

AP - 97

# STAGE 1 & 2 WORKPLANS

DATE:

10-10-08

October 10, 2008

## STAGE 1 & 2 ABATEMENT PLAN

BD JCT. P-26-1 SITE (1R-0426-106)

BD JCT. P-26-2 SITE (1R-0426-107)

T21, R37E, SECTION 26 UNIT LETTER P  
LEA COUNTY, NEW MEXICO



PREPARED BY:



P. O. Box 7624  
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PREPARED FOR:



122 WEST TAYLOR  
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October 13, 2008

RECEIVED TRIDENT ENVIRONMENTAL

2008 OCT 13 PM 12 21

Mr. Edward Hansen  
New Mexico Energy, Minerals, & Natural Resources  
Oil Conservation Division, Environmental Bureau  
1220 S. St. Francis Drive  
Santa Fe, New Mexico 87504

RE: Stage 1 and 2 Abatement Plan  
BD Jct. P-26-1 Site (1R-0426-106)  
BD Jct. P-26-2 Site (1R-0426-107)  
T21S-R37E-Section 26, Unit Letter P

RECEIVED  
OCT 13 PM 12 21

Dear Mr. Hansen

On behalf of Rice Operating Company (ROC), enclosed are the proposed Stage 1 and 2 Abatement Plan and Notice of Publication for the above-referenced sites. The two sites are in close proximity of each other (within 350 feet) and have similar impacts and characterization profiles; therefore, they are being combined into one abatement plan per your approval on September 8, 2008.

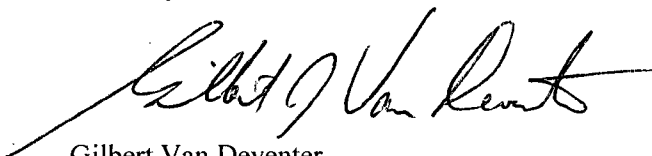
After approved by the Division, ROC will give written notice of the Stage 1 and 2 Abatement Plan to the following persons:

- (a) surface owners of record within one (1) mile of the perimeter of the site,
- (b) the Lea County commissioner,
- (c) those persons, as identified by the Director, who have requested notification;
- (d) the New Mexico Trustee for Natural Resources, and any other local, state or federal governmental agency affected, as identified by the Director.

Upon your review, ROC will issue the approved public notice for publication in the Albuquerque Journal and the Hobbs News Sun pursuant to OCD Rule 19.G.(2). A copy of these publications and notice to owners and all interested parties will be provided.

If you have any questions please call me at 432-638-8740 or Hack Conder at 505-393-9174.

Sincerely,



Gilbert Van Deventer  
Trident Environmental

cc: Hack Conder, Rice Operating Company  
Marvin Burrows, Rice Operating Company

**NOTICE OF PUBLICATION**  
**State of New Mexico**  
**Energy, Minerals and Natural Resources Department**  
**Oil Conservation Division**

Notice is hereby given that pursuant to New Mexico Oil Conservation Division Regulations, the following Stage 1 and 2 Abatement Plan has been submitted to the Director of the Oil Conservation Division, 1220 S. St. Francis Dr., Santa Fe, New Mexico 87505, Telephone (505) 476-3440:

Rice Operating Company, Marvin Burrows, Engineering Manager, Telephone (505) 393-9174, 122 West Taylor, Hobbs, New Mexico 88240, has submitted a Stage 1 and 2 Abatement Plan for a release at the BD Jct. P-26-1 (NMOCD Case No. 1R-0426-106) and BD Jct. P-26-2 (NMOCD Case No. 1R-0426-107) sites. Both junction box sites are located in Section 26, Township 21 south, Range 37 east, approximately 2 miles east of Eunice, New Mexico. Rice Operating Company operates a saltwater disposal pipeline at the site. Soil boring and groundwater samples at the site have exhibited elevated chloride concentrations. The Stage 1 and 2 Abatement Plan proposes the following site abatement activities: (1) Corrective actions to the vadose zone at each site have already taken place with the new construction and relocation of watertight junction boxes, upgrade to poly pipeline, and installation of a one-foot thick clay barrier at 6 ft bgs. The surrounding area is supportive of vegetation and each site has been re-seeded with a mixture of native grasses and plants that will re-vegetate the area at a natural rate. (2) ROC proposes to install one groundwater recovery well at each site which will share a single groundwater treatment system. Once installed, the performance of the system will be monitored until the chloride mass contributed by releases from the former junction boxes has been mitigated.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. The Stage 1 and 2 Abatement Plan may be viewed at the above address or at the Oil Conservation Division District Office, 1625 N. French Drive, Hobbs, New Mexico 88240, Telephone (505) 393-6161 between 8:00 a.m. and 4:00 p.m., Monday through Friday. Prior to ruling on any proposed Stage 1 and 2 Abatement Plan, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which written requests for a public hearing that includes reasons why a hearing should be held and written comments may be submitted to him.

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## 1.0 EXECUTIVE SUMMARY

The Jct. P-26-1 and P-26-2 sites are operated by Rice Operating Company (ROC) and are located in Township 21 South, Range 37 East, Section 26, unit letter P approximately 2 miles east of Eunice, NM. The two sites are in close proximity of each other (within 350 feet) and have similar impacts and characterization profiles; therefore, they are being combined into one abatement plan as approved by NMOCD on September 8, 2008 (Appendix A). This combined Stage 1 and 2 Abatement Plan incorporates the findings of additional investigations performed after those described in the Investigation and Characterization Plans (ICP) which were submitted to the NMOCD on February 12, 2007. The Stage 2 portion (section 6.0) of this abatement plan proposes corrective actions for vadose zone and groundwater remedies.

The constituents of concern at each site are limited to chloride and total dissolved solids (TDS) which exceed New Mexico Water Quality Control Commission (WQCC) standards for groundwater. There are no indications of adverse hydrocarbon impacts to the vadose zone or groundwater at either site. A maximum chloride concentration of 4,350 milligrams per liter (mg/L) in MW-1 at the P-26-1 site (November 12, 2007) and 5,300 mg/L in MW-1 at the P-26-2 site (April 4, 2008) were observed; however, elevated chloride and TDS concentrations are limited to the near vicinity of the source at each site, and levels have decreased approximately 50 percent at the P-26-1 site.

Corrective actions to the vadose zone at each site have already taken place with the new construction and relocation of watertight junction boxes, upgrade to poly pipeline, and installation of a one-foot thick clay layer at 6 ft bgs to minimize infiltration through the vadose zone. The surrounding area is supportive of vegetation and each site has been re-seeded with a mixture of native grasses and plants that will re-vegetate the area at a natural rate. ROC will monitor the site for continued healthy growth of native vegetation and add amendments if necessary.

As described further in section 6.2, ROC proposes to install one groundwater recovery well at each site which will share a single groundwater treatment system. Once installed, the performance of the system will be monitored until the chloride mass contributed by releases from the former junction boxes has been mitigated. Flow rate, total volume, and chloride content of the recovered and treated groundwater will be measured. Water from the recovery wells will be stored on site for treatment. Treated water will be used for irrigation of the site vegetation. Untreated and/or rejected water will be used in pipeline maintenance operations.

ROC will continue quarterly groundwater sampling at each site.

## **2.0 BACKGROUND AND PREVIOUS WORK**

### **2.1 SITE LOCATIONS AND LAND USE**

The Jct. P-26-1 and P-26-2 sites are located on land owned by Delrose Scott in Township 21 South, Range 37 East, Section 26, unit letter P approximately 2 miles east of Eunice, NM as shown on the attached Site Location Map (Figure 1). Produced water gathered by the BD SWD System in the site area is sent to the C-2 SWD well, which is located approximately 1 mile south-southeast of the Jct. P-26-1 and P-26-2 sites. Land in the site area is primarily utilized for oil & gas production, and cattle ranching. Figure 2 is a recent aerial photograph (2005) showing both sites and other pertinent features.

### **2.2 JCT P-26-1 SITE - PREVIOUS WORK**

In June 2004, ROC initiated replacement activities of the Jct. P-26-1 vent as part of the NMOCD-approved Junction Box Upgrade Program. The P-26-1 junction box was rebuilt at a location approximately 20 feet to the north of its former location. Soil sampling activities at the former vent location were conducted from June 28 to July 1, 2004 and included the installation of eight 12-ft deep trenches.

Between July 8 and July 15, 2004, a 25-ft wide by 35-ft long area was excavated to a depth of 12 feet below ground surface (bgs). Composite soil samples were recovered from the floor of the excavation, from each of the four walls of the excavation, and from the excavated soil. Following the characterization of the soil, the excavated soil was blended and returned to the excavation up to a depth of 6 feet bgs. A one-foot thick compacted clay barrier was installed to prevent potential downward migration of any residual contaminants and the remaining soil was placed above the clay. An identification plate was placed on the surface to mark the location of the clay barrier.

Notice of potential groundwater impact was emailed to the NMOCD on November 16, 2004. A Junction Box Disclosure Report was submitted to the OCD on March 18, 2005 to disclose the site as having potential for adverse impact to the vadose zone and groundwater. The site was placed on a prioritized list of similar sites for further consideration.

An ICP was submitted to NMOCD on February 12, 2007, to address potential environmental concerns at site. NMOCD approved the ICP via email on August 6, 2007, and assigned the site case number 1R-0426-106.

### **2.3 JCT P-26-2 SITE - PREVIOUS WORK**

On June 2, 2004, ROC initiated replacement activities at the P-26-2 junction box as part of the NMOCD-approved Junction Box Upgrade Program. Jct. P-26-2 was rebuilt at a location approximately 67 feet to the north.

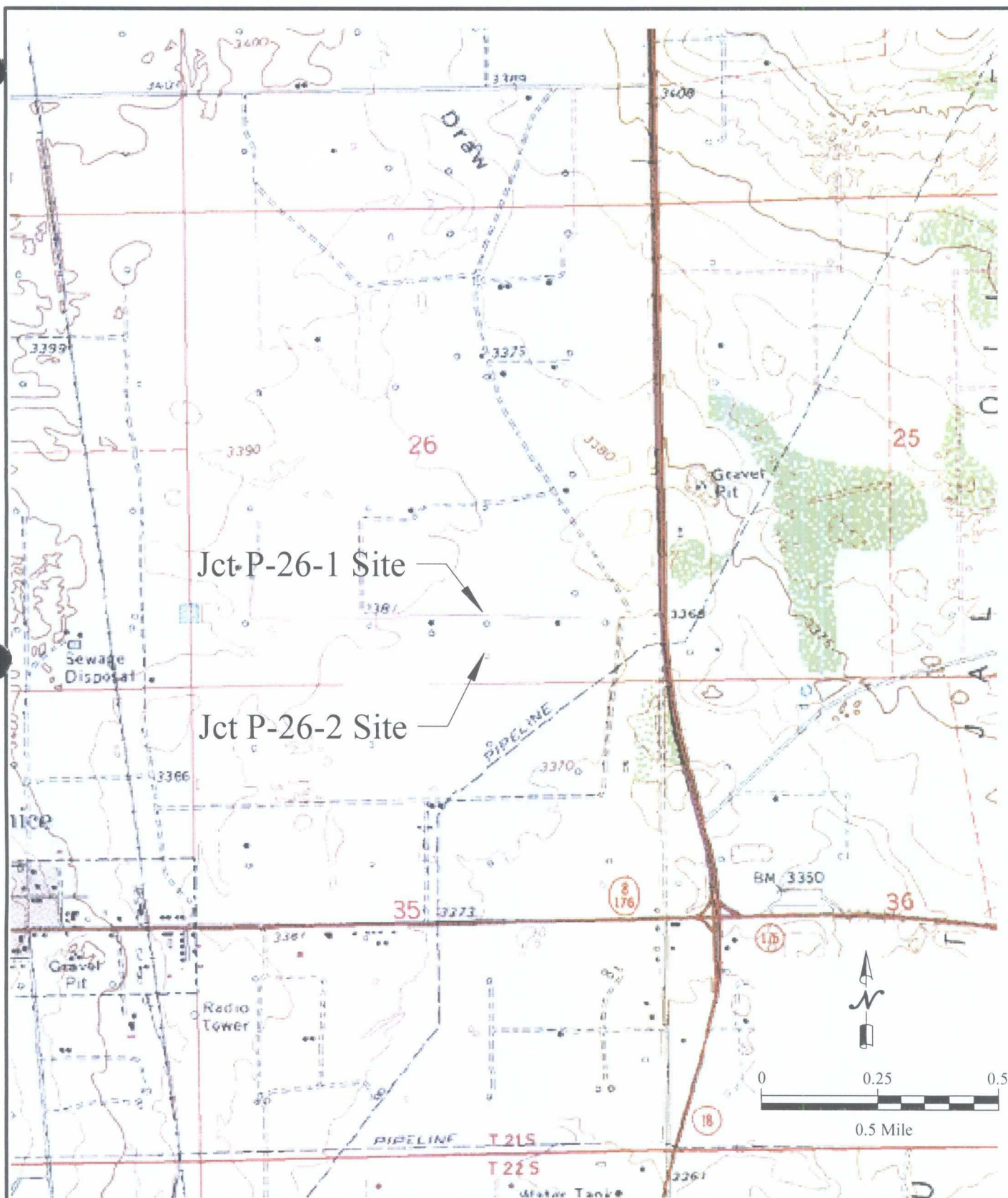


Soil sampling activities at the former P-26-2 junction box site were conducted from June 2 to 4, 2004 and included the installation of four 12-ft deep trenches and one 16-ft deep trench from which soil samples were collected every 2 feet beginning at 4 ft bgs. On June 7, 2004, a 10-ft wide by 12-ft long area was excavated to a depth of 12 ft bgs. Composite soil samples were recovered from the floor of the excavation, from each of the four walls of the excavation, and from the excavated soil.

Following the characterization of the soil, the excavated soil was blended and returned to the excavation up to a depth of 6 feet bgs. A one foot thick compacted clay barrier was installed to prevent potential downward migration of any residual contaminants and the remaining soil was placed above the clay. An identification plate was placed on the surface to mark to location of the clay barrier.

Notice of potential groundwater impact was emailed to the NMOCD on August 25, 2004. A Junction Box Disclosure Report was submitted to the OCD on March 18, 2005 to disclose the site as having potential for adverse impact to the vadose zone and groundwater. The site was placed on a prioritized list of similar sites for further consideration.

An ICP was submitted to NMOCD on February 12, 2007, to address potential environmental concerns at site. NMOCD approved the ICP via email on August 6, 2007, and assigned the site case number 1R-0426-107.



BD Jct P-26-1 & P-26-2 Sites  
T21S - R37E - Section 26, Unit P

**RICE** *Operating Company*

FIGURE 1  
SITE LOCATION MAP





BD Jct P-26-1 & Jct P-26-2 Sites  
T21S - R37E - Section 26, Unit P

**RICE** *Operating Company*

FIGURE 2  
AERIAL PHOTO MAP  
(2005)

### **3.0 GEOLOGY AND HYDROGEOLOGY**

#### **3.1 REGIONAL AND LOCAL GEOLOGY**

According to published information (Nicholson and Clebsch, 1961, Barnes, 1976, and Anderson, Jones, and Green, 1997) the site is underlain by Quaternary Colluvial Deposits composed of sand, silt, and gravel deposited by slope wash and talus from the Tertiary Ogallala Formation. These colluvial deposits are often calichified (indurated with cemented calcium carbonate) with caliche layers from 1 to 20 feet thick. The thickness of the colluvial deposits and Ogallala Formation is approximately 45 feet; however it varies locally as a result of significant paleo-topography at the top of the underlying Triassic Dockum Group. Since Cretaceous Age rocks in the region have been removed by pre-Tertiary erosion, the alluvium and Ogallala Formation rest unconformably on the Triassic Dockum Group. The uppermost unit of the Dockum Group is the Chinle Formation, which primarily consists of micaceous red clay and shale but also contains thin interbeds of fine-grained sandstone and siltstone. The red clays and shale of the Chinle Formation act as an aquitard beneath the unconfined water-bearing formation (colluvial deposits and Ogallala Formation) and therefore limit the amount of recharge to the underlying Dockum Group.

During soil sampling activities, the subsurface soils were generally composed of calcareous very fine-grained sand nearer to the surface (upper 25 feet or so) which transitioned to fine-grained sand (approximately 25-ft to 45-ft bgs), and then to a fine- to medium-grained sand below 45 ft bgs to the bottom of the borings (approximately 60 ft bgs). Variations to this generalized lithologic description occurred from boring to boring. More detailed descriptions of the subsurface lithology are included in the lithologic logs along with other pertinent observations in Appendix B.

#### **3.2 REGIONAL AND LOCAL HYDROGEOLOGY**

Potable groundwater used in southern Lea County is derived primarily from the Ogallala Formation and the Quaternary alluvium. Water from the Ogallala and alluvium aquifers in southern Lea County is used for irrigation, livestock, domestic, industrial, and public supply purposes.

Based on the total depths of water wells in the area (85 to 90 feet) and the depth to groundwater (average of 45 feet bgs), the saturated thickness of the Ogallala Formation in the site area is estimated at approximately 40 - 45 feet.

Nicholsen and Clebsch (1961) found that the regional gradient of the Ogallala and interconnected colluvial aquifer in the site area generally flows toward the southeast and the hydraulic gradient varies from approximately 0.001 to 0.01 feet/feet.

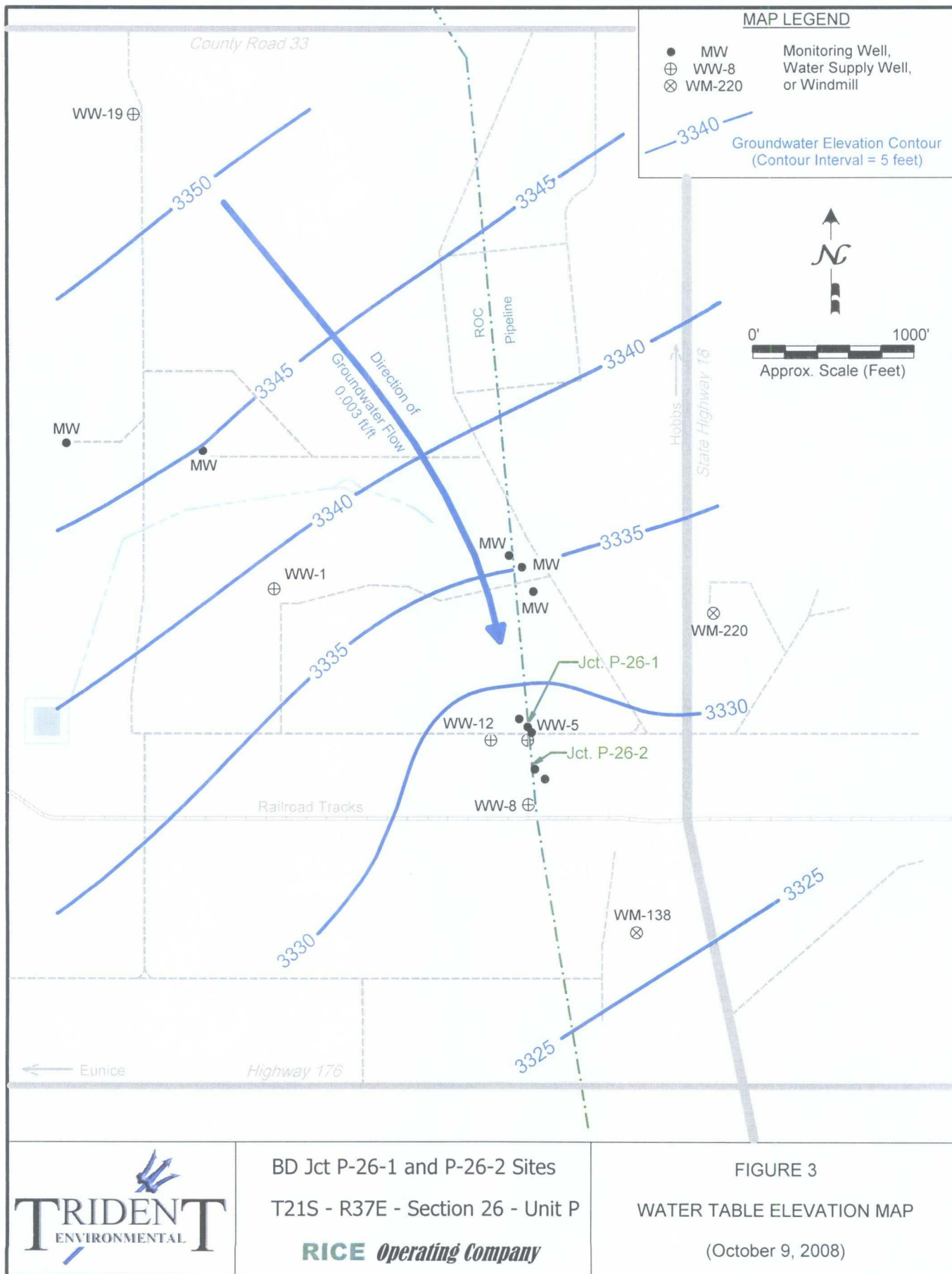
Based on the known depth to groundwater data from accessible wells located within a mile of the Jct. P-26 sites the magnitude of the regional groundwater gradient is 0.003 feet/foot and the prevailing direction of flow is to the southeast (Figure 3). However, the magnitude and direction of the groundwater gradient in the vicinity of the P-26-1 and P-26-2 sites is significantly influenced by the groundwater withdrawal from several nearby industrial water supply wells. Based on records from the New Mexico Office of the State Engineer (NMSEO) these wells are consistently pumping at a combined rate of approximately 80 to 90 gallons per minute (gpm). The groundwater withdrawal induces groundwater to flow from the site towards the water supply wells. During times when the water supply wells are not in service the gradient intermittently returns to the prevailing southeast direction.

A summary of active water wells located in the vicinity of the Jct. P-26-1 and P-26-2 sites are listed in Table 1 below. These wells are also depicted in Figure 3.

**TABLE 1**  
**SUMMARY OF ACTIVE WATER WELLS**

Well ID	Well Type/Use	T21S- R37E		Distance from Jct. P-26-1 Site	Distance from Jct. P-26-2 Site
		Sec	UL		
WW-1	Industrial Supply	26	K	2,640' ft NW	2,770' ft West
WW-5	Industrial Supply	26	P	120' ft South	240' ft North
WW-8	Industrial Supply	26	P	650' ft South	300' ft SSW
WW-12	Industrial Supply	26	O	330' ft WSW	430' ft NW
WM-220	Windmill/Livestock	25	I	1,920' ft NE	2,100' ft NE

There are no surface water bodies located within a ½ mile of the site.





#### 4.0 SOIL AND GROUNDWATER INVESTIGATION

ROC conducted initial upper vadose zone delineation field activities at the Jct. P-26-1 and P-26-2 sites in June 2004. Results of those activities were disclosed to NMOCD in November 2004 (Notice of potential groundwater impact) and March 2005 (Junction Box Disclosure Report). A comprehensive description of these initial investigations was provided in the ICP and submitted to NMOCD in February 2007. The above-referenced documents are included with this abatement plan submission in portable document format on compact disk.

On October 29 and 30, 2007, a soil boring (B-1) was advanced immediately adjacent to the former junction box at a point where the early investigations indicated maximum chloride mass within the vadose zone to further delineate depth of impact in the vadose zone at both sites. Field testing of the soil borings suggested chloride impact to groundwater was likely; therefore, a monitoring well was installed just outside of the southeast corner of excavated area around each of the former junction boxes. After two quarters of sampling data confirmed groundwater impact, additional upgradient (MW-2) and downgradient (MW-3) wells were installed at the Jct. P-26-1 site on June 3, 2008, to determine the local groundwater gradient direction and lateral extent of groundwater impact. Only one downgradient well (MW-2) was necessary at the Jct. P-26-2 site since upgradient conditions can be characterized by the downgradient well at the Jct. P-26-1 site.

Results of chloride field testing at all soil borings and monitoring wells are depicted in Figure 4 and summarized in Table 2. Detailed descriptions of the lithology, field chloride tests, and well construction are also shown on the lithologic and well construction logs in Appendix B.

Copies of the laboratory analytical reports and chain of custody forms are included in Appendix C.

# MAP LEGEND

MW-1  Monitoring Well

10/29/07 Date

Depth	Cl
5'-7'	1242
10'-12'	623
15'-17'	692
20'-22'	1877
25'	1105
30'	2506
35'	1554
40'	1445

Chloride Concentrations in ppm  
at specified depths  
(feet below ground surface)

MW-2  
06/03/08

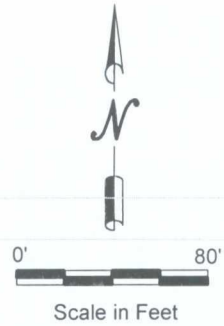
Depth	Cl
5'	115
10'	201
15'	213
20'	280
25'	280
30'	171
35'	170
40'	144
45'	139

MW-1  
10/29/07

Depth	Cl
5'-7'	1242
10'-12'	623
15'-17'	692
20'-22'	1877
25'	1105
30'	2506
35'	1554
40'	1445

MW-3  
06/03/08

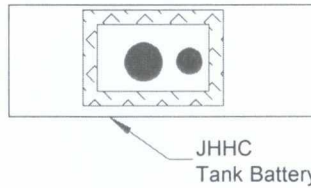
Depth	Cl
5'	138
10'	142
15'	148
20'	151
25'	205
30'	247
35'	202
40'	227
45'	236



Former P-26-1 Jct Box

B-1  
10/29/07

Depth	Cl
12'-14'	1001
15'-17'	2801
20'-21'	2611
25'-26'	2122
30'-31'	2481
35'-36'	1623
40'-41'	1704
45'	1570



Former P-26-2 Jct Box

B-1  
10/29/07

Depth	Cl
10'-12'	209
15'-17'	294
20'-22'	2658
25'-26'	5025
30'-31'	2555
35'-36'	2309
40'	2100

MW-1  
10/29/07

Depth	Cl
5'-7'	516
10'-12'	359
15'-17'	564
20'-22'	457
25'	344
30'	285
35'	285
40'	353
45'	979

MW-2  
06/03/08

Depth	Cl
5'	144
10'	115
15'	122
20'	145
25'	209
30'	87
35'	122
40'	119
45'	139



BD Jct P-26-1 & Jct P-26-2 Sites  
T21S - R37E - Section 26, Unit P  
**RICE** Operating Company

FIGURE 4  
CHLORIDE CONCENTRATIONS  
IN VADOSE ZONE



**TABLE 2**  
**SUMMARY OF CHLORIDE CONCENTRATIONS IN VADOSE ZONE**

Jct. P-26-1 Site		
Boring/ Monitoring Well	Depth (ft bgs)	Field Chloride (ppm)
B-1	12' - 14'	1001
	15' - 17'	2801
	20' - 21'	2611
	25' - 26'	2122
	30' - 31'	2481
	35' - 36'	1623
	40' - 41'	1704
	45'	1570
MW-1	5' - 7'	1242
	10' - 12'	623
	15' - 17'	692
	20' - 22'	1877
	25'	1105
	30'	2506
	35'	1554
	40'	1445
MW-2	45'	1464
	5'	115
	10'	201
	15'	213
	20'	280
	25'	280
	30'	171
	35'	170
MW-3	40'	144
	45'	139
	5'	138
	10'	142
	15'	148
	20'	151
	25'	205
	30'	247
	35'	202
	40'	227
	45'	236

Jct. P-26-2 Site		
Boring/ Monitoring Well	Depth (ft bgs)	Field Chloride (ppm)
B-1	10' - 12'	209
	15' - 17'	294
	20' - 22'	2658
	25' - 26'	5025
	30' - 31'	2555
	35' - 36'	2309
	40'	2100
MW-1	5' - 7'	516
	10' - 12'	359
	15' - 17'	564
	20' - 22'	457
	25'	344
	30'	285
	35'	285
	40'	353
MW-2	45'	979
	5'	144
	10'	115
	15'	122
	20'	145
	25'	209
	30'	87
	35'	122
	40'	119
	45'	139

Note: Values with depth intervals indicate split-spoon samples. All others are from cutting returns.

## **5.0 GROUND WATER QUALITY**

### **5.1 GROUNDWATER MONITORING PROGRAM**

The monitoring wells at the Jct. P-26-1 and P-26-2 sites have been sampled on a quarterly basis for major ions, chloride, TDS, benzene, toluene, ethylbenzene, and xylenes (BTEX) since November 12, 2007.

### **5.2 CONSTITUENTS OF CONCERN IN GROUNDWATER**

BTEX concentrations in all monitoring wells at the Jct. P-26-1 and P-26-2 sites have been below the WQCC standards and laboratory detection limits during each sampling event; therefore regulated hydrocarbons are not constituents of concern at either site.

The constituents of concern in groundwater at each site are limited to chloride and TDS which exceed WQCC standards of 250 mg/L and 1,000 mg/L, respectively.

- The elevated chloride and TDS concentrations are limited to the near vicinity of the former junction box locations at each site.
- Maximum chloride (4,350 mg/L ) and TDS (8,396 mg/L) concentrations in monitoring well MW-1 at the Jct. P-26-1 site were recorded on November 12, 2007. The levels of these constituents have since decreased by 50 percent, with chloride and TDS concentrations of 2,160 mg/L and 4,930 mg/L, respectively, during the last sampling event on July 16, 2008.
- Chloride (5,300 mg/L) and TDS (9,870 mg/L) concentrations in monitoring well MW-1 at the Jct. P-26-2 site have remained relatively stable during the period of record (November 2007 through July 2008).
- The upgradient and downgradient monitoring wells at each site allow complete characterization of the lateral extent of chloride and TDS impact to groundwater.

A summary of historical analytical results and ground water elevations is listed in Table 3. Analytical results for the most recent sampling event conducted on July 16, 2008, are also depicted in graphical format in Figure 5. A copy of the laboratory analytical report and chain of custody form for the most recent ground water sampling event is included in Appendix C.

**TABLE 3**  
**SUMMARY OF GROUNDWATER MONITORING RESULTS**

Site	Monitoring Well	Sample Date	Depth to Groundwater (feet BTOC)	Groundwater Elevation (feet AMSL)	Chloride (mg/L)	TDS (mg/L)	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylene (mg/L)
P-26-1	MW-1	11/12/07	50.37	3329.04	4,350	8,396	<0.002	<0.002	<0.002	<0.006
		01/14/08	49.80	3329.61	3,900	7,655	<0.001	<0.001	<0.001	<0.003
		04/04/08	50.00	3329.41	3,000	6,340	<0.001	<0.001	<0.001	<0.003
		07/15/08	50.28	3329.13	2,160	4,930	<0.001	<0.001	<0.001	<0.003
	MW-2	07/15/08	49.51	3329.72	196	968	<0.001	<0.001	<0.001	<0.003
	MW-3	07/15/08	49.20	3328.68	212	926	<0.001	<0.001	<0.001	<0.003
P-26-2	MW-1	11/12/07	47.39	3330.30	5,000	9,415	<0.002	<0.002	<0.002	<0.006
		01/14/08	47.84	3329.85	5,100	9,453	<0.001	<0.001	<0.001	<0.003
		04/04/08	47.45	3330.24	5,300	10,100	<0.001	<0.001	<0.001	<0.003
		07/16/08	48.07	3329.62	5,300	9,870	<0.001	<0.001	<0.001	<0.003
	MW-2	07/16/08	47.11	3329.41	432	1,470	<0.001	<0.001	<0.001	<0.003
	WQCC Standards					250	1,000	0.01	0.75	0.75

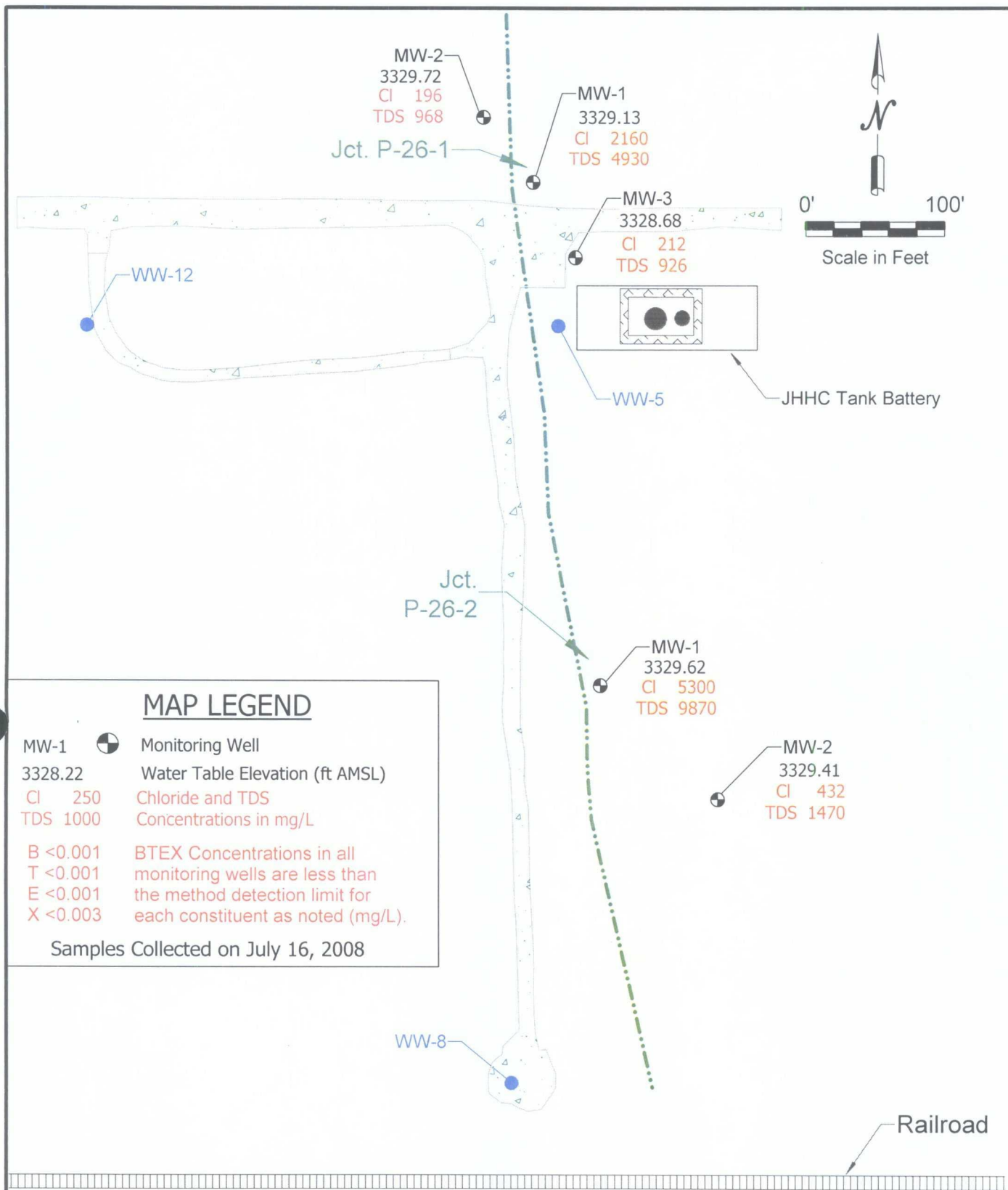
Total Dissolved Solids (TDS), chloride, sulfate, and BTEX concentrations listed in milligrams per liter (mg/L).

Analyses performed by Cardinal Laboratories (Hobbs NM).

Values in boldface type indicate concentrations exceed New Mexico Water Quality Commission (WQCC) standards.

BTOC - Below Top of Casing

AMSL - Above Mean Sea Level



BD Jct P-26-1 & Jct P-26-2 Sites  
T21S - R37E - Section 26, Unit P  
**RICE** Operating Company

FIGURE 5  
WATER TABLE ELEVATIONS AND  
CHLORIDE, TDS, and BTEX  
CONCENTRATIONS IN  
GROUNDWATER

## **6.0 STAGE 2 ABATEMENT PLAN**

The WQCC groundwater standards for chloride (250 mg/L) and TDS (1,000 mg/L) were exceeded at each site with the Jct. P-26-1 site having a lower level of impact. Corrective actions to the vadose zone and groundwater are proposed below.

### **6.1 CORRECTIVE ACTION TO THE VADOSE ZONE**

The following corrective actions taken at the Jct. P-26-1 and P-26-2 sites have successfully mitigated past and future threats to the vadose zone or groundwater:

- The new construction and relocation of watertight junction boxes
- Upgrade from A/C line to poly line
- Installation of a one-foot thick clay barrier at 6 ft bgs to minimize infiltration through the vadose zone.
- Placement of clean topsoil and application of a native seed mixture to encourage re-vegetation.

The surrounding area is supportive of vegetation and has been re-seeded with a mixture of native grasses and plants that will re-vegetate the area at a natural rate. ROC will monitor the site for continued healthy growth of native vegetation and add amendments if necessary.

### **6.2 CORRECTIVE ACTION TO GROUNDWATER**

One 4-in diameter monitoring well will be completed adjacent to the original monitoring wells (MW-1) at each site to a total depth reaching the base of the aquifer which is estimated at 85 ft to 90 ft bgs. Each well will be screened continuously throughout the saturated zone and the lower 5 feet of vadose zone for groundwater removal. Due to the close proximity of each site to one another (within 350 feet) only one groundwater treatment system is necessary for both sites.

Groundwater will be recovered from the recovery wells by a solar powered pump system and stored on site for treatment to remove chloride and TDS to levels below WQCC standards. Treated water will be used for irrigation of the site vegetation. Untreated and/or rejected water will be used in pipeline maintenance operations.

### 6.3 SCHEDULE OF PROPOSED ACTIVITIES

This plan proposes a source removal program which will be initiated soon after approval of this abatement plan. Experience suggests a pumping rate of 2 to 4 gallons per minute may be possible from each of the 4-inch diameter wells completed at these sites. The proposed program includes:

1. Installation of recovery wells, pumping, and storage system as proposed in section 6.2
2. Measurement of water levels in the recovery wells and monitoring well(s).
3. Collection of groundwater samples from the recovery wells for chloride analysis on a monthly basis,
4. Measurements of the flow rate and total flow from the recovery wells at each site visit.

If the groundwater at the site becomes suitable for mature livestock (i.e. less than 3,000 mg/L TDS, NMSU Guide M-112, 1995), and a pump-and-use groundwater restoration program is no longer feasible or necessary, the evaluation of alternatives suggests that natural restoration in conjunction with the existing industrial water use, and a groundwater monitoring program provides the best abatement option.

When evaluating any proposed remedy or investigative work, ROC will confirm that there is a reasonable relationship between the benefits created by the proposed remedy or assessment and the economic and social costs. The remedy that offers the greatest environmental benefit while causing the least environmental impairment will be selected.

## **APPENDIX A**

### **NMOCD Correspondence**



# New Mexico Energy, Minerals and Natural Resources Department

**Bill Richardson**  
Governor

**Joanna Prukop**  
Cabinet Secretary  
**Reese Fullerton**  
Deputy Cabinet Secretary

**Mark Fesmire**  
Division Director  
Oil Conservation Division



RECEIVED  
AUG 15 2008

LEGISLATING  
HOBBS, NM

**CERTIFIED MAIL**  
**RETURN RECEIPT NO: 3929 4449**

August 12, 2008

Hack Conder  
Rice Operating Company  
122 West Taylor  
Hobbs, New Mexico 88240

**RE: REQUIREMENT TO SUBMIT ABATEMENT PLAN**

Dear Mr. Conder:

The New Mexico Oil Conservation Division (OCD) has determined after reviewing your Notification of Groundwater Impact for each of the following four sites:

- 1) Rice Justis E-1 Vent  
Unit E, Section 1, T25S, R37E  
Lea County, New Mexico  
OCD Case #1R0423-06
- 2) Rice BD P-26-1 Vent  
Unit P, Section 26, T21S, R37E  
Lea County, New Mexico  
OCD Case #1R0426-106
- 3) Rice BD P-26-2  
Unit P, Section 26, T21S, R37E  
Lea County, New Mexico  
OCD Case #1R0426-107
- 4) Rice Hobbs Jct. E-4 Vent  
Unit E, Section 4, T19S, R38E  
Lea County, New Mexico  
OCD Case #1R0428-71



Hack Conder  
August 12, 2008  
Page 2

that the Rice Operating Company (ROC) must submit for each of the four sites a separate Stage 1 Abatement Plan in accordance with OCD Rule 19 (19.15.1.19 NMAC) to investigate the ground water contamination at each of these sites. The Stage 1 Abatement Plans must be submitted to the OCD Santa Fe Office with a copy provided to the OCD Hobbs District Office and must meet of all the requirements specified in OCD Rule 19 (19.15.1.19 NMAC), including, but not limited to, the public notice and participation requirements specified in Rule 19G. The Stage 1 Abatement Plan is due sixty (60) days from the receipt by ROC of this written notice.

ROC's Stage 1 Abatement Plans must specifically meet all of the requirements specified in OCD Rule 19E.3, including, but not limited to, a site investigation work plan and monitoring program that will enable it to characterize the release using an appropriate number of isoconcentration maps and cross sections that depict the contamination that has been released from the sites and to provide the data necessary to select and design an effective abatement option. ROC may, if it chooses, concurrently submit a Stage 2 Abatement Plan that addresses appropriate proactive abatement options.

ROC should submit one paper copy and an electronic copy on CD for each of the Plans and for all future workplans and/or reports for each of the Plans. Please be sure to include the current corresponding OCD Case # on each of the respective Abatement Plans. An Abatement Plan # will be assigned as each of the Plans are submitted to the OCD. If you have any questions, please contact Edward J. Hansen of my staff at (505) 476-3489 or <mailto:edwardj.hansen@state.nm.us>.

Sincerely,



Wayne Price  
Environmental Bureau Chief

WP:EJH:ejh

cc: Chris Williams, OCD Hobbs District Supervisor  
Larry Johnson, OCD Hobbs

Gil Van Deventer

From: "Hansen, Edward J., EMNRD" <edwardj.hansen@state.nm.us>  
To: "Haskell Conder" <hconder@riceswd.com>  
"Marvin Burrows" <mburrows@riceswd.com>; "Gil Van Deventer" <gilbertvandeventer@suddenlink.net>  
Monday, September 08, 2008 6:06 PM  
Attach: image001.jpg  
Subject: RE: Request for Single AP for two BD P-26 sites

Dear Mr. Conder:

The New Mexico Oil Conservation Division (OCD) has reviewed your request to incorporate both the BD P-26-1 Vent (#1R0426-106) and the BD Jct P-26-2 (#1R0426-107) into one Stage 1 and Stage 2 Abatement Plan. The OCD hereby approves the incorporation.

Also, please be advised that NMOCD approval of this abatement plan incorporation does not relieve the owner/operator of responsibility should operations pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD approval does not relieve the owner/operator of responsibility for compliance with any OCD, federal, state, or local laws and/or regulations.

If you have questions regarding this matter, please contact me at 505-476-3489.

Edward J. Hansen  
Hydrologist  
Environmental Bureau


---

**From:** Gil Van Deventer [mailto:gilbertvandeventer@suddenlink.net]  
**Sent:** Thursday, August 28, 2008 5:18 PM  
**To:** Hansen, Edward J., EMNRD  
**Cc:** Marvin Burrows; Haskell Conder  
**Subject:** Request for Single AP for two BD P-26 sites

Hello Edward

In your letter dated August 12, 2008 (attached), NMOCD requested that Rice Operating submit *separate* abatement plans for the BD P-26-1 Vent (#1R0426-106) and the BD Jct P-26-2 (#1R0426-107) sites. Would it be acceptable to NMOCD if we combined these sites into a *single* combined Stage 1 and 2 Abatement Plan? These sites are close together (~ 350 ft) and share similar chloride levels of groundwater impact. We plan on proposing the same corrective actions to groundwater that will likely include a recovery well at each site but connected to the same treatment system.

Thanks - Gil

 map showing relative locations of the two P-26 sites pictured below:

# **APPENDIX B**

**Lithologic Logs**

**and**

**Well Construction Diagrams**

# SOIL BORING LITHOLOGIC LOG



BOREHOLE NO.: B-1 TOTAL DEPTH: 45 Feet  
 SITE ID: BD Jct. P-26-1 Vent CLIENT: RICE Operating Company  
 CONTRACTOR: Harrison & Cooper, Inc. COUNTY: Lea  
 DRILLING METHOD: Air Rotary STATE: New Mexico  
 START DATE: 10/29/07 LOCATION: T21S-R37E-Sec 26-Unit P  
 COMPLETION DATE: 10/29/07 FIELD REP.: G. Van Deventer  
 COMMENTS: Boring located 14 feet west-southwest of former junction box (plate marker)  
Photo at left shows drilling of B-1 (facing west). Orange pin flagging identifies active brine water lines.

	Sample			Chloride (ppm)	PID (ppm)	USCS	LITHOLOGIC DESCRIPTION: LITHOLOGY, COLOR, GRAIN SIZE, SORTING, ROUNDING, CONSOLIDATION, DISTINGUISHING FEATURES
	Depth	Time	Type				
3/8 Bentonite Hole Plug			Surface				
	5					BF	Compacted backfill material consisting of fine-grained sand, moderate orange pink (5YR 8/4) with some very pale orange (10YR 8/2) calcium carbonate in matrix.
						CL	Compacted clay layer, grayish red (5R 4/2).
	10					BF	Compacted backfill material consisting of fine-grained sand, moderate orange pink (5YR 8/4) with some very pale orange (10YR 8/2) calcium carbonate in matrix.
	1450		Split Spoon	1001		SM/CAL	Very fine-grained sand, olive gray (5Y 4/1), with calcium carbonate in matrix, loose, unconsolidated, dry, slight hydrocarbon odor.
	1455		Split Spoon	2801			Fine-grained sand, moderate orange pink (5YR 8/4) with some very pale orange (10YR 8/2) calcium carbonate in matrix. Sand grains are moderately well-sorted, subrounded, unconsolidated, dry. Sample submitted for laboratory analysis with results as follows: Chloride = 866 mg/kg.
	1500		Split Spoon	2611			Very fine-grained sand with calcium carbonate in matrix, very pale orange (10YR 8/2), moderately hard (indurated caliche). Sand grains are moderately sorted, subrounded, unconsolidated, dry.
	1510		Split Spoon	2122		SW	Fine-grained sand, light brown (5YR 6/4), moderately hard, moderate sorting of subrounded sand grains, unconsolidated, dry.
	1520		Split Spoon	2481		SM/CAL	Very fine- and fine-grained sand with calcium carbonate in matrix, very pale orange (10YR 8/2), moderately hard (indurated caliche). Sand grains are medium sorted, subrounded, dry.
	1530		Split Spoon	1623			Very fine-grained sand, very pale orange (10YR 8/2), hard (indurated caliche). Sand grains are medium sorted, subrounded, dry.
	1542		Split Spoon	1704			Very fine-grained sand, very pale orange (10YR 8/2), hard (indurated caliche). Sand grains are medium sorted, subrounded, dry.
	1556		Cuttings	1570			Very fine-grained sand, very pale orange (10YR 8/2), hard (indurated caliche). Sand grains are medium sorted, subrounded, unconsolidated, slightly moist.
							Bottom of boring at 45 ft below ground surface.
	50						

5"

# LITHOLOGIC LOG AND MONITORING WELL CONSTRUCTION DIAGRAM



MONITORING WELL NO.: MW-1

TOTAL DEPTH: 55 Feet

SITE NAME: BD Jct. P-26-1 Vent Site

CLIENT: RICE Operating Company

CONTRACTOR: Harrison & Cooper, Inc.

COUNTY: Lea

DRILLING METHOD: Air Rotary

STATE: New Mexico

START DATE: 10/29/07

LOCATION: T21S-R37E-Sec 26 - Unit P

COMPLETION DATE: 10/29/07

FIELD REP.: G. Van Deventer

COMMENTS: Located approximately 12 feet southeast of former junction box (plate marker).

Photo at left shows completed MW-1 (facing northwest) and new junction box (right-center).

	Sample		Chloride (ppm)	PID (ppm)	USCS	LITHOLOGIC DESCRIPTION: LITHOLOGY, COLOR, GRAIN SIZE, SORTING, ROUNDING, CONSOLIDATION, DISTINGUISHING FEATURES
	Depth	Time Type				
		Surface				Fine-grained sand, grayish orange (5YR 7/4) with some very pale orange (10YR 8/2) calcium carbonate in matrix. Sand grains are medium-sorted, subrounded, unconsolidated, dry.
	5					
	1620	Split Spoon	1242			Fine-grained sand, grayish orange (5YR 7/4) with some very pale orange (10YR 8/2) calcium carbonate in matrix. Sand grains are medium-sorted, subrounded, unconsolidated, dry.
	10					
	1625	Split Spoon	623			Fine-grained sand, pale yellowish brown (10YR 6/2) with some very pale orange (10YR 8/2) calcium carbonate in matrix. Sand grains are medium-sorted, subrounded, unconsolidated, dry.
	15					
	1628	Split Spoon	692			Very fine and fine-grained sand with calcium carbonate in matrix, very pale orange (10YR 8/2). Sand grains are medium-sorted, subrounded, unconsolidated, dry.
	20					
	1630	Split Spoon	1877			Very fine and fine-grained sand with calcium carbonate in matrix, very pale orange (10YR 8/2). Sand grains are medium-sorted, subrounded, unconsolidated, dry.
	25	1634 Cuttings	1105		SM/CAL	Very fine and fine-grained sand with calcium carbonate in matrix, very pale orange (10YR 8/2), hard (indurated caliche). Sand grains are medium-sorted, subrounded, dry.
	30	1636 Cuttings	2506			Very fine and fine-grained sand with calcium carbonate in matrix, very pale orange (10YR 8/2), hard (indurated caliche). Sand grains are medium-sorted, subrounded, dry. Sample submitted for laboratory analysis with results as follows: Chloride = 903 mg/kg.
	35	1638 Cuttings	1554			Very fine and fine-grained sand with calcium carbonate in matrix, very pale orange (10YR 8/2), hard (indurated caliche). Sand grains are medium-sorted, subrounded, dry.
	40	1640 Cuttings	1445			Very fine and fine-grained sand with calcium carbonate in matrix, very pale orange (10YR 8/2), hard (indurated caliche). Sand grains are medium-sorted, subrounded, dry.
	45	1642 Cuttings	1464			Very fine and fine-grained sand, grayish orange (5YR 7/4) with some very pale orange (10YR 8/2) calcium carbonate in matrix, hard (indurated caliche). Sand grains are medium-sorted, subrounded, dry.
	50	1645 Cuttings	543		SW	Groundwater encountered Fine and medium-grained sand, light brown (5YR 5/6), moderately well sorted, subrounded, damp.
	55	1650 Cuttings	537			Fine and medium-grained sand, light brown (5YR 5/6), moderately well sorted, subrounded, wet Bottom of boring at 55 feet below ground surface.
	60					
	65					



# LITHOLOGIC LOG AND MONITORING WELL CONSTRUCTION DIAGRAM



MONITORING WELL NO.: MW-2

TOTAL DEPTH: 62 Feet

SITE NAME: BD Jct. P-26-1 Vent Site

CLIENT: RICE Operating Company

CONTRACTOR: Harrison & Cooper, Inc.

COUNTY: Lea

DRILLING METHOD: Air Rotary

STATE: New Mexico

START DATE: 06/03/08

LOCATION: T21S-R37E-Sec 26 - Unit P

COMPLETION DATE: 06/03/08

FIELD REP.: G. Van Deventer

COMMENTS: Located approximately 80 ft NW of the former junction box (plate marker) and 100 ft NW of MW-1.

Photo at left shows completed MW-2 in foreground (facing SE). Drill rig in background is at MW-3.

Sample		Chloride	PID	USCS	LITHOLOGIC DESCRIPTION:
Depth	Time	(ppm)	(ppm)		
					LITHOLOGY, COLOR, GRAIN SIZE, SORTING, ROUNDING, CONSOLIDATION, DISTINGUISHING FEATURES
					Fine-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4). Calcium carbonate in matrix. Sand grains are moderately well sorted, subrounded/rounded, unconsolidated, dry.
5	0842	Cuttings	115		Fine-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4). ~5% calcium carbonate in matrix. Sand grains are moderately well sorted, subrounded/rounded, unconsolidated, dry.
10	0843	Cuttings	201		Very fine and fine-grained sand, very pale orange (10YR 8/2), with ~10% calcium carbonate in matrix. Sand grains are medium-sorted, subrounded, unconsolidated, dry.
15	0844	Cuttings	213		Fine and medium-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4), moderately well sorted, subrounded, dry, <5% calcium carbonate in matrix..
20	0848	Cuttings	280		Fine and medium-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4), moderately well sorted, subrounded/rounded, dry, <5% calcium carbonate in matrix..
25	0849	Cuttings	280	SM/CAL	Fine-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4), medium sorted, subrounded, dry, <10% calcium carbonate (semi-hard caliche) in matrix..
30	0852	Cuttings	171		Fine-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4), medium sorted, subrounded, dry, <10% calcium carbonate (semi-hard caliche) in matrix..
35	0853	Cuttings	170		Fine-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4), medium sorted, subrounded, dry, <10% calcium carbonate (semi-hard caliche) in matrix..
40	0855	Cuttings	144		Fine-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4), medium sorted, subrounded, dry, <10% calcium carbonate (semi-hard caliche) in matrix..
45	0859	Cuttings	139		Fine-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4), medium sorted, subrounded, dry, <10% calcium carbonate (semi-hard caliche) in matrix..
50					Groundwater encountered
55				SW	Fine and medium-grained sand, light brown (5YR 5/6), moderately well sorted, subrounded, damp
60					Fine and medium-grained sand, light brown (5YR 5/6), moderately well sorted, subrounded, moist
65					Fine and medium-grained sand, light brown (5YR 5/6), moderately well sorted, subrounded, wet
					Bottom of boring at 62 ft below ground surface.

# LITHOLOGIC LOG AND MONITORING WELL CONSTRUCTION DIAGRAM



MONITORING WELL NO.: MW-3

TOTAL DEPTH: 62 Feet

SITE NAME: BD Jct. P-26-1 Vent Site

CLIENT: RICE Operating Company

CONTRACTOR: Harrison & Cooper, Inc.

COUNTY: Lea

DRILLING METHOD: Air Rotary

STATE: New Mexico

START DATE: 06/03/08

LOCATION: T21S-R37E-Sec 26 - Unit P

COMPLETION DATE: 06/03/08

FIELD REP.: G. Van Deventer

COMMENTS: Located approximately 75 ft SE of the former junction box (plate marker) and 60 ft SE of MW-1.

Image at left shows relative location of monitoring wells and former junction box.

Depth	Time	Type	Chloride (ppm)	PID (ppm)	USCS	LITHOLOGIC DESCRIPTION:
						LITHOLOGY, COLOR, GRAIN SIZE, SORTING, ROUNDING, CONSOLIDATION, DISTINGUISHING FEATURES
1025		Surface				Fine-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4). Calcium carbonate in matrix. Sand grains are moderately well sorted, subrounded/rounded, unconsolidated, dry.
5		Cuttings	138			Fine-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4). ~5% calcium carbonate in matrix. Sand grains are moderately well sorted, subrounded/rounded, unconsolidated, dry.
10		Cuttings	142			Very fine and fine-grained sand, very pale orange (10YR 8/2), with ~10% calcium carbonate in matrix. Sand grains are medium-sorted, subrounded, unconsolidated, dry.
15		Cuttings	148			Fine and medium-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4), moderately well sorted, subrounded, dry, <5% calcium carbonate in matrix..
20		Cuttings	151			Fine and medium-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4), moderately well sorted, subrounded/rounded, dry, <5% calcium carbonate in matrix..
25		Cuttings	205		SM/CAL	Fine-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4), medium sorted, subrounded, dry, <10% calcium carbonate (semi-hard caliche) in matrix..
30		Cuttings	247			Fine-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4), medium sorted, subrounded, dry, <10% calcium carbonate (semi-hard caliche) in matrix..
35		Cuttings	202			Fine-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4), medium sorted, subrounded, dry, <10% calcium carbonate (semi-hard caliche) in matrix..
40		Cuttings	227			Fine-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4), medium sorted, subrounded, dry, <10% calcium carbonate (semi-hard caliche) in matrix..
45		Cuttings	236			Fine-grained sand, very pale orange (10YR 8/2) with some grayish orange (5YR 7/4), medium sorted, subrounded, dry, <10% calcium carbonate (semi-hard caliche) in matrix..
						Groundwater encountered
50						Fine and medium-grained sand, light brown (5YR 5/6), moderately well sorted, subrounded, damp
55					SW	Fine and medium-grained sand, light brown (5YR 5/6), moderately well sorted, subrounded, moist
60						Fine and medium-grained sand, light brown (5YR 5/6), moderately well sorted, subrounded, wet
65						Bottom of boring at 62 ft below ground surface.

Cement  
3/8 Bentonite Hole Plug  
2" Sched 40 PVC Blank Casing  
3/8 Bentonite Hole Plug  
20/40 Brady Silica Sand Pack  
2" Diameter Screen with 0.010" Slots  
20/40 Brady Silica Sand Pack  
5"





# SOIL BORING LITHOLOGIC LOG

BOREHOLE NO.: B-1 TOTAL DEPTH: 40 Feet  
 SITE ID: BD Jct. P-26-2 CLIENT: RICE Operating Company  
 CONTRACTOR: Harrison & Cooper, Inc. COUNTY: Lea  
 DRILLING METHOD: Air Rotary STATE: New Mexico  
 START DATE: 10/30/07 LOCATION: T21S-R37E-Sec 26-Unit P  
 COMPLETION DATE: 10/30/07 FIELD REP.: G. Van Deventer  
 COMMENTS: Boring located 8 feet west of former junction box (plate marker).  
Photo at left shows drilling of B-1 (facing west) with marker plate in foreground.

	Sample		Chloride (ppm)	PID (ppm)	USCS	LITHOLOGIC DESCRIPTION: FEATURES
	Depth	Time Type				
3/8 Bentonite Hole Plug  5"		Surface			BF	Compacted backfill material consisting of fine-grained silty sand with calcium carbonate in matrix, pale yellowish brown (10YR 6/2), loose, unconsolidated, dry.
	5				CL	Compacted clay layer, dusky red (5R 3/4).
	10				BF	Compacted backfill material consisting of fine-grained silty sand with calcium carbonate in matrix, pale yellowish brown (10YR 6/2), loose, unconsolidated, dry.
	1405	Split Spoon	209	0		
	15				SW/CAL	Fine-grained sand with calcium carbonate in matrix, pale yellowish brown (10YR 6/2), unconsolidated, dry.
	1408	Split Spoon	294	4		Fine-grained sand with calcium carbonate in matrix, pale yellowish brown (10YR 6/2), unconsolidated, dry.
	20					
	1422	Split Spoon	2658	0		Fine-grained sand, grayish orange (5YR 7/4) with some very pale orange (10YR 8/2) calcium carbonate in matrix, moderately hard. Sand grains are medium-sorted, subrounded, unconsolidated, dry.
	25				SM/CAL	Very fine-grained sand with calcium carbonate in matrix and intermittent hard (indurated) caliche, very pale orange (10YR 8/2). Sand grains are medium-sorted, subrounded, unconsolidated, dry. Sample submitted for laboratory analysis with results as follows: Chloride = 4670 mg/kg.
	1435	Split Spoon	5025	0		
	30					Very fine-grained sand with calcium carbonate in matrix and intermittent hard (indurated) caliche, very pale orange (10YR 8/2). Sand grains are medium-sorted, subrounded, unconsolidated, dry.
	1445	Split Spoon	2555	0		
	35					Very fine-grained sand with calcium carbonate in matrix and intermittent hard (indurated) caliche, very pale orange (10YR 8/2). Sand grains are medium-sorted, subrounded, unconsolidated, dry.
	1449	Split Spoon	2309	0		
	40	1505 Cuttings	2100			Very fine and fine-grained sand with calcium carbonate in matrix and intermittent hard (indurated) caliche, pale yellowish brown (10YR 6/2). Sand grains are medium-sorted, subrounded, unconsolidated, dry.
						Bottom of boring at 40 feet below ground surface.
	45					
	50					



TOTAL DEPTH: 56 Feet

CLIENT: **RICE** Operating Company

COUNTY: Lea

STATE: New Mexico

LOCATION: T21S-R37E-Sec 26 - Unit P

FIELD REP.: G. Van Deventer

COMMENTS: Located approximately 15 feet southeast of former junction box (plate marker).

Photo at left shows MW-1 drilling activities (facing southeast). Orange pin flagging identifies active brine water lines and marker plate is shown in foreground.

Sample		Chloride	PID	USCS	LITHOLOGIC DESCRIPTION:
Depth	Time	(ppm)	(ppm)		LITHOLOGY, COLOR, GRAIN SIZE, SORTING, ROUNDING, CONSOLIDATION, DISTINGUISHING FEATURES
		Surface		SW	Fine-grained dune sand, light brown (5YR 6/4), well sorted, well-rounded, unconsolidated, dry.
5					
	1540	Split Spoon	516	SM/CAL	Very fine-grained sand with calcium carbonate in matrix, very pale orange (10YR 8/2), unconsolidated, dry.
10	1542				
		Split Spoon	359	SW	Fine-and medium-grained sand, pale yellowish brown (10YR 6/2) and grayish orange (10YR 7/4), moderately well-sorted, subrounded, unconsolidated, dry.
15					
	1543	Split Spoon	564		Fine-and medium-grained sand, pale yellowish brown (10YR 6/2) and grayish orange (10YR 7/4), moderately well-sorted, subrounded, unconsolidated, dry. Sample submitted for laboratory analysis with results as follows: Chloride = 162 mg/kg.
20					
	1545	Split Spoon	457		Fine-and medium-grained sand, pale yellowish brown (10YR 6/2) and grayish orange (10YR 7/4), moderately well-sorted, subrounded, unconsolidated, dry.
25	1602	Cuttings	344		Fine and medium-grained sand with slight calcium carbonate in matrix, light brown (5YR 6/4), moderately well-sorted, subrounded, dry.
30	1604	Cuttings	285	SW/CAL	Fine and medium-grained sand with slight calcium carbonate in matrix, light brown (5YR 6/4), moderately well-sorted, subrounded, dry.
35	1606	Cuttings	285	SM/CAL	Fine-grained sand with calcium carbonate in matrix and intermittent hard (indurated) caliche, very pale orange (10YR 8/2) and grayish orange (10YR 7/4), moderately well-sorted, subrounded, dry.
40	1608	Cuttings	353		Fine-grained sand with calcium carbonate in matrix and intermittent hard (indurated) caliche, very pale orange (10YR 8/2) and grayish orange (10YR 7/4), moderately well-sorted, subrounded, dry.
45	1610	Cuttings	979	SW	Fine-and medium-grained sand, light brown (5YR 6/4), moderately well-sorted, subrounded, slightly moist.
50	1615	Cuttings	470		Fine-and medium-grained sand, light brown (5YR 6/4), moderately well-sorted, subrounded, slightly moist.
55	1620	Cuttings	605		Fine-and medium-grained sand, pale yellowish brown (10YR 6/2), well-sorted, sub to well-rounded, moist.
60	1625	Cuttings	41		Fine-and med-grained sand, pale yellowish brown (10YR 6/2), well-sorted, sub to well-rounded, moist.
					Bottom of boring at 60 ft below ground surface.
65					

Cement

3/8 Bentonite Hole Plug

2" Sched 40 PVC Blank Casing

3/8 Bentonite Hole Plug

Cement

20/40 Brady Silica Sand Pack

2" Diameter Screen with 0.010" Slots

20/40 Brady Silica Sand Pack

5"

# LITHOLOGIC LOG AND MONITORING WELL CONSTRUCTION DIAGRAM



MONITORING WELL NO.: MW-2

TOTAL DEPTH: 58 Feet

SITE NAME: BD Jct. P-26-2 Site

CLIENT: RICE Operating Company

CONTRACTOR: Harrison & Cooper, Inc.

COUNTY: Lea

DRILLING METHOD: Air Rotary

STATE: New Mexico

START DATE: 06/03/08

LOCATION: T21S-R37E-Sec 26 - Unit P

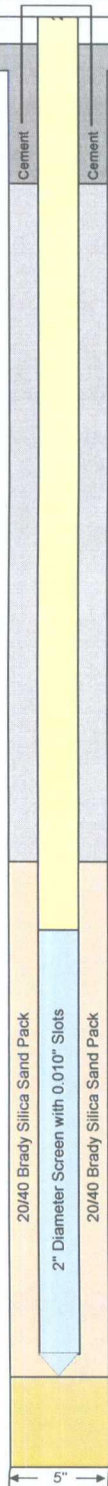
COMPLETION DATE: 06/03/08

FIELD REP.: G. Van Deventer

COMMENTS: Located approximately 115 ft SE of the former junction box (plate marker) and 100 ft SE of MW-1.

Image at left shows relative location of monitoring wells and former junction box.

Depth	Time	Type	Chloride (ppm)	PID (ppm)	USCS	LITHOLOGIC DESCRIPTION: LITHOLOGY, COLOR, GRAIN SIZE, SORTING, ROUNDING, CONSOLIDATION, DISTINGUISHING FEATURES
1300		Surface			SW	Fine-grained dune sand, light brown (5YR 6/4), well sorted, well-rounded, unconsolidated, dry.
5	1304	Cuttings	144		SM	Very fine- to fine-grained sand, very pale orange (10YR 8/2) and grayish orange pink (5YR 7/2), subangular, medium to poorly sorted, dry.
10	1306	Cuttings	115		SM/CAL	Very fine-grained sand, grayish orange (10YR 7/4) with very pale orange (10YR 8/2) soft and hard caliche. Sand grains are subrounded/subangular, medium to poorly sorted, dry.
15	1308	Cuttings	122		SW	Fine- to medium-grained sand, very pale orange (10YR 8/2) and grayish orange (10YR 7/4). Sand grains are subrounded/subangular, medium sorted, dry.
20	1310	Cuttings	145		SM/CAL	Very fine- to fine-grained sand, grayish orange pink (5YR 7/2), with some slightly hard caliche chunks, very pale orange (10YR 8/2), dry.
25	1312	Cuttings	209			Very fine- to fine-grained sand, grayish orange pink (5YR 7/2), with some slightly hard caliche chunks, very pale orange (10YR 8/2), dry.
30	1314	Cuttings	87			Very fine- to fine-grained sand, grayish orange pink (5YR 7/2), with some slightly hard caliche chunks, very pale orange (10YR 8/2), dry.
35	1316	Cuttings	122			Very fine- to fine-grained sand, grayish orange pink (5YR 7/2), with some slightly hard caliche chunks, very pale orange (10YR 8/2), dry.
40	1318	Cuttings	119		SW	Very fine- to fine-grained sand, grayish orange pink (5YR 7/2), with some very pale orange (10YR 8/2) calcium carbonate (<5%) in matrix, dry.
45	1325	Cuttings	139			Medium- to coarse-grained sand, pale reddish brown (10YR 5/4), medium to well graded, slightly damp.
50						Medium- to coarse-grained sand, pale reddish brown (10YR 5/4), medium- to well-graded, moist.
55					GW	Medium- to coarse-grained sand, pale reddish brown (10YR 5/4), medium- to well-graded, wet.
60						Medium- to coarse-grained sand and pea gravel, pale reddish brown (10YR 5/4), well-graded, wet.
65						Bottom of boring at 62 ft below ground surface. Bottom of well was set at 58 ft where natural gravelly sands filled in.



# **APPENDIX C**

**Laboratory Reports**

**and**

**Chain of Custody Documentation**



PHONE (575) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR  
RICE OPERATING COMPANY  
ATTN: HACK CONDER  
122 W. TAYLOR ST.  
HOBBS, NM 88240  
FAX TO: (575) 397-1471

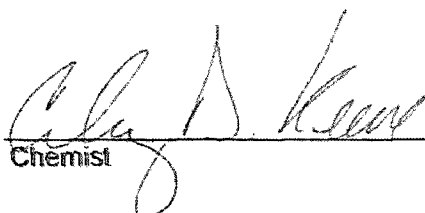
Receiving Date: 07/21/08  
Reporting Date: 07/28/08  
Project Number: NOT GIVEN  
Project Name: BD P-26-1 VENT  
Project Location: T21S R37E SEC26 P ~ LEA CO., NM

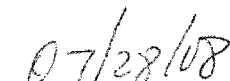
Sampling Date: 07/16/08  
Sample Type: WATER  
Sample Condition: COOL & INTACT  
Sample Received By: KS  
Analyzed By: AB

LAB NUMBER	SAMPLE ID	BENZENE (mg/L)	TOLUENE (mg/L)	ETHYL BENZENE (mg/L)	TOTAL XYLENES (mg/L)
ANALYSIS DATE:		07/21/08	07/21/08	07/21/08	07/21/08
H15202-1	MONITOR WELL #1	<0.001	<0.001	<0.001	<0.003
H15202-2	MONITOR WELL #2	<0.001	<0.001	<0.001	<0.003
H15202-3	MONITOR WELL #3	<0.001	<0.001	<0.001	<0.003
Quality Control		0.100	0.103	0.106	0.313
True Value QC		0.100	0.100	0.100	0.300
% Recovery		100	103	106	104
Relative Percent Difference		1.0	<0.1	2.8	<0.1

METHOD: EPA SW-846 8021B

TEXAS NELAP CERTIFICATION T104704398-08-TX FOR BENZENE, TOLUENE, ETHYL BENZENE,  
AND TOTAL XYLENES.

  
Chemist

  
Date

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# CARDINAL LABORATORIES

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ANALYTICAL RESULTS FOR  
RICE OPERATING COMPANY  
ATTN: HACK CONDER  
122 W. TAYLOR STREET  
HOBBS, NM 88240  
FAX TO: (575) 397-1471

Sampling Date: 07/16/08  
Sample Type: WATER  
Sample Condition: COOL & INTACT  
Sample Received By: KS  
Analyzed By: HM/KS

Receiving Date: 07/21/08  
Reporting Date: 07/27/08  
Project Number: NOT GIVEN  
Project Name: BD P-26-1 VENT  
Project Location: T21S R37E SEC26 P-LEA COUNTY, NM

LAB NUMBER	SAMPLE ID	Na (mg/L)	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Conductivity (u S/cm)	T-Alkalinity (mgCaCO <sub>3</sub> /L)
ANALYSIS DATE:		07/25/08	07/25/08	07/25/08	07/27/08	07/23/08	07/23/08
H15202-1	MONITOR WELL #1	1,020	264	165	14.8	6,870	216
H15202-2	MONITOR WELL #2	151	62.5	44.7	7.8	1,280	208
H15202-3	MONITOR WELL #3	161	64.1	43.7	7.2	1,290	220
Quality Control		NR	52.1	51.0	3.03	1,416	NR
True Value QC		NR	50.0	50.0	3.00	1,413	NR
% Recovery		NR	104	102	101	100	NR
Relative Percent Difference		NR	< 0.1	< 0.1	5.4	0.1	NR

METHODS:	SM3500-Ca-D 3500-Mg E	8049	120.1	310.1
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		Cl (mg/L)	SO <sub>4</sub> (mg/L)	CO <sub>3</sub> (mg/L)	HCO <sub>3</sub> (mg/L)	pH (s.u.)	TDS (mg/L)
ANALYSIS DATE:		07/24/08	07/24/08	07/23/08	07/23/08	07/23/08	07/21/08
H15202-1	MONITOR WELL #1	2,160	299	0	264	7.22	4,930
H15202-2	MONITOR WELL #2	196	187	0	254	7.62	968
H15202-3	MONITOR WELL #3	212	174	0	268	7.63	926
Quality Control		500	42.8	NR	976	7.01	NR
True Value QC		500	40.0	NR	1000	7.00	NR
% Recovery		100	107	NR	97.6	100	NR
Relative Percent Difference		< 0.1	6.2	NR	3.7	0.1	NR

METHODS:	SM4500-Cl-B	375.4	310.1	310.1	150.1	160.1
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*[Signature]*  
Chemist

07-28-08  
Date

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ANALYTICAL RESULTS FOR  
RICE OPERATING COMPANY  
ATTN: HACK CONDER  
122 W. TAYLOR ST.  
HOBBS, NM 88240  
FAX TO: (575) 397-1471

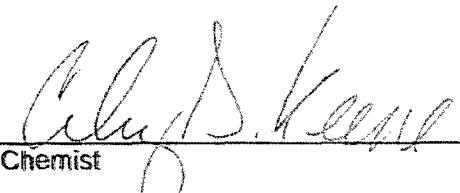
Receiving Date: 07/21/08  
Reporting Date: 07/28/08  
Project Number: NOT GIVEN  
Project Name: BD P-26-2  
Project Location: T21S R37E SEC26 P ~ LEA CO., NM

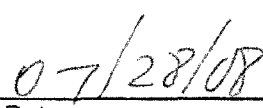
Sampling Date: 07/16/08  
Sample Type: WATER  
Sample Condition: COOL & INTACT  
Sample Received By: KS  
Analyzed By: AB

LAB NUMBER	SAMPLE ID	BENZENE (mg/L)	TOLUENE (mg/L)	ETHYL BENZENE (mg/L)	TOTAL XYLENES (mg/L)
ANALYSIS DATE:		07/21/08	07/21/08	07/21/08	07/21/08
H15201-1	MONITOR WELL #1	<0.001	<0.001	<0.001	<0.003
H15201-2	MONITOR WELL #2	<0.001	<0.001	<0.001	<0.003
Quality Control		0.100	0.103	0.106	0.313
True Value QC		0.100	0.100	0.100	0.300
% Recovery		100	103	106	104
Relative Percent Difference		1.0	<0.1	2.8	<0.1

METHOD: EPA SW-846 8021B

TEXAS NELAP CERTIFICATION T104704398-08-TX FOR BENZENE, TOLUENE, ETHYL BENZENE,  
AND TOTAL XYLENES.

  
Cheryl S. Keene  
Chemist

  
07/28/08  
Date

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# ARDINAL LABORATORIES

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ANALYTICAL RESULTS FOR  
RICE OPERATING COMPANY  
ATTN: HACK CONDER  
122 W. TAYLOR STREET  
HOBBS, NM 88240  
FAX TO: (575) 397-1471

Receiving Date: 07/21/08  
Reporting Date: 07/27/08  
Project Number: NOT GIVEN  
Project Name: BD P-26-2  
Project Location: T21S R37E SEC26 P-LEA COUNTY, NM

Sampling Date: 07/16/08  
Sample Type: WATER  
Sample Condition: COOL & INTACT  
Sample Received By: KS  
Analyzed By: HM/KS

LAB NUMBER	SAMPLE ID	Na (mg/L)	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Conductivity (uS/cm)	T-Alkalinity (mgCaCO <sub>3</sub> /L)
ANALYSIS DATE:		07/25/08	07/25/08	07/25/08	07/27/08	07/23/08	07/23/08
H15201-1	MONITOR WELL #1	3,250	208	131	80.6	14,900	300
H15201-2	MONITOR WELL #2	248	99.4	75.8	9.2	2,030	240
Quality Control		NR	52.1	51.0	3.03	1,416	NR
True Value QC		NR	50.0	50.0	3.00	1,413	NR
% Recovery		NR	104	102	101	100	NR
Relative Percent Difference		NR	< 0.1	< 0.1	5.1	0.1	NR

METHODS:	SM3500-Ca-D	3500-Mg E	8049	120.1	310.1
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	Cl (mg/L)	SO <sub>4</sub> (mg/L)	CO <sub>3</sub> (mg/L)	HCO <sub>3</sub> (mg/L)	pH (s.u.)	TDS (mg/L)
ANALYSIS DATE:	07/24/08	07/24/08	07/23/08	07/23/08	07/23/08	07/21/08
H15201-1	5,300	448	0	366	7.30	9,870
H15201-2	432	253	0	293	7.49	1,470
Quality Control	500	42.8	NR	976	7.01	NR
True Value QC	500	40.0	NR	1000	7.00	NR
% Recovery	100	107	NR	97.6	100	NR
Relative Percent Difference	< 0.1	6.2	NR	3.7	0.1	NR

METHODS:	SM4500-Cl-B	375.4	310.1	310.1	150.1	160.1
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Chemist

Date

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