### C-144 Permit Package for Battle 1H North Workover Pit/Alternative Method for Temporary Storage of Produced Water Section 34 T21S R33E Lea County NM



View of existing south fresh water frac pond (left) and North Pit (right)

Prepared for BC Operating, Inc. Midland, Texas

Prepared by R.T. Hicks Consultants, Ltd. Albuquerque, New Mexico

### R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuguergue, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266-0745

November 7, 2014

Dr. Tomas Oberding NMOCD District 1 1625 French Drive Hobbs, NM 88240 Via E-Mail

RE: BC Operating, Battle 1H North Workover Pit for the Temporary Storage of Produced Water

#### Dear Tomas:

On behalf of BC Operating, R.T. Hicks Consultants, Ltd. is pleased to submit the C-144 application package for the above-referenced project. This is the second of two temporary pits that will be repurposed through significant modification to become a two-cell MWFM Pit. In order to understand how these two temporary pit permits fit in the strategy, I have included a "best-case" schedule of operations. At this time, the schedule is a theoretical and, as always, will change when there are boots on the ground implementing the project.

		Volume of Stored				
Work Element	Date	North Pit	South Pit			
Submit Permit for South Temporary Pit	11/5/2014					
Collect geotechnical samples for berm design	11/5/2014					
Fresh water removed from South Temporary Pit	11/9/2014					
Submit Permit for North Temporary Pit	11/9/2014					
OCD Approves South Temporary Pit for short time	11/10/2014					
PW flows to South Pit	11/10/2014	-				
Temporary Pit Permit for North Pit approved	11/14/2014		6,000.00			
Abe well is hydraulically stimulated	11/14/2014		6,000.00			
Frac of Abe Well empties North Pit of fresh water	11/18/2014		12,000.00			
Design Berms Complete plus Contract Specifications	11/24/2014		21,000.00			
Merchant sells fresh water remaining in North Pit	11/26/2014		24,000.00			
MWFM Pit Permit Submit	11/28/2014		27,000.00			
Solicit bids for construction	11/28/2014		27,000.00			
PW flows to North Temporary Pit	12/1/2014		31,500.00			
All PW in South Pit moved to North Pit	12/1/2014	31,500.00	0			
MWFM Pit Permit Approved by OCD	12/15/2014	52,500.00	0			
Temporary Permit for South Pit ends	12/15/2014	52,500.00	0			
Start Berm Re-habilitation	12/15/2014	52,500.00	0			
Complete re-built berm South Pit and tests	12/25/2014	57,000.00	-			
Install Liner Leak Dectection South Pit	12/27/2014	57,000.00	-			
PW to South Pit	12/30/2014	0	57,000.00			
Complete re-built berm North Pit and tests	1/4/2015	0	57,000.00			
Install Liner Leak Dectection North Pit	1/7/2015	0	57,000.00			
All PW in South Pit treated/moved to North Pit	1/10/2015	57,000.00	0			
PW flows to South Pit per MWFM pit permit	1/13/2015	57,000.00				
RT Hicks Responsibilty						
Pettigrew Responsibility						
OCD Actions						

Pettigrew has collected the samples 11/5

Permit for North Pit ahead of schedule

Produced does not flow into South Pit until OCD approval.

The frac and fresh water transfer empties North Pit by 11/26

MWFM pit application submitted after design completed by Pettigrew

South Pit stores less than 32,000 bbls (6-feet of freeboard). North Pit will probably store only 57,000 bbls of water – as this is maximum storage of South Pit

OCD approves MWFM Pit permit and berm rehabilitation begins

After new primary liner installed in South Pit, PW transferred from North Pit and north pit berm rehabilitation begins. PW flow to disposal, drilling or other approved re-use.

When the North Pit is reconstructed to meet criteria for MWFM Pit, normal operation begins as described in the MWFM pit permit.

#### Please note the following:

- 1. The distance between the bottom of the pit and groundwater is more than 200 feet.
- 2. The impoundments proposed for the temporary storage of produced water have a 20-mil poly secondary liner, leak detection and a 30-mil LLDPE primary liner.
- 3. We have attached two variance requests to allow

- a. an alternative closure method and
- b. a pit larger than 10-acre feet that will hold only 7.4 acre-feet of fluid
- 4. I certify that Hicks Consultants performed a visual inspection of the site.
- 5. BC Operating has authorized me to sign the C-144 as their agent (see attached letter)
- 6. The O&M Plan is attached to this cover letter and is in the body of the permit. The attached version of the O&M Plan contains highlights to emphasize important aspects.
- 7. The attached letter from Onyx Contractors confirms that the existing pits were constructed in conformance with the mandates of the Pit Rule.

If you have any questions or concerns regarding this application, please contact Dale Littlejohn or me. Dale is the primary author of the siting criteria demonstration. As always, we appreciate your work ethic and attention to detail.

Sincerely,

R.T. Hicks Consultants

Randall Hicks Principal

Copy: BC Operating



PO Box 60547 Midland, Texas 79711 Phone: 432-694-7400 Fax: 432-694-7411

November 6, 2014

Mr. Billy Moore BC Operating, Inc. PO Box 50820 Midland, Texas 79710 Via E-Mail and US Mail

Dear Mr. Moore,

Thank you for supplying us with a copy of the NM Pit Rule. As you requested in our phone conversation, we examined Section 19.15.17.11 Design and Construction Specifications, Subsections A, B, F and J. This letter is our confirmation that construction and lining of the BC Operating frac ponds located near the Battle 1H well in Lea County meet or exceed the requirements of the New Mexico Pit Rule and the Design/Construction Plan for the permit applications.

We completed the earthen foundation and liner installation on September 17, 2014. The dimensions of the pits are as shown on the attached drawing. We confirm that the liner systems in both pits consist of

- 1. A primary liner consisting of 30-mil LLDPE
- 2. A 10-oz geotextile drainage mat beneath the primary liner
- 3. A secondary liner consisting of 20-mil poly.
- 4. A 10-foot long, 6-inch diameter leak detection pipe (perforated) and solid riser (PVC Sch 40) that is placed between the primary and secondary liner in a sump on the low side of each cell.

We confirm that the existing fresh water frac ponds are:

• North pit 280 feet north/south by 280 feet east/west and 13 feet deep

• South pit 200 feet north/south by 200 feet east/west and 13 feet deep

The measured bottom of the two pits are:

• North pit 228 feet by 228 feet (2H:1V side slope)

• South pit 148 feet by 148 feet (2H:1V side slope)

When we constructed the pit, we scraped the topsoil and this material is the base of the pit levee. Upon final closure of the pits, this material can be removed to place over the ground surface.



P.O. Box 50820 Midland, Texas 79710 4000 N. Big Spring Street, Suite 310 Midland, Texas 79705 (432) 684-9696 Fax (432) 686-0600

October 16, 2014

Randall Hicks 901 Rio Grande Blvd NW STE F-142 Albuquerque, NM 87104

RE:

Battle Frac Pits Lea County, NM

Dear Mr. Hicks,

Pursuant to our conversation, BC Operating, Inc. would like to utilize a produced water pit at our "Battle Prospect", located in Section 34, T21S-R33E, Lea County, NM. BC Operating, Inc. constructed two pits, one being 280' x 280' x 13' deep for fresh water, and one being 200' x 200' x 13' deep for production water. BC Operating, Inc. plans on recycling the produced water to eventually reuse in our fracs. Attached is a spreadsheet that gives you the location of the produced water pits. Also attached, you will find the surface use agreement and signature pages giving us permission to have this pit on this land.

Therefore, BC Operating, Inc. does hereby authorize Randall Hicks as an authorized agent to obtain Produced water pit permits on behalf of BC Operating, Inc. in Sec. 34, T21S-R33E to be used for the purpose of conducting oil and gas activities. Furthermore, Mr. Hicks shall abide by all applicable laws in the State of New Mexico.

Sincerely,

Billy Moore Engineer

OFF: 432-684-9696 ext. 750

DIR: 432-770-4217 bmoore@bcoperating.com

BC OPERATING, INC.
Crown Oil Partners V, LP
Crump Energy Partners II, LLC

### Statement Explaining Why the Applicant Seeks a Variance

The prescriptive mandates of the Rule that are the subject of this variance request are the following:

### 19.15.17.13 CLOSURE AND SITE RECLAMATION REQUIREMENTS:

- C. Closure where wastes are destined for disposal at division approved off-site facilities. This subsection applies to permanent pits, temporary pits, multi-well fluid management pits, drying pads and tanks associated with closed-loop systems and below-grade tanks.
- (2) The operator shall close the pit, drying pad or below-grade tank by first removing all contents and, if applicable, synthetic liners and transferring those materials to a division approved facility.
- (3) The operator shall test the soils beneath the pit, drying pad for closed-loop system or below-grade tank as follows...

And

#### 19.15.17.11 DESIGN AND CONSTRUCTION SPECIFICATIONS

**F** (10) The volume of a temporary pit shall not exceed 10 acre feet, including freeboard.

The pits were recently constructed as fresh water ponds and are being used to store fresh water for hydraulic fracturing of nearby wells. BC Operating wishes to use treated produced water in lieu of fresh water for future E&P activities. The operator intends to rehabilitate the fresh water frac ponds by installing an additional liner and leak detection system, converting the pits to meet the design and construction standards of NMOCD Rules for Multi-Well Fluid Management pits. This conversion will require several months and the operator has the opportunity to use produced water in lieu of fresh water right now.

The conversion of the fresh water frac ponds to a two-cell MWFM Pit is the ultimate objective. Approving the permits for temporary workover pits is a stopgap measure to enable the operator to begin conservation of fresh water resources as soon as possible. If approved by OCD, the temporary pits will be closed soon after approval of a MWFM pit permit. Any solids (i.e. blow sand or mineral precipitates) in the pits will be removed to off-site disposal (e.g. R360 landfill) in accordance with 19.15.17.13.C (2) above. The liners will not be removed, but will be employed as the secondary and tertiary liners for a proposed MWFM Pit. Perhaps the language of the Rule "and, if applicable, synthetic liners" makes moot a request for a variance to leave the existing liners in place. If a variance from this section of the Rule is necessary, we hereby request it.

With respect to 19.15.17.13.C (3), the soils beneath the proposed temporary pits will be tested as described – but not within six months after the workover rig (stimulation rig) is released from first well served by the pits. The testing of the soils beneath the pit will occur at closure of an approved MWFM Pit that is eventually created from the fresh water frac ponds. If OCD approves the use of the fresh water frac ponds as temporary workover pits, a variance from this portion of the Rule is necessary.

With respect to 19.15.17.11.F(10), the O&M Plan of the permit restricts the volume of produced water stored in the North Pit to 10 acre-feet. According to the "best case" schedule, the North Pit would store only 7 acre feet. In either case, the O&M Plan in the permit will cause the North Pit to maintain more than 6 feet of freeboard, causing the pit to be about ½ full.

### Demonstration That the Variance Will Provide Equal or Better Protection of Fresh Water, Public Health and the Environment

As described in the C-144 and attachments, the fresh water frac ponds are double lined ponds with interliner leak detection. The primary liner is 30-mil LLDPE. The depth to groundwater is more than 200 feet. These pits would be used on a temporary basis – the time required to generate a MWFM pit permit,

### BC Operating Battle 1H

make the necessary alterations to the ponds (e.g. install a different primary liner and an additional leak detection system). Most important, approval to allow these ponds to hold treated and untreated produced water for use in E&P operations will conserve the fresh water resource.

Given the short duration of use, the depth to groundwater, the construction of the ponds and the commitment to maintain 6 feet of freeboard in each pit we believe the data and the operational plan demonstrates that allowing storage of produced water provides equal protection of fresh water, public health and the environment than strict compliance with the Pit Rule.

### **Operating and Maintenance Plan**

The operator will maintain and operate the pits in accordance with the following plan to contain liquids and maintain the integrity of the liner to prevent contamination of fresh water and protect public health and the environment. Solids, other than blow-sand, are not expected to accumulate in the workover pits.

The purpose of the workover pits is to facilitate the use of produced water in a manner approved by division rules that prevents the contamination of fresh water and protects public health and the environment. If re-use of any residual fluids in the workover pits is not possible, the fluids will be sent to disposal at a division-approved facility (R360).

In addition to limited workover of the Battle 1H well (30-025-41364), no more than 3 of the following wells will be stimulated using produced water stored in the workover pits:

- 1. Abe State #2H
- 2. Abe State #1H
- 3. Abe State #3H
- 4. Battle #2H
- 5. Chili Parlour #2H

Because the berms/levees surrounding the pits do not exhibit sufficient structural stability to allow storage of produced water with 2-feet of freeboard:

- The South Temporary Pit will contain no more than 35,000 bbls of produced water, which translates into 6 feet of freeboard.
- The North Temporary Pit will contain no more than 73,000 bbls of produced water, which translates into 6 feet of freeboard.

The operator will not discharge into or store any hazardous waste in the pits.

If the liner develops a leak or if any penetration of the liner occurs above the liquid's surface, then the operator will repair the damage or initiate replacement of the liner within 48 hours of discovery or will seek a variance from the division district office within this time period.

If visible inspection or evidence in the leak detection system suggest that the liner developed a leak or if any penetration of the liner occurs below the liquid's surface, then the operator will remove all liquid above the damage or leak line within 48 hours of discovery. The operator will also notify the district division office (19.15.29 NMAC) within this same 48 hours of the discovery and repair the damage or replace the liner.

The operator will install and use a header and diverter described in the design/construction plan in order to prevent damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes during injection or withdrawal of liquids.

As described in the design/construction plan, diversion ditches and berms around the pits are not necessary to prevent the collection of surface water run-on.

### C-144 Supplemental Documentation for Temporary Pits

BP Operating Battle 1H

The operator will maintain on site (within the fence surrounding the pits) an oil absorbent boom to contain and remove oil from the stored fluid surface.

The operator will only discharge treated produced water, untreated produced water or fresh into the pits.

The operator will maintain the temporary pits free of miscellaneous solid waste or debris. Immediately after cessation of workover operations on any well, the operator will remove any visible or measurable layer of oil from the surface of the stored fluid.

The operator will remove all free fluids from the temporary pits within 60 days from the date that the last workover rig (stimulation rig) associated with the permit is released. The operator will note the date of this release upon Form C-105 or C-103 upon well or workover completion. The operator may request an extension up to two months from the division district office as long as this additional time does not exceed the temporary pits life span (Subsection R of 19.15.17.7 NMAC).

### Monitor, Inspection, and Reporting Plan

The operator will inspect the pits daily while the pits contain produced water and document such inspections at least monthly until the pits is closed. In addition to daily inspections, the operator will perform a more detailed "low water" inspection after a stimulation event empties the pit(s).

### On a weekly basis the operator will transmit a report to OCD detailing the following information:

- Visually inspect the liner. If a liner's integrity is compromised, or if any penetration of the liner occurs above the water surface, then The operator will notify the appropriate Division district office within 48 hours (phone or email).
- The operator will inspect the system for injection or withdrawal of liquids from the pits and document that the design prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes is working appropriately (see Design and Construction Plan for data relating to this equipment).
- The operator will inspect the pond surface for visible oil
- The operator will measure the freeboard
- Inspect the levee around the pits to check for erosion

### On a weekly basis, the operator will

- Measure H<sub>2</sub>S concentrations on the down-wind side of the pits that is nearly full
- Inspect the leak detection system for evidence of damage or malfunction and monitor for leakage (see Design and Construction Plan for data relating to this equipment).
- Inspect the pits for dead migratory birds and other wildlife. Within 30 days of discovery, The operator will report such findings to the appropriate wildlife agency and to the appropriate Division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring.

The operator will also provide OCD with a monthly report via email with all the monitoring data.

### C-144 and Site Specific Information for Temporary Pit

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

# State of New Mexico Energy Minerals and Natural Resources Department Oil Conservation Division 1220 South St. Francis Dr. Santa Fe, NM 87505

Form C-144 Revised June 6, 2013

For temporary pits, below-grade tanks, and multi-well fluid management pits, submit to the appropriate NMOCD District Office.

For permanent pits submit to the Santa Fe Environmental Bureau office and provide a copy to the appropriate NMOCD District Office.

### Proposed Alternative Method Permit or Closure Plan Application

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Type of action:  Below grade tank registration  Permit of a pit or proposed alternative method  Closure of a pit, below-grade tank, or proposed alternative method  Modification to an existing permit/or registration  Closure plan only submitted for an existing permitted or non-permitted pit, below-grade tank, or proposed alternative method
Instructions: Please submit one application (Form C-144) per individual pit, below-grade tank or alternative request
lease be advised that approval of this request does not relieve the operator of liability should operations result in pollution of surface water, ground water or the avironment. Nor does approval relieve the operator of its responsibility to comply with any other applicable governmental authority's rules, regulations or ordinances.
1.  Operator: <u>BC Operating, Inc</u> OGRID #: <u>160825</u>
Address: PO Box 50820, Midland, Texas 79710
Facility or well name: Battle 1H NorthWorkover Pit
API Number: 30-025-41364 OCD Permit Number:
U/L or Qtr/Qtr Section 34 Township 21S Range 33E County: Lea
Center of Proposed Design: Latitude <u>32.4406446 Longi</u> tude <u>-103.4406446 NAD:</u> □1927 □ 1983
Surface Owner:  Federal State Private Tribal Trust or Indian Allotment
Pit:       Subsection F, G or J of 19.15.17.11 NMAC         Temporary:       □ Drilling       ☑ Workover         □ Permanent       □ Emergency       □ Cavitation       □ P&A       □ Multi-Well Fluid Management       Low Chloride Drilling Fluid       □ yes ☑ no         ☑ Lined       □ Unlined       Liner type:       Thickness       _30mil       ☑ LLDPE       □ HDPE       □ PVC       ☑ Otherand 20 mil poly secondary liner         ☑ String-Reinforced       PRIMARY LINER ONLY         Liner Seams:       ☑ Welded       □ Factory       □ Other Volume 149,902 barrels (19 acre feet) Dimensions: L_280 x W_280 x D_13 feet
Below-grade tank: Subsection I of 19.15.17.11 NMAC
Volume:bbl Type of fluid:
Tank Construction material:
☐ Secondary containment with leak detection ☐ Visible sidewalls, liner, 6-inch lift and automatic overflow shut-off
☐ Visible sidewalls and liner ☐ Visible sidewalls only ☐ Other
Liner type: Thicknessmil
Alternative Method:
Submittal of an exception request is required. Exceptions must be submitted to the Santa Fe Environmental Bureau office for consideration of approval.
s.  Fencing: Subsection D of 19.15.17.11 NMAC (Applies to permanent pits, temporary pits, and below-grade tanks)
Chain link, six feet in height, two strands of barbed wire at top (Required if located within 1000 feet of a permanent residence, school, hospital, institution or church)
⊠ Four foot height, four strands of barbed wire evenly spaced between one and four feet
Alternate Please specify Game Fence may be employed in lieu of barbed wire

Netting: Subsection E of 19.15.17.11 NMAC (Applies to permanent pits and permanent open top tanks)						
Screen Netting Other						
Monthly inspections (If netting or screening is not physically feasible)						
7.						
Signs: Subsection C of 19.15.17.11 NMAC						
☑ 12"x 24", 2" lettering, providing Operator's name, site location, and emergency telephone numbers						
☐ Signed in compliance with 19.15.16.8 NMAC						
8. X						
<u>Variances and Exceptions:</u> Justifications and/or demonstrations of equivalency are required. Please refer to 19.15.17 NMAC for guidance.						
Please check a box if one or more of the following is requested, if not leave blank:						
Variance(s): Requests must be submitted to the appropriate division district for consideration of approval.						
Exception(s): Requests must be submitted to the Santa Fe Environmental Bureau office for consideration of approval.						
9.						
Siting Criteria (regarding permitting): 19.15.17.10 NMAC  Instructions: The applicant must demonstrate compliance for each siting criteria below in the application. Recommendations of acceptable and the compliance of the complia	otable source					
material are provided below. Siting criteria does not apply to drying pads or above-grade tanks.						
<b>General siting</b>						
Ground water is less than 25 feet below the bottom of a low chloride temporary pit or below-grade tank.	☐ Yes ☐ No					
- NM Office of the State Engineer - iWATERS database search; USGS; Data obtained from nearby wells	⊠ NA					
Ground water is less than 50 feet below the bottom of a Temporary pit, permanent pit, or Multi-Well Fluid Management pit.  NM Office of the State Engineer - iWATERS database search; USGS; Data obtained from nearby wells See Figures 1 & 2	☐ Yes ⊠ No ☐ NA					
Within incorporated municipal boundaries or within a defined municipal fresh water well field covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended. ( <b>Does not apply to below grade tanks</b> ) See Figure 5  - Written confirmation or verification from the municipality; Written approval obtained from the municipality	☐ Yes ⊠ No					
Within the area overlying a subsurface mine. ( <b>Does not apply to below grade tanks</b> ) See Figure 7  - Written confirmation or verification or map from the NM EMNRD-Mining and Mineral Division	☐ Yes ⊠ No					
Within an unstable area. (Does not apply to below grade tanks) See Figure 8  - Engineering measures incorporated into the design; NM Bureau of Geology & Mineral Resources; USGS; NM Geological Society: Tonographic man	☐ Yes ⊠ No					
Society; Topographic map  Within a 100-year floodplain. (Does not apply to below grade tanks) See Figure 9  - FEMA map						
Below Grade Tanks						
Within 100 feet of a continuously flowing watercourse, significant watercourse, lake bed, sinkhole, wetland or playa lake (measured						
from the ordinary high-water mark).	☐ Yes ☐ No					
- Topographic map; Visual inspection (certification) of the proposed site						
Within 200 horizontal feet of a spring or a fresh water well used for public or livestock consumption; - NM Office of the State Engineer - iWATERS database search; Visual inspection (certification) of the proposed site	☐ Yes ☐ No					
Temporary Pit using Low Chloride Drilling Fluid (maximum chloride content 15,000 mg/liter)						
Within 100 feet of a continuously flowing watercourse, or any other significant watercourse or within 200 feet of any lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark). (Applies to low chloride temporary pits.)  - Topographic map; Visual inspection (certification) of the proposed site	☐ Yes ☐ No					
Within 300 feet from a occupied permanent residence, school, hospital, institution, or church in existence at the time of initial	☐ Yes ☐ No					
<ul> <li>application.</li> <li>Visual inspection (certification) of the proposed site; Aerial photo; Satellite image</li> </ul>						
Within 200 horizontal feet of a spring or a private, domestic fresh water well used by less than five households for domestic or stock watering purposes, or 300feet of any other fresh water well or spring, in existence at the time of the initial application.  NM Office of the State Engineer - iWATERS database search; Visual inspection (certification) of the proposed site	☐ Yes ☐ No					

Within 100 feet of a wetland.  - US Fish and Wildlife Wetland Identification map; Topographic map; Visual inspection (certification) of the proposed site	☐ Yes ☐ No						
Temporary Pit Non-low chloride drilling fluid							
Within 300 feet of a continuously flowing watercourse, or any other significant watercourse, or within 200 feet of any lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark).  - Topographic map; Visual inspection (certification) of the proposed site See Figure 3	☐ Yes ⊠ No						
Within 300 feet from a permanent residence, school, hospital, institution, or church in existence at the time of initial application.  - Visual inspection (certification) of the proposed site; Aerial photo; Satellite image. See Figure 4							
Within 500 horizontal feet of a spring or a private, domestic fresh water well used by less than five households for domestic or stock watering purposes, or 1000 feet of any other fresh water well or spring, in the existence at the time of the initial application;  - NM Office of the State Engineer - iWATERS database search; Visual inspection (certification) of the proposed site See Figures 1 & 2  Within 300 feet of a wetland.  - US Fish and Wildlife Wetland Identification map; Topographic map; Visual inspection (certification) of the proposed site See Figure 6	☐ Yes ⊠ No						
Permanent Pit or Multi-Well Fluid Management Pit							
Within 300 feet of a continuously flowing watercourse, or 200 feet of any other significant watercourse, or lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark).  - Topographic map; Visual inspection (certification) of the proposed site	☐ Yes ☐ No						
Within 1000 feet from a permanent residence, school, hospital, institution, or church in existence at the time of initial application.  - Visual inspection (certification) of the proposed site; Aerial photo; Satellite image	☐ Yes ☐ No						
Within 500 horizontal feet of a spring or a fresh water well used for domestic or stock watering purposes, in existence at the time of initial application.  - NM Office of the State Engineer - iWATERS database search; Visual inspection (certification) of the proposed site							
Within 500 feet of a wetland.  - US Fish and Wildlife Wetland Identification map; Topographic map; Visual inspection (certification) of the proposed site	☐ Yes ☐ No						
Temporary Pits, Emergency Pits, and Below-grade Tanks Permit Application Attachment Checklist: Subsection B of 19.15.17.9 No. Instructions: Each of the following items must be attached to the application. Please indicate, by a check mark in the box, that the doct attached.  Hydrogeologic Report (Below-grade Tanks) - based upon the requirements of Paragraph (4) of Subsection B of 19.15.17.9 NMAC Hydrogeologic Data (Temporary and Emergency Pits) - based upon the requirements of Paragraph (2) of Subsection B of 19.15.17.9 Siting Criteria Compliance Demonstrations - based upon the appropriate requirements of 19.15.17.10 NMAC Design Plan - based upon the appropriate requirements of 19.15.17.11 NMAC Operating and Maintenance Plan - based upon the appropriate requirements of 19.15.17.12 NMAC Closure Plan (Please complete Boxes 14 through 18, if applicable) - based upon the appropriate requirements of Subsection C of 19.1 and 19.15.17.13 NMAC Previously Approved Design (attach copy of design) API Number:  or Permit Number:  or Permit Number:	nments are  NMAC  5.17.9 NMAC						
Multi-Well Fluid Management Pit Checklist: Subsection B of 19.15.17.9 NMAC  Instructions: Each of the following items must be attached to the application. Please indicate, by a check mark in the box, that the doct attached.  Design Plan - based upon the appropriate requirements of 19.15.17.11 NMAC  Operating and Maintenance Plan - based upon the appropriate requirements of 19.15.17.12 NMAC  A List of wells with approved application for permit to drill associated with the pit.  Closure Plan (Please complete Boxes 14 through 18, if applicable) - based upon the appropriate requirements of Subsection C of 19.13 and 19.15.17.13 NMAC  Hydrogeologic Data - based upon the requirements of Paragraph (4) of Subsection B of 19.15.17.9 NMAC  Siting Criteria Compliance Demonstrations - based upon the appropriate requirements of 19.15.17.10 NMAC  Previously Approved Design (attach copy of design) API Number:  or Permit Number:	15.17.9 NMAC						

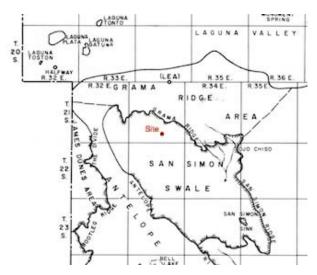
12. Permanent Pits Permit Application Checklist: Subsection B of 19.15.17.9 NMAC					
Instructions: Each of the following items must be attached to the application. Please indicate, by a check mark in the box, that the description of the following items must be attached to the application.	documents are				
### Hydrogeologic Report - based upon the requirements of Paragraph (1) of Subsection B of 19.15.17.9 NMAC    Siting Criteria Compliance Demonstrations - based upon the appropriate requirements of 19.15.17.10 NMAC    Climatological Factors Assessment    Certified Engineering Design Plans - based upon the appropriate requirements of 19.15.17.11 NMAC    Dike Protection and Structural Integrity Design - based upon the appropriate requirements of 19.15.17.11 NMAC    Leak Detection Design - based upon the appropriate requirements of 19.15.17.11 NMAC    Liner Specifications and Compatibility Assessment - based upon the appropriate requirements of 19.15.17.11 NMAC    Quality Control/Quality Assurance Construction and Installation Plan    Operating and Maintenance Plan - based upon the appropriate requirements of 19.15.17.11 NMAC    Freeboard and Overtopping Prevention Plan - based upon the appropriate requirements of 19.15.17.11 NMAC					
<ul> <li>Nuisance or Hazardous Odors, including H₂S, Prevention Plan</li> <li>□ Emergency Response Plan</li> <li>□ Oil Field Waste Stream Characterization</li> <li>□ Monitoring and Inspection Plan</li> <li>□ Erosion Control Plan</li> <li>□ Closure Plan - based upon the appropriate requirements of Subsection C of 19.15.17.9 NMAC and 19.15.17.13 NMAC</li> </ul>					
13.					
Proposed Closure: 19.15.17.13 NMAC Instructions: Please complete the applicable boxes, Boxes 14 through 18, in regards to the proposed closure plan.					
Type: Drilling Workover Emergency Cavitation P&A Permanent Pit Below-grade Tank Multi-well Fl	uid Management Pit				
Alternative   Proposed Closure Method:   Waste Excavation and Removal   Waste Removal (Closed-loop systems only)   On-site Closure Method (Only for temporary pits and closed-loop systems)   In-place Burial   On-site Trench Burial   Alternative Closure Method	ard Wallagement Fit				
14.					
Waste Excavation and Removal Closure Plan Checklist: (19.15.17.13 NMAC) Instructions: Each of the following items must be a closure plan. Please indicate, by a check mark in the box, that the documents are attached.  ☐ Protocols and Procedures - based upon the appropriate requirements of 19.15.17.13 NMAC ☐ Confirmation Sampling Plan (if applicable) - based upon the appropriate requirements of Subsection C of 19.15.17.13 NMAC ☐ Disposal Facility Name and Permit Number (for liquids, drilling fluids and drill cuttings) ☐ Soil Backfill and Cover Design Specifications - based upon the appropriate requirements of Subsection H of 19.15.17.13 NMAC ☐ Re-vegetation Plan - based upon the appropriate requirements of Subsection H of 19.15.17.13 NMAC ☐ Site Reclamation Plan - based upon the appropriate requirements of Subsection H of 19.15.17.13 NMAC	utacnea to the				
15. Siting Criteria (regarding on-site closure methods only): 19.15.17.10 NMAC Instructions: Each siting criteria requires a demonstration of compliance in the closure plan. Recommendations of acceptable sour provided below. Requests regarding changes to certain siting criteria require justifications and/or demonstrations of equivalency. P 19.15.17.10 NMAC for guidance.					
Ground water is less than 25 feet below the bottom of the buried waste NM Office of the State Engineer - iWATERS database search; USGS; Data obtained from nearby wells	☐ Yes ☐ No ☐ NA				
Ground water is between 25-50 feet below the bottom of the buried waste  - NM Office of the State Engineer - iWATERS database search; USGS; Data obtained from nearby wells					
Ground water is more than 100 feet below the bottom of the buried waste.  - NM Office of the State Engineer - iWATERS database search; USGS; Data obtained from nearby wells    Yes   NA   NA					
Within 100 feet of a continuously flowing watercourse, or 200 feet of any other significant watercourse, lakebed, sinkhole, or playa ake (measured from the ordinary high-water mark).  - Topographic map; Visual inspection (certification) of the proposed site					
Vithin 300 feet from a permanent residence, school, hospital, institution, or church in existence at the time of initial application.  - Visual inspection (certification) of the proposed site; Aerial photo; Satellite image					
Vithin 300 horizontal feet of a private, domestic fresh water well or spring used for domestic or stock watering purposes, in existence the time of initial application.  - NM Office of the State Engineer - iWATERS database; Visual inspection (certification) of the proposed site					
Written confirmation or verification from the municipality; Written approval obtained from the municipality	☐ Yes ☐ No				
Within 300 feet of a wetland. US Fish and Wildlife Wetland Identification map; Topographic map; Visual inspection (certification) of the proposed site					
Within incorporated municipal boundaries or within a defined municipal fresh water well field covered under a municipal ordinance	☐ Yes ☐ No				

adopted pursuant to NMSA 1978, Section 3-27-3, as amended.  - Written confirmation or verification from the municipality;	Written approval obtained from the	e municipality	☐ Yes ☐ No
Within the area overlying a subsurface mine.  - Written confirmation or verification or map from the NM E	EMNRD-Mining and Mineral Divisi	on	☐ Yes ☐ No
Within an unstable area.  - Engineering measures incorporated into the design; NM Bu Society; Topographic map	ureau of Geology & Mineral Resour	ces; USGS; NM Geological	
Within a 100-year floodplain FEMA map	☐ Yes ☐ No ☐ Yes ☐ No		
•			165 110
On-Site Closure Plan Checklist: (19.15.17.13 NMAC) Instruction by a check mark in the box, that the documents are attached.  Siting Criteria Compliance Demonstrations - based upon the Proof of Surface Owner Notice - based upon the appropriate Construction/Design Plan of Burial Trench (if applicable) based upon the appropriate protocols and Procedures - based upon the appropriate required Confirmation Sampling Plan (if applicable) - based upon the Waste Material Sampling Plan - based upon the appropriate of Disposal Facility Name and Permit Number (for liquids, drill Soil Cover Design - based upon the appropriate requirements Re-vegetation Plan - based upon the appropriate requirements Site Reclamation Plan - based upon the appropriate requirements	appropriate requirements of 19.15. requirements of Subsection E of 19 ased upon the appropriate requirements of 19.15.17.13 NMAC appropriate requirements of 19.15.17.13 NMAC requirements of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC appropriate requirements of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC ling fluids and drill cuttings or in cast of Subsection H of 19.15.17.13 NMAC	17.10 NMAC .15.17.13 NMAC ents of Subsection K of 19.15.17 e appropriate requirements of 19. 17.13 NMAC use on-site closure standards cannot MAC MAC	.11 NMAC .15.17.11 NMAC
Operator Application Certification:  I hereby certify that the information submitted with this application	n is true, accurate and complete to the	ne best of my knowledge and bel	ief.
Name (Print): Randall Hicks	Title:	Agent	
0			
Signature:	Date:	11/7/2014	
e-mail address: R@rthicksconsult.com	Telephone:50.	5-266-5004	
18. OCD Approval: Permit Application (including closure plan)	Closure Plan (only) OCD	Conditions (see attachment)	
OCD Representative Signature:		Approval Date:	
Title:	OCD Permit Num	ber:	
19. Closure Report (required within 60 days of closure completion) Instructions: Operators are required to obtain an approved closu. The closure report is required to be submitted to the division with section of the form until an approved closure plan has been obtain	re plan prior to implementing any in 60 days of the completion of the	closure activities. Please do not been completed.	
20. Closure Method:  Waste Excavation and Removal ☐ On-Site Closure Method If different from approved plan, please explain.	☐ Alternative Closure Method	☐ Waste Removal (Closed-le	oop systems only)
Closure Report Attachment Checklist: Instructions: Each of the mark in the box, that the documents are attached.  Proof of Closure Notice (surface owner and division)  Proof of Deed Notice (required for on-site closure for private Plot Plan (for on-site closures and temporary pits)  Confirmation Sampling Analytical Results (if applicable)  Waste Material Sampling Analytical Results (required for on Disposal Facility Name and Permit Number  Soil Backfilling and Cover Installation  Re-vegetation Application Rates and Seeding Technique  Site Reclamation (Photo Documentation)  On-site Closure Location: Latitude	e land only)	I to the closure report. Please in	

22. Operator Closure Certification:								
I hereby certify that the information and attachments submitted with this closure report is true, accurate and complete to the best of my knowledge and belief. I also certify that the closure complies with all applicable closure requirements and conditions specified in the approved closure plan.								
Name (Print):	Title:							
Signature:	Date:							
e-mail address:	Telephone:							

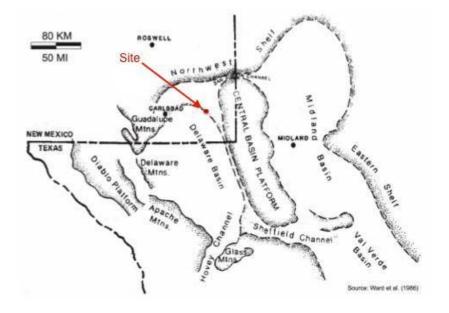
### **Geologic Setting of the Regional Fresh-Water Bearing Formations**

The proposed temporary workover pits/alternative method site are located within the northern edge of the San Simon Swale, which is on the eastern edge of the Pecos Valley Physiographic Province. Regionally, the San Simon Swale drains from the northwest to the southeast, toward the San Simon Sink, located approximately twelve miles to the southeast of the site. The San Simon Swale in this area is approximately seven miles wide extending from Grama Ridge on the northeast to Antelope Ridge on the southwest (see



adjacent map insert). Approximately 220 feet of topographic relief is present from the top of Grama Ridge (3,800 feet ASL) to the valley floor (3,580 feet ASL) located one and one-half mile to the south of the site. The elevation of Antelope Ridge is lower than Grama Ridge, approximately 3750 feet ASL.

Groundwater in the area within and surrounding the San Simon Swale is found only in Mesozoic and Cenozoic Era rocks that were deposited since approximately 235 million years ago. The oldest of these are the Triassic age Dockum Group. They consist of conglomerates, cross-bedded sandstones, claystones, and siltstones that were deposited in a continental fluvial environment over the evaporites of the late Permian Ochoan Series, which had filled the Delaware Basin by that time.



Any Jurassic or Cretaceous age rocks that were deposited above the Triassic have subsequently been removed by erosion leaving an irregular surface on the Triassic rocks. Cenozoic Era rocks in the area consist of the Tertiary age Ogallala Formation and Quaternary age eolian and piedmont deposits. The Ogallala Formation consists of terrestrial sediments (sand with some clay, silt and gravel) that were deposited on the Triassic age rocks. Generally, the Ogallala is capped by a caliche layer, observed at Grama Ridge to the north, being resistant to the erosion that shaped the San Simon Swale.

The Ogallala and associated alluvium aquifers are the primary groundwater source where they are present at the higher elevations outside of the San Simon Swale. Water wells drilled within the San Simon Swale generally target the Triassic age rocks and are designated by the USGS as producing from either Chinle or Santa Rosa aquifers.

### **Distance to Groundwater**

Figure 1, Figure 2, and the discussion presented below demonstrates that groundwater (fresh water as defined by NMOCD Rules) at the location is greater than 100 feet beneath the temporary pits/alternative method.

Figure 1 is an area geologic base map that depicts regional topography (metric contour units) and includes the water wells located nearest to the temporary workover pits/alternative method site for which information is available, regardless of how comprehensive or useful. It also shows:

- 1. The location of the temporary workover pits/alternative method as a squares.
- 2. The Location of the BC Operating Battle #1H oil well as a purple hexagon.
- 3. Water wells from the USGS database as color-coded triangles that indicated the producing aquifer (see Legend).
- 4. Water wells from the New Mexico Office of the State Engineer (OSE) database as a small blue triangle inside a colored circle that indicates the well depth (see Legend). Please note, OSE wells are often miss-located in the WATERS database as older wells are plotted in the center of the quarter, quarter, of the Section Township and Range. Topographic maps and/or aerial photographs verified all of the OSE well locations included on this map.
- 5. Water wells, which are not documented in the public databases but were identified by field inspection or other published reports are shown as a dot inside a color-coded (depth) square.
- 6. BC Operating's newly installed fresh water supply well is shown as a blue circle.
- 7. Depth to water and gauging dates from the most recent and reliable measurement for each well is provided adjacent to the well symbol. It should be noted that in most cases the depth to water provided by the OSE database are from drillers log notes estimated at the time of completion, rather than actual field measurements.

Figure 2 is a regional topographic base map (metric contour units) that depicts the potentiometric surface contours of the shallow-most aquifer surrounding the site. The potentiometric contours are labeled in feet above sea level (ASL). The water wells plotted include only the USGS database and published report water wells from Figure 1 for which a reliable depth to water measurement has been recorded. Figure 2 also shows:

1. The location of the temporary workover pits/alternative method as squares.

- 2. The location of the BC Operating Battle #1H oil well as a purple hexagon.
- 3. BC Operating's newly installed fresh water supply well as a blue circle.
- 4. Groundwater elevations and gauging dates from the most recent available static water level measurement for each well.

### **Site Geology**

The BC Operating temporary workover pits/alternative method are located on an outcrop of Quaternary Age eolian and piedmont deposits (Qe/Qp on Figure 1). These fine-grained sands and clays, along with the Quaternary piedmont deposits and Quaternary lacustrine/playa deposits (Qp and Qpl on Figure 1), are present as a thin covering of the underlying eroded Tertiary or Triassic age rocks. Based on information from Ground-Water Report 6 (GWR-6) *Geology and Ground-Water Conditions in Southern Lea County, New Mexico* by Alexander Nicholson and Alfred Clebsch (1961) and the elevation of the site (3,684 feet ASL), the Triassic age rocks are present approximately 80 feet below the temporary workover pits/alternative method location.

The surface drainage is generally to the southwest, however the area is covered by low stabilized sand dunes and no continuously flowing or any other significant watercourses are present.

#### **Water Table Elevation**

Ten water wells were identified in the area surrounding the temporary workover pits/alternative method site (see Figure 1). A summary of the available water well data, with respect to groundwater elevation, is provided on the table below. In addition to data from the USGS, published, and field verified well information, which is generally considered reliable, the table also includes wells listed on the OSE Waters database. As stated earlier, the groundwater elevations provided for these OSE wells are likely based on driller log notes rather than measurements made under static conditions.

			Well	Locatio	ation Well Source Information						Groundwater Elevation Data									
Well Numbers (see Map)	Township (south)	Range (east)	Section	-	ter Sec proto 16,		NM-OSE Database	USGS Database	Open File Rpt. 95	GW Report No. 6	USGS Topo Sheet	Aerial Photograph	Field Verification	Surface Elevation (published)	Surface Elevation (Topo Sheet)	Well Total Depth (published)	Depth to Water (published)	Groundwater Elev. (published)	Groundwater Elev. (using topo elev.)	Gauging Date
Misc- 72	21	33	18	2	1	1			<b>√</b>	√	<b>√</b>	_		3,900	3,885		143	3,757	3,742	6/21/54
Misc- 73	21	33	18	2	1	1			1		1	_		3,892	3,882	160	148.43	3,744	3,734	11/16/65
USGS-841	21	33	18	4	1	1		✓	✓		√	_		3,855	3,855	123	115.75	3,739	3,739	2/20/96
Misc-71	21	33	25	3	2	4			✓		✓	_		3,666	3,662		58.95	3,607	3,603	2/4/71
BP Op WW	21	33	27	4	3	4		Ν	ew W	'ell	_	_	✓		3,710					
USGS-798	21	33	28	4	2	1		✓	✓	✓	✓	_		3,688	3,688	224	178.85	3,509	3,509	2/21/96
CP 00873	21	33	33	1	1	2	<b>√</b>					✓		İ	3,665	340	180		3,485	1/5/98
USGS-604	22	33	12	4	3	1		✓						3,531		400	324.95	3,206		3/13/96
USGS-719	22	33	13	1	3	2		✓	✓		√	_		3,514	3,515	508	391.13	3,123	3,124	2/20/96
USGS-744	22	34	8	2	3	2	ĺ	✓			✓	_		3,578	3,573	35	30.84	3,547	3,542	2/16/96

<sup>✓</sup> Indicates well was verified, (blank) indicates well not verified, and -- indicates no attempt to verify

Initially, an attempt was made to identify each well using USGS topographic maps. The surface elevation of each well identified on the topographic maps was compared to the published surface elevation, if available. Wells that could not be verified using maps were searched for using

current and historic satellite photographs in an effort to identify windmills, tanks, or roads associated with the well. The following comments should be noted from Figure 1 and the table:

- Well USGS-604 is properly located on Figure 1 and Figure 2 according to the USGS latitude and longitude. However, the USGS database information indicates that the well is located in T-23-S instead of T-22-S. The USGS topographic map identifies the "Allred Well" at this location. The datum elevation (3,531 feet) is consistent with the maps at both locations, so the well has been included on the table and figures for this evaluation.
- The "Rogers" well is shown on the USGS topographic map as a twin to USGS-719, but no depth to water information is available so it is not included on the table or Figures.

### Hydrogeology

GWR-6 indicates that Ogallala groundwater is not present as a regional aquifer in the area surrounding the temporary workover pits/alternative method location, but can be found in wells at higher elevations to the north. The nearest water well, designated by the USGS as an Ogallala producer, is USGS-841, located approximately 4.8 miles to the northwest. The groundwater elevation from this well and other Ogallala/Bolson wells was used to produce Figure 2, however the wells within this area of the San Simon Swale (off the cap rock) produce only from Triassic age rocks. A possible exception is USGS-744 (5.2 miles to the southeast), which is believed to produce from a localized alluvium aquifer.

Based on the potentiometric surface contours created using the available measurements from surrounding wells (Figure 2), we conclude that the groundwater elevation at the temporary workover pits/alternative method site is approximately 3,440 feet ASL. With a surface elevation of 3,684 feet ASL and a maximum pit depth of 13 feet, the depth to groundwater below the pit floor should be approximately 231 feet.

### **Distance to Surface Water**

Figure 3 and the site visit demonstrates that the location is not within 300 feet of a continuously flowing watercourse, or any other significant watercourse, or within 200 feet of any lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark). No continuously flowing watercourses exist within 300 feet of the location. The nearest surface drainage feature (un-named intermittent stream identified on the USGS quadrangle map) is located 3,800 feet to the southwest.

### Distance to Permanent Residence or Structures

Figure 4 and the site visit demonstrates that the location is not within 300 feet from a permanent residence, school, hospital, institution, church, or other structure in existence at the time of initial application.

### **Distance to Non-Public Water Supply**

Figures 1 and 3 demonstrate that the location is not within 500 horizontal feet of a private, domestic fresh water well or spring that less than five households use for domestic or stock

watering purposes, or within 1000 horizontal feet of any other fresh water well or spring, in existence at the time of initial application.

- Figure 1 shows the locations of all area water wells; the nearest fresh water well, other than the BC Operating fresh water supply well is CP-00873, which is located 1.1 miles to the west. There are no known domestic water wells located within the mapping area.
- Figure 3 shows that no springs are identified within the mapping area.

### Distance to Municipal Boundaries and Fresh Water Fields

Figure 5 demonstrates that the location is not within incorporated municipal boundaries or defined municipal fresh water well fields covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended.

- The closest municipality is Eunice, NM approximately 27 miles to the east.
- The closest public well field is located approximately 30 miles to the north.

### **Distance to Wetlands**

Figure 6 demonstrates the location is not within 500 feet of wetlands.

• The nearest designated wetlands is a "Freshwater Pond" located 2.5 miles to the northeast

### **Distance to Subsurface Mines**

Figure 7 and our general reconnaissance of the area demonstrate that the nearest mines are caliche pits.

• The nearest caliche pit is located approximately 3,700 feet to the north-northeast as shown on the adjacent photograph.

### **Distance to High or Critical Karst Areas**

Figure 8 shows the location of the temporary workover pits/alternative method with respect BLM Karst areas

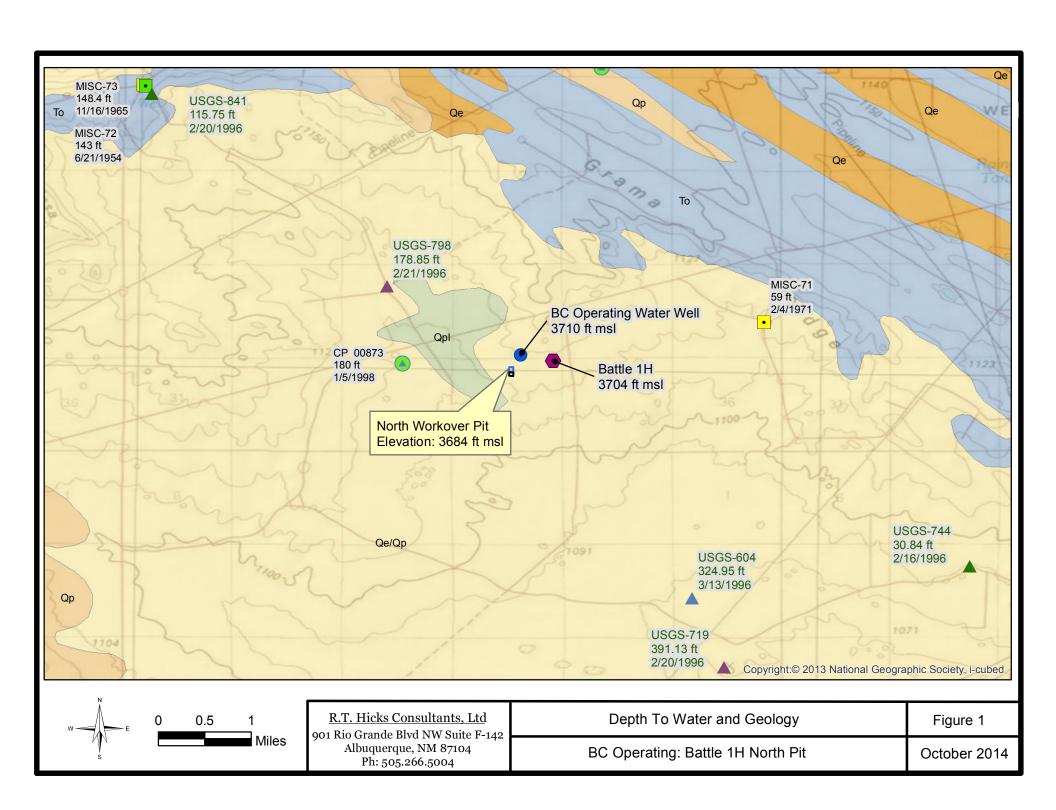
- The temporary workover pits/alternative method are located within a "low" potential karst area.
- The nearest "high" or "critical" potential karst area is located approximately 15 miles west of the site.
- We saw no evidence of unstable ground near the temporary workover pits/alternative method location during the site inspection.

### Distance to 100-Year Floodplain

Figure 9 demonstrates that the location is within an area that has not yet been mapped by the Federal Emergency Management Agency with respect to the Flood Insurance Rate 100-Year Floodplain.

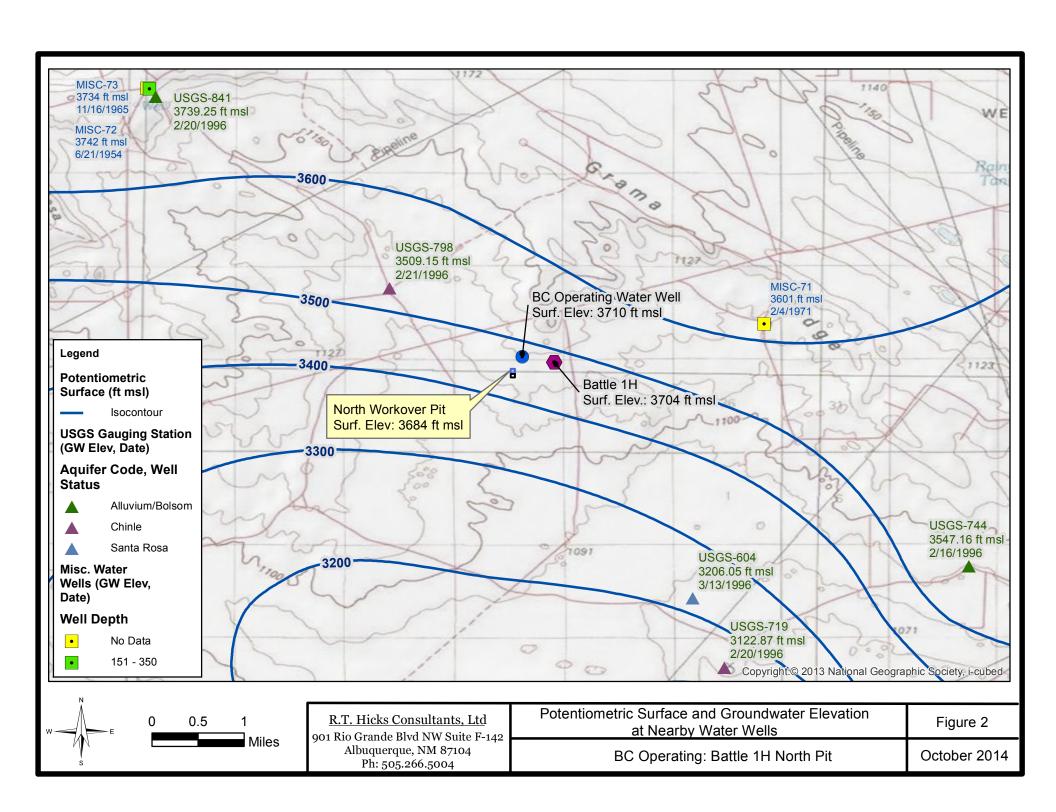
• Areas that are not mapped are designated as "Undetermined Flood Hazard" and are generally considered minimal flood risk.

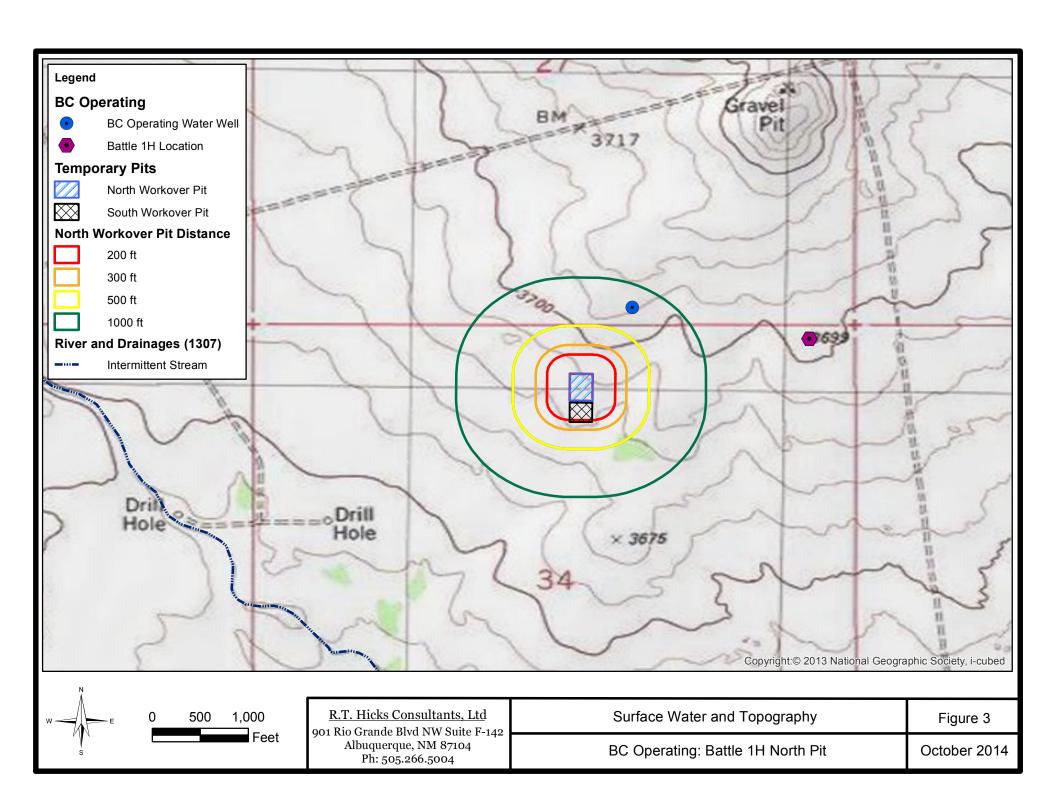
• Our field inspection and examination of the topography permit a conclusion that the location is not within any floodplain.

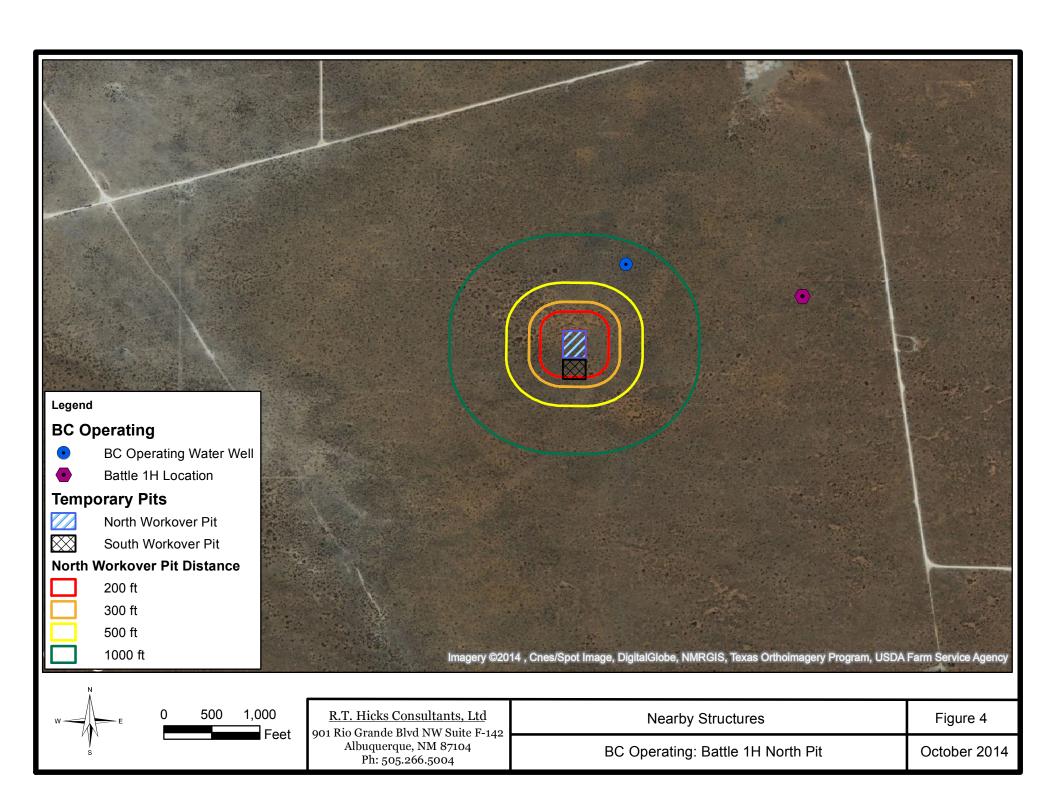


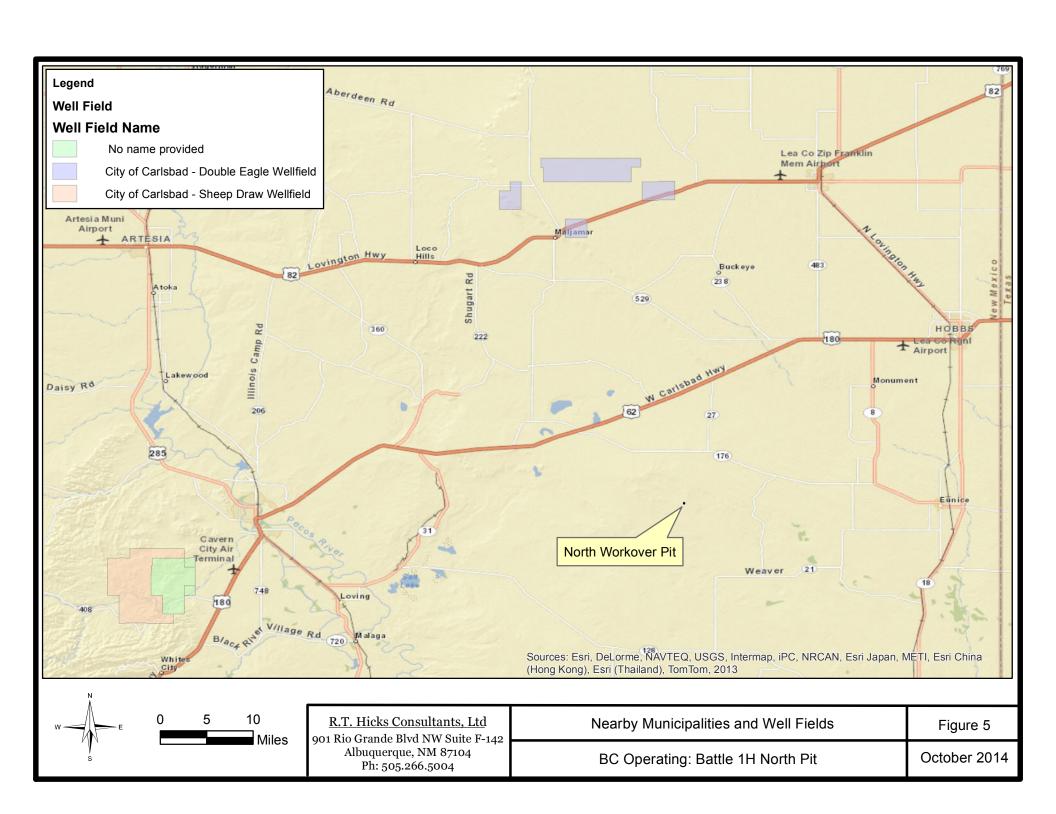
Legend USGS Gauging Station (DTW, Date) Aquifer Code, Well Status Alluvium/Bolsom Chinle Santa Rosa Misc Water Wells (DTW, Date) Well Depth (ft) No Data 151 - 350 OSE Water Wells (DTW, Date) Well Depth (ft) 151 - 350 NM Geology Map Unit, Description Qe, Quaternary-Eolian Deposits Qe/Qp, Quaternary-Eolian Piedmont Deposits Qp, Quaternary-Piedmont Alluvial Deposits Qpl, Quaternary-Lacustrine and Playa Deposits To, Tertiary-Ogallala Formation

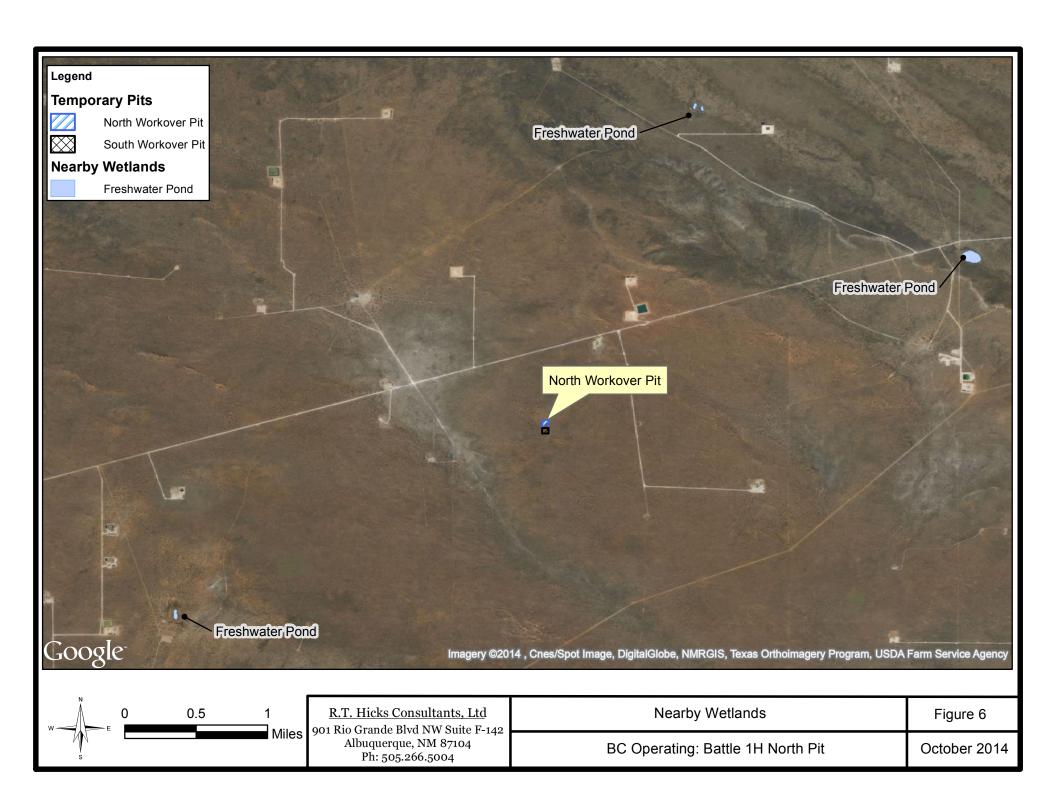
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142	Depth To Water and Geology	Figure 1 Legend
Albuquerque, NM 87104 Ph: 505.266.5004	BC Operating: Battle 1H North Pit	October 2014

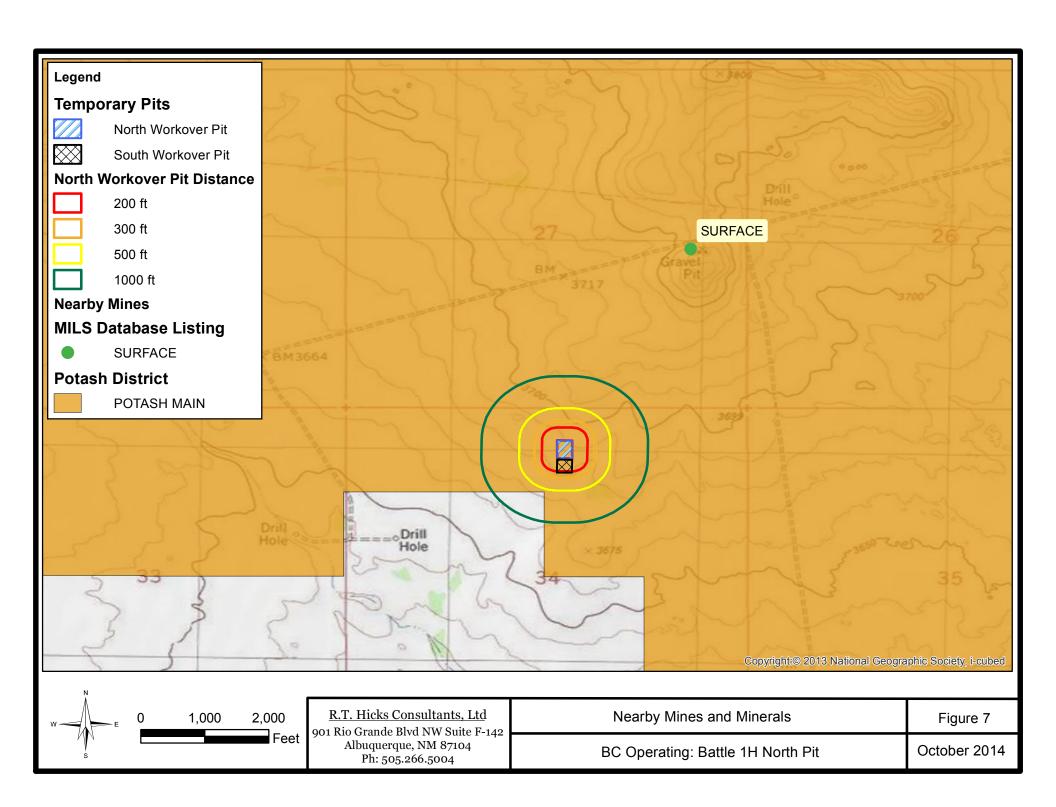


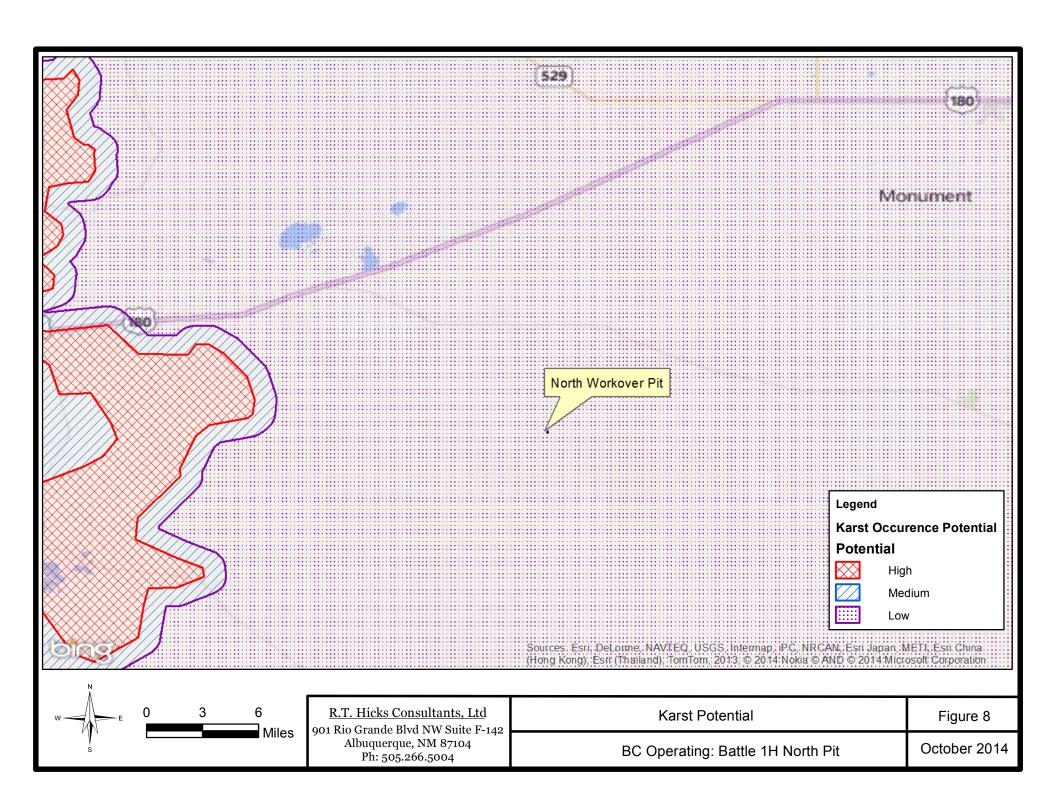


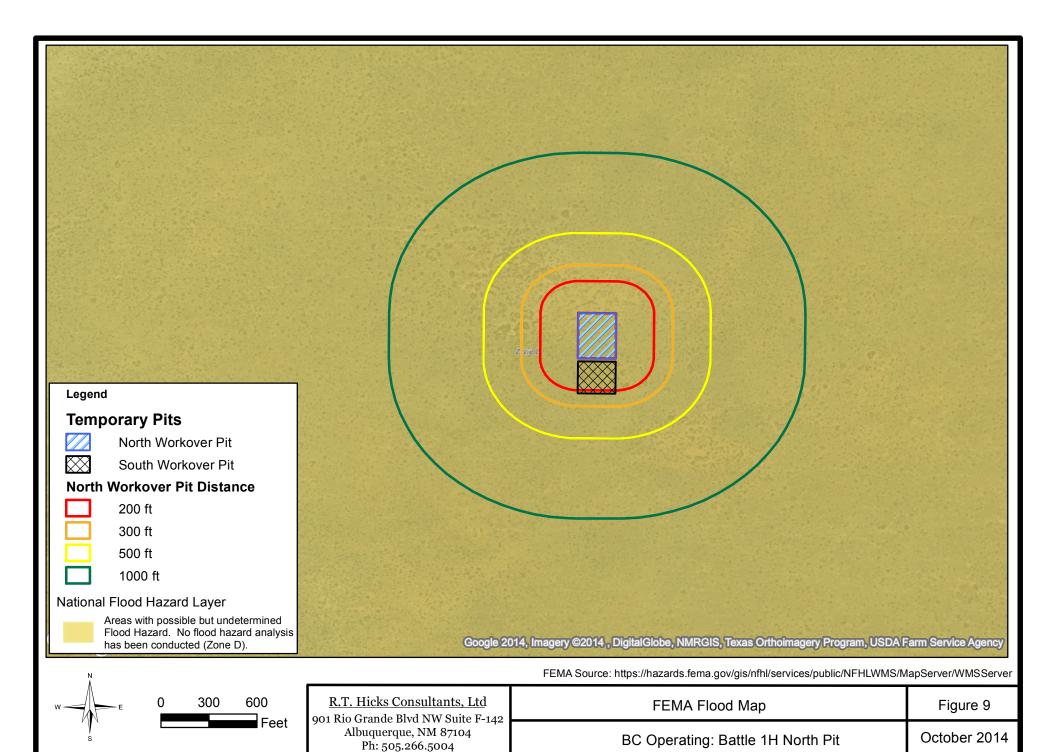




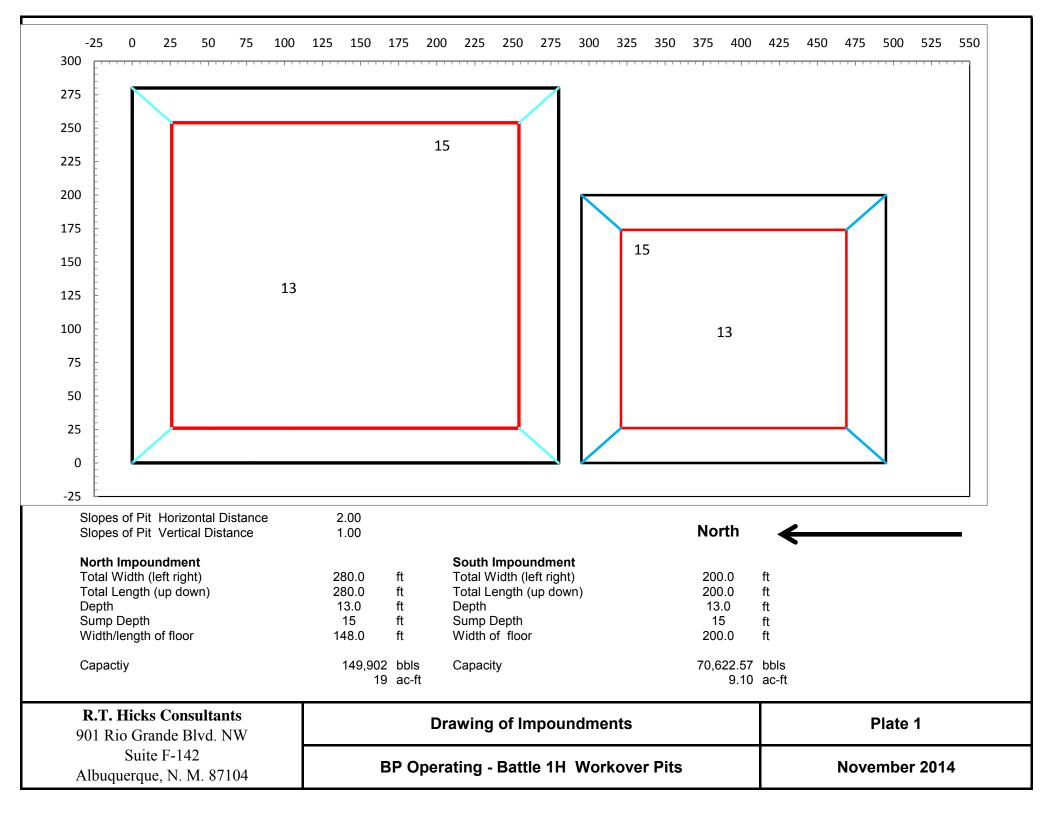








# Site Specific Information Plate



# Site Inspection Photographs



View west showing North Pond (right) and South Pond (left). Ground slopes south and is characterized by low stabilized dunes.



View of undisturbed landscape near ponds.



The North Pond (left) is higher than the South Pond (right). Fresh water is in both ponds at the time of the photograph



View south from between ponds shows how the South Pond levee is above natural grade.

# Plans for K cf\_cj Yf Pit

### **Design/Construction Plan**

Plate 1 shows the design of the temporary workover pits proposed for this project. The workover pits will store <u>untreated</u> produced water in the south pit and <u>treated</u> and untreated produced water (mixed with fresh water as necessary) in the northern temporary pit. The produced water will be used in E&P operations in lieu of fresh water. The workover pits are currently newlyconstructed (9-17-14) fresh water "frac ponds". Appendix A presents photographs of the existing frac pond.

The design features of the proposed workover pits include (for each cell) are:

- 1. A primary liner consisting of 30-mil LLDPE (specifications attached)
- 2. A 10-oz geotextile drainage mat beneath the primary liner (see specifications)
- 3. A 20-mil poly liner as the secondary liner (see specifications)
- 4. A 10-foot long, 6-inch diameter leak detection pipe and riser (PVC Sch 40) that is placed between the primary and secondary liner in a sump on the low side of each cell.

The two workover pits (the existing fresh water frac ponds) are

- North pit 280 feet north/south by 280 feet east/west and 13 feet deep
- South pit 200 feet north/south by 200 feet east/west and 13 feet deep

The slope of the pit walls is (25 horizontal to 13 feet vertical) 2H:1V.

The overflow capacity of the proposed workover pits are

- 149,902 barrels or 19 acre-feet for the north cell
- 70,622.57 barrels or 9.1 acre feet for the south cell

Because the total capacity of the North Pit exceeds the 10-acre foot maximum capacity of temporary pits mandated by the Rule, the operator has submitted a variance to allow the use of the North Pit as a temporary pit. The Operations and Maintenance Plan shows how the North Pit will store no more than 10 acre-feet of produced water.

The temporary storage of fluids, fluid reuse or fluid disposal will be conducted in a manner approved by division rules that prevents the contamination of fresh water and protects public health and the environment.

### Construction/Design Plan of Temporary Pit

### **Stockpile Topsoil**

Prior to constructing the existing frac pond, the qualified contractor striped and stockpiled the topsoil for use as the final cover or fill at the time of closure. The soil stockpile is part of the above-grade levee. The attached letter provides information regarding the construction of the frac pond

### Signage

The operator will post an upright sign in a conspicuous place. The upright sign will not be less than 12 inches by 24 inches with lettering not less than two inches in height on the fence surrounding the pit with the location of the site by quarter-quarter or unit letter, section, township and range; and emergency telephone numbers.

### Fencing:

As the pit is not located within 1000 feet of a permanent residence, school, hospital, institution or church, the operator will fence the pit to exclude livestock with four-wire strands evenly spaced in the interval between one foot and four feet above ground level. The operator will maintain the fence at all times of pit operation.

#### **Earthwork**

As stated in the attached letter, the existing frac ponds (the proposed temporary pits) have a properly constructed foundation and interior slopes consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities. After filling and emptying the northern frac pond once, there is no evidence of liner strain or tears. Nor is there any evidence of erosion or slumping associated with the levee that surrounds the existing frac ponds.

As the existing frac ponds are elevated above ground surface, a berm or ditch need not surround the temporary pit to prevent run-on of surface water.

#### **Liner Installation**

The primary geomembrane liner consists of 30-mil string reinforced LLDPE, as indicated above. The primary liner is composed of an impervious, synthetic material that is resistant to petroleum hydrocarbons, salts and acidic and alkaline solutions. The liner material is resistant to ultraviolet light. Liner compatibility is described in the Appendix.

The secondary liner is 20-mil poly, as indicated above. The secondary liner is composed of an impervious, synthetic material that is resistant to petroleum hydrocarbons, salts and acidic and alkaline solutions. Geotextile material underlies the secondary liner.

For the primary and secondary liner, the contractor:

- 1. minimized liner seams and oriented them up and down, not across a slope
- 2. used factory welded seams where possible
- 3. overlaped liners four to six inches and oriented seams parallel to the line of maximum slope, i.e., oriented along, not across, the slope, prior to any field seaming
- 4. minimized the number of welded field seams in comers and irregularly shaped areas
- 5. utilized only qualified personnel to weld field seams
- 6. avoided excessive stress-strain on the liner
- 7. placed a thick, 10-oz geotextile material under the primary liner to act as a drainage mat for leak detection.
- 8. anchored the edges of all liners in the bottom of a compacted earth-filled trench that is at least 18 inches deep

### C-144 Supplemental Documentation for Temporary Pit

BC Operating Battle 1H

The inflow and outflow system to deliver treated produced water to the pit and to E&P operations will be determined by the water treatment company (outflow to the treatment unit) and BC Operting (inflow to the South Pit). Both companies plan to install a manifold and/or diverter for the inflow and outflow from the pit to ensure that the liner is protected from any fluid force or mechanical damage at any point of discharge into or suction from the lined temporary pit.

As the top of the workover pit is about 2-10 feet above ground surface, a berm or ditch will not surround the temporary pit to prevent run-on of surface water.

The temporary pit will not be used to vent or flare gas and the volume of the temporary drilling pit, including freeboard,

### **Operating and Maintenance Plan**

The operator will maintain and operate the pits in accordance with the following plan to contain liquids and maintain the integrity of the liner to prevent contamination of fresh water and protect public health and the environment. Solids, other than blow-sand, are not expected to accumulate in the workover pits.

The purpose of the workover pits is to facilitate the use of produced water in a manner approved by division rules that prevents the contamination of fresh water and protects public health and the environment. If re-use of any residual fluids in the workover pits is not possible, the fluids will be sent to disposal at a division-approved facility (R360).

In addition to limited workover of the Battle 1H well (30-025-41364), no more than 3 of the following wells will be stimulated using produced water stored in the workover pits:

- 1. Abe State #2H
- 2. Abe State #1H
- 3. Abe State #3H
- 4. Battle #2H
- 5. Chili Parlour #2H

Because the berms/levees surrounding the pits do not exhibit sufficient structural stability to allow storage of produced water with 2-feet of freeboard:

- The South Temporary Pit will contain no more than 35,000 bbls of produced water, which translates into 6 feet of freeboard.
- The North Temporary Pit will contain no more than 73,000 bbls of produced water, which translates into 6 feet of freeboard.

The operator will not discharge into or store any hazardous waste in the pits.

If the liner develops a leak or if any penetration of the liner occurs above the liquid's surface, then the operator will repair the damage or initiate replacement of the liner within 48 hours of discovery or will seek a variance from the division district office within this time period.

If visible inspection or evidence in the leak detection system suggest that the liner developed a leak or if any penetration of the liner occurs below the liquid's surface, then the operator will remove all liquid above the damage or leak line within 48 hours of discovery. The operator will also notify the district division office (19.15.29 NMAC) within this same 48 hours of the discovery and repair the damage or replace the liner.

The operator will install and use a header and diverter described in the design/construction plan in order to prevent damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes during injection or withdrawal of liquids.

As described in the design/construction plan, diversion ditches and berms around the pits are not necessary to prevent the collection of surface water run-on.

### C-144 Supplemental Documentation for Temporary Pits

BP Operating Battle 1H

The operator will maintain on site (within the fence surrounding the pits) an oil absorbent boom to contain and remove oil from the stored fluid surface.

The operator will only discharge treated produced water, untreated produced water or fresh into the pits.

The operator will maintain the temporary pits free of miscellaneous solid waste or debris. Immediately after cessation of workover operations on any well, the operator will remove any visible or measurable layer of oil from the surface of the stored fluid.

The operator will remove all free fluids from the temporary pits within 60 days from the date that the last workover rig (stimulation rig) associated with the permit is released. The operator will note the date of this release upon Form C-105 or C-103 upon well or workover completion. The operator may request an extension up to two months from the division district office as long as this additional time does not exceed the temporary pits life span (Subsection R of 19.15.17.7 NMAC).

### Monitor, Inspection, and Reporting Plan

The operator will inspect the pits daily while the pits contain produced water and document such inspections at least monthly until the pits is closed. In addition to daily inspections, the operator will perform a more detailed "low water" inspection after a stimulation event empties the pit(s).

On a weekly basis the operator will transmit a report to OCD detailing the following information:

- Visually inspect the liner. If a liner's integrity is compromised, or if any penetration of the liner occurs above the water surface, then The operator will notify the appropriate Division district office within 48 hours (phone or email).
- The operator will inspect the system for injection or withdrawal of liquids from the pits and document that the design prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes is working appropriately (see Design and Construction Plan for data relating to this equipment).
- The operator will inspect the pond surface for visible oil
- The operator will measure the freeboard
- Inspect the levee around the pits to check for erosion

On a weekly basis, the operator will

- Measure H<sub>2</sub>S concentrations on the down-wind side of the pits that is nearly full
- Inspect the leak detection system for evidence of damage or malfunction and monitor for leakage (see Design and Construction Plan for data relating to this equipment).
- Inspect the pits for dead migratory birds and other wildlife. Within 30 days of discovery, The operator will report such findings to the appropriate wildlife agency and to the appropriate Division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring.

The operator will also provide OCD with a monthly report via email with all the monitoring data.

### Pit Inspection Form Battle 1H Workover Pits

Month Dec-14

					Staff	
Day	Weekly	Low Water	Activity	Monthly	Gauge	Comments
1 (Mon)						
2	Х				8.75	no birds in pit
3					9	
4					9	
5			Х			Water transfer to frac - pipes are good
6			Х			Water transfer to frac - pipes are good
7		х			2.5	No visible liner problems
8					3	
9	Х				3.5	All OK - no oil on surface, no birds in pit
10					4	
11					4.5	
12					5	
13					5.25	
14					5.75	
15				Х	6.25	No fluid in ports, outer berm and stormater diversion OK, H2S - no alarm,
16					7	
17					7.75	
18					8	
19	Х				8.5	All OK
20					8.75	
21					9	
22			Х			Water transfer to frac - no problems
23			Х			Water transfer to frac - no problems
24		Х			1.75	No visible liner problems
25					2.25	
26	Х				3.75	High wind - liner is OK, no birds
27					4.75	
28					5.5	
29					6.75	
30					7.75	
31					8.5	

### C-144 Supplemental Documentation for Temporary Pit/Alternative Method BP Operating Battle 1H

### **Closure Plan**

After the temporary storage of produced water in the pits, BC Operating intends to close the pits during the conversion of these impoundments to OCD-approved MWFM Pits. The closure process is outlined below. Final closure of the impoundments will follow the mandates of the Pit Rule for MWFM pits. Attached to this closure plan is a recently-approved closure plan for a MWFM Pit in Eddy County. BC Operating will implement this closure plan if OCD approves the modified impoundments as MWFM pits.

Prior to conversion of the existing impoundments to a twin-cell MWFM Pit, BC Operating will:

- 1. Remove fluids from the pits by pumping to
  - a. Tank storage
  - b. Off site disposal
  - c. Approved E&P uses
- 2. Some residual fluid mixed with solids (e.g. blow sand) will remain in the bottom of the impoundments. The solids will be removed from the pit one of two ways:
  - a. Washing the solids to the low-spot of the pit with fresh water and using a vacuum truck or similar unit to remove the liquids and solids to disposal.
  - b. Allowing the residual liquid to evaporate and removing the solids with a broom and shovel or equivalent equipment
- 3. A final fresh water rinse may be required to remove any dried salts or other solids adhering to the liner.

All recovered solids will be transported to R-360 for disposal. Recovered liquids will be removed to disposal or placed into tank storage.

### C-144 Supplemental Information: Closure Plan Multi-Well Fluid Management Pit

The MWFM pit is expected to contain a small volume of solids, the majority of which will be windblown sand and dust with some mineral precipitates from the water.

#### Closure Notice

The operator will not commence closure without first obtaining approval of the closure plan submitted with the C-144 application. To allow for review time and site inspection, the operator will notify the Division's District office at least 30 days prior to cessation of operations and provide a proposed schedule for closure. The operator will close the permitted MWFM pit within 60 days of cessation of operation of the pit in accordance with an approved closure plan.

At least 72 hours, but not more than one week, prior to any closure activities, the operator will notify the surface owner (State Land Office) by certified mail, return receipt requested. This notice will include the project name and location description.

### Excavation and Removal Closure Plan – Protocols and Procedures

- 1. The operator will remove all liquids from the pit and either:
  - a. Dispose of the liquids in a division-approved facility (see Appendix D for a list of injection wells), or
  - b. Recycle, reuse or reclaim the water for reuse in drilling, stimulation or other approved uses.
- 2. The operator will remove all solid pit contents and transfer those materials to the following division-approved facility:

Disposal Facility Name: R360 Permit Number NM 01-0006

- 3. If possible, pit liner that exhibits good integrity may be recycled for use as an underliner of tank batteries or other use as approved by OCD.
- 4. After the removal of the pit contents and liners, soils beneath the MWFM Pit will be tested as follows
  - a. Collect a five-point (minimum) composite from beneath the pit liner sample to include any obviously stained or wet soils, or any other evidence of impact from the pit for laboratory analyses for the constituents listed in Table I of 19.15.17.13 NMAC.
  - b. If any concentration is higher than the parameters listed in Table I, additional delineation may be required and closure activities will not proceed without Division approval.
- 5. If all constituents' concentrations are less than or equal to the parameters listed in Table I, then The operator will proceed to backfill the former pit location in accordance with the Soil Cover Design (below) with non-waste containing, uncontaminated, earthen material blended to the surrounding topography and arranged in a manner that prevents surface erosion.
- 6. Re-vegetation protocols are outlined below

### Soil Cover Design

The operator will backfill the former pit locations and the soil cover will consist of

- At least 3-feet of compacted, uncontaminated, non-waste containing earthen fill with chloride concentrations less than 600 mg/kg as analyzed by EPA Method 300.0.
- Either the background thickness of topsoil or one foot of suitable material to establish vegetation at the site, whichever is greater, over the 3-foot earth material.

### C-144 Supplemental Information: Closure Plan Multi-Well Fluid Management Pit

• Contours to blend with the surrounding topography and to prevent erosion of the cover and ponding over the cover.

### Closure Documentation

Within 60 days of closure completion, The operator will submit a closure report on form C-144, with necessary attachments to document all closure activities including sampling results; information required by 19.15.17 NMAC; a plot plan; and details on back-filling, capping and covering, where applicable.

In the closure report, the operator will certify that all information in the report and attachments is correct and that the operator has complied with all applicable closure requirements and conditions specified in the approved closure plan.

### Reclamation and Re-vegetation

The operator will reclaim to a safe and stable condition that existed prior to oil and gas operations and that blends with the surrounding undisturbed area

Areas not reclaimed as described herein due to their use in production or drilling operations will be stabilized and maintained to minimize dust and erosion.

For all areas disturbed by the closure process that will not be used for production operations or future drilling, the operator will

- A. Replace topsoils and subsoils to their original relative positions
- B. Grade so as to achieve erosion control, long-term stability and preservation of surface water flow patterns
- C. Reseed in the first favorable growing season following closure

Re-vegetation and reclamation plans imposed by the surface owner will be outlined in communications with the OCD.

The operator will notify the Division when the surface grading work element of reclamation is complete.

The operator will notify the Division when the site meets the surface owner's requirements or exhibits a uniform vegetative cover that reflects a life-form ratio of plus or minus fifty percent (50%) of pre-disturbance levels and a total percent plant cover of at least seventy percent (70%) of pre-disturbance levels, excluding noxious weeds.

### Appendix A

⇒bZcfa Uhjcb cb 7 cbglfi Whjcb UbX @jbYfg



Raven Industries 821 W Algonquin St. Sioux Falls, SD 57104 12/2/13

#### **K30B**

Dear RT Hicks Consultants,

K30B is a polyethylene geomembrane with string reinforcement that is resistant to UV light, salts, and acidic and alkaline solutions. The material has a hydraulic conductivity less than 1 x 10-9 cm/s. Test methods EPA SW-846 and EPA 9090A have not been performed on K30B.

The materials that Raven K30B is comprised of are compatible with the chemical components described in the water analysis provided by the RT Hicks Consulting firm. These compounds included ions: sodium, calcium, magnesium, barium, potassium, iron, strontium, manganese, chloride, sulfate, carbonate, and bicarbonate. The analysis also included a small amount of hydrogen sulfide and carbon dioxide. Stating these chemical species are compatible with the liner in this context means beneficial properties such as strength, elongation, and flexibility of the liner would not be significantly affected by long-term contact with the components described in the water analysis.

Sincerely,

**Justin Norberg** 

Product Development Specialist Engineered Films Division Raven Industries 1813 E Ave. Sioux Falls, SD 57104 (605)335-0288 Justin.Norberg@Ravenind.com

/ustimorhug

# **DURA+SKRIM®** K30B, K36B & K45B

Scrim Reinforced Polyethylene - NSF/ANSI Standard 61 Certified



### **Product Description**

DURA•SKRIM® K30B, K36B and K45B are linear low density polyethylene geomembranes reinforced with a heavy dense scrim reinforcement. In addition to excellent dimensional stability the K-Series reinforcement provides unmatched tear and tensile strength. DURA•SKRIM® K-Series membranes are formulated with thermal and UV stabilizers to assure a long service life.

### **Product Use**

DURA•SKRIM® K30B, K36B and K45B are used in applications that require exceptional outdoor life and demand high tear strength and resistance to thermal expansion.

DURA•SKRIM® K30B, K36B and K45B are manufactured from a very chemical-resistant, Linear Low Density Polyethylene with excellent cold crack performance. The DURA•SKRIM®, K30B, K36B & K45B are certified under the NSF/ANSI Standard 61, Drinking Water System Components - Health Effects.

### Size & Packaging

DURA•SKRIM® K30B, K36B and K45B are available in a variety of widths and lengths to meet the project requirements. Large diameter mill rolls are available to assure an efficient seaming process. Factory welded panels are accordion folded and tightly rolled on a heavy-duty core for ease of handling and time saving installation.





**Containment Liner** 

Product	Part #
DURA+SKRIM	K30B
DURA+SKRIM	K36B
DURA+SKRIM	K45B

#### **APPLICATIONS**

Waste Lagoon Liners R	emediation Covers
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Floating Covers Landfill Caps

Daily Landfill Covers Erosion Control Covers

Modular Tank Liners Canal Liners

Tunnel Liners Disposal Pit Liner

Remediation Liners Water Containment Ponds

Earthen Liners Heap Leach Liner

Interim Landfill Covers Secondary Containment Fertilizer

## DURA+SKRIM® K30B, K36B & K45B



Scrim Reinforced Polyethylene - NSF/ANSI Standard 61 Certified

PRO-FORMA DATA SHEET	DURA+SKRIM K30B		DURA+SKRIM K36B		DURA+SKRIM K45B		
PROPERTIES	TEST METHOD	Minimum Roll Averages	Typical Roll Averages	Minimum Roll Averages	Typical Roll Averages	Minimum Roll Averages	Typical Roll Averages
Appearance		Black	Black	Black	Black	Black	Black
THICKNESS		27 mil	30 mil	32 mil	36 mil	40 mil	45 mil
WEIGHT LBS/MSF, (OZ/YD <sup>2</sup> )		116 (16.7)	125 (18.0)	136 (19.6)	155 (22.3)	175 (25.2)	200 (28.8)
Construction		Dense scrim reinforced polyethylene					
*PLY ADHESION - LBF/IN	ASTM D 6636	17 or FTB	20 or FTB	21 or FTB	28 or FTB	24 or FTB	32 or FTB
TENSILE STRENGTH - LBF/IN	ASTM D 7003	165 MD 159 TD	182 MD 170 TD	170 MD 166 TD	186 MD 175 TD	178 MD 170 TD	195 MD 180 TD
TENSILE ELONGATION AT BREAK % (FILM BREAK)	ASTM D 7003	480 MD 430 TD	540 MD 500 TD	500 MD 450 TD	575 MD 520 TD	520 MD 470 TD	590 MD 550 TD
TENSILE ELONGATION AT BREAK % (SCRIM BREAK)	ASTM D 7003	32 MD 32 TD	35 MD 35 TD	32 MD 32 TD	35 MD 35 TD	32 MD 32 TD	35 MD 35 TD
TONGUE TEAR STRENGTH - LBF	ASTM D 5884	185 MD 160 TD	195 MD 185 TD	160 MD 120 TD	180 MD 140 TD	140 MD 120 TD	175 MD 145 TD
GRAB TENSILE - LBF (SCRIM BREAK)	ASTM D 7004	260 MD 245 TD	270 MD 255 TD	280 MD 270 TD	300 MD 290 TD	260 MD 245 TD	270 MD 255 TD
GRAB TENSILE ELONGATION AT BREAK % (SCRIM BREAK)	ASTM D 7004	25	32	25	32	25	32
HIGH PRESSURE OIT (HPOIT)	ASTM D 5885	1000 min	2400 min	1000 min	2400 min	1000 min	2400 min
PUNCTURE RESISTANCE - LBF	ASTM D 4833	85	100	110	120	120	133
MAXIMUM USE TEMPERATURE		180° F		180° F		180° F	
MINIMUM USE TEMPERATURE		-70	°F	-70° F		-70° F	

<sup>\*</sup>Raven modified QC procedure



The data listed in this Pro-Forma data sheet is representative of initial production runs. These values may be revised at anytime without notice as additional test data becomes available.



DURA SKRIM® K30B, K36B and K45B are linear low density polyethylene geomembranes reinforced with a heavy dense scrim reinforcement. In addition to excellent dimensional stability the K-Series reinforcement provides unmatched tear and tensile strength. DURA SKRIM® K-Series membranes are formulated with thermal and UV stabilizers to assure a long service life.

Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance, odor transmission, longevity as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage. Limited Warranty available at www.RavenEFD.com



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Sioux Falls, SD 57117-5107

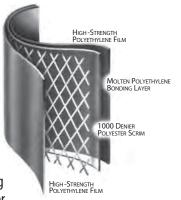
### **DURA+SKRIM®** R20BDV

Scrim Reinforced Polyethylene



### **Product Description**

DURA•SKRIM® R20BDV consists of virgin outer layers of high-strength polyethylene film laminated together with hot molten polyethylene. DURA•SKRIM® R20BDV is black on one side and gray on the other for added versatility. The outer layers are formulated with thermal and UV stabilizers to assure long outdoor life. A layer of polyester



scrim reinforcement placed between these plies greatly enhances tear resistance and increases service life. DURA•SKRIM's heavyduty diamond reinforcement responds to tears immediately by surrounding and stopping the tear.

### **Product Use**

DURA\*SKRIM® R20BDV is used in applications that require exceptional outdoor life and demand high puncture and excellent barrier properties. DURA\*SKRIM® R20BDV is manufactured from a very chemical-resistant, virgin polyethylene.

### Size & Packaging

DURA•SKRIM® R20BDV is available in a variety of widths and lengths. Panel sizes up to 57,000 square feet are available. All panels are accordion folded every six feet and tightly rolled on a heavy-duty core for ease of handling and time-saving installation.





Landfill Cover

Product	Part #
DURA+SKRIM	R20BDV

### **APPLICATIONS**

Underslab Vapor Retarders	Earthen Liners
Modular Tank Liners	Interim Landfill Caps
Daily Landfill Covers	Remediation Covers
Remediation Liners	<b>Erosion Control Covers</b>

# RUFCO® 2000B, 3000B & 4000B Meets GRI-GM17 Standard Specification



### **Product Description**

RUFCO® 2000B, 3000B and 4000B are membranes consisting of a very flexible, linear low-density polyethylene (LLDPE). LLDPE provides high elongation, tremendous tear resistance and bursting strength. A minimum carbon black content of 2.0% provides excellent protection from UV rays and harsh weather conditions. Manufactured from virgin resins, RUFCO® 2000B, 3000B and 4000B do not contain plasticizers which can migrate to the surface, causing premature aging.

### **Product Use**

RUFCO® 2000B, 3000B and 4000B are used in applications that require excellent outdoor longevity and chemical resistance. These are very flexible materials that will conform to uneven surfaces. Rufco® 2000B, 3000B and 4000B meet the GRI-GM17 Standard Specification.

### Size & Packaging

RUFCO® 2000B is available in 50,000 square foot panels and RUFCO® 3000B in up to 35,000 square foot panels. RUFCO® 4000B is available in up to 25,000 square foot panels. All panels are accordion folded and tightly rolled onto a heavy duty core for ease of handling and time saving installation.





Large Factory Welded Panel

Product	Part #
RUFCO	2000B
RUFCO	3000B
RUFCO	4000B

#### **APPLICATIONS**

Decorative Ponds	Oil Field Pit Liners
Pond/Canal Liners	Mine Tailing Ponds
Outdoor Covers	Interim Landfill Caps
Fire Ponds	Waste Water Ponds
Remediation Liners	Golf Course Pond Liners
Vapor Retarders	Farm Ponds
Brine Ponds	Leachate Collection Ponds

# **RUFCO**<sup>®</sup> 2000B, 3000B & 4000B

ISO 9001:2008
CERTIFIED MANAGEMENT SYSTEM

Meets GRI-GM17 Standard Specification

		RUFCO 2000B		RUFCO 3000B		RUFCO 4000B		
PROPERTIES	TEST METHOD	Min. Roll Averages	Typical Roll Averages	Min. Roll Averages	Typical Roll Averages	Min. Roll Averages	Typical Roll Averages	
THICKNESS mils, (mm)	ASTM D5199	20.0 (0.50)	21.0 (0.53)	30.0 (0.75)	31.2 (0.78)	40.0 (1.00)	41.5 (1.04)	
DENSITY g/cm³	ASTM D792 or ASTM D1505	0.939 Max.						
*Tensile Strength lbf/in. width, (N/mm width)	ASTM D6693 1. Tensile Strength at Break 2. % Elongation at Break	76 (13) 800	120 (21) 950	125 (22) 800	165 (29) 1000	180 (32) 800	220 (39) 1000	
*Tear Resistance lbf, (N)	ASTM D1004	11 (49)	14 (62)	16 (71)	20 (89)	22 (98)	27 (120)	
Puncture Resistance lbf, (N)	ASTM D4833	30 (133)	45 (200)	45 (200)	60 (267)	60 (267)	80 (356)	
CARBON BLACK %	ASTM D1603 D4218	2-3						
CARBON BLACK DISPERSION	ASTM D5596	Pass						
OXIDATIVE INDUCTION TIME (OIT) or HIGH PRESSURE OIT	ASTM D3895 ASTM D5885	>100 min. >400 min.						
Oven Aging at 85 <sup>0</sup> C (90 Days)	ASTM D5721/D5885	Pass		Pass		Pass		
UV Resistance (1600 Hours)	GRI GM11	Pass		Pass		Pass		
Maximum Use Temperature			180°F 82°C		180°F 82°C		180°F 82°C	
LOW TEMP, IMPACT FAILURE TEMP F, (C)	ASTM D746		<-70 (<-57)		-70 (<-57)		-70 (<-57)	
DIMENSIONAL STABILITY % CHANGE	ASTM D1204	<2						
MULTIAXIAL TENSION % ELONGATION	ASTM D5617	>90	>120	>90	>120	>90	>120	
Environmental Stress Crack Resistance Hours to Failure	ASTM D5397 Appendix A	>400						
Perms grains/ft²/hr/in. Hg (grams/m²/day/mm Hg)	ASTME96 Method 73 <sup>0</sup> F,50% RH		0.045 (0.030)		0.029 (0.019)		0.022 (0.014)	
FACTORY SEAM REQUIREMENTS								
Bonded Seam Strength Ibf/in width, (N/cm width)	ASTM D4545 Mod.**	40 (70)	45 (79)	60 (105)	70 (119)	75 (131)	80 (140)	
SEAM PEEL ADHESION Ibf/in width, (N/cm width)	ASTM D4545 Mod.**	30 (53)	40 (63)	45 (63)	60 (93)	70 (105)	85 (121)	

Nominal Weight /Thousand Square Feet: RUFCO 2000B - 100 lbs., RUFCO 3000B - 150 lbs., RUFCO 4000B - 200 lbs.

<sup>\*\*</sup> Raven Industries performs seam testing at 12" per minute.



RUFCO® 2000B, 3000B and 4000B are membranes consisting of a very flexible, linear low-density polyethylene (LLDPE). LLDPE provides high elongation, tremendous tear resistance and bursting strength. A minimum carbon black content of 2.0% provides excellent protection from UV rays and harsh weather conditions. Manufactured from virgin resins, RUFCO 2000B, 3000B and 4000B do not contain plasticizers which can migrate to the surface, causing premature aging.

Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance, odor transmission, longevity as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage. Limited Warranty available at www.RavenEFD.com



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<sup>\*</sup> Tests are an average of MD and TD directions.