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Prepared for:

EL PASO FIELD SERVICES
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Farmington, New Mexico 87401

FINAL WORK PLAN FOR JAQUEZ COM C#1 AND JAQUEZ COM E#1 SOUTH FIELD AREA SAN JUAN COUNTY, NEW MEXICO

September 2002

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1.0 INTRODUCTION

1.1 INTRODUCTION

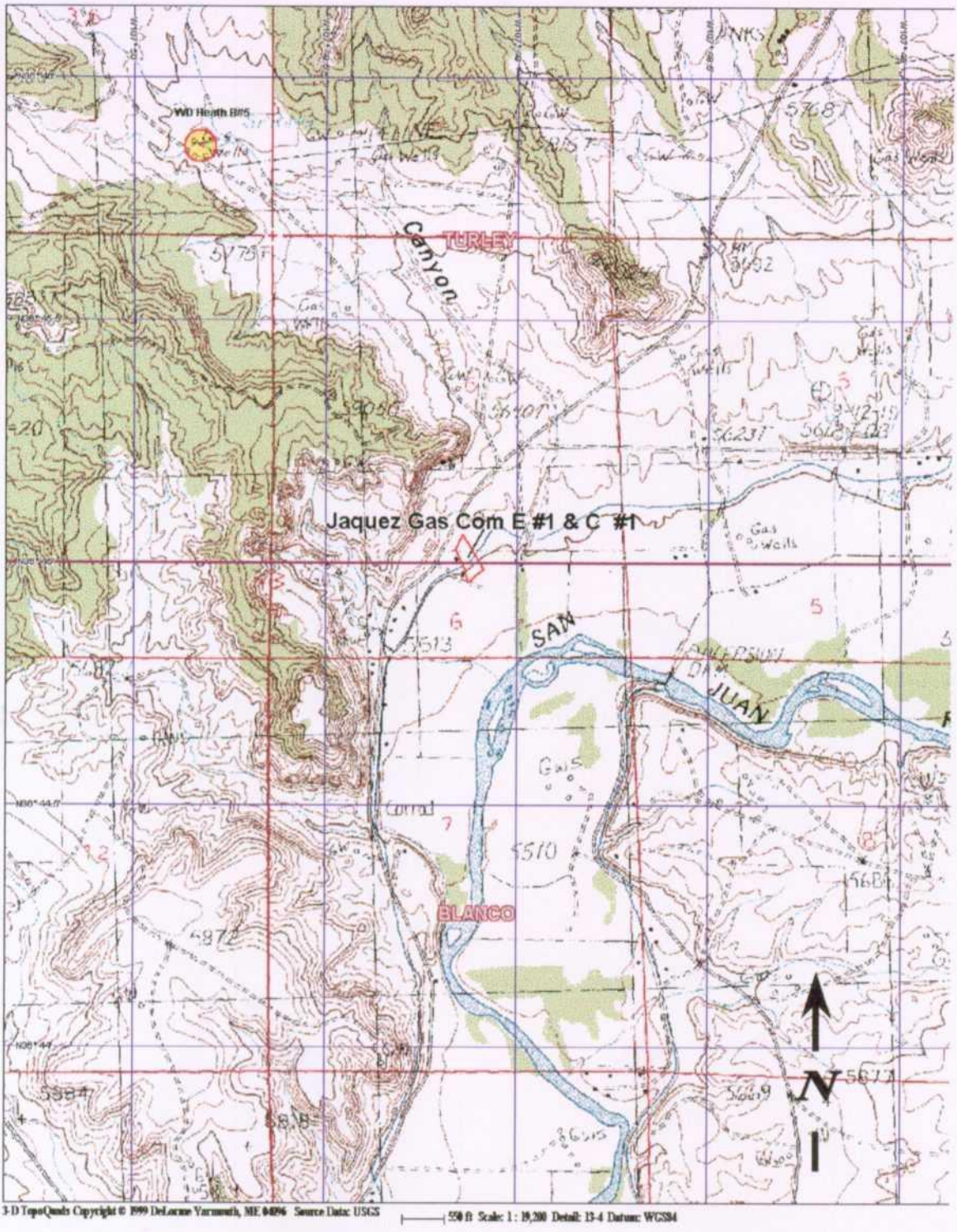
This Work Plan for the Jaquez Com C#1 and Jaquez Com. E#1 South Field Area (Work Plan) has been prepared on behalf of El Paso Field Services (EPFS) to describe groundwater remediation measures for the South Field Area located immediately south and across the Citizen's Ditch of the Jaquez site. The Jaquez site is located in San Juan County, New Mexico in Section 6, Township 29N, Range 9W, as shown in Figure 1-1, *Jaquez Site Location.*

The objective of this Work Plan is to describe the installation and monitoring of oxygen releasing compound (ORC) which will be used to reduce levels of hydrocarbons in groundwater by enhancing the dissolved oxygen in the shallow groundwater to allow the natural biological processes to reduce contaminant levels to below regulatory standards. Regulatory drivers for groundwater remediation at this site include New Mexico Oil Conservation Division (NMOCD) guidelines and the New Mexico Water Quality Control Commission (NMWQCC) regulations. Constituents of potential concern at the Jaquez site include benzene, toluene, ethylbenzene, and xylene (BTEX) compounds.

The Jaquez site is presently occupied by local residents and is predominantly used for farming. The Citizens Ditch, a perennial elevated surface water conveyance used for both irrigation and as a potable water source for the City of Bloomfield, bisects the site into north and south areas. The berm soils beneath the ditch are presumed contaminated with hydrocarbons due to migration of contaminants from the original source on the north area of the site. High groundwater elevations caused by leakage from the ditch also compound remediation accessibility and effectiveness.

The south area of the site has been subjected to enhanced biodegradation with passive venting and nutrient (nitrate) amendments. Remediation activities in the south area are hindered by adverse slope stability along the ditch berm, combined with the previously mentioned high groundwater table in the area. Seasonal water loss from Citizen's Ditch contributes to the relatively shallow groundwater table on the southern portion of the site. In addition, two Amoco-owned subsurface pipelines cross the site in a north/south direction.

Sections 2.0 and 3.0 of this Work Plan summarize the available information relating to the Jaquez site including a description of previous site activities and investigations, and a description of the, historic groundwater quality data. A conceptual design for the proposed remedial action is described in Section 4.0, and reporting is addressed in Section 5.0.



JAQUEZ GAS COM E#1 & C#1 SITE LOCATION	FIGURE 1.1

2.0 SITE BACKGROUND

2.1 SITE BACKGROUND

The Jaquez site is located in San Jaun County approximately 5 miles northeast of Blanco New Mexico. There are two meter stations on the northern portion of this site located within 40 feet of each other. The site is bisected into north and south areas by Citizen's Ditch, an elevated irrigation and potable water supply conveyance. Figure 2-1, *Jaquez Site Layout,* presents a detailed site layout and location of the South Area.

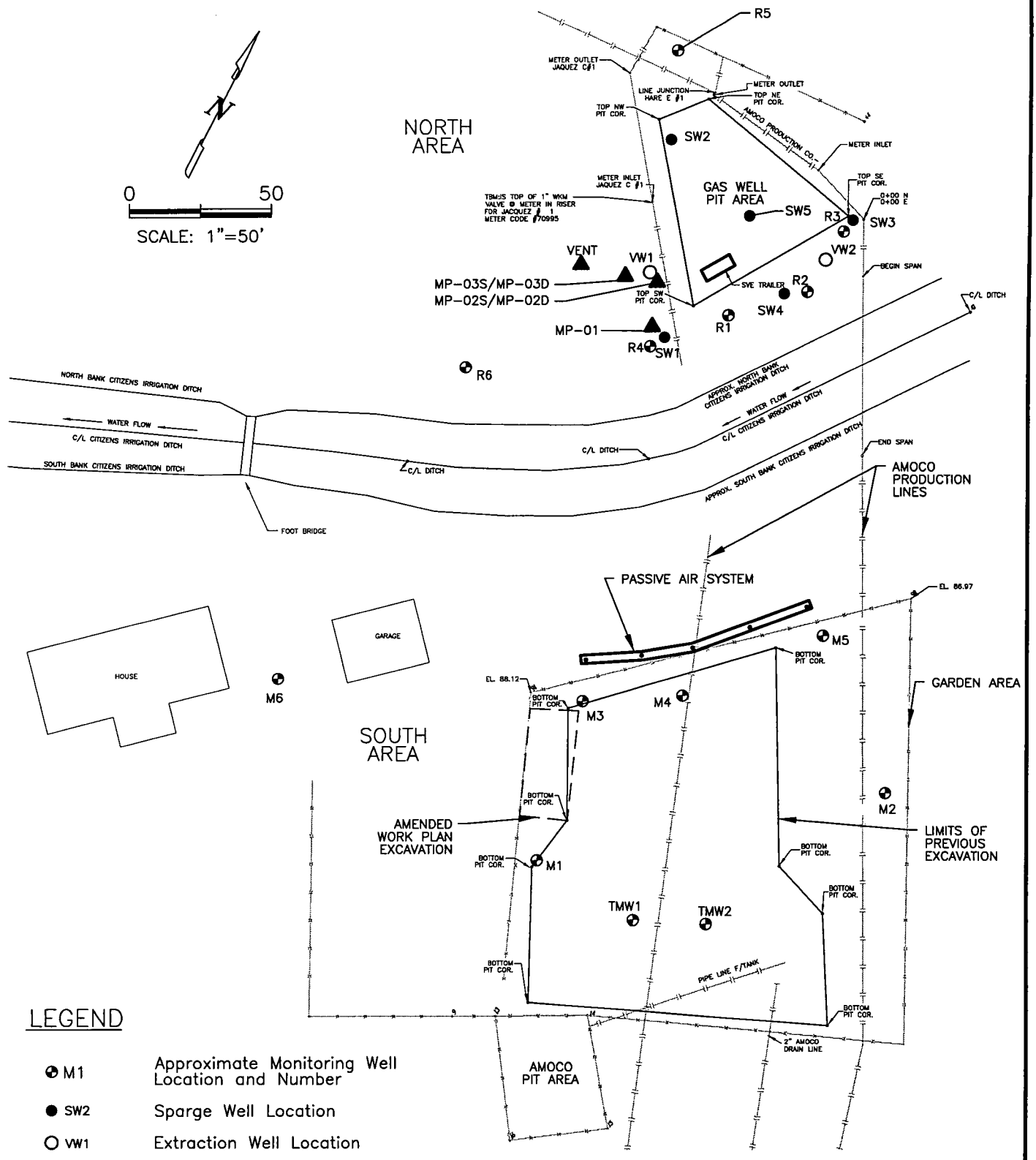
Previous Investigations. The Jaquez site was identified in 1992 when the adjoining landowners expressed concern regarding potential hydrocarbon contamination in a garden area south of the two meter site locations. EPFS, then El Paso Natural Gas, initiated a comprehensive soil and groundwater investigation of the meter site and nearby garden area in March 1993, as directed by OCD. In June 1993, EPFS submitted a remediation plan to OCD for excavation activities at both the north and south portions of the site, and excavated hydrocarbon-contaminated soils in August and September 1993. Groundwater monitoring wells R-1 through R-5 (north portion of the site) and M-1 through M-5 (south portion of the site) were also installed and sampled.

In June 1999, the landowner encountered discolored soils while plowing in the garden area. As a result, EPFS and NMOCD sampled the site and recommended additional soil and groundwater investigation. In November 1999, a test trench was dug across the field revealing a small area of residual contamination on the west site of the garden area. Additional investigations were conducted in December 1999 to further investigate allegations of a second pit location on the north side of the site. No evidence of an additional pit or impacted soils were found during that investigation.

In January 2000, additional downgradient monitoring wells were installed west of the site near the landowner residence, as requested by NMOCD and the landowner. In addition, a six-inch diameter irrigation well north of Citizen's Ditch was sampled in February 2000. No BTEX was detected above analytical laboratory detection limits for these samples. Also in February 2000, six Citizen's Ditch sediment samples were collected during a brief closure of the conveyance for hydrocarbon analyses. All sediment samples were below OCD standards. In July 2000, temporary monitoring wells TMW-1 and TMW-2 were installed and sampled near the fenceline in the south area of the site. No detectable contamination was found in these samples. Surface water samples (above and below the site) from the Citizen's Ditch have been collected on a regular basis since June 2000. No detectable contaminants of concern have been noted in these samples. Sampling to date does not show any measurable hydrocarbon impacts to water quality conveyed across the Jaquez site by Citizen's Ditch.

Previous Remedial Action. Remedial activities have been ongoing since 1993 at the Jaquez site. In addition to the excavation of contaminated soils mentioned above, passive and belt-type hydrocarbon skimmers were installed in two wells on the north side of the site to collect free-phase hydrocarbons from wells that indicated seasonal accumulations of free-product. By 1998, approximately 265 gallons of free-phase hydrocarbons were recovered from the north area wells. Continued hydrocarbon decreases were observed in 1999 and during 2000, no free-phase hydrocarbons were observed.

In January 2000, air sparging and vapor extraction activities were initiated on the north side of Citizen's Ditch to address residual soil and dissolved-phase groundwater contamination in the former pit area. This aggressive remediation has considerably reduced hydrocarbon concentrations in the northern portion of the site to levels at or near the NMOCD remediation standards. It is anticipated that the remediation systems located on the northern portion of the site will be sampled for closure during 2003.



JAQUEZ SITE LAYOUT

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FIGURE 2.1

Jaquez_02.dwg

The area south of Citizen's Ditch has been subjected to passive venting and nutrient amendments since 1998 in an effort to enhance biological degredation. Hydrocarbon concentrations in groundwater below the southern portion of the site have shown a reducing trend during that time. Only one well, M-4, currently contains groundwater contamination above NMOCD standards. Due to the suspected presence of hydrocarbon contaminated soils beneath Citizen's Ditch and extending to the berm on the south side, additional remedial actions will be taken to advance cleanup at this site.

Summary of All Previous Activities. A chronological summary of all activities at the Jaquez site is provided below.

- Late 1992 – The landowner expressed concerns regarding potential hydrocarbon contamination in a garden area near the meter site location.
- March 1993 – EPFS performed its first soil and groundwater investigation on the meter site location.
- June 1993 – EPFS submitted a remediation work plan to the OCD.
- August 1993 – EPFS initiated remediation activities.
- September 1993 - Monitoring wells R1 through R5 were installed north of Citizens Ditch and M1 through M5 were installed south of Citizens Ditch. Benzene, toluene, ethylbenzene, and/or total xylenes (BTEX) concentrations exceeded NMWQCC standards in monitoring wells R1, R2, R4, M3, and M4.
- December 1996 – EPFS injected approximately 500 gallons of aqueous urea nitrate into the passive vent system at the south side of Citizens Ditch. EPFS also installed ORC® socks in monitoring wells M3 and M4.
- July 1998 – EPFS reinjected approximately 500 gallons of aqueous urea nitrate into the passive vent system at the south side of Citizens Ditch. EPFS also installed ORC® socks in monitoring wells M3 and M4.
- November 1998 – EPFS investigated a seep discharging into the surface water of an arroyo south of the site. No petroleum hydrocarbons were observed.
- November 1999 – The landowner requested that a test trench be installed across a portion of the south side of Citizens Ditch. The test trench revealed a small area of residual soil contamination on the west edge of a garden area.
- January 2000 – EPFS submitted soil investigation results and an amended work plan for a soil and groundwater investigation. EPFS also installed 2 downgradient wells: TMW1 and TMW2.
- February 2000 – EPFS sampled sediment in the Citizens Ditch and groundwater in the existing 6-inch irrigation well. Six samples of sediment were collected from various locations on the ditch bottom and submitted for laboratory analyses for BTEX and total petroleum hydrocarbons (TPH). With the exception of one sample, the sample results revealed no detectable levels of any analytes. The exceptional sample had a toluene concentration less than 1.0 milligrams per kilogram (mg/kg). The sample was collected approximately 12-ft west of the western pipeline and approximately 3.5-ft from the southern edge of the ditch bank and appeared dark in color with an abundance of organic material. BTEX levels in the groundwater sample collected from the irrigation well were all less than 0.5 micrograms per liter (µg/L).
- June 2000 –EPFS excavated approximately 204 cubic yards (yd^3) of soil from the northwest corner of the garden area on the south side of Citizens Ditch. Soils from ground surface to approximately 3 ft below ground surface (bgs) were not stained. Soils below 3-ft bgs were darker and exhibited elevated field headspace readings. The impacted soils were removed and six soil samples were taken from the excavated area and submitted to a laboratory for BTEX, methyl-*t*-butyl ether (MTBE), and TPH analyses. BTEX concentrations in 5 of the 6 soil samples analyzed were less than 0.025 mg/kg. MTBE concentrations in each of the 6 samples were less than 0.13 mg/kg. TPH concentrations, in the form of C6-C10, C-10-C22,

or C22-C36 hydrocarbon ranges were less than 10 mg/kg. The soil sample collected near M3 at approximately 6 to 6.5-ft bgs, beneath the water table had trace levels of each BTEX constituent, totaling less than 0.75 mg/kg total BTEX. The same sample exhibited 75 mg/kg TPH. Petroleum-hydrocarbon impacted soils were disposed of properly offsite and the excavation was backfilled with 98.79 tons of 3-inch minus aggregate rock in the bottom of the excavation, as requested by the landowner, over which was placed clean soil mixed with livestock manure.

- June 2000 (continued) - EPFS injected 670 gallons of 10.4 percent aqueous urea nitrate (volume basis) into the passive air system south or Citizens Ditch. Furthermore, EPFS installed 2 temporary monitoring wells in the garden areas south of Citizens Ditch.
- August 2000 – EPFS sampled a seep observed at the toe of the ditch embankment on the north side of the former cornfield. The water from the toe of the ditch bank was running into the north side of the former cornfield and mixing with the fresh manure causing puddles of dark brown to black water. Laboratory analyses of the seep sample revealed no detectable levels of BTEX.
- September 200-Present- Continued operations and maintenance of the remediation systems along with monitoring and reporting according to the project schedule.

3.0 DESCRIPTION OF HISTORICAL DATA

3.1 GROUNDWATER ANALYTICAL DATA

Groundwater analytical data collected at the Jaquez site (both north and south areas) since January 2000 are presented in Table 3.1. A potentiometric surface map based on the site data collected May 22, 2002 is presented in Figure 3-1, *Groundwater Contour Map, Jaquez Com C#1 and Jaquez Com E#1.*

As shown in Table 3.1, the wells located on the southern portion of the site have exhibited relatively low benzene concentrations with few exceptions. The primary area of concern at the southern portion of the site is the area near monitoring well M-4. Data in this well have ranged from 11 µg/l in February 2000 to a high of 99 µg/l in November 2000. The benzene concentration in this well during the last sampling round (collected May 23, 2002) indicates benzene concentrations in M-4 of 51 µg/l.

The monitoring wells located on the northern portion of the site indicate either a significant reduction in concentration during the past two years (R-1, R-2, and R-4) or have been relatively clean during the entire reporting period (R-3, R-5, and R-6). It is interesting to note the dramatic decrease in concentrations in the most contaminated wells in the north area during the period between November 2000 and February 2001. This is most likely the result of optimizing the active remediation systems currently operating in the source area.

Based on the site hydrology and the analytical results discussed above, the area of concern in the southern portion of the site appears to be the relatively narrow area along the AMOCO pipeline running across the Citizen's Ditch, as shown in Figure 3-2, *Benzene Concentration Map, Jaquez Com C#1 and Jaquez Com E#1.* It is likely that the conveyance ditch is providing a hydraulic source that travels along the pipeline backfill in a north/south orientation.

TABLE 3.1

SUMMARY OF AROMATIC HYDROCARBONS IN GROUND WATER
JAQUEZ, NM

		Analytical Parameters			
	Sample	Benzene	Toluene	Ehtylbenzene	Xylenes
Monitoring Well	Date	µg/l	µg/l	µg/l	µg/l
MW-1	1/19/00	<0.5	<0.5	<0.5	<0.5
	5/30/00	<0.5	<0.5	<0.5	<0.5
	6/22/00	<0.5	<0.5	<0.5	<0.5
	8/22/00	<0.5	<0.5	<0.5	<0.5
	11/17/00	<0.5	<0.5	<0.5	<0.5
	2/14/01	10	<0.5	<0.5	<0.5
	5/31/01	1	<0.5	<0.5	0.6
	8/21/01	<0.5	<0.5	<0.5	<0.5
	11/28/01	<0.5	<0.5	<0.5	<0.5
	2/22/02	<0.5	<1.0	<0.5	<0.5
	5/22/02	<0.5	<0.5	<0.5	<1.0
MW-2	1/19/00	<0.5	<0.5	<0.5	<0.5
	5/30/00	<0.5	<0.5	<0.5	<0.5
	6/22/00	<0.5	<0.5	<0.5	<0.5
	8/22/00	<0.5	<0.5	<0.5	<0.5
	11/20/00	<0.5	<0.5	<0.5	<0.5
	2/14/01	<0.5	<0.5	<0.5	<0.5
	5/31/01	<0.5	<0.5	<0.5	<0.5
	8/21/01	<0.5	<0.5	<0.5	<0.5
	11/28/01	<0.5	<0.5	<0.5	<0.5
	2/22/02	<0.5	<1.0	<0.5	<0.5
	5/23/02	<0.5	<0.5	<0.5	<1.0
MW-3	1/19/00	4.1	2.8	1.6	3.7
	2/24/00	30	21	2.3	9.4
	5/30/00	2.1	<0.5	0.9	2.2
	6/22/00	0.6	<0.5	<0.5	<0.5
	7/25/00	<0.5	<0.5	<0.5	1.1
	8/22/00	0.6	<0.5	<0.5	2.2
	11/20/00	1.1	<0.5	<0.5	3.4
	2/14/02	0.6	<0.5	<0.5	0.6
	5/31/01	1.2	<0.5	<0.5	1.7
	8/21/01	1.6	<0.5	1.2	4.5
	11/28/01	0.7	<0.5	<0.5	<0.5
	2/22/02	<0.5	<0.5	<0.5	1.1
	5/23/02	<0.5	<0.5	<0.5	<1.0
MW-4	1/19/00	27	<0.5	<0.5	9.7
	2/24/00	11	<0.5	5.6	5.5
	5/30/00	38	1.1	<0.5	23
	6/22/00	44	1.6	8.9	16
	7/25/00	51	0.6	<0.5	13
	8/22/00	87	0.5	1.2	32
	11/17/00	99	<0.5	0.5	5
	2/14/01	94	<0.5	0.7	13
	5/31/01	78	<0.5	<0.5	<0.5
	8/21/01	30	<0.5	1.4	7.8
	11/28/01	78	<0.5	11	78
	2/22/02	34	<0.5	<0.5	3.4
	5/23/02	51	<0.5	<0.5	2.2

TABLE 3.1

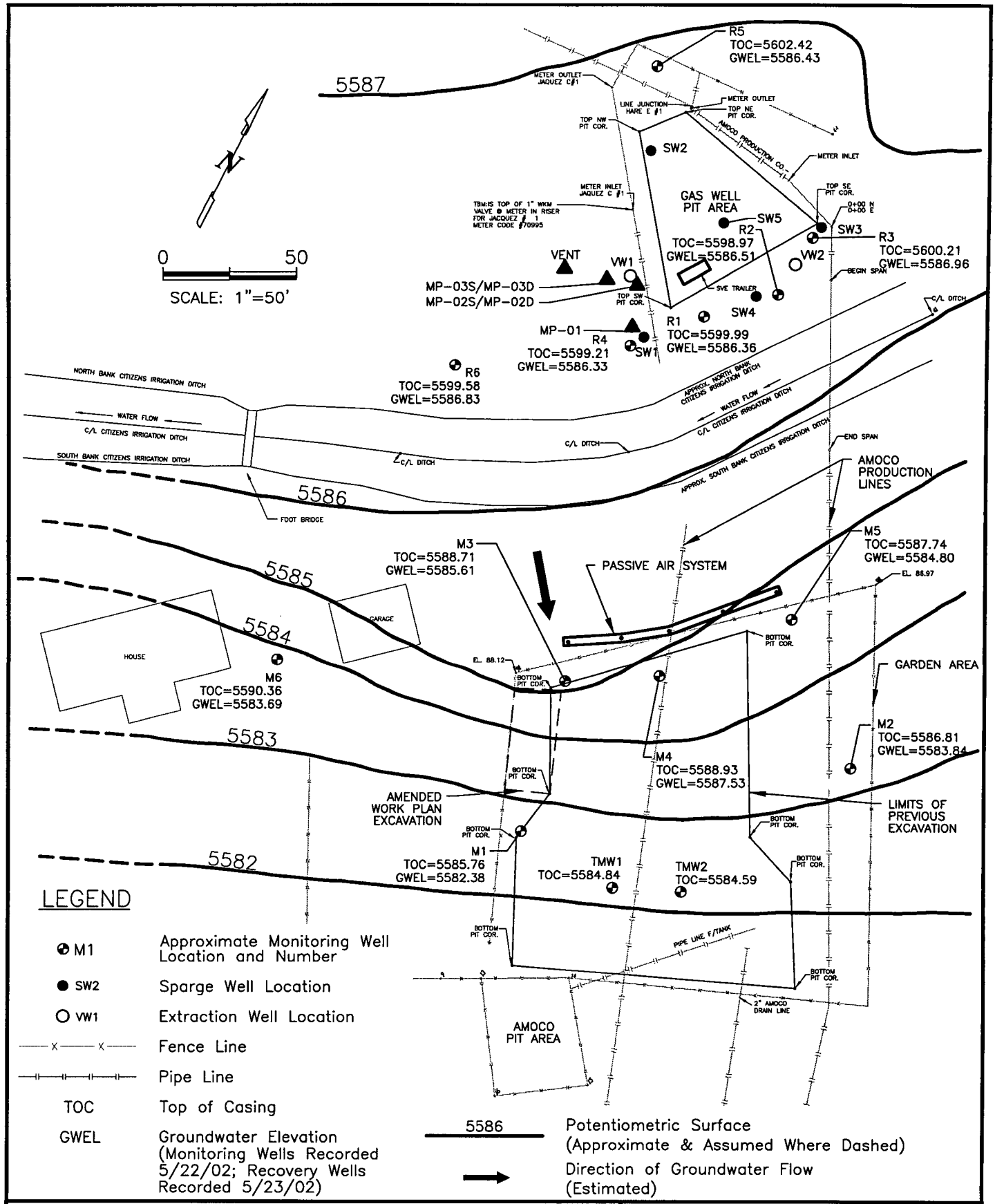
SUMMARY OF AROMATIC HYDROCARBONS IN GROUND WATER
JAQUEZ, NM

		Analytical Parameters			
	Sample	Benzene	Toluene	Ehtylbenzene	Xylenes
Monitoring Well	Date	µg/l	µg/l	µg/l	µg/l
MW-5	1/19/00	<0.5	<0.5	<0.5	<0.5
	5/30/00	<0.5	<0.5	<0.5	<0.5
	6/22/00	<0.5	<0.5	<0.5	<0.5
	8/22/00	43	<0.5	<0.5	<0.5
	11/17/00	2.6	<0.5	<0.5	<0.5
	2/14/01	<0.5	<0.5	<0.5	<0.5
	5/31/01	0.6	<0.5	<0.5	<0.5
	8/21/01	<0.5	<0.5	<0.5	<0.5
	11/28/01	5.6	<0.5	<0.5	<0.5
	2/22/02	<0.5	<0.5	<0.5	<1.0
	5/22/02	<0.5	<0.5	<0.5	<1.0
MW-6	1/19/00	<0.5	<0.5	<0.5	<0.5
	5/30/00	<0.5	<0.5	<0.5	<0.5
	6/22/00	<0.5	<0.5	<0.5	<0.5
	8/22/00	<0.5	<0.5	<0.5	<0.5
	11/17/00	<0.5	<0.5	<0.5	<0.5
	2/14/01	<0.5	<0.5	<0.5	<0.5
	5/31/01	<0.5	<0.5	<0.5	<0.5
	8/21/01	<0.5	<0.5	<0.5	<0.5
	11/28/01	<0.5	<0.5	<0.5	<0.5
	2/22/02	<0.5	<0.5	<0.5	<0.5
	5/22/02	<0.5	<0.5	<0.5	<1.0
R-1	1/20/00	2500	3800	180	1900
	5/31/00	2300	1000	120	2000
	6/26/00	2400	690	150	2000
	7/26/00	4900	2900	150	3100
	8/23/00	2500	1400	180	2200
	11/20/00	3500	2700	210	2900
	2/15/01	120	<10	<10	190
	6/1/01	17	<2.5	<2.5	19
	8/23/01	22	1.2	1	4.2
	11/28/01	100	17	3.9	24
	2/21/02	23	1.3	2.1	6.1
	5/23/02	<0.5	<0.5	<0.5	<1.0
R-2	1/20/00	1200	2000	<130	1500
	5/31/00	2300	3200	280	3000
	6/26/00	1300	1300	79	1100
	7/26/00	3600	3200	150	2300
	8/23/00	1600	1500	82	1100
	11/20/00	770	1300	170	1500
	2/15/01	620	400	43	440
	6/1/01	120	12	15	70
	8/23/01	<2.5	22	22	310
	11/28/01	26	5.8	<5.0	85
	2/21/02	20	<1.0	3.1	35
	5/23/02	<0.5	<0.5	2.4	30

TABLE 3.1

SUMMARY OF AROMATIC HYDROCARBONS IN GROUND WATER
JAQUEZ, NM

		Analytical Parameters			
	Sample	Benzene	Toluene	Ehtylbenzene	Xylenes
Monitoring Well	Date	µg/l	µg/l	µg/l	µg/l
R-3	1/20/00	<0.5	<0.5	0.5	5.2
	5/31/00	1	1.4	0.5	5.4
	6/26/00	<0.5	<0.5	<0.5	<0.5
	7/26/00	<0.5	<0.5	<0.5	<0.5
	8/23/00	<0.5	<0.5	<0.5	<0.5
	11/20/00	<0.5	<0.5	<0.5	<0.5
	2/15/01	2.2	<0.5	<0.5	<0.5
	6/1/01	<0.5	<0.5	<0.5	<0.5
	8/23/01	1.3	<0.5	<0.5	<0.5
	11/28/01	<0.5	<0.5	<0.5	<0.5
	2/21/02	<0.5	<0.5	<0.5	<1.0
	5/23/02	<0.5	<0.5	<0.5	<1.0
R-4	1/20/00	280	89	60	690
	5/31/00	960	980	29	1900
	6/26/00	950	1000	43	2500
	7/26/00	520	400	50	1600
	8/23/00	1500	1800	110	1800
	11/20/00	590	580	110	1800
	2/15/01	19	<10	<10	36
	6/1/01	3.4	<0.5	<0.5	2.2
	8/23/01	86	20	<2.5	12
	11/28/01	79	0.5	1.5	13
	2/21/02	120	2.6	0.56	7.5
	5/23/02	<0.5	<0.5	<0.5	<1.0
R-5	1/20/00	<0.5	<0.5	<0.5	<0.5
	5/31/00	<0.5	<0.5	<0.5	<0.5
	6/26/00	<0.5	<0.5	<0.5	<0.5
	8/23/00	<0.5	<0.5	<0.5	<0.5
	11/20/00	<0.5	<0.5	<0.5	0.9
	2/15/01	<0.5	<0.5	<0.5	<0.5
	6/1/01	<0.5	<0.5	<0.5	<0.5
	8/23/01	<0.5	<0.5	<0.5	<0.5
	11/28/01	<0.5	<0.5	<0.5	<0.5
	2/21/02	<0.5	<1.0	<0.5	<0.5
	5/23/02	<0.5	<0.5	<0.5	<1.0
R-6	1/20/00	<0.5	<0.5	<0.5	<0.5
	5/31/00	<0.5	<0.5	<0.5	<0.5
	6/26/00	<0.5	<0.5	<0.5	<0.5
	8/23/00	<0.5	<0.5	2.6	13
	11/20/00	<0.5	<0.5	<0.5	<0.5
	2/15/01	<0.5	<0.5	<0.5	<0.5
	6/1/01	<0.5	<0.5	<0.5	<0.5
	8/23/01	<0.5	<0.5	<0.5	<0.5
	11/28/01	<0.5	<0.5	<0.5	<0.5
	2/21/02	<0.5	<0.5	<0.5	<1.0
	5/23/02	<0.5	<0.5	<0.5	<1.0



GROUNDWATER CONTOUR MAP
JAQUEZ COM C#1 AND
JAQUEZ COM E#1 (5/22/02)

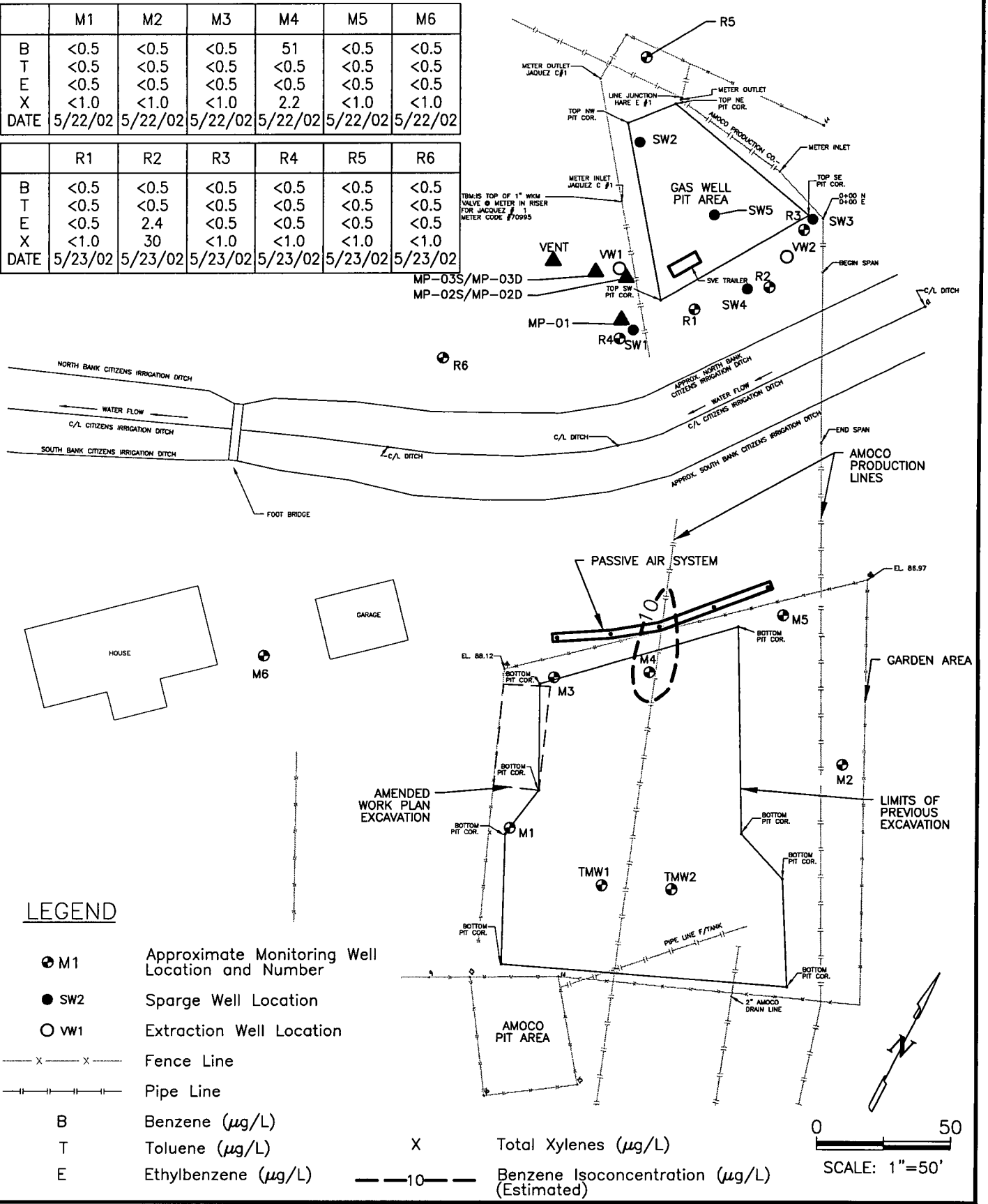
EL PASO FIELD SERVICES

FIGURE 3.1

Jaquez_02.dwg

	M1	M2	M3	M4	M5	M6
B	<0.5	<0.5	<0.5	51	<0.5	<0.5
T	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
E	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
X	<1.0	<1.0	<1.0	2.2	<1.0	<1.0
DATE	5/22/02	5/22/02	5/22/02	5/22/02	5/22/02	5/22/02

	R1	R2	R3	R4	R5	R6
B	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
T	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
E	<0.5	2.4	<0.5	<0.5	<0.5	<0.5
X	<1.0	30	<1.0	<1.0	<1.0	<1.0
DATE	5/23/02	5/23/02	5/23/02	5/23/02	5/23/02	5/23/02



LEGEND

- M1 — Approximate Monitoring Well Location and Number
- SW2 — Sparge Well Location
- VW1 — Extraction Well Location
- —— X —— X —— Fence Line
- ——||——||—— Pipe Line
- B — Benzene (µg/L)
- T — Toluene (µg/L)
- E — Ethylbenzene (µg/L)
- X — Total Xylenes (µg/L)
- ——10—— Benzene Isoconcentration (µg/L) (Estimated)

Jaquez_02.dwg

BENZENE CONCENTRATION MAP JAQUEZ COM C#1 AND JAQUEZ COM E#1 (5/22/02)

EL PASO FIELD SERVICES

FIGURE 3.2

4.0 PROPOSED REMEDIAL ACTION

4.1 PROPOSED REMEDIAL TECHNOLOGY-ENHANCED NATURAL ATTENUATION

Based on the past success under similar conditions, the relatively low concentrations of aromatic hydrocarbons in the southern area monitoring wells, and the limited area of contamination, it is apparent that application of an oxygen enhancement to the site may increase the natural biological degradation of the site contaminants to concentrations below NMWQCC standards for aromatic hydrocarbons. Previous attempts at enhanced biodegredgation using alternate electron receptors (nitrate) have proven to be relatively ineffective. Therefore, it is proposed that groundwater contamination in the southern portion of the site be addressed by enhancing the oxygen concentration through application of oxygen-releasing compound (ORC).

When hydrated, ORC releases molecular oxygen to the groundwater, which then diffuses and is available for use as an electron receptor, increasing the rate of natural bioremediation. The only infrastructure required to implement this remedy is the installation of a line of direct-push ORC injection points bracketing the impacted area. Monitoring for this remedy will be performed in the existing monitoring well M-4.

4.2 ORC INJECTION CONCEPTUAL DESIGN

In order to introduce oxygen into the shallow aquifer system, a single row of ORC treatment injection points will be installed using a direct-push drilling system. These four injection points, shown in Figure 4-1, *Proposed ORC Injection Locations*, are based on the concept that the current source for dissolved phase contamination in monitoring well M-4 is beneath the existing ditch bank and cannot be mechanically removed without potential disturbance to the conveyance ditch. The injection points have been located to ensure long-term containment of the relatively low dissolved phase contamination along the pipeline corridor.

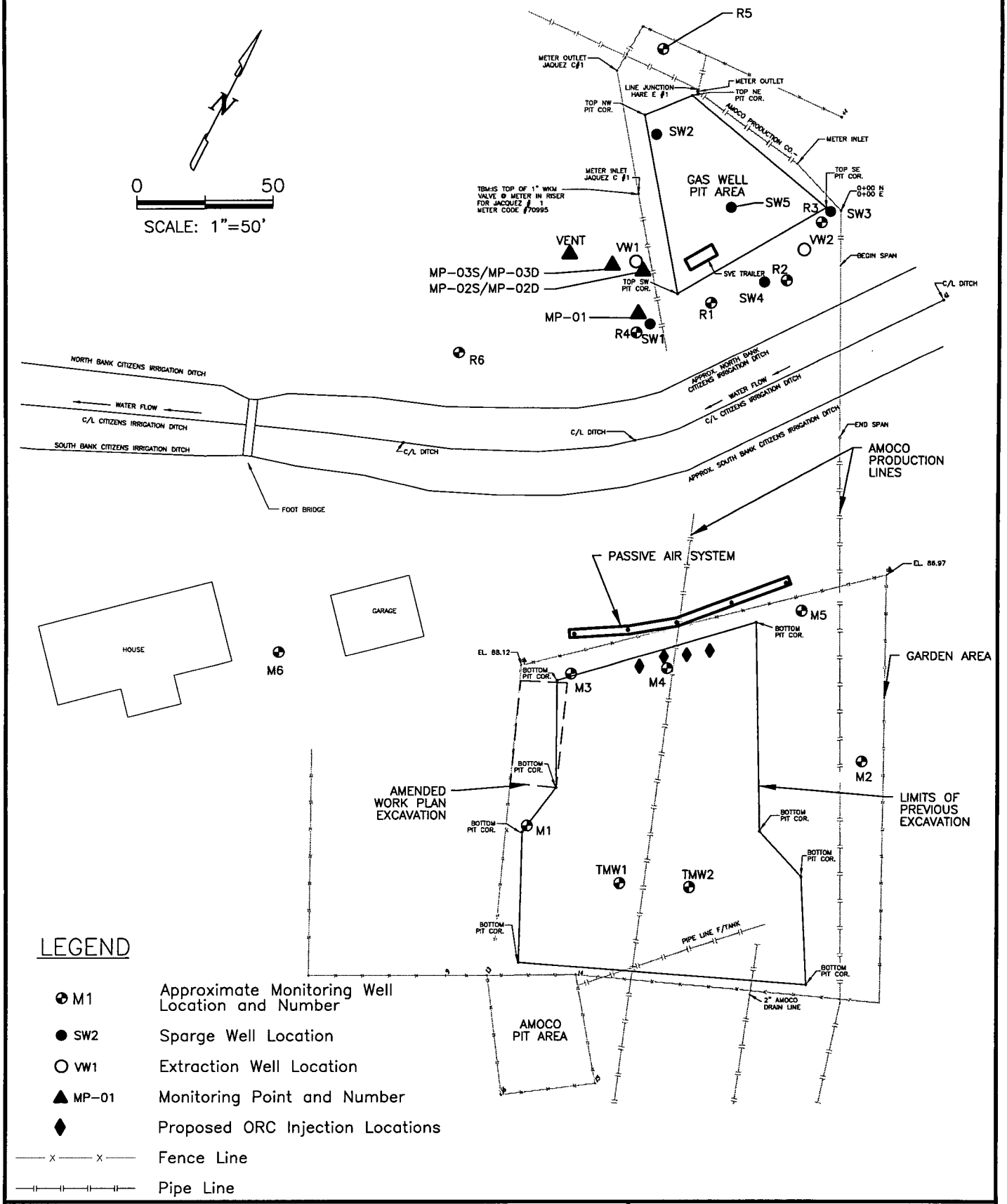
To estimate the amount of ORC product needed and injection point spacing, MWH applied site-specific data and assumptions into a model developed by the manufacturers of ORC. Based on the model input, injection point spacing of approximately 8-foot intervals across the plume is recommended with an initial dosage of ORC of approximately 120 pounds, or 30 pounds per injection point. The ORC will be directly injected into the subsurface to approximately 15 feet below ground surface. Please see Appendix A for ORC application information and dosage calculations.

4.3 REMEDIAL SYSTEM MONITORING

Groundwater samples will continue to be collected on a quarterly basis from the entire (north and south area) monitoring network currently being sampled. In addition to the quarterly groundwater samples, field parameters (including pH, temperature, specific conductance, oxygen-reduction potential, and dissolved oxygen) will be measured from MW-4 on a monthly basis until dissolved oxygen concentrations in this well indicate that the ORC injection points are effective.

4.4 OPERATIONS AND MAINTENANCE

Limited operations and maintenance (O&M) activities are anticipated for this remedy. Based on the remedial system monitoring, additional ORC injection may be required, however, actual ORC usage is site dependent and is difficult to predict because the total mass of the source area (beneath Citizen's Ditch) are not known. Therefore, the injection of additional oxygen enhancement will be defined based on the results of the performance monitoring.



Jaquez_02.dwg

PROPOSED ORC INJECTION LOCATIONS
JAQUEZ COM C#1 AND
JAQUEZ COM E#1

EL PASO FIELD SERVICES

FIGURE 4.1

5.0 REPORTING

Following installation of the ORC injection points, existing monitoring well M-4 will be monitored according to the schedule discussed in Section 4.3. These data will be presented in the Jaquez Annual Report along with a discussion of the effectiveness of the ORC application.

6.0 REFERENCES

EPFS, 2002. *Monthly Report for December 2001 Jaquez Com C #1 and Jaquez Com E #1 Site.* January 2002.

EPFS, 2002. *Monthly Report for November 2001 Jaquez Com C #1 and Jaquez Com E #1 Site.* January 2002.

EPFS, 2002. *Jaquez Com. C#1 and Jaquez Com. E#1 Annual Report.* April 2002.

EPFS, 2001. *Jaquez Com C #1 and Jaquez Com E #1 Soil Vapor Extraction Remediation System.* October 2001.

EPFS, 2001. *Jaquez Com C #1 and Jaquez Com E #1 Annual Report for Soil and Groundwater Remediation.* April 2001.

EPFS, 2001. *Jaquez Com C #1 and Jaquez Com E #1 Remediation System Evaluation.* December 2000.

APPENDIX A

OXYGEN RELEASING COMPOUND PRODUCT INFORMATION

ORC Design Software for Barriers Using Slurry Injection

US Version 3.0

Regenesis Technical Support: USA (949) 366-8000, www.regenesis.com

Site Name: Jaquez South Field Area
Location: Farmington, NM
Consultant: MWH

Site Conceptual Model/Extent of Plume Requiring Remediation

Width of plume (intersecting gw flow direction)	30	ft		
Depth to contaminated zone	3	ft		
Thickness of contaminated saturated zone	15	ft		
Nominal aquifer soil (gravel, sand, silty sand, silt, clay)	silty sand			
Effective porosity	0.3			
Hydraulic conductivity	10	ft/day	=	3.5E-03 cm/sec
Hydraulic gradient	0.005	ft/ft		
Seepage velocity	60.8	ft/yr	=	0.167 ft/day

Dissolved Phase Oxygen Demand:

Individual species that represent oxygen demand:	Contaminant Conc (mg/L)	Contaminant Loading (lb/yr)	Stoich. (wt/wt) O_2/contam.	ORC (lb/yr) (10% O_2)
Benzene	0.05	0.03	3.1	1
Toluene	0.02	0.01	3.1	0
Ethylbenzene	0.01	0.01	3.2	0
Xylenes	0.08	0.04	3.2	1
MTBE	0.00	0.00	2.7	0
dichloroethene	0.00	0.00	0.7	0
vinyl chloride	0.00	0.00	1.3	0
reduced metals: Fe (+2) and Mn(+2)	5.00	2.56	0.1	3
User added, also add stoichiometric demand	0.00	0.00	0.0	0
User added, also add stoichiometric demand	0.00	0.00	0.0	0
Measures of total oxygen demand				
Total Petroleum Hydrocarbons	10.00	5.12	3.1	159
Biological Oxygen Demand (BOD)	30.00	15.37	1	154
Chemical Oxygen Demand (COD)	90.00	46.11	1	461

Length of time to eval. contaminant flow into barrier: 1 yr

Summary of Estimated ORC Requirement Measures

	ORC for Dissolved Phase Flux (lb)	Add Dem Factor (1 to 10x)	ORC Total w/ Add Dem Factor	ORC Cost at $ 10.00	
Individual Species: Total BTEX, MTBE	5	5	26	$ 258	<-
Total Petroleum Hydrocarbons	159	2	318	$ 3,176	
Biological Oxygen Demand (BOD)	154	2	307	$ 3,074	
Chemical Oxygen Demand (COD)	461	1	461	$ 4,611	

Select above measure (button) to specify required ORC quantity (in 30 lb increments) ——————> 30 lbs ORC

Delivery Design for ORC Slurry

Spacing within rows (ft)		8.0	feet
# points per row		4	points/row
Number of rows		1.0	no.for rows
Number of points in grid		4	points
Required ORC per foot	Minimum Dose Override->	2.0	lbs/foot
Total ORC	Minimum Dose Override->	120	lbs of ORC

Slurry Mixing Volume for Injections

Pounds per location	30	pounds
Buckets per location	1.0	buckets
Design solids content (20-40% by wt. for injections)	30%	
Volume of water required per hole (gal)	8	gallons
Total water for mixing all holes (gal)	34	gallons
Simple ORC Backfilling: min hole diameter for 67% slurry	2.3	inches
Feasibility for slurry injection in sand: ok up to 15 lb/ft	(ok)	
Feasibility for slurry injection in silt: ok up to 10 lb/ft	(ok)	
Feasibility for slurry injection in clay: ok up to 5 lb/ft	(ok)	

Project Summary		
ORC bulk material for slurry injection (lbs)		120
Number of 30 lb ORC buckets		4.0
ORC bulk material cost	$	11.00
Cost for bulk ORC material	$	1,320
Shipping and Tax Estimates in US Dollars		
Sales Tax rate: 0%	$	-
Total Matl. Cost	$	1,320
Shipping (call for amount)	$	-
Total Regenesis Material Cost	$	1,320

ORC Slurry Injection Cost Est. (responsibility of customer to contract work)		
Footage for each inj. point = uncontaminated + HRC inj. interval (ft)		18
Total length for direct push for project (ft)		72
Estimated daily installation rate (ft per day: 400 for push, 150 for drillir		400
Estimated points per day (15 to 30 is typical for direct push)		22.2
Required number of days		1
Mob/demob cost for injection subcontractor	$	1,000
Daily rate for inj. Sub. ($1-2K for push $3-4K for drill rig)	$	1,500
Total injection subcontrator cost for application	$	2,500
Total Install Cost (not including consultant, lab, etc.)	$	3,820

Other Project Cost Estimates		
Design	$	-
Permitting and reporting	$	-
Construction management	$	-
Groundwater monitoring and rpts	$	-
Other	$	-
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Other	$	-
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