

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



View of existing north fresh water frac pond (right) and South Pond (left)

**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 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266-0745

November 4, 2014

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

RE: BC Operating, Battle 1H South 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. Please withdraw the C-144 application transmitted to OCD on 10/27/14. Field measurement confirmed the size of this impoundment does not exceed 10-acre feet and the 10/30/14 meeting with Scott Dawson and Jim Griswold in Santa Fe created a different approach that is described in the Operations and Maintenance Plan.

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 a Variance request to allow an alternative closure method
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.

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

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...

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.

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.

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 inter-liner 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, 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 and the construction of the ponds we believe these data demonstrate that allowing storage of produced water provides equal protection of fresh water, public health and the environment than strict compliance with the Pit Rule.

BC  PERATING, INC.

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  PERATING, INC.

Crown Oil Partners V, LP
Crump Energy Partners II, LLC

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 H₂S 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

R.T. Hicks Consultants, Ltd.

901 Rio Grande Blvd. NW, Suite F-142
Albuquerque, NM 87104

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.

Pit, Below-Grade Tank, or
Proposed Alternative Method Permit or Closure Plan Application

- 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

Please 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 environment. Nor does approval relieve the operator of its responsibility to comply with any other applicable governmental authority's rules, regulations or ordinances.

1.
Operator: BC Operating, Inc OGRID #: 160825
Address: PO Box 50820, Midland, Texas 79710
Facility or well name: Battle 1H South Workover 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 32.442092701827 Longitude -103.552947058609 NAD: 1927 1983
Surface Owner: Federal State Private Tribal Trust or Indian Allotment

2.
 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 Other and 20 mil poly secondary liner
 String-Reinforced PRIMARY LINER ONLY
Liner Seams: Welded Factory Other _____ Volume 70,622 barrels (9.1 acre feet) Dimensions: L 200x W 200x D 13 feet

3.
 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: Thickness _____ mil HDPE PVC Other _____

4.
 Alternative Method:
Submittal of an exception request is required. Exceptions must be submitted to the Santa Fe Environmental Bureau office for consideration of approval.

5.
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 _____

6.

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.

Variations and Exceptions:

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 source material are provided below. Siting criteria does not apply to drying pads or above-grade tanks.*

General siting

Ground water is less than 25 feet below the bottom of a low chloride temporary pit or below-grade tank.

- NM Office of the State Engineer - iWATERS database search; USGS; Data obtained from nearby wells

- Yes No
- 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. **(Does not apply to below grade tanks) 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. **(Does not apply to below grade tanks) 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; Topographic map

- Yes No

Within a 100-year floodplain. **(Does not apply to below grade tanks) See Figure 9**

- FEMA map

- Yes No

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).

- Topographic map; Visual inspection (certification) of the proposed site

- Yes No

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 application.

- Visual inspection (certification) of the proposed site; Aerial photo; Satellite image

- Yes No

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** Yes No

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** Yes No

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 Yes No

Within 500 feet of a wetland.
 - US Fish and Wildlife Wetland Identification map; Topographic map; Visual inspection (certification) of the proposed site Yes No

10.
Temporary Pits, Emergency Pits, and Below-grade Tanks Permit Application Attachment 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 documents are 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 NMAC
 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 19.15.17.9 NMAC and 19.15.17.13 NMAC
 Previously Approved Design (attach copy of design) API Number: _____ or Permit Number: _____

11.
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 documents are 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 19.15.17.9 NMAC 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: _____

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 documents are attached.

- 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 19.15.17.12 NMAC
- Freeboard and Overtopping Prevention Plan - based upon the appropriate requirements of 19.15.17.11 NMAC
- Nuisance or Hazardous Odors, including H₂S, Prevention Plan
- Emergency Response Plan
- Oil Field Waste Stream Characterization
- Monitoring and Inspection Plan
- Erosion Control Plan
- Closure Plan - based upon the appropriate requirements of Subsection C of 19.15.17.9 NMAC and 19.15.17.13 NMAC

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 Fluid 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

14. **Waste Excavation and Removal Closure Plan Checklist:** (19.15.17.13 NMAC) **Instructions:** Each of the following items must be attached to the 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

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 source material are provided below. Requests regarding changes to certain siting criteria require justifications and/or demonstrations of equivalency. Please refer to 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	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> 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	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA
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	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA
Within 100 feet of a continuously flowing watercourse, or 200 feet of any other significant watercourse, lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark). - Topographic map; Visual inspection (certification) of the proposed site	<input type="checkbox"/> Yes <input type="checkbox"/> 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	<input type="checkbox"/> Yes <input type="checkbox"/> No
Within 300 horizontal feet of a private, domestic fresh water well or spring used for domestic or stock watering purposes, in existence at the time of initial application. - NM Office of the State Engineer - iWATERS database; Visual inspection (certification) of the proposed site	<input type="checkbox"/> Yes <input type="checkbox"/> No
Written confirmation or verification from the municipality; Written approval obtained from the municipality	<input type="checkbox"/> Yes <input type="checkbox"/> No
Within 300 feet of a wetland. US Fish and Wildlife Wetland Identification map; Topographic map; Visual inspection (certification) of the proposed site	<input type="checkbox"/> Yes <input type="checkbox"/> No
Within incorporated municipal boundaries or within a defined municipal fresh water well field covered under a municipal ordinance	<input type="checkbox"/> Yes <input type="checkbox"/> No

adopted pursuant to NMSA 1978, Section 3-27-3, as amended.

- Written confirmation or verification from the municipality; Written approval obtained from the municipality

Yes No

Within the area overlying a subsurface mine.

- Written confirmation or verification or map from the NM EMNRD-Mining and Mineral Division

Yes No

Within an unstable area.

- Engineering measures incorporated into the design; NM Bureau of Geology & Mineral Resources; USGS; NM Geological Society; Topographic map

Yes No

Within a 100-year floodplain.

- FEMA map

Yes No

16.

On-Site Closure Plan Checklist: (19.15.17.13 NMAC) *Instructions: Each of the following items must be attached to the closure plan. Please indicate, by a check mark in the box, that the documents are attached.*

- Siting Criteria Compliance Demonstrations - based upon the appropriate requirements of 19.15.17.10 NMAC
- Proof of Surface Owner Notice - based upon the appropriate requirements of Subsection E of 19.15.17.13 NMAC
- Construction/Design Plan of Burial Trench (if applicable) based upon the appropriate requirements of Subsection K of 19.15.17.11 NMAC
- Construction/Design Plan of Temporary Pit (for in-place burial of a drying pad) - based upon the appropriate requirements of 19.15.17.11 NMAC
- 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 19.15.17.13 NMAC
- Waste Material Sampling Plan - based upon the appropriate requirements of 19.15.17.13 NMAC
- Disposal Facility Name and Permit Number (for liquids, drilling fluids and drill cuttings or in case on-site closure standards cannot be achieved)
- Soil Cover Design - 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

17.

Operator Application Certification:

I hereby certify that the information submitted with this application is true, accurate and complete to the best of my knowledge and belief.

Name (Print): Randall Hicks Title: Agent

Signature:  Date: 11/4/2014

e-mail address: R@rthicksconsult.com Telephone: 505-266-5004

18.

OCD Approval: Permit Application (including closure plan) Closure Plan (only) OCD Conditions (see attachment)

OCD Representative Signature: _____ **Approval Date:** _____

Title: _____ **OCD Permit Number:** _____

19.

Closure Report (required within 60 days of closure completion): 19.15.17.13 NMAC

Instructions: Operators are required to obtain an approved closure plan prior to implementing any closure activities and submitting the closure report. The closure report is required to be submitted to the division within 60 days of the completion of the closure activities. Please do not complete this section of the form until an approved closure plan has been obtained and the closure activities have been completed.

Closure Completion Date: _____

20.

Closure Method:

- Waste Excavation and Removal On-Site Closure Method Alternative Closure Method Waste Removal (Closed-loop systems only)
- If different from approved plan, please explain.

21.

Closure Report Attachment Checklist: *Instructions: Each of the following items must be attached to the closure report. Please indicate, by a check 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 land only)
- Plot Plan (for on-site closures and temporary pits)
- Confirmation Sampling Analytical Results (if applicable)
- Waste Material Sampling Analytical Results (required for on-site closure)
- 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 _____ Longitude _____ NAD: 1927 1983

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: _____

Siting Criteria (19.15.17.10 NMAC) for BC Operating, Inc.:
South and North Temporary Workover Pits/Alternative Method
Battle No. 1H

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.



Siting Criteria (19.15.17.10 NMAC) for BC Operating, Inc.:
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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, 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.

Siting Criteria (19.15.17.10 NMAC) for BC Operating, Inc.:
South and North Temporary Workover Pits/Alternative Method
Battle No. 1H

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 Numbers (see Map)	Well Location						Well Source Information					Groundwater Elevation Data						Gauging Date	
	Township (south) Range (east) Section	Quarter Section OSE protocol (64, 16, 4)			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.)		
Misc- 72	21	33	18	2	1	1		✓	✓	✓	--	--	3,900	3,885	143	3,757	3,742	6/21/54	
Misc- 73	21	33	18	2	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		New Well		--	--	✓							
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	✓				✓	--		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		✓		✓	--	--	3,578	3,573	35	30.84	3,547	3,542	2/16/96

✓ 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

Siting Criteria (19.15.17.10 NMAC) for BC Operating, Inc.:
South and North Temporary Workover Pits/Alternative Method
Battle No. 1H

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

Siting Criteria (19.15.17.10 NMAC) for BC Operating, Inc.:
South and North Temporary Workover Pits/Alternative Method
Battle No. 1H

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.

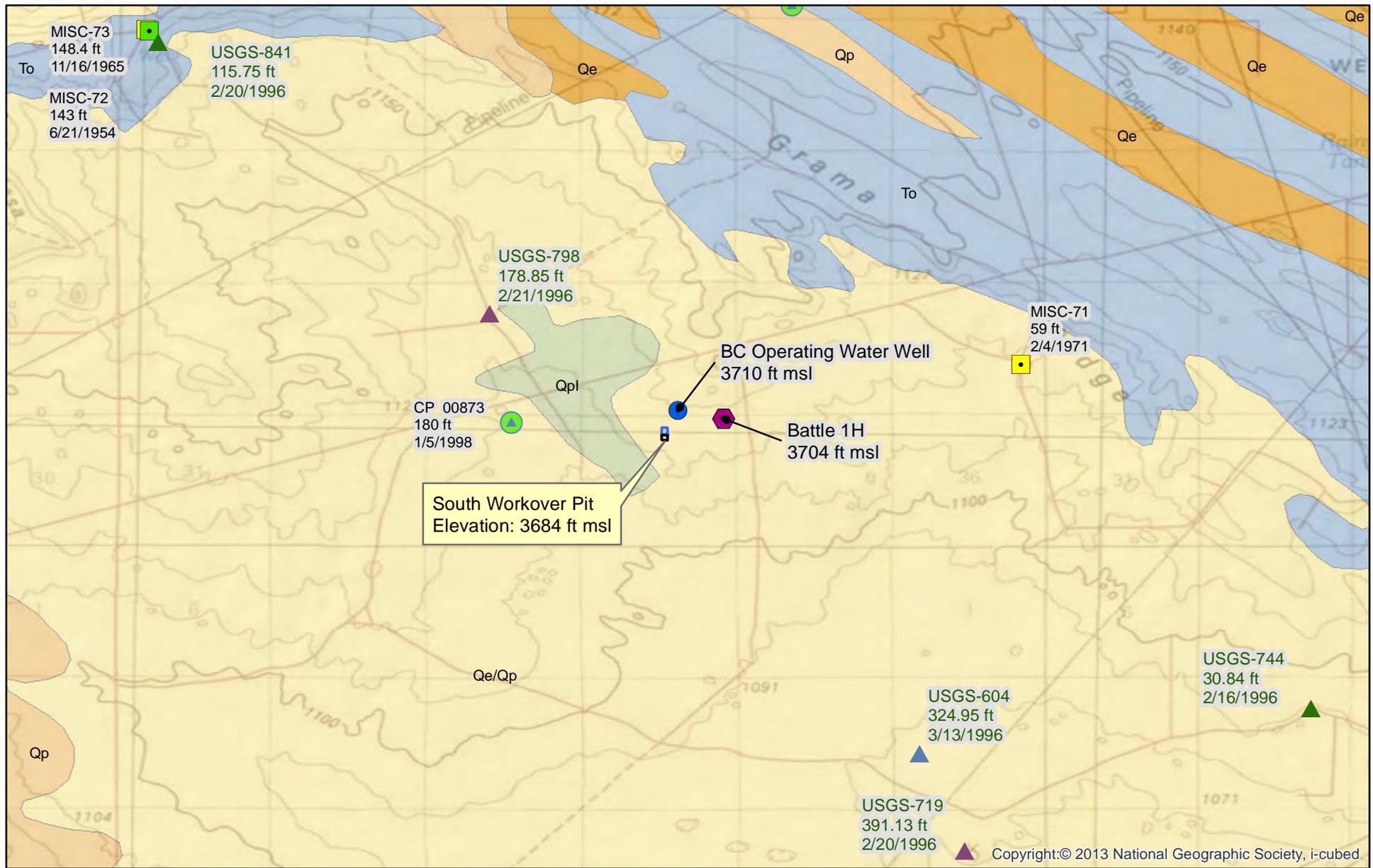
Distance to 100-Year Floodplain

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.

Siting Criteria (19.15.17.10 NMAC) for BC Operating, Inc.:
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Battle No. 1H

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



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Depth To Water and Geology

BC Operating: Battle 1H South Pit

Figure 1

October 2014

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)

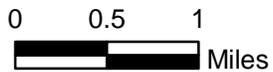
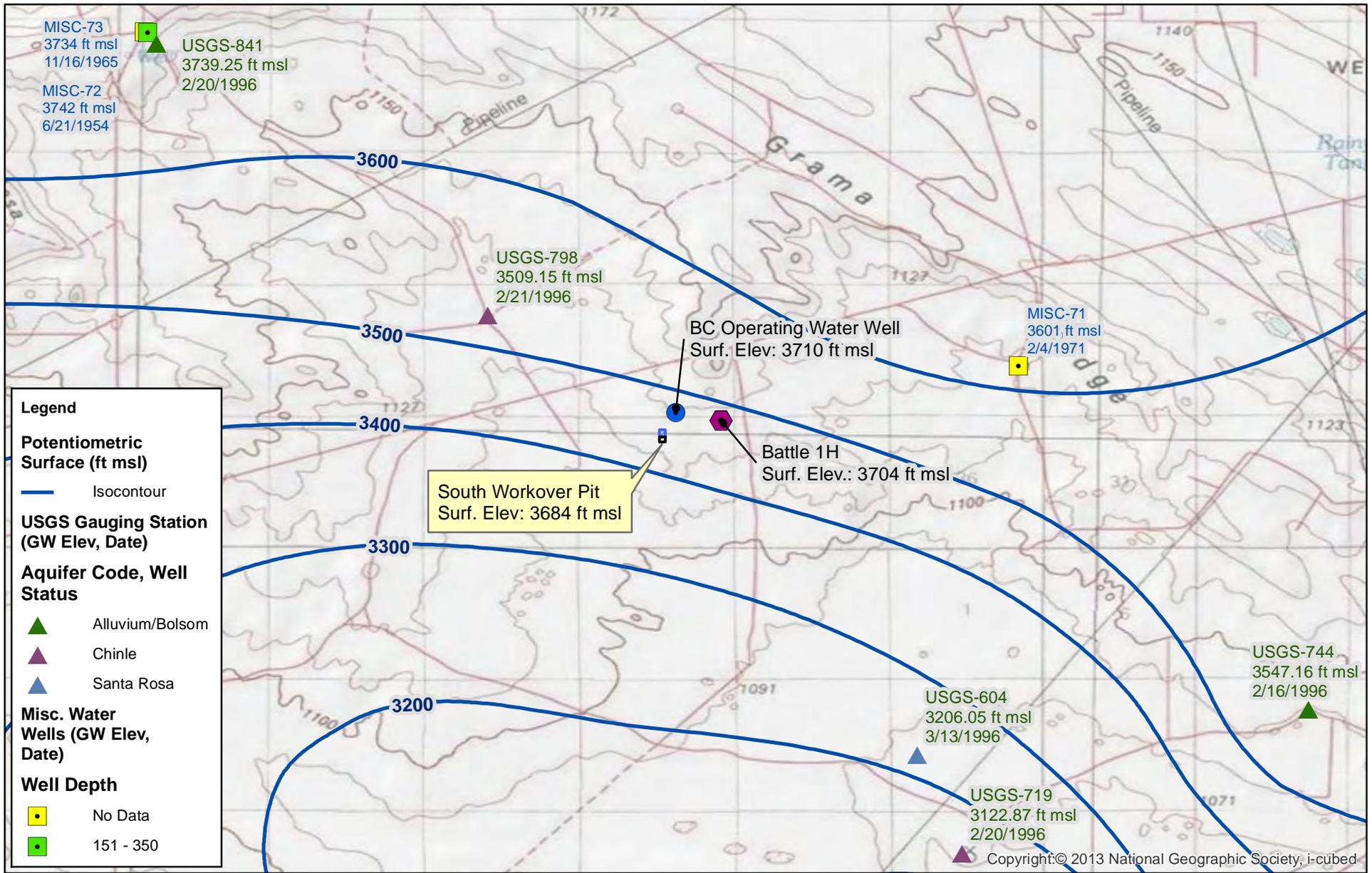
-  151 - 350

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 Albuquerque, NM 87104 Ph: 505.266.5004	Depth To Water and Geology	Figure 1 Legend
	BC Operating: Battle 1H Pit	October 2014



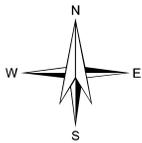
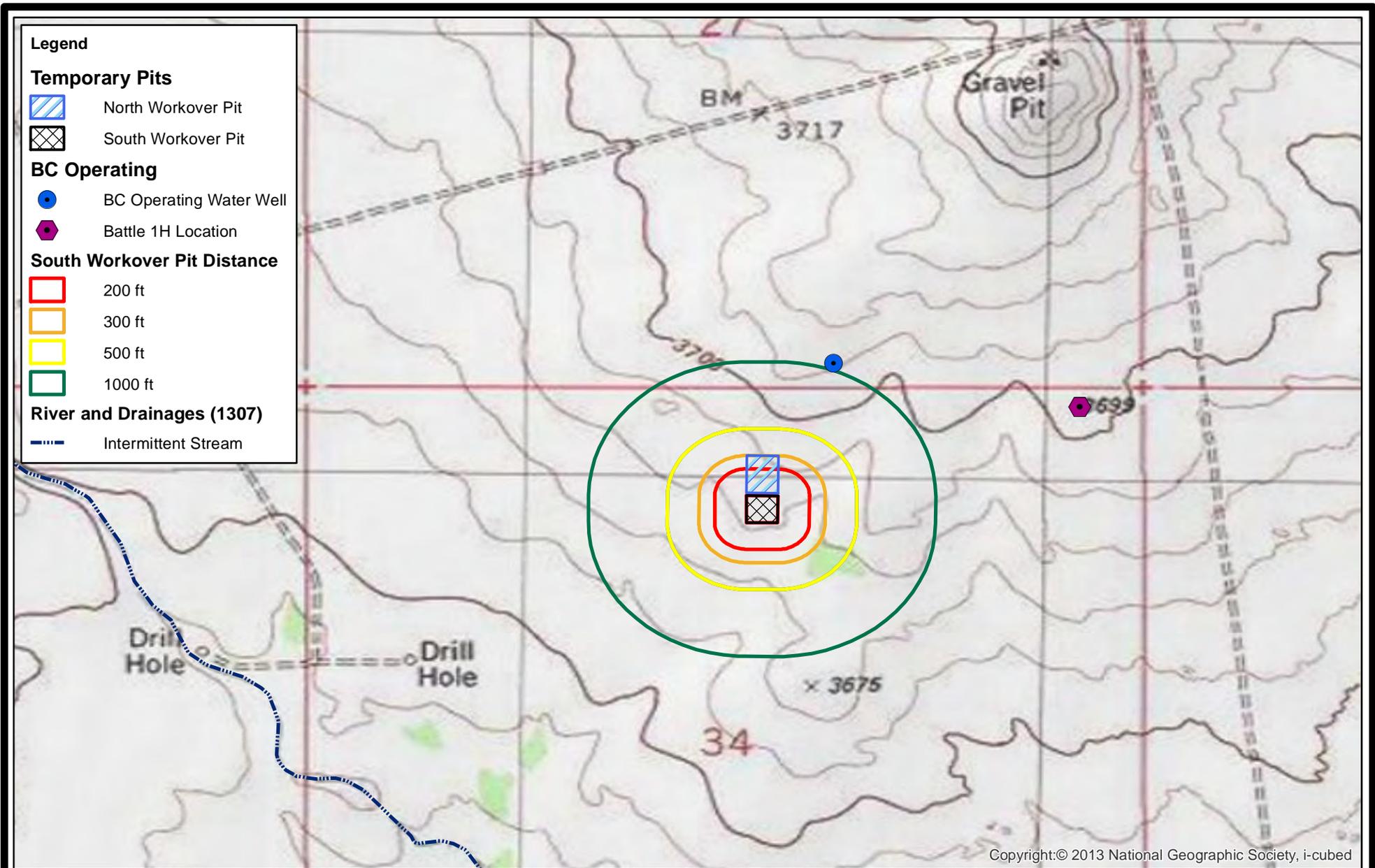
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Potentiometric Surface and Groundwater Elevation
 at Nearby Water Wells

BC Operating: Battle 1H South Pit

Figure 2

October 2014



0 500 1,000
Feet

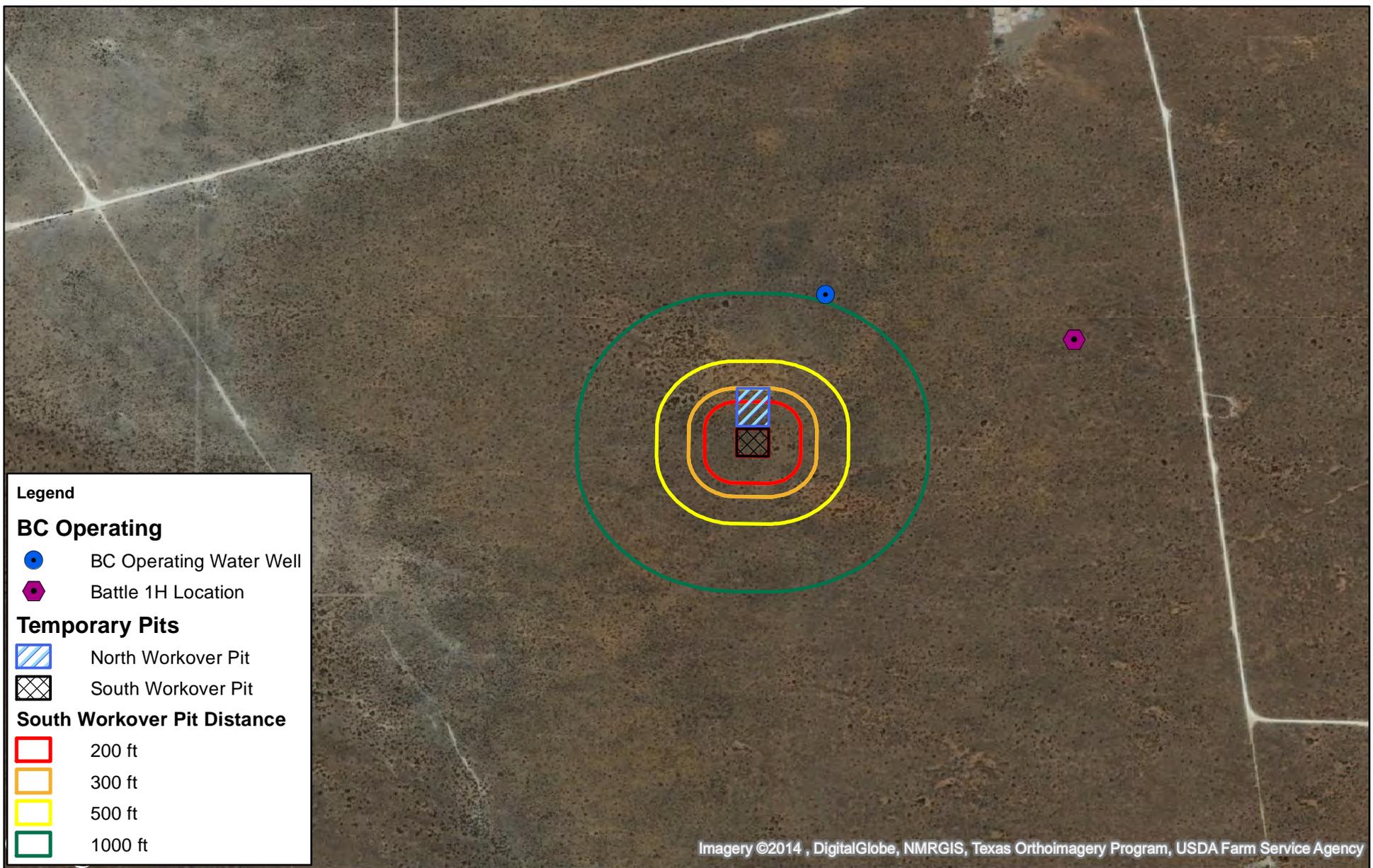
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Surface Water and Topography

BC Operating: Battle 1H South Pit

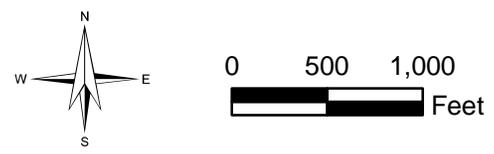
Figure 3

October 2014



- Legend**
- BC Operating**
-  BC Operating Water Well
 -  Battle 1H Location
- Temporary Pits**
-  North Workover Pit
 -  South Workover Pit
- South Workover Pit Distance**
-  200 ft
 -  300 ft
 -  500 ft
 -  1000 ft

Imagery ©2014 , DigitalGlobe, NMRGIS, Texas Orthoimagery Program, USDA Farm Service Agency



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Nearby Structures
BC Operating: Battle 1H South Pit

Figure 4
 October 2014

Legend

Well Field

Well Field Name

- No name provided
- City of Carlsbad - Double Eagle Wellfield
- City of Carlsbad - Sheep Draw Wellfield



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013



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Nearby Municipalities and Well Fields

BC Operating: Battle 1H South Pit

Figure 5

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Nearby Wetlands
BC Operating: Battle 1H South Pit

Figure 6
October 2014

Legend

Temporary Pits

-  North Workover Pit
-  South Workover Pit

South Workover Pit Distance

-  200 ft
-  300 ft
-  500 ft
-  1000 ft

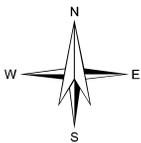
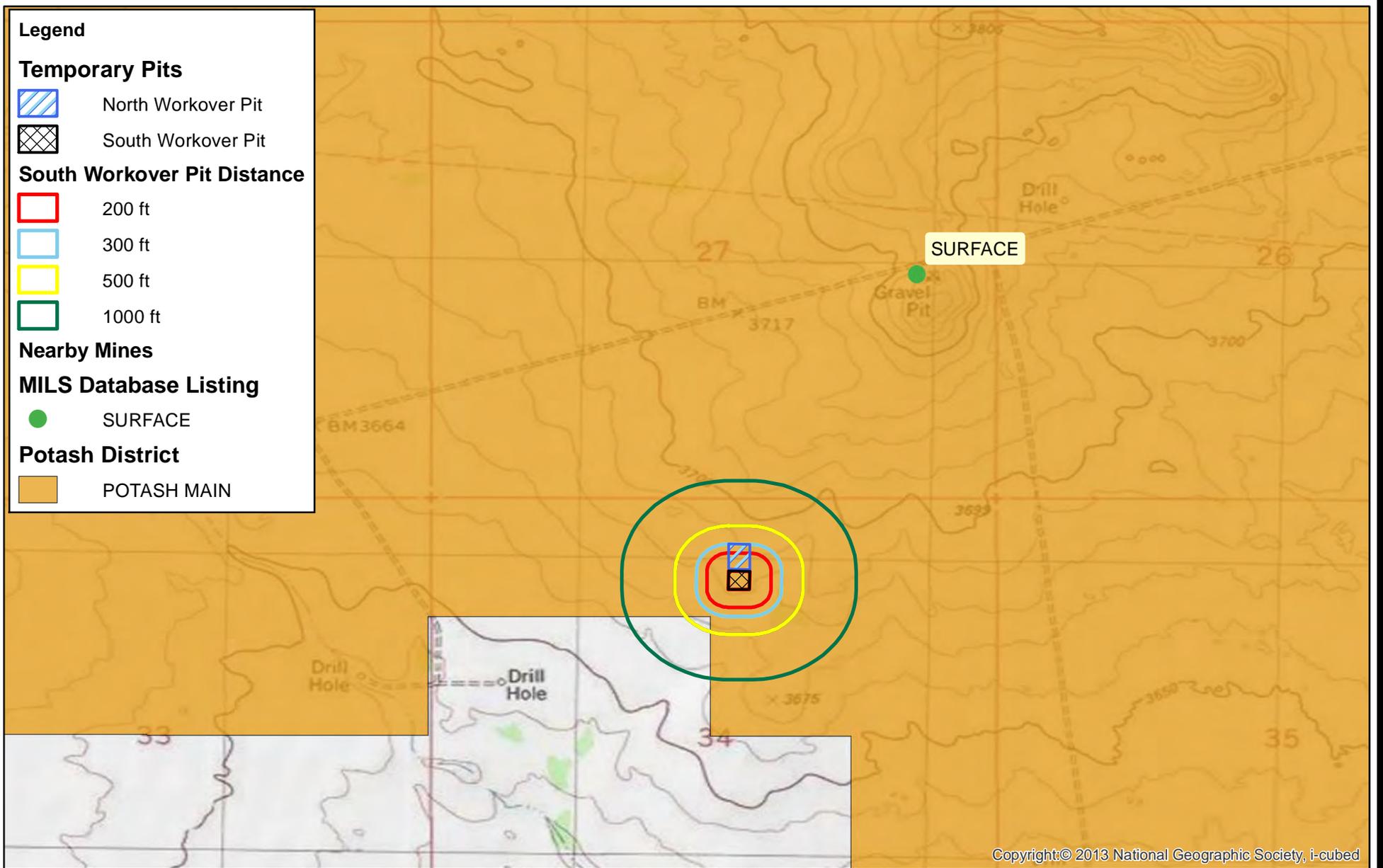
Nearby Mines

MILS Database Listing

-  SURFACE

Potash District

-  POTASH MAIN



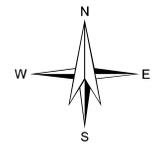
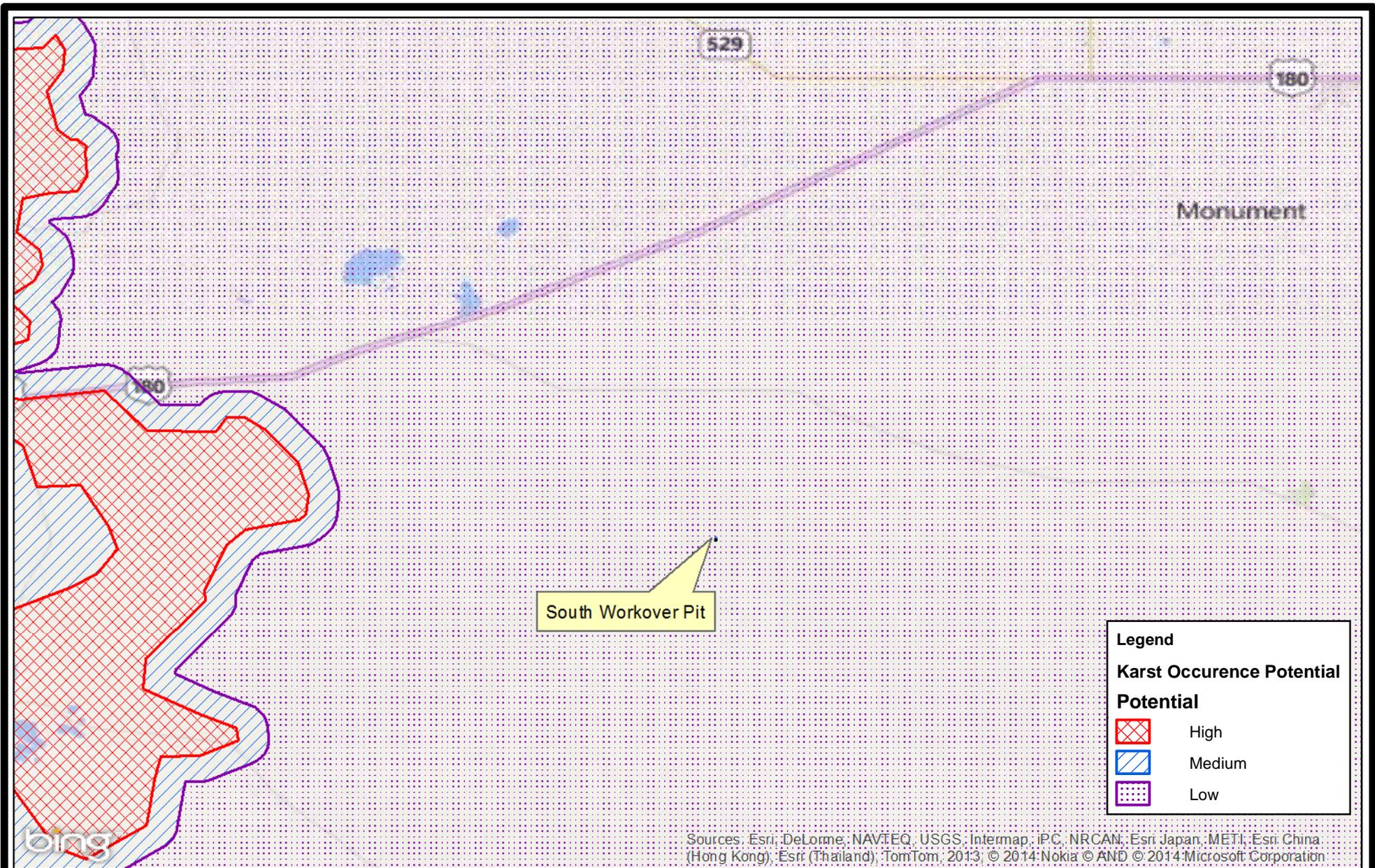
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Nearby Mines and Minerals

BC Operating: Battle 1H South Pit

Figure 7

October 2014



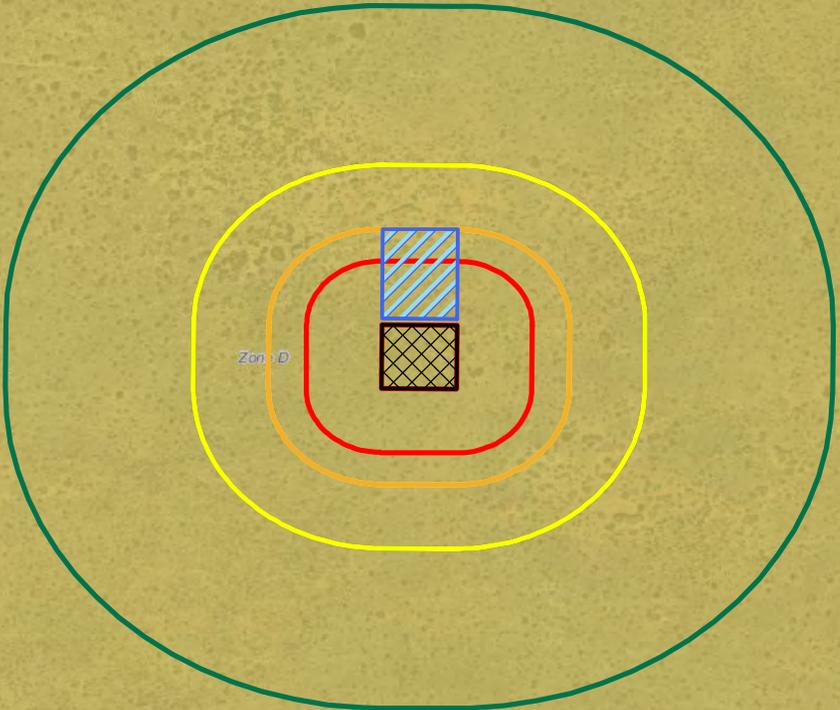
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Karst Potential

BC Operating: Battle 1H South Pit

Figure 8

October 2014



Legend

Temporary Pits

-  North Workover Pit
-  South Workover Pit

South Workover Pit Distance

-  200 ft
-  300 ft
-  500 ft
-  1000 ft

National Flood Hazard Layer

-  Areas with possible but undetermined Flood Hazard. No flood hazard analysis has been conducted (Zone D).

Google 2014, Imagery ©2014, DigitalGlobe, NMRGIS, Texas Orthoimagery Program, USDA Farm Service Agency

FEMA Source: <https://hazards.fema.gov/gis/nfh/services/public/NFHLWMS/MapServer/WMS/Server>



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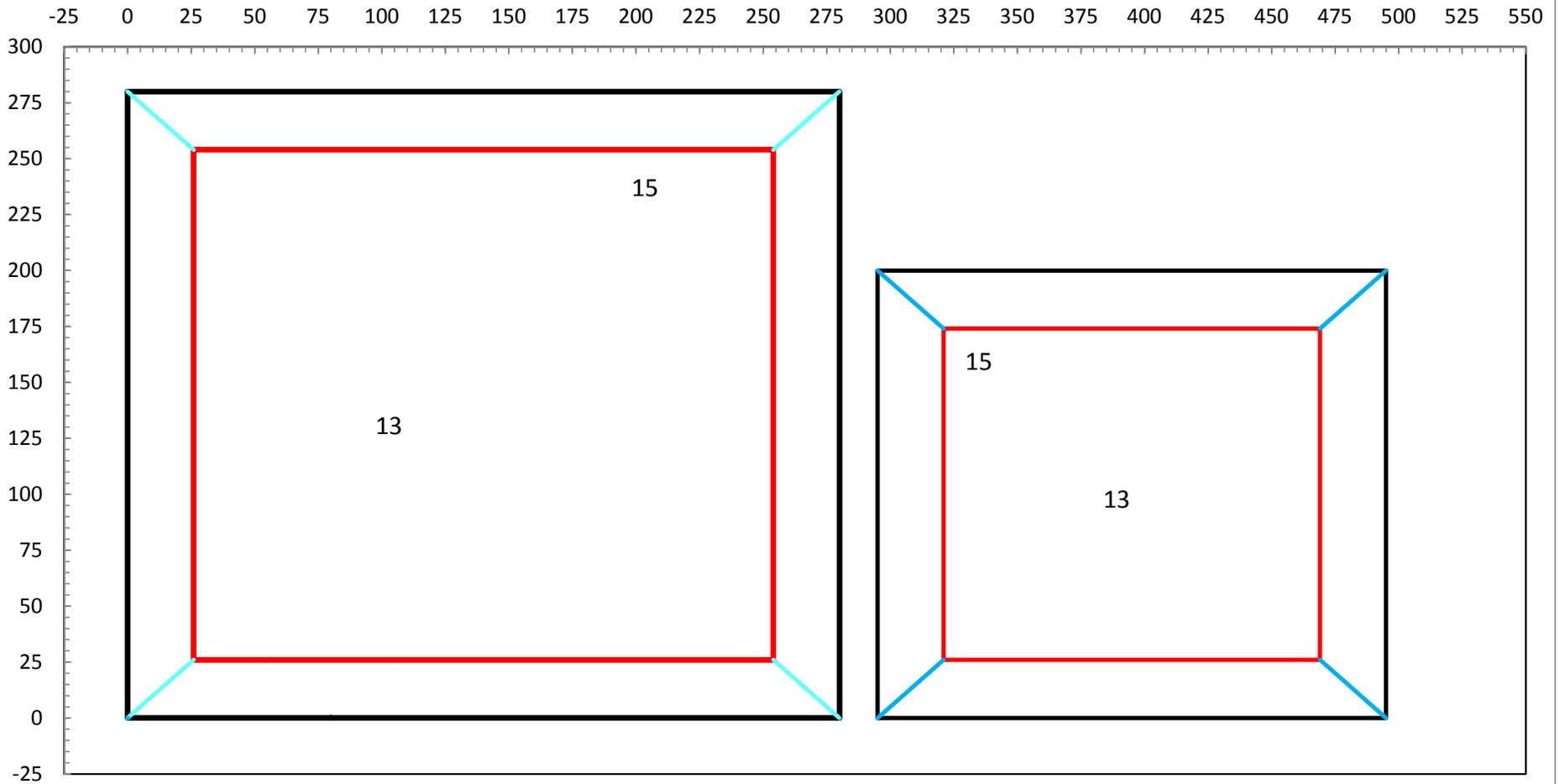
FEMA Flood Map
BC Operating: Battle 1H Pit

Figure 9
 October 2014

Site Specific Information Plate

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Slopes of Pit Horizontal Distance 2.00
 Slopes of Pit Vertical Distance 1.00

North ←

North Impoundment

Total Width (left right) 280.0 ft
 Total Length (up down) 280.0 ft
 Depth 13.0 ft
 Sump Depth 15 ft
 Width/length of floor 148.0 ft

South Impoundment

Total Width (left right) 200.0 ft
 Total Length (up down) 200.0 ft
 Depth 13.0 ft
 Sump Depth 15 ft
 Width of floor 200.0 ft

Capacity 149,902 bbls
 19 ac-ft

Capacity 70,622.57 bbls
 9.10 ac-ft

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Drawing of Impoundments

Plate 1

BP Operating - Battle 1H Workover Pits

November 2014

Site Inspection Photographs

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



View of undisturbed landscape near r qpf u.



The North Rqpf (left) is higher than the South Rqpf (right). Fresh water is in both r qpf u'at the time of the photograph



View south from between r qpf u shows how the South Rqpf levee is above natural grade.

Plans for K cf_cj Yf Pit

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Design/Construction Plan

Plate 1 shows the design of the temporary workover pits proposed for this project. The workover pits will store untreated produced water in the south pit and treated 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 newly-constructed (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. overlapped 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 corners 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 Operating (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 H₂S 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

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

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

Ujcb'cb'7 cbgfi Wjcb'UbX' @bYfg



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 1×10^{-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,

A handwritten signature in black ink that reads "Justin Norberg". The signature is written in a cursive, slightly slanted style.

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

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 | Remediation Covers |
| 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

PROPERTIES	TEST METHOD	DURA♦SKRIM K30B		DURA♦SKRIM K36B		DURA♦SKRIM K45B	
		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/YD²)		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	

*Raven modified QC procedure

PRO-FORMA Sheet Contents:

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



Scan QR Code to download current technical data sheets via the Raven website.

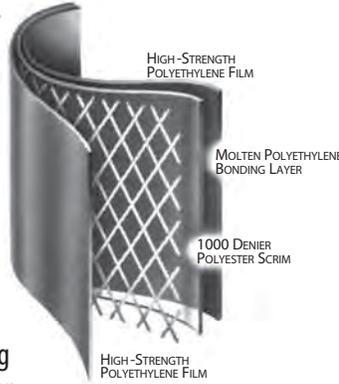


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Email: efdsales@ravenind.com
www.ravenefd.com
1/11 EFD 1251

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 heavy-duty 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 | Erosion Control Covers |

Product Description

RUF^{CO}® 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, RUF^{CO}® 2000B, 3000B and 4000B do not contain plasticizers which can migrate to the surface, causing premature aging.

Product Use

RUF^{CO}® 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. RUF^{CO}® 2000B, 3000B and 4000B meet the GRI-GM17 Standard Specification.

Size & Packaging

RUF^{CO}® 2000B is available in 50,000 square foot panels and RUF^{CO}® 3000B in up to 35,000 square foot panels. RUF^{CO}® 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.



Holding Pond



Large Factory Welded Panel

Product	Part #
RUF ^{CO}	2000B
RUF ^{CO}	3000B
RUF ^{CO}	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 |

PROPERTIES	TEST METHOD	RUF ^{CO} 2000B		RUF ^{CO} 3000B		RUF ^{CO} 4000B	
		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/cm ³	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 85⁰C (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/ft ² /hr/in. Hg (grams/m ² /day/mm Hg)	ASTM E96 Method 73 °F, 50% RH		0.045 (0.030)		0.029 (0.019)		0.022 (0.014)
FACTORY SEAM REQUIREMENTS							
BONDED SEAM STRENGTH lbf/in width, (N/cm width)	ASTM D4545 Mod.**	40 (70)	45 (79)	60 (105)	70 (119)	75 (131)	80 (140)
SEAM PEEL ADHESION lbf/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: RUF^{CO} 2000B - 100 lbs., RUF^{CO} 3000B - 150 lbs., RUF^{CO} 4000B - 200 lbs.

* Tests are an average of MD and TD directions.

** Raven Industries performs seam testing at 12" per minute.



RUF^{CO}® 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, RUF^{CO} 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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