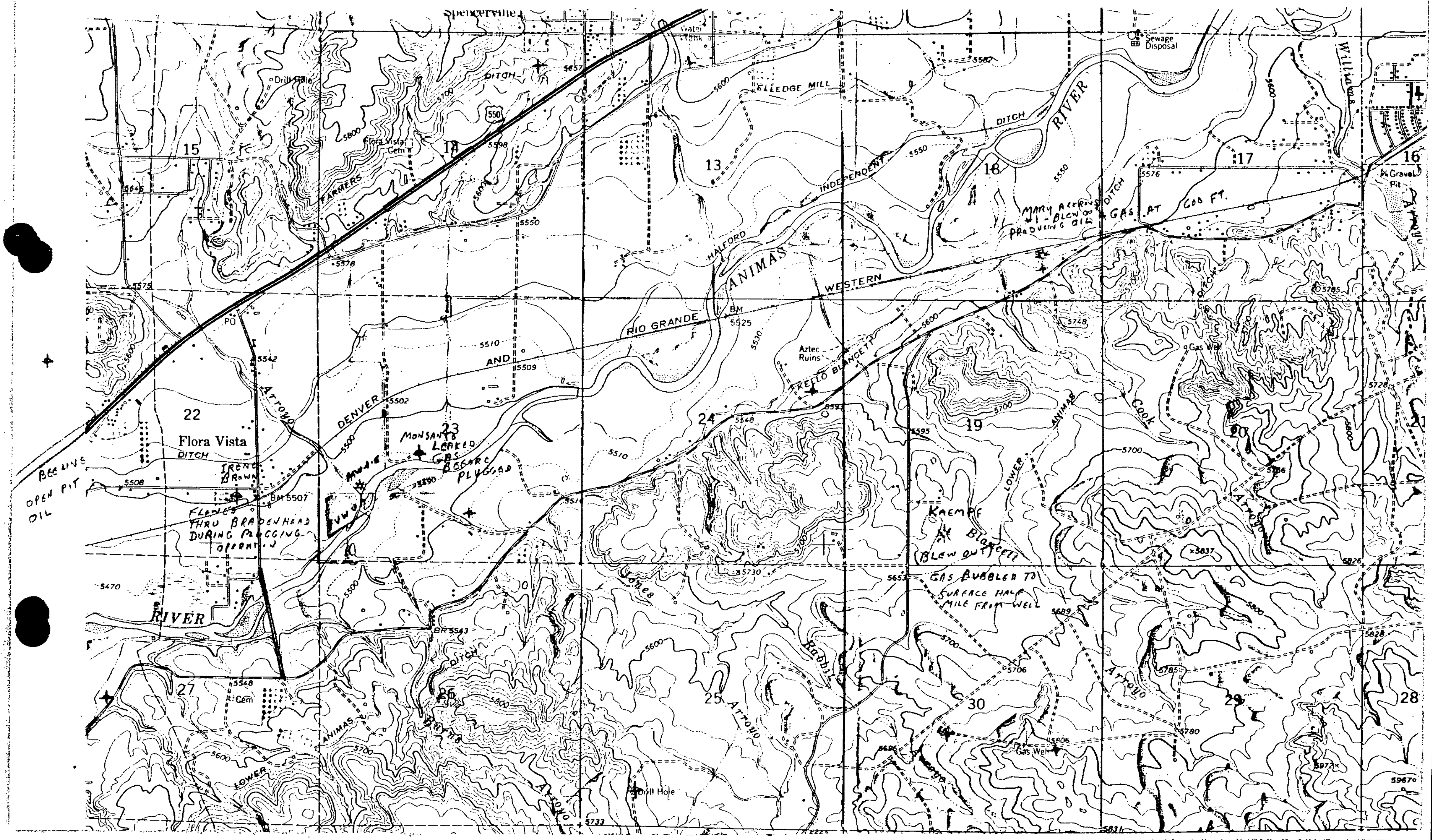
For: Monsanto Chemical and Manana Gas, Inc.

18. I hereby certify that the information above is true and complete to the best of my knowledge and belief.

SIGNED [signature] TITLE President, Walsh Engr. & Prod. Corp. DATE 1/24/77

APPROVED BY [signature] TITLE [illegible] DATE JAN 25 1977

CONDITIONS OF APPROVAL, IF ANY:


Flora Vista
RIVER
DITCH
Arroyo
DENVER
AND
RIO GRANDE
WESTERN
ANIMAS
HALFORD
INDEPENDENT
ELLEDGE MILL
FARMERS
RIVER
LOWER
ANIMAS
Cook
Aztec Ruins
KELLO BLANCETT
Sewage Disposal
Gravel Pit
Gas Well
Drill Hole
15
22
23
24
13
18
17
16
27
26
25
30
29
28
19
20
550
BEC LINE OPEN PIT OIL
TRENO BROWN
FLAWED THRU BRADENHEAD DURING PLUGGING OPERATION
MONSANTO LEAKED GAS BEFORE PLUGGED
KAEMPF Blancett BLEW OUT
GAS BUBBLED TO SURFACE HALF MILE FROM WELL
MARY ARROYO #1 - BLEW OUT PRODUCING OIL GAS AT 600 FT.

T30N, R12W

H
E
A
L
T
H
& ENVIRONMENT DEPARTMENT

STATE OF NEW MEXICO

OFFICE OF EPIDEMIOLOGY
P.O. Box 968, Santa Fe. New Mexico 87504-0968
(505) 827-0006
Harry F. Hull, M.D., State Epidemiologist

GARREY CARRUTHERS
GOVERNOR
LARRY GORDON
SECRETARY
CARLA L. MUTH
DEPUTY SECRETARY

MEMORANDUM

DATE: May 22, 1987

TO: Dennis McQuillan, Groundwater/Hazardous Wastes Bureau

FROM: Millicent Eidson, Environmental Epidemiologist m.e.

SUBJECT: USE OF FLORA VISTA COMMUNITY WATER SUPPLY WELL

I have been informed that the Flora Vista Community water supply well has been contaminated with petroleum, as evidenced by odor and a visible film on the water surface. It is the recommendation of the Office of Epidemiology that the well not be used, since we believe its use could pose a public health risk.

As discussed in Vol. 4 of Drinking Water and Health, National Academy Press, 1982, crude or refined oils may contain as many as one million different compounds. Thus it is difficult to assess toxicity precisely because of the number of compounds involved and the expense of laboratory sampling. However, the four major groups of compounds all have toxic effects. Intoxication with alkanes can result in transient depression of the central nervous system, or polyneuropathy with chronic exposure. Alkenes have weak anesthetic properties. The naphthenes act as general anesthetics and have depressant effects on the central nervous system. The aromatic hydrocarbons have many toxic effects including myelotoxicity, mutagenicity, and cancer.

cc: Stuart Castle, Water Supply Program

STATE OF NEW MEXICO COUNTY OF SAN JUAN

IN THE DISTRICT COURT

FLORA VISTA WATER USERS ASSOCIATION,

Plaintiff,

vs. No. CV 86-00154-4

MANANA GAS, INC., and EL PASO NATURAL GAS COMPANY,

Defendants.

NOTICE TO TAKE DEPOSITION

TO: MANANA GAS INC.
-and-
BYRON CATON, its Attorney
333 East Main Street
Farmington, New Mexico 87401

NOTICE IS HEREBY GIVEN that Plaintiff will take the deposition of DAVID BOYER, upon oral interrogatories, in order to generate testimony for trial in lieu of live testimony, before a Certified Court Reporter and Notary Public from Santa Fe Deposition Service, at the hour of 10:00 o'clock a.m. on Wednesday, June 3, 1987, at the offices of Santa Fe Deposition Services, 1437 Paseo De Peralta, Santa Fe, New Mexico 87501.

PLEASE BE THEN AND THERE PRESENT.

I HEREBY CERTIFY that a true copy of the foregoing pleading was mailed to opposing counsel of record this 26 th day of
May, 1987.

[signature]

[signature]
RICHARD L. LOUGEE
Attorney at Law
108 North Orchard, Suite 201
Farmington, New Mexico 87401
(505) 327-5281

ENCLOSURE FOR YOUR INFORMATION

Date: May 27, 1987
Our File No.:
Your File No.:

Re: Flora Vista Water v. Manana Gas

We enclose the following to keep you informed of the progress of this matter:

Notice to Take Deposition

Please contact us if you have any questions.

TO
Mr. David Boyer
Energy and Minerals Department
P.O. Box 2088
Santa Fe, NM 87501-2088

RICHARD L. LOUGEE
Attorney at Law
108 NORTH ORCHARD, SUITE 201
FARMINGTON, NEW MEXICO 87401
Phone: (505) 327-5281

RECEIVED
MAY 26 1987
OIL CONSERVATION DIVISION

STATE OF NEW MEXICO COUNTY OF SAN JUAN

IN THE DISTRICT COURT

FLORA VISTA WATER USERS ASSOCIATION,

Plaintiff,

vs. No. CV 86-00154-4

MANANA GAS, INC., and
EL PASO NATURAL GAS COMPANY,

Defendants.

NOTICE TO TAKE DEPOSITION

TO: FLORA VISTA WATER USERS ASSOCIATION
-and-
RICHARD L. LOUGEE, its Attorney
108 North Orchard, Suite 201
Farmington, New Mexico 87401

NOTICE IS HEREBY GIVEN that Defendant Manana Gas, Inc., will take the deposition of DAVID BOYER, upon oral interrogatories, before a Certified Court Reporter and Notary Public from Santa Fe Deposition Service, at the hour of 10:00 o'clock a.m. on Wednesday, June 3, 1987, at the offices of Santa Fe Deposition Services, 1437 Paseo De Peralta, Santa Fe, New Mexico 87501.

PLEASE BE THEN AND THERE PRESENT.

BRIONES, ODENWALD & CATON, P.A.
333 East Main Street
Farmington, New Mexico 87401
(505) 325-0258

Byron Caton
Attorney for Defendant
Manana Gas, Inc.
State Bar Number 542

I HEREBY CERTIFY THAT A TRUE AND CORRECT COPY OF THE FOREGOING WAS MAILED TO OPPOSING COUNSEL OF RECORD THIS 22nd DAY OF May, 19 87

STATE OF NEW MEXICO

IN THE ELEVENTH JUDICIAL DISTRICT COURT OF SAN JUAN COUNTY

CAUSE NO. CV 86-00154-4

FLORA VISTA WATER USERS ASSOCIATION,

Plaintiff,

vs.

MANANA GAS, INC., and
EL PASO NATURAL GAS COMPANY,

Defendants.

S U B P O E N A

TO: DAVID BOYER
525 Camino De Los Marquez
Santa Fe, New Mexico

Greetings:

You and each of you are commanded to appear before a Certified Shorthand Reporter and Notary Public for the taking of your deposition on Wednesday, May 27, 1987, at 10:00 o'clock a.m., at Santa Fe Deposition Services, located at 1437 Paseo De Peralta, Santa Fe, New Mexico.

And this do ye under the penalty of the law.

In witness whereof I have hereunto set my hand as clerk of said Court, and affixed the Seal of said District Court, on this 19th day of May, 1987.

Eula M. Dunagan
Clerk of the District Court

COURT
SEAL

By ____________________
Deputy Clerk

BRIONES, ODENWALD & CATON, P.A., Attorneys for Defendant Manana Gas, Inc.
333 East Main Street
Farmington, New Mexico 87401
Telephone: (505) 325-0258

STATE OF NEW MEXICO | COUNTY OF SAN JUAN

IN THE DISTRICT COURT

FLORA VISTA WATER USERS ASSOCIATION,

Plaintiff,

vs. | No. CV 86-00154-4

MANANA GAS, INC., and
EL PASO NATURAL GAS COMPANY,

Defendants.

NOTICE TO TAKE DEPOSITION

TO: FLORA VISTA WATER USERS ASSOCIATION
-and-
RICHARD L. LOUGEE, its Attorney
108 North Orchard, Suite 201
Farmington, New Mexico 87401

NOTICE IS HEREBY GIVEN that Defendant Manana Gas, Inc., will take the deposition of DAVID BOYER, upon oral interrogatories, before a Certified Court Reporter and Notary Public from Santa Fe Deposition Service, at the hour of 10:00 o'clock a.m. on Wednesday, May 27, 1987, at the offices of Santa Fe Deposition Services, 1437 Paseo De Peralta, Santa Fe, New Mexico 87501.

PLEASE BE THEN AND THERE PRESENT.

BRIONES, ODENWALD & CATON, P.A.
333 East Main Street
Farmington, New Mexico 87401
(505) 325-0258

Byron Caton
Attorney for Defendant
Manana Gas, Inc.
State Bar Number 542

I HEREBY CERTIFY THAT A TRUE AND CORRECT COPY OF THE FOREGOING WAS MAILED TO OPPOSING COUNSEL OF RECORD THIS 19th DAY OF May, 19 87.

Drew Bates Letter of 4/27/87

1. What kind of "solubility" tested for?
2. What caused gas evolution in samples B-3, C-1, K & M; what kind of test was used?

3. Sulfate Analysis - What does it show?
4. Why would "flushing" remove sulfates this year and not previous years? In other words, why would there be a change since the pit has been closed for 7 years?
5. K, 100 ft/day; actual movement a lot less.
6. Sulfates not a problem, oil is

7. Why M & O have hydrocarbons & not rest
8. SO_4 from $BaSO_4$ in drilling muds

W. B. MARTIN & ASSOCIATES, INC.
709 North Butler, Farmington, New Mexico 87401
Phone: (505) 326-4507

MAY - 7 1987
OIL CONSERVATION DIVISION
SANTA FE

April 27, 1987

Flora Vista Water Users Association
P. O. Box 171
Flora Vista, New Mexico 87415

Attention: Bert Barns

The following are summarized lab results and recommendations from drilling 25± pilot holes around Mary Wheeler #1E's gas well.

1) S#1, #2, #3 were samples taken at different depths 15' SW of Supply Well #4. These samples showed no solubility and feel that the hydrocarbon level is undetectable. S#3 sample was used as a base for this particular area. Samples # B-3, C-1, K, and M showed moderate to vigorous gas evolution for 20-30 seconds. All of these samples are in the reserve pit area and the gas released was not broken down except in sample M. Sample M gave off H_2S (Hydrogen Sulfide gas) rotten egg scent. The reasoning for the H_2S evolution for this sample over the other samples is due to the high concentration of hydrocarbons. No solubility tests have been performed on the second set of samples, but feel that the only possible samples that might have H_2S evolution is sample O, see Fig. 7 in relation to sample M.

2) During the sulfate analysis of the first set of samples A-M, the sulfate count was extremely high as compared to samples N-V of the second set. The explanation for this, even though samples M and N are only 7 linear feet apart, the samples were taken 3 weeks apart. March, 1987, was an extremely cold month and the water table was lower than during the middle of April, 1987. Due to the permeability of the river rock and its high porosity of 25%, the system was probably flushed with the increase of runoff. Due to the high concentrations of sulfates recorded that a source for bacteria to thrive on in and around this area was present during the lessor flow periods fall-winter and then during the vast amount of runoff in the first part of April it had flushed the system. According to Boyer's report, that ground movement in this area is up to 100'/day, so to flush this area from the gas well to the supply well would take less than 3 days. These results can show the process of contamination from the reserve pit area to supply well #1 into the water system. A corrective method in treating high sulfates is by using chlorine in the water system. Since the sulfate content has been reduced from 14,000 ppm down to less than 1000 ppm in three weeks during the first part of run-off these flushings might have brought an excessive amount of sulfates into the system which it was unable to handle.

ND

P

3) Hydrocarbon test results were very noticeable in sample M from 5-7' depth ranging from 200-1000 ppm and also in sample O @ 7' ranging from 100-800 ppm. The high level of hydrocarbon detected from Richard Cheney's report did not exceed 23 ppm. Normal detection level is .01. Sample detection for representative sample No. A-M was less than 5 ppm and most of those second set of samples were less than .1 ppm. The level of hydrocarbons detected in samples M &O 100-1000$\pm$ ppm of C_6-C_{22} shies very strongly away from the possibility of being dead animal decomposition. Most recent animal decomposition usually produces CO_2 and Methane, something similar at a fertilizing plant. From the gas, peaks on the chromatograph chart and comparing to other oilfield hydrocarbon source areas showed similar results, especially in the heavy carbon chain levels C_7 - C_{10}. During high runoff times and the permeability level of the ground water beds that a good implementation of a charcoal filter will aid in absorbing the hydrocarbons out.

4) Bentonite tests were high for sample K which from visual sample description can be assumed to be drilling mud residual.

In summary, there is a drastic change in sulfate content between samples A-M and samples N-V resulting from the increased water runoff. Sulfates can be treated out of the water with chlorine, but if hydrocarbons are present then the possibility of chlorinated hydrocarbons can be formed. Chlorinated hydrocarbons if ingested are usually detoxified in the liver and can be classified as a carcinagen. A solution to both of these problems would be by implementing both a charcoal filter and utilizing ozone to purify the system. There are probably some State guidelines on this type of system. The samples that were taken are still in cold storage and additional tests can be taken.

Sincerely,

Andrew A. Bates

Drew Bates
Engineering and Operations Manager

Date: 3-27-87

Mary Wheeler 1-E

Time	Location
7:00 AM	S_4 @ SW of S_4 #1 @ 2' #2 @ 4' #3 @ 6' #4 @ 8'
8:00 AM 11	A Location Southeast corner toward river edge reserve pit #1 @ 2' #2 @ 5' #3 @ 7' water table
8:30 AM 111	B Location 20' East of oil line in reserve pit #1 @ 3' #2 @ 4' CMT #3 @ 5' #4 @ 7' frac sand
9:10 AM 1111	C Location SE 24' NE of oil line #1 @ 3' #2 @ 4'
10:00 AM	Location @ 85' East of wellhead edge of Reserve pit
10:45 AM	D Location @ SW limit @ 2.5'
11:00 AM 1111	Location @ 11.5' East of B" East edge E @ #1 @ 3' E #2 @ 5'-7' 5' mud 7' water table
11:10 AM	F Location @ 12.5' SE of separator pit 2' soil very unconsolidated river rock very permeable #1 @ 3' #2 @ 5'-7' frac sand @ 6' water table @ 7'
12:00 PM	G Location 8' South of separator pit south post corner #1 sample @ 2' Unable to go below 3' check for hydrocarbon
12:30 PM	H Location 4' due South of Separator pit #1 @ 4' #2 @ 5' too rocky too many bits Shaley and very wet - little intermediate sand

Date: 3-27-87

Mary Wheeler 1-E

Time	Location
12:44 PM	I Location 12' SW corner separator pit I #1 @ 3' I #2 @ 4' very unconsolidated and permeable unable to go below 4-1/2'
1:15 PM	J Location @ 38' SE of separator pit J #1 @ 4' J #2 @ 9' frac sand water table @ 7.5'
1:45 PM	K 45' SE of pit on surface Mud with hydrocarbons bogged down
2:00 PM	L 55' SE of separator pit #1 @ 3-5' #2 @ 7' water table
2:30 PM	M 75' South of separator pit @ 5-7' Threw drive line

4-16-87 @ 7:30 AM

SAMPLING #

N	@ 7' SE of M able to get down 5' sample taken @ 2' and 5' West edge of reservoir pit last of visible signs.
O	@ 20' East of M @ 2' @ 6' @ 7' still in reserve pit Black scent of drilling mud and possible hydrocarbons definitely not soil. 22' East of monitor well 7' definite hydrocarbons sample descriptions. Water table @ 7.5' Found combination lock @ 6'
P	@ 12' NE of monitor well @ 6.5' scent of hydrocarbons Black samples
Q	@ 17.5' East of P 24' NE of monitor well representative sample @ 6-7' no hydrocarbon clear sand check hydrocarbons no contamination.
R	@ 7' South of monitor well dark contaminated sample water table up to 3' in depth
S	@ 3', 5' water table 3'6" 8' West of drainage creek check sulfate and hydrocarbons.
T	@ 20' NE of S, @ 7' 3' water table Sulfates - Hydrocarbons
U	@ 20' East of S, total 10' depth samples out
V	@ 25' SW of S, total 6' deep very permeable sulfates and hydrocarbons.

Tech. Inc.
333 E. Main St.
Farmington, NM 87401
(505)327-3311

7 April 1987

Laboratory Analysis Report

alysis requested by: Mr. D. Bates

Mr. Drew Bates

Farmington NM 87401

Solubility test in 15% HCl

Sample #	Analysis	Result
A#2	Solubility	Moderate gas evolution for 20 sec.
A#3	Solubility	Moderate gas evolution for 20 sec.
B#3	Solubility	Vigorous gas evolution for 30 sec.
C#	Solubility	Vigorous gas evolution 30 sec.
K	Solubility	Vigorous gas evolution 30 sec.
M	Solubility	Vigorous gas evolution for 30 sec.
M		Hydrogen sulfide gas evolved.
S#1	Solubility	Very slight gas evolution.
S#2	Solubility	Very slight gas evolution.
S#3	Solubility	Very slight gas evolution.

Analysis date: 5 April 1987

Sample Received: 28 March 1987

Analyst: H. P. Hamlow

Inc.
. Main St.
ington, NM 87401
5)327-3311

7 April 1987

Laboratory Analysis Report

sis requested by: Mr. D. Bates

Mr. Drew Bates

Farmington NM 87401

Analysis on Core Samples

Sample #	Analysis	Result
B#3	Sulfate	24450 ppm
B#4	Sulfate	3620 ppm
C#1	Sulfate	52800 ppm
F#1	Sulfate	1810 ppm
F#2	Sulfate	450 ppm
G#1	Hydrocarbons	none or < 5 ppm
J	Hydrocarbons	none or < 5 ppm
J#2	Hydrocarbons	none or < 5 ppm
	Sulfate	3160
K	Hydrocarbons	none or < 5 ppm
	Sulfate	24700 ppm
L#2	Hydrocarbons	none or < 5 ppm
	Sulfate	7280 ppm
K	Hydrocarbons	none or < 5 ppm
	Sulfate	24700 ppm
L#2	Hydrocarbons	none or < 5 ppm
	Sulfate	7280 ppm
M	Hydrocarbons	200-1000 ppm

Tech. Inc.
333 E. Main St.
Farmington, NM 87401
(505)327-3311

21 April 1987

Laboratory Analysis Report

FloraVista Water Users
109 N. Orchard
Farmington NM 87401

Analysis of dirt core samples.

Analysis requested by Mr. Drew Bates.

Sample #	Analysis	Result
N	Hydrocarbons	none or less than .1 ppm.
O @ 6'	Hydrocarbons	none or less than Ø.1 ppm
O @ 7'	Hydrocarbons	1ØØ-8ØØ ppm.
P @ 6.5'	Hydrocarbons	none or less than Ø.1 ppm
Q (Clean sand)	Hydrocarbons	none or less than Ø.1 ppm
R	Hydrocarbons	none or less than Ø.1 ppm
U	Hydrocarbons	none or less than Ø.1 ppm
V	Hydrocarbons	none or less than Ø.1 ppm

Analysis date: 2Ø April 1987

Sample Received: 16 April 1987

Analyst: H. P. Hamlow

Lab # 25Ø9-949

NTBK# 1-81-AT

Tech. Inc.
333 E. Main St.
Farmington, NM 87401
(505)327-3311

21 April 1987

Laboratory Analysis Report

Flora Vista Water Users
108 N. Orchard
Farmington NM 87401

Analysis of dirt core samples.

Analysis requested by Drew Bates.

Sample #	Analysis	Result
N	Sulfate	760 ppm
O @ 6'	Sulfate	106 ppm
O @ 7'	Sulfate	162 ppm
P @ 6.5'	Sulfate	128 ppm
Q	Sulfate	172 ppm
R	Sulfate	84 ppm
U	Sulfate	172 ppm
V	Sulfate	240 ppm

Analysis date: 21 April 1987

Sample Received:16 April 1987

Analyst:H. P. Hamlow

Lab # 2509-949

LNTBK# 2-81

F-331

CDS LABORATORIES

A DIVISION OF CASA DEL SOL, INC.
1474 MAIN AVENUE #131
POST OFFICE BOX 2805
DURANGO, COLORADO 81301

(303) 247-4220
JESUS

Date: 8-1-83

To: Flora Vista Water User
Attn. Richard Cheyney
909 W. Apache
Farmington, N.M. 87401

CDS Lab ID #

Sample Description:

LAB. AUG 23 '83

Sample ID		Analyte	* Analytical results
2456	Gallon Jug	C_6-C_{22}	0.70 mg Total Hydrocarbons
2359	Old Pit	C_6-C_{22}	7.50 mg Total Hydrocarbons
2454	East of Pit	C_6-C_{22}	8.10 mg Total Hydrocarbons
2455	South of Pit	C_6-C_{22}	4.00 mg Total Hydrocarbons

Normal detection Limit 0.01

* Total hydrocarbons [illegible] 350 ML sample

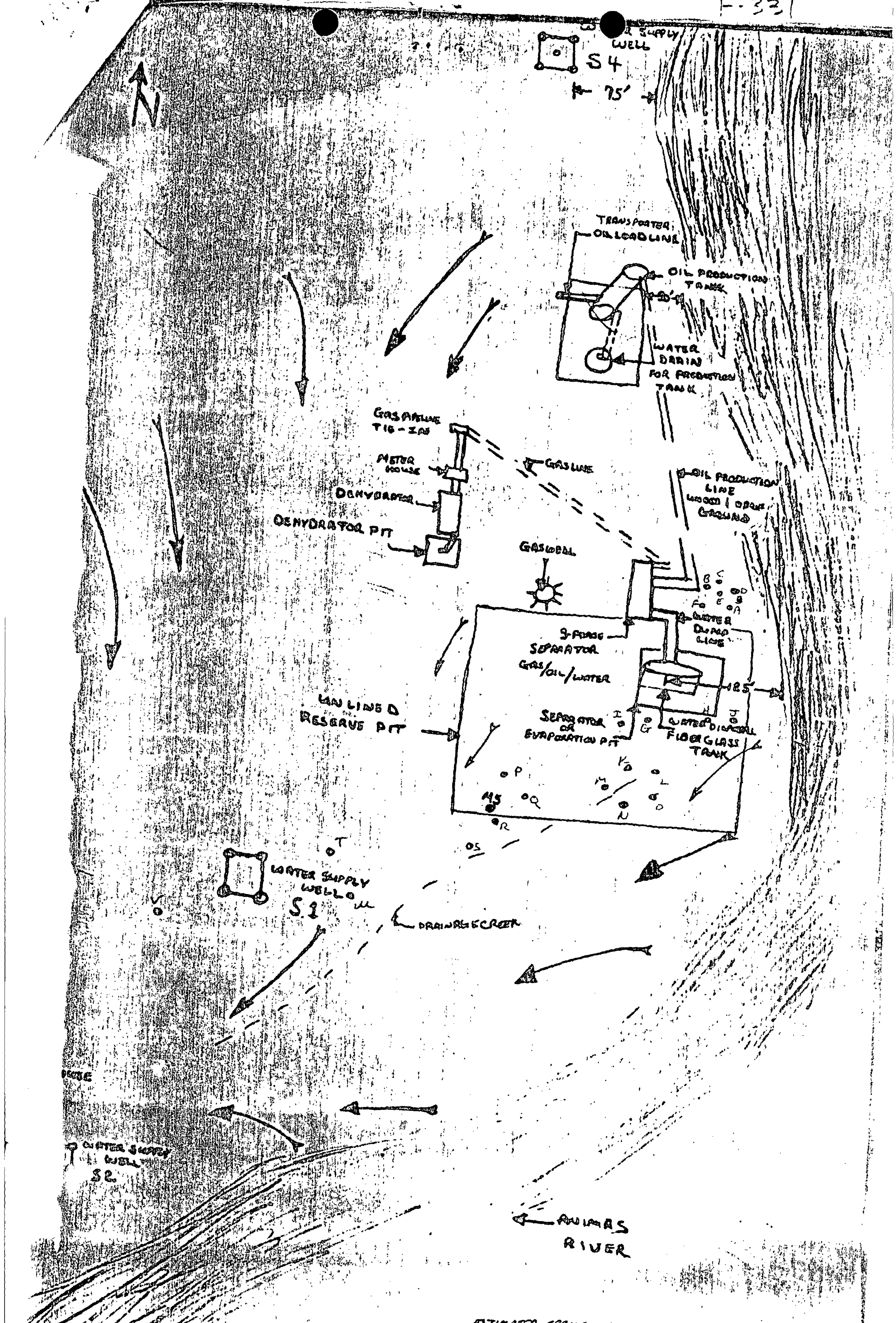
CONCENTRATION BASED ON MG/L

[illegible]	21.43 mg/L of Hydro[illegible]
2456	1.99 mg/L " " "
2455	[illegible] mg/L " " "
2454	[illegible] mg/L " " "

SEE AMMENDED REPORT 8/24/83

Dr. Joe Bowden — Director

F-331



ESTIMATED SPRING-SUMMER
GROUND WATER FLOW DIRECTION
RIVER RECHARGE
(FROM BOYER'S OCT 1986 REPORT)
FIG 6

January 7, 1987   Re: Flora Vista Water v. Manana Gas et al

ENCLOSED PLEASE FIND:

Notice to Take Deposition of David Boyer

Mr. David Boyer
New Mexico Energy and Minerals Dept.
Oil Conservation Division
P.O. Box 2088
Santa Fe, New Mexico 87501

Richard L. Lougee
Attorney at Law
108 N. Orchard Suite 201
Farmington, New Mexico 87401
505-327-5281

STATE OF NEW MEXICO COUNTY OF SAN JUAN

IN THE DISTRICT COURT

FLORA VISTA WATER USERS ASSOCIATION,

Plaintiff,

vs. No. CV 86-00154-4

MANANA GAS, INC., and EL PASO NATURAL GAS COMPANY,

Defendants.

NOTICE TO TAKE DEPOSITIONS

TO: DAVID BOYER

PLEASE TAKE NOTICE that the deposition of David Boyer will be taken at the State Land Office Building, 210 Old Santa Fe Trail, Room 206, Santa Fe, New Mexico on the 15th day of January, 1987 at 1:30 p.m. before a certified court reporter.

PLEASE BE THEN AND THERE PRESENT.

Richard L Lougee

RICHARD L. LOUGEE
Attorney for Plaintiff
108 N. Orchard, Ste. 201
Farmington, NM 87401
(505) 327-5281

RECEIVED
JAN - 9 1987
OIL CONSERVATION DIVISION
SANTA FE

Cancelled DB

I HEREBY CERTIFY that a true copy of the foregoing pleading was mailed to opposing counsel of record this 7th day of Jany, 1987.

Richard L Lougee

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

November 18, 1986

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

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Ed Hartman
Manana Gas, Inc.
P. O. Box 36990
Albuquerque, N.M. 87176

Dear Mr. Hartman:

The New Mexico Oil Conservation Division (OCD) has completed a report on the activities through May, 1986, of this Division and the Environmental Improvement Division (EID) regarding the contamination investigation of Flora Vista Water Well No. 1 (S1). This well, which was contaminated by oil and grease in early 1983, has been out of service since that date. OCD activities in 1985 included installation of five monitoring wells, sampling of water quality from these wells and other ground water at this location, and measurement of water levels to determine ground water direction and rate of flow. EID supplied material and staff to assist in well installation. Activities in 1986, all by the OCD, included additional sampling, water level measurements, an aquifer test to determine aquifer characteristics, and report preparation.

The OCD report is enclosed with this letter, but its major conclusions are summarized below:

1. Water Well No. 1 (S1) remains contaminated by oil. Oil remains in sediments immediately adjacent to the well, and any production pumping will cause continued movement of contaminants into the well.

2. Because of dilution and volatilization of dissolved hydrocarbon constituents in the wellbore, OCD samples did not show levels exceeding health standards. However, if only for esthetic reasons, oil is not acceptable in drinking water systems.

3. Zone of capture calculations based on aquifer test results show that pumping of the well has drawn and will continue to draw water and associated contaminants from the area of the Manana, Inc., Mary Wheeler No. 1E gas well.

4. The source of the oil is past activities at the Mary Wheeler No. 1E gas well. This determination is based on scientific information that is detailed in the report. The exact mechanism

of discharge (e.g., leaky produced water tank, oil storage tank drain pit, reserve or blowdown pit, EPNG dehydrator upsets, or other discharges) could not be established since OCD does not have records of upsets, equipment malfunctions or reserve pit discharges. The contamination may be a combination of one or more of these mechanisms.

5. Capture curves for well S5 show that regular pumping of that well would draw contaminants from the area of S1.

6. Information from the monitor wells show that natural ground water flow is generally from north to south. Ground water from the area of the gas well facility will not intercept any supply wells under non-pumping conditions. However, pumping cones of depression and capture zones will determine the distance and direction from which contaminants are drawn. These have not been determined for the currently used supply wells, and the threat of contamination (if any) cannot be judged.

This report was prepared using public funds, and will be available to any party upon request. All supporting documentation, calculations, sample analyses, etc., remain on file at the OCD office in Santa Fe. With completion of data analysis, and transmittal of the report, the OCD has essentially completed its study of the contamination.

The Oil Conservation Division is charged with regulating oil and gas production discharges so as to protect fresh water. Prior to 1985, only limited oil and gas rules applicable to fresh water protection were in effect in the San Juan Basin. The OCD is researching this matter and no decisions have been made regarding future OCD actions, legal or otherwise, that may be taken to remediate the problem at the site. Before proceeding in any course of action, we will be in contact with you to discuss various options.

In the meantime, I am available to discuss the report and provide suggestions as to further investigation and remedial action that you may wish to pursue. If you have any questions, you may contact me at 827-5812.

Sincerely,

David G. Boyer

DAVID G. BOYER
Hydrogeologist/Environmental Bureau Chief

DGB:dp

cc: Paul Biderman, Secretary, EMD
R. L. Stamets, Director, OCD
Jeff Taylor, OCD-Legal
NM OCD, Aztec District Office

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

November 18, 1986

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

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Dr. Howard Reiquam
Director, Environmental Affairs
El Paso Natural Gas Company
P. O. Box 1492
El Paso, Texas 79978

Dear Dr. Reiquam:

The New Mexico Oil Conservation Division (OCD) has completed a report on the activities through May, 1986, of this Division and the Environmental Improvement Division (EID) regarding the contamination investigation of Flora Vista Water Well No. 1 (S1). This well, which was contaminated by oil and grease in early 1983, has been out of service since that date. OCD activities in 1985 included installation of five monitoring wells, sampling of water quality from these wells and other ground water at this location, and measurement of water levels to determine ground water direction and rate of flow. EID supplied material and staff to assist in well installation. Activities in 1986, all by the OCD, included additional sampling, water level measurements, an aquifer test to determine aquifer characteristics, and report preparation.

The OCD report is enclosed with this letter, but its major conclusions are summarized below:

1. Water Well No. 1 (S1) remains contaminated by oil. Oil remains in sediments immediately adjacent to the well, and any production pumping will cause continued movement of contaminants into the well.

2. Because of dilution and volatilization of dissolved hydrocarbon constituents in the wellbore, OCD samples did not show levels exceeding health standards. However, if only for esthetic reasons, oil is not acceptable in drinking water systems.

3. Zone of capture calculations based on aquifer test results show that pumping of the well has drawn and will continue to draw water and associated contaminants from the area of the Manana, Inc., Mary Wheeler No. 1E gas well.

4. The source of the oil is past activities at the Mary Wheeler No. 1E gas well. This determination is based on scientific information that is detailed in the report. The exact mechanism

of discharge (e.g., leaky produced water tank, oil storage tank drain pit, reserve or blowdown pit, EPNG dehydrator upsets, or other discharges) could not be established since OCD does not have records of upsets, equipment malfunctions or reserve pit discharges. The contamination may be a combination of one or more of these mechanisms.

5. Capture curves for well S5 show that regular pumping of that well would draw contaminants from the area of S1.

6. Information from the monitor wells show that natural ground water flow is generally from north to south. Ground water from the area of the gas well facility will not intercept any supply wells under non-pumping conditions. However, pumping cones of depression and capture zones will determine the distance and direction from which contaminants are drawn. These have not been determined for the currently used supply wells, and the threat of contamination (if any) cannot be judged.

This report was prepared using public funds, and will be available to any party upon request. All supporting documentation, calculations, sample analyses, etc., remain on file at the OCD office in Santa Fe. With completion of data analysis, and transmittal of the report, the OCD has essentially completed its study of the contamination.

The Oil Conservation Division is charged with regulating oil and gas production discharges so as to protect fresh water. Prior to 1985, only limited oil and gas rules applicable to fresh water protection were in effect in the San Juan Basin. The OCD is researching this matter and no decisions have been made regarding future OCD actions, legal or otherwise, that may be taken to remediate the problem at the site. Before proceeding in any course of action, we will be in contact with you to discuss various options.

In the meantime, I am available to discuss the report and provide suggestions as to further investigation and remedial action that you may wish to pursue. If you have any questions, you may contact me at 827-5812.

Sincerely,

David G. Boyer

DAVID G. BOYER
Hydrogeologist/Environmental Bureau Chief

DGB:dp

cc: Paul Biderman, Secretary, EMD
R. L. Stamets, Director, OCD
Jeff Taylor, OCD-Legal
NM OCD, Aztec District Office

STATE OF NEW MEXICO

ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

November 17, 1986

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

MEMORANDUM

TO: ADDRESSEES

FROM: DAVID BOYER, HYDROGEOLOGIST, OIL CONSERVATION DIVISION DWB

SUBJECT: CORRECTED PAGE 3, FINAL REPORT ON FLORA VISTA CONTAMINATION STUDY

The enclosed sheet replaces pages 3 and 4 of the above report. Page 3 is corrected to show that a study progress report was prepared in January, 1986. Please insert the corrected page in your copy of the report.

DB:dp

Enc.

2) Samples were taken from the water supply and monitor wells for organic analyses in March, June, August, September, and October, 1985. The results are shown in Tables 1 and 2. Results of samples from the fiberglass separator tank at the Mary Wheeler No. 1E gas well are shown in Table 3. Inorganic analyses were run on the water supply wells (including the previously contaminated well) and the Animas River in March, and the produced water from the gas well in October.

3) As expected, several monitor wells filled with sand and were cleaned twice using compressed air from two different compressors. The use of these compressors apparently affected the water quality as discussed below.

4) In September all monitor and supply wells were surveyed by Brewer and Associates for both location and elevation. Several well elevations were resurveyed in October. Blueprints from recent aerial photos were received in late December. Water levels were measured in September and October, 1985.

A summary of work performed in 1986 follows:

1) Water levels were measured in January, February, April and May. These are shown in Figures 3 to 6.

2) Samples from the monitoring wells for water quality analysis were taken in January, and April. The contaminated well was sampled in April and May. The water system was sampled for organics in January, April and May. The new fiberglass tank at the Mary Wheeler 1E oil storage tank (used to collect water drained from that tank) was sampled in April and May. The 55-gallon drum at the El Paso Natural Gas dehydrator unit was sampled in January and February. The results of organic analyses of these samples are shown in Tables 1 to 4. Inorganic analyses were run on samples from the contaminated water well in April, and from the dehydrator barrel in February. Discussion on the results is presented in the section on water quality.

3) A 72-hour aquifer test was performed on the contaminated well between April 21 and 25. The test consisted of water level measurements from the pumped well and monitor wells on April 21, 48 hours of pumping April 22-24, and 24 hours of recovery April 24-25. Approximately 5 hours into the test, oil was drawn into the well. The results of this test are discussed in detail in the hydrogeology and water quality sections.

4) A second, short duration test was performed in May to better characterize the volume and nature of the oil. These results are also presented below.

5) A study progress report was prepared in January.

Hydrogeology

The valley of the Animas River contains alluvium consisting mainly of sand and gravel which is outwash material from Pleistocene glaciers in the San Juan Mountains in Colorado. In the vicinity of the Flora Vista wells this alluvium is about 22 to 25 feet thick. Examination of the aerial photograph blueprints provided by Brewer & Associates shows old river channels and meanders in the flood plain. Finer grained silts and clays can be expected to have been deposited in low velocity areas such as point bars and areas of overbank flooding. However, the area where the monitor wells were drilled was found to be a zone of very coarse sand and gravel with some rocks exceeding a foot in diameter.

The presence of a coarse sand and gravel zone usually indicates high ground water permeability. Examination of the pumping level estimates provided in the 1982 EID community water system environmental survey, together with a 1982 Brewer and Associates infiltration gallery feasibility study shows an aquifer permeability of about 750 gallons per day per square foot, or 100 feet per day. This was confirmed by the aquifer test conducted in April. The value is at the lower end of the range for clean sand and gravel mixtures, but still allows for rapid ground water movement.

In September and October, 1985, ground water levels were measured in those monitoring wells where fluid levels were present. The results were used to calculate the direction of ground water flow and the hydraulic gradient. The gradient values were 0.0080 and 0.0081, respectively, or about 43 feet per mile. These values are intermediate between the average river gradient at Flora Vista of 0.004 and the topographic gradient of 0.014 perpendicular to the river at the well field location. The 1986 water levels, measured in January, February, April, and May, showed gradients of 0.0080, 0.0086 and 0.0079, and 0.0071 respectively. The average of the six measured values is 0.0080 or about 42 feet per mile.

The 1985 ground water flow directions are shown on Figures 1 through 2. The direction in September is slightly east of south. By late October, the direction had changed to nearly 20° east of south and continued that direction through January and February (Figures 3 and 4). The April and May measurements (Figure 5 and 6) again show the direction of flow as slightly east of south.

Some reasons for these observed changes in the ground water flow direction may be postulated based on surface and ground water interaction in the area. When river flows are generally low, as in the fall and winter, water stored in the permeable alluvial material in the immediate vicinity of the river during times of spring and summer high flows is discharged back into the river. Additional ground water discharge to the river comes from sources to the northwest of the well field including ground water recharged to the alluvium from the Flora Vista Arroyo, the Halford Independent Ditch, the Farmers Ditch,

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
525 Camino de los Marquez
Santa Fe, New Mexico
87501

TONEY ANAYA
GOVERNOR

October 14, 1986

MEMORANDUM

TO: DICK STAMETS AND DAVE BOYER, OCD

FROM: PAUL L. BIDERMAN, SECRETARY

SUBJECT: FLORA VISTA WELL INVESTIGATION

Dave, thanks to you and the staff for your persistence in finishing the investigation of the Flora Vista well contamination. While you weren't able to answer every question, you have certainly succeeded in shedding light on some of the crucial issues needed to proceed further.

I would like both of you to let me know your thinking at this time over whether the state should sue or leave the matter to any private litigation that may develop. Please brief me soon on the available options so we can decide what further steps if any are appropriate. Again, thanks for all the work thus far in this difficult problem.

PLB:rm

Paul

OFFICE OF THE SECRETARY
(505) 827-5950

ADMINISTRATIVE SERVICES DIVISION (505) 827-5925
CONSERVATION & MANAGEMENT DIVISION (505) 827-5860
MINING & MINERALS DIVISION (505) 827-5970
RESOURCE & DEVELOPMENT DIVISION (505) 827-5900
OIL CONSERVATION DIVISION
(505) 827-5800
Land Office Building, P.O. Box 2088, Santa Fe, New Mexico 87501

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

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

October 9, 1986

Mr. Bert Barnes, President
Flora Vista Water Users Assoc.
P. O. Box 171
Flora Vista, New Mexico 87415

Mr. Richard P. Cheney, Vice Pres.
Lawrence A. Brewer & Assoc. Inc.
P. O. Box 2079
Farmington, New Mexico 87499

Gentlemen:

The New Mexico Oil Conservation Division (OCD) has completed a report on the activities through May, 1986, of this Division and the Environmental Improvement Division (EID) regarding the contamination investigation of Flora Vista Water Well No. 1 (S1). This well, which was contaminated by oil and grease in early 1983, has been out of service since that date. OCD activities in 1985 included installation of five monitoring wells, sampling of water quality from these wells and other ground water at this location, and measurement of water levels to determine ground water direction and rate of flow. EID supplied material and staff to assist in well installation. Activities in 1986, all by the OCD, included additional sampling, water level measurements, an aquifer test to determine aquifer characteristics, and report preparation.

The OCD report is enclosed with this letter, but its major conclusions and recommendations for further study are summarized below:

1. Water Well No. 1 (S1) remains contaminated by oil. Oil remains in sediments immediately adjacent to the well, and any production pumping will cause continued movement of contaminants into the well.

2. Because of dilution and volatilization of dissolved hydrocarbon constituents in the wellbore, OCD samples did not show levels exceeding health standards. However, if only for esthetic reasons, oil is not acceptable in drinking water systems.

3. Zone of capture calculations based on aquifer test results show that pumping of the well has drawn and will continue to draw water and associated contaminants from the area of the Manana, Inc., Mary Wheeler No. 1E gas well.

4. The source of the oil is past activities at the Mary Wheeler No. 1E gas well. The exact mechanism of discharge (e.g., leaky produced water tank, oil storage tank drain pit, reserve or blowdown pit, EPNG dehydrator upsets, or other discharges) could not be established since OCD does not have records of upsets, equipment malfunctions or reserve pit discharges. The contamination may be a combination of one or more of these mechanisms. This determination is based on scientific information that is detailed in the report.

5. Capture curves for well S5 show that regular pumping of that well would draw contaminants from the area of S1. Short test pumping of well S5 should be conducted to determine contamination near that well. It should then be used as a monitor well.

6. Information from the monitor wells show that natural ground water flow is generally from north to south. Ground water from the area of the gas well facility will not intercept any supply wells under non-pumping conditions. However, pumping cones of depression and capture zones will determine the distance and direction from which contaminants are drawn. These have not been determined for the currently used supply wells, and the threat of contamination (if any) cannot be judged.

This study has not received peer review by other qualified hydrogeologists. While I stand by all results and conclusions in the report, it might be to your benefit to have another professional hydrogeologist review it prior to litigation. All supporting documentation, calculations, sample analyses, etc., remain on file at the OCD office in Santa Fe.

This report was prepared using public funds, and will be available to any party upon request. This includes examination of the supporting material described above. With completion of data analysis, and transmittal of the report, the OCD has essentially completed its study of the contamination. We will be available to answer questions and provide limited assistance, but esentially, this report completes our investigative work at the site. The OCD still has the option of litigation, but no decisions have been made to proceed in this area.

This study has involved considerable OCD time and resources, much more than originally anticipated. Besides being useful in determining current contamination and its source, the study demonstrated both what can be accomplished with knowledgeable professional staff, and the difficulties in providing timely completion of the study given the myriad of other duties and responsibilities of the single staff hydrogeologist. The study was undertaken during a transition period when the OCD was attempting to demonstrate that it could handle the responsibility for protecting ground water that may be threatened by the industry it regulates. The record of accomplishment the past two years proves that OCD can be effective in this area.

For the future, consideration will be given to OCD undertaking enforcement action directly after making a sufficient determination of the cause of contamination and the likely responsible party. The Environmental Improvement Division has taken the lead in this area by negotiating "Settlement Agreements" with those persons who have contaminated ground water. These can be used before or after lawsuits are filed, but expensive and lengthy litigation is avoided. EID settlements have provided for cleanup and ground water restoration among other things. They are commonly used for handling leaks from underground gasoline storage tanks. At this time, no decision has been made by OCD on using this approach for the Flora Vista contamination incident.

Again, I remain available to discuss the report, and my apologies at not completing it sooner. You may contact me at 827-5812.

Sincerely,

David G Boyer

DAVID G. BOYER
Hydrogeologist/Environmental Bureau Chief

DGB:dp

cc: Paul Biderman, Secretary, EMD
R. L. Stamets, Director, OCD
NM OCD, Aztec District Office
NM EID Water Supply Section
NM EID Ground Water/Hazardous Waste Bureau
NM EID, Farmington Field Office

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

September 23, 1986

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

Mr. Richard P. Cheney
Vice President
Lawrence A. Brewer & Assoc., Inc.
P. O. Box 2079
Farmington, New Mexico 87401

Dear Mr. Cheney:

This letter is in reference to our phone conversation this morning concerning the El Paso Natural Gas Company dehydrator unit at the Flora Vista Mary Wheeler No. 1-E gas well, Unit M, Section 23, Township 30 North, Range 12 West. The actual measured amount of steam vapor condensation liquids from the dehydration unit is unknown since the OCD has no records of the discharges. However, a rough estimate might be one 55-gallon barrel per 30 to 60 days. This volume would be dependent on the periods the well is operated and on the efficiency of the unit. These fluids contain elevated levels of aromatic hydrocarbons, but very little oil.

Enclosed is a 1984 sketch from Frank Chavez, OCD-Aztec District Supervisor, of the sources of produced water (and other fluids) at a single well site. The figure is general and not specific to the Flora Vista site. According to Mr. Chavez, at Flora Vista, the water drain line from the dehydrator separator previously went to the dehydrator pit or the 55-gallon drum. If the Manana primary separator was not working properly, oil, water and gas would be caught at the dehydrator and oil and water dumped to the drum or pit. Since the gas well produces at least several 42-gallon barrels of water per day, the 55-gallon drum would certainly overflow to the pit if the Manana equipment malfunctioned. Mr. Chavez says that at the present time the piping has been rerouted so that upsets go to the oil storage tank instead of the drum or pit. OCD files do not contain any records of the dates or volumes of any upsets.

Since I am not directly familiar with either the specifics of operation of dehydrator units, or the physical arrangement of equipment and piping at the Flora Vista dehydrator, I suggest that you contact Mr. Chavez or other persons knowledgeable in gas well production operations.

Sincerely,

David G. Boyer

DAVID G. BOYER
Environmental Bureau Chief/Hydrogeologist

DGB:dp

Enclosure

cc: R. L. Stamets
Frank Chavez

Memo

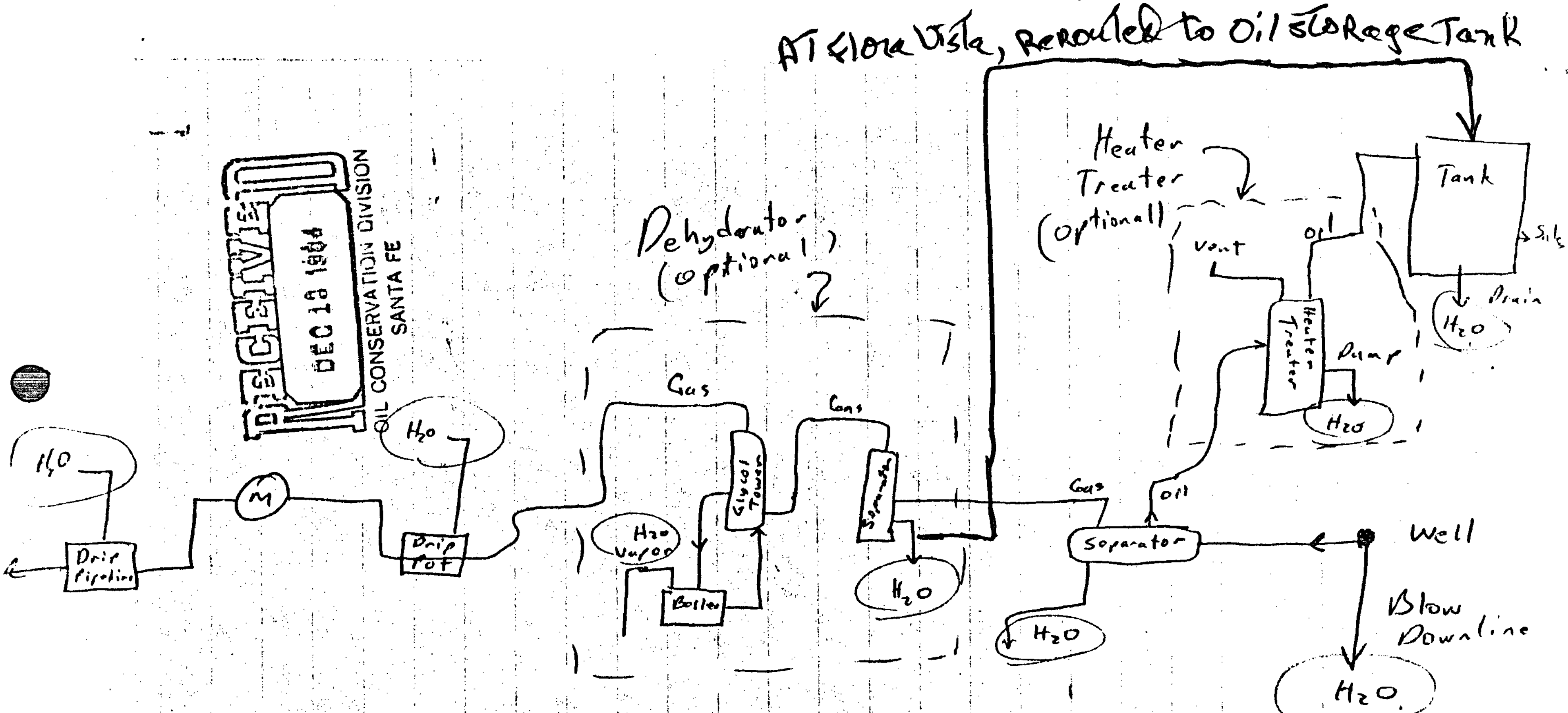
From
FRANK T. CHAVEZ
District Supervisor

To Dave Boyer

This is a sketch of how H_2O ~~&~~ can be collected ~~&~~ discharged at at least 7 places from one well site

Oil Conservation Aztec, New Mexico

RECEIVED
DEC 13 1994
OIL CONSERVATION DIVISION
SANTA FE



Produced H_2O can be put into pits

@ ① production separator + drain

② Heater treater + drain

③ tank drain

④ dehydrator

⑤ all pipeline drip pots

Note to File - EPNG - Mary Wheeler calculation

Assume one "drip" of 1/2 ml every 15 sec
(Less than a leaky faucet)

Then:

$$\frac{1\,ml}{30\,sec} \times \frac{60\,sec}{Min} \times \frac{1440\,min}{Day} \times \frac{1\,l}{1000\,ml} \times \frac{0.946\,qt}{l} \times \frac{Gal}{4\,QTs} = 0.68\,gpd$$

or 20 gals/30 days, 40 gal/60 days

More if faster drip, rain in barrel
Less if well off, dehydrator efficient.

By comparision - worst case seen
by me: Dehydrator at Leeper Gas
Comm #1 (Cedar Hill at River)
on 5/2/85
Collected 250 ml drip in bottle in 22 secs
or 232 gallons/day.

D. G. Boyer
9/23/86

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

September 4, 1986

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

Mr. Richard P. Cheney
Vice President
Lawrence A. Brewer &
Associates, Inc.
P. O. Box 2079
Farmington, N.M. 87401

Dear Mr. Cheney:

This letter is in reference to the final report on the Flora Vista well contamination which I had said would be finished by this week. It isn't, and I apologize and take responsibility for the failure to complete it within the agreed upon time. I don't believe in making commitments I can't keep; its unprofessional. However, in this case, I have badly overextended myself. Your report is second to another one (which was due August 14) nearing completion. I estimate I am four weeks away (maximum) from completing yours. This will include my working evenings and weekends (which my supervisor disapproves of) until completion.

The main problem is that I am the only hydrogeologist the Oil Conservation Division has to perform groundwater-related permitting and contamination investigation statewide. I have a chemical engineer and petroleum geologist that assist in hydrologic matters to the extent their expertise allows. I am also responsible for administrative duties as supervisor and Environmental Bureau Chief. The attached material summarizes these responsibilities and the workload. (This excerpt is from an EPA grant request; a six-month EPA funded technical position was approved starting this month.)

While this letter does nothing to advance your report, I hope it helps to put the matter in perspective. Again, my apologies to you, and my personal commitment for a finished report within 30 days.

Sincerely,

David G. Boyer

DAVID G. BOYER
Hydrogeologist/Environmental Bureau Chief

Attachment

DGB:dp

cc: R. L. Stamets
Paul Biderman

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Flora Vista Water Users Association Owner's Well No. ____
Street or Post Office Address P.O. Box 171
City and State Flora Vista, N.M. 87415

Well was drilled under Permit No. SJ-588-1 Exploratory and is located in the:

a. ____ ¼ SW ¼ SW ¼ SW ¼ of Section 23 Township 30-N Range 12 W N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in ____ County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Bob Savage License No. WD-847

Address P.O. Box 2434 Farmington, N.M. 87401

Drilling Began 12-7-81 Completed 12-9-81 Type tools Cable Tool Size of hole 10 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 25 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 6 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
6	25	19	Boulders + Sand	100

Section 3. RECORD OF CASING

Diameter	Pounds	Threads	Depth in Feet	Length	Type of Shoe	Perforations
From SEO office S.F.! 10"	30	Weld		15	Factory	None-Set Sand Screen

Tom Barker

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well ~~Flora Vista Water Ussers Assoc.~~ Owner's Well No. ______
Street or Post Office Address Box 171
City and State Flora Vista, N.M. 87415

Well was drilled under Permit No. SJ 588 and is located in the:

a. ____ ¼ ____ ¼ ____ ¼ ____ ¼ of Section ______ Township ______ Range ______ N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in ______ County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor Terry G Hood License No. WD 717

Address Rt 3 Box 234 A Flora Vista, N.M.

Drilling Began 6/1/84 Completed 6/6/84 Type tools CableTool Size of hole 10 in.

Elevation of land surface or ______ at well is 5400 ft. Total depth of well 22 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 3 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
12	22	10	Water Bearing Sand & Gravel	150

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
10	.205		0	22	22	Drive Shoe	14	22

84 JUN 26 AM 11:17
STATE ENGINEER OFFICE
ALBUQUERQUE, N. MEX

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______
State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ______ FWL ______ FSL ______

File No. ______ Use ______ Location No. ______

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material En[illegible]
From	To		
0	12	12	Overburden & Boulders
12	22	10	Water Bearing Sand & Gravel

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office [illegible] the State Engineer. All sections, [illegible]ept Section 5, shall be answered as complete[illegible] and accurately as possible when any well is [illegible] When [illegible]rm is used as a plugging record [illegible] tion[illegible] and [illegible] n 5 need be completed.

Revised June 1972

STATE ENGINEER OFFICE
WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Flora Vista Water Ussers Assoc. Owner's Well No. 2
Street or Post Office Address Box 171
City and State Flora Vista,N.M. 87415

Well was drilled under Permit No. SJ 588 and is located in the:

a. ____ ¼ ____ ¼ ____ ¼ ____ ¼ of Section ____ Township ____ Range ____ N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in ____ County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Terry G. Hood License No. WD 717

Address Flora Vista,N.M.

Drilling Began 11/30/84 Completed 12/7/84 Type tools CableTool Size of hole 10 in.

Elevation of land surface or ____ at well is 5400 ft. Total depth of well 22 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 4 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
12	22	10	Water Bearing Sand & Gravel	100

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
10	.205		0	22	22	Drive Shoe	14	22

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

84 DEC 17 P 1:17
STATE ENGINEER OFFICE
DISTRICT I
ALBUQUERQUE, N. MEX.

'84 DEC 11 AM 2:40

Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ____ FWL ____ FSL ____

File No. ____ Use ____ Location No. ____

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encount.
0	12	12	Sand & Boulders
12	22c	10	Water Bearing Sand & Gravel

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

[signature]
Driller

RUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office State Engineer. All sections except Section 5, shall be answered as completely and accurately as possible when any we ... record, only Section (a) and Section ...

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Flora Vista Water Ussers Assoc. Owner's Well No. # 1
Street or Post Office Address Box 171
City and State Flora Vista, N.M. 87415

Well was drilled under Permit No. SJ 588 and is located in the:

a. ____ ¼ ____ ¼ ____ ¼ ____ ¼ of Section ____ Township ____ Range ____ N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in ____ County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Terry G. Hood License No. WD 717

Address Rt 3 Box 234-A Flora Vista N.M.

Drilling Began 11/30/84 Completed 12/7/84 Type tools CableTool Size of hole 10 in.

Elevation of land surface or ____ at well is 5400 ft. Total depth of well 22 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 3 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
12	22	10	Water Bearing Sand & Gravel	120

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
10	.205		0	22	22	Drive Shoe	14	22

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

84 DEC 17 P 1:16
STATE ENGINEER OFFICE
DISTRICT I
ALBUQUERQUE, N. MEX.

Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____ State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ____ FWL ____ FSL ____

File No. ____ Use ____ Location No. ____

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
0	12	12	OverBurden & Boulders
12	22	10	Water Bearing Sand & GRavel

Section 7. REMARKS AND ADDITIONAL INFORMATION

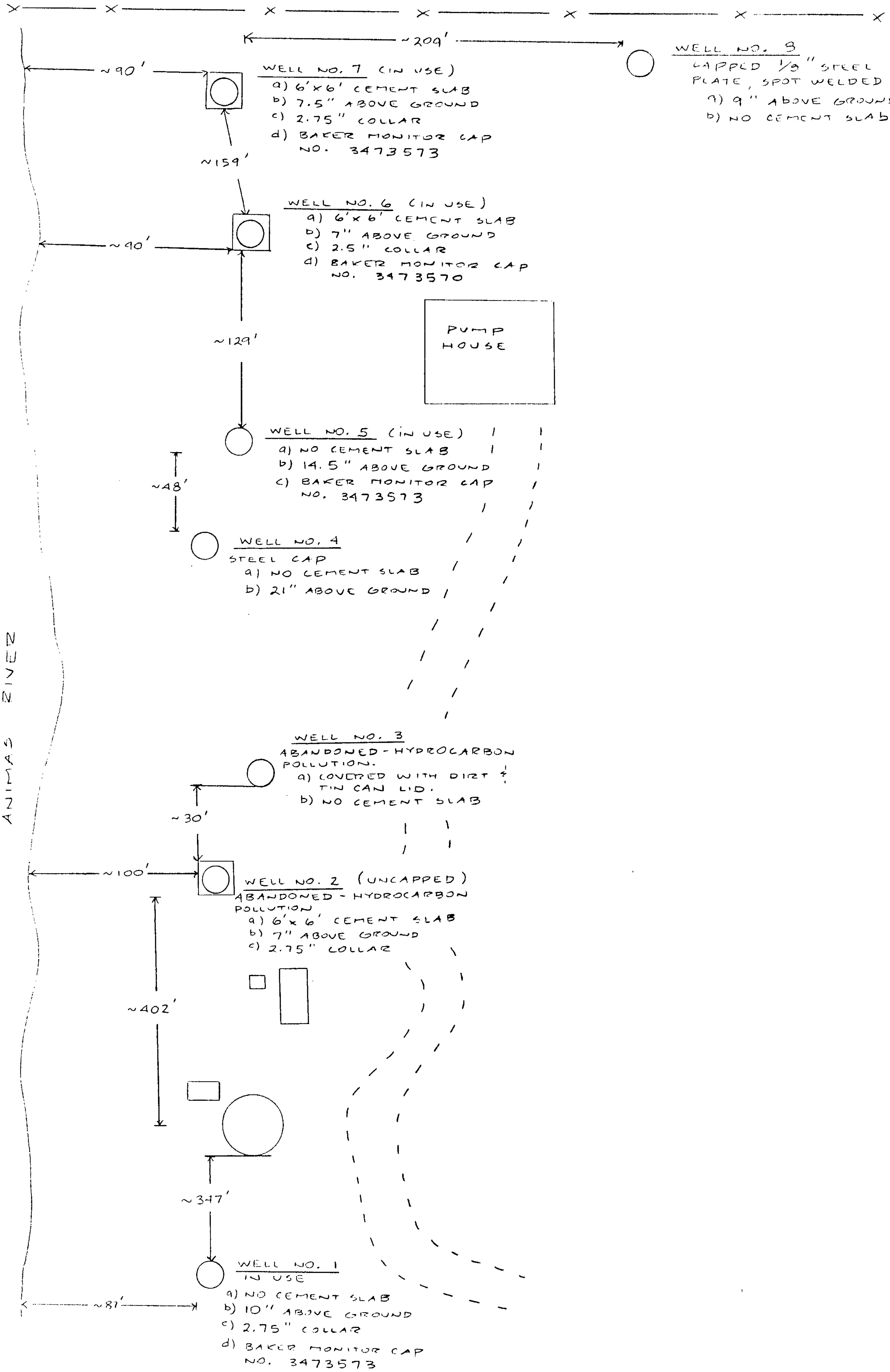
The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Toy B. Hood
Driller

[illegible]UCTIONS: This form should be [illegible]cuted in triplicate, preferably typewritten, and [illegible]mitted to the appropriate district office [illegible]ate Engineer. All [illegible] except Section 5, shall be answered as completely [illegible] accurately as possi[illegible] [illegible] ...ed b[illegible]

FLORA VISTA WATER USERS ASSOCIATION SJ 588
FIELD INSPECTION
APRIL 4, 1935

NW CORNER OF THE SW1/4 SW1/4 SECTION 23, T30N, R12W



STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

50 YEARS

1935 - 1985

TONEY ANAYA
GOVERNOR

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

April 9, 1986

Mr. Richard P. Cheney
Vice President
Lawrence A. Brewer &
Associates, Inc.
P. O. Box 2079
Farmington, N.M. 87401

Dear Mr. Cheney:

As mentioned previously by letter and in person, the Oil Conservation Division wishes to conduct an aquifer pumping test on the Flora Vista Well No. 1 that was previously contaminated. We have tentatively scheduled the entire week of April 21-25 for work in Farmington, mainly at the Flora Vista site. Before final arrangements are made, I need to know if all the equipment needed to conduct the test is available. The following are our anticipated requirements:

1. Installation of a pump in Well No. 1 with a capacity near that of the original pump, or with a capacity close to the rate to be pumped if the well is to be placed back in service. The pump should be capable of non-stop pumping at its capacity for at least 72 hours. A valve or other method to "fine-tune" the discharge rate should be installed. A pipe or tube to allow access to the pumped well for drawdown and recovery measurements also needs to be provided. Installation and testing should be completed no later than Friday, April 18, to allow 48 to 72 hours of water level stabilization prior to the test.

2. An accurate method for measuring discharge is needed. My preference would be a calibrated in-line flow meter close to the pump. Any valve should not interfere with flow measurement accuracy.

3. A tap should be available close to the pump discharge to collect water samples for analysis.

4. Discharge should be routed a good distance away from the area, either by pipe or hose. Discharge should not be into the river or wherever it could impact the monitor or supply wells. An on-site inspection prior to start of the test would be the best way to determine the discharge location.

Our current plans are for pumping continuously beginning no later than 8 a.m., Tuesday, April 20. Pumping is to be continued for 72 hours followed by collecting 24 to 36 hours of recovery data. This agency will arrange for State staff to be on site for the entire pumping sequence. We will also provide interpretation of the test results.

To complete our planning, we need to know as quickly as possible whether this equipment will be ready by the dates listed. Please contact either myself at 827-5812 or Jami Bailey at 827-5884 regarding these preparations.

Sincerely,

David G. Boyer

DAVID G. BOYER
Environmental Bureau Chief

DGB:dp

cc: Bert Barnes, Flora Vista Water Users Assoc.

IN THE ELEVENTH JUDICIAL DISTRICT COURT
STATE OF NEW MEXICO, COUNTY OF SAN JUAN

No. CV 86-00154-4

FLORA VISTA WATER USERS ASSOCIATION,	:
Plaintiff,	:
v.	:
MANANA GAS, INC., and EL PASO NATURAL GAS COMPANY,	:
Defendants.	:

A N S W E R

COMES NOW the defendant, El Paso Natural Gas Company, and for its answer to plaintiff's complaint states:

FIRST DEFENSE

Plaintiff's complaint fails to state a claim upon which relief may be granted.

SECOND DEFENSE

1. This defendant is without information sufficient upon which to form a belief as to the truth of the allegations of paragraphs 1, 2, and 5 of plaintiff's complaint, and the same are therefore denied.

2. This defendant denies the allegations of paragraphs 3, 8, 9, 10, 11, and 12 and all of the separate prayers for relief numbered 1 through 4 of plaintiff's complaint.

3. In answer to paragraph 4 of plaintiff's complaint, this defendant admits that the complaint alleges acts which occurred in San Juan County, New Mexico, but denies that any actionable conduct occurred therein and denies all other allegations of paragraph 4.

4. In answer to paragraph 6 of plaintiff's complaint, this defendant admits there is a well located at the place indicated in paragraph 6 of plaintiff's complaint but denies it is solely a gas well and denies all other allegations of paragraph 6.

5. In answer to paragraph 7 of plaintiff's complaint, this defendant admits that El Paso Natural Gas Company has received gas from the Mary Wheeler No. 1-E well but denies all other allegations of paragraph 7.

FIRST ALTERNATIVE AFFIRMATIVE DEFENSE

Plaintiff's claims are barred by its own comparative negligence, which bars or should ratably reduce the amount of plaintiff's claims.

SECOND ALTERNATIVE AFFIRMATIVE DEFENSE

Plaintiff's claims are barred by the comparative negligence or independent negligence of third persons or of co-defendants to this lawsuit, which should bar or, in the alternative, reduce in a pro rata fashion plaintiff's recoverable damages.

THIRD ALTERNATIVE AFFIRMATIVE DEFENSE

The damages about which plaintiff complains were all the proximate result of an act of God.

FOURTH ALTERNATIVE AFFIRMATIVE DEFENSE

The damages about which plaintiff complains were the proximate result of an independent, intervening cause other than the conduct of this answering defendant.

FIFTH ALTERNATIVE AFFIRMATIVE DEFENSE

Plaintiff's claims are barred by estoppel. Plaintiff and its predecessors have allowed this defendant and other defendants to proceed with well operations and reclamation actions to their detriment, and plaintiff is therefore estopped from complaining of any actions and conduct on the part of this or any other defendant.

SIXTH ALTERNATIVE AFFIRMATIVE DEFENSE

Plaintiff's claims are barred by laches.

SEVENTH ALTERNATIVE AFFIRMATIVE DEFENSE

Plaintiff's claims or some of the events which should have given rise to claims, if any, are barred by the appropriate statutes of limitations.

EIGHTH ALTERNATIVE AFFIRMATIVE DEFENSE

Plaintiff's claims are barred by plaintiff's own failure to mitigate the alleged damages.

WHEREFORE, this answering defendant prays that plaintiff's complaint and all claims and causes of action therein contained be dismissed with prejudice and that this defendant be awarded its costs and such other and further relief as to the court seems proper.

ELDON J. MITRISON
Assistant General Counsel
El Paso Natural Gas Company
P. O. Box 1492
El Paso, Texas 79978
915/541-2600

CIVEROLO, HANSEN & WOLF, P. A.
Attorneys for Defendant
El Paso Natural Gas Company
P. O. Drawer 887
Albuquerque, New Mexico 87103
505/842-8255

By Wayne C. Wolf
Wayne C. Wolf

THIS WILL CERTIFY that a true copy of the foregoing pleading was mailed to opposing counsel of record this 18th day of March, 1986.

Wayne C. Wolf
Wayne C. Wolf

CIVEROLO, HANSEN & WOLF, P.A.
COUNSELORS AND ATTORNEYS AT LAW
OLD BANK BUILDING
219 CENTRAL AVENUE, N.W., SUITE 400
P. O. DRAWER 887
ALBUQUERQUE, NEW MEXICO 87103-0887
TELEPHONE (505) 842-8255

RICHARD C. CIVEROLO
C. LEROY HANSEN
WAYNE C. WOLF
WILLIAM P. GRALOW
LAWRENCE H. HILL
KATHLEEN D. LEBECK
DENNIS E. JONTZ
CARL J. BUTKUS
W. R. LOGAN
JAMES J. WIDLAND
CYNTHIA A. FRY

TERRY R. GUEBERT
ROBERTO C. ARMIJO
MARY E. LEBECK
PAUL L. CIVEROLO
ROSS L. CROWN
R. GALEN REIMER
JULIA R. WALL
CLINTON W. THUTE
JAY F. STEIN
ELLEN M. KELLY
MICHAEL H. SMITH
ANTHONY J. D. CONTRI

March 12, 1986

Mr. David G. Boyer
Environmental Bureau Chief
NEW MEXICO OIL CONSERVATION DIVISION
P.O. Box 2088
Santa Fe, New Mexico 87504-2088

RE: Flora Vista Water Users Association v. Manana Gas, Inc. and El Paso Natural Gas Co.; No. CV 86-00154-4

Dear David:

Pursuant to our telephone conversation of today, please be advised that this firm represents El Paso Natural Gas Company in the above-referenced case. We wish to review all data, technical reports, or other information of this type that are public documents pertaining to your "Report to the Flora Vista Water Users Association." We plan on doing so on Monday, April 7, 1986, at 9:30 a.m. Either Wayne Wolf of this office, myself, or both will meet you at that time.

Enclosed please find a copy of the Complaint filed in this action for your reference. This is the most recent pleading that we have.

Sincerely,

CIVEROLO, HANSEN & WOLF, P.A.

Jay F. Stein

Jay F. Stein

JFS/da
Encl.
cc: Wayne Wolf

RECEIVED MAR 6 1986

FILED
DISTRICT COURT
SAN JUAN COUNTY
N. M.

FEB 14 8 42 AM '86

STATE OF NEW MEXICO ~~COUNTY OF~~ SAN JUAN

IN THE DISTRICT COURT

FLORA VISTA WATER USERS
ASSOCIATION,

Plaintiff,

vs. No. CV 86-00154-4

MANANA GAS INC, and EL PASO
NATURAL GAS COMPANY,

Defendants.

COMPLAINT TO RECOVER DAMAGES
FOR PROPERTY DAMAGES

COMES NOW, the Plaintiff, by and through its attorney, Richard L. Lougee, and for its cause of action against the Defendants herein alleges and states as follows:

1. That Plaintiff is, and at all times material hereto was, a New Mexico corporation formed in accordance with the provisions of Sec. 73-5-2 et seq. NMSA 1978.

2. That the Defendant Manana Gas Inc. is, and at all times material hereto was, a New Mexico corporation formed under the laws of that state.

3. That the Defendant El Paso Natural Gas Company is, and at all times material hereto was, on information and belief, a Texas corporation formed under the laws of that state.

4. That the events which give rise to this Complaint occurred in the County of San Juan, State of New Mexico.

5. That the Plaintiff operates, and at all times material hereto has operated, an approved community water system for the Flora Vista area located approximately halfway between Farmington and Aztec on U. S. Highway 550.

6. That in January of 1980, a gas well owned and operated by the Defendant Manana Gas Inc. was drilled in unit M (SW/4 SW/4) of Section 24, Township 29 North, Range 11 West in the vicinity of Plaintiff's water system as aforedescribed.

7. That the gas well aforedescribed in paragraph 6 above, more particularly the Mary Wheeler No. 1-E, was placed in service in July 1980, with the natural gas being received by the Defendant El Paso Natural Gas Company via a pipeline at the site.

8. That on February 24, 1983, Plaintiff discovered that one of its water wells was contaminated with oil and grease and said well was taken out of service.

9. That Plaintiff has since learned that its entire site is contaminated and cannot be used for the production of domestic water.

10. That, on information and belief, the cause of the aforedescribed contamination is a leak in an unlined slush pit owned and operated by the Defendant Manana Gas Inc. at the Mary

Wheeler No. 1-E site.

11. That, on information and belief, a further cause of the aforedescribed contamination is an improperly maintained gas dehydrator owned and operated by the Defendant El Paso Natural Gas Co. Inc. at the aforedescribed site.

12. That as a result of the Defendants' negligence as aforedescribed in failing to care for and maintain their equipment, the Plaintiff has suffered and will continue to suffer damages in an amount to be proven at trial.

WHEREFORE, Plaintiff prays judgment against the Defendants herein:

1. For compensatory damages in an amount to be proven at trial.

2. For consequential damages in an amount to be proven at trial.

3. For its attorney's fees and costs

4. For such other and further relief as the Court deems proper.

Richard L Lougee

RICHARD L. LOUGEE
Attorney for Plaintiff
108 N. Orchard, Ste. 201
Farmington, NM 87401
(505) 327-5281

VERIFICATION

STATE OF NEW MEXICO)
: ss
COUNTY OF SAN JUAN)

BERT BARNS, after first being duly sworn upon his oath states: That he is the President of Flora Vista Water Users Association, the Plaintiff in the above entitled cause; that he has read the foregoing Complaint and believes the contents contained therein to be true and correct.

BERT BARNS

On this 13th day of February, 1976, before me personally appeared BERT BARNS to me known to be the person described in and who executed the foregoing document, and acknowledged that he executed the same as his free act and deed.

Patricia D. Brown
Notary Public

My Commission Expires:

Jan 12, 1976

ELEVENTH JUDICIAL DISTRICT COURT
COUNTY OF SAN JUAN
STATE OF NEW MEXICO

FILED DISTRICT COURT SAN JUAN COUNTY

FEB 14 8 43 AM '86

Eula M. Dunagan

FLORA VISTA WATER USERS ASSOCIATION,

Plaintiff ,

vs.

No. CV 86-00154-C

MANANA GAS INC. and EL PASO NATURAL GAS COMPANY,

Defendants.

RECEIVED - HAND DELIVERED TO EMIL AT 6505 PRAIRIE NE AT 9:30 PM SUNDAY 4-13/86

SUMMONS

TO: Defendants

Defendant(s), Greeting:

You are hereby directed to serve a pleading or motion in response to the Complaint within 30 days after service of the Summons, and file the same, all as provided by law.

You are notified that, unless you so serve and file a responsive pleading or motion, the Plaintiff(s) will apply to the Court for the relief demanded in the Complaint.

Attorney for Plaintiff: RICHARD L. LOUGEE
108 N. Orchard, Ste. 201, Farmington, NM 87401

WITNESS the Honorable James L. Brown, District Judge of said Court of the State of New Mexico and Seal of the District Court of said county, this 14th day of February, 1986.

EULA M. DUNAGAN
DISTRICT COURT CLERK

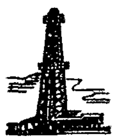
(Seal)

by Cecilia Hanson
Deputy

NOTE:

This summons does not require you to see, telephone or write to the District Judge of the Court at this time.

It does require you or your attorney to file your legal defense to this case in writing with the Clerk of the District Court within 30 days after the summons is legally served on you. If you do not do this, the party suing may get a Court Judgment by default against you.



Ed Hartman

President
Mañana Gas, Inc.
Realtor
Certified Public Accountant

P.O. Box 36990
Albuquerque, New Mexico 87176
TELE: (505) 884-4863 (O)
(505) 884-4945 (H)

FILED
DISTRICT COURT
SAN JUAN COUNTY
N M

FEB 14 8 42 AM '86

[signature] COUNTY OF SAN JUAN

STATE OF NEW MEXICO

IN THE DISTRICT COURT

FLORA VISTA WATER USERS
ASSOCIATION,

Plaintiff,

vs.

No. CV 86-00154-4

MANANA GAS INC, and EL PASO
NATURAL GAS COMPANY,

Defendants.

COMPLAINT TO RECOVER DAMAGES
FOR PROPERTY DAMAGES

COMES NOW, the Plaintiff, by and through its attorney, Richard L. Lougee, and for its cause of action against the Defendants herein alleges and states as follows:

1. That Plaintiff is, and at all times material hereto was, a New Mexico corporation formed in accordance with the provisions of Sec. 73-5-2 et seq. NMSA 1978.

2. That the Defendant Manana Gas Inc. is, and at all times material hereto was, a New Mexico corporation formed under the laws of that state.

3. That the Defendant El Paso Natural Gas Company is, and at all times material hereto was, on information and belief, a Texas corporation formed under the laws of that state.

4. That the events which give rise to this Complaint occurred in the County of San Juan, State of New Mexico.

5. That the Plaintiff operates, and at all times material hereto has operated, an approved community water system for the Flora Vista area located approximately halfway between Farmington and Aztec on U. S. Highway 550.

6. That in January of 1980, a gas well owned and operated by the Defendant Manana Gas Inc. was drilled in unit M (SW/4 SW/4) of Section 24, Township 29 North, Range 11 West in the vicinity of Plaintiff's water system as aforedescribed.

7. That the gas well aforedescribed in paragraph 6 above, more particularly the Mary Wheeler No. 1-E, was placed in service in July 1980, with the natural gas being received by the Defendant El Paso Natural Gas Company via a pipeline at the site.

8. That on February 24, 1983, Plaintiff discovered that one of its water wells was contaminated with oil and grease and said well was taken out of service.

9. That Plaintiff has since learned that its entire site is contaminated and cannot be used for the production of domestic water.

10. That, on information and belief, the cause of the aforedescribed contamination is a leak in an unlined slush pit owned and operated by the Defendant Manana Gas Inc. at the Mary

Wheeler No. 1-E site.

11. That, on information and belief, a further cause of the aforedescribed contamination is an improperly maintained gas dehydrator owned and operated by the Defendant El Paso Natural Gas Co. Inc. at the aforedescribed site.

12. That as a result of the Defendants' negligence as aforedescribed in failing to care for and maintain their equipment, the Plaintiff has suffered and will continue to suffer damages in an amount to be proven at trial.

WHEREFORE, Plaintiff prays judgment against the Defendants herein:

1. For compensatory damages in an amount to be proven at trial.

2. For consequential damages in an amount to be proven at trial.

3. For its attorney's fees and costs

4. For such other and further relief as the Court deems proper.

Richard L. Lougee

RICHARD L. LOUGEE
Attorney for Plaintiff
108 N. Orchard, Ste. 201
Farmington, NM 87401
(505) 327-5281

VERIFICATION

STATE OF NEW MEXICO)
: ss
COUNTY OF SAN JUAN)

BERT BARNS, after first being duly sworn upon his oath states: That he is the President of Flora Vista Water Users Association, the Plaintiff in the above entitled cause; that he has read the foregoing Complaint and believes the contents contained therein to be true and correct.

BERT BARNS

On this 13th day of February, 1986, before me personally appeared BERT BARNS to me known to be the person described in and who executed the foregoing document, and acknowledged that he executed the same as his free act and deed.

Patricia D. Brown
Notary Public

My Commission Expires:

Jan 12, 1986

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☐ Telephone ☒ Personal	Time 1:20PM	Date 2/13/86 (in Flora Vista at FVWU Office)

Originating Party	Other Parties
Dave Boyer - OCD	Ray Penrod - Flora Vista Water Users Assoc

Subject: File search for more specific info. on 1983 pumping at time of well contamination

Discussion: Penrod recollections: (1) Well #1 had 10 Hp pump that delivered 90-95 gpm, #2 had 7 Hp @ 40-45 gpm capacity & located behind pumphouse. Well #1 was in service in late 80 or early 1981. (2) Penrod does not remember seeing an oil phase in well - only gassy smell. (3) Ray does not recall exactly when Manana replaced pit but does not think it was at same time as the well went bad - maybe a year later. (4) Ray saw a green film in a pit by the dehydrator during excavation work. (5) City of Aztec provides some water for system - even today

Conclusions or Agreements: File search - FVWA Records: Jan 83 - 2,955,288 gal; Feb 83 - 3,714,016 gal; 1983 Total - 46,893,442 gal. Aztec records (estimated due to broken meter during part of period): 12/15-1/15/83 - 1,154,000 gal; 1/15-2/15/83 - 1,116,000; 2/15-3/15/83 - 1,156,000 gal (Date of leak ~ Feb 24, 1983)

Distribution: Flora Vista File

Signed: D T Boyer

(P.S. Penrod said #1 well on more than #2 - No time clocks)

March 1,156,000

~~[illegible]~~ -

Go To SSO

BeRT Barns 325-7577

No time clocks - Ray? check

In 1983 ~~334-6043~~

10 Hp - 90-95 gpm #1
7 Hp 40-45 #2 (Before pump work Not 55)

Partially City of Aztec
January 1983 - 2,955,288
February 83 3,714,016
1983 46,893,442 Total
{Meter Readings ~ Dec 15 - Jan 15, Jan 15 - Feb 15}

Jan ~~[illegible]~~
Jan 1,154000 EST
Feb 1,116,000
Mar 1,156,000

334-9456 Utilities -

Flora Vista Possible Dates March 10-14, March 31 - April 4

Well #1 in service late 80, early 81

No oil Phase in well - Gassy Smell

Ray says Manons pit replaced 1 yr after well contaminated (not at same time as well went bad.) Saw green Films by ~~[illegible]~~ Dehydrator

Leak in Surface casing?

	FUWA	City of Aztec Portion	
Jan	2,955,288	1,154,000	
Feb	3,714,016	1,116,000	
Total	6,669,304	2270,000	Diff 4,399,304

Avg for 59 days - 74,564 gpd

~~31~~
~~28~~
~~59~~
~~31~~
90

113039
38067 gpd
74972 → 75,000

~~38475~~ 107570
36613
70957
71,000 gpd

31
31
/62

75,000 gpd x $\frac{1 \text{ day}}{1440 \text{ min}}$ = 52 gpm

66% of water from wells
34% from Aztec

for 1983 use: 30,949,672 would have been from wells
or ~~85~~ 84794 gpd ≃ 85,000 gpd Avg!

70% from #1 if pumped equally
70% + since #1 on more

∇ 5 ft below land

water wells 27 ft deep ; screened lower 8 ? ft.

~ 12 ft drawdown at 75 gpm

some wells are pumped continuously, some intermittently

newer water wells :

Well # 2 100 gpm

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

50 YEARS
1935 - 1985

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

February 7, 1986

MEMORANDUM

TO: ADDRESSEES

FROM: DAVID BOYER, HYDROGEOLOGIST DHB

SUBJECT: CORRECTION FOR GAS WELL LOCATION

The location of the Mary Wheeler Well No. 1-E gas well was incorrectly given on page 2 of the report entitled "Progress Report on Flora Vista Contamination Study, January 1986", which was recently sent to you. The correct location is Unit M of Section 23, Township 30 North, Range 12 West. A corrected page 2 is enclosed as a replacement page. I apologize for any inconvenience this error may have caused.

Enc.

average delivery in 1983 of about 100,000 gpd. The system was placed in service in 1981 with two wells each with pump capacities of 60-70 gallons per minute (gpm).

In January, 1980, a gas well owned by Manana Gas, Inc. of Albuquerque was drilled in unit M (SW/4 SW/4) of Section 23, Township 30 North, Range 12 West. The well, Mary Wheeler No. 1-E, was placed in service in July, 1980, with the natural gas being received by El Paso Natural Gas via a pipeline at the site.

Manana facilities at the site include the well, an oil-water separator, a fiberglass tank (capacity approximately 120 barrels) holding produced water and some oil from the separator, an oil tank for storing oil produced with the gas and a tank drain pit for discharging water separated from the oil (now replaced with a small fiberglass tank). A reserve (mud pit) and a blowdown pit were both likely present at one time but have been covered over. The original fiberglass tank was replaced with a second identical tank in early 1983 due to discovery of a leak. El Paso Natural Gas facilities include a gas dehydrator, a dehydrator pit with a 55 gallon drum serving as a collector, and a gas meter house.

The entire site occupies an area of approximately 220 x 75 feet and is located northeast of water supply well S1. Distances from the water well to the fiberglass produced water tank, gas well, and dehydrator pit are 235 feet, 255 feet, and 285 feet, respectively. Figure 1 shows the relationship of the various oil and gas facilities to the water wells.

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

50 YEARS
1935 - 1985

TONEY ANAYA
GOVERNOR

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

February 5, 1986

Mr. Ed Hartman
Manana Gas, Inc.
P.O. Box 36990
Albuquerque, NM 87176

Dear Mr. Hartman:

At the request of the Flora Vista Water Users Association and their consultants, Brewer & Associates, the Oil Conservation Division (OCD) has performed ground water quality sampling and made hydrologic measurements in the vicinity of a community water supply well (S1) that was contaminated with oil and grease in February 1983. A possible source of this contamination may have been produced water and/or other fluids that could have been released to the subsurface from the Mary Wheeler No. 1E gas well (M-23-30N-12W) and/or attendant field processing equipment at the site. A progress report of the investigation with the results available to date is being provided to you and to El Paso Natural Gas Company. The OCD plans to make additional measurements and collect further data through the fall of this year.

Two samplings of fluids from Manana's produced water tank were taken one each in September and October, as part of the study. On both occasions, I understand that the OCD Aztec District Office notified your local representative as to the day and approximate time of day of the sampling. However, no Manana representative was present for either sampling.

If you have any questions regarding this report, or planned future work, please contact me at the above address, or by telephone at 827-5812.

Sincerely,

David G. Boyer

DAVID G. BOYER
Environmental Bureau Chief

DGB/dp

cc: R. L. Stamets, OCD Director
Frank Chavez, OCD Aztec District Office

50 YEARS

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

1935 - 1985

TONEY ANAYA
GOVERNOR

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

February 5, 1986

Mr. Howard Reiquam, Ph.D., Director
Environmental Affairs Dept.
El Paso Natural Gas Co.
P.O. Box 1492
El Paso, Texas 79978

Dear Mr. Reiquam:

At the request of the Flora Vista Water Users Association and their consultants, Brewer & Associates, the Oil Conservation Division (OCD) has performed ground water quality sampling and made hydrologic measurements in the vicinity of a community water supply well (S1) that was contaminated with oil and grease in February 1983. A possible source of this contamination may have been produced water and/or other fluids that could have been released to the subsurface from the Mary Wheeler No. 1E gas well (M-23-30N-12W) and/or attendant field processing equipment at the site. A progress report of the investigation with the results available to date is being provided to you and to Manana, Inc. The OCD plans to make additional measurements and collect further data through the fall of this year.

If you have any questions regarding this report, or planned future work, please contact me at the above address, or by telephone at 827-5812.

Sincerely,

David G Boyer

DAVID G. BOYER
Environmental Bureau Chief

DGB/dp

cc: R. L. Stamets, OCD Director
Frank Chavez, OCD Aztec District Office

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

50 YEARS

1935 - 1985

TONEY ANAYA
GOVERNOR

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

January 31, 1986

Mr. Bert Barnes, President
Flora Vista Water Users
Association
P.O. Box 171
Flora Vista, NM 87415

Mr. Richard P. Cheney,
Vice President
Lawrence A. Brewer &
Associates, Inc.
P.O. Box 2079
Farmington, NM 87401

Gentlemen:

The New Mexico Oil Conservation Division (OCD) has completed a report on the activities through January, 1986, of this Division and the Environmental Improvement Division (EID) regarding the contamination investigation of Flora Vista Water Well No. 1 (S1). This well, which was contaminated by oil and grease in early 1983, has been out of service since that date. OCD activities in 1985 included installation of five monitoring wells, sampling of water quality from these wells and other ground water at this location, and measurement of water levels to determine ground water direction and rate of flow. EID supplied material and staff to assist in well installation.

The OCD report is enclosed with this letter but its major conclusions and recommendations for further study are summarized below:

1) No verifiable contamination was detected in 1985 in either the unused water supply wells or the monitor wells except for low level contamination detected in samples taken within 24 hours of cleaning the well with an air compressor. The latest sampling for which results are available (October 1985) did not detect hydrocarbons either in the monitor wells or in a composite of the water wells currently supplying the system.

2) Methane at concentrations 1200 times ambient levels was detected in the monitor well closest to the gas well in August. The source is likely the decay of

shallow buried organic material. The gas well itself is not a likely source of methane since it has 227 feet of surface casing cemented back to the surface.

3) Ground water movement in the vicinity of the monitor wells in fall 1985 - winter 1986 was towards the river and away from the currently used water supply wells. The flow has a seepage velocity range of 3 to 4 feet per day.

4) Based on the available information, the produced water tank at the Manana Mary Wheeler 1E gas well, the gas well itself, and the dehydrator pit are all likely to have been within the zone of influence ("cone of depression") of the pumping S1 well at the time the water well was contaminated in February 1983. Actual pumping rates and pumping cycle information at the time of contamination would better define the extent of pumping well influence.

5) The estimate of travel time for unretarded soluble contaminants to have moved from the vicinity of the gas well to the pumping water well is approximately 100 days.

6) The rate of ground water movement is such that a single plume of contaminated produced water originating in the vicinity of the gas well in 1983 has now moved beyond the water well.

7) Because of the passage of time, water pumped from well S1 would not show contamination unless a zone of residual oil saturation is present at or near the produced water tank or other facilities.

8) To determine the presence and concentrations of any residual oil between the site of the leaky pit and well S1, exploration digging with the backhoe is recommended, followed by sampling. If oil is found, capture of soluble constituents is again a possibility and well No. 1 (S1) may again evidence contamination if pumped continually.

9) The OCD intends to measure water levels and sample water quality of the monitor wells and other available wells through at least the fall of 1986.

10) Well S5 should be capped to prevent introduction of contaminants. However, both wells S1 and S5 should have caps that allow for access for periodic water level measurements, water quality sampling, and pumping if necessary.

11) An aquifer test using well S1 as the pumped well should be performed for at least 72 hours at a rate of 60 gpm or at the rate the well would be pumped if put back in service. This test would determine accurate aquifer parameters and detect any contamination in the immediate vicinity of the well.

12) Since well S5 is at a distance greater than 500 feet from the gas well and out of the direct path of ground water flow, it is unlikely that pumping S5 will cause capture of any remaining contaminants from the gas well. To test this assumption, additional flow calculations should be made before placing back in service.

13) Sampling of individual pumping water supply wells for purgeable aromatic hydrocarbons should be performed on a regular basis. For convenience, a sampling schedule identical to that required for total trihalomethanes is initially suggested.

The OCD would like to schedule a 72-hour aquifer test in March using well S1. Since we do not have a pump or a water flow measuring device, any assistance the Association could provide would be appreciated. A flow device could either be a calibrated in-line meter, orifice weir, or other accurate device. The pump should have a valve to control discharge so that a constant rate is maintained. Also, a pipe or hose will be needed to divert the water away from the monitor wells to prevent recharge. If these items can be obtained, the test can be performed.

The attached report and the proposed work represent a substantial commitment of time and effort by the three-person staff of the OCD Environmental Bureau. I hope that the information we have provided, and that which we will provide over the next eleven months, will be useful in any action you take to resolve the matter.

If you have any questions regarding this letter or the report, please contact me at 827-5812.

Sincerely,

David G. Boyer

DAVID G. BOYER,
Hydrogeologist
Environmental Bureau Chief

DGB/dp

Enc.

cc: Paul Biderman, Secretary EMD
R. L. Stamets, Director OCD
NM OCD, Aztec District Office
NM EID Water Supply Section
NM EID Ground Water/Hazardous Waste Bureau
NM EID, Farmington Field Office

STATE OF NEW MEXICO 23-30N-12W

ENERGY AND MINERALS DEPARTMENT San Juan

OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

LARRY KEHOE
SECRETARY

December 26, 1979

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501
(505) 827-2434

Manana Gas, Inc.
P. O. Box 145
Farmington, New Mexico 87401

Attention: Ed Hartman

Administrative Order NSL-1125

Gentlemen:

Reference is made to your application for a non-standard location for your Mary Wheeler Well No. 1 E to be located 892 feet from the South line and 624 feet from the West line of Section 23, Township 30 North, Range 12 West, NMPM, Basin Dakota Pool, San Juan County, New Mexico.

By authority granted me under the provisions of Rule 3 of Order No. R-1670-V, the above-described unorthodox location is hereby approved.

Sincerely,

JOE D. RAMEY,
Director

JDR/RLS/dr

cc: Oil Conservation Division - Aztec
Oil & Gas Engineering Committee - Hobbs

NO. OF COPIES RECEIVED	5	
DISTRIBUTION		
SANTA FE	1	
FILE	1	
U.S.G.S.	2	
LAND OFFICE		
OPERATOR	1	

NEW MEXICO OIL CONSERVATION COMMISSION

APPROVAL VALID FOR 90 DAYS UNLESS DRILLING COMMENCED,

EXPIRES 3-17-80

30-045-24092

Form C-101
Revised 1-1-65

5A. Indicate Type of Lease: STATE ☐ FEE ☒

5. State Oil & Gas Lease No.

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

1a. Type of Work: DRILL ☒ DEEPEN ☐ PLUG BACK ☐

b. Type of Well: OIL WELL ☐ GAS WELL ☐ OTHER SINGLE ZONE ☐ MULTIPLE ZONE ☐

7. Unit Agreement Name

8. Farm or Lease Name: Mary Wheeler

2. Name of Operator: Manana Gas, Inc.

9. Well No.: 1-E

3. Address of Operator: P. O. Box 145, Albuquerque, N.M. 87401

10. Field and Pool, or Wildcat: Basin Dakota

4. Location of Well: UNIT LETTER M LOCATED 892 FEET FROM THE South LINE AND 624 FEET FROM THE West LINE OF SEC. 23 TWP. 30-N RGE. 12-W NMPM

W/320

12. County: San Juan

19. Proposed Depth: 6500

19A. Formation: Dakota

20. Rotary or C.T.: Rotary

21. Elevations (Show whether DF, RT, etc.): 5483 GL

21A. Kind & Status Plug. Bond: Blanket

21B. Drilling Contractor: Four Corners Drlg.

22. Approx. Date Work will start: December 31, 1979

23.

PROPOSED CASING AND CEMENT PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	SACKS OF CEMENT	EST. TOP
12¼ "	8 5/8"	24#	200	150	Surface
7 7/8"	4 1/2",	10.5#	6500	600	1600'

Manana Gas, Inc. will drill a 6500 ft. Dakota test with rotary tools. Mechanical logs will be run at TD. The Dakota formation will be selectively perforated and hydro-fracted. A 10" 3000 psi BOP with blind and pipe rams will be operational at all times while drilling. A 6" 3000 psi double gate manual BOP will be utilized for completion.

RECEIVED DEC 18 1979 OIL CON. COM. DIST. 3

This is an infill Dakota well and the gas is dedicated under the original gas contract with El Paso Natural Gas Company.

DV cementing tools will be set at the base of the Point Lookout sandstone and at the base of the Pictured Cliffs sandstone for a 3 stage cement job as follows:
TD - 5350 with 250 sax - 4400" - 3200" with 260 sax - 1900" 1600" with 65 sax

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: IF PROPOSAL IS TO DEEPEN OR PLUG BACK, GIVE DATA ON PRESENT PRODUCTIVE ZONE AND PROPOSED NEW PRODUCTIVE ZONE. GIVE BLOWOUT PREVENTER PROGRAM, IF ANY.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

Signed E. J. Hartman Title President Date 12/17/79

(This space for State Use)

APPROVED BY Frank T. Chavez TITLE DEPUTY OIL & GAS INSPECTOR, DIST. #3 DATE DEC 18 1979

CONDITIONS OF APPROVAL, IF ANY:

Cement tops must extend 100' above Cliff House sand and 100' above Fruitland sand.

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION
P. O. BOX 2088
SANTA FE, NEW MEXICO 87501

Form C-102
Revised 10-1-78

All distances must be from the outer boundaries of the Section

Operator	Lease	Well No.
Manana Gas Inc.	Mary Wheeler	# 1-E

Unit Letter	Section	Township	Range	County
M	23	30N	12W	San Juan

Actual Footage Location of Well:
892 feet from the South line and 624 feet from the West line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage:
5483	Dakota	Basin Dakota	320 Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

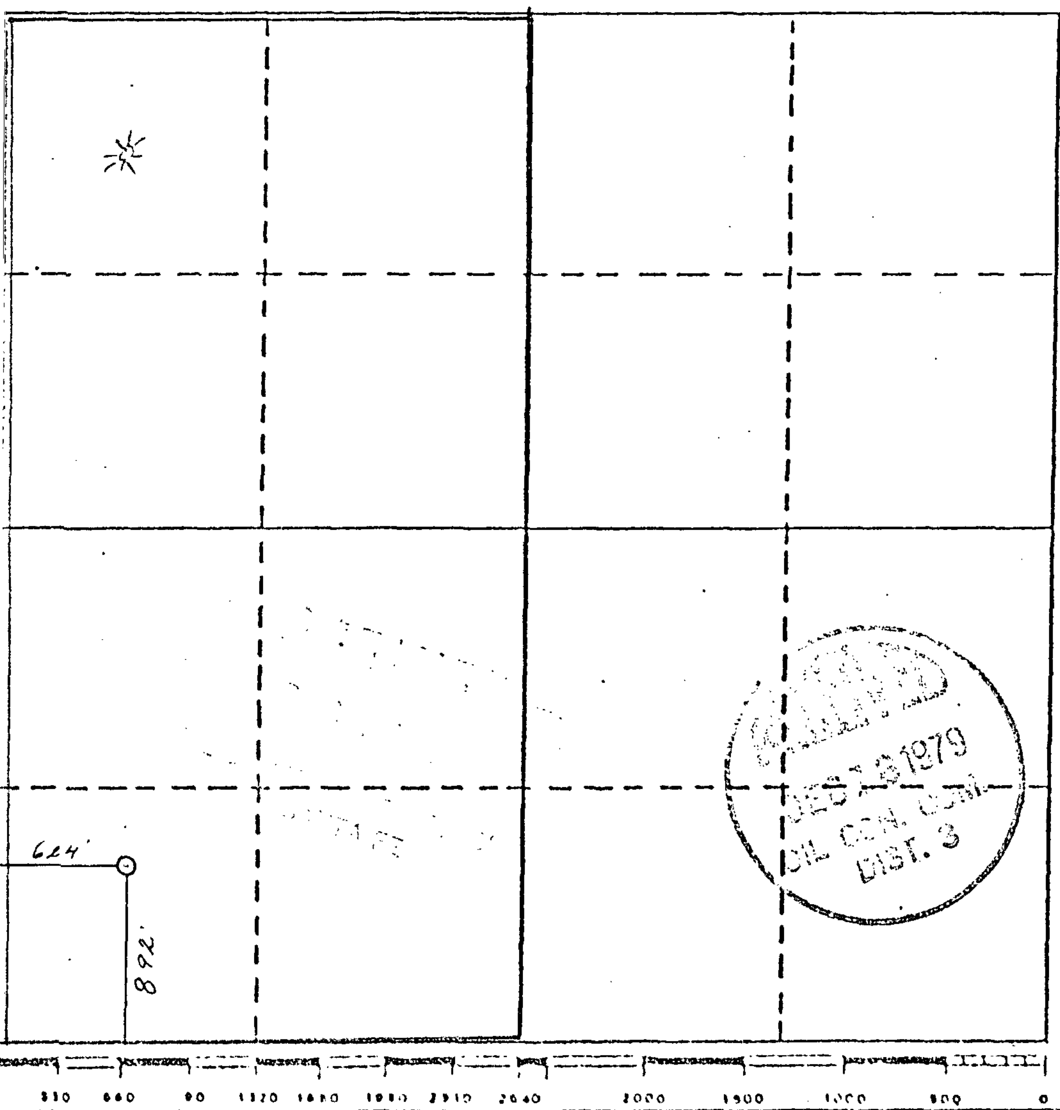
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling. etc?

[X] Yes [ ] No If answer is "yes," type of consolidation communitization

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) ____________

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Division.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

Ed Hartman
Name
Pres.
Position
Manana Gas, Inc.
Company
11/29/79
Date

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

November 29, 1979
Date Surveyed

Registered Professional Engineer and/or Land Surveyor

N.M. #1161
Certificate No.

DISTRIBUTION		
SANTA FE		/
FILE		/
U.S.G.S.		
LAND OFFICE		
TRANSPORTER	OIL	/
	GAS	/
OPERATOR		/
PRORATION OFFICE		

NEW MEXICO OIL CONSERVATION COMMISSION

REQUEST FOR ALLOWABLE
AND
AUTHORIZATION TO TRANSPORT OIL AND NATURAL GAS

Form C-104
Supersedes Old C-104 and C-110
Effective 1-1-65

30-045-24093

I.

Operator
Manana Gas, Inc.
Address
Box 145, Farmington, New Mexico 87401 (505) 325-3066

Reason(s) for filing (Check proper box)
New Well [X]
Recompletion [ ]
Change in Ownership [ ]
Change in Transporter of: Oil [ ] Dry Gas [ ] Casinghead Gas [ ] Condensate [ ]

Other (Please explain) add Trans.

If change of ownership give name and address of previous owner ______

II. DESCRIPTION OF WELL AND LEASE

Lease Name	Well No.	Pool Name, Including Formation	Kind of Lease State, Federal or Fee	Lease No.
Mary Wheeler	1 E	Basin-Dakota	Fee	

Location
Unit Letter M ; 892 Feet From The South Line and 624 Feet From The West
Line of Section 23 Township 30 N Range 12 W , NMPM, San Juan County

III. DESIGNATION OF TRANSPORTER OF OIL AND NATURAL GAS

Name of Authorized Transporter of Oil [ ] or Condensate [X]	Address (Give address to which approved copy of this form is to be sent)
The Permian Corporation	Box 1183, Houston, Texas 77001
Name of Authorized Transporter of Casinghead Gas [ ] or Dry Gas [X]	Address (Give address to which approved copy of this form is to be sent)
El Paso Natural Gas Company	Box 1492, El Paso, Texas 79978

If well produces oil or liquids, give location of tanks.	Unit	Sec.	Twp.	Rge.	Is gas actually connected?	When
	M	23	30 N	12 W	No	

If this production is commingled with that from any other lease or pool, give commingling order number: ______

IV. COMPLETION DATA

Designate Type of Completion – (X)	Oil Well	Gas Well	New Well	Workover	Deepen	Plug Back	Same Res'v.	Diff. Res'v.
		X	X					

Date Spudded	Date Compl. Ready to Prod.	Total Depth	P.B.T.D.
1/28/80	3/8/80	6488	6441
Elevations (DF, RKB, RT, GR, etc.)	Name of Producing Formation	Top Oil/Gas Pay	Tubing Depth
5495 KB	Dakota	6197	6198
Perforations 6197-6202, 6210-12, 6240-44, 6246-48, 6276-93, 6315-21, 6344-46, 6362-65, 6410-12.			Depth Casing Shoe 6484

TUBING, CASING, AND CEMENTING RECORD

HOLE SIZE	CASING & TUBING SIZE	DEPTH SET	SACKS CEMENT
12¼	8 5/8	227	390
7 7/8	4½	6484	1372
	2 3/8	6198	

V. TEST DATA AND REQUEST FOR ALLOWABLE

(Test must be after recovery of total volume of load oil and must be equal to or exceed top allowable for this depth or be for full 24 hours)

OIL WELL

Date First New Oil Run To Tanks	Date of Test	Producing Method (Flow, pump, gas lift, etc.)	
Length of Test	Tubing Pressure	Casing Pressure	Choke Size
Actual Prod. During Test	Oil-Bbls.	Water-Bbls.	Gas-MCF

RECEIVED
MAR 11 1980
OIL CON. COM.
DIST. 3

GAS WELL

Actual Prod. Test-MCF/D	Length of Test	Bbls. Condensate/MMCF	Gravity of Condensate
812 MCF, 829 AOF	3 Hours		
Testing Method (pitot, back pr.)	Tubing Pressure (shut-in)	Casing Pressure (shut-in)	Choke Size
1 point	1794	1816	3/4"

VI. CERTIFICATE OF COMPLIANCE

I hereby certify that the rules and regulations of the Oil Conservation Commission have been complied with and that the information given above is true and complete to the best of my knowledge and belief.

AR Kendrick
(Signature)
Vice President
(Title)
3/10/80
(Date)

OIL CONSERVATION COMMISSION

APPROVED MAR 23 1980, 19__

BY Frank S. Chavez

TITLE SUPERVISOR DISTRICT # 3

This form is to be filed in compliance with RULE 1104.

If this is a request for allowable for a newly drilled or deepened well, this form must be accompanied by a tabulation of the deviation tests taken on the well in accordance with RULE 111.

All sections of this form must be filled out completely for allowable on new and recompleted wells.

Fill out only Sections I, II, III, and VI for changes of owner, well name or number, or transporter, or other such change of condition.

Separate Forms C-104 must be filed for each pool in multiple

SANTA FE	1	
FILE	1	
U.S.G.S.	2	
LAND OFFICE		
OPERATOR	1	

NEW MEXICO OIL CONSERVATION COMMISSION
WELL COMPLETION OR RECOMPLETION REPORT AND LOG

5a. Indicate Type of Lease: State [ ] Fee [X]

5. State Oil & Gas Lease No.

1a. TYPE OF WELL: OIL WELL [ ] GAS WELL [X] DRY [ ] OTHER

b. TYPE OF COMPLETION: NEW WELL [X] WORK OVER [ ] DEEPEN [ ] PLUG BACK [ ] DIFF. RESVR. [ ] OTHER

7. Unit Agreement Name

8. Farm or Lease Name: Mary Wheeler

2. Name of Operator: Manana Gas, Inc.

9. Well No.: 1 E

3. Address of Operator: Box 145, Farmington, New Mexico 87401 325-3066

10. Field and Pool, or Wildcat: Basin Dakota

4. Location of Well

UNIT LETTER M LOCATED 892 FEET FROM THE South LINE AND 624 FEET FROM THE West LINE OF SEC. 23 TWP. 30 N RGE. 12 W NMPM

12. County: San Juan

15. Date Spudded	16. Date T.D. Reached	17. Date Compl. (Ready to Prod.)	18. Elevations (DF, RKB, RT, GR, etc.)	19. Elev. Cashinghead
1/28/80	2/9/80	3/8/80	5495 KB	5483

20. Total Depth	21. Plug Back T.D.	22. If Multiple Compl., How Many	23. Intervals Drilled By →	Rotary Tools	Cable Tools
6488	6441			0-6488	

24. Producing Interval(s), of this completion — Top, Bottom, Name: 6197-- 6412 Dakota

25. Was Directional Survey Made: No

26. Type Electric and Other Logs Run: ES-Ind, GR-Caliper --CNL-Density

27. Was Well Cored: No

28. CASING RECORD (Report all strings set in well)

CASING SIZE	WEIGHT LB./FT.	DEPTH SET	HOLE SIZE	CEMENTING RECORD	AMOUNT PULLED
8 5/8	24	227	12¼	390 sx	none
4½	10.5	6484	7 7/8	1372 sx	none

29. LINER RECORD

SIZE	TOP	BOTTOM	SACKS CEMENT	SCREEN

30. TUBING RECORD

SIZE	DEPTH SET	PACKER SET
2 3/8	6198	none

31. Perforation Record (Interval, size and number)
6197-6202, 6210-12, 6240-44, 6246-48, 6276-93, 6315-21, 6344-46, 6362-65, 6410-12.

32. ACID, SHOT, FRACTURE, CEMENT SQUEEZE, ETC.

DEPTH INTERVAL	AMOUNT AND KIND MATERIAL USED
6197-6412	1500 gals HCl., 91000 gals water, 55,500 lbs sand

33. PRODUCTION

Date First Production	Production Method (Flowing, gas lift, pumping — Size and type pump)	Well Status (Prod. or Shut-in)
	1 point back pressure	shut in

Date of Test	Hours Tested	Choke Size	Prod'n. For Test Period →	Oil — Bbl.	Gas — MCF	Water — Bbl.	Gas—Oil Ratio
3/8/80	3	3/4					

Flow Tubing Press.	Casing Pressure	Calculated 24-Hour Rate →	Oil — Bbl.	Gas — MCF	Water — Bbl.	Oil Gravity — API (Corr.)
S.I. 1794	S.I. 1816			812 MCF 829 AOF		

34. Disposition of Gas (Sold, used for fuel, vented, etc.)

Test Witnessed By

35. List of Attachments

RECEIVED MAR 11 1980 OIL CON. COM. DIST. 3

36. I hereby certify that the information shown on both sides of this form is true and complete to the best of my knowledge and belief.

SIGNED AR Kendrick TITLE Vice President DATE 3/10/80

Form C-122
Revised 9-1-65

NEW MEXICO OIL CONSERVATION COMMISSION

MULTIPOINT AND ONE POINT BACK PRESSURE TEST FOR GAS WELL

Type Test: [X] Initial [ ] Annual [ ] Special		Test Date: 3/8/80	
Company: Manana Gas, Inc.	Connection: El Paso Natural Gas Company		
Pool: Basin	Formation: Dakota		Unit
Completion Date: 2/29/80	Total Depth: 6484	Plug Back TD: 6441	Elevation: 5483 CH	Farm or Lease Name: Mary Wheeler

Csg. Size	Wt.	d	Set At	Perforations	Well No.
4.500	10.5	4.052	6484	From 6197 To 6412	1 E

Tbg. Size	Wt.	d	Set At	Perforations	Unit Sec. Twp. Rge.
2.375	4.7	1.995	6198	From Open ended	M-23-30N-12W

Type Well – Single – Bradenhead – G.G. or G.O. Multiple	Packer Set At	County
Single	none	San Juan

Producing Thru	Reservoir Temp. °F	Mean Annual Temp. °F	Baro. Press. – P_a	State
Tubing			12	New Mexico

L	H	Gg	% CO_2	% N_2	% H_2S	Prover	Meter Run	Taps
		0.730						

NO.	FLOW DATA: Prover Line Size	X Orifice Size	Press. p.s.i.g.	Diff. h_w	Temp. °F	TUBING DATA: Press. p.s.i.g.	Temp. °F	CASING DATA: Press. p.s.i.g.	Temp. °F	Duration of Flow
SI						1794		1816		8 days
1.	2"	.75	60		65			301		3 Hours
2.										
3.										
4.										
5.										

RATE OF FLOW CALCULATIONS

NO.	Coefficient (24 Hour)	$\sqrt{h_w P_m}$	Pressure P_m	Flow Temp. Factor Ft.	Gravity Factor Fg	Super Compress. Factor, Fpv	Rate of Flow Q, Mcfd
1	12.365		72	.9952	.9066	1.011	812
2							
3							
4							
5							

NO.	P_r	Temp. °R	T_r	Z
1.				
2.				
3.				
4.				
5.				

Gas Liquid Hydrocarbon Ratio ______ Mcf/bbl.
A.P.I. Gravity of Liquid Hydrocarbons ______ Deg.
Specific Gravity Separator Gas ______ X X X X X X X X X
Specific Gravity Flowing Fluid X X X X X
Critical Pressure ______ P.S.I.A. ______ P.S.I.A.
Critical Temperature ______ R ______ R

P_c 1828 P_c^2 3 341 584

NO	P_t^2	P_w	P_w^2	$P_c^2 - P_w^2$
1	5184	313	90 601	3250983
2				
3				
4				
5				

(1) $\frac{P_c^2}{P_c^2 - P_w^2}$ = 1.0279 (2) $\left[\frac{P_c^2}{P_c^2 - P_w^2}\right]^n$ = 1.0208

AOF = Q $\left[\frac{P_c^2}{P_c^2 - P_w^2}\right]^n$ = 829

Absolute Open Flow 829 Mcfd @ 15.025 Angle of Slope θ ______ Slope, n 829

RECEIVED MAR 14 1980 OIL CON. COM. DIST. 3

Remarks:

Approved By Commission:	Conducted By:	Calculated By:	Checked By:
	H. E. McAnally	H. E. McAnally	

Form 23-119 (Rev. 4-73)

EL PASO NATURAL GAS COMPANY
POST OFFICE BOX 990
FARMINGTON, NEW MEXICO

NOTICE OF GAS CONNECTION

DATE July 23, 1980

THIS IS TO NOTIFY THE OIL CONSERVATION COMMISSION THAT CONNECTION FOR PURCHASE OF

GAS FROM Manana Gas, Inc. — Operator

Mary Wheeler #1-E — Well Name

93-151-01 — Meter Code

72501-51 — Site Code

M — Well Unit

23-30-12 — S-T-R

Basin Dakota — Pool

El Paso Natural Gas Company — Name of Purchaser

WAS MADE ON July 15, 1980, — Date

FIRST DELIVERY July 16, 1980 — Date

AOF 829

CHOKE 812

RECEIVED
AUG 0 1 1980
OIL CONSERVATION DIVISION
SANTA FE

El Paso Natural Gas Company
Purchaser

Original Signed by
Charles A. Thomas
Representative

Assistant Chief Dispatcher
Title

cc: Operator Farmington
Oil Conservation Commission – 2
Proration – El Paso

File

JUL OIL C

WELL S T R		JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	[illegible]	NOV	DEC	YR-PROD	MP	ACCUM.
S W MOUNDS COM																
1C 229N14W	GAS	214	265	661	456	308	221	186	119	47	6		NONE	2483		1334267
	OIL															7410
	WAT	2	8	45	20	10	10	5		2	5	5	5	117		
TWIN MOUNDS																
1D2530N14W	GAS	1400	1699	1770	1665	705	1942	2070	1927	1280	886	974	902	17220		1157870
	OIL	9	20	21	29	11			4	1	1	13	2	111		14476
	WAT	5	5	5	5	20	20	20	20	20	20	15	15	170		
E 1H2530N14W	GAS										7712	8512	2929	19153		19153
	OIL										108	119	20	247		247
	WAT												10	10		
COMPANY TOTAL	OIL	297	331	390	444	330	299	420	552	665	746	743	654	5871		324514
	GAS	52663	45682	59479	57910	53448	54814	56068	56368	79776	80618	79328	82071	758225		27416345
	WAT	124	133	207	152	157	172	217	217	166	175	158	173	2051		
CURTIS J. LITTLE					**											
FEDERAL COM																
R 2M1228N13W	GAS	5186	4573	5087	3956	5470		5516	3909	4026	4236	4326	2973	49258		68491
	OIL	66	41	50	46	69	23	41	30	34	37	26	21	484		779
FEDERAL 2 11																
2O1128N13W	GAS	LAST PROD. DATE 12/78													U	390289
	OIL															28145
COMPANY TOTAL	OIL	66	41	50	46	69	23	41	30	34	37	26	21	484		28924
	GAS	5186	4573	5087	3956	5470		5516	3909	4026	4236	4326	2973	49258		458780
LIVELY EXPLORATION CO.					**											
LIVELY																
1I2728N 8W	GAS	1074	659	830	634	587	517	675	504	616	816	635	837	8384		230075
	OIL	12	23	19	15	20	13	12	12	20	16	9	16	187		3293
	WAT	8	8	8	8	8	7	7	8	7	8	8	8	93		
2E2128N 8W	GAS	4475	4566	4313	4253	4117	3963	4081	4134	4106	4139	4361	3954	50462		660626
	OIL	31	20	22	18	40	7	1		19	50	50	22	280		5781
	WAT	9	9	9	9	9	8	8	9	7	9	9	9	104		
3N 929N 8W	GAS	6787	7454	7801	7015	6550	6351	6818	6097	6323	6460	6401	6801	80858		927732
	OIL															329
	WAT	6	6	6	6	6	6	6	6	5	6	6	6	71		
4D1429N 8W	GAS	1155	1735	1369	1013	1170	966	1061	971	1000	1001	1054	1167	13662		250756
	OIL															21
	WAT	5	5	5	5	5	4	4	5	4	5	5	5	57		
5P 129N 9W	GAS				226	358	598	396	486	470	431	366	401	3732		58535
	OIL															610
	WAT										4	5	5	14		
6G3029N 8W	GAS	2395	2160	2517	2496	2574	2428	2553	2587	2418	2423	2192	2326	29069		389912
	OIL															52
	WAT	5	5	5	5	5	5	5	5	5	5	5	5	60		
Y 7E3530N 8W	GAS	2026	2112	2149	2170	2056	1065	1080	167	294	2086			15205		254789
	WAT	6	6	6	6	6	6	6	6	6	2			56		
8N1229N 8W	GAS	770	875	1038	859	871	813	934	796	763	799	685	778	9981		166716
	OIL															44
	WAT	6	6	6	6	6	5	5	6	6	6	5	5	68		
9D 329N 8W	GAS	3020	1743	1777	1055	724	850	970	667	616	625	544	1092	13683		175625
10F1729N 8W	GAS	3120	2795	2968	2812	3222	3024	3131	3082	3056	3082	2972	3084	36348		391553
	OIL															320
	WAT	10	10	10	9	10	9	9	10	10	10	10	10	117		
11I1628N 8W	GAS	2830	2522	2395	2519	2509	2270	1687	2524	2080	3102	2111	2203	28752		323548
	OIL	22	16	35	6	38	15	4	24	18	25	17	18	238		4763
	WAT	5	5	5	5	5	4	4	5	5	5	5	5	58		
12L3628N 8W	GAS	1388	860	1767	1224	1401	740	874	1092	1125	861	1388	1122	13842		180941
	OIL	1	2	10		3	7							23		1840
	WAT	10	10	10	10	10	9	5	7	7	10	10	10	108		
13A1828N 8W	GAS	3206	3137	2876	2777	2821	2463	3404	2325	2931	3472	2865	2724	35001		392137
	OIL	14	26	21	17	14	15	10	20	20	25	19	17	218		2078
	WAT	5	5	5	5	5	5	5	4	4	5	5	5	58		
16L2029N 9W	GAS	1033	570	764	941	913	840	1014	766	904	947	645	817	10154		135352
	OIL	5	1	1	6	5	1	2					5	26		544
17P 126N 8W	GAS	2144	1911	2136	2048	2006	1918	2321	1873	1334	1866	1871	1652	23080		185741
	OIL	41	46	57	36	53	34	46	41	45	40	52	37	528		5198
	WAT	6	6	6	6	6	5	5	6	3	6	6	6	67		
18M 126N 8W	GAS	1909	1096	2011	1427	1817	1750	1917	1702	1547	2054	1799	1961	20990		203576
	OIL	19	11	5	2	27	23	23	19	27	24	27	22	229		3381
	WAT	6	6	6	6	6	5	5	6	5	6	6	6	69		
19C1226N 8W	GAS	4787	4214	3407	4387	3166	4340	4269	4165	4178	3329	3825	2584	46651		539476
	OIL	62	57	55	50	54	45	55	57	52	31	74	3	595		8639
	WAT	15	15	15	18	14	16	17	15	15	15	15	15	185		
20P1226N 8W	GAS	2793	2554	2722	2620	2707	2449	2445	2431	2533	2502	2811	2744	31311		306862
	OIL	31	29	27	26	28	27	32	26	35	31	28	28	348		5520
	WAT	5	5	5	5	5	4	4	5	5	5	5	5	58		
21L3127N 7W	GAS	2809	2106	1949	1818	2045	1901	1836	2287	2062	2060	1607	1800	24280		234079
	OIL	28	25	18	20	23	7	4	20	23	23	21	9	221		2793
	WAT	5	5	5	5	5	4	4	5	5	5	5	5	58		
25L2930N 8W	GAS	1262	1384	1237	1200	1292	1405	1344	1090	1022	1274	971	1372	14853		117804
	WAT	5	5	5	5	6	4	5	5	5	5	5	5	60		
26N 729N 8W	GAS	1096	672	768	813	869	849	891	906	722	972	759	795	10112		81912
	WAT	8	8	8	8	8	7	7	8	8	8	8	8	94		
27P1828N 8W	GAS	3335	3515	3074	3032	3094	2732	2341	2228	3134	3174	3122	3316	36097		343855
	OIL	17	14	10	29	1	2	19	23	19	24	26	8	192		1728
30M2030N 9W	GAS	2784	2455	3104	3146	2432	2326	2881	1947	2710	2874	2503	2893	32056		226393
	OIL															5
LIVELY COM																
14K3630N 8W	GAS	1630	1423	1623	1442	1584	1405	1439	1363	1463	1433	1118	1480	17403		206365
	WAT	5	5	5	5	5	4	4	5	5	5	5	5	58		
15H3230N 8W	GAS	1842	1544	1755	1602	1696	1647	1662	1647	1584	1669	1443	1740	19831		26765[illegible]
	WAT	5	5	5	5	5	4	4	5	5	5	5	5	58		
COMPANY TOTAL	OIL	283	270	280	225	306	196	208	242	278	289	323	185	3095		46939
	GAS	59670	54062	56350	53529	52581	49610	52024	47837	48991	53451	48048	49643	625796		7252010
	WAT	135	135	135	137	135	121	119	131	122	135	133	133	1571		
LYNCO OIL CORPORATION					**											
DICK HUNT FEDERAL																
1I1230N14W	GAS	87	1992	1821	1856	1292	1763	1610	1792	1463		1774	972	16422		394351
	OIL					165								165		11726
2H 130N14W	GAS	964	1892	1425	1540	370	571	2183	2011	191		1330	508	12985		234038
	OIL					60								80		590
SCHUMACHER																
3E1830N10W	GAS	LAST PROD. DATE 08/79													S	540645
COMPANY TOTAL	OIL					225								225		12316
	GAS	1051	3884	3246	3396	1662	2334	3793	3803	1654		3104	1480	29407		1169034
M AND M PRODUCTION AND OPERATION					**											
MEXICO FEDERAL A																
1I1024N 6W	GAS	624	609	903	817	448	352	367	326	391	111	374	307	5629		251223
	OIL															1567
MANANA GAS INCORPORATED					**											
ANNIE B																
1N1330N12W	GAS	2618	2355	2520	1672	2147	2419	2126	2149	2218	1915	1913	1805	25857		124381
	OIL	6	6	15	7	7	10	10	11	13	8	11	13	117		604
BETTY HARTMAN																
1P1430N12W	GAS	2979	2765	2739	2207	2552	2678	2784	2760	2451	2620	2426	2565	31526		131922
	OIL	30	31	19	22	17	16	23	19	20	16	27	20	260		1213
MARY WHEELER																
1D2330N12W	GAS	6779	6584	6536	4468	5016	5664	4769	5159	5388	5370	5478	5534	66745		324786
	OIL	90	74	81	77	67	83	72	83	90	79	77	77	950		4780
E 1M2330N12W	GAS							5327	8372	6504	7200	6729	6336	40468		40468
	OIL							240	284	228	228	236	184	1400		1400
COMPANY TOTAL	OIL	126	111	115	106	91	109	345	397	351	331	351	294	2727		7997
	GAS	12376	11704	11795	8347	9715	10761	15006	18440	16561	17105	16546	16240	164596		621457
MARATHON OIL COMPANY					**											
JICARILLA APACHE																
8P2726N 5W	GAS	3958	5216	5119	4915	4629	3214	2463	3937	2591	4438	4911	5041	50432		960344
	OIL	43	38	23	33	20	14	15	17	14	12	26	20	275		8780
	WAT	15	14	14	14	15	14	15	13	11	10	11	9	155		
9A2826N 5W	GAS	22490	16958	17692	19529	21110	13667	11552	19496	19198	16562	19625	14025	211904		4561929
	OIL	115	83	83	113	117	103	50	173	117	133	190	83	1360		48276
	WAT	2	2	2	84	87	72	58	2	72	70	70	74	595		
10B2726N 5W	GAS	6293	4741	5935	5664	6142	4456	2934	7029	4736	5245	6478	4800	64453		1351080
	OIL	38	48	45	30	150		17	47	37	23	50	40	525		12827
	WAT	22	21	22	17	18	18	14	13	12	11	13	11	192		
11M2826N 5W	GAS	5262	6022	5373	5689	2536	3991	4682	4209	5535	4899	3742	4632	56572		1339506
	OIL	60	63	52	40	73	43	32	38	57	35	63	53	609		21569
	WAT	30	28	28	27	28	19	17	18	17	17	17	15	261		
12A3326N 5W	GAS	5640	5996	6457	6058	5719	4006	4943	4002	4956	6101	6523	6129	66530		1430964
	OIL	37	44	41	41	47	38	23	23	41	40	40	41	456		13648
	WAT	44	33	35	34	35	30	24	22	21	18	20	21	337		
13M3326N 5W	GAS	3471	3603	3146	2878	2715	2887	4336	2969	3513	4503	2693	3082	39796		994610
	OIL	23	20	14	18	12	13	20	14	23	26	19	20	222		11411
	WAT	30	28	23	23	24	23	17	14	13	13	13	13	234		

1980

WELL S T R		JAN	FEB	M[illegible]	APRIL	MAY	JUNE	JULY	AUG	SEPT	[illegible]	NOV	DEC	YR-PROD MP	ACCUM.
25L2930N 8W	GAS	1287	1036	[illegible]	1324	1511	1000	1344	948	1626	[illegible]	1195	1276	14935	132739
	WAT	5	5	5									2	17	
26N 720N 8W	GAS	667	726	680	610	665	642	731	656	666	650	822	658	8173	90085
	WAT	8	8	8									5	29	
27P1828N 8W	GAS	2557	3093	2639	2869	2755	2558	2156	3050	2959	2876	2791	2597	32900	376755
	OIL			7		1						7	2	17	1745
	WAT												5	5	
30M2030N 9W	GAS	2833	871	458	1745	2366	2426	2341	2336	2219	2510	2684	3077	25866	252259
	OIL														5
	WAT												5	5	
LIVELY COM															
14K3630N 8W	GAS	1320	619	312	182	538	817	636	945	951	1078	1550	1741	10689	217054
	WAT	5	5	5										15	
15H3230N 9W	GAS	1429	1298	1267	1420	1651	1437	1497	1645	1466	1515	1340	1408	17373	285023
	WAT	5	5	5										15	
COMPANY TOTAL	OIL	243	190	172	360	959	1252	692	838	533	526	438	1391	7594	54533
	GAS	48638	40688	39101	60515	100500	81313	75650	86509	79895	77836	78055	99346	868046	8120056
	WAT	133	129	122									461	845	
M AND M PRODUCTION AND OPERATION					**										
MEXICO FEDERAL A															
1I1024N 6W	GAS	581	523	527	519	288	384	439	397	262	338	817		5075	256238
	OIL														1567
MANANA GAS INCORPORATED					**										
ANNIE B															
1N1330N12W	GAS	1919	1672	1939	1696	1733	1460	1554	1572	1520	1667	1285	1393	19410	143791
	OIL	14	9	14	6	15	4	1	3	5	7	9	4	91	695
BETTY HARTMAN															
1P1430N12W	GAS	2388	2315	2619	2419	2318	2205	2342	2104	2595	2592	1958	2638	28493	160315
	OIL	16	25	30	21	24	13	17	17	19	16	28	19	245	1458
MARY WHEELER															
1D2330N12W	GAS	5818	4937	5816	5309	4347	4738	4818	4598	4073	5594	4818	5342	60208	384994
	OIL	69	64	84	56	74	76	94	31	70	83	70	55	826	5606
F 1M2330N12W	GAS	6054	5237	5955	5628	5036	5288	5377	5170	4874	5613	5169	5231	64632	105100
	OIL	205	142	102	145	113	157	108	123	127	139	127	140	1628	3028
COMPANY TOTAL	OIL	304	240	230	228	226	250	220	174	221	265	234	218	2790	10787
	GAS	16179	14161	16329	15052	13434	13691	14091	13444	13062	15466	13230	14604	172743	794200
MARATHON OIL COMPANY					**										
JICARILLA APACHE															
8P2726N 5W	GAS	4774	3780	4300	3507	2729	1950	3996	3871	3650	4067	3704	4685	45013	1005357
	OIL	27	18	15		2	19			3	17	14	31	146	8926
	WAT	9	8	9	9	7	7		6	6	6	5	6	78	
9A2826N 5W	GAS	21349	19158	15983	4583	11117	366		24811	15379	10419	10189	23248	156601	4718530
	OIL	152	127	114	70	83			141	143	127	107	135	1199	49475
	WAT	74	62	62	40	36			62	60	50	54	62	562	
10B2726N 5W	GAS	6478	5322	5629	2075	3718	128	273	8685	5810	5528	4374	7571	55591	1406671
	OIL	47	30	28	15	33		3	48	40	35	27	57	363	13190
	WAT	11	10	11	7	8		1	7	6	9	10	10	90	
11M2826N 5W	GAS	5288	3464	5670	3111	2066	3229	6189	6000	4910	6605	5780	4821	57133	1396639
	OIL	58	42	58	40	12	23	47	67	46	67	73	23	556	22125
	WAT	15	12	16	15	14	6	12	12	10	12	10	11	145	
12A3326N 5W	GAS	5769	4024	6491	6405	4985	3302	7698	6584	5519	3027	8129	7519	69451	1500415
	OIL	55	37	46	46	37	20	47	52	24	34	28	21	447	14095
	WAT	16	14	16	14	10	6	13	13	11	6	12	15	146	
13M3326N 5W	GAS	2797	2905	3697	2488	2702	2421	3792	2877	2962	3555	4560	4666	39422	1034032
	OIL	20	15	32	23	11	12	24	20	14	21	38	49	279	11690
	WAT	13	12	13	13	11	5	9	9	8	9	8	9	119	
14M3426N 5W	GAS	6149	4571	5888	2820	4963	2867	5530	6596	5374	5233	4565	5903	60459	1894726
	OIL	68	48	62	20	55	27	40	230	58	60	50	52	770	21627
	WAT	15	13	15	9	9	5	12	12	10	12	10	13	135	
16I3426N 5W	GAS	4874	3269	3094	2923	3368	2233	3538	2542	2679	3610	4190	6683	43003	732605
	OIL	48	31	31	20	26	24	24	24	18	37	52	49	384	5904
	WAT	13	12	13	12	10	5	10	12	11	12	12	12	134	
OHIO GOVT															
2P1528N11W	GAS	417	273	311	183	247	210	231	229	208	243	213	233	2998	4525241
	OIL														38430
OHIO A GOVT															
2I2328N11W	GAS	15738	12019	10330	15756	11579	13084	10124	8201	9447	13228	9333	13708	142547	7786081
	OIL	68	40	37	28	56	53	46	40	32	72	48	63	593	59134
	WAT	6		6	6	5		4	4	4	4	4	4	47	
OHIO C GOVT															
2E2628N11W	GAS	2167	2469	2548	2364	2303	1597	936	1857	1220	2060	1612	1641	22774	5727696
	OIL	17	10	20	27	2	8	2	5	2	15	15	5	128	58382
	WAT	11	10	13	13	10		9	6	9	9	11	11	112	
3P2628N11W	GAS	5952	7927	7916	7050	5633	4971	4210	5832	4888	7659	4620	7072	73730	4432890
	OIL	30	80	55	52	49	22	19	40	50	60	17	53	527	42026
	WAT	9	8	9	9	7		10	11	11	11	11	11	107	
E 3M2628N11W	GAS						5370	12285	12969	11906	12295	10335	11432	76591	76591
	OIL						286	109	145	89	130	80	97	936	936
	WAT							24	24	20	21	19	16	124	
COMPANY TOTAL	OIL	590	478	498	341	366	494	361	812	519	675	549	635	6318	345940
	GAS	81752	69181	71857	53265	55410	41728	58802	91053	73951	77529	71604	99192	845313	36237474
	WAT	192	161	183	147	127	34	104	178	166	161	166	180	1799	
T.H. MCELVAIN OIL & GAS PROPERTIES					**										
MILLER A															
1A1324N 7W	GAS	4502	4417	4325	3478	4930	4801	4077	5382	4280	3122	1160		44474	2007309
	OIL	21	12	16	14	19	11	18	20	20	12			163	9821
	WAT	5	5	5	5	5	5	5	5	5	5	5		55	
MILLER B															
5N1224N 7W	GAS	5645	4557	1429	3489	5829	5877	5768	6040	5926	4837	3270	5099	57765	2335647
	OIL	3	4						50		34	5	11	107	8071
	WAT	5		5	5	5	5	5	5	5	5	5	5	55	
COMPANY TOTAL	OIL	24	16	16	14	19	11	18	70	20	46	5	11	270	16892
	GAS	10147	8974	5754	6966	10759	10678	9845	11422	10206	7959	4430	5099	102239	4342951
	WAT	10	5	10	10	10	10	10	10	10	10	10	5	110	
JEROME P. MCHUGH					**										
APACHE															
1O1826N 3W	GAS	2602	2128	1520	1201	1788	320	913	1706	1605	535	1859	1849	18026	453124
	OIL														2481
2L1826N 3W	GAS	1820	1184	1180	1171	936	701	939	1035	1302	776	834	1603	13481	351700
	OIL	26	13	21	8	13	6	5	11	18	7	22	15	165	5800
3O1926N 3W	GAS	LAST PROD. DATE 12/74												S	265286
	OIL														3171
4L1926N 3W	GAS												145	145	103629
	OIL														1329
5E1726N 3W	GAS	1985	2369	1341	1056	1872	579	869				1675	2821	14567	439003
	OIL	28	35	32	15	29	20	9				50	38	256	9236
6M1726N 3W	GAS	2886	3486	848	3337	2684	1457	1127			14	249	6337	22425	532595
	OIL	109	99	55	76	81	40	22			3	7	181	673	28870
7O2026N 3W	GAS	841	1137	897	846	606	254	502				554	710	6347	268923
	OIL	11	28	22	8	16	4	13				2	7	111	14288
8B2026N 3W	GAS	LAST PROD. PRIOR TO 6/73												T	880
	OIL														539
BOLIN HARDIE															
1D3429N 8W	GAS	528	414	530	449	681	679	718	640	488	569	694	414	6804	470730
	OIL														5240
COLKET															
1C1525N11W	GAS	11124	8453	10019	8791	7108	2436		10487	10473	10168	7500	7774	94332	1102131
	OIL	79	62	60	54	47			100	74	83	51	60	670	7985
E 1K1525N11W	GAS	14968	9210	10883	9623	6446	2041		2249	7507	6543	6112	4779	80361	96993
	OIL	117	75	87	69	49			25	57	48	42	37	606	1021
ERIN STAYS COM															
1A 225N11W	GAS	6438	7180	6528	6687	6044	800		2964	13262	9366	8033	9231	76533	488034
	OIL	91	79	87	83	94			62	159	136	113	133	1037	6923
E 1C 225N11W	GAS			13141	19395	11772	1572					23635	17023	86538	86538
	OIL			505	401	246					64	410	205	1831	1831
FLORANCE															
1E2628N 8W	GAS	2639	1857	3202	2254	2288	2819	2566	2740	2875	2646	2728	1984	30598	685962
	OIL	24	22	33	33	22	21	21	26	26	28	30	18	304	7863
HARDIE															
1C2629N 8W	GAS	1771	2027	2026	1838	1783	1596	2152	1738	1416	1476	1589	1397	20809	615707
	OIL														1370
E 1K2629N 8W	GAS											5967	3607	9574	9574
	OIL											97	56	153	153
2O2829N 8W	GAS	188	289	256	176	207	210	135	120	148	162	322	652	2865	428740
	OIL	11	2										7	20	2734
E 2M2829N 8W	GAS											16569	17946	34515	34515
	OIL											210	147	357	357
4M2429N 8W	GAS	2256	1616	1476	1246	1638	1305	2176	2999	1652	1559	1389	1327	20639	601533
	OIL														545
E 4E2429N 8W	GAS									8547	17197	14724	11861	52329	52329
	OIL									21	19	4	4	48	48
5O2328N 8W	GAS	2592	2057	2684	2287	2394	2689	2661	2594	2585	2534	2530	2446	30053	827130
	OIL	20	21	28	24	18	23	16	18	6	19	37	5	235	8592

1981

WELL S T R		JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YR-PROD MP	ACCUM.
21L3127N 7W	GAS	2093	1880	2170	1833	1823	2361	1890	523		348	760	3037	18718	276029
	OIL	12	6	4	4	5	17	20	3			5	33	109	3066
	WAT	10	10	10	10	10	10	10				2	2	74	
E 21D3127N 7W	GAS	9229	6144	7002	6076	5562	5153	5234	1292		759	1182	8370	56003	70827
	OIL	298	105	157	120	92	115	93	15		17	60	171	1243	1820
	WAT	50	30	30	30	20	35	40	2			10	20	267	
25L2930N 8W	GAS	1268	1135	978	1160	1004	1104	1188	1072	1134	679		1279	12001	144740
	WAT	2	10	10	10	15	15	20	20	20	10		5	137	
26N 729N 8W	GAS	868	657	805	697	631	770	782	763	742	699	666	594	8674	98759
	WAT	5	10	10	10	15	10	10	10	20	20	15	5	140	
27P1828N 8W	GAS	2823	2255	2763	2171	2725	2934	2619	2417	2747	2101		2267	27822	404577
	OIL	8	30	3	20	14	9	11	15	15	13		3	141	1886
	WAT			30	10	15	15	15	20	20	20		15	160	
30M2030N 9W	GAS	3113	2738	2988	2463	2666	2515	2670	2771	2662	1956		2248	28790	281049
	OIL														5
	WAT	5	15	15	20	20	20	20	20	20	15		10	180	
LIVELY COM															
14K3630N 8W	GAS	1843	1399	1394	1223	1307	1354	1310	1121	1332	961		1089	14333	231387
	WAT			10	10	15	15	15	15	15	10		5	110	
15H3230N 8W	GAS	1358	1268	1415	1293	1210	1403	1299	1266	1499	927	891	985	14814	299837
	WAT		15	15	15	15	10	10	10	10	5		5	110	
COMPANY TOTAL	OIL	838	500	660	771	1354	746	585	388	310	152	174	705	7183	61716
	GAS	94423	77345	91173	101733	105330	76228	82041	64949	79492	66097	41292	109605	989708	9109764
	WAT	447	495	770	845	730	647	650	326	330	308	178	323	6049	
M AND M PRODUCTION AND OPERATION															
MEXICO FEDERAL A															
1I1024N 6W	GAS	409	410	410	357	321	258	242	296	175	301	332	307	3818	260116
	OIL														1567
MANANA GAS INCORPORATED															
ANNIE B															
1N1330N12W	GAS	1615	1110	1217	1026	1632	1339	1304	1690	1519	1045	183	1252	14932	158723
	OIL	7	6	6	2		2	2	1	2	3	3	7	41	736
BETTY HARTMAN															
1P1430N12W	GAS	2149	2078	1963	1464	2384	2204	1940	2093	1909	1762	394	3001	23341	183656
	OIL	17	14	19	11	30	11	6	19	18	4	3	25	177	1635
MARY WHEELER															
1D2330N12W	GAS	5229	4196	4373	1775	4797	1461	426		851	3307	6236	6111	38762	423756
	OIL	74	46	54	25	76	1	26		4	56	78	77	517	6123
E 1M2330N12W	GAS	5027	4203	4446	3237	4677	1197	473		752	3561	6702	5309	39584	144684
	OIL	128	100	86	110	121	2	48		3	142	130	152	1022	4050
COMPANY TOTAL	OIL	226	166	165	148	227	16	82	20	27	205	214	261	1757	12544
	GAS	14020	11587	11999	7502	13490	6201	4143	3783	5031	9675	13515	15673	116619	910919
MARATHON OIL COMPANY															
JICARILLA APACHE															
8P2726N 5W	GAS	4877	2697	3038	3638	3349	2359	1641	3241		1494	3834	4058	34226	1039583
	OIL	24	20	31	24		2	6	21		5	18	2	153	9079
	WAT	6	4	5	5	4	3	2	2		1	3	3	38	
E 8K2726N 5W	GAS									16464	16934	18453	17848	69699	69699
	OIL									436	63	144	93	736	736
	WAT									11	11	14	11	47	
9A2826N 5W	GAS	19571	6853	10521	8449	10580	7533	5714	10620	6224			21719	107784	4826314
	OIL	153	57	102	25	123	80	33	37	33			105	748	50223
	WAT	68	30	68	42	48	34	23	30	6	13		52	414	
10B2726N 5W	GAS	7419	2639	5164	3768	2727	2739	2727	4480		2601	5265	3862	43391	1450062
	OIL	82	20	27	18	33	13	33	37		3	62	20	348	13538
	WAT	11	4	10	11	10	7	10	4		4	2	5	78	
E 10C2726N 5W	GAS										14568	10659	12834	38061	38061
	OIL										130	87	53	270	270
	WAT										31	23	22	76	
11M2826N 5W	GAS	5740	3506	2238	1283	807	959	981	2962		2192	4128	5575	30371	1427010
	OIL	55	38	20	23	15	8	12	45		3	98	89	406	22531
	WAT	12	6	11	11	6	5	6	3		4	9	12	85	
E 11C2826N 5W	GAS										33625	21514	11492	66631	66631
	OIL										895	266	53	1214	1214
	WAT										31	14	4	49	
12A3326N 5W	GAS	7252	3942	3525	2435	3733	2442	1172	2593		3469	5316	5580	41459	1541874
	OIL	46	12	21	21	31	3	6	18		9	71	54	292	14387
	WAT	12	9	15	14	15	9	6	6		4	10	13	113	
E 12J3326N 5W	GAS									31047	34651	33790	27438	126926	126926
	OIL									694	361	461	202	1718	1718
	WAT									21	24	16	16	77	
13M3326N 5W	GAS	4092	2683	3283	2418	2109	1427	1816	2625	150	1726	5426	4411	32166	1066198
	OIL	14	14	28	21	34	5	2	35		2	61	37	253	11943
	WAT	7	5	9	9	7	6	4	3		2	7	8	67	
E 13E3326N 5W	GAS									9791	15990	10561	9617	45959	45959
	OIL									295	405	131	91	922	922
	WAT									13	28	20	21	82	
14M3426N 5W	GAS	7320	4701	1697	4723	3290	3346	3422	4867		4330	9151	5500	52347	1947073
	OIL	52	43	27	45	79	23	23	43		23	124	55	537	22004
	WAT	13	10	13	13	12	10	6	3		4	11	6	101	
16I3426N 5W	GAS	5621	4481	3968	4137	3658	2713	1886	3631		610	4101	4990	39796	772401
	OIL	55	26	39	6	40	9	12	31		3	57	75	353	6257
	WAT	15	13	15	14	14	9	6	6		5	10	13	120	
E 16A3426N 5W	GAS										19235	25032	25529	69796	69796
	OIL										645	849	133	1627	1627
	WAT											11	15	26	
OHIO GOVT															
2P1528N11W	GAS	226	244	273	238	250	237	250	219	192	214	218	259	2820	4528061
	OIL														38430
OHIO A GOVT															
2I2328N11W	GAS	13911	7597	8382	10434	7069	9825	1705	531			3072	13227	75753	7861834
	OIL	71	54	18	40	31	56	3				24	72	369	59503
	WAT	4	3	3	4	4	3	1				2	6	30	
OHIO C GOVT															
2E2628N11W	GAS	1623	1127	1387	1623	1120	1481	1120	860	774	902	1230	661	13908	5741604
	OIL	13	8	5	3	2		2	3					36	58418
	WAT	13	12		12	11	11	11	9	9	4	4	2	98	
E 2A2628N11W	GAS		5188	5345	6497	4208	3534	1160	1462	1325	1267	1726	8713	40425	40425
	OIL		27	20	28	18	13	2	3	12		5	62	190	190
	WAT		4	3	4	3	3	8					6	31	
3P2628N11W	GAS	7723	5792	6276	7018	497	6604	497	4657	1648		2741	863	44316	4477206
	OIL	26	18	15	37		3		55	12		8	5	179	42225
	WAT	10	10	11	14	1	5	1	5	1		2		60	
E 3M2628N11W	GAS	11309	10289	8360	7018	1033	6286	3009	6768	2022		3827	11110	71031	147622
	OIL	118	83	40	37	55	15	3	47	33		32	102	565	1501
	WAT	16	13	14	14	2	8	4	7	1		3	9	91	
COMPANY TOTAL	OIL	709	420	393	328	461	230	137	375	1515	2547	2498	1303	10916	356716
	GAS	96684	61739	63457	63679	44430	51485	27100	49516	69637	153808	170044	195286	1046865	37284339
	WAT	187	123	177	167	137	113	88	78	62	166	161	224	1683	
T.H. MCELVAIN OIL & GAS PROPERTIES															
MILLER A															
1A1324N 7W	GAS			58	1409	2877	3490	3498	3674		2360	3245	3668	24279	2031588
	OIL				22	92	18		23		7	21	21	204	9025
	WAT				5	5	5		5		5	5	5	35	
MILLER B															
5N1224N 7W	GAS	5472	5282	4260	5307	5843	6413	5459	5474	5215	3752	5264	4448	62189	2397831
	OIL		12			2		2				72	4	92	8163
	WAT											5	5	10	
COMPANY TOTAL	OIL		12		22	94	18	2	23		7	93	25	296	17188
	GAS	5472	5282	4318	6716	8720	9903	8957	9148	5215	6112	8509	8116	86468	4429419
	WAT				5	5	5		5		5	10	10	45	
JEROME P. MCHUGH															
APACHE															
1O1826N 3W	GAS	2600	1561	1447	952	1184	600	934	1252	972	1068	1140	1607	15317	468441
	OIL														2481
	WAT												22	22	
E 1A1826N 3W	GAS	4103	4556	2721	3116	4127	4107	4272	2488		5749	4682	2480	42401	42401
	OIL	102	93	92	96	111	124	132	59	9	197	143	64	1222	1222
	WAT												11	11	
2L1826N 3W	GAS	2733	1066	1072	1043	852	489	662	944		1380	999	1197	12437	364137
	OIL	24	11	16	5	10	5	5	7		8		5	96	5896
	WAT												39	39	
3D1926N 3W	GAS	LAST PROD. DATE 12/74												S	265286
	OIL														3171
E 3H1926N 3W	GAS	67	18					10	27	45	488	275	172	1102	1102
	OIL	6	3		5	26	10	10		4	86	62	52	264	264
4L1926N 3W	GAS	203	100	148	13									464	104093
	OIL														1329
5E1726N 3W	GAS	2588	1361	1285	1231	1191	808	1007	1576		614	1746	663	14070	453073
	OIL	31	29	35	33	22	11	4	7		2	8	5	187	9423
	WAT												16	16	
E 5G1726N 3W	GAS				464	910	778	945	639		1949	1161	917	7763	7763
	OIL				40	187	108	119	71		291	167	40	1023	1023
	WAT												23	23	

1982

WELL S T R		JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	[illegible]	NOV	DEC	YR-PROD	MP	ACCUM.
2E2128N 8W	GAS	3552	2176	2410	2910	2691	1798	2279	2443	1320	1725	3759	2251	29314		761090
	OIL	35	32	22	22	30	13	26	3	8	10	27	23	251		6293
	WAT	30	30	10	2	7	3	8	1	1	2	2	1	97		
E 2H2128N 8W	GAS	2102	1489	1351	1530	793	217	1238	1487	1100	920	1259	1267	14753		105067
	OIL	67	43	28	42	19	6	28	33	26	19	60	11	382		3865
	WAT	15	15	10	6	2	1	2	1	3	2	13	1	71		
3N 929N 8W	GAS	8586	5571	6673	7183	608	2746	212	1286	3503	5514		5170	47052		1104771
	OIL															329
	WAT	30	15	10	10	1			1	3	2	3	4	79		
E 3E 929N 8W	GAS	12599	8014	9782	13244	1376	1707	1047	2105	12245	6144	1413	4880	74556		400275
	OIL		21	24	36		3	7	5	21	8	3	4	132		224
	WAT	30	25	25	6		2	1	2	12	4	1	2	110		
4D1429N 8W	GAS	1929	236	432	1185	1909	1395	1551	1352	1172	899	1191	1230	14481		289459
	OIL															21
	WAT				2	1	1				1		1	6		
5P 129N 9W	GAS	319	209	381	436	418	473	441	412	435	315	391	318	4548		71029
	OIL															610
	WAT	10	10	10	12	16	12	7	4	7	14	7	2	111		
6G3029N 8W	GAS	2311	356	919	1799	3307	2645	2340	2084	1573	2271	2099	2034	23738		464496
	OIL															52
	WAT	5	5		4	4	10	4	4	6	6	5	6	59		
E 7L3530N 8W	GAS	6656		1224			4829	1087	2908	5239	3379	274	1900	27496		79585
	WAT	10		1			10	2	2	6	4	1	1	37		
Y 7E3530N 8W	GAS	LAST PROD. DATE 10/80													D	254789
8N1229N 8W	GAS	514	393	445	386	432	366	284	444	550	455	604	811	5684		188669
	OIL															44
	WAT	5	5	5	4	1	3		1					24		
9O 329N 8W	GAS	1408	286	28	1353	1271	958	1301	836	1296	1146	1043	1043	11969		210076
	WAT	5			5			1		12	3		4	30		
10F1729N 8W	GAS	2467	462	3029	2658	474	208	244	119	4991	765	1285	3983	20685		477695
	OIL	3	1	2	5					2	1		9	23		380
	WAT	5		15	15					1		1	1	38		
E 10M1729N 8W	GAS	6638	786	1121	15829	2263	187	343	1103	10417	3849	1606	13439	57581		136900
	WAT	15		2	200	3				3	3	2	3	231		
11I1628N 8W	GAS	2529	1999	1506	2542	474	428	567	3479	2548	70	900	3415	20457		394595
	OIL	20	21	9	33					18		2	12	115		5229
	WAT	10	5	4	1			1	2	8		1	5	37		
E 11B1628N 8W	GAS	7043	4233	1372	3857	1135	136	1295	9528	7913	3393	2321	6676	48902		101912
	OIL	112	68	4	27	59		36	106	113	54	54	80	713		1935
	WAT	10	20	3	13	4		25	31	38	17	9	4	174		
12L3628N 8W	GAS	832		593	846	941	214	934	1433	1004	829	1109	893	9628		217062
	OIL	10		11	14	15	2	14			1	7	10	84		2003
	WAT	30		15	12	18	6	34	25	9	26	14	6	195		
13A1828N 8W	GAS	2863	57	379	2510	1948	1382	2186	1805	1783	2296	1674	1720	20603		465402
	OIL	7		2	16	8	3	5	7	4	5	5	8	70		2301
	WAT	5			2	1			1	2	1	1	2	15		
16L2029N 9W	GAS	630	284	713	457	386	501	434	369	332	305	158	148	4717		158912
	OIL			17	1									18		579
	WAT			2				1				1		4		
17P 126N 8W	GAS	1546	1711	1729	1426	2080	2049	1973	1463	1385	1869	1284	1615	20130		246088
	OIL	26	35	28	22	25	8	18	11	15	16		29	233		6400
	WAT	5	5	5	6	3	3	2	1	4	3	4	8	49		
E 17H 126N 8W	GAS	671	879	702	589	891	871	868	736	705	703	481	605	8701		28096
	OIL	18	33	42	28	43	55	16	16	22	21		15	309		2160
	WAT				13	9	2	4	6	9	9	10	2	64		
18M 126N 8W	GAS	1038	518	335	411	197	213	1643	2789	2102	1261	194	2030	12731		251378
	OIL	5	11	7	5			14	25	4	24	7	14	116		3964
	WAT	5	2	2	1		4	4	3	3	2	2	6	34		
E 18D 126N 8W	GAS	2749	666	282	1338	286	1318	4652	4680	4353	2649	264	4338	27575		118436
	OIL	17	14		16		3		55	23	24	8	60	220		1154
	WAT	5	2		16		1	9	6	30	19	3	3	94		
19C1226N 8W	GAS	4347	2388	4529	3750	2254	495	1451	4412	4622	2131	1166	4645	36190		652561
	OIL	67	33	57	21	26	6	15	29	16	14	18	53	355		9773
	WAT	60	70	75	12	11	6	16	25	14	24	22	35	370		
E 19N1226N 8W	GAS	1606	2129	2436	1859	389	5	504	2730	1895	1443	243	2323	17562		41748
	OIL	17	45	32	12	5		11	32	17	24	4	35	234		631
	WAT	5	5	5	7			3	1	9	4	1	3	43		
20P1226N 8W	GAS	2564	1833	1770	769	1080	257	1664	2474	2189	2426	1285	2806	21117		371912
	OIL	31	24	13	10	6	5	23	28	22	40	18	42	262		6226
	WAT	5	5	5	1	1	1	3	2	12	2	4	8	49		
E 20B1226N 8W	GAS	4130	3248	2683	1649	707	38	1737	4792	3545	2752	2301	3455	31037		75542
	OIL	46	34	16	12		5	38	34	23	62	22	29	321		1076
	WAT	10	15	10	2		2	9	8	42	9	7	6	120		
21L3127N 7W	GAS	2792	1782	465	1801	823	473	248	252	3660	2418	2289	2298	19301		295330
	OIL	26	15		19	5	18	3	6	38	21	21	27	199		3265
	WAT	10	7		10	3	2			8	4	3	6	53		
E 21D3127N 7W	GAS	5292	3407	747	2375	868	124	1221	1528	5415	4598	3977	3258	32810		103637
	OIL	117	62		70	18	1	10	24	137	86	85	87	697		2517
	WAT	25	20	2	15	3	1			36	16	16	4	138		
25L2930N 8W	GAS	1376	563	244	1186	1314	913	911	896	808	625	687	424	9947		154687
	WAT	10	5	1	4	2	2	1	2	1		3	2	33		
26N 729N 8W	GAS	686	658	721	650	708	681	655	587	419	714	518	586	7583		106342
	WAT	10	20	10	7	5	11	2	6	6	3	3	2	85		
27P1828N 8W	GAS	3462	337	452	2614	2583	360	3288	3225	2400	2935	2734	2351	26741		431318
	OIL	3		8	17	19	3	26	12	2	3	4	3	100		1986
	WAT	15		1	2	2	1	2	2	18	3	4	3	53		
30M2030N 9W	GAS	3548	666	502	2188	2447	1331	2486	2984	3098	2434	2705	2774	27163		308212
	OIL															5
	WAT	30		2	3	4	4	2	2	4	4	4	2	61		
LIVELY COM																
14K3630N 8W	GAS	1687	357	249	1387	2192	1706		1228	1512	918	1672	1283	14191		245578
	WAT	5		2	7		8		3	9	6	7	4	51		
15H3230N 8W	GAS	1468	447	478	871	2926	2013		1326	1339	1361	1271	1139	14639		314476
	WAT	5			2	3						1	1	12		
COMPANY TOTAL	OIL	655	492	324	438	307	166	305	453	511	448	366	559	5004		66720
	GAS	103414	48140	51466	84698	43823	34330	42858	71008	97853	66513	44939	88203	777245		9890723
	WAT	422	286	232	404	107	98	146	146	318	195	156	139	2649		
M AND M PRODUCTION AND OPERATION																
MEXICO FEDERAL A																
1I1024N 6W	GAS	411	308	1759	358	404	814	698	553	727	283	200	296	6811		266927
	OIL			180										180		1747
MANANA GAS INCORPORATED																
ANNIE B																
1N1330N12W	GAS	768		187	444	1191	1266	1205	1317	967	829	1325	1047	10546		169269
	OIL	11							43		2			56		792
BETTY HARTMAN																
1P1430N12W	GAS	1851		281	986	3299	1942		2361	2048	2069	2052	2303	19192		202848
	OIL	10					17	17	16	10	17	16	17	120		1755
MARY WHEELER																
1O2330N12W	GAS	3299	1985	5449	2900	2384	1390	699	588	818	817	3193	6845	30367		454123
	OIL	75	34	93	54	49	14		17	2	1	58	118	515		6638
E 1M2330N12W	GAS	3913	3767	4377	2662	3461	1309	75	1006	834	729	2177	6527	30837		175521
	OIL	108	106	128	46	85	23		80	37	14	143	171	941		4991
COMPANY TOTAL	OIL	204	140	221	100	134	54	17	156	49	34	217	306	1632		14176
	GAS	9831	5752	10294	6992	10335	5907	1979	5272	4667	4444	8747	16722	90942		1001761
MARATHON OIL COMPANY																
JICARILLA APACHE																
8P2726N 5W	GAS	3880	611			3962	458	895	4822	106			3223	17957		1057540
	OIL	2				9			34				31	76		9155
	WAT	3				1		1	4				4	13		
E 8K2726N 5W	GAS	17553	16179	16214	9262		10375		13107	574	2198			85462		155161
	OIL	70	90	63	63	8	28	8	127		10			467		1203
	WAT	11	10	11	5		5		10		1			53		
9A2826N 5W	GAS	22644	19466	13340		9367			6073		4646		12758	88294		4914608
	OIL	103	246	93		8					7		27	484		50707
	WAT	54	50	31		22					1		22	180		
E 9O2826N 5W	GAS	2752	22976	17986	14415	3355	279	21045	15145	13031	2356		5118	118458		118458
	OIL	264	248	214	209	33	35	310	199	142	52		83	1789		1789
	WAT	10	21	19	14	4	3	12	12	10	4		4	113		
10B2726N 5W	GAS	4177	837			2914	3105		6745	219		9489	6566	34052		1484114
	OIL	43	2			30	28		53			108	36	300		13838
	WAT	6				3	4		7			8	5	33		
E 10C2726N 5W	GAS	14600	14515	14793					14121	539		16807	13440	88815		126876
	OIL	97	133									28	31	289		559
	WAT	21	20	17					5			10	5	78		
11M2826N 5W	GAS	3407	235			2237	2820		6192	428				15319		1442329
	OIL	66				19	29		77					191		22722
	WAT	12				3	3		10					28		
E 11C2826N 5W	GAS	16933	7539	15734		2293			23208	564	14340			80611		147242
	OIL	176	63	100	27	30			315	20	158			889		2103
	WAT	10	5	9	10	1			12	2	7			56		
12A3326N 5W	GAS	5912	1112			2302		210	8302	6589	1837		3658	29922		1571796
	OIL	63				6			69	89	3		37	267		14654
	WAT	12				5			13	10	2		5	47		
E 12J3326N 5W	GAS	26110	19622	21973				2322	33791	24130	15965		10183	154096		281022
	OIL	228	217	171					212	202	114		103	1247		2965
	WAT	13	12	12					10	10	7		6	70		

1983

WELL S T R		JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	1984 PROD	MP	ACCUM
13A1828N 8W	GAS	1691	1586	1465	1520	1550	1574	1646	1497	1854	2041	1268	2093	19885		485287
	OIL	6	20	7	6	17	3	11	2		40		8	120		2421
	WAT	1	1	2	1	1	1	1	1	1	2	1	1	14		
16L2029N 9W	GAS	503	1104	660	485	548	695	596	452	512	545	623	672	7395		166307
	OIL					20	1	12						33		612
	WAT	1	2	2	1	2	1	1	1	1	2	2	2	18		
17P 126N 8W	GAS	1376	1567	1333	1293	1415	1336	1349	1382	1411	1102	1300	1096	15960		262048
	OIL	22	29	28	20	32	22	34	17	41	24	25	36	330		6730
	WAT	2	2	2	1	2	1	2	2	4	2	4	4	28		
E 17H 126N 8W	GAS	604	557	619	575	559	575	594	657	608	619	469	604	7040		35136
	OIL	26	27	35	19	28	26	10	11	13	21	8	17	241		2401
	WAT	2	1	2	1	2	1	15	2	2	3	3	3	37		
18H 126N 8W	GAS	1093	1063	1469	1353	1412	1295	1450	1256	1363	1279	1269	1251	15553		266931
	OIL	17	29	23	15	4	11	36	22	16	22	19	24	238		4202
	WAT	3	4	3	1	1	2	4	2	2	2	2	4	30		
E 18D 126N 8W	GAS	3524	2363	3475	3293	3031	2676	2662	2793	2512	2601	14636	2117	45683		164119
	OIL	24	27		10	54	25	25		1	21	21	30	238		1392
	WAT	4	3	2	2	6	2	2	7	3	14	4	6	55		
19C1226N 8W	GAS	3459	3288	2852	3822	2624	2767	3195	3131	2892	2257	1825	2423	34535		687096
	OIL	37	33	40	29	43	31	49	32	31	26	19	40	409		10182
	WAT	28	25	22	20	17	11	14	14	14	14	28	32	239		
E 19N1226N 8W	GAS	1524	1351	1738	1560	799	688	804	717	731	661	743	774	12090		53838
	OIL	18	23	20	11	11	19	13	19	14	18	14	17	197		828
	WAT	1	2	2	1	1	2	2	1	1	2	3	3	21		
20P1226N 8W	GAS	1514	1293	2070	2315	1855	1874	1908	1853	1764	1844	1207	1953	21450		393362
	OIL	13	22	28	28	34	32	30	33	27	34	8	37	326		6552
	WAT	2	2	2	2	2	1	2	1	2	4	3	2	25		
E 20B1226N 8W	GAS	3102	2493	3105	2596	2462	2535	2516	2509	2464	2426	2251	2565	31024		106566
	OIL	29	16	44	29	30	25	26	26	21	29	22	24	321		1397
	WAT	6	1	3	2	3	2	2	2	2	3	5	4	35		
21L3127N 7W	GAS	1961	2233	7686	1624	1626	1964	1882	1799	1940	1891	1756	1474	27836		323166
	OIL	21	26	15	13	16	12	25	15	19	18	61	11	252		3517
	WAT	4	3	3	1	1	1	2	3	1	1	2	2	24		
E 21O3127N 7W	GAS	2908	2891	2985	2802	2598	2543	2483	2222	2168	2273	1922	2135	29930		133567
	OIL	79	64	90	36	62	55	49	42	44	66	6	53	646		3163
	WAT	5	5	4	2	4	2	3	3	2	6	12	2	50		
25L2930N 8W	GAS	641	895	1038	950	889	872	761	859	787	890	834	671	10087		164774
	WAT	3	2	2	1	1	1	2	2	1	2	2	2	21		
26N 729N 8W	GAS	595	550	636	640	658	636	665	677	681	644	566	529	7477		113819
	WAT	2	4	5	1	2	2	4	3	2	3	3	2	33		
27P1828N 8W	GAS	2674	2345	2126	2273	2112	2379	2110	2069	2142	2518	1997	2223	26968		458286
	OIL	2	3			10						3	15	33		2019
	WAT	2	4	3	3	2	2	4	2	3	3	4	4	36		
30M2030N 9W	GAS	2449	2642	2354	2340	2626	2389	2553	2530	2300	2783	2579	2508	30053		338265
	OIL															5
	WAT	4	6	6	2	3	2	2	2	2	4	3	3	39		
LIVELY COM																
14K3630N 8W	GAS	1010	1530	1451	1326	1347	1439	1276	1238	1240	1411	1364	1435	16067		261645
	WAT	4	3	3	3	3	3	3	4	3	4	1		34		
15H3230N 8W	GAS	1158	1398	1132	1044	1125	1155	1039	1071	1051	1059	994	932	13158		327634
	WAT	1				1								2		
COMPANY TOTAL	OIL	418	429	396	323	464	385	506	368	330	592	329	486	5026		71746
	GAS	72185	97217	64232	61921	65661	49408	49351	57907	56519	63557	79588	90694	808240		10698963
	WAT	120	124	108	79	118	65	102	81	84	131	125	161	1298		
LOBO PRODUCTION					***											
MESA TWIN MOUNDS																
1D3030N14W	GAS														U	
2L3030N14W	GAS														S	
COMPANY TOTAL	GAS															
M AND M PRODUCTION AND OPERATION					***											
MEXICO FEDERAL A																
1I1024N 6W	GAS	193	560	602	479	567	225	292	539	408	360	257	256	4738		271665
	OIL															1747
MANANA GAS INCORPORATED					***											
ANNIE B																
1N1330N12W	GAS	1189	1025	869	767	500	356	798	1059	969	1077	1204	824	10637		179906
	OIL				2						7	2	17	28		820
BETTY HARTMAN																
1P1430N12W	GAS	2596	2032	2108	1745	1588	1451	1800	2034	1812	2166	1596	2018	22946		225794
	OIL	17	14	16	8	10		14	11	10	11	28	6	145		1900
MARY WHEELER																
1O2330N12W	GAS	5281	4028	294	2759	2624	547	2030	5761	4480	5287	3239	4304	40634		494757
	OIL	114	57		54	40		28	103	49	93	77	61	676		7314
E 1M2330N12W	GAS	6733	4216	884	4235	3333	834	3135	5859	3788	4085	3190	3452	43744		219265
	OIL	202	141		130	61		128	110	77	140	91	50	1130		6121
COMPANY TOTAL	OIL	333	212	16	194	111		170	224	136	251	198	134	1979		16155
	GAS	15799	11301	4155	9506	8045	3188	7763	14713	11049	12615	9229	10598	117961		1119722
MARATHON OIL COMPANY					***											
BOLACK																
1H1627N11W	GAS	1396	938	2015	2014	1741	1774	1638	758	1530	1950	1470	681	17905		1297356
	OIL	20	3	7	18	24	5	5	5	7	6	10		110		10538
	WAT							4	3	3	4	3	3	20		
E 1P1627N11W	GAS	2328	2050	4479	3735	3417	3271	2767	2414	2692	2988	3191	3403	36735		213271
	OIL	2	8	55	19	41	19	14	5	6	7	12	10	198		1452
	WAT							7	3	4	4	4	4	26		
2N1527N11W	GAS	1210	1141	1270	1384	1258	1389	1437	1290	1242	1460	1226	1435	15742		987728
	OIL		3	12	5	12	10	8	5	7	7	6	9	84		8124
	WAT							4	4	4	4	4	4	24		
R 3G2127N11W	GAS	8422	5826	8266	8872	4719	4713	2344						43162		313113
	OIL	39	27	88	24	73		28						279		2490
4A2827N11W	GAS	558	433	342	773	636	611	629	446	583	627	618	552	6808		1123480
	OIL					23	15	7	5	5	5	7		67		11881
	WAT							5	4	4	4	4	4	25		
EVENSEN																
2P1927N10W	GAS	2487	3218	3610	3663	2934	3275	2772	2847	2941	3176	3318	3217	37458		1360454
	OIL	8	20	17	18	37	17	11	14	6	7	13	12	180		17102
	WAT							22	17	17	17	17	17	107		
FRONTIER AZTEC A																
1O 827N11W	GAS	2887	2762	3377	3157	3260	2872	2593	1572	3400	2698	2880	3908	35366		1893620
	OIL	12		47	17	6	7	8				7	8	112		14137
	WAT								18	29	26	28	31	132		
FRONTIER AZTEC B																
1L2827N11W	GAS	688	391	140	146	48	84	100	129	283	598	701	990	4298		1529893
	OIL		13	36	1								2	52		12430
	WAT							8	3	5	7	7	7	37		
JICARILLA APACHE																
8P2726N 5W	GAS	5729	4864	4290	2961									17844		1075384
	OIL	15	55	34									2	106		9261
	WAT	9	8	8	5								1	31		
E 8K2726N 5W	GAS	13206	13933	12931	9386	1898	2273				13849	749		68225		223386
	OIL	12									2			14		1217
	WAT	9	9	9	6	1	1							35		
9A2826N 5W	GAS	25887	12473	11215			20494	103				5368		75540		4990148
	OIL	120	13	33			52					20		238		50945
	WAT	56	27	22			18					2		125		
E 9O2826N 5W	GAS	26401	12490			3032	16546	58			15635	816	5624	80602		199060
	OIL	159					135				35		38	367		2156
	WAT	13	7			1	7				4			32		
10B2726N 5W	GAS	5057		4496			1443				7158	258	682	19094		1503208
	OIL	35		40			8				80	6		169		14007
	WAT	6		3							3		1	13		
E 10C2726N 5W	GAS	13709		5684						754	20405	831		41383		168259
	OIL	62		18						6	67			153		712
	WAT	7		4							8			19		
11M2826N 5W	GAS		1023	10127	5737	1487	3277						4315	25966		1468295
	OIL		26	112	81	5	24						51	299		23021
	WAT		2	6	5	1	1						2	17		
E 11C2826N 5W	GAS			7425	2704	5025					22099	5350		42603		189845
	OIL			68	82	20					298	15		483		2586
	WAT			2	2	1					7	2		14		
12A3326N 5W	GAS	11095	2721		1097						8197	1064		24174		1595970
	OIL	65	32		9						61			167		14821
	WAT	13	3		1						4			21		
E 12J3326N 5W	GAS	30627	9655	11678							31298	1157		84415		365437
	OIL	145	25	28							271			469		3434
	WAT	15	4	5			1				12			37		
13M3326N 5W	GAS	6218	4461	3678	2114	931	511				2529	3258	277	23977		1114796
	OIL	38	7	34	14	8					3		5	109		12258
	WAT	6	5	6	3	1								21		
E 13E3326N 5W	GAS	9607	6976	3473		2102	831				8942	316		32247		126656
	OIL	132	37	23		35					123			350		1774
	WAT	10	10	5		1					6			32		
14M3426N 5W	GAS	11374	10463	2447		1590	1682							27556		2009785
	OIL	72	55	28		5								160		22537
	WAT	5	5	3		1								14		

1984

WELL S T R		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR-PROD	ACCUM.
	OIL	5	7	6	58	23	27	27	0	0	0	12	109	278	15998
	WAT	3	3	4	15	5	0	38	15	0	0	5	15	103	462
BASIN DAKOTA (PRORATED GAS)				AMOCO PRODUCTION CO							HANCOCK GAS COM				
E 1I1530N12W00DK	GAS	6908	0	4119	1305	6730	5960	5955	3408	0	5065	7016	5194	51660	68635
	OIL	139	238	94	0	141	104	108	49	0	74	122	92	1161	1164
	WAT	34	0	12	0	46	34	0	0	0	0	0	0	126	172
BASIN DAKOTA (PRORATED GAS)				AMOCO PRODUCTION CO							HANCOCK GAS COM				
1L1530N12W00DK	GAS	1128	1544	1480	1305	1576	2212	2823	1783	162	699	2330	2009	19051	535408
	OIL	3	6	6	0	4	66	30	13	0	0	6	46	180	13977
	WAT	1	4	2	0	2	10	0	5	0	0	15	20	59	402
***** SECTION TOTAL WELLS =			5												
BASIN DAKOTA (PRORATED GAS)				BETA DEVELOPMENT COMPANY							OLLIE SULLIVAN				
1A2230N12W00DK	GAS	4461	3222	0	0	0	7493	5884	3992	0	0	0	174	25226	1644114
	OIL	117	8	0	0	0	93	32	0	0	0	0	0	250	21894
	WAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BASIN DAKOTA (PRORATED GAS)				SOUTHLAND ROYALTY COMPANY							FLORA VISTA				
1F2230N12W00DK	GAS	1293	0	0	374	2512	2475	2427	2010	1256	1395	1107	1256	16105	773790
	OIL	5	0	0	14	40	35	31	20	23	16	22	8	214	10787
	WAT	4	0	0	34	116	129	133	133	13	124	129	133	948	1643
FLORA VISTA MESAVERDE (GAS)				MERRION OIL AND GAS CORPORATION							OSBORN				
1M2230N12W00MV	GAS	0	0	23	124	257	0	0	0	0	135	0	0	539	2044160
	OIL	0	0	14	0	0	0	0	0	0	0	0	0	14	10588
	WAT	1	0	0	0	0	0	0	0	0	0	0	0	1	1
***** SECTION TOTAL WELLS =			3												
BASIN DAKOTA (PRORATED GAS)				BETA DEVELOPMENT COMPANY							CHARLES HUTTON				
1A2330N12W00DK	GAS	0	0	0	0	3434	2187	627	2667	844	2121	1103	1520	14503	432813
	OIL	15	0	0	0	2	5	24	9	24	14	14	31	138	9054
	WAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BASIN DAKOTA (PRORATED GAS)				MANANA GAS INCORPORATED							MARY WHEELER				
1D2330N12W00DK	GAS	3299	1985	5449	2900	2384	1390	699	588	818	817	3193	6845	30367	454123
	OIL	75	34	93	54	49	14	0	17	2	1	58	118	515	6638
	WAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0

01/21/85 Well Suspected of Causing Flora Vista Contamination

OIL CONSERVATION DIVISION
1983 SELECTED LOCATION SUMMARYS
NORTHWEST

WELL S T R		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR-PROD	ACCUM.
BASIN DAKOTA (PRORATED GAS)				MANANA GAS INCORPORATED							MARY WHEELER				
E 1M2330N12W00DK	GAS	3913	3767	4377	2662	3461	1309	75	1006	834	729	2177	6527	30837	175521
	OIL	108	106	128	46	85	23	0	80	37	14	143	171	941	4991
	WAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
***** SECTION TOTAL WELLS =			3												
AZTEC PICTURED CLIFFS (GAS)				B.H. KEYES & M.N. KEYES, T.A.							BLANCETT				
1G2430N12W00PC	GAS	64	45	80	84	44	0	0	0	0	0	0	0	317	105451
	OIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	WAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BASIN DAKOTA (PRORATED GAS)				BETA DEVELOPMENT COMPANY							JOSE JAQUEZ				
1K2430N12W00DK	GAS	124	101	460	521	764	654	652	625	585	554	549	197	5786	183377
	OIL	0	10	18	16	10	8	20	10	25	14	15	71	217	16920
	WAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
***** SECTION TOTAL WELLS =			2												
BASIN DAKOTA (PRORATED GAS)				AMOCO PRODUCTION CO							STEDJE GAS COM				
1F2730N12W00DK	GAS	850	196	713	1140	1738	2099	2102	1533	1059	1461	1433	1394	15718	854347
	OIL	75	0	0	43	0	54	5	11	14	15	21	13	251	15338
	WAT	0	0	0	7	15	10	16	7	5	5	7	5	77	592
FLORA VISTA MESAVERDE (GAS)				AMOCO PRODUCTION CO							STEDJE GAS COM				
1F2730N12W00MV	GAS	0	161	0	0	0	0	0	0	0	0	0	0	161	4121162
	OIL	0	0	0	0	0	0	0	0	0	0	0	0	0	25907
	WAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Memo

From

DAVID G. BOYER
Hydrogeologist

To

July 28 - Plans - Contact
Aug 7 - Lindrith

Old Manana Tank at
Flora Vista
10/85

Old Manana Tank at
Flora Vista

10/85

Flora Vista Aquifer Test
4/21-25/86

Flora Vista Aquifer Test
4/21-25/86

Flora Vista Aquifer Test
4/21-25/86

Flora Vista Aquifer Test

4/21-25/86

Flora Vista Aquifer Test
4/21-25/86

Flora Vista Aquifer Test
4/21-25/86


HONDA

Sierra Vista Aquifer Test
4/21-25/86

Flora Vista Aquifer Test

4/21-25/86

Flora Vista Aquifer Test
4/21-25/86

Flora Vista Aquifer Test
4/21-25/86

Flora Vista Aquifer Test
4/21-25/86

Flora Vista Aquifer Test

4/21-25/86

Sierra Vista Aquifer Test
4/21-25/86


PLANTERS
CHEM
I-CHEM RESEARCH
MULTI-MIXER

Flora Vista 8/15/91

8/15/91, Flora Vista

Flora Vista 8/15/91

Flora Vista 8/15/97

Flora Vista 8/15/91

Flora Vista 8/05/9

Flora Vista 8/15/91,

Flore Vista 8/15/09

Flora Vista 8/15/99

Flore Vista 8/15/91


KOMATSU

Flore Vista 8/15/91

trench T-2 facing East

Flora Vista / El Paso

June 13, 89

Flora Vista / El Paso

June 13, 89

N-S trench from tank ℄

Trench T-5

Flora Vista / El Paso

June 13

N to S in trench T-5

L

Flora Vista / El Paso

June 13

trench wall of T-5
note black tk stain from
appr. surface to water level

??

Flora Vista / El Paso

June 13

T-6 perpendicular to T-5
facing N.E. – ~~delinea~~
marks approx boundary
of dehydrator pit

Flora Vista / El Paso
June 13

T-6 perp to T-5
facing N.E
marks boundary of
dehydrator pit

Flora Vista / El Paso
June 14, 89

View to North of
dwelling 2B by the gas
well

Flora Vista / El Paso

June 16, 89

MW 5 (OLD) background

&

MW# 4 (new)

facing west

Flora Vista / El Paso
June 16, 89
Reserve Pit,
North bell hole, note
layer of concrete & chalk
layer of drilling mud

Flora Vista / El Paso
June 16/87

Reserve Pit Center
Bell Hole, note end of
pipe and multicolored
laminated clay area on
trench wall

Flora Vista / El Paso
June 16, 89

Shot from top of water
tank ~~of~~ to South of
study site after completed

FLORA Vista Contamination Site

Trench "A," East End

8/17/87

negative#

2

4AM

Photo by DWB

Flora Vista Contamination

Site Trench "A" 8/17/87

Negative #1

1

Photo by Ray B

Flora Vista Contamination
Site Trench "A" 8/17/87

Negative #
0

DAN

FLORA VISTA Contamination
Site Trench "A" 8/17/87

Negative II

(-0)

MM

Flora Vista Contamination (40)
Site, East end, trench "D"

8/17/87

Negative #24

Photo by DEB

Flora Vista Contamination Site
East end, trench "D"

8/17/87

(23)

Flora Vista Contamination Site
Looking east, trench "D"
8/17/87

Negative #
32

Flora Vista Contamination Site

Soil from Trench "D" 8/17/89

Negative #
(21)

Photo by [illegible]

Flora Vista Contamination (OC)
Site Trench "D" 8/17/87

Negative #20

Photo by [illegible]

Flora Vista Contamination
site Trench "B" looking West
8/17/89

Negative #
(19)

Photo by DGB

Flora Vista contamination (31)
Site Trench "D" looking west

8/17/87

Negative #18

Photo by [illegible]

Flora Vista Contamination Site
Trench "D" Center

8/17/87

(17)

Photo by R.G.K

Flora Vista Contamination Site
Trench "D" Center, looking east.
8/17/87

Negative #
(16)

Photo by [illegible]

Flora Vista Contamination Site

Digging Trench "F" 8/17/89

Negative #8

8

VAN

Photo by BJR

Flora Vista Contamination
Site Dehydrator
8/17/87

Negative #
7

Photo by DGB

Flora Vista Contamination Site, Digging Trench "F"
8/14/87

Negative #
6
6

RGB

Plore Vista Contamination
Site Trench "E" 8/17/87

Negative #5

Photo by RVB

Flora Vista Contamination
Site Trench "E" Center
8/14/87

Negative #
4
KGN

Photo by DGB

Flora Vista Contamination Site
Trench "E" looking east
8/15/87

Negative #
3

8/17/8-

EPNG DEHYDRATOR

8/17/87

EPNG DEHYDRATOR

NOTE FRESH DRIP

8/17/87

EPNG DEHYDRATOR

NOTE FRESH DRIP

8/17/87

EPNG DEHYDRATOR

8/17/87

(F)

8/17/87

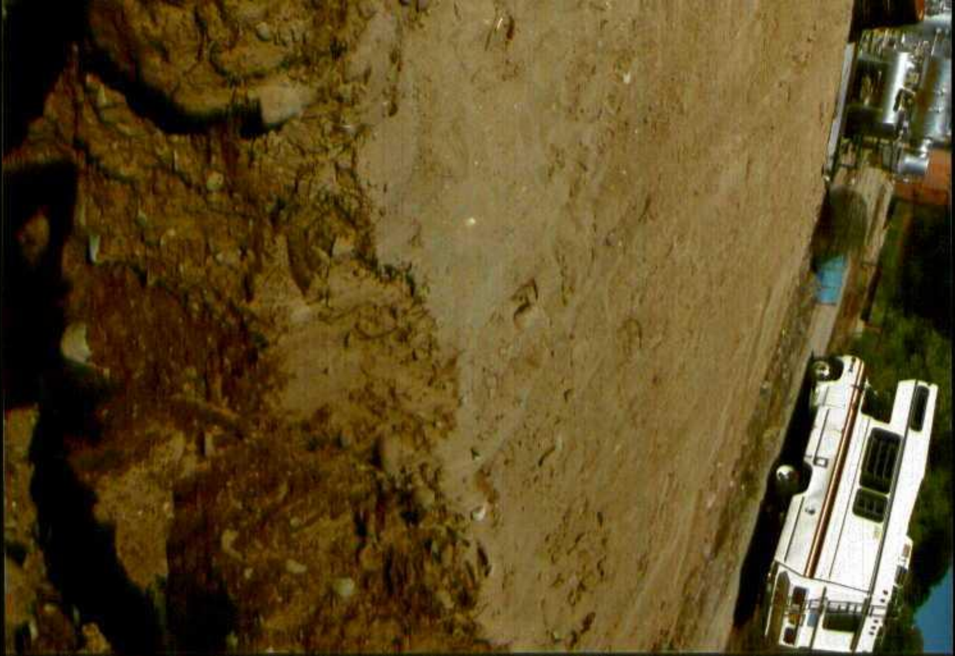
(F)

8/17/87

(F)

8/17/87

(F)



8/17/87 (F)

8/17/87

(F) AFTER IT WAS
FILLED IN

81:7/87

(F) AFTER IT WAS
FILLED IN

(J)

8/18/87

(I)

8/17/87

(E)


JOHN DEERE

8/17/87

(E)

8|17|87

(E)

81/17/87

(E)

8/17/87

(F) AFTER IT WAS
FILLED IN

BREWER
ASSOCIATES, INC.

ENGINEERS • ARCHITECTS • SURVEYORS

P. O. BOX 2079 • FARMINGTON, NM 87499 • (505) 327-3303
400 PILE ST., SUITE 300 • CLOVIS, NM 88101 • (505) 763-4255
DURANGO, COLORADO • (303) 247-5766

December 26, 1985

Mr. David Boyer
New Mexico Oil Conservation Division
Post Office Box 2088
Santa Fe, New Mexico 87504-2088

RE: FLORA VISTA WATER USERS ASSOCIATION

Dear Mr. Boyer:

Please find enclosed one set of prints of the Flora Vista Well and Test Well Locations, including aerial photographs. We have also included a copy of this letter for the file.

Sincerely yours,

BREWER ASSOCIATES, INCORPORATED

George T. Walters, P.L.S.
Vice President

GTW:gv F-331

Enclosures

cc: File

BREWER
ASSOCIATES, INC.

ENGINEERS • ARCHITECTS • SURVEYORS

P. O. BOX 2079 • FARMINGTON, NM 87499 • (505) 327-3303
400 PILE ST., SUITE 300 • CLOVIS, NM 88101 • (505) 763-4255
DURANGO, COLORADO • (303) 247-5766

November 8, 1985

Mr. Dave Boyer
State Of New Mexico
Oil Conservation Division
PO Box 2088
Santa Fe, New Mexico 87504

RE: FLORA VISTA WATER USERS ASSOCIATION
ELEVATIONS FOR TEST WELL MONITORS

Dear Mr. Boyer:

We are submitting herewith two (2) copies each of the elevations which we have taken to the nearest 1/100th of a foot for the above referenced project. In addition, we are also enclosing two (2) copies each of the area outlining that portion of the Crouch Mesa County Road Extension within the Lee Acres Land-fill area.

Very truly yours,

BREWER ASSOCIATES, INCORPORATED

Robert A. Echols, Jr.

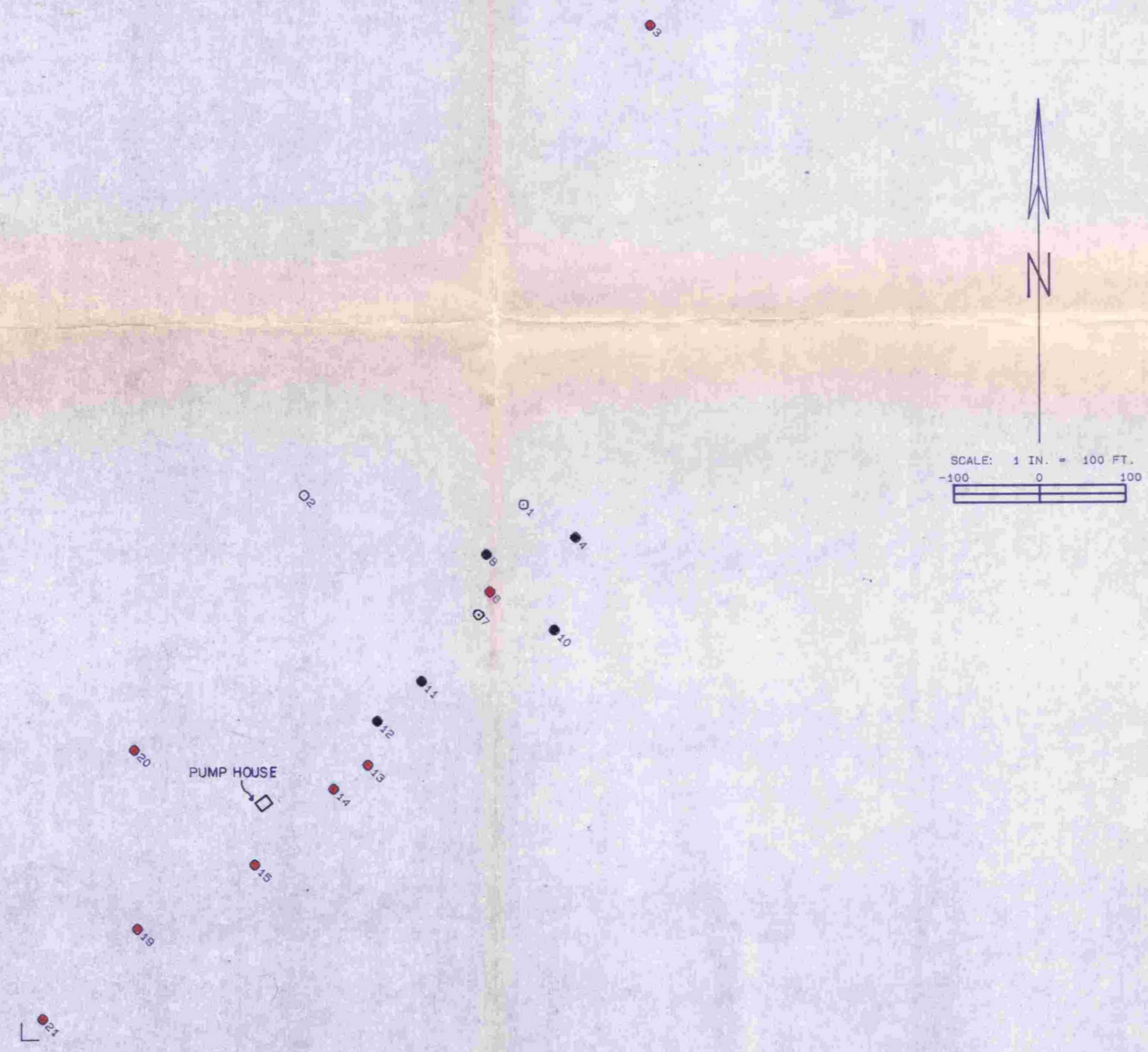
Robert A. Echols, Jr., P.E.
Engineering Division Director

RAE:rr F-331

Enclosures

Lawrence A. Brewer, P.E., L.S.
George E. Bennett, Jr., A.I.A.
Richard P. Cheney, P.E., L.S.
George T. Walters, P.L.S.
Robert A. Echols, Jr., P.E.

FLORA VISTA WELL AND TEST WELLS LOCATIONS



RUN BY: JDW 9/13/85
JOB: FLORA VISTA WELL'S TEST LOCATION DISK-SURVEY #2

POINT	NORTH	EAST	ELEV.	
1	10000	10000		FD. REBAR
2	10010.7201674	9744.2245555		FD. REBAR
3	10558.0800542	10148.890608	106.37	WELL
M5 4	9961.833901	10059.8338515	100.18	TEST WELL 5
5	9939.4073038	10083.6995464		
S1 6	9898.6519976	9959.7176712	.46 100.48	WELL
SX1 7	9872.0911083	9946.3881401	99.74	OLD WELL
M3 8	9942.1493784	9956.135828	101.90	TEST WELL 3
9	9738.7881714	9774.5036874		
M4 10	9854.2064626	10034.8727437	98.51	TEST WELL 4
M1 11	9794.6137317	9879.9361151	100.61	TEST WELL 1
M2 12	9748.1732121	9828.3824133	100.46	TEST WELL 2
13	9697.0633913	9817.2577553	100.29	WELL
S5 14	9669.1202509	9777.1979868	99.45	WELL
15	9580.6995465	9685.1565287	98.42	WELL
16	9653.0379898	9706.7613464	100.88	PUMPHOUSE SLAB
17	9662.4853289	9698.7654782		
18	9606.4530754	9583.2667245		
19	9506.4186671	9549.2187282	97.07	WELL
20	9714.4714054	9546.2960701	99.15	WELL
21	9401.6061461	9438.5830708	96.95	WELL
22	9535.9786329	9542.4122932		
50	9180.7791972	12105.5650402		
	SET IRON ROD AT RIVER		92.40	

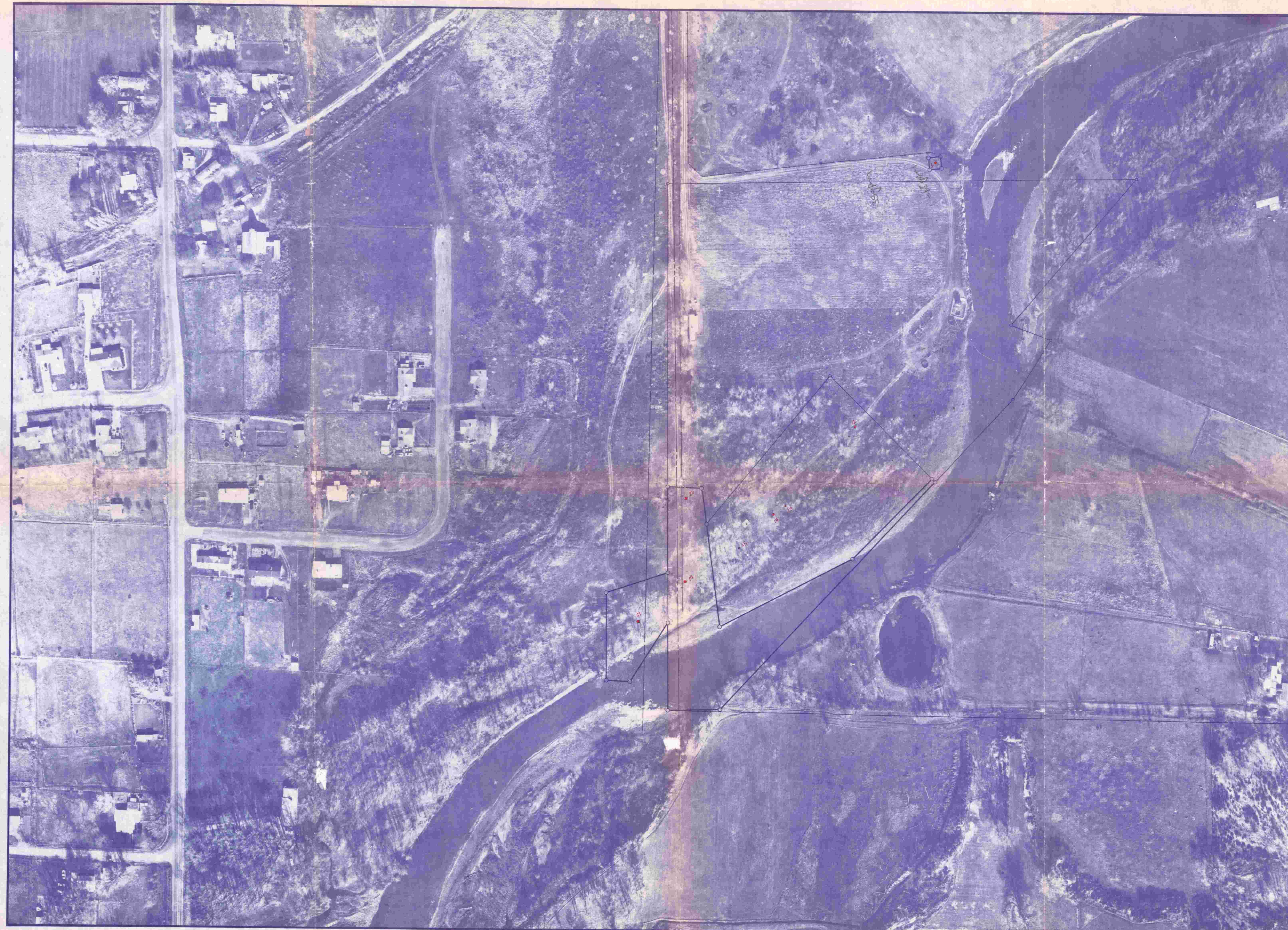
BM. 100. ON SLAB AT WELL 6

DATE	REVISION	BY

BREWER ASSOCIATES, INC.
ENGINEERS · ARCHITECTS · SURVEYORS
909 W. APACHE FARMINGTON, NEW MEXICO 87401
CLOVIS, NEW MEXICO DURANGO, COLORADO

FLORA VISTA WATER USERS
FLORA VISTA, NEW MEXICO

DATE: 9/13/85
DRAWN BY: J.D.W
PROJ. F-331
SCALE: 1"=100'
SHEET
OF



DATE	REVISION	BY

LAWRENCE A. BREWER & ASSOCIATES, INC.
Engineering · Architecture · Surveying

909 W. Apache   Farmington, New Mexico 87401
900 Main Avenue   Durango, Colorado 87301

DATE:
DRAWN BY:
PROJ. NO.
SCALE:
SHEET
OF

Date	Revision	Approved

WELL AND TRANSMISSION LINE

FLORA VISTA WATER USERS ASSOC.

Drawn By: AT	Date: 3-80
Scale: As Noted	Project No.: F-152

LAWRENCE A. BREWER & ASSOCIATES, INC.
CONSULTING ENGINEERS
FARMINGTON NEW MEXICO

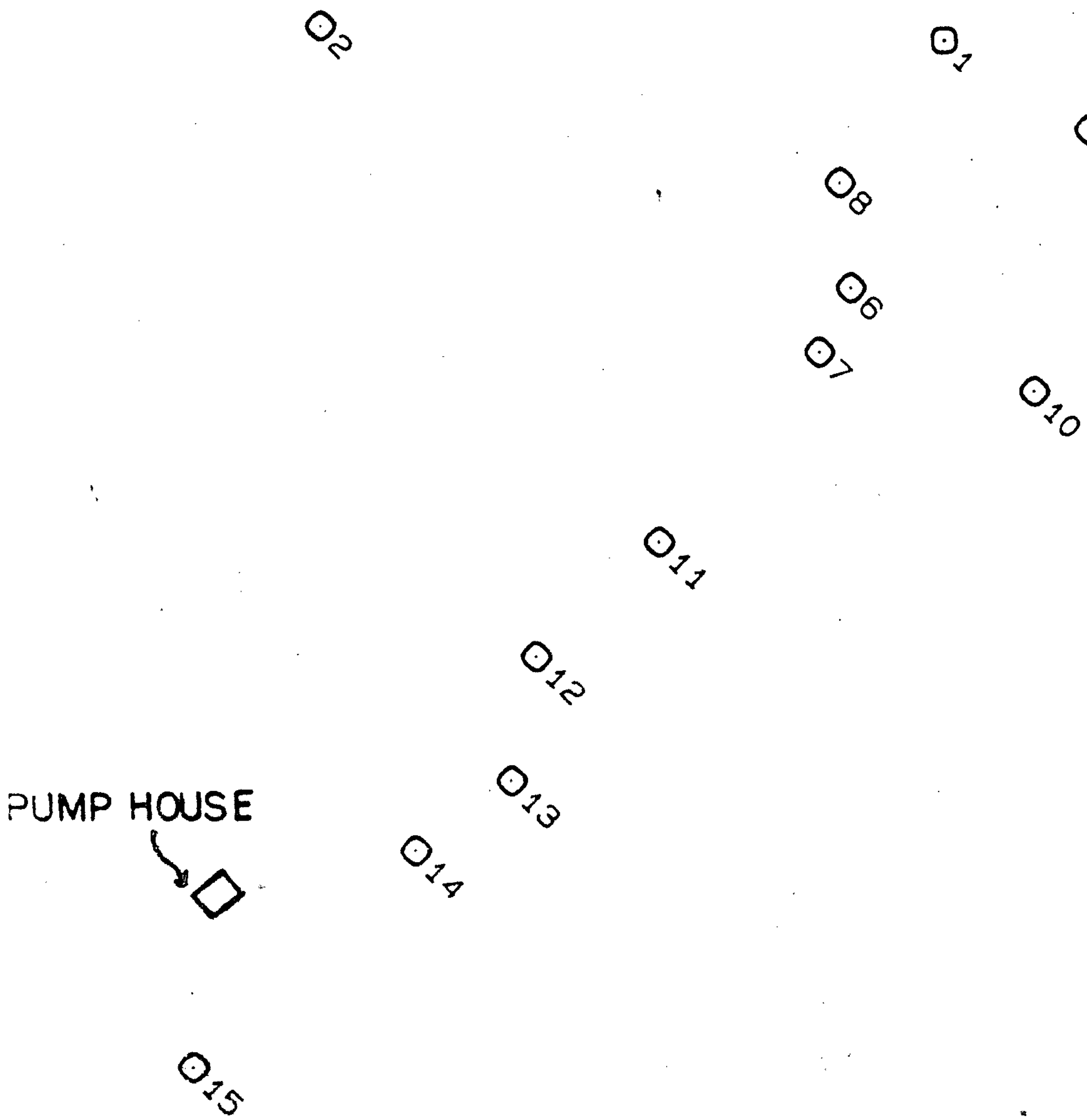
SHEET 1 OF 9

DATE	REVISION	BY

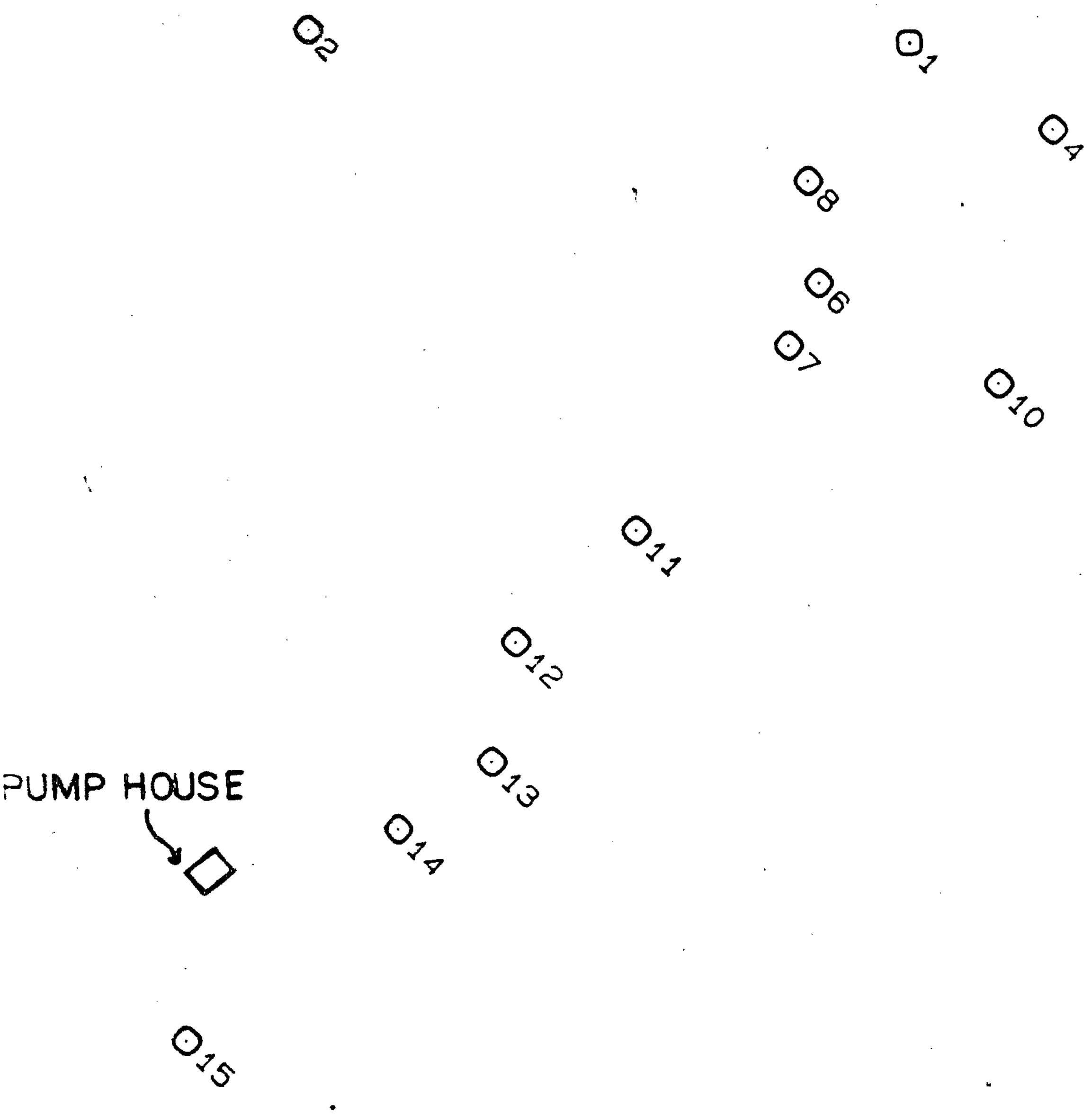
LAWRENCE A. BREWER & ASSOCIATES, INC.
Engineering · Architecture · Surveying

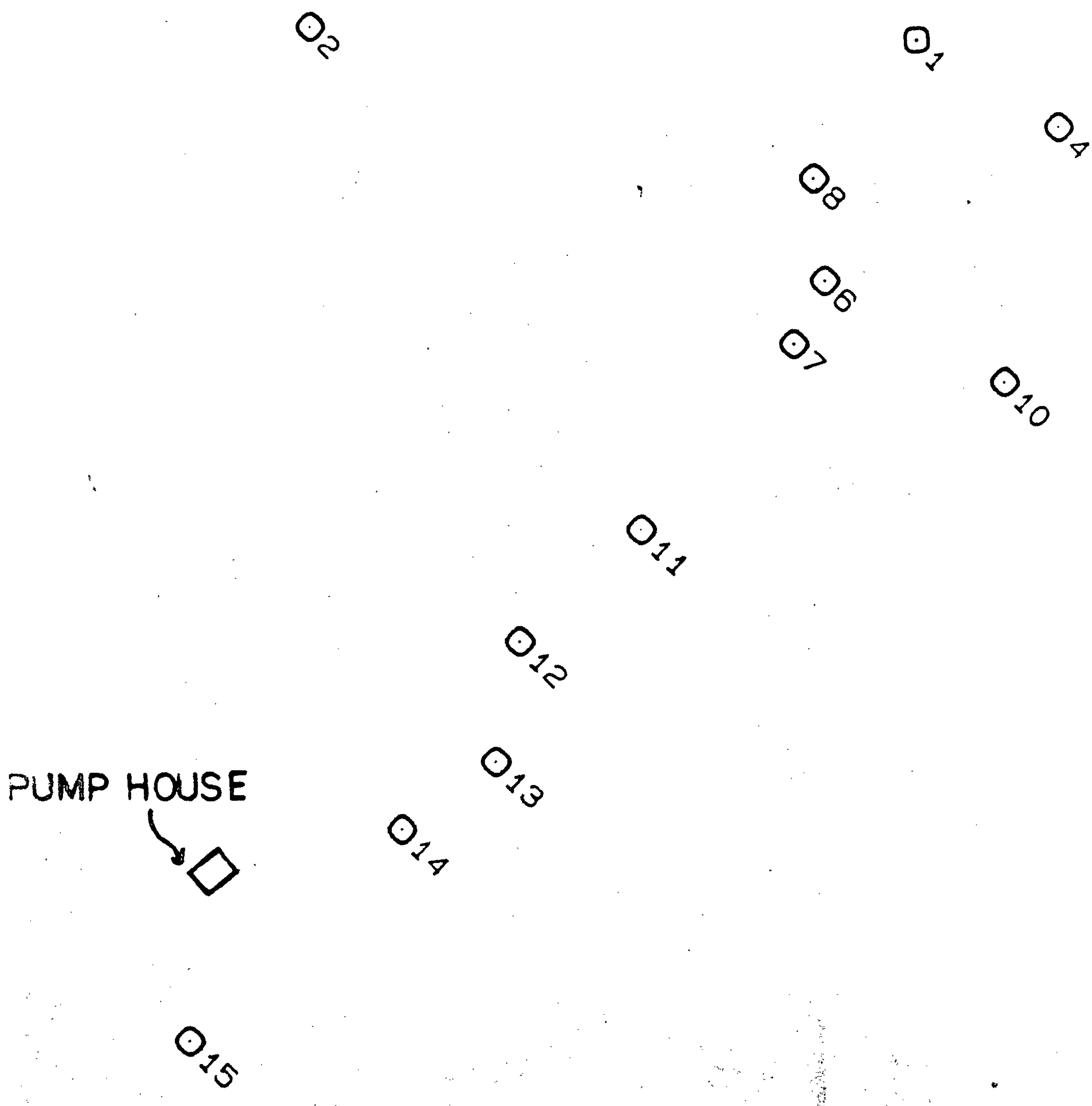
909 W. Apache · Farmington, New Mexico 87401
900 Main Avenue · Durango, Colorado 87301

DATE:

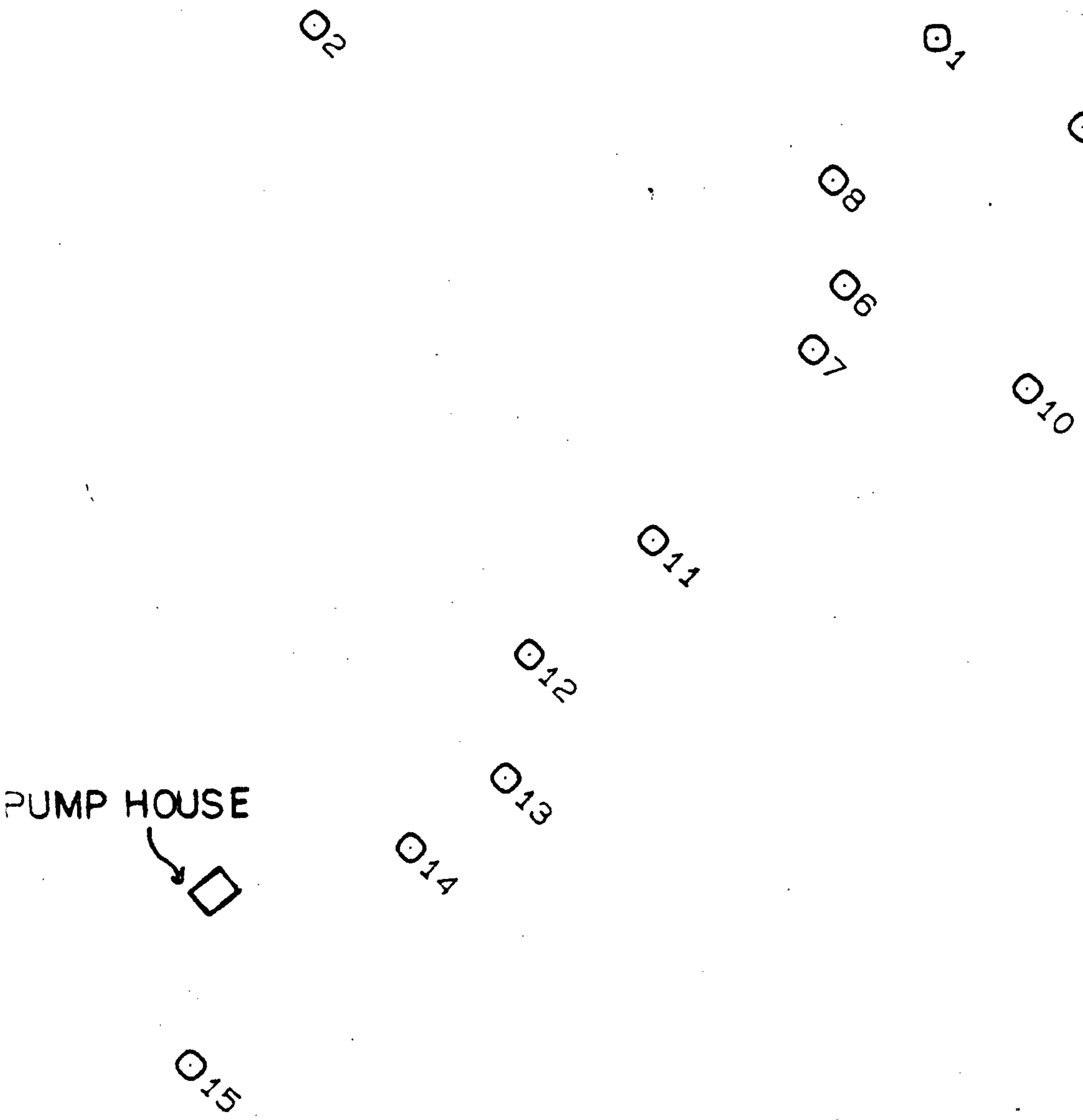


2
1
4
8
6
7
10
11
12
13
PUMP HOUSE
14
15

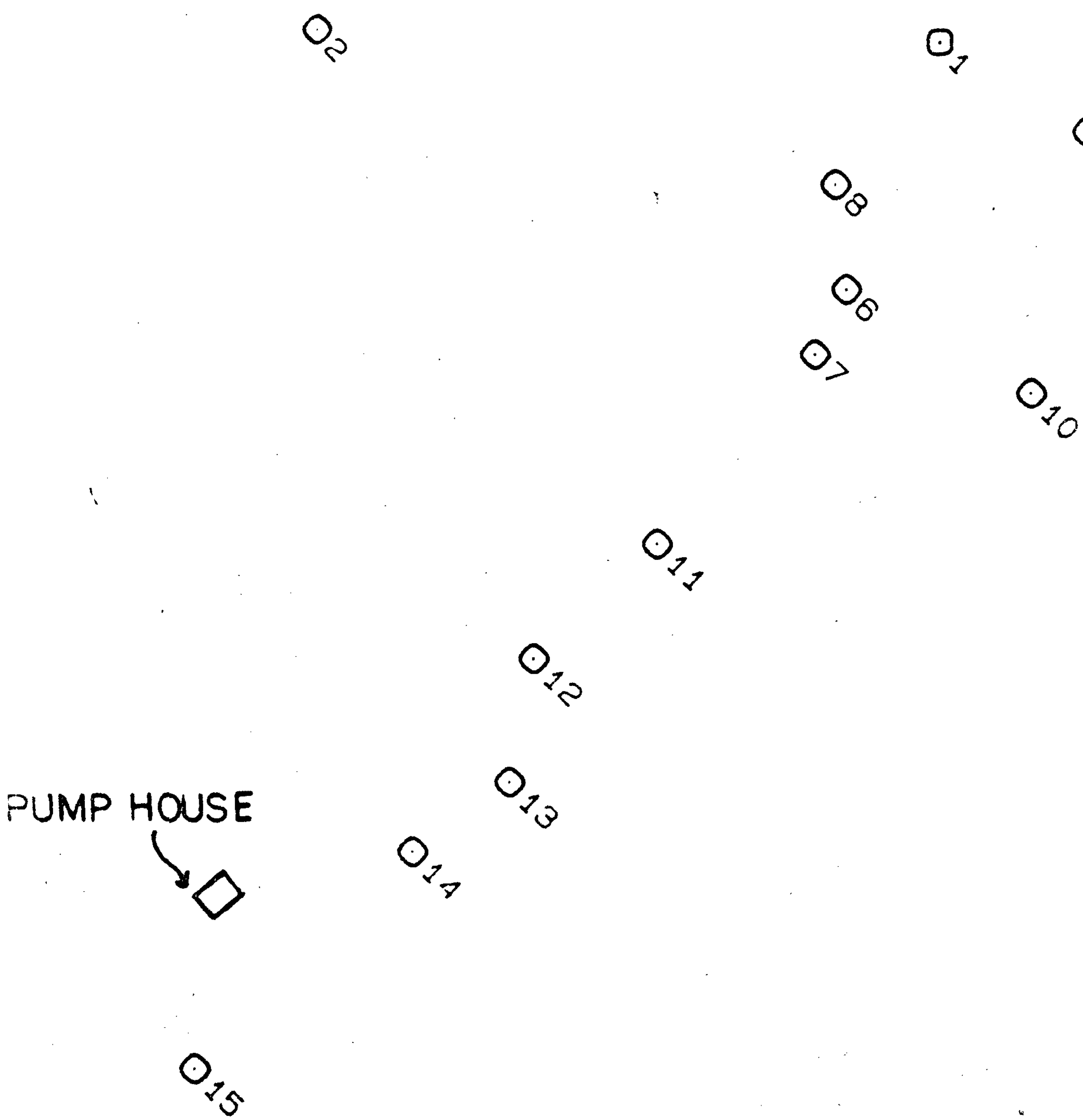

2
1
4
8
6
7
10
11
12
13
PUMP HOUSE
14
15

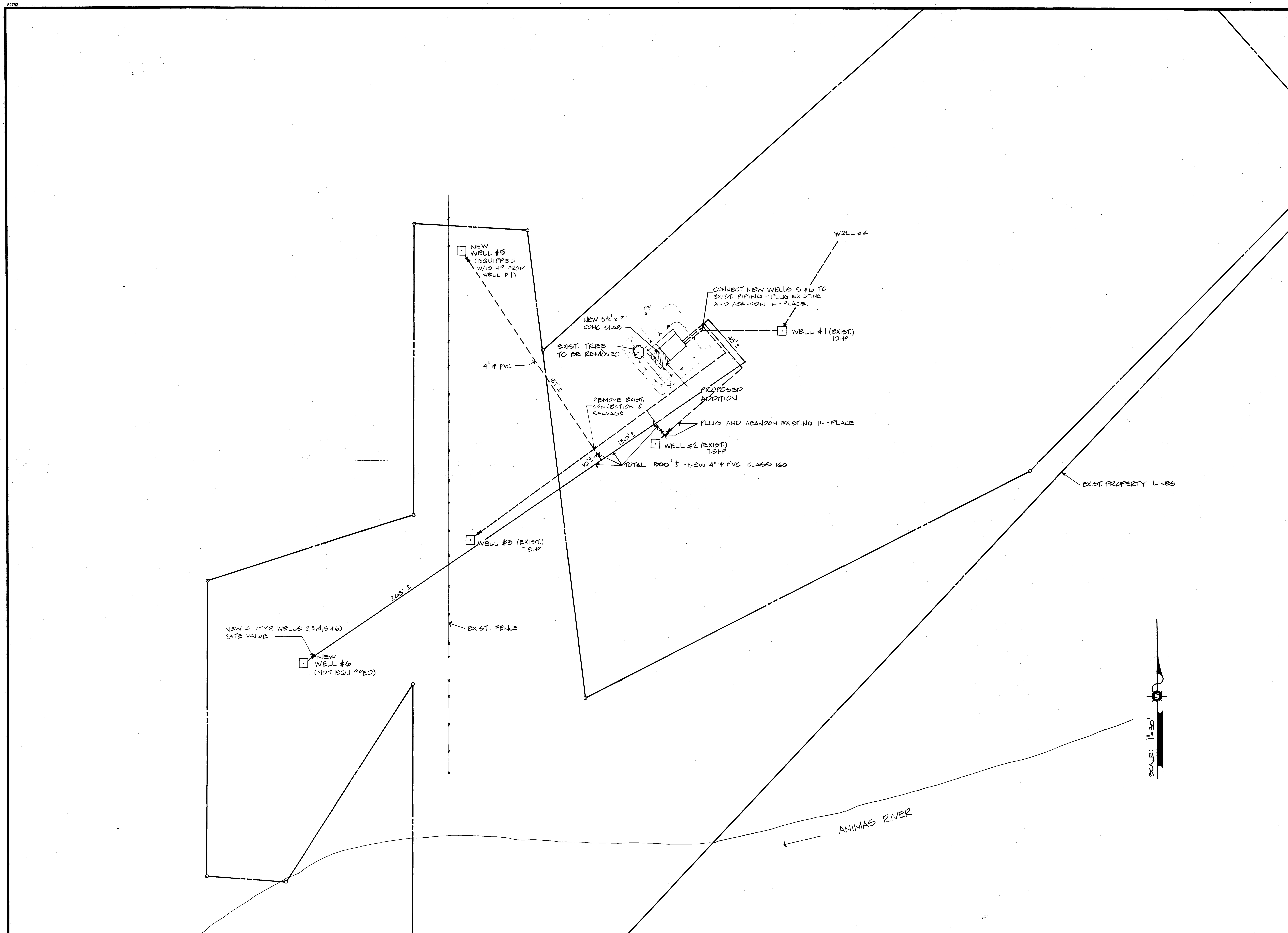


2
1
4
8
6
7
10
11
12
13
PUMP HOUSE
14
15



2
1
4
8
6
7
10
11
12
13
PUMP HOUSE
14
15


PUMP HOUSE



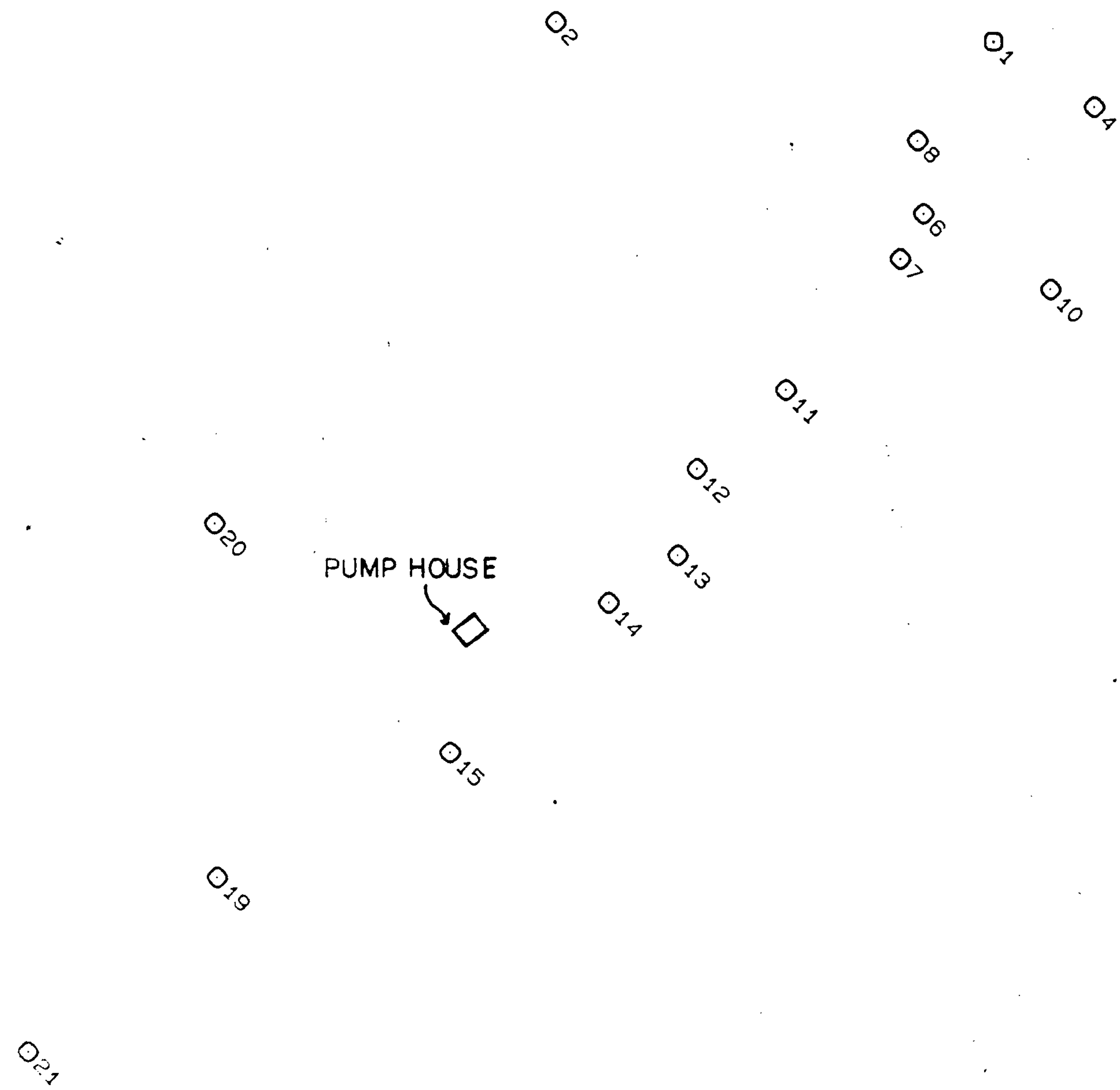
DATE	REVISION	BY
7/18/85	WELL #5 (REVISION/DELETED CHAINLINK FENCE	RAE

LAWRENCE A. BREWER & ASSOCIATES, INC.
Engineering · Architecture · Surveying
909 W. Apache Farmington, New Mexico 87401
900 Main Avenue Durango, Colorado 87301

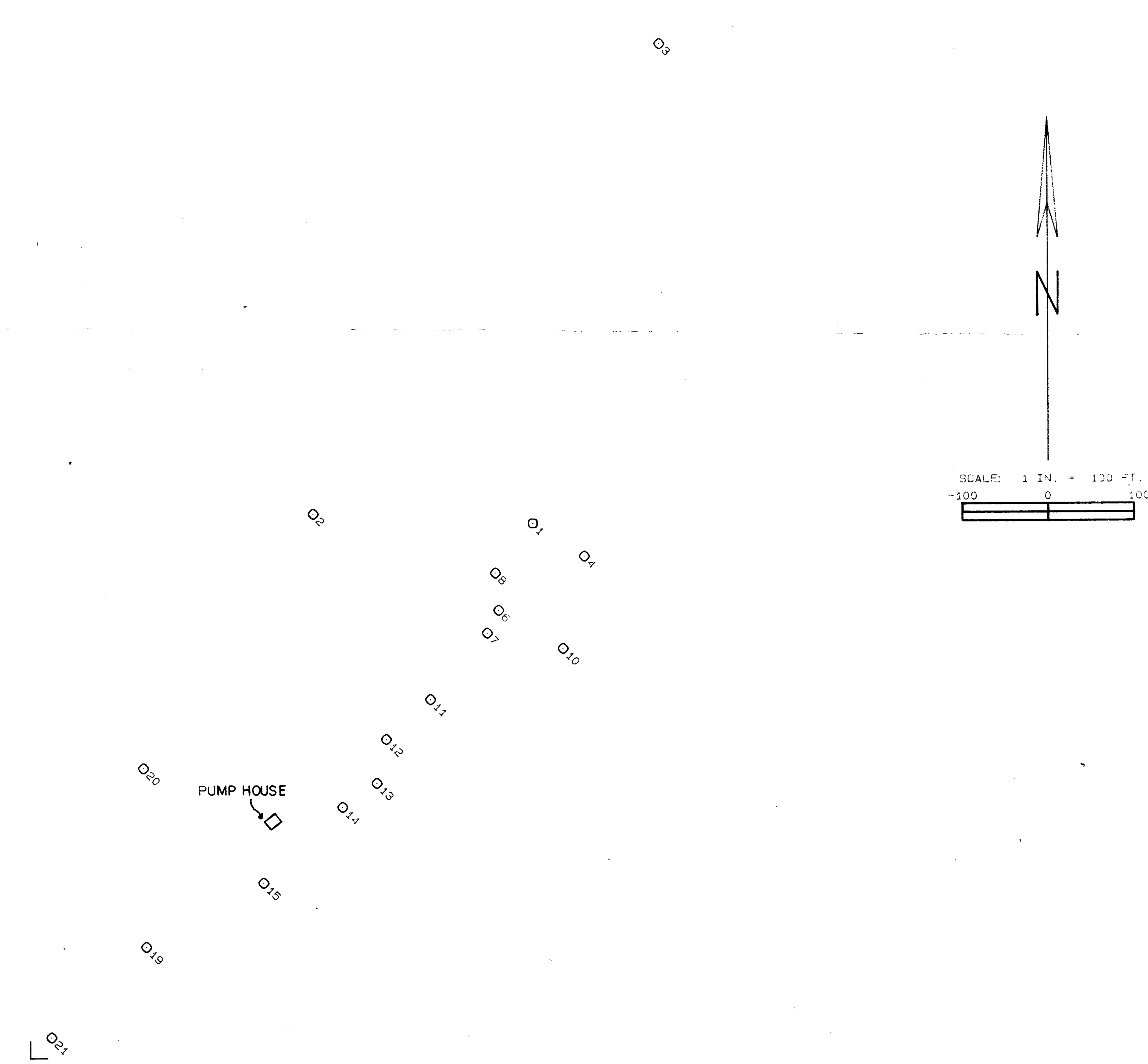
SITE PLAN

FLORA VISTA PUMP STATION ADDITION
FLORA VISTA WATER USERS ASSOCIATION
FLORA VISTA, NEW MEXICO

DATE: 4/20/85
DRAWN BY: AT
PROJ. NO. F-330
SCALE: 1"=30'
SHEET 1 OF 3


2
1
4
8
6
7
10
11
12
20
PUMP HOUSE
13
14
15
19
21

FLORA VISTA WELL AND TEST WELLS LOCATIONS



RUN BY: JDW 9/13/85
JOB: FLORA VISTA WELL'S TEST LOCATION — DISK-SURVEY #2

POINT	NORTH	EAST	ELEV.	
1	10000	10000		FD. REBAR
2	10010.7201674	9744.2245555		FD. REBAR
3	10558.0800542	10148.890608	106.37	WELL
4	9961.833901	10059.8338515	100.18	TEST WELL 5
5	9939.4073038	10083.6995464		
6	9898.6519976	9959.7176712	100.48	WELL
7	9872.0911083	9946.3881401	99.74	OLD WELL
8	9942.1493784	9956.135828	101.90	TEST WELL 3
9	9738.7881714	9774.5036874		
10	9854.2064626	10034.8727437	98.51	TEST WELL 4
11	9794.6137317	9879.9361151	100.61	TEST WELL 1
12	9748.1732121	9828.3824133	100.46	TEST WELL 2
13	9697.0633913	9817.2577553	100.29	WELL
14	9669.1202509	9777.1979868	99.45	WELL
15	9580.6995465	[illegible].1565287	98.42	WELL
16	9653.0379898	9706.7613464	100.88	PUMP HOUSE SLAB
17	9662.4853289	9698.7654782		
18	9606.4530754	9583.2667245		
19	9506.4186671	9549.2187282	97.07	WELL
20	9714.4714054	9546.2960701	99.15	WELL
21	9401.6061461	9438.5830708	96.95	WELL
22	9535.9786329	9542.4122932		
50	9180.7791972	12105.5650402		
	SET IRON ROD AT RIVER		92.40	

BM, 100', ON SLAB AT WELL 6

DATE	REVISION	BY

BREWER ASSOCIATES, INC.
ENGINEERS · ARCHITECTS · SURVEYORS
909 W. APACHE FARMINGTON, NEW MEXICO 87401
CLOVIS, NEW MEXICO DURANGO, COLORADO

FLORA VISTA WATER USERS
FLORA VISTA, NEW MEXICO

DATE: 9/13/85
DRAWN BY: J.D.W
PROJ. F-331
SCALE: 1"=100'
SHEET Revised
OF 11/8/85

Manana Gas, Inc.
P.O. BOX 36990
ALBUQUERQUE, NEW MEXICO 87176

ED HARTMAN, PRES.

TELE: (505) 884-4863
(505) ~~884-0814~~

December 7, 1985

New Mexico Conservation Division
1000 Rio Brazos Rd.
Aztec, N.M. 87410

Oil Conservation Division
P.O. Box 2088
Santa Fe, N.M. 87501

Gentlemen:

Enclosed are the following Produced Water Pit Registration forms:

Name of Well	Location
Sullivan # 1	J-25-29N-11W
Aunt Maggie # 1	I-25-29N-11W
Aunt Maggie # 3	J-25-29N-11W
Phyllis Hartman # 1	N-24-29N-11W
Betty Hartman # 1	P-14-30N-12W
Annie B # 1	N-13-30N-12W
Charlie # 1	I-7-30N-11W
Bobbie Herrera # 1 (P.C.)	K-4-30N-11W
Bobbie Herrera # 1 (Fruit)	K-4-30N-11W
Mary Ackroyd # 1	J-18-30N-11W
Mary Ackroyd # 2	J-18-30N-11W
Finch # 1	A-22-29N-11W
Clarence # 1	C-24-29N-11W
Gale # 1-R	M-13-29N-11W
Mary Wheeler # 1	D-23-30N-12W
Mary Wheeler # 1-E	M-23-30N-~~11W~~ 12W
Gigi # 1	M-24-29N-11W

Please advise if you need any further information in this matter.

Very truly yours

Ed Hartman

Ed Hartman
EMH/nh
Encl.

DEC 10 1985
OIL CON. DIV.
DIST. 3

STATE OF NEW MEXICO
Energy and Minerals Department

OIL CONSERVATION DIVISION
P. O. Box 2088
Santa Fe, New Mexico 87501
(505) 827-5800

AZTEC DISTRICT OFFICE
1000 Rio Brazos Road
Aztec, New Mexico 87410
(505) 334-6178

PRODUCED WATER
PIT REGISTRATION FORM
(Instructions on Back)

Owner/Operator: Manana Gas, Inc., P.O. Box 36990, Albuquerque, N.M. 87176
(List information only for pits operated by you at a lease or at other locations)

Well and Lease, or Facility Name: Mary Wheeler #1-E

Location: Unit M Sec. 23-30N-12W

(A) Pit	(B) Maximum Daily Discharge to Each Pit	(C) Pit Type	(D) Depth to Ground Water	(E) Sample of Discharge to Each Pit	
				TDS (in mg/l) or conductivity & temperature	Sample Date
Primary Pit/ Produced Water Pit	5 bpd*	Fiberglass Separator Pit 6 Deep 12 Diameter	7 ft. (est.)	37,050	9/25/85
Ancillary Pit(s)					

RECEIVED
DEC 10 1985
OIL CON. DIV.
DIST. 3

* phonecall from Ed Hartman, pres. 12/30/85 RGB
Est. by Trucker Volume.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☒ Telephone ☐ Personal

Time 9:20AM

Date 12/30/85

Originating Party	Other Parties
Mañana Gas - Ed Hartman - 884-4863	Dave Boyer OCD

Subject Mary Wheeler 1E - Discharge volume

Discussion The pit registration form for the above well had no volume listed. Hartman says was 5bbl/day based on pumper volumes (same as Mary Wheeler #1). In any event, says doesn't matter since have tank in now. Second tank - First "floated" + cracked + leaked. Now don't pump dry - leave fluid ~~[illegible]~~ in for weight. First tank replaced within 30 days of first use.

Conclusions or Agreements

Distribution Flora Vista file
Pit ~~Tank~~ Registration file

Signed D G Boyer

BREWER
ASSOCIATES, INC.

ENGINEERS • ARCHITECTS • SURVEYORS

P. O. BOX 2079 • FARMINGTON, NM 87499 • (505) 327-3303
400 PILE ST., SUITE 300 • CLOVIS, NM 88101 • (505) 763-4255
DURANGO, COLORADO • (303) 247-5766

RECEIVED
NOV 14

November 8, 1985

Mr. Dave Boyer
State Of New Mexico
Oil Conservation Division
PO Box 2088
Santa Fe, New Mexico 87504

RE: FLORA VISTA WATER USERS ASSOCIATION
ELEVATIONS FOR TEST WELL MONITORS

Dear Mr. Boyer:

We are submitting herewith two (2) copies each of the elevations which we have taken to the nearest 1/100th of a foot for the above referenced project. In addition, we are also enclosing two (2) copies each of the area outlining that portion of the Crouch Mesa County Road Extension within the Lee Acres Landfill area.

Very truly yours,

BREWER ASSOCIATES, INCORPORATED

Robert A. Echols, Jr.

Robert A. Echols, Jr., P.E.
Engineering Division Director

RAE:rr F-331

Enclosures

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☒ Telephone ☐ Personal | Time 9:30 | Date 9/9/85

Originating Party	Other Parties
Dave Boyer - OCD Santa Fe	Charles Gholson - OCD Aztec

Subject Testing of Flora Vista Mañana Gas Well

Discussion Head Space Test for Flora Vista Monitor Well #5 shows 1256 ppm methane - Charlie previously examined Mañana records and found no drop in production; Bradenhead test also found no leaks - Charlie feels well has mechanical integrity. Location of monitor hole in swampy area (and in area of old reserve pit) may mean source is shallow anaerobic decomposition of organics.

Conclusions or Agreements

Distribution Flora Vista File

Signed D G Boyer

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

50 YEARS
1935 - 1985

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

M E M O R A N D U M

TO R. L. STAMETS, DIRECTOR OCD

FROM D. G. BOYER, GEOLOGIST, ENVIRONMENTAL BUREAU DGB

DATE AUGUST 26, 1985

SUBJECT: MEETING WITH RICHARD CHENEY (BREWER AND ASSOCIATES) AND BERT BARNES (PRESIDENT, FLORA VISTA WATER USERS ASSOCIATION).

On Friday, August 23, I met with Cheney and Barnes to discuss results of OCD's investigation of the Flora Vista water well contamination, and to give them some suggestions as to where I think future investigation emphasis ought to be placed.

I described to them the work we have already accomplished (monitoring wells installed, and multiple samples taken from them and on-line water system), and results of our analysis (trace levels of toluene at 13 and 5 ppb in two monitor wells between the contaminated and supply well and pumping wells, and toluene at 6 ppb in the contaminated well itself). The levels of toluene detected are far below both the existing WQCC standard (15,000 ppb) and the proposed lower standard (250 ppb). The results are the only 1985 resuts that show any contamination whatsoever in any of the monitoring sites, or the contaminated well. One sample, taken in August 1983, by a former OCD employee and analyzed by a laboratory no longer in business, showed "oil and grease" hydrocarbon contamination, and no trace of benzene or toluene contamination at the detection levels available (10 ppb). Until July, 1985 the out-of-service contaminated well had no sanitary cover and only a bucket with a rock covered the ten inch diameter well. Therefore, there is no assurance that the contamination we are seeing now was not introduced during the past 2 1/2 years that the pump has been removed from the well.

This fact would surely be brought out in any future litigation.

I told them the USGS was interested in looking at the site for an aquifier test if the nearby pumping wells do not cause too much interference. The wells will need to be surveyed, and water levels obtained before the USGS makes a decision. Surveying will be performed by Cheney's firm in the next few weeks under my direction. Cheney and I agreed that heavy pumping of the contaminated well for at least several days is needed to determine the current status of water quality, and whether any hydrocarbon contamination would be captured if the well was put back in service.

Both Cheney and Barnes were upset by the lack of OCD (and EID) action in 1983. They estimate that the Water Users Association has spent approximately $150,000 on new wells, land aquisitions, etc., and they are looking to recover damages from the responsible parties. They do have some evidence of their own indicating the source of the contamination (see Cheney letter of March 2, 1983, attached). Cheney talked about involving the State agencies (OCD/EID) in any lawsuit since it appears they did not perform their responsibilities in a timely manner. I told him I would have our attorney call their lawyer (Rick Lougee, 327-5281) in Farmington to discuss the issue. Cheney also mentioned possible legislation to require that all groundwater quality responsibilities be placed under one agency. My answer was that OCD/EID lines of authority are now better defined and that OCD agency response is now better. Though that may be the case now, Cheney said that the law may have to be modified to avoid future problems of this type.

As a result of this meeting, I plan to have Jeff Taylor call their attorney, and I intend to return to Farmington in the next several weeks to assist in well surveying, and continue development of the monitor wells (they still have sand and mud in some of them).

cc: Jeff Taylor

STATE OF NEW MEXICO

OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

[X] Telephone [ ] Personal	Time 10:30AM	Date 8/5/85

Originating Party	Other Parties
Dave Boyer OCD	BERT BARNES President Flora Vista Water Users Assoc

Subject: Notification of finding of contamination

Discussion: Barnes was called to notify him that we found trace levels of Toluene and xylenes in OCD monitor wells #1 & 2 and in the ~~##~~ unused municipal well #1, and that Phil and Jami will resample today. The monitor wells contaminated are between the previously contaminated well and the other supply wells used for the community supply. Barnes ~~col~~ gave me the name of their legal counsel and we briefly discussed the need for additional data before any such action is initiated

Conclusions or Agreements: Barnes asked that we not initiate press contacts - I agreed stating that notification has been limited to Charles Roybal (EMD) and Dennis McQuillan (EID). Barnes also stated that he will have Rep. Cheney call for technical details.

Distribution: Flora Vista File
~~Mike Stogner - Acting Director~~
Dick Stamets - Director
Jeff Taylor Legal Counsel

Signed: Dave Boyer

TONEY ANAYA
GOVERNOR

DENISE D. FORT
DIRECTOR

ENVIRONMENT department

STATE OF NEW MEXICO

ENVIRONMENTAL IMPROVEMENT DIVISION
DISTRICT I FIELD OFFICE/724 WEST ANIMAS
FARMINGTON, NEW MEXICO 87401
(505)327-9851

July 3, 1985

Mr. Bert Barnes, President
Flora Vista Water Users Association
P.O. Box 171
Flora Vista, New Mexico 87415

Dear Mr. Barnes:

On June 20, 1985 the annual environmental survey of the Flora Vista Water Supply System was conducted. The survey is attached for your review and file.

The system supplies water to approximately 1,600 consumers. Currently the system is purchasing water from the City of Aztec and is pumping water from 2 wells. The pump for the chlorination feed line is broken, therefore much of the water is not being disinfected. Since the chlorinator is not working, Well #3 is not being used because it has sulfur contamination and there is no chlorine to remove the sulfur. Two new wells are drilled and will be put in use when the pump house renovations are done.

Following is a list of deficiencies noted during the inspection:

- There is no schedule for preventative maintenance and no records are kept of the maintenance which has been done nor who is doing it. Most manufacturers provide information with their product for scheduling preventative maintenance. Based on the number of complaints this office receives about sediment in the water, it seems that your system has quite a number of problems that a regular maintenance schedule could help to cut down. Historically, many problems that plague water systems could have been avoided if the system had had a preventative maintenance program.

- There is no method of keeping track of the equipment in the system whether it is in use or in the spare parts inventory.

- There is no product information available should it be needed in case of an emergency.

- The pump house expansion is anticipated this summer. When done, the fan switch for the chlorination room should be located outside the pump house. A signal light indicating fan operation should also be provided outside the entrance.

- The garden hose attached to the pipes in the pump house needs a backflow prevention device on it.

- The New Mexico Occupational Health and Safety Bureau strongly recommends that 26° Baume (56%) ammonia be provided at the pump house to check for chlorine gas leaks. The ammonia solution must not be stored in the room with the chlorine cylinders. It is also recommended that a self-contained breathing apparatus or gas mask system with oxygen tanks be provided should a chlorine leak occur. However, a written contingency plan outlining the responsibilities of the System and the Flora Vista Fire Department, and agreed upon by both in the case of a leak or similar type emergency would be acceptable by the Division. Further information can be obtained from Sam Rogers, Technical Services Section, Occupational Health and Safety Bureau. To ensure that the needs of the system and its employees are met, I recommend that you utilize the Occupational Health and Safety Bureau's Onsite Consultation Services. A pamphlet explaining the service is enclosed.

I would like to thank Ray Penrod and Rex Rosenbaugh for their time and help during the survey. If I can be of any assistance, please contact me at 327-9851.

Sincerely,

Carol M Miller

Carol Miller,
Environmental Associate

Enclosure
CM:lm
cc:Water Supply Section
File

N/A - Not Applicable
N-Av - Not Available
Est. - Estimated

NM Health and Environment Department
Environmental Improvement Division

Community Water Supply, etc.

Inspection Form

Section A - GENERAL INFORMATION

Inspection Date: 06-20-85

WSS CODE:	WATER SUPPLY SYSTEM NAME	COUNTY:
100-24	Flora Vista Water Users	San Juan

System Address/LOCATION
P.O. Box 171, Flora Vista, NM 87415

OWNER:	OWNER ADDRESS (if different than above)	PHONE
Flora Vista Water Users Assoc.		334-6045

Population Served	# Connections	# Meters	Max. System Production GPD	Average System Production GPD
1600	580	580	Poten. ☐ Actual ☐	No Records Kept

System Source (check Approp. Boxes)
Distribution Only ☐ Well(s) ☒ # of Wells 2
Spring(s) ☐ Infiltration Gallery ☐ Surface ☐

Additional or Qualifying Information:

Aquadene - a phosphate chemical added to water to keep chlorine from reacting with iron and manganese and turning the water black.

Expand pump house late summer.

Booster pump - control panel out of room with pipes.

Will get sand filters on the lines coming into pump house feeding main line.

Two new wells with 10 hp motors have been drilled and will be put into use with expanded pump house.

Wells #1 & 2 are in use.

Well #3 is contaminated with H_2S - is off until chlorine begins again.

Old #4 contaminated with natural gas. #5 & 6 are drilled and ready to use when expansion complete.

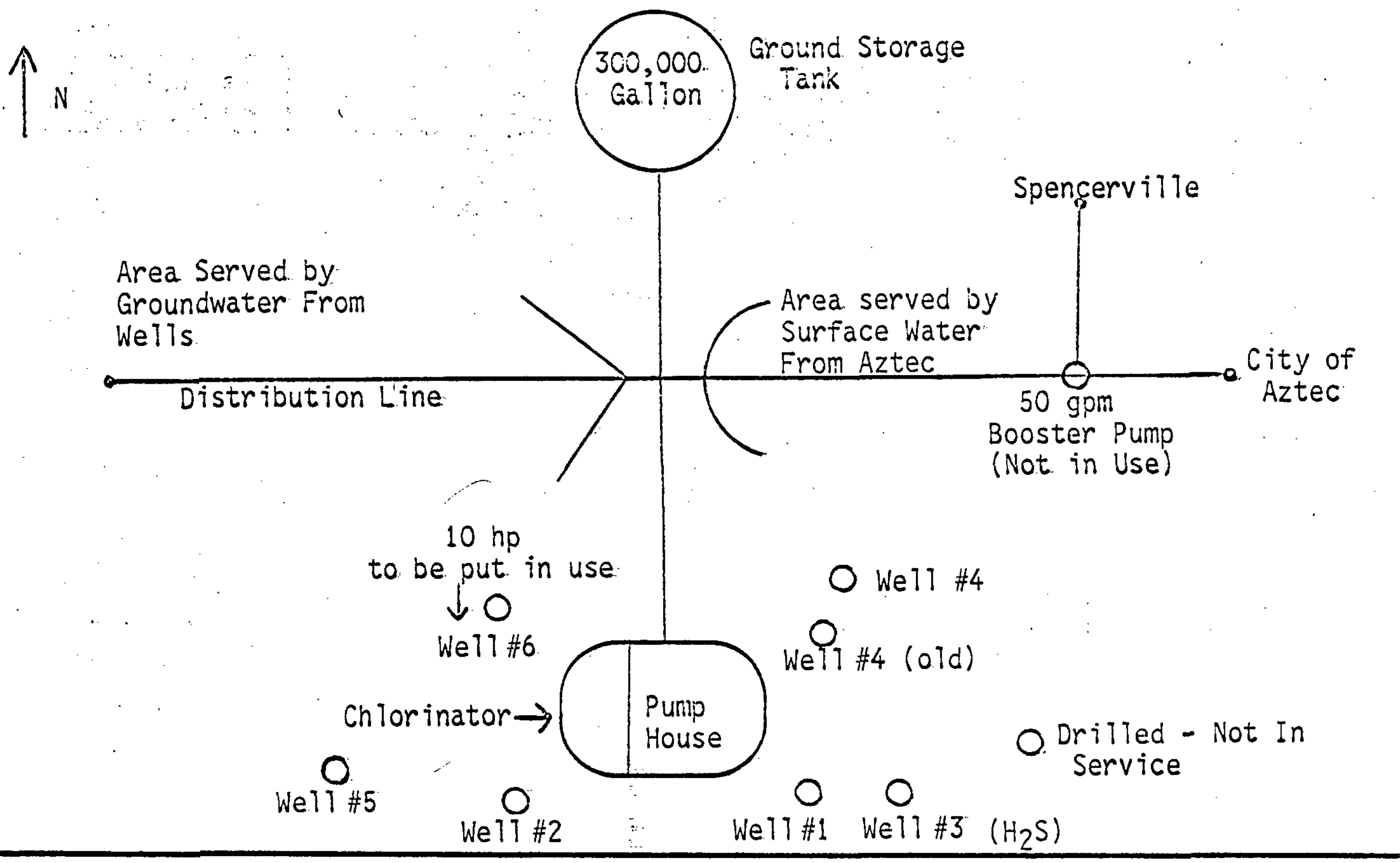
The pump house chlorination room needs a fan switch outside the pump house. Chlorine cylinders must be secured to wall at all times. Ammonia is needed to check for chlorine leaks & a working self-contained breathing apparatus.

System Personnel - Name/Classification	Level of Certification Required	Level of Certification Obtained
Ray Penrod	-0-	-0-
Rex Rosenbaugh - Assistant	-0-	-0-

Information furnished by:	Business Phone:
Ray Penrod / Manager	334-6045
Survey Performed by:	Business Phone:
Carol Miller and Len Murray	327-9851

Section A (Continued)

SIMPLIFIED FLOW DIAGRAM OR SCHEMATIC OF THE SYSTEM (INDICATE NORTH IF APPROPRIATE)



Section B - Source Information

WELL Identification	Well Depth	Pump Depth	Pump Capacity GPM	Well Drawdown feet	Pump Type	Static Water Level	Age of Pump	Date Well Drilled
Well #1	25'	18'	45	5'-6'	Submers.	≃ 8'	5 yrs.	1930
Well #2	25'	20½'	45	5'-6'	Submers.	≃ 8'	5 yrs.	1980
Well #3	26'	21'	90	10'	Submers.	≃ 8'	1 yr.	3/84
Well #4	25'	N/A	20	N/A	Submers.	≃ 8'	1 yr.	1984
Well #5	25'	20'	90		Submers.	≃ 8'	to be installed	1985
Well #6	25'	20'	90		Submers.	≃ 8'	"	1985
Old Well #4 (Gas Contaminated)	25'	21'	45	15'	Submers.	≃ 8'	2 yrs.	8/84

Source	Number (each)	Total Capacity	Remarks, Deficiencies, and Recommendations
Artesian Wells			
Springs			
Infiltration Galleries			

Section C - Gravity Storage and Pressure Tank Reservoirs

Gravity Storage Reservoir Indent.	Storage Capacity (gallons)	Date Built	Exterior Condition	Tank Material	Cathodic Protection	Tank Openings Secured	Overflow Screened	Vent Screen
#1	300,000	1979	Good	Steel	No	Yes	No	yes

Pressure Tank I.D.	Volume (gallons)	Age	Exterior Condition	Additional Information

Remarks, Deficiencies or Recommendations

Section D - WATER DISTRIBUTION

Booster Pump Stations	Total Number of Stations 1	Remarks, Deficiencies or Recommendations. 50 gpm in-line centrifugal pump Not in Use
Type of Disinfection Facilities	Chlorine Gas	Remarks, etc. Gas chlorination provided at wells. Purchased water disinfected at Aztec.
System Pressure	Max. 90 psi Min. 55 psi	Remarks, etc. There may be pressure problems in summer due to limits on the amount of water purchased from Aztec.
Pipe Materials in system	PVC [X] STEEL [ ] C.I. [ ] Other [X] (Cement Asbestos)	Deficiencies (including cross-connections observed) Garden hose on lines in pump house needs a vacuum breaker to prevent back flow contamination.
Type of Distribution System	Gravity [X]	Pressure [X] when wells are in use Both [ ]

Contaminant	Next Sample Date	Sample Frequency	Remarks
Microbiological	X	2	
Turbidity	X	N/A	
Organics		N/A	
Inorganic	7/87	3 yrs.	
Radiological	3/86	4 yrs.	
Secondary			

Section E - GENERAL OPERATION AND MAINTENANCE (O & M)

Does the system keep up to date O&M records?	Yes [ ]	No [X]
Are preventative maintenance activities routinely practiced?	Yes [ ]	No [X]
The importance of Cross Connection Control was discussed with the Operator. Indicate observed cross connections above (Pipe Materials in System)	Yes [ ]	No [X]

Section F - SURFACE WATER SUPPLY INFORMATION

Source (check one)	Remarks or Deficiencies N/A
Lake ☐	
Stream ☐	

Section G - WATER TREATMENT PLANT INFORMATION

Unit Operations	Remarks or Deficiencies
Plant Intake Structure	
Plant Location (Siting)	
Pretreatment, Raw Water Storage or Presettling Reservoirs	
Coagulation - Sedimentation	
Chemical Addition	
Filtration	
Other Treatment (Ion Exchange, Softening, Reverse Osmosis, etc.)	N/A

Additional Comments or Remarks

KELLAHIN and KELLAHIN
Attorneys at Law
El Patio - 117 North Guadalupe
Post Office Box 2265
Santa Fe, New Mexico 87504-2265

Jason Kellahin
W. Thomas Kellahin
Karen Aubrey

Telephone 982-4285
Area Code 505

May 2, 1985

Jeff Taylor, Esq.
Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87504

"Hand Delivered"

Re: NMOCC Case 8224

Dear Mr. Taylor:

On behalf of Tenneco Oil Company, I am requesting that the OCD Staff provide to us the following post hearing documents concerning its ground water study of the Flora Vista site:

1. All field notes and data;

2. Schematic of site, with all monitoring wells or pit locations, including the direction of gradient and survey points;

3. All chemical analysis reports from all laboratories and for any and all samples taken;

4. Copies of all correspondence, documents, notes, and data concerning the Flora Vista site, including but not limited to, the Manana Mary Wheeler No. 1 well from the date of first reported contamination, and of any Flora Vista well.

Very truly yours,

Original signed by
W. THOMAS KELLAHIN

W. Thomas Kellahin

WTK:ca

cc: Mr. Richard L. Stamets
Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87504

cc: Jennifer Pruitt, Esq.
Environmental Improvement Division
P. O. Box 968
Santa Fe, New Mexico 87501

William F. Carr, Esq.
Attorney at Law
P. O. Box 2208
Santa Fe, New Mexico 87501

Perry Pearce, Esq.
Montgomery Law Firm
P. O. Box 2307
Santa Fe, New Mexico 87501

Millard F. Carr, Esq.
Tenneco Oil Company
P. O. Box 3249
Englewood, Colorado 80155

Mr. Marty Buys
Tenneco Oil Company
P. O. Box 3249
Englewood, Colorado 80155

2/28/85
Flora Vista - Visit w/
Dick Thurstonson (VP WUA)
At time of contamination had 2 wells, have now drilled 4 more. Total of 5 available, only
3 of 4 currently tied in.
Contamination first noticed March-April 1983, sampled Aug. 1983.

Large scale map available?

Depth to water about 4 ft on average, total well depth 20-23'

Screened interval?

Talk to Dick Cheney about technical details +
600 meters (connections)
Get water use info from Gus
5-6 mg/month

Site SW1/4, SW1/4 Sec 23 T30N, R12W
Visit to site:
At oil well, have new production separator, new fiberglass tank on slab, dehydrator has 55 gal drum 3/4 full (Fiberglass tank 2/3 full)
oil tank has poorly seamed joints, no epoxy over seam, hole in bottom with pipe through it

Thurstonson says 2 years ago, EPNG went out ~~drilled~~ dug pits and found oil around dehydrator (he knows of no cleanup by them)

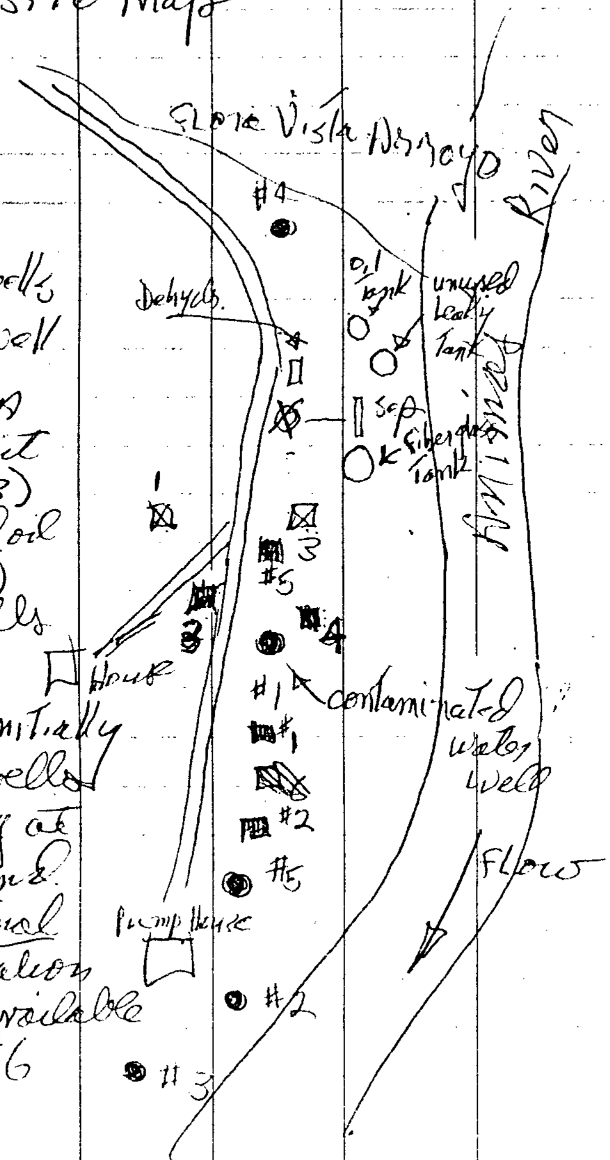
Said WUA dug several (at least 3 pits) and found oil in two (see map). Contaminated well is directly down the presumed hydraulic gradient from the gas well.

Site Map

N.

- water wells
- Gas well
- WL4A dug pit (1983) (#2 & 3 had oil in 1983)
- Mon wells (3/20/85

Suggest initially install wells in pits dug at 2, 5 & 6 and dig additional as information becomes available from 2, 5 & 6



For Flora Vista Trip

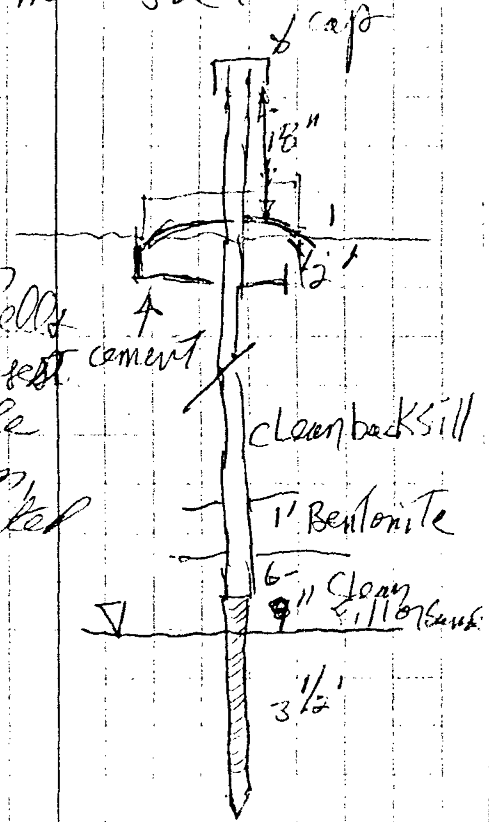
well# 6 goes in first
then 2, 5, 3

other wells as necessary
cleanback fill of sand
1 1/2 ft cement

For sampling
Wide Mouth Bottles w/ caps (Purchase)
Alum foil (")
40 ml vials, culutainers (chain of custody)
Bailers
Wheel barrel (Mine)
Shovel (Mine)
Gas filter etc.

Q. For Cheney - W.T. fluctuation
surveying equip
Pump for contam well
will shoot elevations
after cemented.

Samples from
monitor wells
from next closest
well, sample
from system,
contaminated
well.



3/19/85 Meeting @
Richard P. Cheney
Brewer & Assoc.

Contaminated well was
26' deep, 12' screen
on bottom, DTW ~5'

2 wells at the contaminated
site (one abandoned
~~two~~ after initial exploration)

Well #1 75gpm drawdown 12'
Well #2 100gpm
Wells #3, 5, 6 ~100gpm
Well #4 25gpm

Actual pumping ~75gpm

99
67

32

3/20/85

On site 8AM, Backhoe
arrived 8:35AM

EPNG Representative
Greg. Kardos

Mon Well #1 0910AM

0-18 in Soil-Loamy sand
18-67 in coarse sand
& gravel, cobbles &
rock several inches in
diameter

9:17 First water 67 in,
water has oily sheen

0930 - Depth beneath
water about 1.5'
Sample taken for organics
Sample had slight unidentified odor

Screen interval 48"
Total Screen Segment 55.5"
8'3" TD below land surface
Backfilled with clean sand, gravel & then material removed from well, no bentonite since hole way too long

Pipe section 10' long
Above ground before cut 70", after cut 19".
(51" cut off of 10' pipe)

Mon well #2 began 10:13
cleaned backhoe

First water 77"
oily sheen
(backhoe leaking hydraulic fluid at bucket
0 - 2' Soil - Sandy
20 - 83" River Rock

Sample taken at completion of hole, 1030 AM, org. only

No ~~oddy~~ odor in water
No odor on dug dirt pile
83" to water
~98" Total depth

122" pipe, 177" Total
cut off 48.25"

Mon Well #3 began 11:45
Cleaned backhoe

20" sand before cobble

First water at 76" - oily sheen
0 - 20" Soil - sandy
20 - 76" River Rock -

123" pipe 178" total
cut off 53½" from pipe end.
Depth to Grout 96"

#3 Not backfilled
w/ clean sand
(screen too coarse

Sample at 1205 pm
For organics, taken
at completion of
hole, depth to water 96"

No odor on dug dirt pile
No odor in sample

completed back fill
12:30 pm

Org. sample from contaminated
water supply well
F.V.S. Well #1 1310 pm
Sample taken about
4 minutes after began pump
Discharge rate 2 gts
in 21.87 sec

Mon. Well #4 Started 1330

0 - 10" Topsoil
10" - 30" Sand, gravel, cobbles

First Water at 38"
Pit caving in. Took samples
as pit was caving in. Vials
contained 3 mg Sodium Thio
sulfate (1400 Samples for org.)
~~Pipe~~ To top of pipe 55 + 28 1/2"

#5
0 - 39.5 Soil, sand & gravel
Black oily layer 39.5 - 49.5"
Water standing at 54"

Water sample at 2:30, 65" deep
(1430)

Soil sample at ~~[illegible]~~ 1435
Backfilled quickly due caving.
Pipe cut at 81.0

Complete Sample from
Flora Vista Water
Supply Well #1
Samples from Gas pump out of open well
8503201538
org, C/A, HM, N
Temp 12.5°C
Cond. 600 μmhos,

Sample from
Flora Vista
Water Supply #~~##~~ 5 RB

8503201555
(#5 well is well btn #1 and Pump House)
Sample from Spigot
inside pump house
(other wells off-line
Well running 15 min.
alone)

Temp ~~###~~ 11°C
cond 610 μmhos

Composite Sample ~~#3 & #5 wells~~
#2 & 3 wells,

8503201626
~~####~~ 11°C, 670 μmhos
Sample for organics,
C/A, HM, N

Temp 10°C
cond 345 μmhos,
Animas River water
8503201635

STATE OF NEW MEXICO

SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE, Albuquerque, New Mexico 8
(505) 841-2500

8 0652 C

ENVIRONMENT AUG 19 1985

OIL CONSERVATION DIVISION

REPORT TO: DAVID G. BOYER
NEW MEXICO OIL CONSERVATION DIV
P.O. BOX 2088
SANTA FE, NM 87501

S.L.D. No.: OR- 652-A,B
DATE REC.: 7/03/85
PHONE 827-5812
USER CODE: 8 2 2 3 5

CONTAINERS WHICH ACCOMPANY THIS FORM ARE COLLECTIVELY REFERED TO AS SAMPLE.

SUBMITTER: NM OIL CONSERVATION — CODE

LOCATION: FLORA VISTA — CODE (TOWNSHIP, RANGE, SECTION, TRACTS)

SOURCE: MON. WELL 1 — CODE (AQUIFER, DEPTH)

COLLECTED: 6/28/85 BY EARP/BAILEY — CODE 8 5 0 6 2 8 1 0 3 5 EB (Y Y M M D D H H M M I I)

SAMPLE TYPE: WATER SOIL OTHER — CODE

NEAREST CITY: FLORA VISTA — CODE

pH=______; Conductivity=______umho/cm at ______ $^{\circ}C$; Chlorine Risidual=______

Dissolved Oxygen=______mg/l; Alkalinity=______; Flow Rate=______

Sampling Location, Methods and Remarks (i.e. odors, etc.)

BAILED MONITOR WELL

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. D. Bailey

Method of shipment to the Laboratory Hand carried

This form accompanies 2 Septum Vials, ___Glass Jugs, ___ ______

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature.

P-Ice Sample stored in an ice bath (not frozen).

P-$Na_2S_2O_3$: Sample preserved with $Na_2S_2O_3$ to remove chlorine residual.

I (we) certify that this sample was transferred from ______
to ______ at (location) ______ on
(date & time) ______ and that the statements in this block are correct
Evidentiary Seals: Not Sealed Intact: Yes No
Signatures ______ ______

(we) certify that this sample was transferred from ______
to ______ at (location) ______ on
(date & time) ______ and that the statements in this block are correct
Evidentiary Seals: Not Sealed Intact: Yes No
Signatures ______ ______

ANALYSES REQUESTED LAB. No.: ORG- 652

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
X	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
X	X	HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
halogenated purge	none detected		
benzene	N.D.*		
toluene	13		
ethylbenzene	N.D.		
p-xylene	N.D.		
m-xylene	N.D.		
o-xylene	1		
		* DETECTION LIMIT	

REMARKS: ~~Trace unsaturated hydrocarbons also detected at 5 ppb.~~ One large peak that may be acetone was also detected.

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes __ NO ✓. Seal(s) broken by: ________ date: ______

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 9 July 85. Analyst's signature: R. Timmer

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: K. Meyerhen

REPORT TO: David G. Boyer
New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, NM 8750[illegible] 85-0266 C

LABORATORY DRG 266 A+B
LAB NUMBER 3-22-85
[redacted]
SLD Users Code No. 82235

ALL CONTAINERS WHICH THIS FORM ACCOMPANIES ARE COLLECTIVELY REFERRED TO AS "SAMPLE".

CERTIFICATE OF FIELD PERSONNEL

Sample Type: Water ☒ Soil ☐ Other ______

Water Supply and/or Code No. Flora Vista Mon. Well #1 (Municipal system)

City & County Flora Vista San Juan

Collected (date & time) 0930, 3/20/85 By (name) Boyer/Baca

pH= — ; Conductivity= — umho/cm at — °C; Chlorine Residual= ______

Dissolved Oxygen= — mg/l; Alkalinity= — ; Flow Rate= —

Sampling Location, Methods & Remarks (i.e. odors etc.)

Sample from pit dug prior to Mon Well Intallation, sample had unidentified odor. Backhoe digging pit had hydraulic fluid leak

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Signed David G Boyer

I certify that I witnessed these field analyses, observations and activities and concur with the statements in this block. Signed Philip L. Baca

Method of Shipment to Laboratory Hand Carried

THIS FORM ACCOMPANIES 2 septum vials with teflon-lined discs identified as:
specimen X ; duplicate X ; triplicate ______; blank(s) ______,
and ______ amber glass jug(s) with teflon-lined cap(s) identified as ______,
and ______ other container(s) (describe) ______ identified as ______.

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature (~20°C).

P-ICE: Sample stored in an ice bath.

P-$Na_2O_3S_2$: Sample preserved with 3 mg $Na_2O_3S_2$/40 ml and stored at room temperature.

CERTIFICATE(S) OF SAMPLE RECEIPT

I (we) certify that this sample was transferred from ______ to ______ at (location) ______ on (date & time) ______ and that the statements in this block are correct.

Disposition of Sample ______. Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ______ ______

I (we) certify that this sample was transferred from ______ to ______ at (location) ______ on (date & time) ______ and that the statements in this block are correct.

Disposition of Sample ______. Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ______ ______

ANALYSES REQUESTED   LAB. No.: ORG- 266

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
X	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
		HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS
		Benzene etc.			

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
aromatic purgeables	none detected		
halogenated purgeables	"		
		* DETECTION LIMIT	1 ug/l

REMARKS: No purgeables detected.*

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:__________ date:______

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 3-25-85. Analyst's signature: [signature]

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: R Meyerhoff

STATE OF NEW MEXICO

85-0653-C

SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE, Albuquerque, New Mexico 87106
(505) 841-2500

RECEIVED AUG 19 1985 OIL CONSERVATION DIVISION SANTA FE

ENVIRONMENT

REPORT TO: DAVID G. BOYER
NEW MEXICO OIL CONSERVATION DIV
P.O. BOX 2088
SANTA FE, NM 87501

S.L.D. No.: OR-653-A-B
DATE REC.: 7/05/85
PHONE 827-5812
USER CODE: 8 2 2 3 5

CONTAINERS WHICH ACCOMPANY THIS FORM ARE COLLECTIVELY REFERED TO AS SAMPLE.

SUBMITTER: NM OIL CONSERVATION DIV CODE

LOCATION: FLORA VISTA CODE (TOWNSHIP RANGE SECTION TRACTS)

SOURCE: MON. WELL 2 CODE (AQUIFER DEPTH)

COLLECTED: 6/28/85 BY EARP/BAILEY CODE 8 5 0 6 2 8 / 0 / 0 [illegible] (Y Y M M D D H H M M I I I)

SAMPLE TYPE: WATER SOIL OTHER CODE

NEAREST CITY: FLORA VISTA CODE

pH=____; Conductivity=____umho/cm at ____°C; Chlorine Risidual=____

Dissolved Oxygen=____mg/l; Alkalinity=____; Flow Rate=____

Sampling Location, Methods and Remarks (i.e. odors, etc.)
BAILED MONITOR WELL 2

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. J. Bailey

Method of shipment to the Laboratory Hand carried

This form accompanies 2 Septum Vials, ___Glass Jugs, ___ ____

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature.

P-Ice Sample stored in an ice bath (not frozen).

P-$Na_2S_2O_3$: Sample preserved with $Na_2S_2O_3$ to remove chlorine residual.

I (we) certify that this sample was transferred from ____
to ____ at (location) ____ on
(date & time) ____ and that the statements in this block are correct
Evidentiary Seals: Not Sealed Intact: Yes No
Signatures ____ ____

(we) certify that this sample was transferred from ____
to ____ at (location) ____ on
(date & time) ____ and that the statements in this block are correct
Evidentiary Seals: Not Sealed Intact: Yes No
Signatures ____ ____

ANALYSES REQUESTED LAB. No.: ORG- 653

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
X	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
X	X	HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
halogenated purge	none detected		
Benzene	N.D.		
Toluene	5		
Ethylbenzene	N.D.		
p-Xylene	N.D.		
m-Xylene	N.D.		
o-Xylene	trace <1ppb		
		* DETECTION LIMIT	1 ugm/l

REMARKS: ~~One [illegible]~~ One large peak was also detected that may be acetone

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes ___ NO X. Seal(s) broken by: ____________ date: ______

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 9 July 85. Analyst's signature: [signature]

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: [signature]

REPORT TO:

David G. Boye
New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, NM 8750

85-0267-C

LABORATORY ORG 267 A+B

LAB NUMBER 3-22-85

[redacted] Code No. 82235

ALL CONTAINERS WHICH THIS FORM ACCOMPANIES ARE COLLECTIVELY REFERRED TO AS "SAMPLE".

CERTIFICATE OF FIELD PERSONNEL

Sample Type: Water ☒ Soil ☐ Other ______

Water Supply and/or Code No. Flora Vista Municipal, Mon. Well #2

City & County Flora Vista, San Juan

Collected (date & time) 1030, 3/20/85 By (name) Boyer/Baca

pH= — ; Conductivity= ______ umho/cm at — °C; Chlorine Residual= —

Dissolved Oxygen= — mg/l; Alkalinity= — ; Flow Rate= —

Sampling Location, Methods & Remarks (i.e. odors etc.)

Sample from pit dug prior to mon well installation. No odors noted. Backhoe leaking hydraulic fluid

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Signed David G Boyer

I certify that I witnessed these field analyses, observations and activities and concur with the statements in this block. Signed Philip L. Baca

Method of Shipment to Laboratory Hand Carried.

THIS FORM ACCOMPANIES ____ septum vials with teflon-lined discs identified as:
specimen ✓ ; duplicate ✓ ; triplicate ______ ; blank(s) ______ ,
and ____ amber glass jug(s) with teflon-lined cap(s) identified as ______ ,
and ____ other container(s) (describe) ______ identified as ______ .

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature (~20°C).

P-ICE: Sample stored in an ice bath.

$P\text{-}Na_2O_3S_2$: Sample preserved with 3 mg $Na_2O_3S_2$/40 ml and stored at room temperature.

CERTIFICATE(S) OF SAMPLE RECEIPT

I (we) certify that this sample was transferred from ______ to ______ at (location) ______ on (date & time) ______ and that the statements in this block are correct.

Disposition of Sample ______ . Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ______ ______

I (we) certify that this sample was transferred from ______ to ______ at (location) ______ on (date & time) ______ and that the statements in this block are correct.

Disposition of Sample ______ . Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ______ ______

ANALYSES REQUESTED. LAB. No.: ORG- 267

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
X	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
		HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS
		Benzene etc			

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
aromatic purgeables	none detected		
halogenated purgeables	"		
		* DETECTION LIMIT	1 ug/l

REMARKS: No purgeables detected. *

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:______________ date:________

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 3-25-85. Analyst's signature: [signature]

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: K Meyerhen

85-0654-B

STATE OF NEW MEXICO

SCIENTIFIC LABORATORY DIVISION

700 Camino de Salud NE, Albuquerque, New Mexico 87106

(505) 841-2500

RECEIVED ... 19 1985 ... ENVIRONMENT

REPORT TO: DAVID G. BOYER
OIL CONSERVATION DIVISION
NEW MEXICO OIL CONSERVATION DIV
P.O. BOX 2088
SANTA FE, NM 87501

S.L.D. No.: OR- 654-A
DATE REC.: 7/5/85
PHONE 827-5812
USER CODE: 8 2 2 3 5

CONTAINERS WHICH ACCOMPANY THIS FORM ARE COLLECTIVELY REFERED TO AS SAMPLE.

SUBMITTER: NM OIL CONSERVATION DIV CODE

LOCATION: FLORA VISTA CODE (TOWNSHIP RANGE SECTION TRACTS)

SOURCE: MON. WELL 3 CODE (AQUIFER DEPTH)

COLLECTED: 6/28/85 BY EARP/BAILEY CODE 8 5 0 6 2 8 0 9 3 0 (Y Y M M D D H H M M I I)

SAMPLE TYPE: WATER SOIL OTHER CODE

NEAREST CITY: FLORA VISTA CODE

pH=____; Conductivity=____umho/cm at ____ °C; Chlorine Risidual=____

Dissolved Oxygen=____mg/l; Alkalinity=____; Flow Rate=____

Sampling Location, Methods and Remarks (i.e. odors, etc.)

BAILED MONITOR WELL

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities J. Bailey

Method of shipment to the Laboratory Hand Carried

This form accompanies 1 Septum Vials, ___Glass Jugs, ___

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature.

P-Ice Sample stored in an ice bath (not frozen).

P-$Na_2S_2O_3$: Sample preserved with $Na_2S_2O_3$ to remove chlorine residual.

I (we) certify that this sample was transferred from ____
to ____ at (location) ____ on
(date & time) ____ and that the statements in this block are correct
Evidentiary Seals: Not Sealed Intact: Yes No
Signatures ____ ____

(we) certify that this sample was transferred from ____
to ____ at (location) ____ on
(date & time) ____ and that the statements in this block are correct
Evidentiary Seals: Not Sealed Intact: Yes No
Signatures ____ ____

ANALYSES REQUESTED LAB. No.: ORG- 654

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
X	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
X	X	HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
halogenated purge	none detected		
benzene	N.D.*		
toluene	N.D.		
ethylbenzene	N.D.		
p-xylene	N.D.		
m-xylene	N.D.		
o-xylene	trace <1 ppb		
		* DETECTION LIMIT	1 μgm/l

REMARKS: All samples should be submitted in duplicate. Three other unsaturated hydrocarbons also detected one at ~1 ppb and two at <20 ppb.

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes ___ NO X. Seal(s) broken by: ______________ date: ________

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 7 July 85. Analyst's signature: [signature]

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: R. Meyerhein

REPORT TO: David G. Boy
New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, NM 87501

LABORATORY ORG 265 A+B

LAB NUMBER 85-0265 C [redacted]

3-22-85

SLD Users Code No. 82235

ALL CONTAINERS WHICH THIS FORM ACCOMPANIES ARE COLLECTIVELY REFERRED TO AS "SAMPLE".

CERTIFICATE OF FIELD PERSONNEL

Sample Type: Water ☒ Soil ☐ Other ______

Water Supply and/or Code No. Flora Vista Municipal, MonWell #3

City & County Flora Vista, San Juan

Collected (date & time) 1205 PM/3/20/85 By (name) Boyd/Baca

pH= —; Conductivity= — umho/cm at — °C; Chlorine Residual= —

Dissolved Oxygen= — mg/l; Alkalinity= — ; Flow Rate= —

Sampling Location, Methods & Remarks (i.e. odors etc.)

Sample from Pit dug prior to mon. well installation
No odors noted. Backhoe leaking hydraulic fluid

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Signed David G Boyd

I certify that I witnessed these field analyses, observations and activities and concur with the statements in this block. Signed Philip L. Baca

Method of Shipment to Laboratory Hand carried.

THIS FORM ACCOMPANIES 2 septum vials with teflon-lined discs identified as:
specimen X ; duplicate X ; triplicate ______ ; blank(s) ______ ,
and ______ amber glass jug(s) with teflon-lined cap(s) identified as ______ ,
and ______ other container(s) (describe) ______ identified as ______ .

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature (~20°C).

P-ICE: Sample stored in an ice bath.

$P\text{-}Na_2O_3S_2$: Sample preserved with 3 mg $Na_2O_3S_2$/40 ml and stored at room temperature.

CERTIFICATE(S) OF SAMPLE RECEIPT

I (we) certify that this sample was transferred from ______ to ______ at (location) ______ on (date & time) ______ and that the statements in this block are correct.

Disposition of Sample ______ . Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ______ ______

I (we) certify that this sample was transferred from ______ to ______ at (location) ______ on (date & time) ______ and that the statements in this block are correct.

Disposition of Sample ______ . Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ______ ______

ANALYSES REQUESTED LAB. No.: ORG- 265

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
X	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
		HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS
		Benzene etc			

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
aromatic purgeables	none detected		
halogenated purgeables	none detected		
		* DETECTION LIMIT	1 ug/l

REMARKS: No purgeables detected.*

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:________________ date:________

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 3-25-85. Analyst's signature: [signature]

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: L Meyerhe[illegible]

AUG 19 1985

ENVIRONMENT

STATE OF NEW MEXICO

0655 C

SCIENTIFIC LABORATORY DIVISION

700 Camino de Salud NE, Albuquerque, New Mexico 87106
(505) 841-2500

REPORT TO: DAVID G. BOYER
NEW MEXICO OIL CONSERVATION DIV
P.O. BOX 2088
SANTA FE, NM 87501

S.L.D. No.: OR-655-A-B
DATE REC.: 7/03/85
PHONE 827-5812
USER CODE: 8 2 2 3 5

CONTAINERS WHICH ACCOMPANY THIS FORM ARE COLLECTIVELY REFERED TO AS SAMPLE.

SUBMITTER: NM OIL CONSERVATION DIV CODE

LOCATION: FLORA VISTA CODE (TOWNSHIP RANGE SECTION TRACTS)

SOURCE: MON. WELL 4 CODE (AQUIFER DEPTH)

COLLECTED: 6/28/85 BY EARP/BAILEY CODE 8 5 0 6 2 8 0 8 4 0 A B (Y Y M M D D H H M M I I)

SAMPLE TYPE: WATER SOIL OTHER CODE

NEAREST CITY: FLORA VISTA CODE

pH=____; Conductivity=____umho/cm at ____°C; Chlorine Risidual=____

Dissolved Oxygen=____mg/l; Alkalinity=____; Flow Rate=____

Sampling Location, Methods and Remarks (i.e. odors, etc.)
BAILED MONITOR WELL

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Jami Bailey

Method of shipment to the Laboratory Hand delivered

This form accompanies 2 Septum Vials, ___Glass Jugs, ___ ____

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature.

P-Ice Sample stored in an ice bath (not frozen).

P-$Na_2S_2O_3$: Sample preserved with $Na_2S_2O_3$ to remove chlorine residual.

I (we) certify that this sample was transferred from ____
to ____ at (location) ____ on
(date & time)____ and that the statements in this block are correct
Evidentiary Seals: Not Sealed Intact: Yes No
Signatures ____ ____

(we) certify that this sample was transferred from ____
to ____ at (location) ____ on
(date & time)____ and that the statements in this block are correct
Evidentiary Seals: Not Sealed Intact: Yes No
Signatures ____ ____

ANALYSES REQUESTED LAB. No.: ORG- 655

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
X	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
X	X	HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
$CHCl_3$	1 ppb		
benzene	N.D.*		
Toluene	N.D.		
ethylbenzene	N.D.		
p-xylene	N.D.		
m-xylene	N.D.		
o-xylene	N.D.		
		* DETECTION LIMIT	1 μgm/l

REMARKS: One unsaturated hydrocarbon detected at <10 ppb.

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by: ________ date: ______

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 9 July 85. Analyst's signature: [illegible]

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: K. Meyerhein

REPORT TO: David G. Boyer
New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, NM 87

85-0264-C

LABORATORY ORG 264 AHB

LAB NUMBER

3-22-85

[redacted]

SLD Users Code No. 82235

ALL CONTAINERS WHICH THIS FORM ACCOMPANIES ARE COLLECTIVELY REFERRED TO AS "SAMPLE".

CERTIFICATE OF FIELD PERSONNEL

Sample Type: Water ☒ Soil ☐ Other ______

Water Supply and/or Code No. Flora Vista Municipal, Mon Well #4

City & County Flora Vista San Juan

Collected (date & time) 1400, 3/20/85 By (name) Boyer/Baca

pH= ______; Conductivity= ______ umho/cm at ______ °C; Chlorine Residual= ______

Dissolved Oxygen= ______ mg/l; Alkalinity= ______; Flow Rate= ______

Sampling Location, Methods & Remarks (i.e. odors etc.)

Sample from Pit dug prior to mon well installation. No odors noted. Backhoe leaking hydraulic fluid

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Signed David G Boyer

I certify that I witnessed these field analyses, observations and activities and concur with the statements in this block. Signed Philip J. Baca

Method of Shipment to Laboratory Hand Carried.

THIS FORM ACCOMPANIES ____ septum vials with teflon-lined discs identified as:
specimen X ; duplicate X ; triplicate ______; blank(s) ______,
and ______ amber glass jug(s) with teflon-lined cap(s) identified as ______,
and ______ other container(s) (describe) ______ identified as ______.

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature (~20°C).

P-ICE: Sample stored in an ice bath.

P-$Na_2O_3S_2$: Sample preserved with 3 mg $Na_2O_3S_2$/40 ml and stored at room temperature.

CERTIFICATE(S) OF SAMPLE RECEIPT

I (we) certify that this sample was transferred from ______ to ______ at (location) ______ on (date & time) ______ and that the statements in this block are correct.

Disposition of Sample ______. Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ______ ______

I (we) certify that this sample was transferred from ______ to ______ at (location) ______ on (date & time) ______ and that the statements in this block are correct.

Disposition of Sample ______. Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ______ ______

ANALYSES REQUESTED | LAB. No.: ORG- 264

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
X	✓	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
		HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS
		Benzeno ate			

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
aromatic purgeables	none detected		
halogenated purgeables	" "		
		* DETECTION LIMIT	1 µg/l

REMARKS: No purgeables detected.*

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:________________ date:________

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 3-25-85. Analyst's signature: [signature]

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: R Meyerhoff

RECEIVED AUG 19 1985 OIL CONSERVATION DIVISION

STATE OF NEW MEXICO

85-0656-B

SCIENTIFIC LABORATORY DIVISION

700 Camino de Salud NE, Albuquerque, New Mexico 87106
(505) 841-2500

REPORT TO: ~~SANTA FE~~ DAVID G. BOYER
NEW MEXICO OIL CONSERVATION DIV
P.O. BOX 2088
SANTA FE, NM 87501

S.L.D. No.: OR-656-A
DATE REC.: 7/03/85
PHONE 827-5812
USER CODE: 8 2 2 3 5

CONTAINERS WHICH ACCOMPANY THIS FORM ARE COLLECTIVELY REFERED TO AS SAMPLE.

SUBMITTER: NM OIL CONSERVATION DIV CODE

LOCATION: FLORA VISTA CODE (TOWNSHIP RANGE SECTION TRACTS)

SOURCE: MON. WELL 5 CODE (AQUIFER DEPTH)

COLLECTED: 6/28/85 BY EARP/BAILEY CODE 8 5 0 6 2 8 0 8 1 0 3 (Y Y M M D D H H M M I I)

SAMPLE TYPE: WATER SOIL OTHER CODE

NEAREST CITY: FLORA VISTA CODE

pH=____; Conductivity=____umho/cm at ____ °C; Chlorine Risidual=____

Dissolved Oxygen=____mg/l; Alkalinity=____; Flow Rate=____

Sampling Location, Methods and Remarks (i.e. odors, etc.)
BAILED MONITOR WELL

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. J. Bailey

Method of shipment to the Laboratory Hand carried

This form accompanies / Septum Vials, ___Glass Jugs, ___

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature.

P-Ice Sample stored in an ice bath (not frozen).

P-$Na_2S_2O_3$: Sample preserved with $Na_2S_2O_3$ to remove chlorine residual.

I (we) certify that this sample was transferred from ____
to ____ at (location) ____ on
(date & time)____and that the statements in this block are correct
Evidentiary Seals: Not Sealed Intact: Yes No
Signatures ____ ____

(we) certify that this sample was transferred from ____
to ____ at (location) ____ on
(date & time)____and that the statements in this block are correct
Evidentiary Seals: Not Sealed Intact: Yes No
Signatures ____ ____

ANALYSES REQUESTED LAB. No.: ORG- 656

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
X	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
X	X	HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
$CHCl_3$	1 ppb		
benzene	N.D.*		
Toluene	N.D.		
ethylbenzene	N.D.		
p-xylene	N.D.		
m-xylene	N.D.		
o-xylene	N.D.		
		* DETECTION LIMIT	1 ug/l

REMARKS: All samples should be submitted in duplicate.
One unsaturated hydrocarbon detected at <10 ppb

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes ___ NO X. Seal(s) broken by: ____________ date: ________

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 9 July 85. Analyst's signature: [signature]

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: K Meyerhen

REPORT TO: David G. Boyer
New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, NM 8750

85-0262 C

LABORATORY ORG 262 A+B

LAB NUMBER

[redacted]

3-22-85

[redacted]sers Code No. 82235

ALL CONTAINERS WHICH THIS FORM ACCOMPANIES ARE COLLECTIVELY REFERRED TO AS "SAMPLE".

CERTIFICATE OF FIELD PERSONNEL

Sample Type: Water ☒ Soil ☐ Other ____

Water Supply and/or Code No. Flora Vista Municipal, Mon Well #5

City & County Flora Vista, San Juan

Collected (date & time) 1430, 3/20/85 By (name) Boyer/Baca

pH=____; Conductivity=____umho/cm at ____°C; Chlorine Residual=____

Dissolved Oxygen=____mg/l; Alkalinity=____; Flow Rate=____

Sampling Location, Methods & Remarks (i.e. odors etc.)

Sample from Pit dug prior to mon well installation
Backhoe leaking hydraulic fluid.

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Signed David G Boyer

I certify that I witnessed these field analyses, observations and activities and concur with the statements in this block. Signed Philip L. Baca

Method of Shipment to Laboratory ____.

THIS FORM ACCOMPANIES 2 septum vials with teflon-lined discs identified as:
specimen X; duplicate X; triplicate ____; blank(s) ____,
and ____ amber glass jug(s) with teflon-lined cap(s) identified as ____,
and ____ other container(s) (describe) ____ identified as ____.

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature (~20°C).

P-ICE: Sample stored in an ice bath.

P-$Na_2O_3S_2$: Sample preserved with 3 mg $Na_2O_3S_2$/40 ml and stored at room temperature.

CERTIFICATE(S) OF SAMPLE RECEIPT

I (we) certify that this sample was transferred from ____ to ____ at (location) ____ on (date & time) ____ and that the statements in this block are correct.

Disposition of Sample ____. Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ____ ____

I (we) certify that this sample was transferred from ____ to ____ at (location) ____ on (date & time) ____ and that the statements in this block are correct.

Disposition of Sample ____. Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ____ ____

ANALYSES REQUESTED **LAB. No.: ORG-** 262

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
X	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
		HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			**SPECIFIC COMPOUNDS**
		Benzene etc			

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
aromatic purgeables	none detected		
halogenated purgeables	" "		
		* DETECTION LIMIT	1 ugm/l

REMARKS: No purgeables detected. *

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:______________ date:______

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 3-25-85. Analyst's signature: [signature]

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: [signature]

REPORT TO: David G. Boyer
New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, NM 87501 85-0275-B

LABORATORY ORG 275 A
LAB NUMBER 3-22-85
SLD Users Code No. 82235

ALL CONTAINERS WHICH THIS FORM ACCOMPANIES ARE COLLECTIVELY REFERRED TO AS "SAMPLE".

CERTIFICATE OF FIELD PERSONNEL

Sample Type: Water ☐ Soil ☒ Other ______

Water Supply and/or Code No. Soil Sample From soil at Mon Well #5

City & County Flora Vista, San Juan

Collected (date & time) 1435, 3/20/85 By (name) Boyer/Baca

pH= — ; Conductivity= — umho/cm at — °C; Chlorine Residual= —

Dissolved Oxygen= — mg/l; Alkalinity= — ; Flow Rate= —

Sampling Location, Methods & Remarks (i.e. odors etc.)

Sample of black oily layer 39-49" deep.
Mason Jar capped with Foil

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Signed David G Boyer

I certify that I witnessed these field analyses, observations and activities and concur with the statements in this block. Signed Philip L. Baca

Method of Shipment to Laboratory Hand carried.

THIS FORM ACCOMPANIES ____ septum vials with teflon-lined discs identified as:
specimen ______; duplicate ______; triplicate ______; blank(s) ______,
and ____ amber glass jug(s) with teflon-lined cap(s) identified as ______,
and 1 other container(s) (describe) Mason jar identified as ______.

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature (~20°C).

P-ICE: Sample stored in an ice bath. capped @ Foil

P-$Na_2O_3S_2$: Sample preserved with 3 mg $Na_2O_3S_2$/40 ml and stored at room temperature.

CERTIFICATE(S) OF SAMPLE RECEIPT

I (we) certify that this sample was transferred from ______ to ______ at (location) ______ on (date & time) ______ and that the statements in this block are correct.

Disposition of Sample ______. Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ______ ______

I (we) certify that this sample was transferred from ______ to ______ at (location) ______ on (date & time) ______ and that the statements in this block are correct.

Disposition of Sample ______. Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ______ ______

ANALYSES REQUESTED — LAB. NO.: ORG-275

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS (See Remarks)
		ALIPHATIC HYDROCARBON SCREEN	X	X	ALIPHATIC HYDROCARBONS
~~X~~	~~X~~	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
		HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER	X	X	HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS
		~~Benzene~~			

REMARKS: Identify if material is from crude hydrocarbon production (if possible) Thanks RRR

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
		* DETECTION LIMIT	

REMARKS: No extractable aliphatics detected

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO___. Seal(s) broken by:____________ date:______

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 4/10/85. Analyst's signature: J. Riddley

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: K Meyerhein

STATE OF NEW MEXICO

SCIENTIFIC LABORATORY DIVISION

700 Camino de Salud NE, Albuquerque, New Mexico 87106

(505) 841-2500

RECEIVED AUG 19 1985 OIL CONSERVATION DIVISION

85-0657-C

REPORT TO: DAVID G. BOYER
NEW MEXICO OIL CONSERVATION DIV
P.O. BOX 2088
SANTA FE, NM 87501

S.L.D. No.: OR-657-A,B
DATE REC.:
PHONE 827-5812
USER CODE: 8 2 2 3 5

CONTAINERS WHICH ACCOMPANY THIS FORM ARE COLLECTIVELY REFERED TO AS SAMPLE.

SUBMITTER: NM OIL CONSERVATION DIV CODE

LOCATION: FLORA VISTA CODE (TOWNSHIP RANGE SECTION TRACTS)

SOURCE: MUNICIPAL WELL #1 CODE (AQUIFER DEPTH)

COLLECTED: 6/28/85 BY BOYER/BAILEY CODE 8 5 0 6 2 8 1 1 3 0 A B (Y Y M M D D H H M M I I)

SAMPLE TYPE: WATER SOIL OTHER CODE

NEAREST CITY: FLORA VISTA CODE

pH=____; Conductivity=____umho/cm at ____°C; Chlorine Risidual=____

Dissolved Oxygen=____mg/l; Alkalinity=____; Flow Rate=____

Sampling Location, Methods and Remarks (i.e. odors, etc.)

BAILED OPEN WELL - NO SANITARY SEAL. 10" ID STEEL CASING.

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. D. Bailey

Method of shipment to the Laboratory Hand carried

This form accompanies 2 Septum Vials, ___ Glass Jugs, ___

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature.

P-Ice Sample stored in an ice bath (not frozen).

P-$Na_2S_2O_3$: Sample preserved with $Na_2S_2O_3$ to remove chlorine residual.

I (we) certify that this sample was transferred from ____
to ____ at (location) ____ on
(date & time) ____ and that the statements in this block are correct
Evidentiary Seals: Not Sealed Intact: Yes No
Signatures ____ ____

(we) certify that this sample was transferred from ____
to ____ at (location) ____ on
(date & time) ____ and that the statements in this block are correct
Evidentiary Seals: Not Sealed Intact: Yes No
Signatures ____ ____

ANALYSES REQUESTED LAB. No.: ORG- 657

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
X	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
X	X	HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
X	X	Natural Gas Head Space			POLYNUCLEAR AROMATIC HYDROCARBONS
		Test			TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	~~[PPB]~~ ppm
$CHCl_3$	1 ppb	methane in Head Space	= Lab Air
Toluene	6 ppb		
benzene	N.D.*	LAB Air	= 1.3 ppm
ethylbenzene	N.D.	MDC	= 1 ppm
p-Xylene	N.D.		
m-Xylene	N.D.		
o-Xylene	N.D.		
		* DETECTION LIMIT	1 µgm/l

REMARKS: One unsaturated hydrocarbon also detected at ≤5 ppb. One large peak also present that may be acetone

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:_______ date:

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 7 July 85. 8/2/85 Analyst's signature: [signature]

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: [signature]

REPORT TO:

David G. Boye
New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, NM

85-0263 C

LABORATORY *ORG 263 A+B*

LAB NUMBER

[redacted]

3-22-85

SLD Users Code No. 82235

ALL CONTAINERS WHICH THIS FORM ACCOMPANIES ARE COLLECTIVELY REFERRED TO AS "SAMPLE".

CERTIFICATE OF FIELD PERSONNEL

Sample Type: Water ☒ Soil ☐ Other ________

Water Supply and/or Code No. *Flora Vista Municipal Supply Well #1*

City & County *Flora Vista, San Juan*

Collected (date & time) *1310, 3/20/85* By (name) *Boyer/Baca*

pH= ______; Conductivity= ________ umho/cm at ______ °C; Chlorine Residual= ________

Dissolved Oxygen= ______ mg/l; Alkalinity= ____________; Flow Rate= ________

Sampling Location, Methods & Remarks (i.e. odors etc.)

Sample at start of pumping, no odors previously contaminated with hydrocarbon, discharge at gasoline pump

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Signed *David G. Boyer*

I certify that I witnessed these field analyses, observations and activities and concur with the statements in this block. Signed *Philip L. Baca*

Method of Shipment to Laboratory ____________.

THIS FORM ACCOMPANIES *2* septum vials with teflon-lined discs identified as:
specimen *X*; duplicate *X*; triplicate ______; blank(s) ______,
and ______ amber glass jug(s) with teflon-lined cap(s) identified as ______,
and ______ other container(s) (describe) ______ identified as ______.

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature (~20°C).

P-ICE: Sample stored in an ice bath.

P-$Na_2O_3S_2$: Sample preserved with 3 mg $Na_2O_3S_2$/40 ml and stored at room temperature.

CERTIFICATE(S) OF SAMPLE RECEIPT

I (we) certify that this sample was transferred from ____________ to ____________ at (location) ____________ on (date & time) ____________ and that the statements in this block are correct.

Disposition of Sample ____________. Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ____________ ____________

I (we) certify that this sample was transferred from ____________ to ____________ at (location) ____________ on (date & time) ____________ and that the statements in this block are correct.

Disposition of Sample ____________. Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ____________ ____________

ANALYSES REQUESTED LAB. No.: ORG- 263

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
X	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
		HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS
		Benzene etc			

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
aromatic purgeables	none detected		
halogenated purgeables	" "		
		* DETECTION LIMIT	1 ug/l

REMARKS: No purgeables detected.*

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X . Seal(s) broken by:_______________ date:________

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 3-25-85 . Analyst's signature: R Furney

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: R Meyerhen

REPORT TO: David G. Boyer
New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, NM 8750

85-0261 C

LABORATORY ORG 261 A+B

LAB NUMBER [redacted]

3-22-85

SLD Users Code No. 82235

ALL CONTAINERS WHICH THIS FORM ACCOMPANIES ARE COLLECTIVELY REFERRED TO AS "SAMPLE".

CERTIFICATE OF FIELD PERSONNEL

Sample Type: Water ☒ Soil ☐ Other

Water Supply and/or Code No. Flora Vista Municipal Supply Well #1

City & County Flora Vista, San Juan

Collected (date & time) 1538, 3/20/85 By (name) Boyer/Baca

pH= — ; Conductivity= 600 umho/cm at 12.5 °C; Chlorine Residual= —

Dissolved Oxygen= — mg/l; Alkalinity= — ; Flow Rate= 79gpm/2.87sec

Sampling Location, Methods & Remarks (i.e. odors etc.)

Sample prior to cessation of pumping previously contaminated with hydrocarbons, sample at discharge of gas pump, No odors

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Signed David G Boyer

I certify that I witnessed these field analyses, observations and activities and concur with the statements in this block. Signed Philip L. Baca

Method of Shipment to Laboratory Hand carried.

THIS FORM ACCOMPANIES 2 septum vials with teflon-lined discs identified as:
specimen X ; duplicate X ; triplicate ; blank(s) ,
and amber glass jug(s) with teflon-lined cap(s) identified as ,
and other container(s) (describe) identified as .

Containers are marked as follows to indicate preservation (circle):

~~NP:~~ No preservation; sample stored at room temperature (~20°C).

P-ICE: Sample stored in an ice bath.

$P-Na_2O_3S_2$: Sample preserved with 3 mg $Na_2O_3S_2$/40 ml and stored at room temperature.

CERTIFICATE(S) OF SAMPLE RECEIPT

I (we) certify that this sample was transferred from ______ to ______ at (location) ______ on (date & time) ______ and that the statements in this block are correct.

Disposition of Sample ______. Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ______ ______

I (we) certify that this sample was transferred from ______ to ______ at (location) ______ on (date & time) ______ and that the statements in this block are correct.

Disposition of Sample ______. Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ______ ______

ANALYSES REQUESTED **LAB. No.: ORG- 261**

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
X	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
		HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS
		Benzoate			

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
aromatic purgeables	none detected		
halogenated purgeables	" "		
		* DETECTION LIMIT	1 ugm/l

REMARKS: No purgeables detected.*

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes__ NO X. Seal(s) broken by:________ date:______

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 3-25-85. Analyst's signature: [signature]

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: R Meyerhe[illegible]

REPORT TO: David G. Boyer
New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, NM 875
85-0259 C

LABORATORY ORG 259 A+B
LAB NUMBER
[redacted]
3-22-85
Users Code No. 82235

ALL CONTAINERS WHICH THIS FORM ACCOMPANIES ARE COLLECTIVELY REFERRED TO AS "SAMPLE".

CERTIFICATE OF FIELD PERSONNEL

Sample Type: Water ☒ Soil ☐ Other

Water Supply and/or Code No. Flora Vista Mun Supply, Composite #2 & 3

City & County Flora Vista, San Juan Cty

Collected (date & time) 1626, 3/20/85 By (name) Boyer/Baca

pH= — ; Conductivity= 670 umho/cm at 11 °C; Chlorine Residual= —

Dissolved Oxygen= — mg/l; Alkalinity= — ; Flow Rate= ~100 gpm

Sampling Location, Methods & Remarks (i.e. odors etc.)

Pumphouse spigot, other wells off, No odors

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Signed David G Boyer

I certify that I witnessed these field analyses, observations and activities and concur with the statements in this block. Signed Philip L. Baca

Method of Shipment to Laboratory Hand carried.

THIS FORM ACCOMPANIES 2 septum vials with teflon-lined discs identified as:
specimen X ; duplicate X ; triplicate ; blank(s) ,
and amber glass jug(s) with teflon-lined cap(s) identified as ,
and other container(s) (describe) identified as .

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature (~20°C).

P-ICE: Sample stored in an ice bath.

P-$Na_2O_3S_2$: Sample preserved with 3 mg $Na_2O_3S_2$/40 ml and stored at room temperature.

CERTIFICATE(S) OF SAMPLE RECEIPT

I (we) certify that this sample was transferred from to at (location) on (date & time) and that the statements in this block are correct.

Disposition of Sample . Seal(s) Intact: Yes ☐ No ☐ .

Signature(s)

I (we) certify that this sample was transferred from to at (location) on (date & time) and that the statements in this block are correct.

Disposition of Sample . Seal(s) Intact: Yes ☐ No ☐ .

Signature(s)

ANALYSES REQUESTED LAB. No.: ORG- 259

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
✓	✓	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
		HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS
		Benzene, etc.			

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
aromatic purgeables	none detected		
$CHCl_3$	4 ppb.		
		* DETECTION LIMIT	1 ugm/l

REMARKS: No aromatic purgeables detected.*

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:_______________ date:______

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 3-25-85. Analyst's signature: [signature]

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: K Meyerhofer

REPORT TO: David G. Boye[redacted]
New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, NM 8750
85-0268 C

LABORATORY ORG 268 A+B
LAB NUMBER 3-22-85
[redacted]
SLD Users Code No. 82235

ALL CONTAINERS WHICH THIS FORM ACCOMPANIES ARE COLLECTIVELY REFERRED TO AS "SAMPLE".

CERTIFICATE OF FIELD PERSONNEL

Sample Type: Water ☒ Soil ☐ Other ______

Water Supply and/or Code No. Flora Vista Mun. Supply Well #5

City & County Flora Vista, San Juan Cty ✓

Collected (date & time) 1555 3/22/85 By (name) Boyer/Baca

pH= — ; Conductivity= 610 umho/cm at 11 °C; Chlorine Residual= —

Dissolved Oxygen= — mg/l; Alkalinity= ______ ; Flow Rate= ~100 gpm

Sampling Location, Methods & Remarks (i.e. odors etc.)

Pumphouse spigot, other wells off. no odors
This well nearest previously contam. well

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Signed David G. Boyer

I certify that I witnessed these field analyses, observations and activities and concur with the statements in this block. Signed Philip L. Baca

Method of Shipment to Laboratory Hand carried

THIS FORM ACCOMPANIES 2 septum vials with teflon-lined discs identified as: specimen X ; duplicate X ; triplicate ______ ; blank(s) ______ , and ______ amber glass jug(s) with teflon-lined cap(s) identified as ______ , and ______ other container(s) (describe) ______ identified as ______ .

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature (~20°C).

P-ICE: Sample stored in an ice bath.

P-$Na_2O_3S_2$: Sample preserved with 3 mg $Na_2O_3S_2$/40 ml and stored at room temperature.

CERTIFICATE(S) OF SAMPLE RECEIPT

I (we) certify that this sample was transferred from ______ to ______ at (location) ______ on (date & time) ______ and that the statements in this block are correct.

Disposition of Sample ______ . Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ______ ______

I (we) certify that this sample was transferred from ______ to ______ at (location) ______ on (date & time) ______ and that the statements in this block are correct.

Disposition of Sample ______ . Seal(s) Intact: Yes ☐ No ☐ .

Signature(s) ______ ______

ANALYSES REQUESTED **LAB. No.: ORG-** 268

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
X	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
		HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			**SPECIFIC COMPOUNDS**
		Benzene, etc.			

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
aromatic purgeables	none detected		
halogenated purgeables	"		
		* DETECTION LIMIT	1 ugm/l

REMARKS: No purgeables detected. *

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:_______________ date:_______

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 3-25-85. Analyst's signature: [signature]

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: R Meyerhein

REPORT TO: David G. Boyer
New Mexico Oil Conservation Division
P.O. Box 2088
Santa Fe, NM 8750[illegible]

85-0273 G

LABORATORY ORG 273 A+B

LAB NUMBER 3-22-85

SLD Users Code No. 82235

ALL CONTAINERS WHICH THIS FORM ACCOMPANIES ARE COLLECTIVELY REFERRED TO AS "SAMPLE".

CERTIFICATE OF FIELD PERSONNEL

Sample Type: Water ☐ Soil ☐ Other ____

Water Supply and/or Code No. ____

City & County ____

Collected (date & time) ____ By (name) ____

pH= ____; Conductivity= ____ umho/cm at ____ °C; Chlorine Residual= ____

Dissolved Oxygen= ____ mg/l; Alkalinity= ____; Flow Rate= ____

Sampling Location, Methods & Remarks (i.e. odors etc.)

Field blank that went out with samples collected near Farmington, Sample #50259 - 0298

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Signed ____

I certify that I witnessed these field analyses, observations and activities and concur with the statements in this block. Signed ____

Method of Shipment to Laboratory ____.

THIS FORM ACCOMPANIES ____ septum vials with teflon-lined discs identified as:
specimen ____; duplicate ____; triplicate ____; blank(s) ____,
and ____ amber glass jug(s) with teflon-lined cap(s) identified as ____,
and ____ other container(s) (describe) ____ identified as ____.

Containers are marked as follows to indicate preservation (circle):

NP: No preservation; sample stored at room temperature (~20°C).

P-ICE: Sample stored in an ice bath.

P-$Na_2O_3S_2$: Sample preserved with 3 mg $Na_2O_3S_2$/40 ml and stored at room temperature.

CERTIFICATE(S) OF SAMPLE RECEIPT

I (we) certify that this sample was transferred from ____ to ____ at (location) ____ on (date & time) ____ and that the statements in this block are correct.

Disposition of Sample ____. Seal(s) Intact: Yes ☐ No ☐.

Signature(s) ____ ____

I (we) certify that this sample was transferred from ____ to ____ at (location) ____ on (date & time) ____ and that the statements in this block are correct.

Disposition of Sample ____. Seal(s) Intact: Yes ☐ No ☐.

Signature(s) ____ ____

40

ANALYSES REQUESTED LAB. No.: ORG- 273

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER POSSIBLE LIST SPECIFIC COMPOUNDS SUSPECTED OR REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
		AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
		HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
halogenated purgeables	none detected		
aromatic purgeables	none detected		
		* DETECTION LIMIT	1 µgm/l

REMARKS: No purgeables detected.*

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:______________ date:______

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 26 Mr 85. Analyst's signature: [signature]

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: K Meyerhen

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 — (505) 8[illegible]555

GENERAL WATER CHEMISTRY and NITROGEN ANALYSIS

DATE RECEIVED	3/22/85
LAB NO.	WC-1910
USER CODE	☐ 59300 ☐ 59600 ☒ OTHER: 82235
Collection DATE	3/20/85
Collection TIME	1538
Collected by — Person/Agency	
SITE INFORMATION ► Sample location	Flora Vista Water Supply well #1
Collection site description	Flora Vista Water Users - this is contaminated well
Station/ well code	
Owner	F.V. W.U.A

SEND FINAL REPORT TO ►

ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
State Land Office Bldg., PO Box 2088
Santa Fe, NM 87501

Attn: David Boyer

SAMPLING CONDITIONS

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water level —	Discharge 7 qts in 2.87 sec	Sample type Grab
pH (00400) —	Conductivity (Uncorrected) 600 µmho	Water Temp. (00010) 12.5°C °C	Conductivity at 25°C (00094) — µmho

Field comments: Sample from Gas Pump out of open well

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted: 1	☒ NF: Whole sample (Non-filtered)	☐ F: Filtered in field with 0.45 µmembrane filter	☐ A: 2 ml H_2SO_4/L added

☒ NA: No acid added ☐ Other-*specify*:

ANALYTICAL RESULTS from SAMPLES

NF, NA

		Units	Date analyzed
☒ Conductivity (Corrected) 25°C (00095)	589	µmho	5/9
☐ Total non-filterable residue (suspended) (00530)		mg/l	
☒ Other: pH	7.58		5/28
☐ Other:			
☐ Other:			

~~NF, A-H₂SO₄~~ NA

		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N total (00630)		mg/l	
☐ Ammonia-N total (00610)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Chemical oxygen demand (00340)		mg/l	
☒ Total organic carbon ( )	1.0	mg/l	6/13
☐ Other:			
☐ Other:			

~~F~~, NA NF

		Units	Date analyzed
☒ Calcium (00915)	103	mg/l	4/15
☒ Magnesium (00925)	9.4	mg/l	4/15 5.90
☒ Sodium (00930)	29.9	mg/l	3/28
☒ Potassium (00935)	0.39	mg/l	3/28
☒ Bicarbonate (00440)	148.3	mg/l	5/6
☒ Chloride (00940)	17.0	mg/l	4/15
☒ Sulfate (00945)	183.4	mg/l	4/4
☒ Total filterable residue (dissolved) (70300)	365		6/5
CO_3	none	mg/l	5/6
☒ Other: Flouride	0.55		4/8

F, A-H_2SO_4

		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N dissolved (00631)		mg/l	
☐ Ammonia-N dissolved (00608)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Other:			

Analyst	Date Reported	Reviewed by
	7/3/85	[signature]

Laboratory remarks

SLD 726 (12/84) *DISTRIBUTION:* **WHITE** — EID, GW&HW Bureau **CANARY** — WS System **PINK** — EID Local Office **GOLDENROD** — SLD

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 — (505) 8[illegible]2555

GENERAL WATER CHEMISTRY and NITROGEN ANALYSIS

DATE RECEIVED 3/22/85	LAB NO. WC-1218	USER CODE ☐ 59300 ☐ 59600 ☒ OTHER: 82235	
Collection DATE 3/20/85	SITE INFORMATION ►	Sample location: Flora Vista Water Supply Well #1	
Collection TIME 1538		Collection site description: Flora Vista Water Users - this is contaminated well	
Collected by — Person/Agency:			

SEND FINAL REPORT TO ►

ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
State Land Office Bldg., PO Box 2088
Santa Fe, NM 87501

Attn: David Boyer

Station/well code:

Owner: F.V. W.U.A

SAMPLING CONDITIONS

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water level: —	Discharge: 7 gts in 2.87 sec	Sample type: Grab
pH (00400): —	Conductivity (Uncorrected): 600 µmho	Water Temp. (00010): 12.5°C °C	Conductivity at 25°C (00094): — µmho

Field comments: Sample from Gas Pump out of open well

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted: 1	☐ NF: Whole sample (Non-filtered)	☒ F: Filtered in field with 0.45 µmembrane filter	☒ A: 2 ml H_2SO_4/L added

☐ NA: No acid added ☐ Other-*specify*:

ANALYTICAL RESULTS from SAMPLES

NF, NA		Units	Date analyzed
☐ Conductivity (Corrected) 25°C (00095)		µmho	
☐ Total non-filterable residue (suspended) (00530)		mg/l	
☐ Other:			
☐ Other:			
☐ Other:			

F, NA		Units	Date analyzed
☐ Calcium (00915)		mg/l	
☐ Magnesium (00925)		mg/l	
☐ Sodium (00930)		mg/l	
☐ Potassium (00935)		mg/l	
☐ Bicarbonate (00440)		mg/l	
☐ Chloride (00940)		mg/l	
☐ Sulfate (00945)		mg/l	
☐ Total filterable residue (dissolved) (70300)		mg/l	
☐ Other:			

NF, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N total (00630)		mg/l	
☐ Ammonia-N total (00610)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Chemical oxygen demand (00340)		mg/l	
☐ Total organic carbon ( )		mg/l	
☐ Other:			
☐ Other:			

F, A-H_2SO_4		Units	Date analyzed
☒ Nitrate-N +, Nitrate-N dissolved (00631)	0.77	mg/l	4/5
☒ Ammonia-N dissolved (00608)	0.14	mg/l	4/22
☒ Total Kjeldahl-N ( )	0.42	mg/l	5/10
☐ Other:			

Analyst	Date Reported	Reviewed by
	5/10/85	[signature]

Laboratory remarks

SLD 726 (12/84) *DISTRIBUTION:* **WHITE** — EID, GW&HW Bureau **CANARY** — WS System **PINK** — EID Local Office **GOLDENROD** — SLD

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 — (505) [illegible] 2555

HEAVY METALS

~~GENERAL WATER CHEMISTRY and [illegible] TROGEN ANALYSIS~~

DATE RECEIVED	3/22/85	LAB NO.	HM-486	USER CODE	☐ 59300	☐ 59600	☒ OTHER: 82235

Collection DATE: 3/20/85
Collection TIME: 1538
Collected by — Person/Agency:

SITE INFORMATION ►
Sample location: Flora Vista Water Supply Well #1
Collection site description: Flora Vista Water Users - this is contaminated well

SEND FINAL REPORT TO ►

ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
State Land Office Bldg., PO Box 2088
Santa Fe, NM 87501

Attn: David Boyer

Station/ well code:
Owner: F.V. W.U.A

SAMPLING CONDITIONS

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water level: —	Discharge: 7 gts in 2.87 sec	Sample type: Grab
pH (00400): —	Conductivity (Uncorrected): 600 µmho	Water Temp. (00010): 12.5°C °C	Conductivity at 25°C (00094): — µmho

Field comments: Sample from Gas Pump out of open well

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted: 1

☐ NF: Whole sample (Non-filtered) ☒ F: Filtered in field with 0.45 µmembrane filter ☐ A: ~~2ml H_2SO_4/L added~~ 5ml HNO_3

☐ NA: No acid added ☐ Other-specify:

ANALYTICAL RESULTS from SAMPLES

NF, NA		Units	Date analyzed
☐ Conductivity (Corrected) 25°C (00095)		µmho	
☐ Total non-filterable residue (suspended) (00530)		mg/l	
☒ Other: ICAPSCAN			
☒ Other: As	<.005	mg/l	
☒ Other: Se	<.005	mg/l	

NF, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N total (00630)		mg/l	
☐ Ammonia-N total (00610)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Chemical oxygen demand (00340)		mg/l	
☐ Total organic carbon ( )		mg/l	
☐ Other:			
☐ Other:			

F, NA		Units	Date analyzed
☐ Calcium (00915)		mg/l	
☐ Magnesium (00925)		mg/l	
☐ Sodium (00930)		mg/l	
☐ Potassium (00935)		mg/l	
☐ Bicarbonate (00440)		mg/l	
☐ Chloride (00940)		mg/l	
☐ Sulfate (00945)		mg/l	
☐ Total filterable residue (dissolved) (70300)		mg/l	
☐ Other:			

F, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N dissolved (00631)		mg/l	
☐ Ammonia-N dissolved (00608)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Other:			

Analyst	Date Reported	Reviewed by
	5/31/85	J. Ashley

Laboratory remarks

SLD 726 (12/84) *DISTRIBUTION:* WHITE — EID, GW&HW Bureau CANARY — WS System PINK — EID Local Office GOLDENROD — SLD

ICAP SCREEN

Lab Number: HM 486

Date Submitted: 3/22/84

By: Boyer

Sample Code: Flora Vista Water Supply Well #1

Date Reported: 5/31/85

By: J. Bobly

Determination	Concentration (µg/ml)
Aluminum	<.10
Barium	<.10
Beryllium	<.10
Boron	<.10
Cadmium	<.10
Calcium	110.
Chromium	<.10
Cobalt	<.10
Copper	<.10
Iron	<.10
Lead	<.10
Magnesium	9.1
Manganese	.47
Molybdenum	<.10
Nickel	<.10
Silicon	5.3
Silver	<.10
Strontium	2.7
Tin	<.10
Vanadium	<.10
Yttrium	<.10
Zinc	<.10

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 — (505) [illegible]-2555

GENERAL WATER CHEMISTRY and NITROGEN ANALYSIS

DATE RECEIVED	3 / 22 / 85
LAB NO.	WC-1211
USER CODE	☐ 59300 ☐ 59600 ☒ OTHER: 82235
Collection DATE	3 / 20 / 85
Collection TIME	1626
Collected by — Person/Agency	Boyer
SITE INFORMATION ► Sample location	~~Com~~ Composite Wells #2 & 3
Collection site description	Flora Vista Water Users Assoc
	From spigot in the pump house with others wells #'s
Station/ well code	
Owner	FVWUA

SEND FINAL REPORT TO ►

ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
State Land Office Bldg., PO Box 2088
Santa Fe, NM 87501

Attn: David Boyer

RECEIVED
AUG 19 1985

SAMPLING CONDITIONS

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water level —	Discharge ~ 100 gpm	Sample type grab
pH (00400) —	Conductivity (Uncorrected) 670 µmho	Water Temp. (00010) 11 °C	Conductivity at 25 °C (00094) — µmho

Field comments: Composite of wells #2 & 3 near and to SW of pump house

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted: 1	☒ NF: Whole sample (Non-filtered)	☐ F: Filtered in field with 0.45 µmembrane filter	☐ A: 2 ml H_2SO_4/L added

☒ NA: No acid added ☐ Other-*specify*:

ANALYTICAL RESULTS from SAMPLES

NF, NA		Units	Date analyzed
☒ Conductivity (Corrected) 25°C (00095)	544	µmho	7/20
☐ Total non-filterable residue (suspended) (00530)		mg/l	
☒ Other: pH	7.6		5/3
☐ Other:			
☐ Other:			

~~F,~~ NA NF		Units	Date analyzed
☒ Calcium (00915)	115	mg/l	4/15
☒ Magnesium (00925)	4.13	mg/l	4/15 6.08
☒ Sodium (00930)	29.9	mg/l	3/28
☒ Potassium (00935)	1.95	mg/l	3/28
☒ Bicarbonate (00440)	161.5	mg/l	5/6
☒ Chloride (00940)	15.8	mg/l	4/15
☒ Sulfate (00945)	178.9	mg/l	4/4
☒ Total filterable residue (dissolved) (70300)	415	mg/l	5/10
CO_3	None		5/6
☒ Other: Flouride	0.49		4/18

~~NF, A-H_2SO_4~~ NA		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N total (00630)		mg/l	
☐ Ammonia-N total (00610)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Chemical oxygen demand (00340)		mg/l	
☒ Total organic carbon ( )	1.7	mg/l	
☐ Other:			
☐ Other:			

F, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N dissolved (00631)		mg/l	
☐ Ammonia-N dissolved (00608)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Other:			

Analyst	Date Reported	Reviewed by
	7 / 20 / 85	[signature]

Laboratory remarks

SLD 726 (12/84) *DISTRIBUTION:* **WHITE** — EID, GW&HW Bureau **CANARY** — WS System **PINK** — EID Local Office **GOLDENROD** — SLD

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 — (505) 84 55

GENERAL WATER CHEMISTRY and NITROGEN ANALYSIS

DATE RECEIVED 3 22 85	LAB NO. WC-1219	USER CODE ☐ 59300 ☐ 59600 ☒ OTHER: 82235	
Collection DATE 3 20 85	SITE INFORMATION ►	Sample location ~~Com~~ Composite Wells #2 & 3	
Collection TIME 1626		Collection site description Flora Vista Water Users Assoc	
Collected by — Person/Agency Boyer			

~~From spigot inside pump house with other wells 2 & 3~~

SEND FINAL REPORT TO ►

ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
State Land Office Bldg., PO Box 2088
Santa Fe, NM 87501

Attn: David Boyer

Station/well code:

Owner: FVWUA

SAMPLING CONDITIONS

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water level —	Discharge ~ 100 gpm	Sample type grab
pH (00400) —	Conductivity (Uncorrected) 670 µmho	Water Temp. (00010) 11 °C	Conductivity at 25°C (00094) — µmho

Field comments: Composite of wells #2 & 3 near and to SW of pump house

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted: 1	☐ NF: Whole sample (Non-filtered)	☒ F: Filtered in field with 0.45 µmembrane filter	☒ A: 2 ml H_2SO_4/L added

☐ NA: No acid added ☐ Other-*specify*:

ANALYTICAL RESULTS from SAMPLES

NF, NA		Units	Date analyzed
☐ Conductivity (Corrected) 25°C (00095)		µmho	
☐ Total non-filterable residue (suspended) (00530)		mg/l	
☐ Other:			
☐ Other:			
☐ Other:			

F, NA		Units	Date analyzed
☐ Calcium (00915)		mg/l	
☐ Magnesium (00925)		mg/l	
☐ Sodium (00930)		mg/l	
☐ Potassium (00935)		mg/l	
☐ Bicarbonate (00440)		mg/l	
☐ Chloride (00940)		mg/l	
☐ Sulfate (00945)		mg/l	
☐ Total filterable residue (dissolved) (70300)		mg/l	
☐ Other:			

NF, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N total (00630)		mg/l	
☐ Ammonia-N total (00610)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Chemical oxygen demand (00340)		mg/l	
☐ Total organic carbon ( )		mg/l	
☐ Other:			
☐ Other:			

F, A-H_2SO_4		Units	Date analyzed
☒ Nitrate-N +, Nitrate-N dissolved (00631)	0.28	mg/l	4/5
☒ Ammonia-N dissolved (00608)	0.06	mg/l	4/22
☒ Total Kjeldahl-N ( )	0.77	mg/l	5/10
☐ Other:			

Analyst	Date Reported	Reviewed by
	5 10 85	[signature]

Laboratory remarks

SLD 726 (12/84) *DISTRIBUTION:* WHITE — EID, GW&HW Bureau CANARY — WS System PINK — EID Local Office GOLDENROD — SLD

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 — (505) 841-[illegible]55

HEAVY METALS

~~GENERAL WATER CHEMISTRY and NITROGEN ANALYSIS~~

DATE RECEIVED	3 22 85	LAB NO.	HM-487	USER CODE	☐ 59300	☐ 59600	☒ OTHER: 82235

Collection DATE: 3 20 85
Collection TIME: 1626
Collected by — Person/Agency: Boyer

SITE INFORMATION ►
Sample location: ~~Com~~ Composite Wells #2 & 3
Collection site description: Flora Vista Water Users Assoc

~~From spigot inside pump house with other wells off~~

SEND FINAL REPORT TO ►
ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
State Land Office Bldg., PO Box 2088
Santa Fe, NM 87501
Attn: David Boyer

Station/well code:
Owner: FVWUA

SAMPLING CONDITIONS

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water level —	Discharge ~ 100gpm	Sample type grab
pH (00400) —	Conductivity (Uncorrected) 670 µmho	Water Temp. (00010) 11 °C	Conductivity at 25°C (00094) — µmho

Field comments: Composite of wells #2 & 3 near and to SW of pump house

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted: 1	☐ NF: Whole sample (Non-filtered)	☒ F: Filtered in field with 0.45 µmembrane filter	☒ A: ~~2 ml H_2SO_4/L added~~ 5ml HNO_3

☐ NA: No acid added ☐ Other-*specify*:

ANALYTICAL RESULTS from SAMPLES

NF, NA		Units	Date analyzed
☐ Conductivity (Corrected) 25°C (00095)		µmho	
☐ Total non-filterable residue (suspended) (00530)		mg/l	
☒ Other: ICAPSCAN			
☒ Other: As	<.005	mg/l	
☒ Other: Se	<.005	mg/l	

F, NA		Units	Date analyzed
☐ Calcium (00915)		mg/l	
☐ Magnesium (00925)		mg/l	
☐ Sodium (00930)		mg/l	
☐ Potassium (00935)		mg/l	
☐ Bicarbonate (00440)		mg/l	
☐ Chloride (00940)		mg/l	
☐ Sulfate (00945)		mg/l	
☐ Total filterable residue (dissolved) (70300)		mg/l	
☐ Other:			

NF, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N total (00630)		mg/l	
☐ Ammonia-N total (00610)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Chemical oxygen demand (00340)		mg/l	
☐ Total organic carbon ( )		mg/l	
☐ Other:			
☐ Other:			

F, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N dissolved (00631)		mg/l	
☐ Ammonia-N dissolved (00608)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Other:			

Analyst	Date Reported	Reviewed by
	5 31 85	J. Ashby

Laboratory remarks

SLD 726 (12/84) *DISTRIBUTION:* **WHITE** — EID, GW&HW Bureau **CANARY** — WS System **PINK** — EID Local Office **GOLDENROD** — SLD

ICAP SCREEN

Lab Number: HM 487

Date Submitted: 3/22/85

By: Boyer

Sample Code: Flora Vista Water System Composite Wells #2+3

Date Reported: 5/31/85

By: J. Ashby

Determination	Concentration (μg/ml)
Aluminum	<.10
Barium	<.10
Beryllium	<.10
Boron	<.10
Cadmium	<.10
Calcium	111.
Chromium	<.10
Cobalt	<.10
Copper	<.10
Iron	<.10
Lead	<.10
Magnesium	9.4
Manganese	.25
Molybdenum	<.10
Nickel	<.10
Silicon	5.4
Silver	<.10
Strontium	2.5
Tin	<.10
Vanadium	<.10
Yttrium	<.10
Zinc	<.10

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 — (505) 8[illegible]-2555

GENERAL WATER CHEMISTRY an[illegible]TROGEN ANALYSIS

DATE RECEIVED	3 / 22 / 85
LAB NO.	WC 1209
USER CODE	☐ 59300 ☐ 59600 ☒ OTHER: 82235
Collection DATE	3/20/85
Collection TIME	1555
Collected by — Person/Agency	Boyer/OCD
SITE INFORMATION ► Sample location	Flora Vista Water Supply Well #5
Collection site description	Sample from spigot in well house w/ the other wells shut off
Station/well code	
Owner	FVWUA

SEND FINAL REPORT TO ►

ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
State Land Office Bldg, PO Box 2088
Santa Fe, NM 87501

Attn: David Boyer

SAMPLING CONDITIONS

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water level —	Discharge ~100 gpm	Sample type Grab
pH (00400) —	Conductivity (Uncorrected) 610 µmho	Water Temp. (00010) 11 °C	Conductivity at 25°C (00094) — µmho

Field comments: This is well between contaminated well #1 and pump house

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted: 1

☒ NF: Whole sample (Non-filtered) ☐ F: Filtered in field with 0.45 µmembrane filter ☐ A: 2 ml H_2SO_4/L added

☒ NA: No acid added ☐ Other-*specify*:

ANALYTICAL RESULTS from SAMPLES

NF, NA		Units	Date analyzed
☒ Conductivity (Corrected) 25°C (00095)	642	µmho	5/9
☐ Total non-filterable residue (suspended) (00530)		mg/l	
☒ Other: pH	7.49		5/3
☐ Other:			
☐ Other:			

~~F,~~ NA NF		Units	Date analyzed
☒ Calcium (00915)	114	mg/l	4/15
☒ Magnesium (00925)	5.5	mg/l	4/15 6.13
☒ Sodium (00930)	34.5	mg/l	3/28
☒ Potassium (00935)	5.07	mg/l	3/28
☒ Bicarbonate (00440)	154.1	mg/l	5/6
☒ Chloride (00940)	18.7	mg/l	4/15
☒ Sulfate (00945)	206.1	mg/l	4/4
☒ Total filterable residue (dissolved) (70300)	430	mg/l	6/5
CO_3	none		5/6
☒ Other: Flouride	~~0.52~~ 0.52		~~5/3~~ 4/8

~~NF, A-H_2SO_4~~ NA		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N total (00630)		mg/l	
☐ Ammonia-N total (00610)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Chemical oxygen demand (00340)		mg/l	
☒ Total organic carbon ( )	3.2	mg/l	6/13
☐ Other:			
☐ Other:			

F, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N dissolved (00631)		mg/l	
☐ Ammonia-N dissolved (00608)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Other:			

Analyst	Date Reported	Reviewed by
	7 / 3 / 85	[illegible signature]

Laboratory remarks

SLD 726 (12/84) *DISTRIBUTION:* **WHITE** — EID, GW&HW Bureau **CANARY** — WS System **PINK** — EID Local Office **GOLDENROD** — SLD

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 — (505) 841-[illegible]5

GENERAL WATER CHEMISTRY and NITROGEN ANALYSIS

DATE RECEIVED 3/22/85 | LAB NO. WC-1217 | USER CODE ☐ 59300 ☐ 59600 ☒ OTHER: 82235

Collection DATE 3/20/85
Collection TIME 1555
Collected by — Person/Agency Boyer/OCD

SITE INFORMATION ►
Sample location: Flora Vista Water Supply Well #5
Collection site description: Sample from spigot in well house with other wells shut off

SEND FINAL REPORT TO ►
ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
State Land Office Bldg, PO Box 2088
Santa Fe, NM 87501
Attn: David Boyer

Station/well code:
Owner: FVWUA

SAMPLING CONDITIONS

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water level —	Discharge ~100 gpm	Sample type Grab
pH (00400) —	Conductivity (Uncorrected) 610 µmho	Water Temp. (00010) 11 °C	Conductivity at 25°C (00094) — µmho

Field comments: This is well between contaminated well #1 and pump house

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted: 1
☐ NF: Whole sample (Non-filtered) ☒ F: Filtered in field with 0.45 µmembrane filter ☒ A: 2 ml H_2SO_4/L added
☐ NA: No acid added ☐ Other-*specify*:

ANALYTICAL RESULTS from SAMPLES

NF, NA		Units	Date analyzed
☐ Conductivity (Corrected) 25°C (00095)		µmho	
☐ Total non-filterable residue (suspended) (00530)		mg/l	
☐ Other:			
☐ Other:			
☐ Other:			

F, NA		Units	Date analyzed
☐ Calcium (00915)		mg/l	
☐ Magnesium (00925)		mg/l	
☐ Sodium (00930)		mg/l	
☐ Potassium (00935)		mg/l	
☐ Bicarbonate (00440)		mg/l	
☐ Chloride (00940)		mg/l	
☐ Sulfate (00945)		mg/l	
☐ Total filterable residue (dissolved) (70300)		mg/l	
☐ Other:			

NF, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N total (00630)		mg/l	
☐ Ammonia-N total (00610)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Chemical oxygen demand (00340)		mg/l	
☐ Total organic carbon ( )		mg/l	
☐ Other:			
☐ Other:			

F, A-H_2SO_4		Units	Date analyzed
☒ Nitrate-N +, Nitrate-N dissolved (00631)	0.17	mg/l	4/5
☒ Ammonia-N dissolved (00608)	0.10	mg/l	4/22
☒ Total Kjeldahl-N ( )	0.13	mg/l	5/10
☐ Other:			

Analyst: | Date Reported: 5/10/85 | Reviewed by: [signature]

Laboratory remarks:

SLD 726 (12/84) *DISTRIBUTION:* WHITE — EID, GW&HW Bureau CANARY — WS System PINK — EID Local Office GOLDENROD — SLD

SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 — (505) 84[illegible]55

HEAVY METALS

~~GENERAL WATER CHEMISTRY~~
and ~~NITROGEN ANALYSIS~~

DATE RECEIVED	3 22 85
LAB NO.	HM-485
USER CODE	☐ 59300 ☐ 59600 ☒ OTHER: 82235
Collection DATE	3 20 85
Collection TIME	1555
Collected by — Person/Agency	Boyer / OCD

SITE INFORMATION ►

Sample location: Flora Vista Water Supply Well #5

Collection site description: Sample from spigot in well house w/ the other wells shut off

SEND FINAL REPORT TO ►

ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
State Land Office Bldg., PO Box 2088
Santa Fe, NM 87501

Attn: David Boyer

Station/well code:

Owner: FVWUA

SAMPLING CONDITIONS

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water level —	Discharge ~100 gpm	Sample type Grab
pH (00400) —	Conductivity (Uncorrected) 610 µmho	Water Temp. (00010) 11 °C	Conductivity at 25°C (00094) — µmho

Field comments: This is well between contaminated well #1 and pump house

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted: 1

☐ NF: Whole sample (Non-filtered) ☒ F: Filtered in field with 0.45 µmembrane filter ☐ ~~A: 2 ml H_2SO_4/L added~~ 5ml HNO3

☐ NA: No acid added ☐ Other-*specify:*

ANALYTICAL RESULTS from SAMPLES

NF, NA		Units	Date analyzed
☐ Conductivity (Corrected) 25°C (00095)		µmho	
☐ Total non-filterable residue (suspended) (00530)		mg/l	
☒ Other: ICAP SCAN			
☒ Other: As	<.005	mg/l	
☒ Other: Se	<.005	mg/l	

NF, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N total (00630)		mg/l	
☐ Ammonia-N total (00610)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Chemical oxygen demand (00340)		mg/l	
☐ Total organic carbon ( )		mg/l	
☐ Other:			
☐ Other:			

F, NA		Units	Date analyzed
☐ Calcium (00915)		mg/l	
☐ Magnesium (00925)		mg/l	
☐ Sodium (00930)		mg/l	
☐ Potassium (00935)		mg/l	
☐ Bicarbonate (00440)		mg/l	
☐ Chloride (00940)		mg/l	
☐ Sulfate (00945)		mg/l	
☐ Total filterable residue (dissolved) (70300)		mg/l	
☐ Other:			

F, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N dissolved (00631)		mg/l	
☐ Ammonia-N dissolved (00608)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Other:			

Analyst	Date Reported	Reviewed by
	5 31 85	J. Ashby

Laboratory remarks

SLD 726 (12/84) *DISTRIBUTION:* **WHITE** — EID, GW&HW Bureau **CANARY** — WS System **PINK** — EID Local Office **GOLDENROD** — SLD

ICAP SCREEN

Lab Number: HM 485

Date Submitted: 3/22/85

By: Boyer

Sample Code: Flora Vista Water Supply Well #5

Date Reported: 5/31/85

By: J. Ashby

Determination	Concentration (μg/ml)
Aluminum	<.10
Barium	<.10
Beryllium	<.10
Boron	<.10
Cadmium	<.10
Calcium	112.
Chromium	<.10
Cobalt	<.10
Copper	<.10
Iron	<.10
Lead	<.10
Magnesium	11.
Manganese	.39
Molybdenum	<.10
Nickel	<.10
Silicon	5.9
Silver	<.10
Strontium	2.8
Tin	<.10
Vanadium	<.10
Yttrium	<.10
Zinc	<.10

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 — (505) [illegible]2555

GENERAL WATER CHEMISTRY and NITROGEN ANALYSIS

DATE RECEIVED 3/22/85	LAB NO. WC-1208	USER CODE ☐ 59300 ☐ 59600 ☒ OTHER: 82235
Collection DATE 3/20/85	SITE INFORMATION ►	Sample location: Animas River
Collection TIME 1635		Collection site description: Animas River directly opposite Flora Vista Well #3
Collected by — Person/Agency: Boyer/OCD		

SEND FINAL REPORT TO ►

ENVIRONMENTAL BUREAU
NM OIL CONSERVATION DIVISION
State Land Office Bldg, PO Box 2088
Santa Fe, NM 87501

Attn: David Boyer

Station/well code:

Owner:

SAMPLING CONDITIONS

☐ Bailed ☐ Pump ☒ Dipped ☐ Tap	Water level —	Discharge —	Sample type Grab
pH (00400) —	Conductivity (Uncorrected) 345 µmho	Water Temp. (00010) 10 °C	Conductivity at 25°C (00094) µmho

Field comments

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted 1	☒ NF: Whole sample (Non-filtered)	☐ F: Filtered in field with 0.45 µmembrane filter	☐ A: 2 ml H_2SO_4/L added

☒ NA: No acid added ☐ Other-specify:

ANALYTICAL RESULTS from SAMPLES

NF, NA		Units	Date analyzed
☒ Conductivity (Corrected) 25°C (00095)	456	µmho	
☐ Total non-filterable residue (suspended) (00530)		mg/l	
☒ Other: pH	7.09		
☐ Other:			
☐ Other:			

~~NF, A-H_2SO_4~~ NA		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N total (00630)		mg/l	
☐ Ammonia-N total (00610)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Chemical oxygen demand (00340)		mg/l	
☒ Total organic carbon ( )	17.0	mg/l	
☐ Other:			
☐ Other:			

~~F~~, NA NF		Units	Date analyzed
☒ Calcium (00915)	60.4	mg/l	4/15
☒ Magnesium (00925)	12.8	mg/l	4/15 4.07
☒ Sodium (00930)	25.3	mg/l	3/28
☒ Potassium (00935)	1.95	mg/l	3/28
☒ Bicarbonate (00440)	162.0	mg/l	5/6
☒ Chloride (00940)	12.5	mg/l	4/15
☒ Sulfate (00945)	116.3	mg/l	4/4
☒ Total filterable residue	368		6/5
(dissolved) (70300) CO_3	none	mg/l	5/6
☒ Other: Flouride	~~0.34~~ 0.29		4/8

F, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N dissolved (00631)		mg/l	
☐ Ammonia-N dissolved (00608)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Other:			

Analyst	Date Reported	Reviewed by
	7/3/85	[signature]

Laboratory remarks

SLD 726 (12/84) *DISTRIBUTION:* **WHITE** — EID, GW&HW Bureau **CANARY** — WS System **PINK** — EID Local Office **GOLDENROD** — SLD

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

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

February 15, 1985

M E M O R A N D U M

TO: R. L. STAMETS, DIRECTOR, OCD

FROM: D. G. BOYER, GEOLOGIST, ENVIRONMENTAL BUREAU

SUBJECT: FLORA VISTA WATER SUPPLY SAMPLING

The OCD and EID are cooperating in an effort to delineate and define the current status of hydrocarbon contamination in the vicinity of the Flora Vista Water Users Association water supply wells. Staff of both agencies plan to be in the Farmington area March 6 to 8 to perform field investigations at this and other sites. Investigation at the Flora Vista site will include sampling of the contaminated well and on-line water supply wells, trenching in the vicinity of the suspected source(s) to determine current contamination status, and installation of monitoring wells as necessary. Testing of samples will include analyses for organic contaminants, heavy metals and general water chemistry.

Because of the nature of the subsurface material (coarse gravels, cobbles and boulders), a backhoe machine will be necessary to reach the water table. I understand the Water Users Association has such equipment available. Attempts today to contact Mr. Bert Barnes (President) to discuss the proposed schedule and backhoe availability have been unsuccessful. I will continue coordination of this effort and will keep you informed.

fd/

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

January 25, 1985

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

Representative Don Silva, Chairman
House Energy and Natural Resources Committee
Executive Legislative Building
Santa Fe, New Mexico 87503

Dear Chairman Silva:

This letter is in response to the request of the House Energy and Natural Resources Committee for information regarding hydrocarbon contamination of a public water-supply well in the community of Flora Vista in San Juan County. The January 23, 1985, Environmental Improvement Division (EID) letter to you summarizes the current situation. One of the public supply wells was contaminated in 1983 and taken out of service while other nearby water wells have shown no evidence of contamination based on EID monitoring. The suspected source of contamination was one or more pits at a nearby natural gas well that received unusable water and other fluids produced with the gas. While the primary pit at this location was lined, it is my understanding that the fiberglass tank developed a leak. The fiberglass tank has been replaced and a small steel tank has been placed in the second pit. The Oil Conservation Division (OCD) is cooperating with EID in planning further tests and sampling on the contaminated water well later this winter. To our knowledge, this is the only contamination case of this type in Northwest New Mexico.

The OCD has initiated steps to prevent such contamination from occurring in the future in the San Juan Basin. Last July the OCD organized a study committee composed of industry, government and citizen groups to investigate the location and extent of San Juan Basin aquifers vulnerable to contamination by disposal of produced water. The committee is to also prepare recommendations for protection of such aquifers. There has been a ban on improper surface disposal of such fluids in Southeast New Mexico since 1969. No such ban has been actively sought in the San Juan Basin before this time as the volumes of produced water there have been generally much smaller and the quality has been better. However, new concerns related to reports of dissolved hydrocarbons in the water exceeding health standards and the Flora Vista case have caused us to pursue such a ban there as well.

An Oil Conservation Commission (OCC) hearing scheduled for February 20, will hear study committee recommendations to prohibit and/or limit such disposal. It is expected that the outcome of this process will be an OCC order prohibiting or controlling disposal of such fluids in a manner that will protect fresh water supplies used for drinking, industrial or agricultural uses.

If you wish further information on this matter, please do not hesitate to contact me.

Sincerely,

R. L. STAMETS,
Director

RLS/DB/dr

cc: Paul Biderman, Secretary
Energy and Minerals Department
Richard Holland, Deputy Director
Environmental Improvement Division
Members, House Natural Resources Committee

TONEY ANAYA
GOVERNOR

DENISE D. FORT
DIRECTOR

HEALTH
ENVIRONMENT department

STATE OF NEW MEXICO

ENVIRONMENTAL IMPROVEMENT DIVISION
P.O. Box 968, Santa Fe, New Mexico 87504-0968
(505) 984-0020

January 23, 1985

Representative Don Silva, Chairman
House Energy and Natural Resources Committee
Executive Legislative Building
Santa Fe, New Mexico 87503

Dear Chairman Silva:

As you know, Flora Vista had to shut down one of its public water-supply wells in 1983 due to hydrocarbon contamination, the source of which appears to be nearby petroleum-production activities. The Oil Conservation Division (OCD) of the Energy and Minerals Department regulates such activities, including their environmental impacts, under the authority of the Oil and Gas Act and the Water Quality Act. The Environmental Improvement Division (EID), however, became involved with the problem for the following reasons:

1. EID regulates and monitors the qualilty of water served by such public systems;
2. EID has been conducting, with funds provided by the U.S. Environmental Protection Agency, a statewide investigation of organic water contaminants, including those attributable to the petroleum industry; and
3. EID explored the possibility of using the federal "Superfund" program to remedy the problem.

Based upon EID's monitoring, Flora Vista's remaining water wells have shown no evidence of contamination. In the summer of 1984, the EID attempted to drill monitoring wells in the area for the purposes of determining the exact source(s) of contamination and whether or not any of Flora Vista's remaining wells were in danger of contamination. EID's hollow-stem drill rig, however, was not capable of penetrating the large quartzite gravel and boulders; EID is exploring the feasibility of acquiring the appropriate drilling capabilities either by capital purchase or by contract services. Lastly, the EID has been advised by the U.S. Environmental Protection Agency that petroleum contamination problems such as Flora Vista are ineligible for "Superfund" cleanup actions.

Don Silva
January 23, 1985
Page 2

By copy of the this letter I am informing the OCD of the House Energy and Natural Resources Committee's interest in Flora Vista, and of your request that the OCD provide information to the committee regarding OCD's present and pending activities to address this problem.

Sincerely,

Anthony Drypolcher

for Richard Holland
Deputy Director, EID

RH/DM/dlr

cc: Richard Stamets, Director, Oil Conservation Division
Members, House Natural Resources Committee

HEALTH ENVIRONMENT department

STATE OF NEW MEXICO

ENVIRONMENTAL IMPROVEMENT DIVISION
P.O. Box 968, Santa Fe, New Mexico 87504-0968
(505) 984-0020

TONEY ANAYA
GOVERNOR

DENISE D. FORT
DIRECTOR

December 7, 1984

Marty Buys
Environmental Coordinator
Tenneco Oil Co.
P.O. Box 3249
Englewood, CO 80155

Dear Mr. Buys:

Douglas Earp, a member of my staff, attended the meeting of the Short Term Water Study Committee on November 29 and after having discussed with him the written recommendations presented and discussed at that meeting, I would like to offer the following comments for your consideration prior to preparation of a revised Recommendations document. The organization and numbering of my comments follow the format of the committee report.

A. Definitions

3. Blowdown Pit: Wording related to the length of time that liquid is allowed to stand in the pit might be deleted from this definition if changes of the type suggested subsequently in regard to the blowdown exemption are made.

6. Special Areas: This definition should more clearly specify that the current list of special areas is based on preliminary information and that any other areas (outside of the "vulnerable areas") in which ground water is subsequently found to be within 50 feet of the ground surface will automatically be classified as "special areas". The random scatter of areas currently included on the list suggests that the water table in surrounding sections might also be within 50 feet of the ground surface. Areas of vulnerable, high quality ground water should be protected whether or not they are presently being used as a source of water.

7. Vulnerable Aquifer: The term "floodplain area" might be defined more specifically (e.g. with respect to the 50 year or 100 year storm event or with respect to elevation above the river). Wording of the parenthetical exclusion following "unconfined aquifers" is too general and might provide an unacceptable loophole. An unconfined aquifer should only be exemptable if it can be reasonably demonstrated that the thickness, makeup, and hydrologic properties of the overlying geologic materials eliminate the possibility that contaminants will ever reach the ground water.

B. Exemptions

1. Blowdown Pits: Discussion during the November 29 meeting demonstrated that the intention of this exemption is to eliminate pits which only contain liquid infrequently. I understand the need to apply limited resources to address the most serious problems first, but I have several reservations with this exemption.

   - First, exemption of pits "in which liquid is not allowed to stand for a period exceeding 96 hours" may inadvertently exempt pits having the greatest potential to contaminate ground water since pits located in highly permeable materials will drain faster than pits located in less permeable materials.

   - Secondly, it is erroneous to assume that contaminants will only migrate toward the water table as long as liquid is present in the pit (i.e. under a positive hydrostatic pressure). Liquid will continue to percolate downward by unsaturted flow as long as there is net potential gradient in the downward direction. A suction or tension (i.e. negative pressure) gradient of this type will be present until such time as the moisture potential equilibrates throughout the unsaturated soil profile (i.e. possibly for several weeks following each application of liquid to the pit). Contaminants can thereby be carried to the water table by surges of unsaturated flow resulting form a series of short term applications of liquid (blowdown or natural precipitation) to the overlying pit, as well as by saturated flow if liquid even occasionally remains in the pit for an extended period of time.

   A more acceptable approach to the blowdown pit exemption would be to evaluate sites on the basis of a) the total volume of liquid discharged to a pit during a specified period of time; b) chemical characteristics of the blowdown liquid (regarding organic as well as inorganic constituents); and c) the attenuation capacity and hydraulic characteristics of the unsaturated zone (e.g. clay and organic matter content). An even better approach would be to eliminate the blowdown pit exemption entirely because of the uncertainties regarding chemical characteristics of the blowdown liquid and variabilities in frequency of blowdown at various wells.

3. Adequacy of the discharge volume and depth to ground water limitations included in the dehydrator pit exemption should be evaluated experimentally. Chemical characteristics of the liquid and chemical attenuation capacity and hydraulic characteristics of the soil should also be considered prior to granting an exemption.

C. Permits

1. Discharge Volume Permit: The adequacy of numerical standards included in this section should be verified prior to adoption.

2. Quality Permit: The operator should be required to demonstrate that concentrations of both organic (including aromatic hydrocarbons) and

inorganic compounds (TDS and Cl at a minimum) in liquid discharged to the pits will not cause degredation of the ground water. A discharge permitted solely on the basis inorganic chemical constituents is not acceptable.

3. Soil Characteristics Permit: The term "low permeabilities" should be quantified. Also, the capacity of the soil to retard movement of both inorganic and organic contaminants, based in part on clay and organic matter content, should be considered during permit evaluation.

D. Conclusions: The statement that "no real evidence of contamination of these waters was found" based on a review of records of various agencies is misleading. At least one water supply well near Flora Vista (water quality data provided in table attached to this letter) has been abandoned due to phenolic and oil and grease contamination originating from the vicinity of a gas well. The lack of additional data may reflect past failures to look for ground water contamination related to oil and gas activities as much as it reflects the absence of contamination.

As a general comment, I would like to reiterate the EID position that the permit evaluation process must include consideration of organic constituents (particularly the benzene family) as well as inorganic constituents of liquid discharged to unlined pits.

Your consideration of these comments is appreciated. Please feel free to contact me or Douglas Earp at (505) 984-0020 if you have questions or if we can be of further assistance to your committee.

Sincerely,

Anthony Drypolcher

Anthony Drypolcher
Bureau Chief
Ground Water/Hazardous Waste Bureau

AD/DE/ps

cc: Dave Boyer
Chris Shuey

Table 23. Flora Vista Area 30N.12W.23 All units are mg/L unless otherwise indicated.

Sampling Station	Contaminated Well	Online
Sampling Date	8/83	6/19/84
Calcium	--	148./150.
Magnesium	20.75	9.6/11.
Sodium	--	41.4
Potassium	--	0.00
Bicarbonate	--	312.7
Sulfate	200.	187.
Chloride	10.4	20.9
Nitrate-N	0.5	0.05
Ammonia-N	--	0.11
Aluminum	2.21	<0.10
Arsenic	1.56	--
Barium	<0.005	<0.10
Beryllium	--	<0.10
Boron	<0.004	<0.10
Cadmium	<0.002	<0.10
Chromium	<0.005	<0.10
Cobalt	<0.003	<0.10
Copper	<0.002	<0.10
Iron	0.15	<0.10
Lead	<0.001	<0.10
Manganese	0.32	0.45
Mercury	0.63	--
Molybdenum	<0.005	<0.10
Nickel	<0.10	<0.10
Selenium	<0.002	--
Silicon	--	5.9
Silver	--	<0.10
Strontium	--	2.6
Tin	--	<0.10
Vanadium	--	<0.10
Yttrium	--	<0.10
Zinc	--	<0.10
TDS	558.	655.
pH (units)	7.3	7.3
COD	--	4.0
TOC	125.	1.0
Aromatic Purgeables	<0.01	ND (Sampled later in 1984)
Phenols	0.40	
Oil & Grease	32.8	
Collector	OCD	EID
Analyst	Ana Cor	SLD

100-24

TONEY ANAYA
GOVERNOR

ENVIRONMENT department

STATE OF NEW MEXICO

Joseph Goldberg,
Secretary

ENVIRONMENTAL IMPROVEMENT DIVISION
DISTRICT I FIELD OFFICE/724 WEST ANIMAS
FARMINGTON, NEW MEXICO 87401

JOSEPH F. JOHNSON
DEPUTY SECRETARY

Telephone #(505)327-9851

Steven Asher, Director

May 23, 1984

Mr. Bert Barnes, President
Flora Vista Water Users Association
P.O. Box 171
Flora Vista, New Mexico 87415

Dear Mr. Barnes:

The annual environmental survey of the Flora Vista Water Supply System was conducted on April 24, 1984. The survey report is attached for your review and file.

The system supplies water to approximately 1,600 consumers. Presently, the system purchases some of its water supply from the City of Aztec and generates the rest of its water supply from wells. Wells number 1 and 3 remain out of service due to oil and grease contamination.

The association's contract with Aztec limits the purchase of water to 36 million gallons per year. This limitation may result in periods of low pressure during the summer when water demand is the highest.

Deficiencies noted during the inspection are listed below:

1. Maintenance records are not being kept. Proper maintenance records would help in identifying problem areas of the system.

2. Fan switch, in pump house chlorination room, should be provided on outside of the pump house. Relocating the fan switch outside the pump house would essentially eliminate the possibility of an operator being overcome by chlorine gas.

3. No screen on overflow pipe for 300,000 gallon tank. The screen would prevent the entrance into the tank's overflow system of small animals, insects or birds.

RECEIVED
JUN 22 1984
WATER SUPPLY
REGULATION SECTION

I wish to thank Mr. Ray Penrod and Mr. Philip Cheney for their time and cooperation in conducting the survey. If I can be of any assistance to you, please contact me.

Sincerely,

Arcelious Stephens

Arcelious Stephens,
Environmentalist III

AS:lm
cc:File
Water Supply Section

RECEIVED
JUN 22 1984
WATER SUPPLY
REGULATION SECTION

N/A - Not Applicable
N-Av - Not Available
Est. - Estimated

NM Health and Environment Department
Environmental Improvement Division

Community Water Supply System Inspection Form

Section A - GENERAL INFORMATION

Inspection Date: 04-24-84

WSS CODE:	WATER SUPPLY SYSTEM NAME	COUNTY:
100-24	Flora Vista Water Users	San Juan

System Address/LOCATION: P.O. Box 171, Flora Vista, New Mexico 87415

OWNER:	OWNER ADDRESS (if different than above)	PHONE
Flora Vista Water Users Assoc		334-6045

Population Served	# Connections	# Meters	Max. System Production	Average System Production
1,600 Est.	550	550	N-Av GPD; Poten. ☐ Actual ☐	10,456,955 ~~GPD~~ YTD 03-20-84

System Source (check Approp. Boxes): Distribution Only ☐ Well(s) ☒ # of Wells 2 in use
Spring(s) ☐ Infiltration Gallery ☐ Surface ☐

Additional or Qualifying Information:

Aquadene - a phosphate chemical added to water to keep chlorine from turning water black from iron and manganese.

Pump house to be expanded later this year.

Fan switch in pump house chlorination room should be provided on outside of the pump house.

Wells #1 and #3 contaminated with oil and grease are still out of service. Currently, the system gets its water from the city of Aztec and wells #2 and #4. Well #4 is a new well.

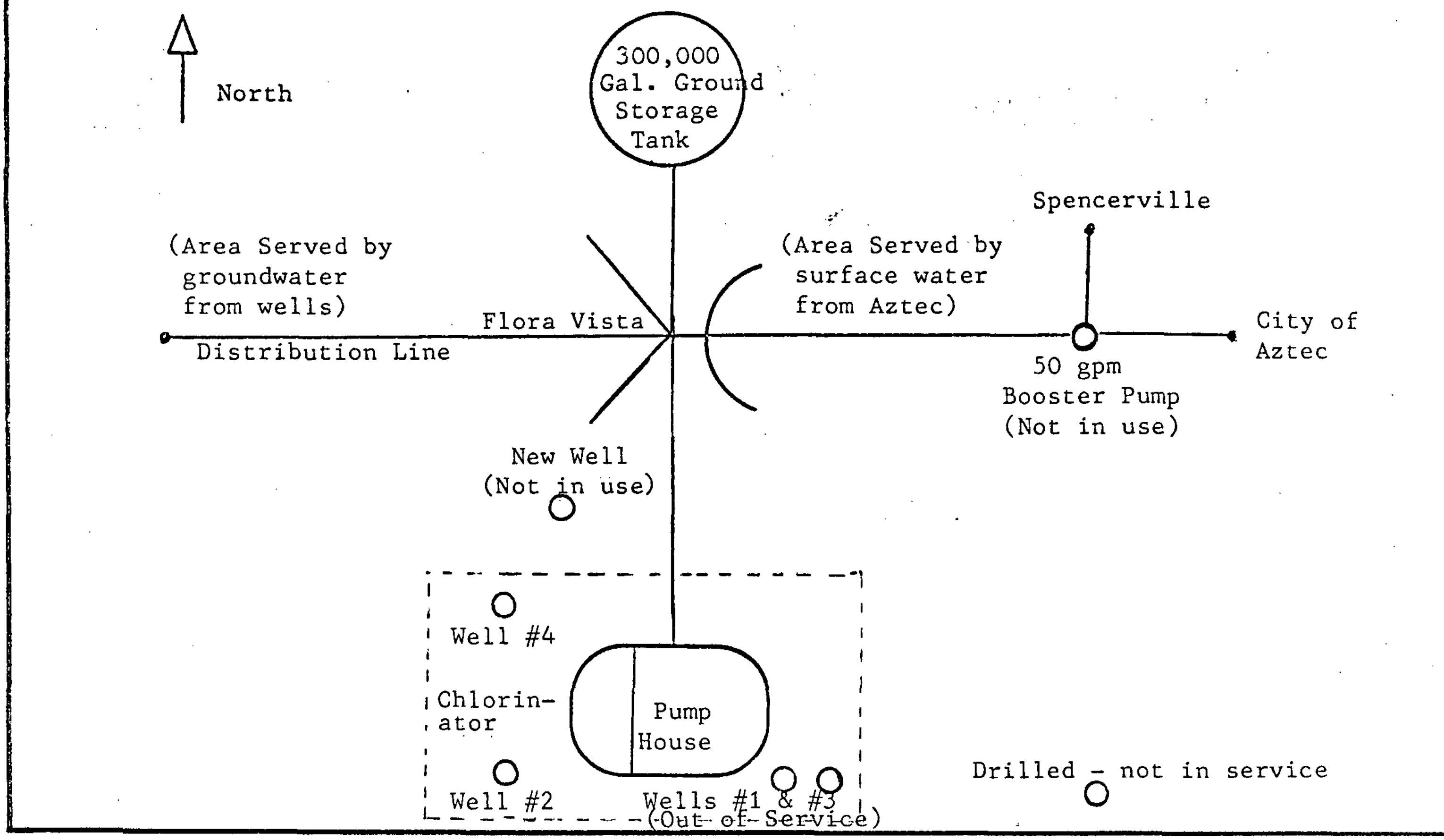
System Personnel - Name/Classification	Level of Certification Required	Level of Certification Obtained
Ray Penrod/Manager	None	None
Philip Cheney/Assistant	None	None

Information furnished by: Ray Penrod/Manager	Business Phone: 334-6045
Survey Performed by: Arcelious Stephens	Phone: 327-9851

RECEIVED
JUN 22 1984
WATER SUPPLY REGULATION SECTION

Section A (Continued)

SIMPLIFIED FLOW DIAGRAM OR SCHEMATIC OF THE SYSTEM (INDICATE NORTH IF APPROPRIATE)



Section B - Source Information

WELL Identification	Well Depth	Pump Depth	Pump Capacity GPM	Well Drawdown feet	Pump Type	Static Water Level	Age of Pump	Date Well Drilled
Well #1	25'	18'	60-70	5'-6'	Submers.	≃ 8'	2 yrs.	1980
Well #2	25'	20½'	60-70	5'-6'	Submers.	≃ 8'	2 yrs.	1980
Well #3	25'	N/A	N/A	N/A	Submers.	≃ 8'	N/A	1980
Well #4	26'	21'	45	15'	Submers.	≃ 8'	New	08/83

Remarks, Deficiencies, and Recommendations

Source	Number (each)	Total Capacity	Remarks, Deficiencies, and Recommendations
Artesian Wells			
Springs			
Infiltration Galleries			

RECEIVED
JUN 22 1984
WATER SUPPLY
REGULATION SECTION

Section C - Gravity Storage and Pressure Tank Reservoirs

Gravity Storage Reservoir Indent.	Storage Capacity (gallons)	Date Built	Exterior Condition	Tank Material	Cathodic Protection	Tank Openings Secured	Overflow Screened	Vent Screen
#1	300,000	1979	Good	Steel	No	Yes	No	Yes

Pressure Tank I.D.	Volume (gallons)	Age	Exterior Condition	Additional Information

Remarks, Deficiencies or Recommendations

Section D - WATER DISTRIBUTION

Booster Pump Stations	Total Number of Stations: 1	Remarks, Deficiencies or Recommendations Rarely, if ever, used 50 gpm in-line centrifugal pump

Type of Disinfection Facilities	Chlorine Gas	Remarks, etc. Gas chlorination provided at wells; Purchased water disinfected by Aztec.
System Pressure	Max. 90 psi Min. 55 psi	Remarks, etc. May be pressure problems in summer due to limitations on amount of water purchased from Aztec.
Pipe Materials in system	PVC [X] STEEL [ ] C.I. [ ] Other [X]	Deficiencies (including cross-connections observed) Check valves installed at every metered connection. Cement asbestos.
Type of Distribution System	Gravity [X]	Pressure [X] When wells are in use. Both [ ]

Contaminant	Next Sample Date	Sample Frequency	Remarks
Microbiological	X	2	
Turbidity	X	N/A	
Organics		N/A	
Inorganic	07/84	3 years	
Radiological	03/86	4 years	
Secondary			

RECEIVED
JUN 22 1984
WATER SUPPLY
REGULATION SECTION

Section E - GENERAL OPERATION AND MAINTENANCE (O & M)

Does the system keep up-to-date O&M records?	Yes [ ] No [ ]
Are preventative maintenance activities routinely practiced?	Yes [X] [illegible]
The importance of Cross Connection Control was discussed with the Operator Indicate observed cross connections above (Pipe Materials in System)	Yes [X] No [ ]

Section F - SURFACE WATER SUPPLY INFORMATION N/A

Source (check one)	Remarks or Deficiencies
Lake ☐	
Stream ☐	

Section G - WATER TREATMENT PLANT INFORMATION N/A

Unit Operations	Remarks or Deficiencies
Plant Intake Structure	
Plant Location (Siting)	
Pretreatment, Raw Water Storage or Presettling Reservoirs	
Coagulation - Sedimentation	
Chemical Addition	
Filtration	
Other Treatment (Ion Exchange, Softening, Reverse Osmosis, etc.)	

Additional Comments or Remarks

EID - 042 Revised 11/82

(505) 345-8964
7300 Jefferson St. NE
Albuquerque, NM 87109

Analytical and Environmental Services

AnaCon Laboratories

To: Environmental Improvement Division
Ground Water Section
P.O. Box 968
Santa Fe, NM 87504-0968

Date: 10 August 1983
JV- 669
Page 1 of 2

OIL + GAS PRODUCED WATER PIT ANALYSIS 10 mi E. of FLORVISTA AREA

Attention: Oscar Simpson

Analyte	Sample Identification/Analytical Results				
	#1 (1-F)	#2 (2-E)	#3(dehydrator)	#4 (4-E)	#5 (5-F)
As	1.56 ppm	3.18 ppm	23.64 ppm	3.13 ppm	9.85 ppm
Cd	<0.002 ppm	<0.002 ppm	0.28 ppm	<0.002 ppm	0.02 ppm
Cr	<0.005 ppm	<0.005 ppm	1.28 ppm	<0.005 ppm	0.06 ppm
Pb	<0.001 ppm	<0.001 ppm	12.64 ppm	0.65 ppm	1.14 ppm
Hg	0.63 ppm	0.12 ppm	5.80 ppm	0.04 ppm	3.18 ppm
Se	<0.002 ppm	<0.002 ppm	1.60 ppm	<0.002 ppm	0.15 ppm
Ba	<0.005 ppm	0.07 ppm	2.08 ppm	0.07 ppm	0.42 ppm
Fe	0.15 ppm	2.92 ppm	19.60 ppm	0.51 ppm	<0.05 ppm
Cu	<0.002 ppm	<0.002 ppm	<0.002 ppm	<0.002 ppm	<0.002 ppm
Mn	0.32 ppm	0.32 ppm	0.64 ppm	2.18 ppm	<0.005 ppm
Mg	20.75 ppm	34.32 ppm	5.32 ppm	34.32 ppm	34.32 ppm
Zn	<0.004 ppm	<0.004 ppm	<0.004 ppm	<0.004 ppm	<0.004 ppm
Al	2.21 ppm	4.38 ppm	<0.05 ppm	1.77 ppm	<0.05 ppm
B	<0.004 ppm	3.63 ppm	<0.004 ppm	<0.004 ppm	16.17 ppm
Co	<0.003 ppm	0.72 ppm	5.00 ppm	<0.003 ppm	<0.003 ppm
Mo	<0.005 ppm	<0.005 ppm	<0.005 ppm	<0.005 ppm	<0.005 ppm
Ni	<0.01 ppm	<0.01 ppm	<0.01 ppm	<0.01 ppm	<0.01 ppm
CN	<0.001 ppm	19.58 ppm	0.058 ppm	0.082 ppm	42.30 ppm
F	6.6 ppm	5.6 ppm	0.33 ppm	2.7 ppm	12.1 ppm
NO_3 as N	0.5 ppm	10.8 ppm	250 ppm	1.5 ppm	80 ppm
SO_4	200 mg/l	1,750 ppm	1,600 ppm	55 ppm	450 ppm
Cl	10.4 ppm	1,164 ppm	310 ppm	3.6 ppm	1,874 ppm
pH	7.3	7.4	6.9	7.8	8.3
TDS	558.0 mg/l	34,454.0 mg/l	NA*	884.0 mg/l	12,300.0 mg/l
Phenols	0.40 ppm	2.0 ppm	0.30 ppm	0.60 ppm	0.35 ppm
Oil& Grease	32.8 ppm	37.1 ppm	NA*	37.5 ppm	54.7 ppm
Benzene	<0.01 ppm	0.18 ppm	13.0 ppm	<0.01 ppm	0.05 ppm
Toluene	<0.01 ppm	<0.01 ppm	13.4 ppm	<0.01 ppm	0.042 ppm
		(some hydrocarbons)	(72 % glycol rest hydro-carbon solvents)		(heavier hydrocarbons present)
TOC	125.07 ppm	171.03 ppm	797.36 ppm	126.93 ppm	640.75 ppm

HEALTH ENVIRONMENT department

STATE OF NEW MEXICO

ENVIRONMENTAL IMPROVEMENT DIVISION
P.O. Box 968, Santa Fe, New Mexico 87504-0968
(505) 984-0020
Steve Asher, Director

GOVERNOR

ROBERT McNEILL
SECRETARY

ROBERT L. LOVATO, M.A.P.A.
DEPUTY SECRETARY

JOSEPH F. JOHNSON
DEPUTY SECRETARY

August 23, 1983

Mr. George Madrid
Lawerance A. Brewer & Associates
P.O. Box 2079
Farmington, NM 87499

RE: Water Analysis of Floravista

Dear Mr. Madrid:

As per our phone conversation of August 18, 1983, I am forwarding you a copy of the water analysis results of the Floravista Well field area.

Sample #1 is from water well #1.

Sample #2 is from the oil-water separator next to the gas well.

Sample #3 is from the glychol dehydrator. SLUDGE

Sample #4 is a sample of water that was in a previously dug open pit. The water level in the pit possibly represents the water table.

Sample #5 is not associated with the Floravista problem.

If you have any questions regarding this matter, please contact me at the above telephone number and addresses.

Sincerely,

Oscar A. Simpson III

Oscar A. Simpson
Water Resource Specialist
Ground Water Section

OAS:egr

Enclosure

LAWRENCE A. BREWER & ASSOCIATES, INC.

CONSULTING ENGINEERS

Lawrence A. Brewer, P.E., L.S.
Richard P. Cheney, P.E., L.S.
George T. Walters, L.S.
Robert A. Echols, Jr., P.E.

August 1, 1983

Mr. Oscar Simpson
New Mexico Oil & Gas Commission
P. O. Box 2088
Santa Fe, New Mexico 87501

RE: FLORA VISTA WATER USERS ASSOCIATION WATER WELLS

Dear Mr. Simpson:

In accordance with Mr. Richard Thurstonson's request, we are submitting herewith the following information regarding the above referenced project:

1. One copy each of the lab analysis of various water samples obtained at the Flora Vista well field.

2. A copy of the driller's log of Well No. 3 (logs of Well No. 1 and No. 2 are similar to the driller's log of Well No. 3).

3. One copy each of all correspondence filed in our office since the wells were determined to be contaminated with hydrocarbons.

We hope this information will be helpful.

Sincerely yours,

LAWRENCE A. BREWER & ASSOCIATES, INC.

George A. Madrid

George A. Madrid, E.I.T.

GAM/tlc F-331

cc: Mr. Frank Chavez
Mr. Richard Thurstonson

complete set of analyses in "Flora Vista Water Analysis" File RTB 8/3/83

909 W. APACHE, FARMINGTON, NM 87401
P. O. BOX 2079, ZIP 87499 (505) 327-3303

DURANGO, COLORADO 81301
P. O. BOX 3327 (303) 247-5766

F-331

CDS LABORATORIES

A DIVISION OF CASA DEL SOL, INC.
1474 MAIN AVENUE #131
POST OFFICE BOX 2605
DURANGO, COLORADO 81301

(303) 247-4220

JESUS

Date: 8-1-83

To: Flora Vista Water User
Attn. Richard Cheyney
909 W. Apache
Farmington, N.M. 87401

CDS Lab ID #

Sample Description:

L.A.B. AUG 23 '83

Sample ID	Analyte	* Analytical results
2456 Gallon Jug	C_6-C_{22}	0.70 mg Total Hydrocarbons
2359 Old Pit	C_6-C_{22}	7.50 mg Total Hydrocarbons
2454 East of Pit	C_6-C_{22}	8.10 mg Total Hydrocarbons
2455 South of Pit	C_6-C_{22}	4.00 mg Total Hydrocarbons

* TOTAL HYDROCARBONS IN 350 ML SAMPLE

Normal detection Limit 0.01

CONCENTRATION BASED ON Mg/L

2359	21.43 Mg/L OF H_2O REC'D
2456	1.99 Mg/L " " "
2455	11.41 Mg/L " " "
2454	23.14 Mg/L " " "

SEE AMMENDED REPORT 8/24/83

Dr. Joe Bowden Director

CDS LABORATORIES — INTERNAL LAB REPORT — CDS ID# 2456

Date Received: 6/1/83
For: Richard Cheyney

Date Results Sent:
To:

Date Billed:
To:

Sample Info: Where
When
Container
How
Preservative

Invoice #
Amount $
Paid / /

FIELD INFORMATION/DATA

Sample Description: (Gallon Jug)

Date Taken: Time:
Date Received in Lab:
Date Completed:
QA Check:

Alkalinity		mg/L
Conductivity at 25°		umhos/cm
Dissolved Oxygen		mg/L
pH		units
Temperature		°C
Flow		

PHYSICAL PARAMETERS

Acidity		mg/L
Alkalinity		mg/L
Color		
Conductivity at 25°		umhos/cm
Dissolved Oxygen		mg/L
Hardness ($CaCO_3$)		mg/L
pH		units
Specific Gravity		mg/L
Temperature		°C
Total Combustables		mg/L
Total Dissolved Solids		mg/L
Total Solids		mg/L
Total Suspended Solids		mg/L
Turbidity (as FTU)		mg/L

TRACE METALS

Total Dissolved mg/L

Aluminum
Antimony
Arsenic
Barium
Beryllium
Boron
Cadmium
Calcium
Chromium:
Total
+3 Form
+4 Form
Cobalt
Copper
Iron
Lead
Magnesium
Manganese
Mercury
Molybdenum
Nickel
Phosphorus
Potassium
Selenium
Silver
Sodium
Thallium
Tin
Uranium
Vanadium
Zinc

CHEMICAL PARAMETERS mg/L

Bicarbonate
BOD
Carbonate
Carbon Dioxide
COD
Chloride
Chlorine Demand
Coliform
Cyanide
Fluoride
MBAS
Nitrogen:
Ammonia
Nitrate
Nitrate/Nitrite
Nitrite
Total
Phenols
Phosphate
Silica
Sulfate
Sulfide

Oil & grease	7.1 mg/L
C_6-C_{22}	2 mg/L

RADIOMETRIC ANALYSIS pCi/L

Gross Alpha
Gross Beta
Radium 226
Radium 228

PESTICIDES pCi/L

HERBICIDES pCi/L

Susan Kay Dickinson for

Dr. Joe Bowden Director

CDS LABORATORIES INTERNAL LAB REPORT CDS ID#- 2359

JUN 14 '83

F-331

Date Received: 5/25/83 Date Results Sent: Date Billed:

For: Richard Cheyney To: To:

Attn. George Madrid

Sample Info: Where

When Container

How Preservative

Invoice #

Amount $

Paid / /

FIELD INFORMATION/DATA

Sample Description: From backhoe pit dug 5/23/83 in old slush pit

Date Taken: Time:

Date Received in Lab:

Date Completed:

QA Check:

Alkalinity		mg/L
Conductivity at 25°		umhos/cm
Dissolved Oxygen		mg/L
pH		units
Temperature		°C
Flow		

PHYSICAL PARAMETERS

Acidity		mg/L
Alkalinity		mg/L
Color		
Conductivity at 25°		umhos/cm
Dissolved Oxygen		mg/L
Hardness ($CaCO_3$)		mg/L
pH		units
Specific Gravity		mg/L
Temperature		°C
Total Combustables		mg/L
Total Dissolved Solids		mg/L
Total Solids		mg/L
Total Suspended Solids		mg/L
Turbidity (as FTU)		mg/L

TRACE METALS

Total Dissolved	mg/L
Aluminum	
Antimony	
Arsenic	
Barium	
Beryllium	
Boron	
Cadmium	
Calcium	
Chromium:	
Total	
+3 Form	
+4 Form	
Cobalt	
Copper	
Iron	
Lead	
Magnesium	
Manganese	
Mercury	
Molybdenum	
Nickel	
Phosphorus	
Potassium	
Selenium	
Silver	
Sodium	
Thallium	
Tin	
Uranium	
Vanadium	
Zinc	

CHEMICAL PARAMETERS

	mg/L
Bicarbonate	
BOD	
Carbonate	
Carbon Dioxide	
COD	
Chloride	
Chlorine Demand	
Coliform	
Cyanide	
Fluoride	
MBAS	
Nitrogen:	
Ammonia	
Nitrate	
Nitrate/Nitrite	
Nitrite	
Total	
Phenols	
Phosphate	
Silica	
Sulfate	
Sulfide	

Oil & grease < 3 mg/L

C_6-C_{22} 7.5 mg/L of H_2O

RADIOMETRIC ANALYSIS pCi/L

Gross Alpha	
Gross Beta	
Radium 226	
Radium 228	

PESTICIDES pCi/L

HERBICIDES pCi/L

Oil & grease from filtrate only.

C_6-C_{22} from extracts of filtrate & soil.

Susan Kay Dickinson for

Dr. Joe Bowden Director

CDS LABORATORIES

INTERNAL LAB REPORT

CDS ID# 2454

Date Received: 6/11/83
For: Richard Cheyney

Date Results Sent:
To:

Date Billed:
To:

Sample Info: Where
When
Container
How
Preservative

Invoice #
Amount $
Paid / /

FIELD INFORMATION/DATA

Sample Description: East of Dehydrator pit Flora Vista
Date Taken: Time:
Date Received in Lab:
Date Completed:
QA Check:

Alkalinity		mg/L
Conductivity at 25°		umhos/cm
Dissolved Oxygen		mg/L
pH		units
Temperature		°C
Flow		

PHYSICAL PARAMETERS

Acidity		mg/L
Alkalinity		mg/L
Color		
Conductivity at 25°		umhos/cm
Dissolved Oxygen		mg/L
Hardness ($CaCO_3$)		mg/L
pH		units
Specific Gravity		mg/L
Temperature		°C
Total Combustables		mg/L
Total Dissolved Solids		mg/L
Total Solids		mg/L
Total Suspended Solids		mg/L
Turbidity (as FTU)		mg/L

TRACE METALS

Total Dissolved mg/L

Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium: Total, +3 Form, +4 Form, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Phosphorus, Potassium, Selenium, Silver, Sodium, Thallium, Tin, Uranium, Vanadium, Zinc

CHEMICAL PARAMETERS mg/L

Bicarbonate, BOD, Carbonate, Carbon Dioxide, COD, Chloride, Chlorine Demand, Coliform, Cyanide, Fluoride, MBAS, Nitrogen: Ammonia, Nitrate, Nitrate/Nitrite, Nitrite, Total, Phenols, Phosphate, Silica, Sulfate, Sulfide

Oil & grease	40 mg/L
C_6-C_{22}	23. mg/L

RADIOMETRIC ANALYSIS pCi/L

Gross Alpha
Gross Beta
Radium 226
Radium 228

PESTICIDES pCi/L

HERBICIDES pCi/L

Susan Kay Dickerson
Dr. Joe Bowden Director

CDS LABORATORIES

INTERNAL LAB REPORT

CDS ID# 2455

Date Received: 6/1/83
For: Richard Cheyney

Date Results Sent:
To:

Date Billed:
To:

Sample Info: Where
When
How
Container
Preservative

Invoice #
Amount $
Paid / /

FIELD INFORMATION/DATA

Sample Description: South of Dehydrator pit Flora Vista
Date Taken: Time:
Date Received in Lab:
Date Completed:
QA Check:

Alkalinity		mg/L
Conductivity at 25°		umhos/cm
Dissolved Oxygen		mg/L
pH		units
Temperature		°C
Flow		

PHYSICAL PARAMETERS

Acidity		mg/L
Alkalinity		mg/L
Color		
Conductivity at 25°		umhos/cm
Dissolved Oxygen		mg/L
Hardness ($CaCO_3$)		mg/L
pH		units
Specific Gravity		mg/L
Temperature		°C
Total Combustables		mg/L
Total Dissolved Solids		mg/L
Total Solids		mg/L
Total Suspended Solids		mg/L
Turbidity (as FTU)		mg/L

TRACE METALS

Total Dissolved	mg/L
Aluminum	
Antimony	
Arsenic	
Barium	
Beryllium	
Boron	
Cadmium	
Calcium	
Chromium:	
Total	
+3 Form	
+4 Form	
Cobalt	
Copper	
Iron	
Lead	
Magnesium	
Manganese	
Mercury	
Molybdenum	
Nickel	
Phosphorus	
Potassium	
Selenium	
Silver	
Sodium	
Thallium	
Tin	
Uranium	
Vanadium	
Zinc	

CHEMICAL PARAMETERS

	mg/L
Bicarbonate	
BOD	
Carbonate	
Carbon Dioxide	
COD	
Chloride	
Chlorine Demand	
Coliform	
Cyanide	
Fluoride	
MBAS	
Nitrogen:	
Ammonia	
Nitrate	
Nitrate/Nitrite	
Nitrite	
Total	
Phenols	
Phosphate	
Silica	
Sulfate	
Sulfide	
Oil & grease	< 3 mg/L
C_6-C_{22}	11.4

RADIOMETRIC ANALYSIS pCi/L

Gross Alpha	
Gross Beta	
Radium 226	
Radium 228	

PESTICIDES pCi/L

HERBICIDES pCi/L

Susan Kay Dickinson for
Dr. Joe Bowden Director

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Flora Vista Water Users Association Owner's Well No. ____

Street or Post Office Address P.O. Box 171

City and State Flora Vista, N.M. 87415

Well was drilled under Permit No. SJ-588-1 Exploratory and is located in the:

a. ____ ¼ SW ¼ SW ¼ SW ¼ of Section 23 Township 30-N Range 12 W N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____ Subdivision, recorded in ____ County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Bob Savage License No. WD-847

Address P.O. Box 2434 Farmington, N.M. 87401

Drilling Began 12-7-81 Completed 12-9-81 Type tools Cable Tool Size of hole 10 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 25 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 6 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
6	25	19	Boulders + Sand	100

Section 3. RECORD OF CASING

[illegible]	Pounds	Threads	Depth in Feet	Length	Type of Shoe	Perforations

Section 6. LOG OF HOLE

Depth in Feet From	To	Thickness in Feet	Color and Type of Material Encountered
0	25.	25	Boulders & SAND

100-24

TONEY ANAYA
GOVERNOR

ROBERT McNEILL
SECRETARY

ROBERT L. LOVATO, M.A.P.A.
DEPUTY SECRETARY

JOSEPH F. JOHNSON
DEPUTY SECRETARY

HEALTH ENVIRONMENT department

STATE OF NEW MEXICO

ENVIRONMENTAL IMPROVEMENT DIVISION
DISTRICT I FIELD OFFICE/724 WEST ANIMAS
FARMINGTON, NEW MEXICO 87401
Russell F. Rhoades, MPH, Director

Telephone #(505)327-9851

RECEIVED
MAY 02 1983
WATER SUPPLY
REGULATION SECTION

April 13, 1983

Mr. Bert Barnes, President
Flora Vista Water Users Association
P.O. Box 171
Flora Vista, New Mexico 87415

Dear Mr. Barnes:

The annual environmental survey of the Flora Vista Water Supply System was conducted March 24, 1983. The survey report is attached for your review and file.

The system supplies water to approximately 1500 consumers. Since February, 1983, the system has been purchasing all of its water from the City of Aztec (WSS #098-24). Prior to February, roughly half of the system's water was from two of three wells drilled by the association in 1980. In February, one of the wells became contaminated with oil and grease, presumably from a newly drilled gas well 300 feet upstream. The wells were taken out of service at that time, and the affected lines of the system were flushed to remove the contamination. The wells will not be placed back into service unless the source of contamination is located and eliminated, and the contaminated aquifer cleaned up. According to Richard Cheney of Brewer and Associates, Inc., the outlook for future use of the wells is bleak.

The association's contract with Aztec limits the purchase of water to 36 million gallons per year. This limitation may result in periods of low pressure during the summer when water demand is the highest. Negotiations to purchase water from the City of Farmington are currently under way.

The only deficiency noted during the inspection was that records of maintenance performed are not being kept. Proper maintenance records would help in identifying problem areas of the system.

I wish to thank Mr. Ray Penrod for his time and cooperation in conducting the survey. I would like to encourage the association to have Mr. Penrod attend the Northwest New Mexico Water and Wastewater Operator Short School scheduled for May 9-12, 1983, in Farmington. More information is available from this office. If I can be of any service to you, feel free to contact me.

Sincerely,

David A. Tomko

David A. Tomko,
Environmentalist III

DAT:lm
cc: Water Supply Section
File

N/A - Not Applicable
N-Av - Not Available
Est. - Estimated

NM Health and Environment Department
Environmental Improvement Division

Community Water Supply System

Inspection Form

Section A - GENERAL INFORMATION

		Inspection Date: 03-24-83
WSS CODE: 100-24	WATER SUPPLY SYSTEM NAME Flora Vista Water Users Association	COUNTY: San Juan

System Address/LOCATION
P.O. Box 171, Flora Vista, New Mexico 87415

OWNER:	OWNER ADDRESS (if different than above)	PHONE
Flora Vista Water Users Assoc		334-6045

Population Served	# Connections	# Meters	Max. System Production	Average System Production
1500 Est.	431	431	N-Av GPD Poten. ☐ Actual ☐	100,000 GPD (January 1983)

System Source (check Approp. Boxes)
Distribution Only ☒ Well(s) ☒ # of Wells 3 Not in use due to oil & grease contamination
Spring(s) ☐ Infiltration Gallery ☐ Surface ☐

Additional or Qualifying Information:

In 1981, the water system placed into service 2 wells with a pump control house and chlorination facilities (see March 23, 1982 survey). In February, 1983, the wells became contaminated with oil and grease, presumably from a near by drilled gas well 300 feet upstream. The wells were shut down at that time, and the affected lines of the system were flushed. Due to the contamination, the wells cannot be placed back into service unless the source of contamination is verified and eliminated and the contaminated aquifer cleaned up, which might not be for several years, if ever.

Currently, the systems only source of water is purchased from the City of Aztec and is limited to 36 million gallons per year. Negotiations are currently under way to purchase finished water from Farmington. Purchasing water from Farmington would require the construction of almost 1 mile of pipeline to connect the systems.

System Personnel - Name/Classification	Level of Certification Required	Level of Certification Obtained
Ray Penrod / Maintenance Supervisor	None	None

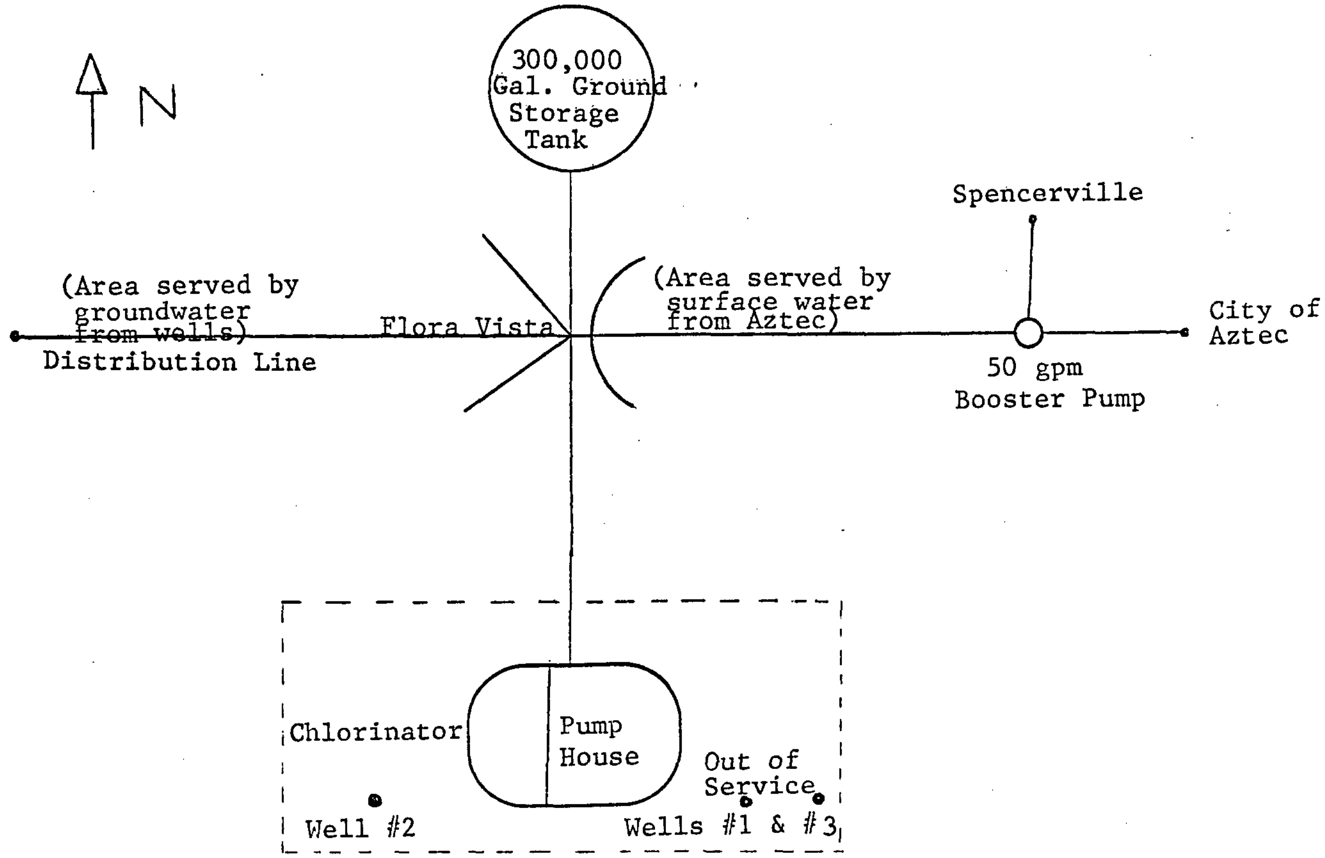
RECEIVED
MAY 0 3 1983
WATER SUPPLY
REGULATION SECTION

Information furnished by: Ray Penrod	Business Phone: 334-6045
Survey Performed by: David A. Tomko, Environmentalist III	Business Phone: 327-9851

EID - 042 Revised 11/82

Section A (Continued)

SIMPLIFIED FLOW DIAGRAM OR SCHEMATIC OF THE SYSTEM (INDICATE NORTH IF APPROPRIATE)



Section B - Source Information

WELL Identification	Well Depth	Pump Depth	Pump Capacity GPM	Well Drawdown feet	Pump Type	Static Water Level	Age of Pump	Date Well Drilled
Well #1	25'	18'	60-70	5'-6'	Submers.	≃ 8'	2 yrs.	1980
Well #2	25'	20½'	60-70	5'-6'	Submers.	≃ 8'	2 yrs.	1980
Well #3	25'	N/A	N/A	N/A	No Pump	≃ 8'	N/A	1980

Remarks, Deficiencies, and Recommendations

All wells shut down due to oil and grease contamination. Contamination found in well #1. Well #2 has not been contaminated, but has been shut down to prevent pulling of contamination through the aquifer. Well #3 was to be used when system expanded and has never been placed into service.

Source	Number (each)	Total Capacity	Remarks, Deficiencies, and Recommendations
Artesian Wells			
Springs			
Infiltration Galleries			

Section C - Gravity Storage and Pressure Tank Reservoirs

Gravity Storage Reservoir Indent.	Storage Capacity (gallons)	Date Built	Exterior Condition	Tank Material	Cathodic Protection	Tank Openings Secured	Overflow Screened	Vent Screen
#1	300,000	1979	Good	Steel	No	Yes	Yes	Yes

Pressure Tank I.D.	Volume (gallons)	Age	Exterior Condition	Additional Information

Remarks, Deficiencies or Recommendations
The storage tank was drained when the oil and grease contamination occurred. The tank has not been placed back into service yet due to insufficient pressure from having entire system on Aztec water.

Section D - WATER DISTRIBUTION

Booster Pump Stations	Total Number of Stations 1	Remarks, Deficiencies or Recommendations Rarely, if ever, used. 50 gpm in-line centrifugal pump.
Type of Disinfection Facilities	Gas Chlorine	Remarks, etc. Gas chlorination provided at wells; Purchased water disinfected by Aztec
System Pressure	Max. 90 psi Min. 55 psi	Remarks, etc. May be pressure problems in summer due to limitations on amount of water purchased from Aztec.
Pipe Materials in system	PVC [X] STEEL [ ] C.I. [ ] Other [X]	Deficiencies (including cross-connections observed) Check valves installed at every metered connection. Cement asbestos
Type of Distribution System	Gravity [X]	Pressure [X] When wells are in use Both [ ]

Contaminant	Next Sample Date	Sample Frequency	Remarks
Micro-biological	X	2	
Turbidity	X	N/A	
Organics		N/A	
Inorganic	07/84	3 years	Only applies if present wells will be placed back into service. Otherwise the Aztec Water Supply System analyses apply.
Radiological	03/86	4 years	
Secondary			

Section E - GENERAL OPERATION AND MAINTENANCE (O & M)

Does the system keep up-to-date O&M records?	Yes [X] (operation)	No [X] (Maintenance)
Are preventative maintenance activities routinely practiced?	Yes [X]	No [ ]
The importance of Cross Connection Control was discussed with the Operator Indicate observed cross connections above (Pipe Materials in System)	Yes [X]	No [ ]

Section F - SURFACE WATER SUPPLY INFORMATION

N/A

Source (check one)	Remarks or Deficiencies
Lake ☐	
Stream ☐	

Section G - WATER TREATMENT PLANT INFORMATION N/A

Unit Operations	Remarks or Deficiencies
Plant Intake Structure	
Plant Location (Siting)	
Pretreatment, Raw Water Storage or Presettling Reservoirs	
Coagulation - Sedimentation	
Chemical Addition	
Filtration	
Other Treatment (Ion Exchange, Softening, Reverse Osmosis, etc.)	

Additional Comments or Remarks

MONTGOMERY & ANDREWS
PROFESSIONAL ASSOCIATION
ATTORNEYS AND COUNSELORS AT LAW

J. O. Seth (1883-1963)
Frank Andrews (1914-1981)

A. K. Montgomery
Seth D. Montgomery
Frank Andrews III
Victor R. Ortega
John E. Conway
Jack M. Morgan
Jeffrey R. Brannen
John B. Pound
Gary R. Kilpatric
Thomas W. Olson
William C. Madison
Walter J. Melendres
Bruce L. Herr
Michael W. Brennan
Robert P. Worcester
John B. Draper
Nancy M. Anderson
Rudolph H. Sacks, Jr.
R. Thomas Dailey
Janet McL. McKay
Edward F. Mitchell III
Carrie L. Parker
Maureen A. Sanders
Mark F. Sheridan
Joseph E. Earnest
Phyllis A. Dow
Wm. Alan Wright
Brad V. Coryell
Candace M. Witt
Wesley B. Howard, Jr.
Thurman W. Moore III
Jack L. Fortner

FARMINGTON OFFICE
Suite 325
First National Bank of Farmington
One First Place
Post Office Box 2700
Farmington, New Mexico 87499-2700

Telephone (505) 327 5074

ALBUQUERQUE OFFICE
Suite 325
500 Copper Avenue, N.W.
Post Office Box 1308
Albuquerque, New Mexico 87103-1308

Telephone (505) 242 9677

SANTA FE OFFICE
325 Paseo de Peralta
Post Office Box 2307
Santa Fe, New Mexico 87504-2307

Telephone (505) 982-3873
Telecopy (505) 982-4289

REPLY TO FARMINGTON OFFICE

March 4, 1985

RECEIVED
MAY 03 1993
WATER SUPPLY
REGULATION SECTION

Mr. Ed Hartman
Manana Gas, Inc.
610 Reilly Hieghts
Farmington, NM 87401

Re: Flora Vista Water Users Association, Inc.

Dear Mr. Hartman:

We have now received a more detailed report from the engineer concerning the contamination of the Flora Vista Water Users Association's wells. As you will note in the engineer's report, a copy of which is enclosed for your reference, the problem appears at this time to be quite significant and potentially quite costly. Under these circumstances, I would once again recommend that you contact your liability insurance carrier, if you have not already done so, so that we can work toward a prompt resolution of the problem.

If you wish to attempt to cooperate in further investigation to minimize the effects of the contamination, please let me know at once. Since it was necessary to close down the wells and the effects are already apparent, your prompt attention will be appreciated.

Very truly yours,

ORIGINAL SIGNED BY
R. THOMAS DAILEY

R. Thomas Dailey

RTD/pe
Enc.
cc: Flora Vista Water Users Assn.

LAWRENCE A. BREWER
& ASSOCIATES, INC.

CONSULTING ENGINEERS

Lawrence A. Brewer, P.E., L.S.
Richard P. Cheney, P.E., L.S.
George T. Walters, L.S.
Robert A. Echols, Jr., P.E.

March 2, 1983

Mr. Thomas R. Dailey, Attorney
P.O. Box 2700
Farmington, New Mexico 87499

Re: Flora Vista Water Users Association
Water Wells

Dear Tom:

As you are aware, the No. 1 and No. 3 wells for the above referenced system have been infiltrated with oil and grease contaminates and have been taken out of service. Samples taken directly from Well No. 1 indicate that the level of oil and grease in the water is 16 milligrams per liter. This seems to be sufficient to develop an oil film on the surface of the water and, in addition, has created a very objectionable odor. In an attempt to determine the source of the contamination, we have conducted an on-site visual survey of the property. As you are probably aware, a gas well has been drilled less than 300 feet upstream from the No. 1 and 3 water wells. We dug a backhoe pit between Well No. 1 and the gas well as far as possible below the groundwater table. As the water began to filter into the pit, a noticeable odor was detected and an oily film appeared on the surface of the water. At this time, it appears that the contamination is probably coming from the gas well. This could be from either one or two sources. It could be coming from an unlined slush pit or the well could have a leak in the casing that is producing the contamination. I have advised the Association to discontinue use of the well field because I believe that continued pumping could pull the contaminates throughout the entire water bearing strata. At this time, I am of the opinion that the entire site has been contaminated and can no longer be used for the production of domestic water. Of course, further investigation will be needed to confirm this opinion. If, in fact, the site has been lost as a water producing area, the monetary damage to the Association will be extensive. The wells cost approximately $5,000.00 a piece to drill and equip. There

909 W. APACHE, FARMINGTON, NM 87401
P. O. BOX 2079 ZC 87499 (505) 327-3303

DURANGO, COLORADO 81301
P. O BOX 3327 (303) 247-5766

is also a well house with an electronic monitoring system installed adjacent to the well field that cost approximately $31,000.00 to construct. There is also approximately $12,000.00 worth of control cable and six-inch waterline that will be a total loss. In addition to these improvements, the Association paid $20,000.00 for the land. The Association can purchase a limited amount of water from the City of Aztec. This supply is not sufficient to furnish the entire Association with water in the summer months. It also costs considerably more to purchase than it did to produce the same amount of water from the wells. All of the previously mentioned billing and equipment items were installed utilizing funds obtained from a Farmers Home Administration loan. This loan must be repaid. The loss of the facilities will create a severe economic strain on the Association. It is my opinion that the Farmers Home Administration, The New Mexico Environmental Improvment Division, and the Oil Conservation Division of the Energy and Minerals Department should be made aware of the problems. The Association will need assistance to determine the actual source and extent of pollution. If I can be of additional assistance, please feel free to contact me.

Sincerely yours,

LAWRENCE A. BREWER & ASSOCIATES, INC.

Richard P. Cheney, P.E.
Vice President

RPC:ps W-152-D, W-152-E

F 83-1525

LAWRENCE A. BREWER & ASSOCIATES, INC.

CONSULTING ENGINEERS

Lawrence A. Brewer, P.E., L.S.
Richard P. Cheney, P.E., L.S.
George T. Walters, L.S.
Robert A. Echols, Jr., P.E.

March 2, 1983

Mr. Thomas R. Dailey, Attorney
P.O. Box 2700
Farmington, New Mexico 87499

Re: Flora Vista Water Users Association
Water Wells

Dear Tom:

As you are aware, the No. 1 and No. 3 wells for the above referenced system have been infiltrated with oil and grease contaminates and have been taken out of service. Samples taken directly from Well No. 1 indicate that the level of oil and grease in the water is 16 milligrams per liter. This seems to be sufficient to develop an oil film on the surface of the water and, in addition, has created a very objectionable odor. In an attempt to determine the source of the contamination, we have conducted an on-site visual survey of the property. As you are probably aware, a gas well has been drilled less than 300 feet upstream from the No. 1 and 3 water wells. We dug a backhoe pit between Well No. 1 and the gas well as far as possible below the groundwater table. As the water began to filter into the pit, a noticeable odor was detected and an oily film appeared on the surface of the water. At this time, it appears that the contamination is probably coming from the gas well. This could be from either one or two sources. It could be coming from an unlined slush pit or the well could have a leak in the casing that is producing the contamination. I have advised the Association to discontinue use of the well field because I believe that continued pumping could pull the contaminates throughout the entire water bearing strata. At this time, I am of the opinion that the entire site has been contaminated and can no longer be used for the production of domestic water. Of course, further investigation will be needed to confirm this opinion. If, in fact, the site has been lost as a water producing area, the monetary damage to the Association will be extensive. The wells cost approximately $5,000.00 a piece to drill and equip. There is also a well house with an electronic monitoring system installed adjacent to the well field that cost approximately $31,000.00 to construct. There is also approximately $12,000.00 worth of control cable and six-inch waterline that will be a total loss. In addition to these improvements, the Association paid $20,000.00 for the land. The Association can purchase a limited amount of water from the City of Aztec. This supply is not sufficient to furnish the entire Association with water in the summer months. It also costs considerably more to purchase than it did to produce the same amount of water from the wells. All of the previously mentioned billing and equipment items were installed utilizing funds obtained from a Farmers Home Administration loan. This loan must be repaid. The loss of the facilities will create a severe economic strain on the Association. It is my opinion that the Farmers Home Administration, The New Mexico Environmental Improvment Division, and the Oil Conservation Division of the Energy and Minerals Department should be made aware of the problems. The Association will need assistance to determine the actual source and extent of pollution. If I can be of additional assistance, please feel free to contact me.

Sincerely yours,

LAWRENCE A. BREWER & ASSOCIATES, INC.

Richard P. Cheney, P.E.
Vice President

RPC:ps W-152-D, W-152-E

FLORA VISTA WATER USERS ASSOCIATION, INC.
Post Office Box 171
Flora Vista, New Mexico 87415

March 1983

Last year we reported to you that we would be supplying most of our water needs from our own wells. This was accomplished but due to circumstances beyond our control we have discontinued pumping these wells. Copies of letters from our engineer and attorney are enclosed for your information.

Due to the above and other problems in getting information from Farmers Home Administration, we are asking for another chance in our by-laws. We wish to change our annual meeting to the fourth Monday in April of each year. Hopefully this will provide ample time to prepare annual reports with varified information. Your support in this action will be appreciated.

We wish to thank Richard "Dick" Thurstonson for his services as director and president during the past three years. H. Kyne White has been a great service to our Association by his interest and loyal attendance at our board meetings and representing all of us at the County Rural Water Users Association meetings. Thanks to both Dick and Kyne for jobs well done. Both gentlemen have agreed to run for re-election for another term.

In accordnace with Article V, Section 3 of our Association by-laws this is to notify you of our annual meeting to be held at 7:00 PM at the new fire station, Flora Vista on Monday April 25. In the event you cannot attend this meeting, please exercise your right to vote by marking your ballot and returning it to us in the stamped envelope enclosed. PLEASE RETURN BALLOT AT YOUR EARLIEST CONVENIENCE.

BEST WISHES TO EACH OF YOU AND YOURS FOR THE BALANCE OF 1983.

BOARD OF DIRECTORS
Flora Vists Water Users Association, Inc.

100-24

Bruce King
GOVERNOR

George S. Goldstein, Ph.D.
SECRETARY

Larry J. Gordon, M.S., M.P.H.
DEPUTY SECRETARY

HEALTH & ENVIRONMENT department

STATE OF NEW MEXICO

ENVIRONMENTAL IMPROVEMENT DIVISION

DISTRICT I FIELD OFFICE/724 WEST ANIMAS
FARMINGTON, NEW MEXICO 87401
Thomas E. Baca, M.P.H., Director

Telephone #(505)327-9851

April 16, 1982

Mr. Dick Thurstonson, President
Flora Vista Water Users Association
P.O. Box 171
Flora Vista, New Mexico 87415

Dear Mr. Thurstonson:

The annual environmental survey of the Flora Vista Water Supply System was conducted March 23, 1982, with the aid of Mr. Ray Penrod. Enclosed is a copy of the survey report.

The system is supplying water to approximately 1500 consumers. The water is obtained from two sources. Consumers roughly east of the Flora Vista Post Office receive water purchased from the City of Aztec (WSS #098-24). Approximately 1.5 million gallons are purchased monthly. The consumers west of the Post Office receive water pumped from two wells that is then chlorinated and either delivered to the consumers or stored in a 300,000 gallon ground storage tank. The well supply system has been in operation for approximately one year.

The following deficiencies were observed during the inspection:

1. Employee safety devices are needed at the chlorine room. The switch to the ventilation fan should be mounted outside the door to the chlorine room to allow venting of any chlorine gas from the room prior to entry. The employees should be provided with a self-contained breathing apparatus that would allow safe entry into a chlorine atmosphere to repair a leaking chlorine cylinder.

2. The control panel for the pumps is not functioning properly. The pumps fail to restart after being shut off due to electric failures, lightning, etc. Also, the low/high level controls for the storage tank are not functioning.

3. The storage tank lid should be kept locked at all times to prevent unauthorized entry to the tank.

4. The storage tank overflow should be screened to prevent entry of insects and small animals that may contaminate the water.

5. Records of maintenance performed need to be kept.

6. A sample for radiological parameters was collected the day of the inspection. The results are forthcoming.

I wish to thank Mr. Ray Penrod for his time and cooperation in conducting the survey. I would like to encourage Mr. Penrod to attend the Northwest New Mexico Water and Wastewater Operators Short School scheduled to be held May 10 - 14, 1982 in Farmington. Information regarding the school can be obtained from this office or from Cas Ruybalid of Bloomfield Water and Wastewater. If I can be of service to you, feel free to contact me.

Sincerely,

David A. Tomko

David A. Tomko,
Environmentalist III

Enclosure
DAT:lm
cc: File
✓Water Supply Section, EID

HEALTH & ENVIRONMENT

STATE OF NEW MEXICO

COMMUNITY WATER SUPPLY SYSTEM

ENVIRONMENTAL SURVEY

Survey date
03-23-82

SECTION A - GENERAL INFORMATION

WSS Code	Water Supply System Name	County
100-24	Flora Vista Water Users Association	San Juan

System Address / Location

P.O. Box 171, Flora Vista, New Mexico 87415

Owner	Owner Adress (if different than above)
Flora Vista Water Users Association	Same

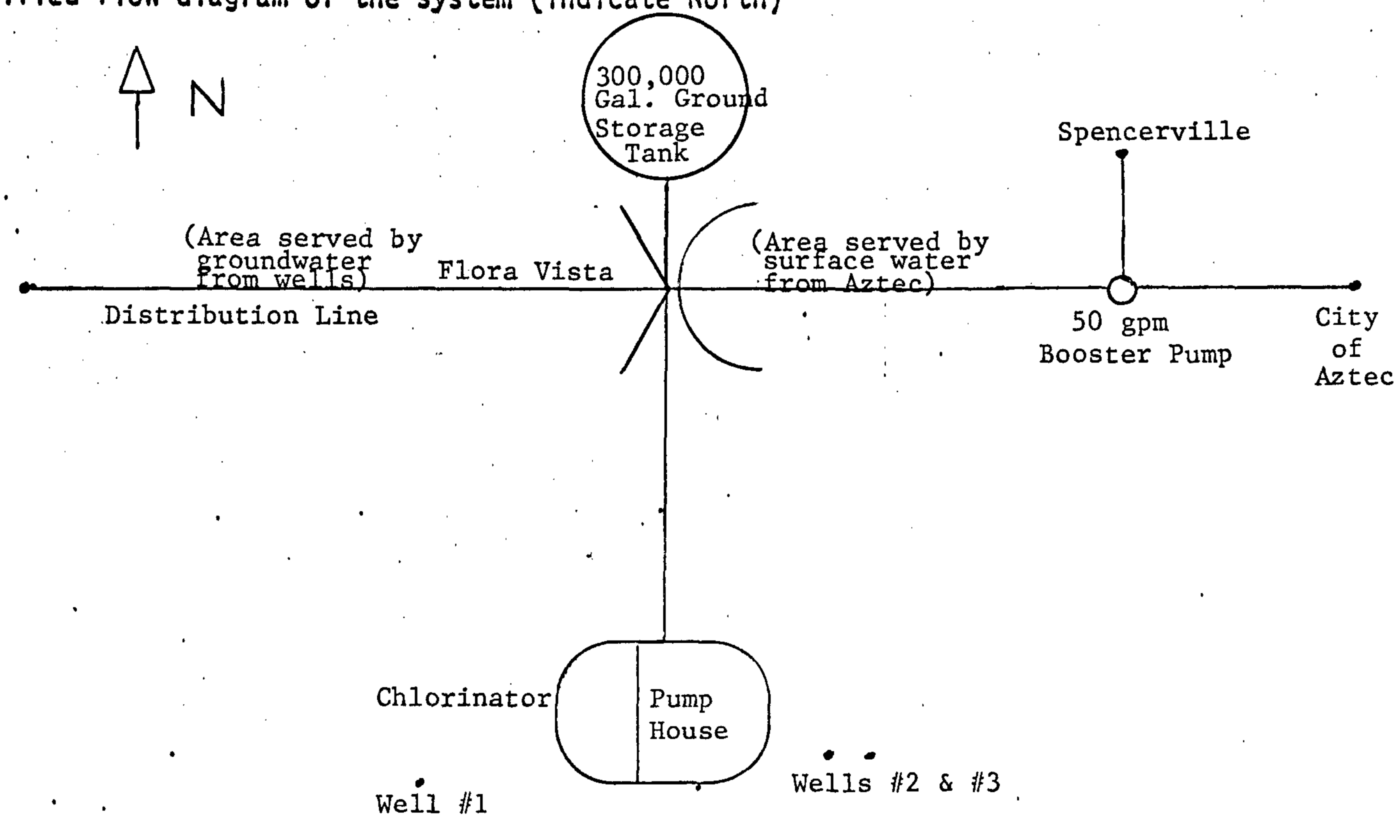
Population (Estimated)	# Connections	# Meters	Maximum System Delivery	Average System Delivery
1500	493	493	170,000 GPD	91,500 GPD

System Source (check appropriate boxes)

☒ - Well(s) - # 3 ☐ Spring(s) ☐ Infiltration Gallery ☒ Surface

Additional Information Purchase water from City of Aztec (1.5 million gallons/month), and have wells for part of system.

Simplified flow diagram of the system (indicate North)



Information Furnished by:	Telephone	Business Phone
Ray Penrod, Maintenance Engineer		334-6045

Evaluation Performed By:	Telephone
David A. Tomko, Environmentalist III	327-9851

Well Identification	Depth	Pump Depth	Pump Capacity GPM	Well Drawdown	Pump Type	Static Water level	Meets Sanitary Requir.?	Age of Well
#1	25'	20½'	60-70 gpm	5'-6'	Submersible 7½ hp	≃8'	Yes	1 yr.
#2	25'	18'	60-70 gpm	5'-6'	Submersible 7½ hp	≃8'	Yes	1 yr.
#3	25'	--	--			≃8'	--	1 yr.

Spring Adequately Protected? ☐ - Yes ☐ - No

Remarks or Deficiencies

No Pump at Well #3

SECTION C - FINISHED WATER MANAGEMENT

Finished Water Boosting or Reducing Stations	Number 1	Remarks or Deficiencies Rarely Used
Total Pumping Capacity	Amount 50 gpm	In-line centrifugal pump
Disinfection - Type	Gas	Safety measures needed; self-contained breathing apparatus and switch to chlorine room fan should be located outside of the chlorine room.
Amount Used /24 hrs	10 lbs/day	
Average Daily Residual	≃1.0 ppm	
Average Pressure	65 psi	
Cross-connection Control Program?	☐ - Yes ☒ - No	Check valves installed at every metered connection
Pipe Material Used	PVC - Cement Asbestos	2" - 6"
Type of Distribution System	Pressure and Gravity	
Microbiological	No. of Samples per month 2	
Compliance Status	1 non-sampling in 1981	
Chemical Quality Organic	Last Sample Date --	Also see City of Aztec Water Supply System for analyses (098-24)
Inorganic	07-06-81 In Compliance	
Radiological	03-23-82 No results yet	
Secondary	--	

Tank Identification	Capacity	Age	Condition	Construct. Materials	Cathodic Protection	Tank Locked?	Overflow Screened?
#1	300,000	1 yr.	Excellent	Steel	No	No	No

Pressure Tanks	Capacity	Age	Condition	Operating and Pressure Range

Remarks or Deficiencies

Tank lid not locked at time of inspection and overflow screen should be reattached.

SECTION E - SYSTEM PERSONNEL

Personnel Classification	Level of Certifica. Required	Level of Certification Currently Obtained
Maintenance Engineer/Operator	None	None

SECTION F - NOTATIONS AND RECOMMENDATIONS

1. Adequate Operating & Maintenance Records?	Adequate operating records; No maintenance records kept
2. Adequate Operating & Maintenance Personnel?	Yes
3. Is Preventative Maintenance Practiced?	Yes
4. Adequate Disinfection?	Yes
5. Adequate Storage?	Yes
6. Adequate Water Quality Data?	Yes - radiological samples to be analyzed

RECOMMENDATIONS:

7. Control panel not functioning properly. Pumps are not reset automatically. Also, float switch at storage tank not operating properly.

Flora Vista Water Users Association
President: Dick Thurstonson 334-6031 (Home) 334-9060 (Office)
Vice President: Bert Barners 325-7577

SECTION G - SURFACE WATER SUPPLY INFORMATION REFER TO CITY OF AZTEC (098-24) FOR TREATMENT OF SURFACE WATER

Source (check one)	Remarks or Deficiencies
☐ - Lake	
☐ - Stream	
Raw Water Storage Capacity	Watershed Pollutant Possible Sources

SECTION H - TREATMENT PLANT INFORMATION

Operations	Remarks or Deficiencies
Plant Intake	
Plant Location	
Presettling Reservoirs	
Coagulation-Sedimentation (chemicals used)	
Filtration	
Disinfection	
Other Treatment	
Average Daily Turbidity	

Additional Comments or Remarks

APPENDIX "B"

RANNEY METHOD WESTERN CORPORATION

WATER SUPPLY ENGINEERS AND CONTRACTORS

RANNEY METHOD

RANNEY COLLECTORS
SURFACE WATER INTAKES
ARTIFICIAL RECHARGING
CONSTRUCTION DEWATERING

P. O. BOX 6387
KENNEWICK, WASHINGTON 99336
TELEPHONE: (509) 586-6947

October 28, 1981

Lawrence A. Brewer & Associates, Inc.
P.O. Box 2079
Farmington, New Mexico 87401

Attn: Mr. Richard P. Cheney
Vice President

Re: Ranney Collector Water Supply
Flora Vista Water Users Association
Flora Vista, New Mexico

Gentlemen:

This letter-report sets forth the results of a test drilling program conducted for the Flora Vista Water Users Association in order to determine the feasibility of developing a naturally-filtered water supply of at least 600 gpm by means of a Ranney Collector constructed adjacent to the Animas River.

During the course of this investigation, test drilling was carried out at three sites, designated as Sites A,B, and C and located as shown in Figure SW-99-01. A total of four test holes were drilled at these sites, the written logs of which are attached to this report.

Site A:

Test Holes 1 and 2 were located at Site A, which is on property belonging to the Water Users Association. Test Hole 1, located 40 feet from the Animas River and 300 feet downstream from the upstream property line, encountered sand, gravel, silt and clay from ground surface to a depth of 22 feet, where shale bedrock occurred. In general, the material encountered was tight, with cemented layers, and had to be drilled. The only loose material was a sand and gravel layer occurring at the shallow depth of 7 to 10 feet.

Preliminary test pumping on September 5, with the well perforated at a depth of 13 to 18 feet, showed a drawdown of 7.0 feet after 2 hours of pumping at a rate of 75 gpm.

Subsequent pumping on September 6 showed a drawdown of 6.4 feet after 2 hours of pumping at a rate of 90 gpm. The chemical analyses of water samples taken during this period are given as follows:

Constituent	T.H. 1 9/5/81	T.H. 1 9/6/81	Association Wells 9/1/81	Animas River 9/1/81
	Parts Per Million, except pH			
Hardness	308	--	360	291
P. Alkalinity	0	--	0	0
M.O. Alkalinity	170	--	239	154
Iron	0.15	0.03	trace	trace
Manganese	trace	0.07	0.3	0
pH	7.8	7.8	7.8	8.5
Temperature (^{o}F)	60	60	62	80

The chemical quality of the water from Test Hole 1 is similar to that of the Association's existing wells and does not contain excessive amounts of iron or manganese.

In order to further explore the water potential of this site, a 6-inch observation well (T.H.2) was drilled 50 feet downstream from Test Hole 1 and a 12-hour pumping test was conducted. Test Hole 1 was pumped from 10:00 a.m. until 10:00 p.m. on September 8, 1981. Water levels were recorded continuously in Test Hole 2 and the abandon Association well, located 130 feet inland from Test Hole 1, with the following results:

Depth to Water (feet) Q = 90 gpm (?)

Days 1/Δt	Time	Δt	T.H.2	s	r^2/t	Abandon Assoc. Well	s_a	r^2/t_a	Remarks
–	10:00 a.m.	0	5.24	–		7.09	–		Static water levels
24	11:00 a.m.	60	6.25	1.01	41.67	7.14	0.05	281.67	
12	12:00 noon	120	6.38	1.14	20.83	7.16	0.07	140.83	
8	1:00 p.m.	180	6.51	1.27	13.89	7.19	0.10	93.89	
6	2:00 p.m.	240	6.65	1.41	10.42	7.29	6.20	70.42	
4.8	3:00 p.m.	300	6.73	1.49	8.33	7.35	0.26	56.33	
4	4:00 p.m.	360	6.86	1.62	6.94	7.42	0.33	46.94	
3.4	5:00 p.m.	420	6.93	1.69	5.95	7.46	0.37	41.24	
3	6:00 p.m.	480	6.99	1.75	5.21	7.49	0.40	35.21	
2.7	7:00 p.m.	540	7.05	1.81	4.63	7.52	0.43	31.30	
2.4	8:00 p.m.	600	7.10	1.86	4.17	7.55	0.46	28.17	
2.2	9:00 p.m.	660	7.13	1.89	3.79	7.58	0.49	25.61	
2.00	10:00 p.m.	720	7.18	1.94	3.47	7.60	0.51	23.47	End test

The total drawdowns for the 12-hour test were 1.94 feet for Test Hole 2 and 0.51 feet for the abandon Association Well.

These drawdowns are considered to be excessive, indicating a low permeability in the order of magnitude of 750 gallons per day per square foot. More important, however, is the fact that water levels continued to decline throughout the test period and stabilization did not occur. This indicates that no recharge occurs from the Animas River. Apparently, the cemented sand and gravel zones occurring in the upper portion of the formation effectively seal off the Animas River and prevent recharge from the river.

With this lack of recharge or replenishment from the Animas River, it is concluded that a firm, dependable, naturally-filtered water supply cannot be developed and therefore this site is not considered suitable for the construction of a Ranney Collector.

Site B:

Test Hole 3 was located at Site B, which is on the Irene Brown property, just upstream from the Flora Vista Bridge. Test Hole 3, located 240 feet upstream from the bridge and 70 feet from the Animas River, showed the existence of sand, gravel, and silt from ground surface to a depth of 24 feet, where impermeable silty sand and clay was encountered. As was the case with Test Hole 1, the material encountered was tight, with cemented layers, and had to be drilled.

However, loose sand and gravel was encountered at depths of 17 to 24 feet. Initial attempts to pump the well with the perforations at a depth of 18 to 23 feet were unsuccessful. A second attempt to pump the well, with the perforations relocated at a depth of 15 to 20 feet, was unsuccessful due to excessive sand clogging the pump and hoses.

Again, it appears that the cemented sand and gravel zones, which extend to a depth of 17 feet, effectively seal off the Animas River and prevent recharge.

Site C:

Test Hole 4 was located at Site C, which is on the Todd Hickman property about ¼ mile upstream from Site A. Test Hole 4, located 30 feet from the Animas River, showed the existence of sand, gravel and silt from ground surface to a depth of 25 feet, where fine silty sand was encountered. As with the previous drilling, the material encountered was tight, with cemented layers, the only loose sand and gravel being a small zone occurring at a depth of 20 to 23 feet. Test pumping, with the well perforated at a depth of 18.5 to 23.5 feet, showed a drawdown of 10.4 feet at a pumping rate of 50 gpm without stabilization of the water levels.

In summary, the results of the test drilling program show that this entire stretch of the Animas River Valley, i.e., Sites A,B, and C, is underlain by alluvial deposits which consist of cemented sand and gravel in the upper portion and only small zones of loose, water-bearing sands and gravels near the base of the formation. These upper cemented sand and gravel zones effectively seal off the Animas River and prevent recharge to the aquifer.

Since river recharge or replenishment does not occur, it is concluded that a firm, dependable, naturally-filtered water supply cannot be developed and it is therefore recommended that no further consideration be given to the development of a Ranney Collector water supply within this stretch of the river valley.

We enclose our Invoice No. 99-01 in the amount of $16,839.34 covering the total cost of this investigation. If you have any questions or need additional information, please let us know.

Very truly yours,

RANNEY METHOD WESTERN CORPORATION

Frederick C. Mikels

Frederick C. Mikels, P.E.
President & Chief Engineer

Enclosure

FCM/sk

$750 \frac{gpd}{ft^2} \times \frac{ft^3}{7.48\,gal} = 100\,ft/day = K$

(Do Semilog plot) (Sept. 81 Test)

$\bar{v} = \frac{K}{n}\left(i\right) = \frac{100\,ft}{.25\,day}\,0.008 = 3.2\,ft/day$

1168 ft/yr. (Sept 20 / Oct 25)

Thiem Eq. from Ranney Test.

$K = \frac{Q}{\pi(h_2^2 - h_1^2)} \ln\frac{r_2}{r_1}$ $TH_2 : r_2 = 50\,ft$, $A : r_1 = 130\,ft$

at $t = 12\,hr$, $h_2 = 19 - s_2 = 19 - 1.94 = 17.06$

$h_1 = 19 - s_1 = 19 - 0.51 = 18.49$

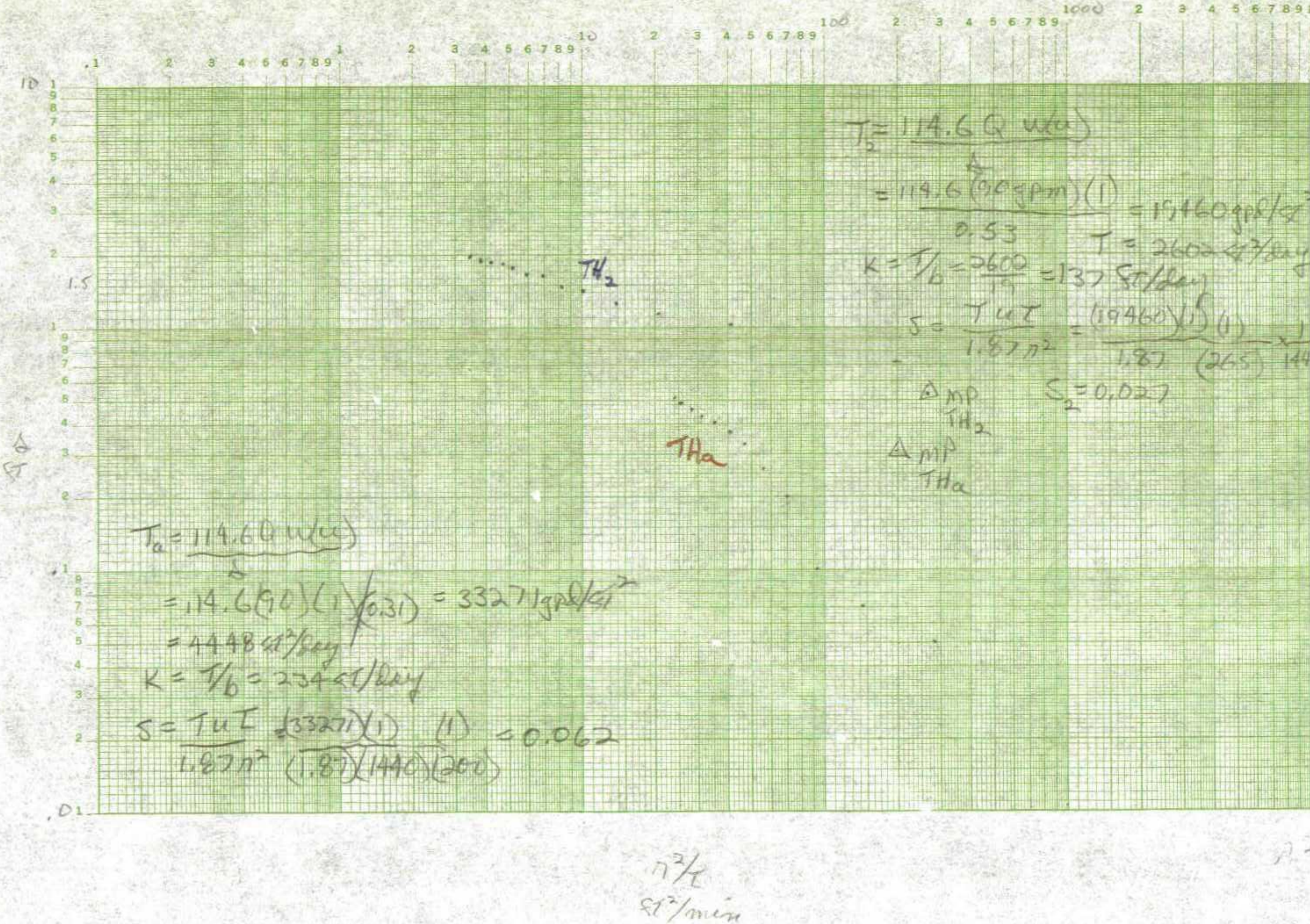
$K = \frac{90 \ln\frac{50}{130}}{\pi(291.04 - 341.88)} = \frac{90}{\pi(-50.84)}(-0.96)$

$= \frac{90\,gpm}{\pi(\quad)} \times \frac{1440\,min}{day}(0.01880) = 775\,gpd/ft^2$

(for $Q = 73\,gpm$, $K = 646\,gpd/ft^2$

$K = \frac{T}{b} = \frac{Q}{2\pi b(s_1 - s_2)} \ln\frac{r_2}{r_1} = \frac{90\frac{gal}{min} \times \frac{1440\,min}{day}}{(2\pi)(19\,ft)(0.51 - 1.94)\,ft} \ln\left(\frac{50}{130}\right)$

$= 725\,gpd/ft^2$



$$T_2 = \frac{114.6\,Q\,w(u)}{s} = \frac{114.6\,(90\,gpm)(1)}{0.53} = 19460\ gpd/ft^2$$

$T = 2602\ ft^2/day$

$$K = T/b = \frac{2600}{19} = 137\ ft/day$$

$$S = \frac{T\,u\,t}{1.87\,r^2} = \frac{(19460)(1)(1)}{1.87\ (265)} \times \frac{1}{1440}$$

$S_2 = 0.027$

Δ mp TH₂

Δ mp THa

$$T_a = \frac{114.6\,Q\,w(u)}{s} = 114.6(90)(1)/(0.31) = 33271\ gpd/ft^2$$

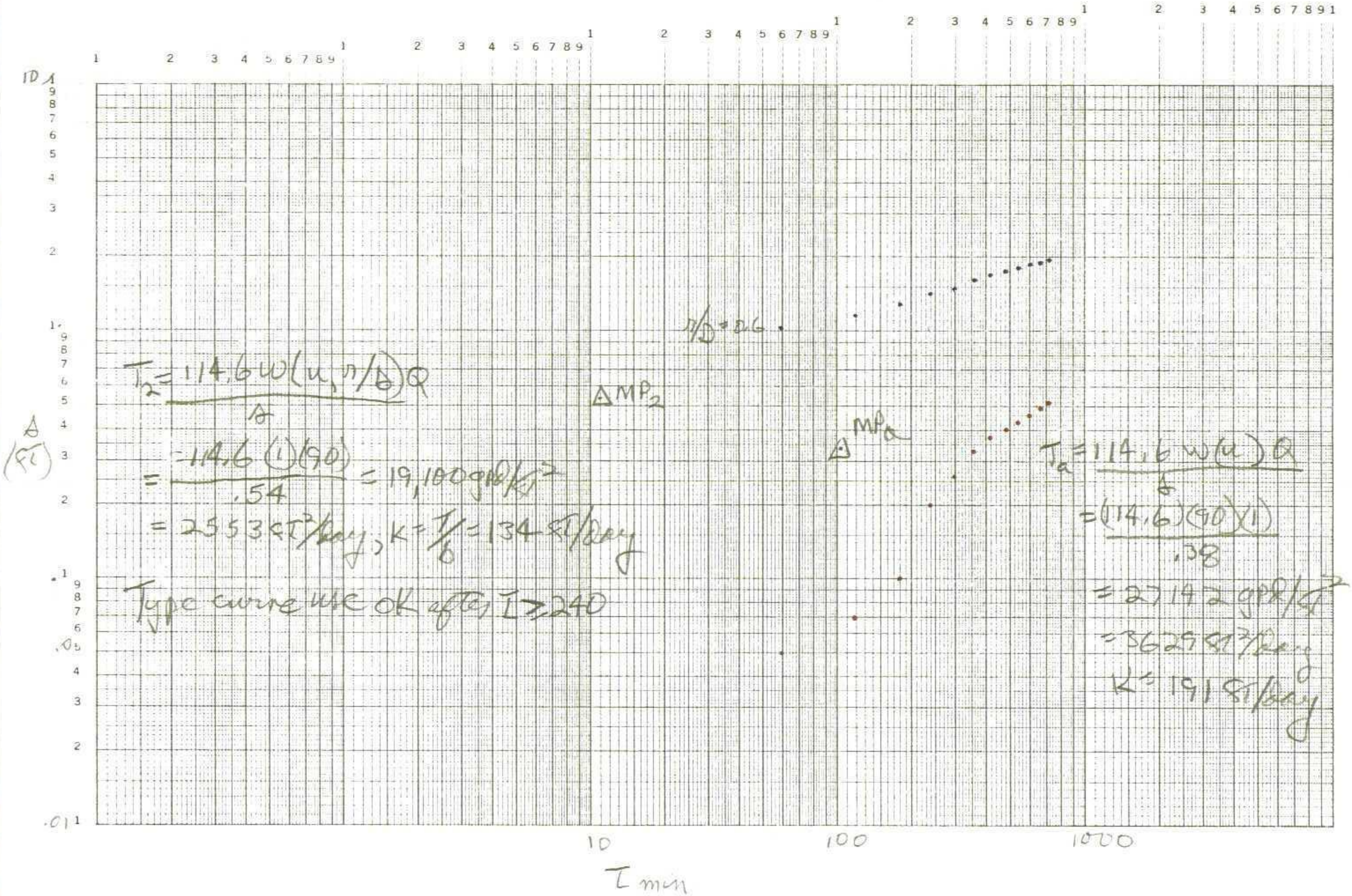
$= 4448\ ft^2/day$

$K = T/b = 234\ ft/day$

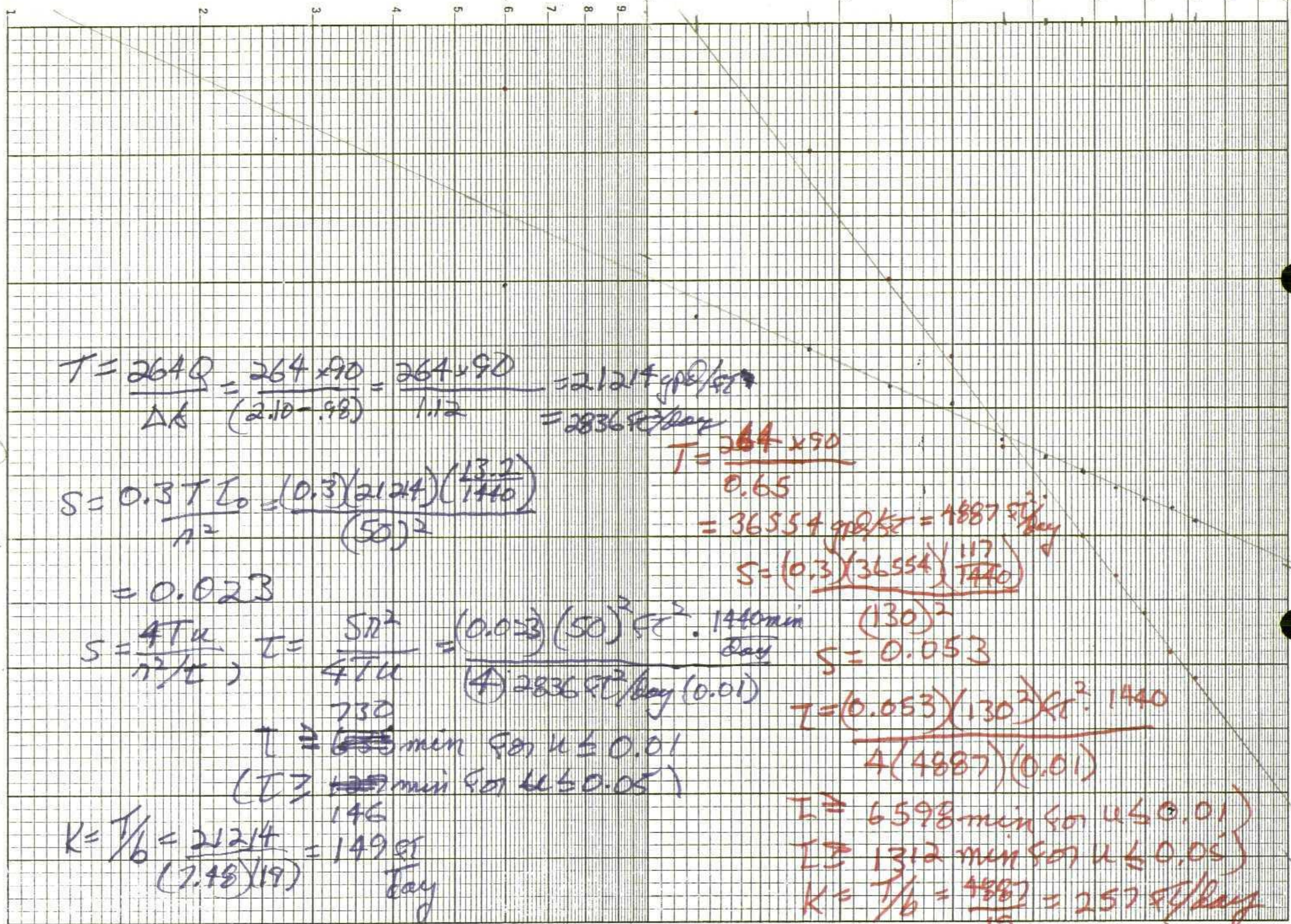
$$S = \frac{T\,u\,t}{1.87\,r^2} = \frac{(33271)(1)}{(1.87)(1440)}\ \frac{(1)}{(200)} = 0.062$$

K+E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7520



K&E SEMI-LOGARITHMIC 46 4970
2 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.



$T = \frac{264Q}{\Delta s} = \frac{264 \times 90}{(2.10 - .98)} = \frac{264 \times 90}{1.12} = 21214 \text{ gpd/ft} = 2836 \text{ ft}^2/\text{day}$

$S = \frac{0.3\, T t_0}{r^2} = \frac{(0.3)(21214)\left(\frac{13.2}{1440}\right)}{(50)^2}$

$= 0.023$

$S = \frac{4Tu}{r^2/t}$, $t = \frac{Sr^2}{4Tu} = \frac{(0.023)(50)^2 \text{ ft}^2 \cdot \frac{1440 \text{ min}}{\text{Day}}}{(4)\, 2836 \text{ ft}^2/\text{day}\, (0.01)}$

$t \geq$ ~~655~~ 730 min for $u \leq 0.01$

($t \geq$ ~~129~~ 146 min for $u \leq 0.05$)

$K = T/b = \frac{21214}{(7.48)(19)} = 149 \frac{\text{ft}}{\text{Day}}$

$T = \frac{264 \times 90}{0.65}$

$= 36554 \text{ gpd/ft} = 4887 \text{ ft}^2/\text{day}$

$S = \frac{(0.3)(36554)\left(\frac{117}{1440}\right)}{(130)^2}$

$S = 0.053$

$t = \frac{(0.053)(130^2) \text{ ft}^2 \cdot 1440}{4(4887)(0.01)}$

$t \geq 6598$ min for $u \leq 0.01$

$t \geq 1312$ min for $u \leq 0.05$

$K = T/b = \frac{4887}{19} = 257 \text{ ft/day}$

LAWRENCE A. BREWER
& ASSOCIATES, INC.

CONSULTING ENGINEERS

May 24, 1982

Flora Vista Water Users Association
P.O. Box 171
Flora Vista, New Mexico 87415

Southside Water Users Association
Route 2 Box 266-C
Aztec, New Mexico 87410

Re: CAC Project 81-29
Merger and Infiltration Gallery Feasibility Study

Gentlemen:

Transmitted herewith is the Feasibility Study for the above referenced CAC project. As you can see in the "Conclusions", we did not find a suitable location for an infiltration gallery. Without the ability to produce an acceptable quantity of domestic water, there appears to be no advantage to merging the two systems either for operational purposes or for production purposes. If you have questions regarding this report, please feel free to contact me at your convenience.

Sincerely yours,

LAWRENCE A. BREWER & ASSOCIATES, INC.

Richard P. Cheney, P.E.
Vice President

RPC:pmd F-152 S-170

Enclosures

909 W. APACHE, FARMINGTON, NM 87401
P. O. BOX 2079 (505) 327-3303

DURANGO, COLORADO 81301
P. O. BOX 3327 (303) 247-5766

INDEX

SECTION I GENERAL

A. Purpose of Study:

The purpose of this study was to determine the feasibility of developing a radial infiltration gallery to produce domestic water to serve the Flora Vista and Southside Water Users Associations. These Associations are located in the Animas River Valley between the Cities of Farmington and Aztec, New Mexico. The Flora Vista Water Users Association serves the area north of the Animas River and the Southside Water Users Association serves the area south of the Animas River. The Flora Vista Association has 475 service taps at this time serving approximately 1,520 people. The Southside Water Users Association has approximately 180 service taps serving approximately 576 people. Both Associations obtain water from the City of Aztec. The Flora Vista Water Users Association has recently developed a well field consisting of three wells and a control station that services approximately 70% of the users. The balance of the users are still served by the City of Aztec. The Southside Water Users Association has installed a similar system; however, the ratio of users served by the Association's well is approximately 30% and the balance of the Southside users are served with water obtained from the City of Aztec. An additional purpose of the study was to determine the feasibility of merging the two domestic water systems into one system. It was anticipated that if the systems could produce a sufficient quantity of water to serve both systems that several economic advantages could be gained by combining the systems and producing water for their own consumption. Water produced by a radial well collector or infiltration gallery does not require any additional treatment and can be distributed directly to the users with only the addition of the proper amounts of chlorine. It was further anticipated that by combining the systems, they could afford to hire a permanent full-time manager to supervise the operation and maintenance of all facilities.

B. Area To Be Served:

The area proposed to be served by the development of a radial well collector consists primarily of those areas adjacent to the Animas River lying between the City Limits of Farmington and Aztec, New Mexico. A recent study prepared for San Juan County indicated that this service area had a population of approximately 5,500. The service area is outlined on the map attached to this report.

C. Need For Facility:

Due to the rapid population increase in the San Juan Basin, all communities are finding it more difficult to meet the growing demand for domestic water. Rural water users associations who are totally dependent on cities such as Farmington, Aztec, and Bloomfield, find that their service is the first to be curtailed in times of peak demand. As indicated previously, the total population of the proposed service area is approximately 5,500. The present combined service population is approximately 2,100. This indicates that there is a present growth possibility of approximately 2.5 times the existing service. The additional demand would result from existing residents requesting service from the rural water users association. For these reasons, it would be advantageous for the rural systems to develop their own supplies either singly or in groups if feasible.

Development of a firm, dependable domestic water supply owned and controlled by the Associations would tend to stabilize consumer costs throughout the area. Farmington and Aztec generally charge the rural water users association a rate that is equal to 1.5 times the domestic rate in the respective cities. Rural associations with few customers per mile of pipeline must charge higher rates for water than are available in other areas. It was anticipated that the development of an Association owned production system would allow the Associations to provide service to their customers at more economical rates. Both Flora Vista and Southside Water Users Associations own water rights in the Animas River and currently produce water from wells adjacent to the river. If a collection gallery of any type was constructed, water rights would have to be transferred to the gallery location. This would involve submitting an application to change point of diversion to the New Mexico State Engineer. Such an application is not appropriate at this time.

D. Proposed Facilities:

The proposed facilities would consist of the construction of a radial well collector or an infiltration gallery with appurtenant pumping and chlorination facilities. These two types of systems were considered because they can be developed to such an extent that the only treatment required for production of the water is chlorination. Shallow wells in the area contain high amounts of iron and manganese and water produced from these type of wells require additional treatment. An infiltration gallery or radial collector well can develop water at a rate that will induce oxygen into the aquifer if there is an adequate hydraulic tie to the river. Oxygen induced into the natural water supply will cause a bacterial growth that will fix iron and manganese in the aquifer so that it will not be present in product water. A radial well collector consist of a caisson sunk to a predetermined depth with horizontal pipes driven hydraulically parallel with the river bed. The length of hydraulically driven pipe is directly dependent upon the depth of the water bearing strata. If the strata has a shallow depth and a low permeability, then an infiltration gallery is constructed. An infiltration gallery consists of a caisson sunk to a predetermined depth with collector lines installed by conventional methods to an adequate length to develop the required amount of water. In both instances, the aquifer must have a strong hydraulic tie to the river so that water of an acceptable quality and quantity may be produced. Pumps, controls and chlorination facilities would be installed in an enclosed housing covering the top of the caisson in both instances. Attached is a partial copy of a report prepared by Serge Spirodonoff in 1963. This report effectively describes a radial well collector and infiltration gallery system. As can be seen from the Spirodonoff Report, an extensive geohydrological survey must be conducted in order to properly design the collector system. This geohydrological survey would be required and is applicable to any type of infiltration gallery system design. With this in mind, the Ranney Method Western Corporation was contracted to drill test wells and provide development testing for the collector system. The Ranney Report is attached as Appendix "B" to this report. The initial area selected for testing was property identified as Site "A" on a location map owned by the Flora Vista Water Users Association.

The Association presently has three wells in operation at this site and it was felt that the alluvium in this area held possibilities for the development of a collector gallery. As can be seen in the report on Site "A", a cemented area of sand and gravel occurring in the upper portion of the alluvium formations effectively sealed off the Animas River and prevented recharge from the river making the site unsuitable for the development of a collector. Site "B" located approximately one-half mile downstream from Site "A" was selected because of some knowledge of the formation underlying the river at that point. Drill test performed for design of the footings of the Flora Vista Bridge indicated that a sand and gravel layer of appropriate thickness might be available near the location of the bridge. Site "B" is also near a six-inch water transmission line owned by the Flora Vista Water Users Association which could have been utilized for transmission of product water. The same cemented sand and gravel layer was encountered and test pumping was not successful at this site. An additional site identified as Site "C" on the location map was selected approximately one-half mile upstream from Site "A". Site "C" was selected after a review of the 1937, geohydrological survey conducted by the State Engineer that indicated that the river had been in this position since 1937. The drilling, however, indicated that the same cemented sand and gravel layers existed at this location as at the previous two locations. At this point, the drilling and research investigations had consumed all of the available funds for the project and it was determined that further exploration was not economically feasible at this time.

E. Conclusions:

The Ranney Method Western Corporation Report specifically states, "In summary, the results of the test drilling program show that this entire stretch of the Animas River Valley, i.e. Sites "A", "B" and "C", is underlane by alluvial deposits which consist of cemented sand and gravel in the upper portion and only small zones of loose water bearing sand and gravel. near the base of the formation. These upper cemented sand and gravel zones effectively seal off the Animas River and prevent recharge to the aquifer. Since river recharge or replenishment does not occur, it is concluded that a firm, dependable naturally filtered water supply can not be developed and it is, therefore, recommended that no further consideration be given to the development of a Ranney Collector water supply within this stretch of the river valley."

The first paragraph on page three of the Ranney Report further states, "More important, however, is the fact that water levels continue to decline throughout the test period and stabilization did not occur. This indicates that no recharge occurs from the Animas River. Apparently, the cemented sand and gravel zones occurring in the upper portion of the formation effectively seal off the Animas River and prevent recharge from the river." Because there is no positive hydraulic tie to the river, it is the opinion of the Ranney Company and Lawrence A. Brewer & Associates, Inc. that the development of any type of infiltration gallery in this stretch of the river would be inappropriate. The feasibility of a merger of the two systems was dependent upon the development of a suitable water supply for both associations. Without the ability to produce domestic water of adequate quantities, there is no operational or economical advantage to combining the systems. At this time, it is recommended that the associations continue operations as they have in the past and that they seek further funding for additional studies to determine if there are other areas adjacent to the river that might be suitable for the development of infiltration galleries or if there would be areas adjacent to the river suitable for the development of a system that would produce water by conventional means such as a standard filtration plant.

F. Acknowledgements:

This Geohydrological Survey and Report was prepared utilizing funds provided by the New Mexico Department of Energy through the Community Assistance Council. Other funds were provided by the respective Associations.

* * * * * * * *

Design and Use of Radial Collector Wells

Serge V. Spiridonoff

A paper presented on Sep. 26, 1963, at the California Section Meeting, San Francisco, Calif., by Serge V. Spirodonoff, San. Eng. Assoc., State of California Dept. of Public Health, Bureau of San. Eng., Santa Rosa, Calif.

RADIAL collector wells are horizontal perforated conduits that intercept and collect ground water derived principally from surface water infiltration. Such supplies are usually found in the sand and gravel deposits underlying and hydraulically connected with surface sources, such as rivers, lakes, or oceans.

The radial collector well was developed and became practical in the 1930's and later was greatly improved. Since then, many municipalities throughout the world have successfully operated this type of infiltration gallery to obtain part of their water supply, among them Sacramento and Crescent City, Calif.

Radial collector wells provide an inexpensive and relatively simple method of obtaining water of a high quality for industrial and municipal use. The outstanding features of the radial collector well is:

1. The horizontal perforated collector pipe (the configuration and length of which vary) enable a large area of an aquifer to be exploited.

2. The removal of fine sand and gravel in the path of the projected collector pipe establishes an artificial aquifer of much higher permeability than the virgin soil. After construction, the collector pipe simply serves as a subdrain in a filter surrounded by a circle of coarse gravels several feet in diameter.

3. The unrestricted access and independent control of each collector pipe permit easy regulation of flow into a caisson and inspection and backwash of the collector pipe.

Design Details

The radial collector well consists of the following:

A central, sectionally poured-in-place, reinforced-concrete, vertical shaft of a large diameter—13 ft or more—is sunk as a caisson to a predetermined depth. The average depth of the caisson below ground level is 70 ft, although the depth of one is more than 200 ft (the construction of which, incidentally, required lowering the caisson through 130 ft of wet ground). The wall thickness for a relatively shallow collector shaft is 18 in.; for a relatively deep one, 24 in. The bottom of the caisson is a heavy reinforced-concrete slab, the thickness and the weight of which has no effect on caisson stability, owing to the interrelations of caisson size and weight.

Approximately 4 ft from the bottom of the caisson shaft are one or more tiers of horizontal perforated steel pipe, each pipe surrounded by a screen and connected to a valved port in the caisson wall. The number of ports for

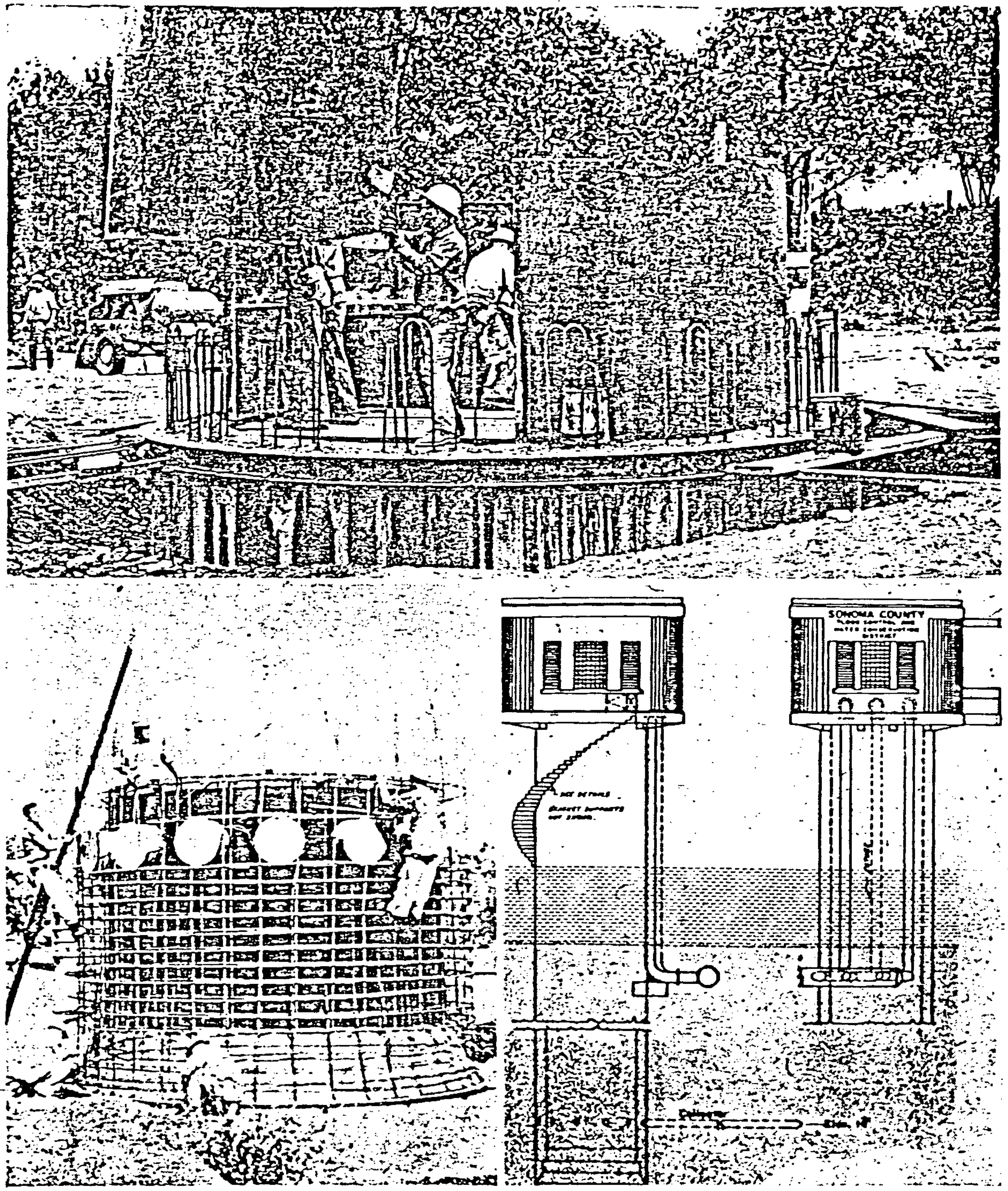


Fig. 1. Caisson Construction and General Structure of Radial Collector Wells

In photograph at top, steel inner forms for a section of reinforced-concrete caisson are being set. At lower left is shown the construction of another such section to be emplaced 60 ft below the river bed; on this section may be seen the port holes through which the collector pipe will be projected. At lower right is a diagram showing the general structural characteristics of radial collector wells.

collection piping is usually more than that indicated by design requirements in order to anticipate future needs or unforeseen difficulties that may be encountered during the projection of the collector piping. The ports are usually no less than 22½ deg apart.

The collector piping usually has an 8⅝-in. OD and a ⅜-in. wall thickness. The pipe is frequently made of a special copper alloy steel, but it may be of other acceptable material. The slots in the pipe, cut with a saw, are ⅜ in. wide, and 1½ in. long; the perforated area equals about 20 per cent of the total surface area. In general, 8-ft lengths of pipe are used.

The total length of collector pipe required depends upon the following variables, as determined in field tests: the quality of the water; minimum loss of head; and porosity and transmissibility of the formation. The lower the entrance velocity the better the water quality, the fewer the small particles that enter the collector, and the smaller the chance of incrustation.

The length of the individual collection pipe will be in the range of 110–200 ft, the value depending on the porosity and transmissibility of the collection medium. Photographs of caisson construction and a general structural diagram at a radial collector well are shown in Fig. 1.

Construction Methods

Inside the laterals, as they are driven outward during construction, a rubber packing, called the "sand line," is inserted in 2-in. or larger pipe and prevents water from entering the pipe at all points except through the slots of the driving head. This water flows at a very high velocity and carries all the finer material from the vicinity of the driving head into the caisson, developing a bed of gravel and coarse sand around the lateral as it is moved outward. The holes in the driving head are sized to allow the passage of sand and gravel up to a size larger than that of the smaller slots of the screen. After all but 1–2 ft of an 8-ft section of collection pipe has been driven out into the stratum, another 8-ft section is welded to the first. The extension of the lateral is continued until the driving head strikes an immovable object or the pipe has reached the design length. For each foot of collector pipe projected, 4–7 cu ft of fine sand is usually removed.

Collector pipe is driven into the aquifer with two hydraulic jacks of 100-ton capacity each. These are placed against opposite points on the wall of the caisson shaft. The force required, greatest in the first few feet of penetration, diminishes with distance. At 100 ft, force for projection is approximately equal to the weight of the pipe projected plus the frictional resistance of the pipe moving against loose gravel. Hydraulic jack and sand line operation during projection of the collector pipe is shown in Fig. 2.

A difficulty in the installation of the collector pipe involves the selection of a proper relation between the rate of removal of particles from the stratum and the rate of projection of the pipe. If this relation is not correct, the pipe may easily be projected from the horizontal plane.

The ground water infiltrating the horizontal collector pipe flow into the central vertical shaft, where turbine pumps operated by automatic switches discharge the water into the distribution system. Chlorination is normally the only treatment needed. Deep well pumps, motor starters, and other equipment are usually located on top of the collector shaft and above high-water levels.

Yield

The sand and gravel deposits underlying and hydraulically connected with a surface source, such as a river, lake, or sea, act as a filter medium. Such deposits are among the most productive sources for water supplies.

Fig. 2. Hydraulic Jack and Sand Line Operation During Projection of Collector Wells

In the photograph, water and fine material being removed from around the driving head of the collector pipe are discharged into the caisson. The quick-opening valve controlled by the operator's right hand is open; his left hand is on an air valve (closed during flushing), which is connected to the sand line. A surging condition is created in the vicinity of the driving head by reciprocally opening and closing the two valves, thus reversing the direction of flow. The pipe being projected and the jack are clearly visible.

Since the development of the radial collector in the early 1930's, more than 200 collector systems have been constructed. The median yield of a single collector is estimated at 6,000–7,000 gpm; however, collectors constructed along the Wabash River produce 10,000–15,000 gpm (Table 1). The collector constructed for Sacramento[1] averages 9 mgd for each 1,000 ft of collector pipe, and a collector constructed for the Sonoma Flood Control and Water Conservation District[2] is designed to provide 30 mgd for only 2,000 ft of collector pipe. Compared with the capacity of conventional types of infiltration galleries (1 mgd per 1,000 ft of collector pipe),[3] the advantages of the radial collector appear to be very substantial.

The yield of the radial collector well may be estimated by the methods of computation discussed by Kazmann,[4] or those of Mikels and Klaer,[5] or those of Meinzer and Wenzel.[6]

In general, however, the potential yield of a collector depends upon the following five factors: the thickness of the water-bearing formation; the available drawdown; the effective radius of the collector; the permeability of the water-bearing formation; and the distance to the effective line source or effective line of infiltration.

Limitations

To be successful, a radial collector should be located in an aquifer of exceptional permeability and with an abundant surface source. In most areas, there is a sharp decline in the permeability of the aquifer and a deterioration in the quality of water in older aquifers at a distance from the river or stream channel. These

RANNEY METHOD WESTERN CORPORATION

WATER SUPPLY ENGINEERS AND CONTRACTORS

RANNEY METHOD

RANNEY COLLECTORS
SURFACE WATER INTAKES
ARTIFICIAL RECHARGING
CONSTRUCTION DEWATERING

P. O. BOX 6387
KENNEWICK, WASHINGTON 99336
TELEPHONE: (509) 586-6947

October 28, 1981

Lawrence A. Brewer & Associates, Inc.
P.O. Box 2079
Farmington, New Mexico 87401

Attn: Mr. Richard P. Cheney
Vice President

Re: Ranney Collector Water Supply
Flora Vista Water Users Association
Flora Vista, New Mexico

Gentlemen:

This letter-report sets forth the results of a test drilling program conducted for the Flora Vista Water Users Association in order to determine the feasibility of developing a naturally-filtered water supply of at least 600 gpm by means of a Ranney Collector constructed adjacent to the Animas River.

During the course of this investigation, test drilling was carried out at three sites, designated as Sites A,B, and C and located as shown in Figure SW-99-01. A total of four test holes were drilled at these sites, the written logs of which are attached to this report.

Site A:

Test Holes 1 and 2 were located at Site A, which is on property belonging to the Water Users Association. Test Hole 1, located 40 feet from the Animas River and 300 feet downstream from the upstream property line, encountered sand, gravel, silt and clay from ground surface to a depth of 22 feet, where shale bedrock occurred. In general, the material encountered was tight, with cemented layers, and had to be drilled. The only loose material was a sand and gravel layer occurring at the shallow depth of 7 to 10 feet.

Preliminary test pumping on September 5, with the well perforated at a depth of 13 to 18 feet, showed a drawdown of 7.0 feet after 2 hours of pumping at a rate of 75 gpm.

Sat. thick = 22 − 4 = 18
A = 7
1175

Subsequent pumping on September 6 showed a drawdown of 6.4 feet after 2 hours of pumping at a rate of 90 gpm. The chemical analyses of water samples taken during this period are given as follows:

Constituent	T.H. 1 9/5/81	T.H. 1 9/6/81	Association Wells 9/1/81	Animas River 9/1/81
	Parts Per Million, except pH			
Hardness	308	--	360	291
P. Alkalinity	0	--	0	0
M.O. Alkalinity	170	--	239	154
Iron	0.15	0.03	trace	trace
Manganese	trace	0.07	0.3	0
pH	7.8	7.8	7.8	8.5
Temperature (^{o}F)	60	60	62	80

The chemical quality of the water from Test Hole 1 is similar to that of the Association's existing wells and does not contain excessive amounts of iron or manganese.

In order to further explore the water potential of this site, a 6-inch observation well (T.H.2) was drilled 50 feet downstream from Test Hole 1 and a 12-hour pumping test was conducted. Test Hole 1 was pumped from 10:00 a.m. until 10:00 p.m. on September 8, 1981. Water levels were recorded continuously in Test Hole 2 and the abandon Association well, located 130 feet inland from Test Hole 1, with the following results:

Depth to Water (feet)

Days 1/Δt	Time	Δt	T.H.2	s	r²/t	Abandon Assoc. Well	s_a	r²/ta	Remarks
–	10:00 a.m.	0	5.24	–	r²/t	7.09	–		Static water levels
24	11:00 a.m.	60	6.25	1.01	41.67	7.14	0.05	281.67	
12	12:00 noon	120	6.38	1.14	20.83	7.16	0.07	140.83	
8	1:00 p.m.	180	6.51	1.27	13.89	7.19	0.10	93.89	
6	2:00 p.m.	240	6.65	1.41	10.42	7.29	0.20	70.42	
4.8	3:00 p.m.	300	6.73	1.49	8.33	7.35	0.26	56.33	
4	4:00 p.m.	360	6.86	1.62	6.94	7.42	0.33	46.94	
3.4	5:00 p.m.	420	6.93	1.69	5.95	7.46	0.37	40.24	
3	6:00 p.m.	480	6.99	1.75	5.21	7.49	0.40	35.21	
2.7	7:00 p.m.	540	7.05	1.81	4.63	7.52	0.43	31.30	
2.4	8:00 p.m.	600	7.10	1.86	4.17	7.55	0.46	28.17	
2.2	9:00 p.m.	660	7.13	1.89	3.79	7.58	0.49	25.61	
2.00	10:00 p.m.	720	7.18	1.94	3.47	7.60	0.51	23.47	End test

The total drawdowns for the 12-hour test were 1.94 feet for Test Hole 2 and 0.51 feet for the abandon Association Well.

These drawdowns are considered to be excessive, indicating a low permeability in the order of magnitude of 750 gallons per day per square foot. More important, however, is the fact that water levels continued to decline throughout the test period and stabilization did not occur. This indicates that no recharge occurs from the Animas River. Apparently, the cemented sand and gravel zones occurring in the upper portion of the formation effectively seal off the Animas River and prevent recharge from the river.

With this lack of recharge or replenishment from the Animas River, it is concluded that a firm, dependable, naturally-filtered water supply cannot be developed and therefore this site is not considered suitable for the construction of a Ranney Collector.

Site B:

Test Hole 3 was located at Site B, which is on the Irene Brown property, just upstream from the Flora Vista Bridge. Test Hole 3, located 240 feet upstream from the bridge and 70 feet from the Animas River, showed the existence of sand, gravel, and silt from ground surface to a depth of 24 feet, where impermeable silty sand and clay was encountered. As was the case with Test Hole 1, the material encountered was tight, with cemented layers, and had to be drilled.

However, loose sand and gravel was encountered at depths of 17 to 24 feet. Initial attempts to pump the well with the perforations at a depth of 18 to 23 feet were unsuccessful. A second attempt to pump the well, with the perforations relocated at a depth of 15 to 20 feet, was unsuccessful due to excessive sand clogging the pump and hoses.

Again, it appears that the cemented sand and gravel zones, which extend to a depth of 17 feet, effectively seal off the Animas River and prevent recharge.

Site C:

Test Hole 4 was located at Site C, which is on the Todd Hickman property about ¼ mile upstream from Site A. Test Hole 4, located 30 feet from the Animas River, showed the existence of sand, gravel and silt from ground surface to a depth of 25 feet, where fine silty sand was encountered. As with the previous drilling, the material encountered was tight, with cemented layers, the only loose sand and gravel being a small zone occurring at a depth of 20 to 23 feet. Test pumping, with the well perforated at a depth of 18.5 to 23.5 feet, showed a drawdown of 10.4 feet at a pumping rate of 50 gpm without stabilization of the water levels.

In summary, the results of the test drilling program show that this entire stretch of the Animas River Valley, i.e., Sites A,B, and C, is underlain by alluvial deposits which consist of cemented sand and gravel in the upper portion and only small zones of loose, water-bearing sands and gravels near the base of the formation. These upper cemented sand and gravel zones effectively seal off the Animas River and prevent recharge to the aquifer.

Since river recharge or replenishment does not occur, it is concluded that a firm, dependable, naturally-filtered water supply cannot be developed and it is therefore recommended that no further consideration be given to the development of a Ranney Collector water supply within this stretch of the river valley.

We enclose our Invoice No. 99-01 in the amount of $16,839.34 covering the total cost of this investigation. If you have any questions or need additional information, please let us know.

Very truly yours,

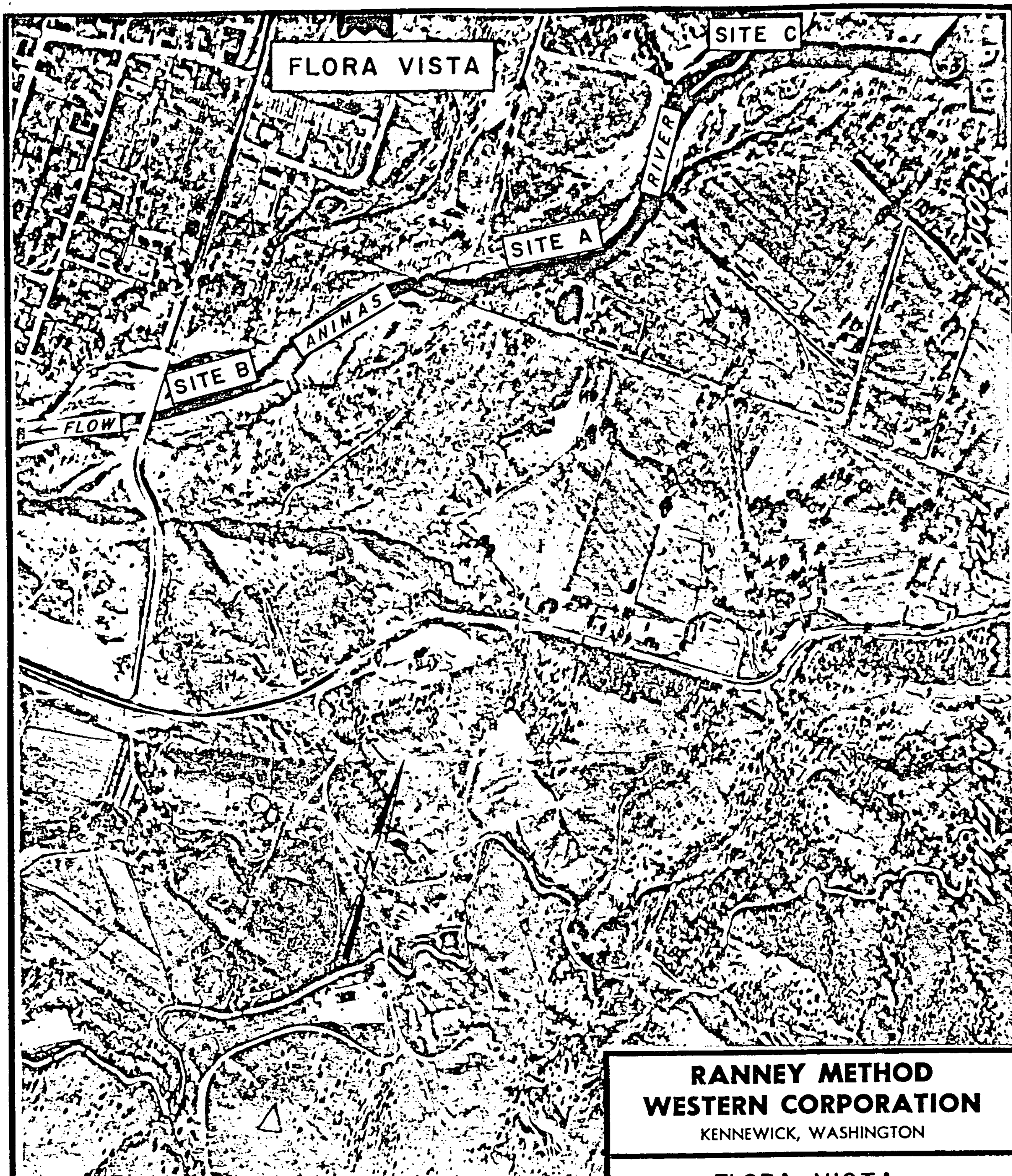
RANNEY METHOD WESTERN CORPORATION

Frederick C. Mikels

Frederick C. Mikels, P.E.
President & Chief Engineer

Enclosure

FCM/sk



SCALE

1 INCH = 667 FEET

RANNEY METHOD WESTERN CORPORATION
KENNEWICK, WASHINGTON

FLORA VISTA
WATER USERS ASSOCIATION

LOCATION MAP

DRAWN: MSE	APPROVED: FCM
DATE: 10/28/81	FIG.: SW-99-01

RANNEY METHOD

Ranney Method Western Corporation

Kennewick, Washington

Well No. T.H. 1 (Site A) Survey No. SW-99

Owner Flora Vista Water User's Association Location Flora Vista, New Mexico

Well Location 40 ft. from Animas River, 300 ft. downstream from Assoc.'s property line.

Diameter 8-inch Depth 23 feet

Total Casing 20 feet Perforations: Top 13 ft. Bottom 18 ft.

Elevations: Top of Casing 2 ft. above ground Ground

Static Water Level 9-5-81 4.0 feet below ground surface.

FROM	TO	DESCRIPTION OF MATERIAL
0	2	Surface sand & gravel (to 6" +).
2	7	Red cemented sand & gravel (to 6"), hard, drilled, no water.
7	10	Sand, small gravel, silty (few 6"), loose, bailed, fair water
10	13	Silty sand, small gravel, broken, snug, drilled, slow water.
13	16	Cemented sand & gravel, silt, tight, drilled, slow water.
16	22	Red silt, sand & gravel, broken, tight, drilled, slow water.
22	23	Greenish shale.
		9-5-81: 7.0 foot of drawdown after 2 hours of pumping at
		75 gpm. Well temperature-60°F., Total Hardness-308 ppm,
		M.O. Alkalinity-170 ppm, Iron-0.15 ppm, Manganese-trace.
		9-6-81: 6.4 feet of drawdown after 2 hours of pumping at
		90 gpm. Well temperature-60°F., Iron-0.03 ppm,
		Manganese-0.07 ppm.

Driller Shorty Thompson Well Drilling Date Started 9-2-81

Report by Gordon E. Hamm Date Completed 9-5-81

RANNEY METHOD

Ranney Method Western Corporation

Kennewick, Washington

Well No. T.H. 2 (Site A) Survey No. SW-99

Owner Flore Vista Water User's Association Location Flora Vista, New Mexico

Well Location 40 ft. from Animas River, 50 ft. downstream from T.H. 1

Diameter 6-inch Depth 19.5 ft.

Total Casing 21.5 ft. Perforations: Top 13.5 ft. Bottom 19.5 ft.

Elevations: Top of Casing 2 ft. above ground Ground

Static Water Level 9-8-81 3.24 feet below ground surface.

FROM	TO	DESCRIPTION OF MATERIAL
0	3	Surface sand & gravel (to 6" +).
3	14	Cemented sand & gravel, silty, drilled, slow water.
14	19.5	Brown sand, small gravel, silt, drilled, water.
		Pocket of black silt at 18 feet.

Driller Shorty Thompson Well Drilling Date Started 9-5-81

Report by Gordon E. Hamm Date Completed 9-7-81

RANNEY METHOD

Ranney Method Western Corporation

Kennewick, Washington

Well No. T.H. 3 (Site B)   Survey No. SW-99

Owner Flora Vista Water User's Assocation   Location Flora Vista, New Mexico

Well Location Irene Brown Property. 240 ft. upstream from bridge. 70 ft. from Animas River.

Diameter 8-inch   Depth 25.5 feet

Total Casing Pulled   Perforations: Top 15 ft. Bottom 20 ft.

Elevations: Top of Casing ____   Ground ____

Static Water Level 9-16-81 2.35 feet below ground surface.

FROM	TO	DESCRIPTION OF MATERIAL
0	4	Silt, sand & gravel (to 6" +).
4	6	Cemented sand, gravel & cobbles, drilled, no water.
6	10	Red silty sand, pea gravel, cobbles, drilled, slow water.
10	12	Brown sand, pea gravel (3" to 4"), heaves, bailed, fair water.
12	17	Cemented sand & gravel, broken, hard, drilled, no water.
17	22	Grey sand, small gravel, heaves, bailed, fair water.
22	24	Tan fine to coarse sand, very little gravel, bailed, fair wate
24	25.5	Silty sand, clay, broken gravel, tight, drilled, no water,
		Oil streaks, bad smell.
		Could not test pump well because of sand clogging
		pump and hoses.

Driller Shorty Thompson Well Drilling   Date Started 9-14-81

Report by Gordon E. Hamm   Date Completed 9-17-81

RANNEY METHOD

Ranney Method Western Corporation

Kennewick, Washington

Well No. T.H. 4 (Site C) Survey No. SW-99

Owner Flora Vista Water User's Association Location Flora Vista, New Mexico

Well Location Todd Hickman Property, 30 ft. from Animas River.

Diameter 10-inch Depth 25.5 ft.

Total Casing Pulled Perforations: Top 18.5 ft. Bottom 23.5 ft.

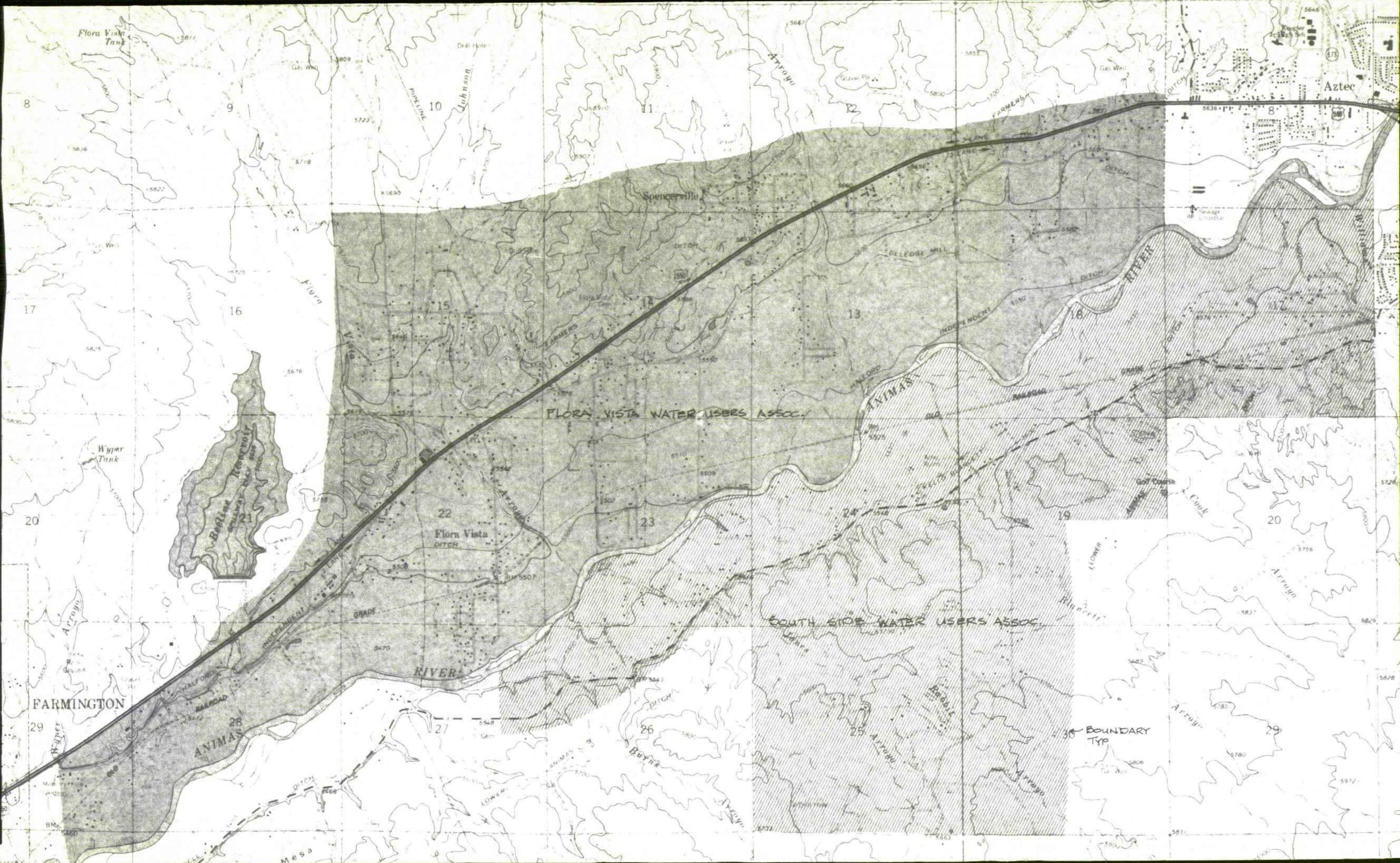
Elevations: Top of Casing 2 ft. above ground Ground

Static Water Level 9-22-81 6.2 feet below ground surface.

FROM	TO	DESCRIPTION OF MATERIAL
0	4	Silty sandy soil.
4	11	Red silty sand & gravel,(few 6"), snug, drilled, no water.
11	20	Cemented sand & gravel, tight, drilled, no water.
20	23	Brown sand & pea gravel (t0 5"), loose, bailed, fair water.
23	25	Fine sand, broken gravel, very tight, drilled, slow water.
25	25.5	Fine silty sand, oil streaks, drilled, no water.
		10.4 feet of drawdown for a pumping rate of 50 gpm.
		Water level did not stabilize.

Driller Shorty Thompson Well Drilling Date Started 9-19-81

Report by Gordon E. Hamm Date Completed 9-23-81


Flora Vista Tank
Aztec
Spencerville
FLORA VISTA WATER USERS ASSOC.
Flora Vista
Wyper Tank
FARMINGTON
ANIMAS
RIVER
SOUTH SIDE WATER USERS ASSOC.
BOUNDARY TYP
FARMERS
DITCH
INDEPENDENT
HALFORD
RAILROAD
GRADE
ELLEDGE MILL
Arroyo
Johnson
PIPELINE
Gas Well
Golf Course
Cook
LOWER
Mesa
Bure