1R- 500

WORKPLANS

Date:

7-1-11

Hansen, Edward J., EMNRD

From: Katie Jones [kjones@riceswd.com]
Sent: Monday, January 23, 2012 10:40 AM
To: Hansen, Edward J., EMNRD
Cc: Hack Conder; L Peter Galusky; Laura Pena
Subject: BD N-18 BGT (1R-500) CAP Addendum
Attachments: BD N-18 BGT - spoil pile lab.pdf; BD N-18 BGT excavating to 30 ft, facing NW 1.17.12.JPG

Mr. Hansen:

The following is an Addendum to the BD N-18 BGT (1R-500) Corrective Action Plan (CAP) submitted to the NMOCD on July 1, 2011 and approved on July 13, 2011.

The site has been excavated to dimensions of 98x98 ft to a depth of 27 ft below ground surface (bgs) with a 4-5 ft deep shelf extending 5 ft north, south, east, and west. Personnel began excavating the site to 30 ft bgs, and an unexpected rock layer was encountered making excavating almost impossible. An area of approximately 15x15 ft required almost 4 days of field work to reach the depth of 30 ft bgs. A photograph showing progress as of January 17, 2012 is attached. Excavated soil has also yielded unexpectedly low chloride concentrations that meet backfill requirements, as approved by the NMOCD. A composite sample from each of the four spoil piles was analyzed by Cardinal Laboratories and yielded concentrations of 304 mg/kg, 608 mg/kg, 352 mg/kg, and 464 mg/kg (lab analysis is attached). A bottom composite sample was also field titrated this morning, January 23, 2012, and yielded a chloride concentration of 855 mg/kg. Based on the unexpected rock layer and the lower concentrations of chloride encountered at depth, ROC proposes installing the synthetic liner at 27 ft bgs as noted in the following Addendum to the NMOCD approved CAP.

Page 3, paragraph 1: *Vadose (unsaturated) Zone Remedy*; red lettering will be deleted from the paragraph and blue lettering will be added to the paragraph.

"Although Multi-Med modeling indicates that residual, contributed soil chlorides do not pose a threat to groundwater quality without any remedy, we nevertheless propose to install a synthetic double liner system across the former tank area to preclude any possibility of potential future groundwater impacts (Figure 3). The bottom liner will be installed at an approximate depth of ~~30~~27 ft bgs and encompass an area of approximately 98 ft by 98 ft. Excavated soil material having a chloride concentration less than 2,000 mg/kg chloride and 100 PID (petroleum hydrocarbons) will be placed on top of this lower liner. The upper liner will be installed approximately 4 to 5 ft bgs and encompass an area of approximately 108 ft by 108 ft. Soil material having a chloride concentration of less than 500 mg/kg and 100 PID will be placed on top of the upper liner and graded to the natural ground contour. Excavated soil will be evaluated for use as backfill and any soil requiring disposal will be properly disposed of at a NMOCD approved facility. The ground surface above the liner system will be covered with caliche as the site will remain part of an active and operating SWD system."

If you have any questions or require any additional information, please contact myself at (575)393-9174 or Hack Conder at (575)631-6432.

Thank you.

Katie Jones
Environmental Project Manager
RICE *Operating Company*


01/17/2012

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Thank you.

Katie Jones
Environmental Project Manager
RICE *Operating Company*

CARDINAL Laboratories

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

January 14, 2012

Hack Conder

Rice Operating Company

112 W. Taylor

Hobbs, NM 88240

RE: BD N-18 BGT

Enclosed are the results of analyses for samples received by the laboratory on 01/12/12 16:37.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-11-3. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (*). For a complete list of accredited analytes and matrices visit the TCEQ website at www.tceq.texas.gov/field/qa/lab_accred_certif.html.

Cardinal Laboratories is accreditated through the State of Colorado Department of Public Health and Environment for:

Method EPA 552.2	Haloacetic Acids (HAA-5)
Method EPA 524.2	Total Trihalomethanes (TTHM)
Method EPA 524.4	Regulated VOCs (V1, V2, V3)

Accreditation applies to public drinking water matrices.

This report meets NELAP requirements and is made up of a cover page, analytical results, and a copy of the original chain-of-custody. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Hope S. Moreno

Hope Moreno

Inorganic Technical Director

CARDINAL Laboratories

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

Analytical Results For:

Rice Operating Company
Hack Conder
112 W. Taylor
Hobbs NM, 88240
Fax To: (575) 397-1471

Received:	01/12/2012	Sampling Date:	01/12/2012
Reported:	01/14/2012	Sampling Type:	Soil
Project Name:	BD N-18 BGT	Sampling Condition:	Cool & Intact
Project Number:	22/37	Sample Received By:	Celey D. Keene
Project Location:	NOT GIVEN		

Sample ID: 10 PT COMP STOCKPILE A (H200070-01)

Chloride, SM4500Cl-B mg/kg **Analyzed By: AP**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**304**	16.0	01/13/2012	ND	416	104	400	0.00	

Sample ID: 8 PT COMP STOCKPILE B (H200070-02)

Chloride, SM4500Cl-B mg/kg **Analyzed By: AP**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**608**	16.0	01/13/2012	ND	416	104	400	0.00	

Sample ID: 8 PT COMP STOCKPILE C (H200070-03)

Chloride, SM4500Cl-B mg/kg **Analyzed By: AP**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**352**	16.0	01/13/2012	ND	416	104	400	0.00	

Sample ID: 8 PT COMP SPOIL PILE (H200070-04)

Chloride, SM4500Cl-B mg/kg **Analyzed By: AP**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	**464**	16.0	01/13/2012	ND	416	104	400	0.00	

Cardinal Laboratories *=Accredited Analyte

Hope S. Moreno

Hope Moreno, Inorganic Technical Director

CARDINAL Laboratories

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

Notes and Definitions

ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference
**	Samples not received at proper temperature of 6°C or below.
***	Insufficient time to reach temperature.
-	Chloride by SM4500Cl-B does not require samples be received at or below 6°C
	Samples reported on an as received basis (wet) unless otherwise noted on report

Cardinal Laboratories

*=Accredited Analyte

Hope S. Moreno

Hope Moreno, Inorganic Technical Director

CARDINAL Laboratories

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

101 East Marland, Hobbs, NM 88240
(575) 393-2326 FAX (575) 393-2476

Company Name:	Rice Operating Co	**BILL TO**	
Project Manager:	Hack Conder	P.O. #:	
Address:	122 W Taylor	Company:	
City:	Hobbs State: NM Zip: 88240	Attn:	
Phone #:	575-393-9174 Fax #:	Address:	
Project #:	Project Owner:	City:	
Project Name:		State: Zip:	
Project Location:	BD N-18 BGT (22/37)	Phone #:	
Sampler Name:	Robert Egans	Fax #:	

FOR LAB USE ONLY				MATRIX						PRESERV.			SAMPLING		ANALYSIS REQUEST
Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	ACID/BASE:	ICE / COOL	OTHER:	DATE	TIME	Cl-
H20070															
01	10 pt. Composite Stock Pile A	C	1			✓					✓		1-12-12	9:40 AM	✓
02	8pt. Composite Stock Pile B	C	1			✓					✓		1-12-12	9:50 AM	✓
03	8pt Composite Stock Pile C	C	1			✓					✓		1-12-12	10:00 AM	✓
04	8pt. Composite Spoil Pile	C	1			✓					✓		1-12-12	12:30	✓

Relinquished By:	Date: 1/12/12	Received By:	Phone Result: ☐ Yes ☐ No Add'l Phone #:
	Time: 4:37p		Fax Result: ☐ Yes ☐ No Add'l Fax #:
Relinquished By:	Date:	Received By:	REMARKS:
	Time:		

Delivered By: (Circle One)	Sample Condition	CHECKED BY:	
Sampler - UPS - Bus - Other: 1.5°C	Cool: ☑ Yes ☐ No Intact: ☑ Yes ☐ No	(Initials)	

† Cardinal cannot accept verbal changes. Please fax written changes to 505-393-2476

#26

Texerra

627 Forest View Way Monument, Colorado 80132
Tel: 719-339-6791 E-mail: lpg@texerra.com

July 1st, 2011

Mr. Edward Hansen
New Mexico Energy, Minerals, & Natural Resources
Oil Conservation Division, Environmental Bureau
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505

Re: Rice Operating Company
Site Summary and Corrective Action Plan
BD N-18 Below Grade Tanks
UL-N, Sec 18, T22S, R37E
NMOCD Case No. 1R-500

Sent via E-mail and U.S. Certified Mail w/ Return Receipt No. 7011 0110 0001 5863 4813

Mr. Hansen,

This report is to serve as a summary of the history and investigative activities associated with Rice Operating Company's BD N-18 Below Grade Tank (BGT) site and to present a Corrective Action Plan (CAP) to remediate and protect groundwater quality at this location. The site is located approximately 4 miles southwest of Eunice, New Mexico (Figures 1 & 2). The depth to groundwater is approximately 100 ft below ground surface (bgs).

History of Site Characterization Activities

In follow-up to a June 8th, 2009 meeting with Brad Jones and Edward Hansen of NMOCD, Rice Operating Company (ROC) completed an integrity test of the two below-grade tanks at the BD N-18 SWD system and completed a preliminary soils investigation on October 12th, 2009. The purpose of this work was to determine if the past or continued operation of these below grade tanks pose a threat to groundwater quality. Palmer of Texas conducted a tank integrity test of the BD N-18 tanks in July of 2009 and found the tanks have integrity. The natural background soil chloride concentration, as measured from a sample taken in a grassy area adjacent to the facility was 194 ppm. The composite/average chloride concentration taken from multiple, representative points from the excavated soil material was 432 ppm. The composite/average soil chloride concentration taken from the east tank was 720 ppm and that from the west tank was 1,580 ppm. Soil hydrocarbon concentrations for gasoline range organics (GRO) and diesel range organics (DRO) were below laboratory detection limits (< 10 ppm) for both tank composite samples. Diesel range organics (DRO) measured 310 ppm in the excavated soil pile. The fact that the tanks have integrity and that hydrocarbons were only found in the excavated soil indicates that the source of all contaminants was from surface overflow rather than tank leakage.

Subsequent to this initial investigation, ROC conducted further soil sampling and analyses, installed monitor wells and sampled groundwater. This work, which is briefly summarized below, was

presented in Texerra's site characterization report of April 29th, 2011 and subsequently approved by OCD on May 4th, 2011.

ROC analyzed soils for chlorides and petroleum hydrocarbons at varying depths from near the surface (5 ft bgs) to the groundwater capillary fringe (approximately 100 ft bgs) beneath the former tanks (these having been removed and replaced in 2010 with new above-ground tanks located to the southwest on the lease pad) and in areas exhibiting apparent surface evidence of historical impacts (Figure 3). ROC also installed groundwater monitor wells at BD N-18 BGT and at up-gradient and down-gradient locations, and sampled groundwater for chlorides and BTEX (Figure 4).

It is clear from the high groundwater chloride concentration in the up-gradient monitor well (MW-2: 1,220 ppm) that the on-coming regional, base-line groundwater is not pristine but has been degraded by historical impacts from up-gradient sources and not caused by activities at the BD N-18 BGT location (see Figure 2). Nevertheless, historical activities at the subject site do appear to have caused a moderate increase in down-gradient groundwater chlorides, as evidenced by the elevated groundwater chloride concentration beneath the site (MW-1: 2,400 ppm) and a down-gradient concentration that is moderately elevated above that of the on-coming (up- gradient) groundwater (MW-3: 1,720 ppm). This is supported by the generally elevated levels of soil chlorides measured at and across the affected area. It should be pointed out that no petroleum hydrocarbons (either as BTEX in groundwater or PID in soils) were found in this investigation.

Further Site Analysis and Modeling

The estimated extent (in plan view) of the affected area that has contributed chlorides to groundwater is given in Figure 3. The estimated, calculated mass of groundwater chloride contributed from historical operations of these former below grade tanks is approximately 1,927 kg (Table 1).

The model Multi-Med was run to anticipate the potential movement of residual, contributed soil chlorides into groundwater. Using an infiltration rate of 1.5 inches/yr (and other parameter values as summarized in Table 2) the maximum projected increase in groundwater chloride was projected to be less than 200 mg/kg (Figure 5).

These estimates and projections support the Corrective Action Plan proposed below.

Proposed Corrective Action Plan

Saturated Zone (groundwater) Remedy

We propose to remedy the contributed mass of groundwater chlorides (1,927 kg) by pumping water from the near-source well (MW-1) to remove an equivalent mass of chlorides. Our calculations indicate that this will be accomplished through the removal of approximately 4,400 bbls of groundwater from MW-1 (Table 1) and that this will over the course of approximately 64 days (depending upon the actual well yield and the actual, measured concentration of the pumped groundwater).

Vadose (unsaturated) Zone Remedy

Although Multi-Med modeling indicates that residual, contributed soil chlorides do not pose a threat to groundwater quality without any remedy, we nevertheless propose to install a synthetic double-liner system across the former tank area to preclude any possibility of potential future groundwater impacts (Figure 3). The bottom liner will be installed at an approximate depth of 30 ft bgs and encompass an area of approximately 98 ft by 98 ft. Excavated soil material having a chloride concentration less than 2,000 mg/kg chloride and 100 PID (petroleum hydrocarbons) will be placed on top of this lower liner. The upper liner will be installed approximately 4 to 5 ft bgs and encompass an area of approximately 108 ft by 108 ft. Soil material having a chloride concentration of less than 500 mg/kg and 100 PID will be placed on top of the upper liner and graded to the natural ground contour. Excavated soil will be evaluated for use as backfill and any soil requiring disposal will be properly disposed of at a NMOCD approved facility. The ground surface above the liner system will be covered with caliche as the site will remain part of an active and operating SWD system.

Upon the removal of the equivalent, contributed chloride mass and the installation of the double liner system, we will submit a report to OCD documenting this work and request remediation termination or similar closure status.

ROC is the service provider (agent) for the BD SWD System and has no ownership of any portion of the pipeline, well, or facility. The System is owned by a consortium of oil producers, System Parties, who provide all operating capital on a percentage ownership/usage basis. Environmental projects of this magnitude require System Party AFE approval, and work begins as funds are received. In general, project funding is not forthcoming until NMOCD approves the work plan. Therefore, your timely review of this submission would be greatly appreciated.

Please do not hesitate to contact either myself or Katie Jones at Rice Operating Company if you have any questions or need additional information.

Thank you.

Sincerely,

L. Peter Galusky, Jr. Ph.D.
Principal

Copy: Rice Operating Company

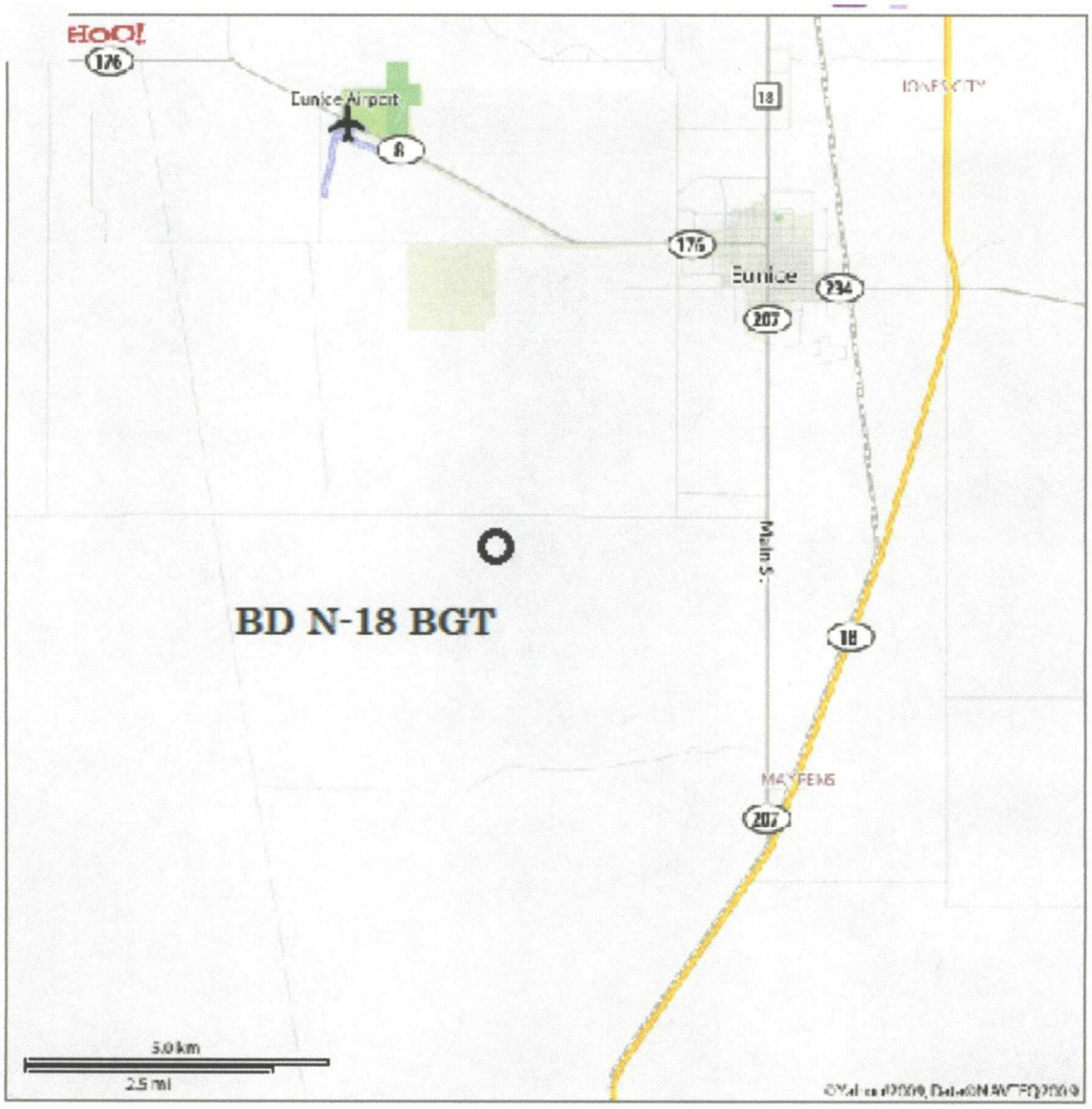


Figure 1 – BD N-18 BGT site location.

Figure 2 – BD N-18 BGT location relative to nearby and up-gradient oil-field operations.

SB-1

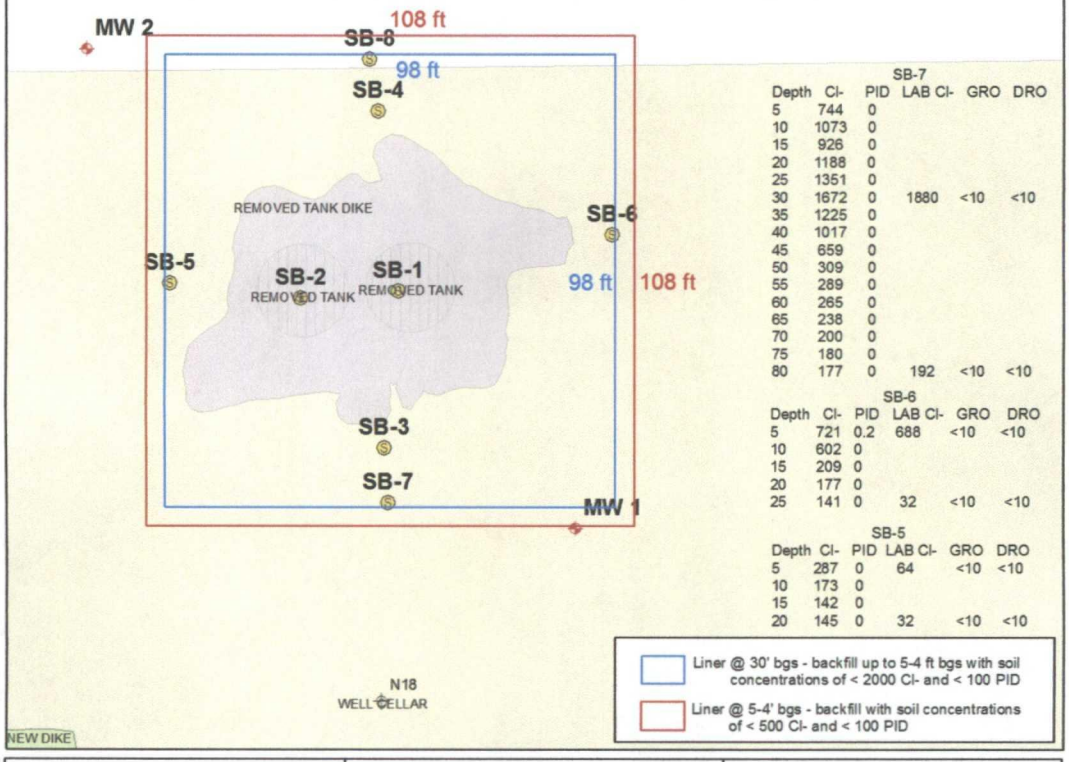
Depth	Cl-	PID	LAB Cl-	GRO	DRO
5	1302	2.3			
10	1328	1.2			
15	1249	0.9			
20	900	0.5			
25	1276	0.3			
30	1870	0.2	1630	<10	<10
35	1200	0.3			
40	993	0.3			
45	1033	0.7			
50	821	0.7			
55	690	0.9			
60	724	0.9			
65	988	1.0			
70	996	0.9			
75	929	1.2			
80	1110	1.0			
85	768	1.2			
90	817	1.0			
95	585	0.9			
100	523	0.5	448	<10	57.8

SB-2

Depth	Cl-	PID	LAB Cl-	GRO	DRO
5	1420	0.5			
10	1552	0			
15	1624	0			
20	1633	0			
25	1764	0			
30	1747	0	2680	<10	<10
35	1224	0			
40	1078	0			
45	845	0			
50	969	0			
55	626	0			
60	847	0			
65	958	0			
70	653	0			
75	469	0			
80	1036	0			
85	604	0			
90	1069	0			
95	1173	0			
100	821	0	672	<10	<10

SB-8

Depth	Cl-	PID	LAB Cl-	GRO	DRO
5	594	0.7			
10	620	1.1			
15	634	0.9			
20	800	0			
25	1054	0	1520	<10	<10
30	1097	0			
35	673	0			
40	584	0			
45	453	0			
50	316	0			
55	293	0			
60	394	0			
65	397	0			
70	420	0			
75	330	0			
80	339	0			
85	430	0			
90	423	0			
95	289	0			
100	223	0	192	<10	<10



SB-7

Depth	Cl-	PID	LAB Cl-	GRO	DRO
5	744	0			
10	1073	0			
15	926	0			
20	1188	0			
25	1351	0			
30	1672	0	1880	<10	<10
35	1225	0			
40	1017	0			
45	659	0			
50	309	0			
55	289	0			
60	265	0			
65	238	0			
70	200	0			
75	180	0			
80	177	0	192	<10	<10

SB-6

Depth	Cl-	PID	LAB Cl-	GRO	DRO
5	721	0.2	688	<10	<10
10	602	0			
15	209	0			
20	177	0			
25	141	0	32	<10	<10

SB-5

Depth	Cl-	PID	LAB Cl-	GRO	DRO
5	287	0	64	<10	<10
10	173	0			
15	142	0			
20	145	0	32	<10	<10

RICE ENVIRONMENTAL CONSULTING & SAFETY, LLC

BD N-18 BGT

Legals: UL/N sec. 18 T22S R37E

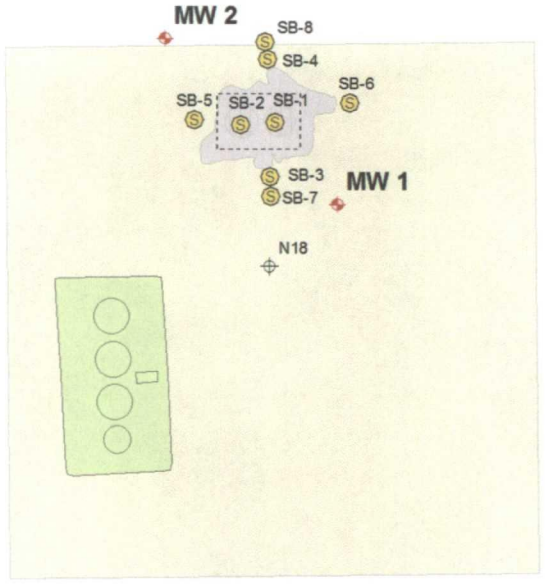
Case #: 1R-500

N W E S

0 15 30 60 Feet

Drawing date: 5-18-11
Drafted by: L. Weinheimer

Figure 3 – BD N-18 BGT proposed liners in relation to monitor wells and soil borings.



MW	Depth to Water	Total Depth	Well Volume	Volume Purged	Sample Date	Cl	TDS	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Sulfate	Comments
1	101.17	146.3	29.3	90	1/14/2011	2400	4110	<0.001	<0.001	<0.001	<0.003	343	clear no odor
1	101.15	146.3	29.3	90	5/11/2011	3100	5450	<0.001	<0.001	<0.001	<0.003	195	clear no odor

MW	Depth to Water	Total Depth	Well Volume	Volume Purged	Sample Date	Cl	TDS	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Sulfate	Comments
2	101.85	115.27	2.1	8	1/14/2011	1220	2490	<0.001	<0.001	<0.001	<0.003	480	clear no odor
2	101.84	115.27	2.1	8	5/11/2011	1450	3210	<0.001	<0.001	<0.001	<0.003	480	clear no odor

MW	Depth to Water	Total Depth	Well Volume	Volume Purged	Sample Date	Cl	TDS	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Sulfate	Comments
3	99.08	116.55	2.8	10	1/14/2011	1720	3040	<0.001	<0.001	<0.001	<0.003	391	clear no odor
3	99.08	116.55	2.8	10	5/11/2011	1400	2840	<0.001	<0.001	<0.001	<0.003	302	clear no odor/no change in water depth

RICE ENVIRONMENTAL RECS CONSULTING & SAFETY, LLC

BD N-18 BGT

Legals: UL/N sec. 18
T22S R37E

NMOCD Case #: 1R-500

N
W E
S

0 45 90 180 Feet

Drawing date: 4-18-11
Drafted by: L. Weinheimer

Figure 4 – BD N-18 BGT groundwater sampling data.

Table 1 – BD N-18 BGT estimated mass of chlorides in groundwater contributed by past operation of the former below grade tanks.

Soil & Groundwater Chloride Calculator
Estimated Mass of Contributed, Residual Chloride
from Saturated Zone Groundwater

Site:	**BD N-18 BGT**	
This estimate prepared by:	L. Peter Galusky, Jr.	
Date:	6/29/2011	
Model Inputs		Notes
length of affected area (ft)	98	estimated
width of affected area (ft)	98	estimated
depth to water table (ft)	100	measured
sat zone affected thickness (ft)	20	prescribed by NMOCD
sat zone porosity	25%	estimated
Cl- conc of affected groundwater (ppm)	2,750	avg of two measurements
Cl- conc of up-gradient groundwater (ppm)	1,335	avg of two measurement
sat zone mass density (lbs/cu yd)	3,000	estimated
Cl- conc of recovery well (ppm)	2,750	MW-1 on location
avg daily pumping rate of recover well (gpm)	2.0	anticipated
Intermediate (calculated) Parameters		
affected area (sq ft)	9,604	calculated
volume of affected groundwater (cu ft)	48,020	calculated
mass of affected groundwater (lbs)	2,995,641	calculated
mass of contributed Cl- in affected groundwater (lbs)	4,239	calculated
avg daily pumping rate of recovery well (bbls/day)	68.6	calculated
Cl- conc of recovery well (lbs/bbl)	1.0	calculated
Cl- conc of recovery well (kg/bbl)	0.4	calculated
Estimated Contributed Cl- Mass and Equivalent Pumping Volume & Time		
mass of contributed Cl- in affected groundwater (kg)	1,927	calculated
approx volume of groundwater to be removed (bbls)	4,400	calculated ... see note, below
# acre feet ...	0.57	calculated
approx # of days pumping required to remove contributed	64	anticipated

Notes

The actual volume of groundwater to be removed will depend upon the measured chloride concentration of the groundwater as it is removed during the course of pumping.

Table 2 – Multi-Med model key input parameter estimates

MultiMed Input Parameter Estimates			
Key Parameters			
			Notes
Source area length	98 ft	29.8704 m	
Source area width	98 ft	29.8704 m	
Infiltration rate	1.5 in/yr	0.0381 m/yr	
wtable depth	100 ft	30.48 m	
bottom depth of liner	30 ft bgs	9.144 m	
dist from liner to water table	85 ft	25.908 m	
aquifer thickness	20 ft	6.096 m	assumed

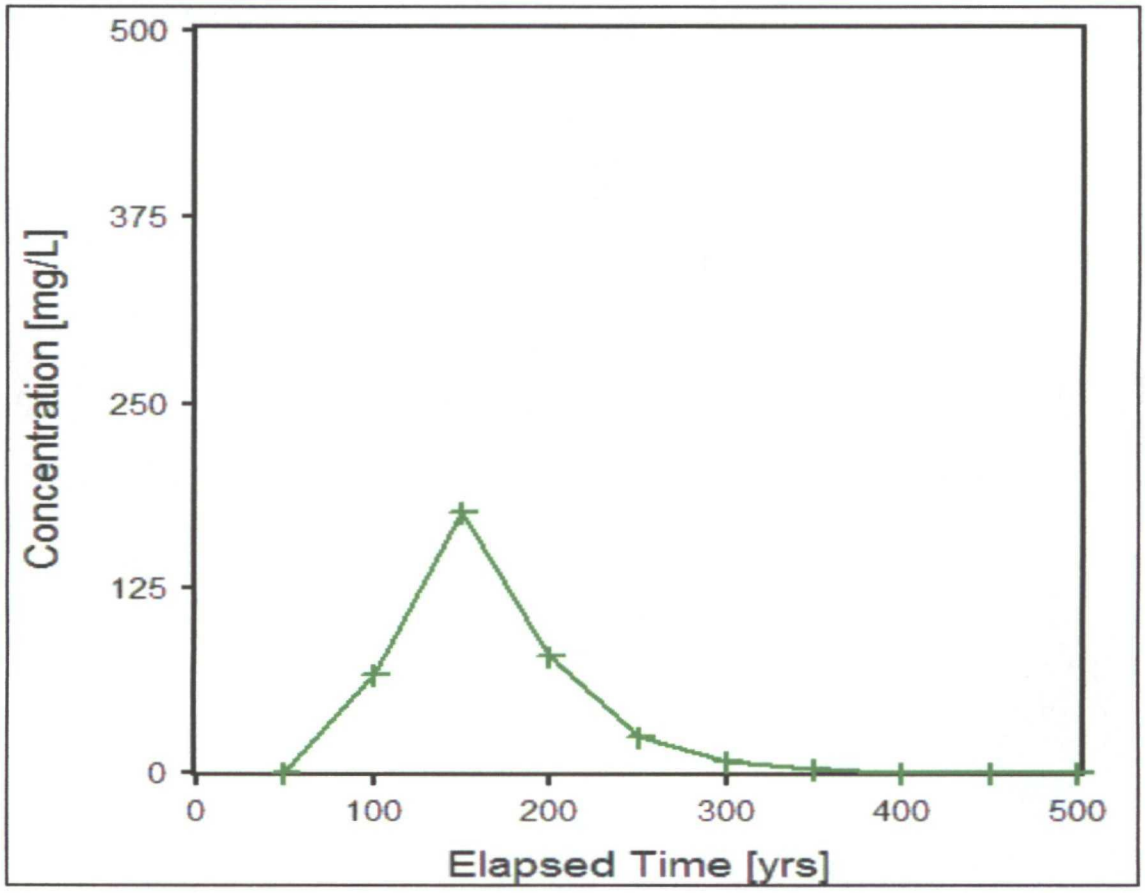


Figure 5 – Projected elevation in groundwater chloride concentration using Multi-Med model.