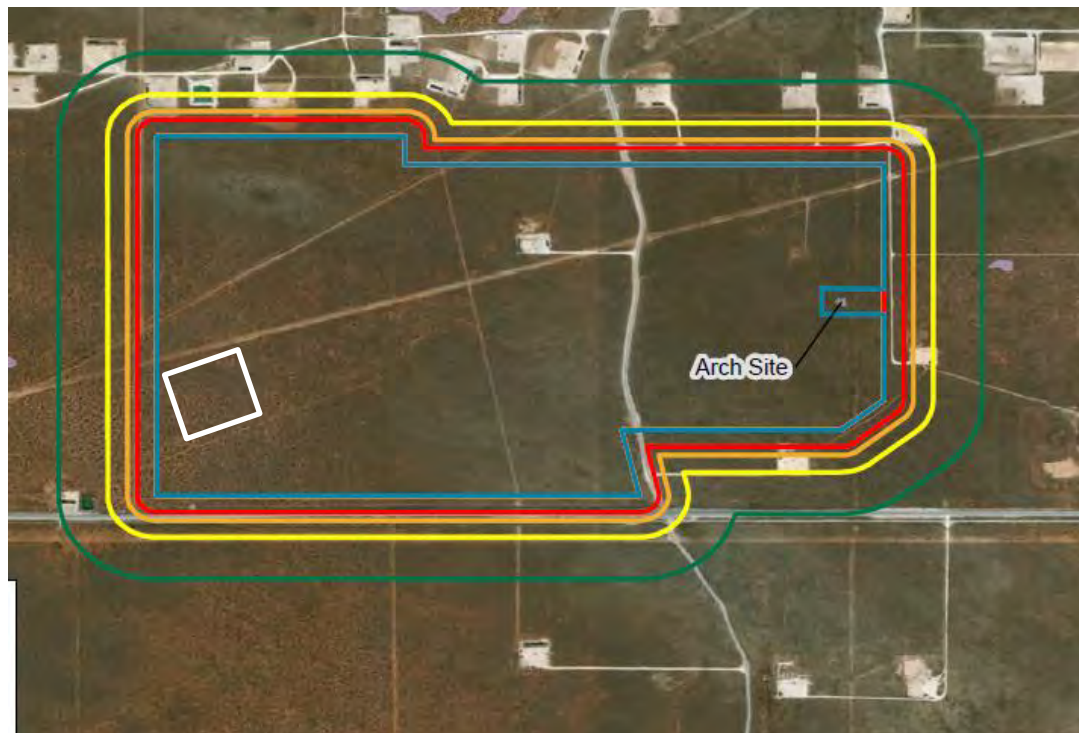


June 2021

# **C-147 Submission Package for North Olympus Recycling Facility and AST Containment Section 16 T24S R33E, Lea County**



*Recent air photo showing the area described in the siting criteria demonstration of this permit. The Olympus AST Containment and Recycling Facility east of the freshwater pond in the southwest quadrant of the area. The EOG Galaxy Recycling Facility (IRF-25) is within the northwest quadrant of the area discussed in the siting criteria.*

**Prepared for:  
TAP ROCK OPERATING, LLC  
602 Park Point Drive  
Golden, CO 80401**

**Prepared by:  
R.T. Hicks Consultants, Ltd.  
901 Rio Grande NW F-142  
Albuquerque, New Mexico**

# R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Since 1996

June 22, 2021

Mr. Mike Bratcher  
NMOCD - District 2, Supervisor  
811 S. First St.  
Artesia, NM 88210  
Via E-Mail

Ms. Victoria Venegas  
NMOCD - District 2  
811 S. First St.  
Artesia, NM 88210  
Via E-Mail

RE: Tap Rock North Olympus AST Containment  
Section 15 T24S R33E, Lea County  
C-147 Volume 1 and Volume 2

Dear Mr. Bratcher and Ms. Venegas:

On behalf of Tap Rock Operating, LLC, R.T. Hicks Consultants is pleased submit a permit for the above-referenced project that consists of one (1) AST Containment. Both documents will be transmitted to OCD via the OCD Online portal. Please note that Tap Rock plans to begin filling the AST with produced water on or about July 29, 2021. We appreciate your timely review.

Volume 1 contains:

- C-147 form signed by the operator,
- AST Operations and Closure Plans (except for some minor syntax/grammar changes, these are verbatim from the approved Pintail AST Containment),
- Siting Criteria Demonstration.

Hicks Consultants affirms that:

- The location meets all siting criteria in the Rule and the location meets the specified setback criteria,
- We conducted a foot survey (in 2018) to check that all setback criteria are met,
- The Operation and Maintenance Plan and Closure Plan are consistent with the Rule and previously approved by OCD.

Volume 2 contains information specific to the design and construction of the proposed AST and variance requests to cause the AST to conform to Rule 34. Specifically, you will find:

- Engineering drawings applicable for the proposed 80,000 bbl. AST Containment that are verbatim from the previously approved Well Water Solutions package for the Zia Hills permit,
- The Design/Construction Plan verbatim from the recently approved Pintail AST Containment (1RG-454), except for minor syntax/grammar changes
- The manual for AST set up from WWS,
- Variances for AST Storage Containments – all of which have been approved by OCD previously (e.g. Pintail Containment).

June 22, 2021

Page 2

In compliance with 19.15.34.10 of the Rule, the original submission was copied to the NM State Land Office who is the owner of the surface upon which the containment will be constructed.

If you have any questions or concerns regarding this registration or the attached C-147, please contact me. As always, we appreciate your work ethic and attention to detail.

Sincerely,  
R.T. Hicks Consultants

A handwritten signature in black ink, appearing to read "Randall T. Hicks". The signature is stylized with a large, looped "R" and a cursive "H".

Randall T. Hicks PGPrincipal

Copy: Tap Rock Operating, LLC  
State Land Office

**C-147**



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-147  
Revised April 3, 2017

## Recycling Facility and/or Recycling Containment

**Type of Facility:** ☒ Recycling Facility ☒ Recycling Containment\*  
**Type of action:** ☒ Permit ☐ Registration  
☐ Modification ☐ Extension  
☐ Closure ☐ Other (explain) \_\_\_\_\_

\* At the time C-147 is submitted to the division for a Recycling Containment, a copy shall be provided to the surface owner.

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: Tap Rock Operating, LLC OGRID #: 372043  
Address: 523 Park Point Drive Suite 200, Golden, CO, 80401  
Facility or well name (include API# if associated with a well): North Olympus Recycling Facility and Containment  
OCD Permit Number: \_\_\_\_\_ (For new facilities the permit number will be assigned by the district office)  
U/L or Qtr/Qtr K Section 16 Township 24S Range 33E County: Lea  
Surface Owner: ☐ Federal ☒ State ☐ Private ☐ Tribal Trust or Indian Allotment

2.

☒ **Recycling Facility:**  
Location of (if applicable): Latitude 32.2155056° Longitude -103.5790828° NAD83 (Approximate)  
Proposed Use: ☐ Drilling\* ☒ Completion\* ☐ Production\* ☐ Plugging\*  
*\*The re-use of produced water may NOT be used until freshwater zones are cased and cemented.*  
☐ Other, *requires permit for other uses. Describe use, process, testing, volume of produced water and ensure there will be no adverse impact on groundwater or surface water.*  
☒ Fluid Storage  
☒ Above ground tanks ☐ Recycling containment ☐ Activity permitted under 19.15.17 NMAC explain type \_\_\_\_\_  
☐ Activity permitted under 19.15.36 NMAC explain type: \_\_\_\_\_ ☐ Other explain \_\_\_\_\_  
☐ For multiple or additional recycling containments, attach design and location information of each containment  
☐ **Closure Report (required within 60 days of closure completion):** ☐ Recycling Facility Closure Completion Date: \_\_\_\_\_

3.

☒ **Recycling Containment:**  
☐ Annual Extension after initial 5 years (attach summary of monthly leak detection inspections for previous year)  
Center of Recycling **See Attachment (adjacent):** (if applicable) Latitude 32.2155056° Longitude -103.5790828° NAD83 (Approximate)  
☐ For multiple or additional recycling containments, attach design and location information of each containment:  
☒ Lined ☐ Liner type: Thickness: **SEE DRAWINGS** ☒ LLDPE ☐ HDPE ☐ PVC ☐ Other  
Primary liner 30 mil LLDPE; Secondary liner 40 mil LLDPE . SEE DRAWINGS ☐ String-Reinforced  
Liner Seams: ☒ Welded ☐ Factory ☐ Other \_ Volume: SEE DRAWINGS Dimensions: (Inside dimensions) SEE DRAWINGS  
☐ Recycling Containment Closure Completion Date: \_\_\_\_\_

4.

**Bonding:**

- ☒ Covered under bonding pursuant to 19.15.8 NMAC per 19.15.34.15(A)(2) NMAC (These containments are limited to only the wells owned or operated by the owners of the containment.)
- ☐ Bonding in accordance with 19.15.34.15(A)(1). Amount of bond \$\_\_\_\_\_ (work on these facilities cannot commence until bonding amounts are approved)
- ☐ Attach closure cost estimate and documentation on how the closure cost was calculated.

5. **Fencing:**

- ☒ Four-foot height, four strands of barbed wire evenly spaced between one and four feet.
- ☐ Alternate. Please specify \_\_\_\_\_

6. **Signs:**

- ☐ 12"x 24", 2" lettering, providing Operator's name, site location, and emergency telephone numbers
- ☒ Signed in compliance with 19.15.16.8 NMAC

7. **Variances:**

Justifications and/or demonstrations that the proposed variance will afford reasonable protection against contamination of fresh water, human health, and the environment.

**Check the below box only if a variance is requested:**

- ☒ Variance(s): Requests must be submitted to the appropriate division district for consideration of approval. If a Variance is requested, include the variance information on a separate page and attach it to the C-147 as part of the application.

**If a Variance is requested, it must be approved prior to implementation. See Volume 2**

8. **Siting Criteria for Recycling Containment**

**Instructions: The applicant must provide attachments that demonstrate compliance for each siting criteria below as part of the application. Potential examples of the siting attachment source material are provided below under each criteria**

**General siting****Ground water is less than 50 feet below the bottom of the Recycling Containment.**

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

☐ Yes ☒ No  
☐ NA

- Written confirmation or verification from the municipality; written approval obtained from the municipality **FIGURE 5**

Within the area overlying a subsurface mine.

☐ Yes ☒ No

- Written confirmation or verification or map from the NM EMNRD-Mining and Minerals Division **FIGURE 7**

Within an unstable area.

☐ Yes ☒ No

- Engineering measures incorporated into the design; NM Bureau of Geology & Mineral Resources; USGS; NM Geological Society; topographic map **FIGURE 8**

Within a 100-year floodplain. FEMA map **FIGURE 9**

☐ Yes ☒ No

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).

☐ Yes ☒ No

- Topographic map; visual inspection (certification) of the proposed site **FIGURE 3**

Within 1000 feet from a permanent residence, school, hospital, institution, or church in existence at the time of initial application.

☐ Yes ☒ No

- Visual inspection (certification) of the proposed site; aerial photo; satellite image **FIGURE 4**

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. **FIGURES 1 and 3**

☐ Yes ☒ No

- NM Office of the State Engineer - iWATERS database search; visual inspection (certification) of the proposed site

Within 500 feet of a wetland. **FIGURE 6**

☐ Yes ☒ No

- US Fish and Wildlife Wetland Identification map; topographic map; visual inspection (certification) of the proposed site

9.

**Recycling Facility and/or Containment Checklist:**

*Instructions: Each of the following items must be attached to the application. Indicate, by a check mark in the box, that the documents are attached.*

- ☒ Design Plan - based upon the appropriate requirements.  
☒ Operating and Maintenance Plan - based upon the appropriate requirements.  
☒ Closure Plan - based upon the appropriate requirements.  
☒ Site Specific Groundwater Data -  
☒ Siting Criteria Compliance Demonstrations -  
☒ Certify that notice of the C-147 (only) has been sent to the surface owner(s)

10.

**Operator Application Certification:**

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

Name (Print):

Phil Churchwell

Title:

Completions Engineer

Signature:



Date:

6-22-21

e-mail address:

pchurchwell@taprk.com

Telephone:

661-303-5085

11.

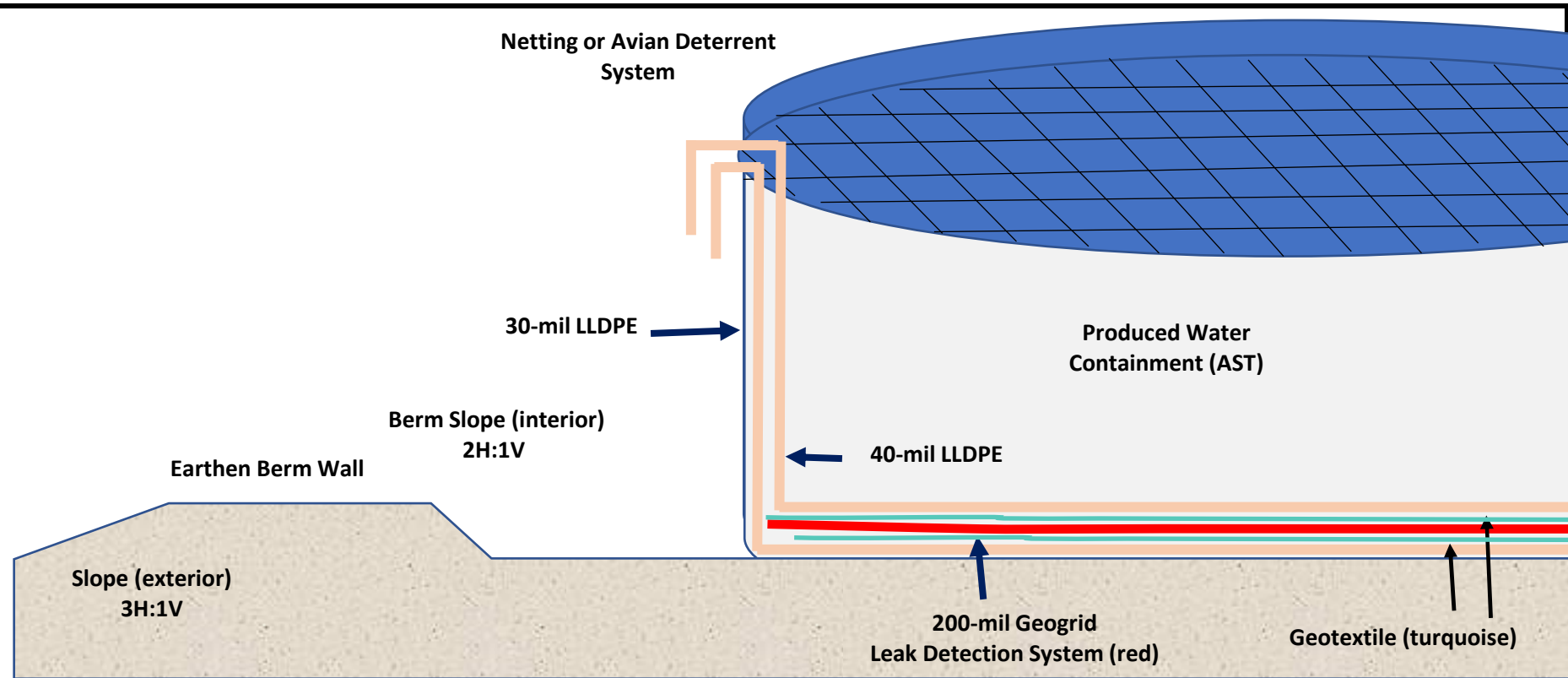
OCD Representative Signature: \_\_\_\_\_

Approval Date: \_\_\_\_\_

Title: \_\_\_\_\_

OCD Permit Number: \_\_\_\_\_

- ☐ OCD Conditions \_\_\_\_\_  
☐ Additional OCD Conditions on Attachment \_\_\_\_\_



### Description of Leak Detection System

- 40-mil LLDPE comprise primary liner and 30-mil LLDPE comprise the secondary liner
- 200-mil geogrid drainage layer lies between the primary and secondary liner per Plate 2
- Geotextile between the geogrid and each liner
- > 3-inch deep sump excavated on down slope side of AST per Sump Design Drawing
- A small hose runs from the collection sump to top of AST via tube (see Section D)
- Every week, a portable self-priming peristaltic pump connects to the leak detection system.
- The self-priming pump discharge hose runs back into the AST, on top of the primary liner
- If fluid is detected, it is tested for conductance to determine the origin of the water (i.e. produced water or condensation)

R.T. Hicks Consultants  
Albuquerque, NM

Design Sketch

Plate 1

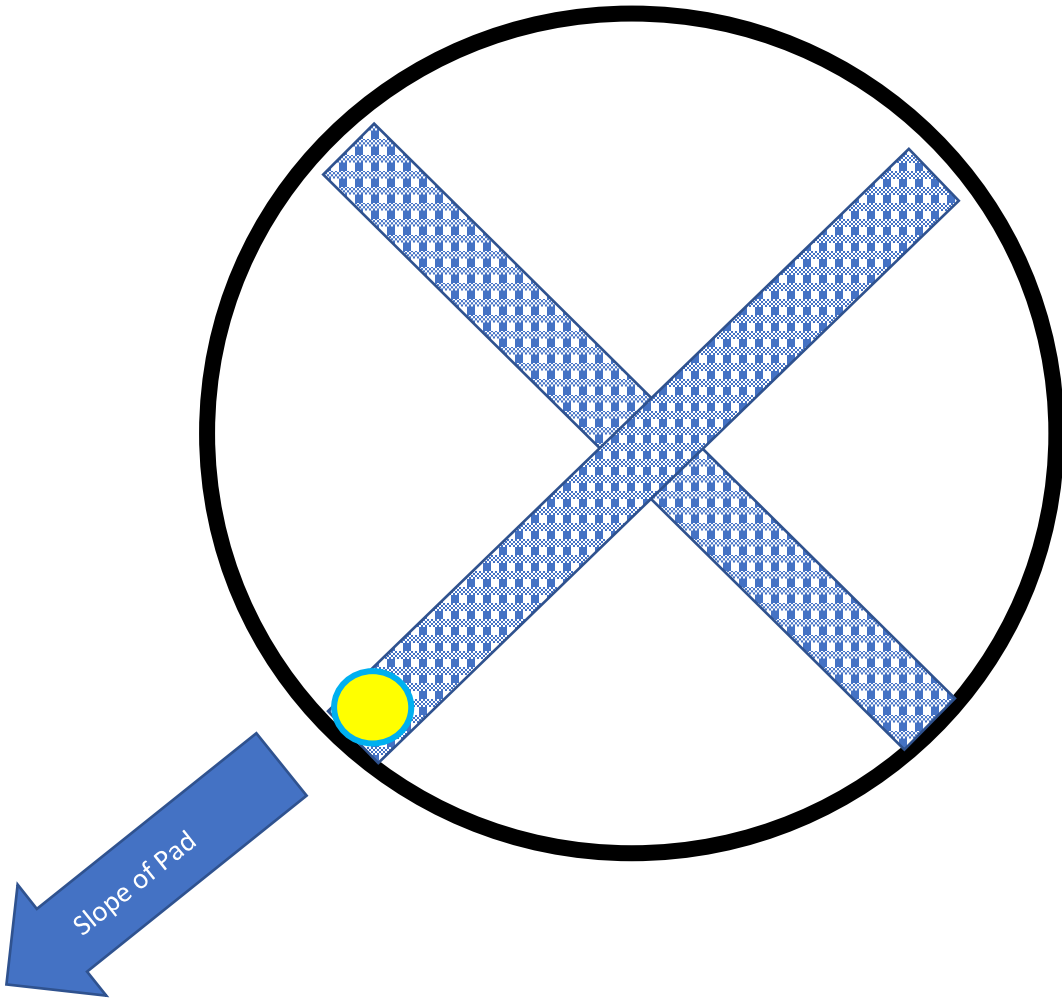
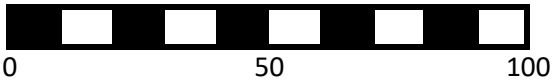
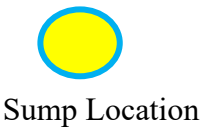
Well Water Solutions

June 2021

Use laser level to determine slope of pad and low point of AST

- 200 mil geogrid placed
  - above 8-oz geotextile and 30-mil secondary liner
  - inside of AST after set up, before install of primary liner
  - below 40-mil primary liner
- geotextile is placed
  - over the 30-mil LLDPE liner inside the steel AST ring
  - under the 40-mil primary liner inside the AST

Sump at lowest point of the AST set up



R.T. Hicks Consultants Albuquerque, NM	Layout of Geogrid Drainage Mat	Plate 2
	WWS - North Olympus AST	June 2021

# **Design and Construction Plan Operation and Maintenance Plan Closure Plan**

## Design and Construction Plan Above Ground Tank (AST) Containments

### General

Examination of the engineering drawings and the SOP for set-up (Appendix Engineering Drawings, Liner Specifications, Set Up) plus the history of solid performance of these AST Containments demonstrates that the AST Containment is designed and will be assembled to ensure the confinement of produced water, to prevent releases and to prevent overtopping due to wave action or rainfall. As the AST Containments are generally less than 190 feet in diameter, wave action is not a meaningful consideration.

These AST Containments are constructed of 12-foot high steel panels and are netted or employ the Mega Blaster Pro avian deterrent system to prevent ingress of migratory birds. AST Containments will be enclosed by a 4-strand barbed wire fence. Thus, complies with the Rule to fence or enclose a recycling containment in a manner that deters unauthorized wildlife and human access and shall maintain the fences in good repair.

The operator shall post an upright sign no less than 12 inches by 24 inches with lettering not less than two inches in height in conspicuous places surrounding the containment. The operator shall post the sign in a manner and location such that a person can easily read the legend. The sign shall provide the following information: the operator's name, the location of the site by quarter-quarter or unit letter, section, township and range, and emergency telephone numbers.

### Site Preparation

#### *Foundation for AST Containment*

Preparation of the soils on site is required to form a dependable base for the AST Containment in accordance with the SOP. If the location of the AST Containment is on an existing pad, the operator has stripped and stockpiled the topsoil for use as the final cover or fill at the time of closure. If the pad is new construction, the operator will strip and stockpile the soil for reclamation upon cessation of site activities.

#### 19.15.34.12 A

(1) The operator shall design and construct a recycling containment to ensure the confinement of produced water, to prevent releases and to prevent overtopping due to wave action or rainfall.

#### 19.15.34.12 D

(1) The operator shall fence or enclose a recycling containment in a manner that deters unauthorized wildlife and human access and shall maintain the fences in good repair. The operator shall ensure that all gates associated with the fence are closed and locked when responsible personnel are not onsite.

#### 19.15.34.12 C

Signs. The operator shall post an upright sign no less than 12 inches by 24 inches with lettering not less than two inches in height in a conspicuous place on the fence surrounding the containment. The operator shall post the sign in a manner and location such that a person can easily read the legend. The sign shall provide the following information: the operator's name, the location of the site by quarter-quarter or unit letter, section, township and range, and emergency telephone numbers.

#### 19.15.34.12 B

Stockpiling of topsoil. Prior to constructing containment, the operator shall strip and stockpile the topsoil for use as the final cover or fill at the time of closure.



## Design and Construction Plan Above Ground Tank (AST) Containments

The foundation soils must be roller compacted smooth and free of loose aggregate over ½ inch. Compaction characteristics must meet or exceed 95% of Standard Proctor Density in accordance with ASTM D 698.

Examination of the SOP shows that the AST Containment contractor will conform to the following mandates of the Rule:

- the AST Containment will have a properly constructed compacted earth foundation and interior slopes (vertical steel) consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear.
- Geotextile will be placed under the liner where needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity.
- If the AST Containment contractor constructs the containment in a levee, the inside grade is no steeper than two horizontal feet to one vertical foot (2H: 1V) and the outside grade no steeper than three horizontal feet to one vertical foot (3H: 1V). The vertical steel walls of the AST Containment are the subject of a variance that has been previously approved by OCD.

The Operator will ensure that at a point of discharge into or suction from the recycling containment, the liner is protected from excessive hydrostatic force or mechanical damage and external discharge or suction lines shall not penetrate the liner.

### *Liner and Leak Detection Materials*

The liner and geotextile specifications show that all primary (upper) liners in a recycling containment shall be geomembrane liners composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. All primary liners shall be *an equivalent liner [to that stated in Rule 34] approved by OCD pursuant to a variance*. The liner system is presented in an earlier section of this submission.

All secondary liners shall be *an equivalent liner [to that stated in Rule 34] approved by OCD pursuant to a*

19.15.34.12 A

(2) A recycling containment shall have a properly constructed foundation and interior slopes consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear. Geotextile is required under the liner when needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity. The operator shall construct the containment in a levee with an inside grade no steeper than two horizontal feet to one vertical foot (2H:1V). The levee shall have an outside grade no steeper than three horizontal feet to one vertical foot (3H:1V). The top of the levee shall be wide enough to install an anchor trench and provide adequate room for inspection and maintenance.

19.15.34.12 A

(6) At a point of discharge into or suction from the recycling containment, the operator shall insure that the liner is protected from excessive hydrostatic force or mechanical damage. External discharge or suction lines shall not penetrate the liner.

19.15.34.12 A

(4) All primary (upper) liners in a recycling containment shall be geomembrane liners composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. All primary liners shall be 30-mil flexible PVC, 45-mil LLDPE string reinforced or 60-mil HDPE liners. Secondary liners shall be 30-mil LLDPE string reinforced or equivalent with a hydraulic conductivity no greater than  $1 \times 10^{-9}$  cm/sec. Liner compatibility shall meet or exceed the EPA SW-846 method 9090A or subsequent relevant publications.



## Design and Construction Plan Above Ground Tank (AST) Containments

variance. The liner system is presented in an earlier section of this submission.

Liner compatibility shall meet or exceed the EPA SW-846 method 9090A or subsequent relevant publications.

The AST Containment will have a leak detection system between the upper and lower geomembrane liners that shall consist of 200-mil geonet to facilitate drainage.

### *Install Secondary Liner, Leak Detection System and Secondary Containment*

All AST containments holding produced water will have a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions. The rule states that the edges of all secondary liners shall be anchored in the bottom of a compacted earth-filled trench. The anchor trench shall be at least 18 inches deep. The lack of an anchor trench with an AST Containment is also the subject of an OCD-approved variance.

The AST Containment Contractor will cause the recycling containment will have a leak detection system between the upper and lower geomembrane liners that shall consist of 200-mil geonet to facilitate drainage. The leak detection system shall consist of a properly designed drainage and collection and removal system placed above the lower geomembrane liner in depressions and sloped to facilitate the earliest possible leak detection (see attached drawing).

The presence of the secondary containment levee or pre-fabricated secondary containment meets the OCD Rule mandate that a recycling containment shall design the containment to prevent run-on of surface water. The containment shall be surrounded by a berm, ditch or other diversion to prevent run-on of surface water.

### **AST Containment Setup**

As with the secondary liner, AST Containment contractor will minimize liner seams and orient them up and down, as much as possible, not across, a slope. Factory welded seams shall be used where possible. AST Containment contractor will employ field seams in

19.15.34.12 A

(3) Each recycling containment shall incorporate, at a minimum, a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions. The edges of all liners shall be anchored in the bottom of a compacted earth-filled trench. The anchor trench shall be at least 18 inches deep.

19.15.34.12 A

(7) The operator of a recycling containment shall place a leak detection system between the upper and lower geomembrane liners that shall consist of 200-mil geonet or two feet of compacted soil with a saturated hydraulic conductivity of  $1 \times 10^{-5}$  cm/sec or greater to facilitate drainage. The leak detection system shall consist of a properly designed drainage and collection and removal system placed above the lower geomembrane liner in depressions and sloped to facilitate the earliest possible leak detection.

19.15.34.12 A

(8) The operator of a recycling containment shall design the containment to prevent run-on of surface water. The containment shall be surrounded by a berm, ditch or other diversion to prevent run-on of surface water.

19.15.34.12 A

(5) The operator of a recycling containment shall minimize liner seams and orient them up and down, not across, a slope of the levee. Factory welded seams shall be used where possible. The

## Design and Construction Plan Above Ground Tank (AST) Containments

geosynthetic material that are thermally seamed. Prior to field seaming, AST Containment contractor shall overlap liners four to six inches and minimize the number of field seams and corners and irregularly shaped areas. There shall be no horizontal seams within five feet of the AST Containment bottom. Qualified personnel shall perform field welding and testing.

### *Fluid Injection/Withdrawal Flow Diverter*

The injection or withdrawal of fluids from the containment shall be accomplished through a header, diverter or other hardware that prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.

operator shall ensure field seams in geosynthetic material are thermally seamed. Prior to field seaming, the operator shall overlap liners four to six inches. The operator shall minimize the number of field seams and corners and irregularly shaped areas. There shall be no horizontal seams within five feet of the slope's toe. Qualified personnel shall perform field welding and testing.

19.15.34.13 B

(3) The injection or withdrawal of fluids from the containment shall be accomplished through a header, diverter or other hardware that prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.

## Operations and Maintenance Plan Above Ground Tank Containment (AST)

### General Specifications

This plan provides additional protocols to cause the proposed recycling containments (AST Containments) to conform to NMOCD Rules.

The operator will maintain and operate the recycling containments and facility 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.

- The operator will use the treated produced water in the containments for drilling, completion (stimulation), producing or processing oil or gas or both. If other uses are planned, the operator will notify the OCD through the submission of a modified C-147.
- For all exploration and production operations that use produced water, the operator will conduct these activities in a manner consistent with hydrogen sulfide gas provisions in 19.15.11 NMAC or NORM provisions in 19.15.35 NMAC, as applicable.
- The operator will address all releases from the recycling and re-use of produced water in accordance with 19.15.29 NMAC.
- The operator will not discharge into or store any hazardous waste in the recycling containments, but they may hold fluids such as freshwater, brackish water, recycled and treated water, water generated by oil or gas processing facilities, or other waters that are gathered for well drilling or completion. The recycling facility will not be used for the disposal of produced water. The operator will maintain the containments free of miscellaneous solid waste or debris.
- The operator will verify that no oil is on the surface of the contained fluid. If oil is observed, the oil shall be removed using an absorbent boom or other device and properly disposed at an approved facility. An absorbent boom or other device will be maintained on site.
- The operator will install and use a header and diverter described in the design/construction plan in

19.15.34.10 B

Recycling containments may hold produced water for use in connection with drilling, completion, producing or processing oil or gas or both.

19.15.34.8 A

(5) All operations in which produced water is used shall be conducted in a manner consistent with hydrogen sulfide gas provisions in 19.15.11 NMAC or NORM provisions in 19.15.35 NMAC, as applicable.

19.15.34.8 A

(6) All releases from the recycling and re-use of produced water shall be handled in accordance with 19.15.29 NMAC.

19.15.34.10 B

Recycling containments may hold produced water for use in connection with drilling, completion, producing or processing oil or gas or both. Such fluids may include fresh water, brackish water, recycled and treated water, fluids added to water to facilitate well drilling or completion, water produced with oil and gas, flowback from operations, water generated by an oil or gas processing facility or other waters that are gathered for well drilling or completion but may not include any hazardous waste.

19.15.34.9 G

Recycling facilities may not be used for the disposal of produced water.

19.15.34.13 B

(1) The operator shall remove any visible layer of oil from the surface of the recycling  
(7) The operator shall install, or maintain on site, an oil absorbent boom or other device to contain an unanticipated release.

19.15.34.13 B

(3) The injection or withdrawal of fluids from the containment shall be accomplished through a header, diverter or other hardware that prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.

## Operations and Maintenance Plan Above Ground Tank Containment (AST)

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.

- Pursuant to an approved variance, the operator will maintain at least 2-feet of freeboard in each AST containment. Under extenuating circumstances, which will be noted on the inspection log as described below, the operator may temporarily exceed the freeboard mandate.
- 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 suggests 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 within this same 48 hours of the discovery and repair the damage or replace the liner.
- In the event of a leak due to a hole in the liner, the following steps will be followed:
  1. If the source of the fluid is uncertain, comparative field tests may need to be performed on both the water in the containment and that which may have been released (e.g. pH, conductance, and chloride).
  2. If the fluid is found to be coming from the containment, determine the location from which the leak is originating.
  3. Mark the point where the water is coming out of the tank.
  4. Locate the puncture or hole in the liner.
  5. Empty the containment to the point of damage in liner.
  6. Clean area of liner that needs to be repaired.

19.15.34.13 B

(2) The operator shall maintain at least three feet of freeboard at each containment.

19.5.34.13 B

(4) If the containment's primary liner is compromised above the fluid's surface, the operator shall repair the damage or initiate replacement of the primary liner within 48 hours of discovery or seek an extension of time from the division district office.

(5) If the primary liner is compromised below the fluid's surface, the operator shall remove all fluid above the damage or leak within 48 hours of discovery, notify the division district office and repair the damage or replace the primary liner.

## Operations and Maintenance Plan Above Ground Tank Containment (AST)

7. Cut out piece of material (patch or tape) to overlay liner.
8. Either weld the patch to the injured area in the liner or apply tape over the rupture.
9. Make sure rupture is completely covered.
10. Monitor as needed.

The operator will inspect and remove, as necessary, surface water run-on accumulated in the secondary containment

### *Monitoring, Inspections, and Reporting*

The containment will contain enough produced water to prevent any shifting of the liner. Weekly inspections shall occur when there is 1-foot depth or more of produced water in the containment. Monthly inspections shall occur when there is less than 1-foot depth of produced water in the containment, as well as when the ASTs are emptied and prior to refilling. An inspection log will be maintained by the operator and will be made available to the division upon request. Inspection may include: freeboard monitoring, leak detection, identifying potential hazards that may have developed, change in site conditions or if the contents of the containment change from the initial use. An "Inspection Form" to be filled out during these routine inspections.

The "AST Visual Inspection Checklist" form to be filled out by the operator during periodic inspections. The form provides a list of observations that will enable early detection of uneven tank panel settlement, soil settlement, liner damage, insufficient liner slack, or leaks. The form is reproduced at the end of this section.

The form "Tank Panel Visual Inspection Check Sheet" will be used by the operator to inspect individual containment panels and connections titled.

Monitoring and Inspection Checklist (routine weekly or monthly inspections):

## Operations and Maintenance Plan Above Ground Tank Containment (AST)

- Visually inspect the liner. If a liner's integrity is compromised, or if any penetration of the liner occurs below the water surface, then the operator will notify the appropriate Division district office within 48 hours (phone or email).
- Inspect the system for injection or withdrawal of liquids from the ASTs 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.
- Inspect the water surface for visible oil.
- Measure the freeboard.
- Inspect the secondary containment berm around the ASTs to check for erosion and collection of surface water run-on.
- If H<sub>2</sub>S is a documented potential issue with the containment, measure H<sub>2</sub>S concentrations on the down-wind side of the facility when produced water is present.
- Inspect the secondary containment for evidence of damage and monitor for leakage.
- Inspect the netting for damage or failure. If netting is jeopardized, repair of the netting shall occur within 48 hours.
- At least monthly, inspect netting (may not be used if Mega Blaster Pro avian deterrent is used) for dead wildlife, including migratory birds. Operator shall report the discovery of a dead animal to the appropriate wildlife agency and to the district within 30 days of discovery. Further prevention measures may be required.
- If observed conditions indicate a potential tank failure is imminent, the vicinity will be immediately cleared and the AST will be drained.

### *Cessation of Operations*

If less than 20% of the total fluid capacity is utilized every six months, beginning from the first withdraw, operation of the facility has ceased and the division district office will be notified. The division district may grant an extension not to exceed six months to determine the cessation of operations.

#### 19.15.34.12 E

Netting. The operator shall ensure that a recycling containment is screened, netted or otherwise protective of wildlife, including migratory birds. The operator shall on a monthly basis inspect for and, within 30 days of discovery, report the discovery of dead migratory birds or other wildlife to the appropriate wildlife agency and to the division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring.

#### 19.15.34.13 C

A recycling containment shall be deemed to have ceased operations if less than 20% of the total fluid capacity is used every six months following the first withdrawal of produced water for use. The operator must report cessation of operations to the appropriate division district office. The appropriate division district office may grant an extension to this determination of cessation of operations not to exceed six months.

## Operations and Maintenance Plan Above Ground Tank Containment (AST)

The operator will remove all fluids from the recycling facility within 60 days of cessation of operations. An extension, not to exceed 2 months, may be granted by the district division for the removal of fluids from the facility.

The breakdown of the containments follows the reverse order of the setup steps presented in the set-up manual

19.15.34.14 A

Once the operator has ceased operations, the operator shall remove all fluids within 60 days and close the containment within six months from the date the operator ceases operations from the containment for use. The division district office may grant an extension for the removal of all fluids not to exceed two months.

# Inspection Form

Date: \_\_\_\_\_

u k k V \ AST Containment

Tank ID: \_\_\_\_\_

Weekly inspection/Fluid level must be maintained &gt; 1 foot

Fluid Level: \_\_\_\_\_

Tank contents: \_\_\_\_\_

Inspection Task	Results		Remarks, Observations, and/or Remedial Actions
Visible Oil on Surface	<input type="checkbox"/> None Observed	<input type="checkbox"/> Yes, Describe Action	
<i>An absorbent boom or similar device is located on site to remove visible oil from surface.</i>			
At least 2 ft of freeboard	<input type="checkbox"/> Yes	<input type="checkbox"/> No, Measure Freeboard	
Evidence of surface water run-on	<input type="checkbox"/> None Observed	<input type="checkbox"/> Yes, Describe	
<i>Check for excessive erosion of perimeter berms.</i>			
Birds or wildlife in net or screen	<input type="checkbox"/> None Observed	<input type="checkbox"/> Yes, Describe	
<i>Within 30 days of discovery (immediately if federally protected species, report dead birds or wildlife to the appropriate agency (USFWS, NMDGF) and to NMOCD district division office.</i>			
Damage to netting or screen	<input type="checkbox"/> None Observed	<input type="checkbox"/> Yes, Describe	
Rupture of Liner	<input type="checkbox"/> None Observed	<input type="checkbox"/> Yes, Describe	
<i>If rupture is above fluid level, repair within 48 hours. If below fluid level, remove fluid above within 48 hours, notify NMOCD district division office, and repair. Immediately notify BLM of any leak</i>			
Clips or clamps properly securing liner	<input type="checkbox"/> Yes	<input type="checkbox"/> No, Describe	
If low level, enough liner slack on panel wall	<input type="checkbox"/> Yes	<input type="checkbox"/> No, Describe	
Uneven gaps between panels	<input type="checkbox"/> None Observed	<input type="checkbox"/> Yes, Describe	
Signs of tank settlement	<input type="checkbox"/> None Observed	<input type="checkbox"/> Yes, Describe	



u    k    k

Erosion of soil surrounding tank (10 ft radius)	<input type="checkbox"/> None Observed	<input type="checkbox"/> Yes, Describe	
Running water on the ground	<input type="checkbox"/> None Observed	<input type="checkbox"/> Yes, Describe	
Unusual ponding of fluid inside berm	<input type="checkbox"/> None Observed	<input type="checkbox"/> Yes, Describe	
Field test (pH, Cl-, conductance, etc.) ponded fluid and compare to fluid in tank. If tank is determined as the source, locate and repair rupture within 48 hours. Notify NMOCD district division office and repair. Immediately notify BLM.			
Rust or corrosion on panels, stairs, or hardware	<input type="checkbox"/> None Observed	<input type="checkbox"/> Yes, Describe	
Damage to any hardware	<input type="checkbox"/> None Observed	<input type="checkbox"/> Yes, Describe	

Additional  
Observations or  
Actions:

Inspected by: \_\_\_\_\_

## Closure Plan Above Ground Tank Containment (AST)

### Closure Plan

The containments are 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.

The operator will notify the division district (phone or email) before initiating closure of the containments and/or facility.

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

1. Residual fluids in the containments will be sent to disposal at a division-approved facility.
2. The operator will remove all solid contents and transfer those materials to the following division-approved facility:  
Disposal Facility Name: R360  
Permit Number NM 01-0006
3. If possible, geomembrane textiles and liners that exhibit good integrity may be recycled for use as an under liner of tank batteries or other use as approved by OCD.
4. Disassemble the recycling containment infrastructure according to manufacturer's recommendations
5. After the disassemble of the containments and removal of the contents and liners, soils beneath the tanks will be tested as follows
  - a. Collect a five-point (minimum) composite from beneath the liner to include any obviously stained or wet soils, or any other evidence of impact from the containments for laboratory analyses for the constituents listed in Table I of 19.15.34.14 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.
  - c. If all constituents' concentrations are less than or equal to the parameters listed in Table I, then the operator will backfill the facility as necessary using non-waste containing, uncontaminated, earthen material and proceed to reclaim the surface to pre-existing conditions.

#### 19.15.34.14 B

The operator shall close a recycling containment by first removing all fluids, contents and synthetic liners and transferring these materials to a division approved facility.

#### 19.15.34.14 C

The operator shall test the soils beneath the containment for contamination with a five-point composite sample which includes stained or wet soils, if any, and that sample shall be analyzed for the constituents listed in Table I below.

(1) If any contaminant concentration is higher than the parameters listed in Table I, the division may require additional delineation upon review of the results and the operator must receive approval before proceeding with closure.

(2) If all contaminant concentrations are less than or equal to the parameters listed in Table I, then the operator can proceed to backfill with non-waste containing, uncontaminated, earthen material.

## Closure Plan Above Ground Tank Containment (AST)

### *Closure Documentation*

Within 60 days of closure completion, the operator will submit a closure report (Form C-147) to the District Division, with necessary attachments to document all closure activities are complete, including sampling results and details regarding backfilling and capping as necessary.

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 closure plan.

### *Reclamation and Re-vegetation*

The operator will reclaim the surface to safe and stable pre-existing conditions that blends with the surrounding undisturbed area. "Pre-existing conditions" may include a caliche well pad that existed prior to the construction of the recycling containment and that supports active oil and gas operations.

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

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

Federal, state trust land, or tribal lands may impose alternate reclamation and re-vegetation obligations that provide equal or better protection of fresh water, human health, and the environment. 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 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. The operator will notify the Division when reclamation and re-vegetation is complete.

19.15.34.14 D

Within 60 days of closure completion, the operator shall submit a closure report on form C-147, including required attachments, to document all closure activities including sampling results and the details on any backfilling, capping or covering, where applicable. The closure report shall 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 division rules or directives.

19.15.34.14 E

Once the operator has closed the recycling containment, the operator shall reclaim the containment's location to a safe and stable condition that blends with the surrounding undisturbed area. Topsoils and subsoils shall be replaced to their original relative positions and contoured so as to achieve erosion control, long-term stability and preservation of surface water flow patterns. The disturbed area shall then be reseeded in the first favorable growing season following closure of a recycling containment. The operator shall substantially restore the impacted surface area to the condition that existed prior to the construction of the recycling containment.

19.15.34.14 G

The re-vegetation and reclamation obligations imposed by federal, state trust land or tribal agencies on lands managed by those agencies shall supersede these provisions and govern the obligations of any operator subject to those provisions, provided that the other requirements provide equal or better protection of fresh water, human health and the environment.

19.15.34.14 F

Reclamation of all disturbed areas no longer in use shall be considered complete when all ground surface disturbing activities at the site have been completed, and a uniform vegetative cover has been established 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.

## **Siting Criteria Figures**

## Siting Criteria (19.15.34.11 NMAC)

### Tap Rock Resources, LLC – North Olympus Containment Site

#### 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 recycling containment (AST) that will contain fluids that cannot be classified as “low-chloride.”**

Figure 1 is a geologic/ topographic map that shows:

- The area where Tap Rock plans the Olympus AST Containment.
- The locations of the Mogi 9 State 1H (Misc-69), Jackson Unit 15H (Misc-98), Atoka Bank BDJ State Com 3H (Misc-136) and the Bettis State Com 2H (Misc-137) where we evaluated cuttings during the 120-foot casing borings (see Appendix Well)
- Water wells from the OSE database as a blue triangle inside colored circles that indicate well depth. 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.
- Water wells from the USGS database as large triangles color-coded to the formation the well was completed in.
- Water wells, which are not documented in the public databases but were identified by field inspection or other published reports as colored squares.
- The depth-to-water from the most recent available measurement for each well is provided adjacent to the well symbol.

Figure 2a is larger area topographic/geologic map that shows:

- The area where Tap Rock plans the North Olympus AST Containment will be placed with the surface elevation.
- The setback distances of the larger area for potential future containments with the estimated surface elevation noted in the center of the area t.
- Water wells measured by the USGS, the year of the measurement and the calculated elevation of the groundwater surface.
- Isocontour lines displaying the maximum elevation of the groundwater surface.

#### Geology

Quaternary Age eolian and piedmont deposits (Qe/Qp on Figures 1 and 2) are the dominant exposed material in the area. These deposits are a thin covering of the underlying Tertiary Ogallala Formation or, in some places, the redbeds of the Dockum Group. The Ogallala Formation (To) is locally exposed and consists primarily of sand with some clay, silt and gravel, generally capped by caliche. 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), the top of the redbeds near Bell Lake is about 3500-3600 above sea level (see Plate 1 of GWR-6, Figure 2b). Because the area outside of the Bell Lake Sink lies at an elevation of 3600 feet, the Ogallala Formation, if it is present, could be about 100 feet thick near Bell Lake. In other nearby areas, the thickness of the Ogallala could be more or less than 100 feet.

OSE well C-03565 is associated with Intercontinental Potash USA exploratory wells. We visited several of the listed wells and observed permanent markers delineating the location of the

## Siting Criteria (19.15.34.11 NMAC) Tap Rock Resources, LLC – North Olympus Containment Site

plugged boring. C-03565 POD3 (2,000-ft northwest) has a total depth of 1,533ft. The deepest unit encountered was a Halite, which is likely the Salado Formation and the unit mapped as Dewey Lake is the top of the Chinle at 55 feet. The caliche, siltstones and sandstone from 0-55 feet (called Gutuna (sic)) is the Ogallala. Review of the driller log (Appendix F) shows that this is the total depth of the boring and no groundwater was observed in this well drilled by mud rotary.

Topographically, the area shown in Figure 1 and 2 slopes gently to the southwest. This sloping surface is punctuated by several closed depressions. The Bell Lake Sink, north of the proposed area in which the containment will be constructed, is a 2-mile wide circular depression is the most obvious of these closed depressions. The Bell Lake Sink has been described as an ancient collapse feature (breccia pipe) associated with the removal of salt due to upward groundwater flow from the Capitan Reef<sup>1</sup>.

### **Groundwater Data**

We relied upon the most recent data measured by the USGS to create the water table elevation map shown in Figure 2 and the “Misc” well data from auger borings logged by a trained geologist. Water level data from the OSE database rely upon observed water levels by drillers during the completion of the water well. The OSE dataset provides some useful data in certain areas. The Bell Lake area contains sufficient high-quality data that we did not rely on OSE data. Jackson Unit 15H rathole (Misc-98), the Mogi 9 State 1H rathole (Misc-69) and the Brininstool 4 State 3H rathole (Misc-70) are lithologic data logged by Hicks Consultants during drilling – the cuttings were dust/dry at a depth of 120 feet. While the borings terminated above the regional aquifer, they provide data that are useful for the mapping. It is these data that help define the horizontal limits of water bodies that are perched within the Bell Lake Sink and similar depressions.

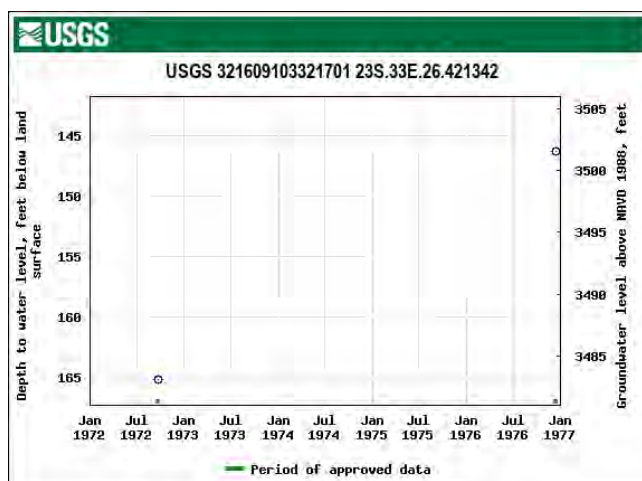
Misc-13 (AKA USGS 14726) is a well located 1.92 miles southeast of the site. The groundwater elevation for this well is 3343.3 feet above mean sea level (1953) and is about 100 feet deeper than surrounding wells. Our data for this well came from Groundwater Report 6, which states it draws water from Triassic-age aquifers. The data from the USGS did not measure a water level in 2013 as the well was pumping.

Below is a chart of the water levels over time in USGS-14767 (USGS 3216....1701), which is 3.94 miles to the southeast and the closest USGS well is static water measurement (2 readings) over time. The water level changes 19 feet over 5 years, which indicates the water level in this well is relatively stable. This well is not shown on Figure 2b.

---

<sup>1</sup> See [http://nmgs.nmt.edu/publications/guidebooks/downloads/57/57\\_p\\_233-242.pdf](http://nmgs.nmt.edu/publications/guidebooks/downloads/57/57_p_233-242.pdf)

## Siting Criteria (19.15.34.11 NMAC) Tap Rock Resources, LLC – North Olympus Containment Site



From the data presented, we conclude:

- The Ogallala Formation is present in the area but the base of this aquifer (the red bed top elevation in Figure 2b) is above the regional water table. Thus, this unit is dry.
- Groundwater in the area is produced from the Triassic Chinle Formation
- The elevation of the groundwater surface beneath the area in which the Olympus Containment will be constructed is no higher than 3450 feet above mean sea level.
- The perched, shallow groundwater zones present within the Bell Lake Sink does not extend to the area beneath the area in which the Olympus Containment will be constructed.
- The distance between the bottom of the containment and the potentiometric surface of the regional aquifer is approximately  $(3618 - 3450 - 25 =) 143$  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 200-feet of any other significant watercourse, lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark).**

- The map depicts an “intermittent stream” located on the north-northeast end of Bell Lake approximately 1 mile north of the subject site and two mapped watercourses south of Route 128.
- No continuously-flowing watercourses, significant watercourse or other water bodies, as defined by NMOCD Rules, exist within the prescribed setback criteria for the siting, trench burial, or in-place closure of a recycling containment at this location.
- The Bell Lake Sink is a topographic low area located north-northeast of the proposed AST. Bell Lake does not contain surface water during the majority of the year. Google Earth images suggest the excavated areas south of the lakebed contained water periodically from 1996 to 2012.
- The Bell Lake Sink is an ancient collapse feature but is not considered a sinkhole as used in NMOCD Rules as it relates to unstable ground.



Siting Criteria (19.15.34.11 NMAC)  
Tap Rock Resources, LLC – North Olympus Containment Site

### **Distance to Permanent Residence or Structures**

**Figure 4 and the site visit demonstrates that the location is not within 1000 feet from an occupied permanent residence, school, hospital, institution, church, or other structure in existence at the time of initial application.**

- The nearest structures are oil and gas wells, and tank batteries, and temporary pits in various phases of closure.
- A cattle gathering area with corrals is located about 1 mile northeast of the location.
- This figure also shows mapped sites associated with potential archeological features

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

**Figures 1 and Figure 2 demonstrate that the location is not within 500 horizontal feet of a spring or fresh water well used for domestic or stock watering purposes, in existence at the time of initial application.**

- Figure 1 shows the locations of all area water wells, active or plugged.
  - The nearest active water well is a commercial freshwater facility located 500 feet from the southwest corner of the area of interest (USGS-14429)
  - The next closest active well is approximately 1 mile north at the Bell Lake ranch headquarters and is used for stock and domestic purposes.
  - Plugged/abandoned wells exist in the Bell Lake Sink.
- There are no known domestic water wells located within 1,000 feet of the proposed AST.
- OSE well series C-03565 and C-03585 are associated with Intercontinental Potash USA exploratory wells. We visited several of the listed wells and observed permanent markers delineating the location of the plugged boring.
- No springs were identified within the mapping area (see Figure 3).

### **Distance to Municipal Boundaries and Fresh Water Fields**

**Figure 5 demonstrates that the location is not within incorporated municipal boundaries or within 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 Jal, NM approximately 28 miles to the southeast.
- The closest public well field is located approximately 50 miles to the west and/or 50 miles north.

### **Distance to Wetlands**

**Figure 6 demonstrates the location is not within 300 feet of wetlands. This also qualifies the location for burial trench or in-place closure.**

- The nearest designated wetland is a “freshwater emergent wetland” located approximately ½ mile to the north (Bell Lake area excavations).
- North of this emergent wetland is the excavation designated as a “freshwater pond.”



Siting Criteria (19.15.34.11 NMAC)  
Tap Rock Resources, LLC – North Olympus Containment Site

### **Distance to Subsurface Mines**

**Figure 7 and our general reconnaissance of the area demonstrate that the nearest mines are caliche pits. This location is not within an area overlying a subsurface mine.**

- The nearest mapped caliche pit is located about 1 mile southwest.

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

**Figure 8 shows the location of the temporary pits with respect to BLM Karst areas.**

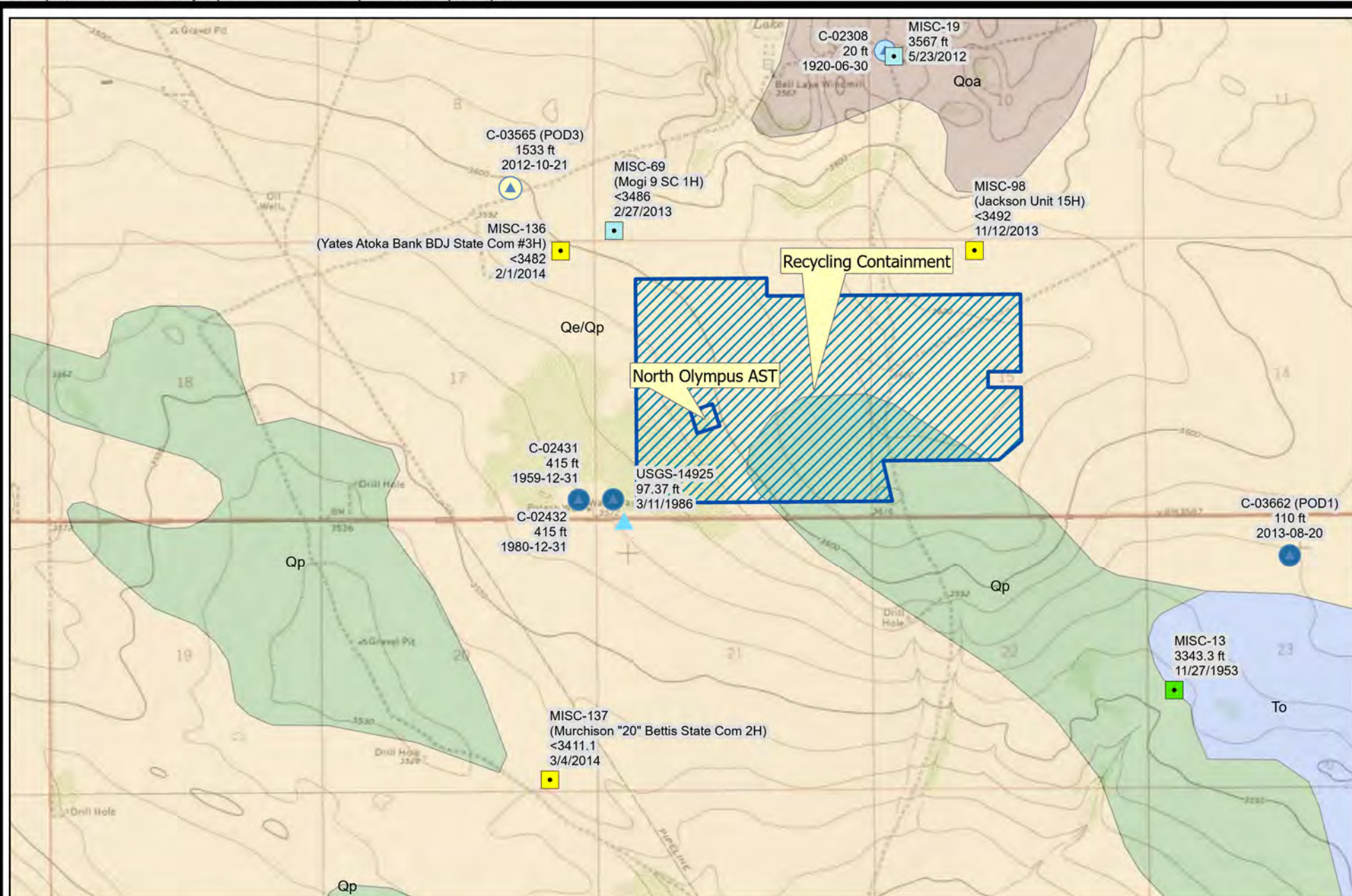
- The proposed temporary pit is located within a “low” potential karst area.
- The nearest “high” or “critical” potential karst area is located approximately 18 miles west of the site.
- No evidence of solution voids were observed near the site during the field inspection.
- No evidence of unstable ground was observed in the area.

### **Distance to 100-Year Floodplain**

**Figure 9 demonstrates that the location is within Zone D as designated by the Federal Emergency Management Agency with respect to the Flood Insurance Rate 100-Year Floodplain.**

- Zone D is described as areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted.
- Our field inspection and examination of the topography permits a conclusion that the location is not within any floodplain and has low risk for flooding.

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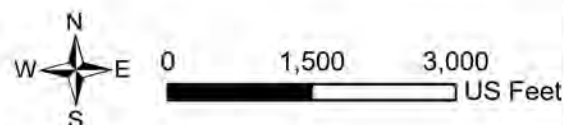
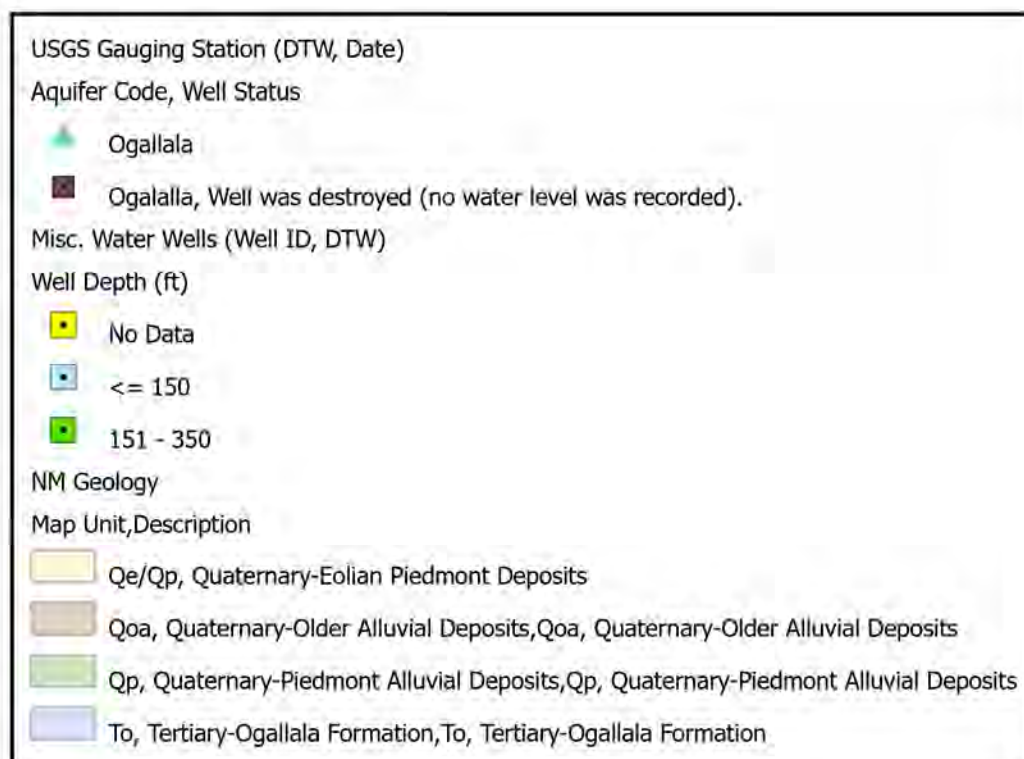


R.T. Hicks Consultants, Ltd  
 901 Rio Grande Blvd NW Suite F-142  
 Albuquerque, NM 87104  
 Ph: 505.266.5004

Depth to Water and Geology  
 Tap Rock Resources  
 Olympus Recycling Containment

Figure 1  
 June 2021

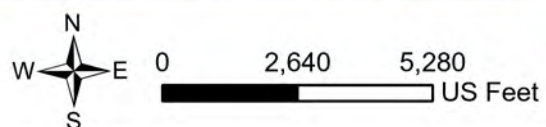
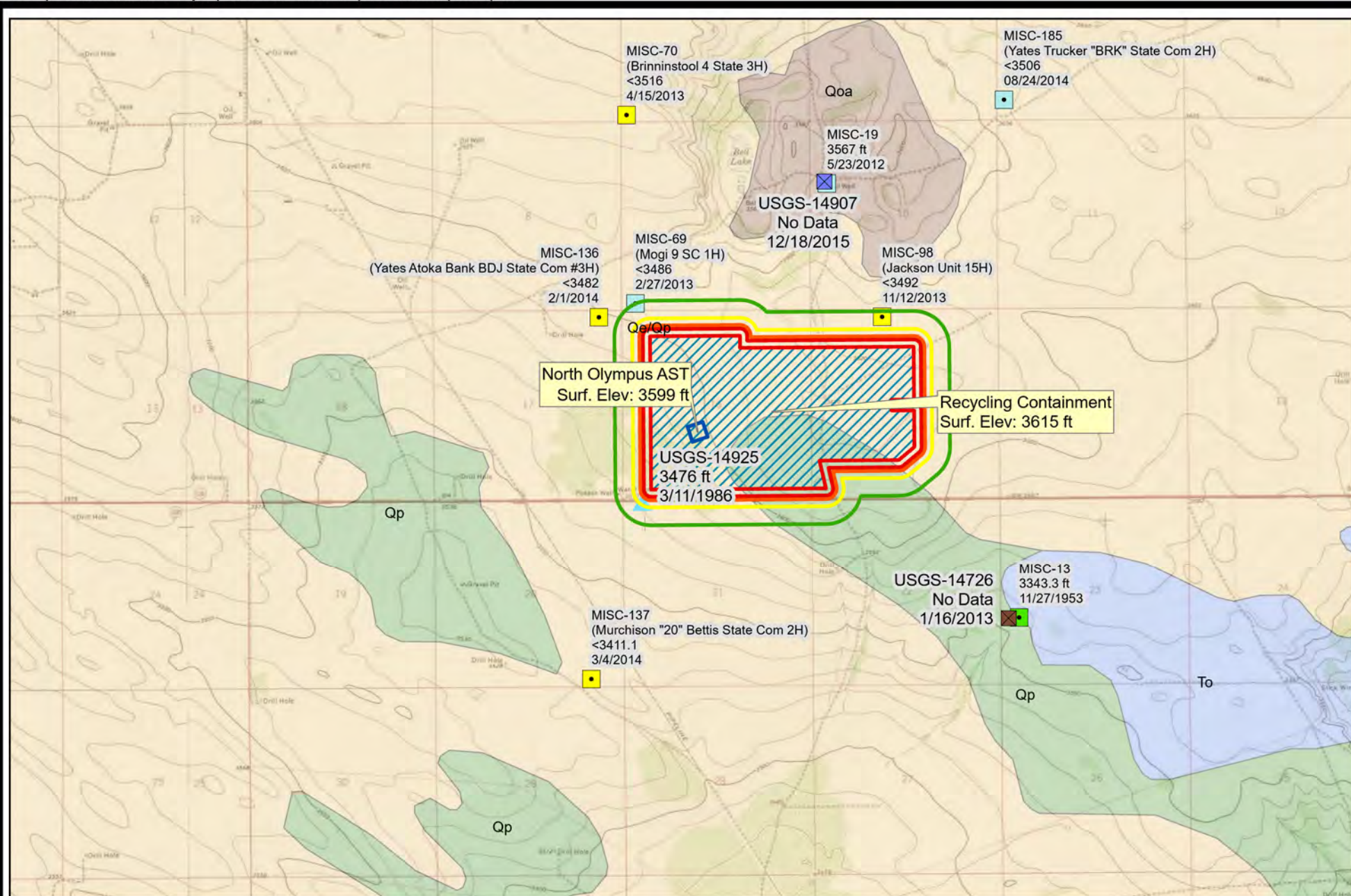
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<b>R.T. Hicks Consultants, Ltd</b> 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Depth to Water and Geology Legend	Figure 1
	Tap Rock Resources Olympus Recycling Containment	June 2021



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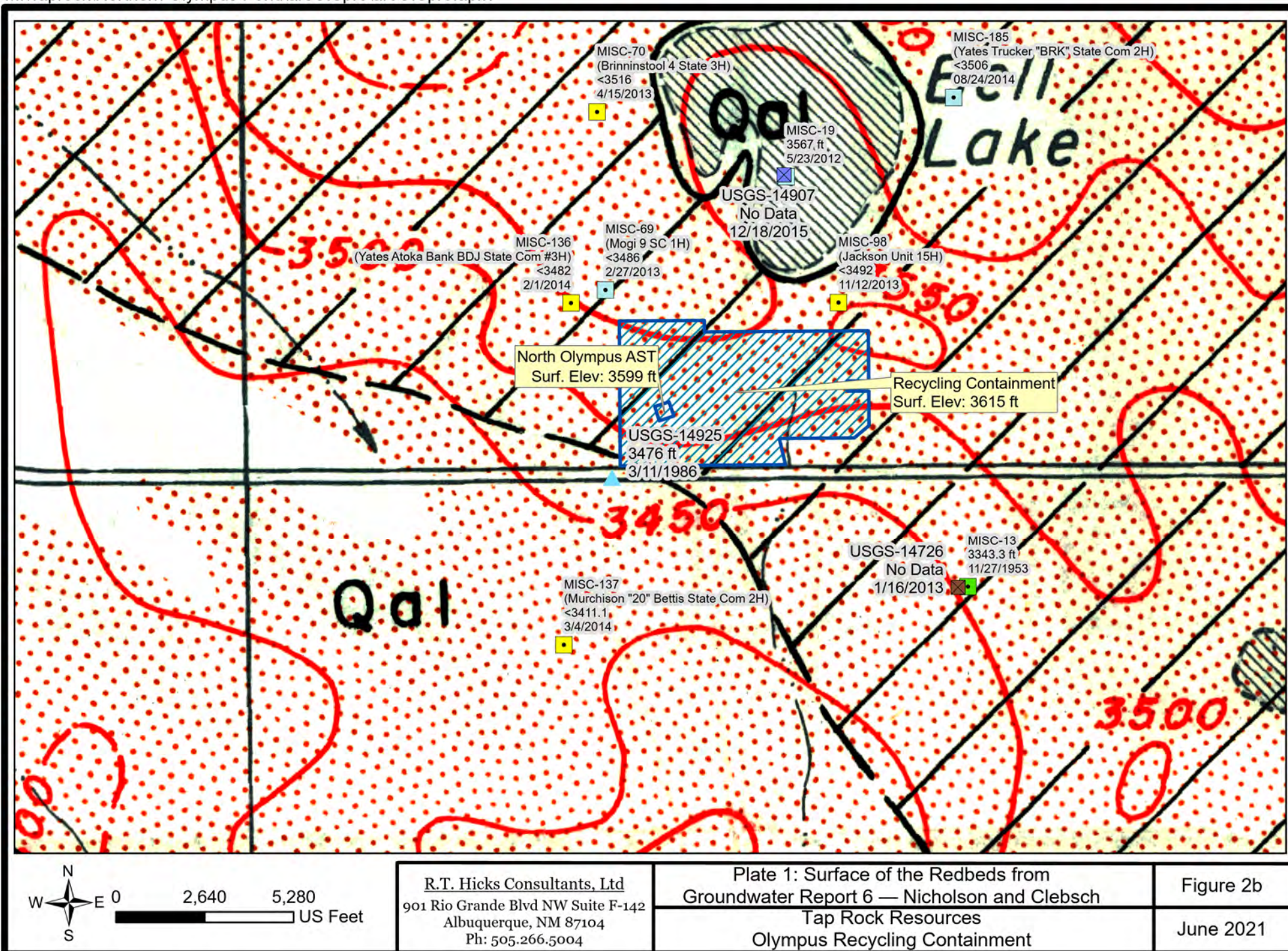
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**Groundwater Elevation and Geology**  
**Tap Rock Resources**  
**Olympus Recycling Containment**

**Figure 2a**  
**June 2021**



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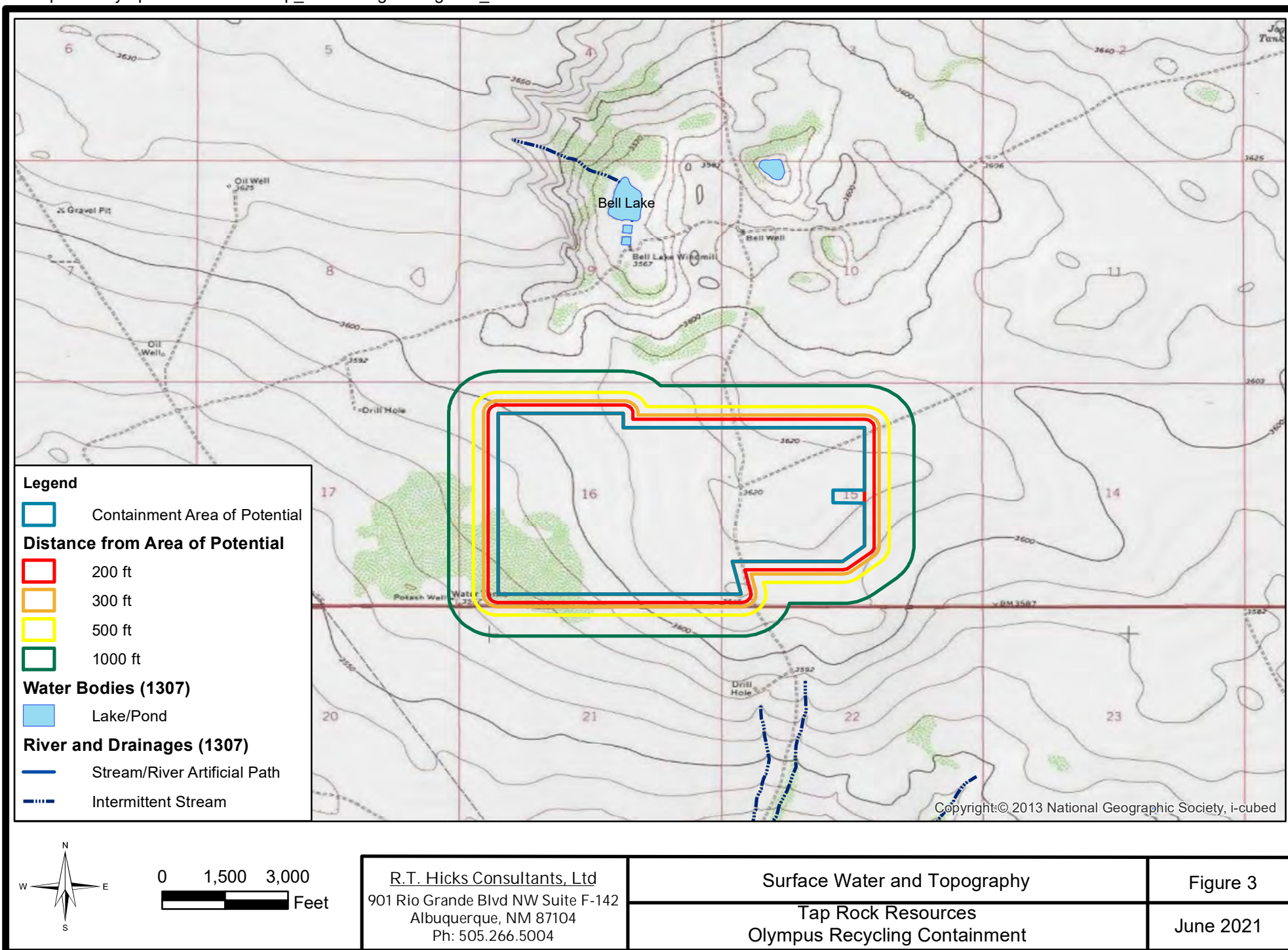
Plate 1: Surface of the Redbeds from  
 Groundwater Report 6 — Nicholson and Clebsch  
 Tap Rock Resources  
 Olympus Recycling Containment

Figure 2b

June 2021

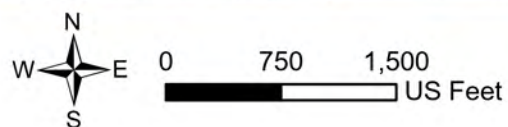
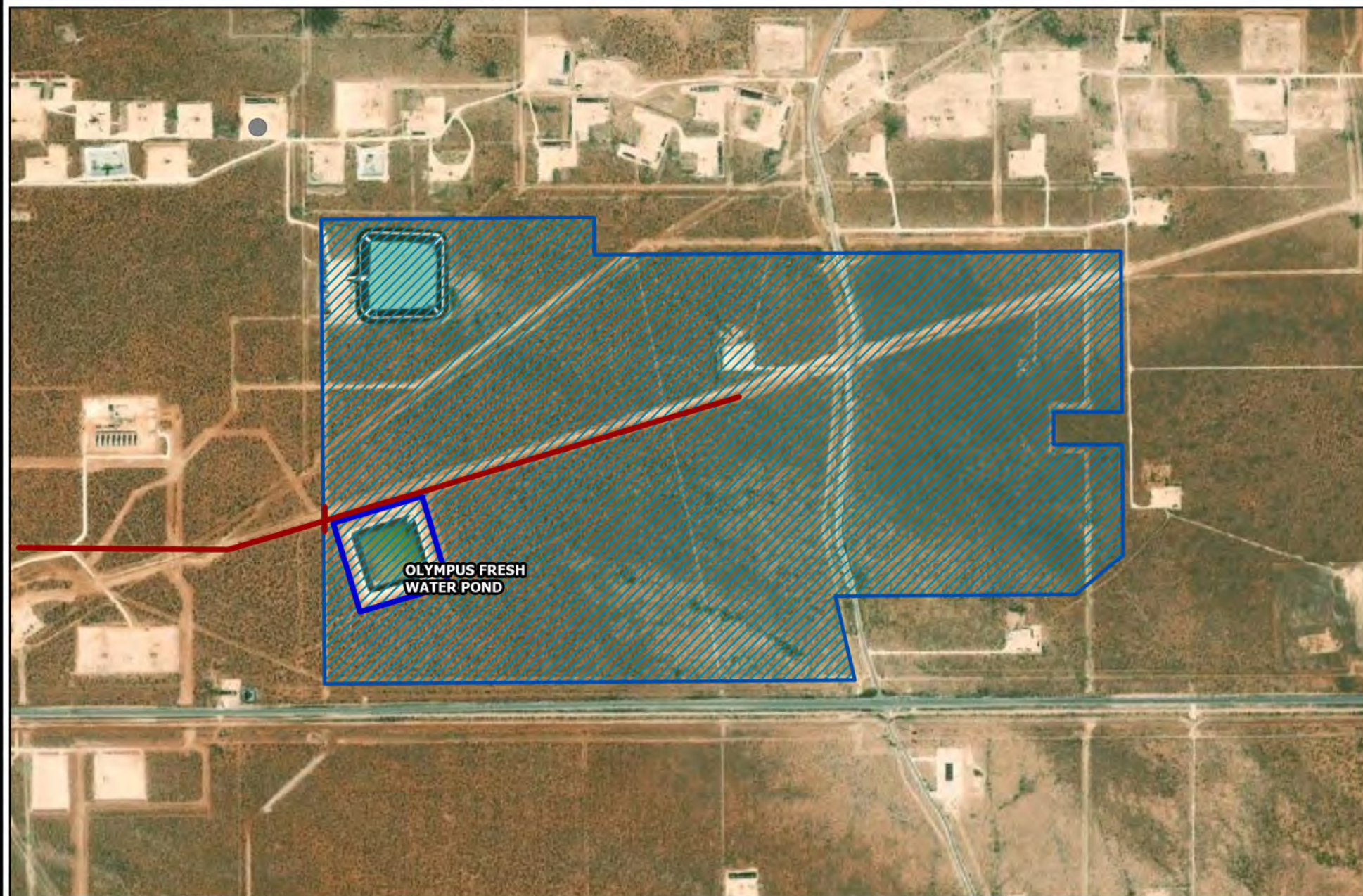


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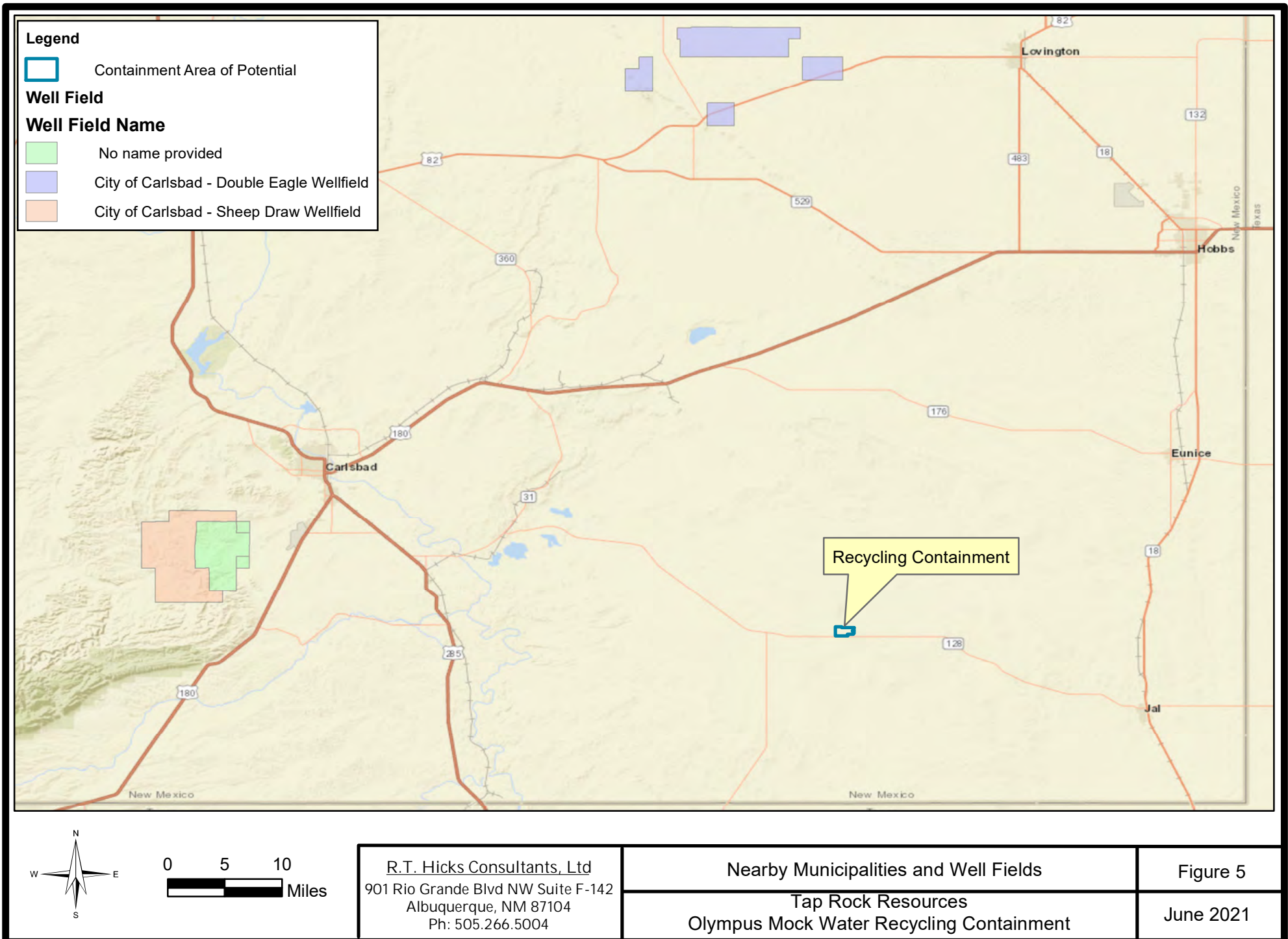
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Ph: 505.266.5004

Nearby Structures  
Tap Rock Resources  
Olympus Recycling Containment

Figure 4  
June 2021

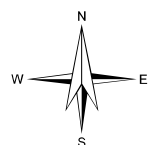
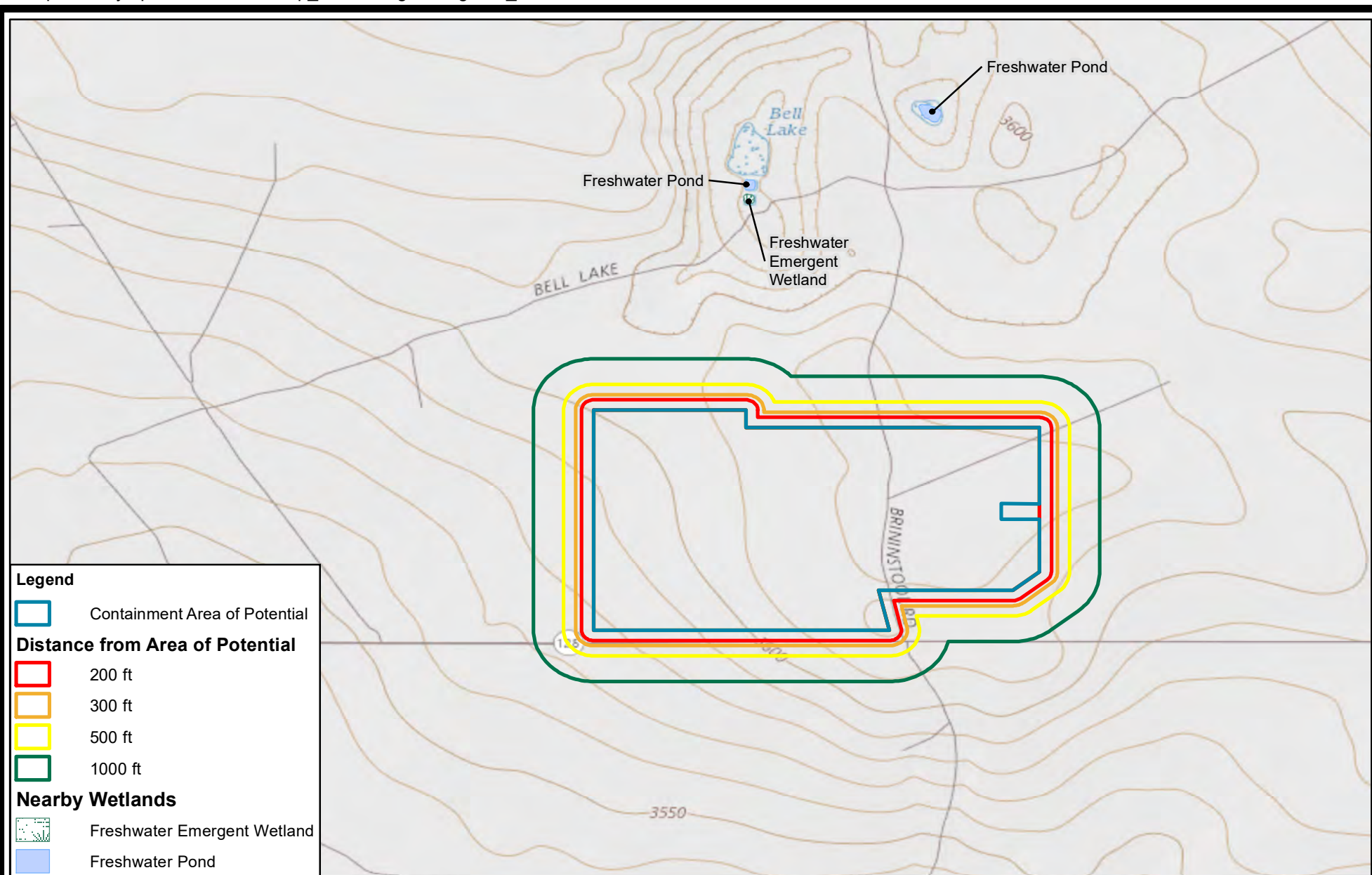


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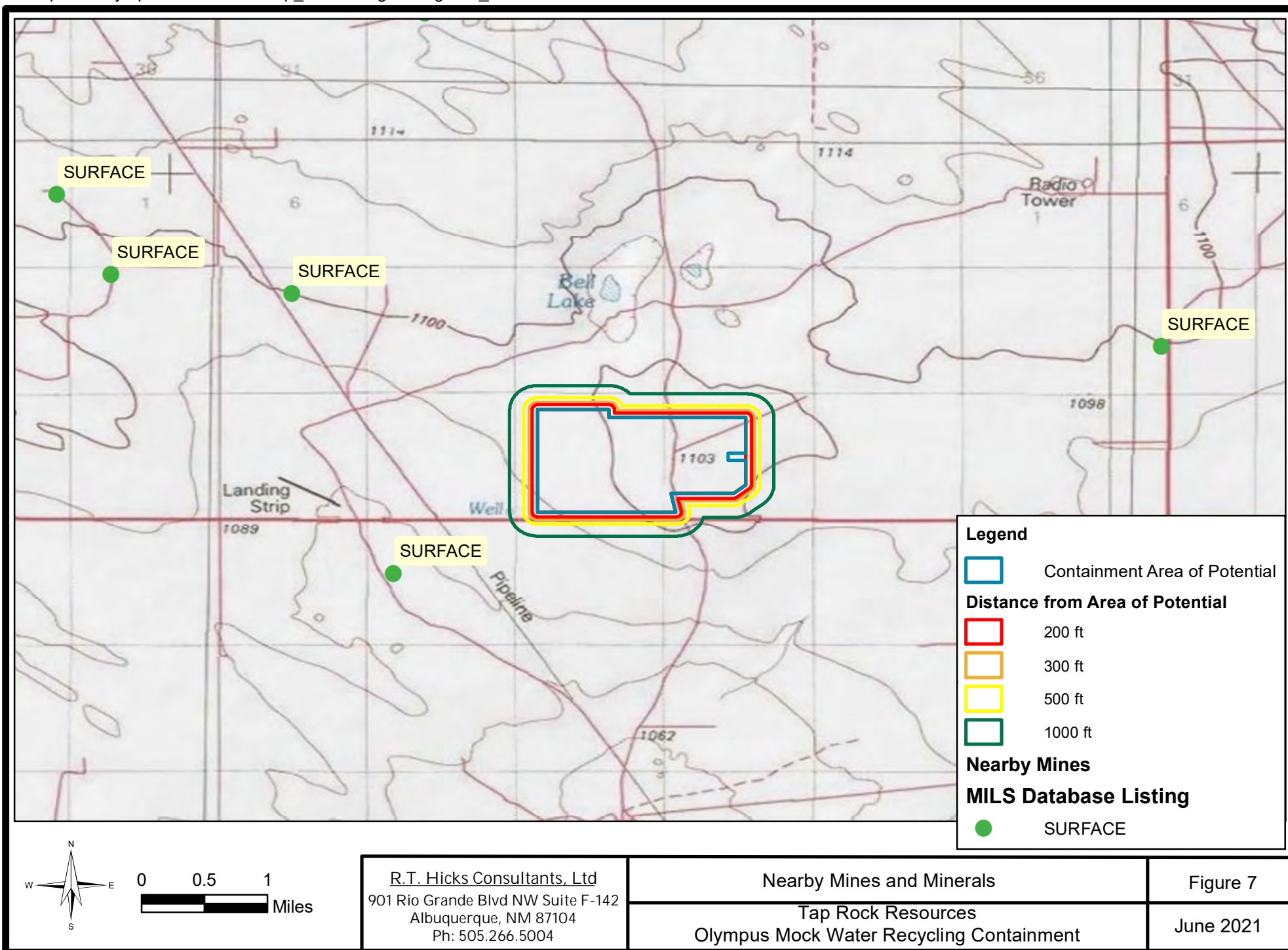
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Nearby Wetlands  
Tap Rock Resources  
Olympus Mock Water Recycling Containment

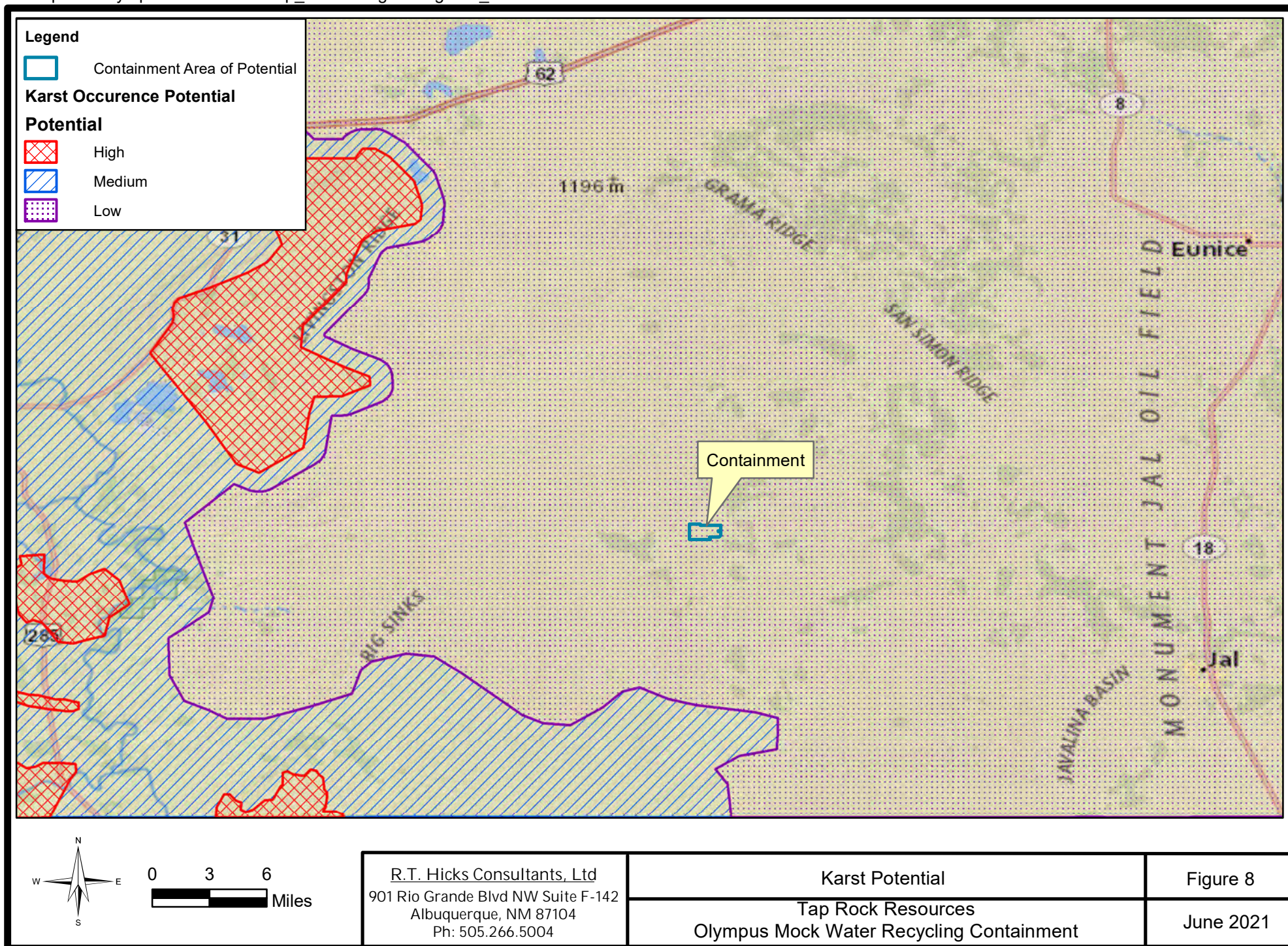
Figure 6  
June 2021

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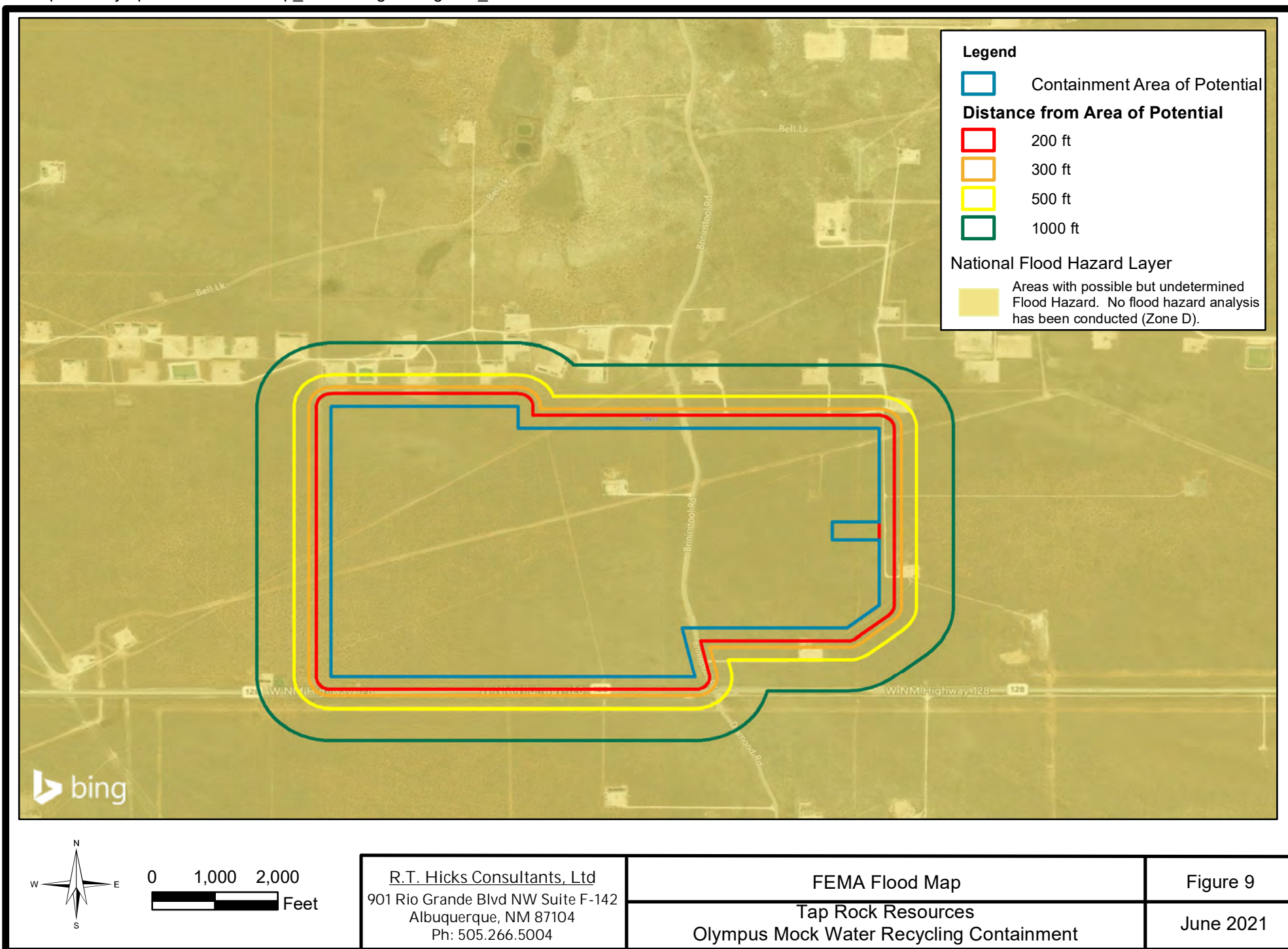


M:\Taprock\Olympus Containment\lap\_nmGIS\Figures\figure8\_karstPotential.mxd





M:\Taprock\Olympus Containment\lap\_nmGIS\Figures\figure9\_femaFlood.mxd



## **Well Logs**

<b>Logger:</b>	Kristin Pope	<b>Client:</b>	Murchison Oil and Gas, Inc.		<b>Well ID:</b>	Rat Hole Boring
<b>Driller:</b>	Ready Drill of Monahans, TX	<b>Project Name:</b>	Jackson Unit #15H			
<b>Drilling Method:</b>	30-inch auger	<b>Location:</b>	Section 15, T24S, R33E, Lea County			
<b>Start Date:</b>	11/12/2013					
<b>End Date:</b>	11/12/2013					
<b>Notes:</b>	all samples were dry					

Depth (feet)	Description	Lithology	Comments	Depth (feet)		
Cellar is 8 feet deep						
8	Fine sand, some caliche, pink-brown, 8-16 feet			8		
10				10		
12				12		
14				14		
16	Caliche, white, hard, 16-18 feet			16		
18				18		
20	Medium sand with caliche, pink-brown, 18 - 33 feet		fluffy pink caliche powder at 24-25 ft	20		
22				22		
24				24		
26				26		
28				28		
30				30		
32				32		
34				34		
36	Fine sand with shale, brown-blue/purple, friable, 33 - 40 feet			36		
38				38		
40				40		
42				42		
44	Fine sand with shale, brown-purple, friable, 40 - 45 feet			44		
46				46		
48	Clay, red, massive, 45- 57 feet		Darkness of color and level of compaction increased with depth during this interval	48		
50				50		
52				52		
54				54		
56				56		
58				58		
60				60		
62				62		
64	clay, brown-red, 58-74 feet			64		
66				66		
68				68		
70				70		
72				72		
74				74		
76				76		
78				78		
80	Clay, some shale and fine-grained sand, brown-red, blue-gray, brown, 76-80 feet			80		
82				82		
84	Fine sand with shale, brown-purple, 80-86 feet			84		
86				86		
88	Fine sand with massive siltstone, brown-yellow, 87-89 feet			88		
90				90		
92	Fine sandstone with fine sand, gray-brown, hard, 89-93 feet			92		
94				94		
96	Shale, red, hard, platy, 93-104 feet			96		
98				98		
100				100		
102				102		
104				104		
106				106		
108				108		
110				110		
112	Fine sand with shale, brown-gray, hard, 104-111 feet			112		
114				114		
116				116		
118				118		
120	Siltstone, gray, hard, 112-120 feet			120		
Boring terminated at 120 feet to install rat hole casing						

<b>R.T. Hicks Consultants, Ltd</b> 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 505-266-5004	<b>Murchison Oil and Gas, Inc.</b>	<b>Plate 1</b>
	<b>Rat Hole Boring Log</b>	<b>November 2013</b>



# WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

[www.ose.state.nm.us](http://www.ose.state.nm.us)

STATE ENGINEER OFFICE  
ROSWELL, NEW MEXICO

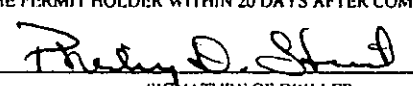
2012 DEC 11 P 4: 02

1. GENERAL AND WELL LOCATION	POD NUMBER (WELL NUMBER) ICP-085				OSE FILE NUMBER(S) C-3565 POD 3				
	WELL OWNER NAME(S) Intercontinental Potash (USA)				PHONE (OPTIONAL) 575-942-2799				
	WELL OWNER MAILING ADDRESS 600 West Bender Boulevard				CITY Hobbs		STATE NM	ZIP 88240	
	WELL LOCATION (FROM GPS)	DEGREES LATITUDE 32	MINUTES 13	SECONDS 39.75 N	* ACCURACY REQUIRED: ONE TENTH OF A SECOND * DATUM REQUIRED: WGS 84				
LONGITUDE 103								35	27.62 W
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS									
2. OPTIONAL	(2.5 ACRE) 1/4	(10 ACRE) 1/4	(40 ACRE) 1/4	(160 ACRE) 1/4	SECTION 8	TOWNSHIP 24	RANGE 33	<input type="checkbox"/> NORTH <input checked="" type="checkbox"/> SOUTH <input type="checkbox"/> EAST <input type="checkbox"/> WEST	
	SUBDIVISION NAME				LOT NUMBER	BLOCK NUMBER	UNIT/TRACT		
	HYDROGRAPHIC SURVEY				MAP NUMBER		TRACT NUMBER		
3. DRILLING INFORMATION	LICENSE NUMBER WD #331		NAME OF LICENSED DRILLER Phillip Stewart			NAME OF WELL DRILLING COMPANY Stewart Brothers Drilling Co.			
	DRILLING STARTED 9/27/2012		DRILLING ENDED 10/21/2012		DEPTH OF COMPLETED WELL (FT) NA	BORE HOLE DEPTH (FT) 1533 FT	DEPTH WATER FIRST ENCOUNTERED (FT) NA		
	COMPLETED WELL IS: <input type="checkbox"/> ARTESIAN <input checked="" type="checkbox"/> DRY HOLE <input type="checkbox"/> SHALLOW (UNCONFINED)						STATIC WATER LEVEL IN COMPLETED WELL (FT) NA		
	DRILLING FLUID: <input type="checkbox"/> AIR <input checked="" type="checkbox"/> MUD <input type="checkbox"/> ADDITIVES - SPECIFY: ETH GEL, PLATINUM PAC, BI-CARB, SODA ASH,								
	DRILLING METHOD: <input checked="" type="checkbox"/> ROTARY <input type="checkbox"/> HAMMER <input type="checkbox"/> CABLE TOOL <input type="checkbox"/> OTHER - SPECIFY: TACKLE, MYLOGEL, NaCl								
	DEPTH (FT) FROM TO		BORE HOLE DIA. (IN)	CASING MATERIAL	CONNECTION TYPE (CASING)	INSIDE DIA. CASING (IN)	CASING WALL THICKNESS (IN)	SLOT SIZE (IN)	
	0 1250		12.625	J-55 #36 steel	threaded	8.921	0.302		
	1250 1533		8.75	NA					
4. WATER BEARING STRATA	DEPTH (FT) FROM TO		THICKNESS (FT)	FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)			YIELD (GPM)		
	NA		NA	NA			NA		
METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA Bypass flow						TOTAL ESTIMATED WELL YIELD (GPM) na			

FOR OSE INTERNAL USE

WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		PAGE 1 OF 2

STATE ENGINEER OFFICE ROSWELL, NEW MEXICO							
5. SEAL AND PUMP	TYPE OF PUMP: <input type="checkbox"/> SUBMERSIBLE <input type="checkbox"/> JET <input checked="" type="checkbox"/> NO PUMP - WELL NOT EQUIPPED <input type="checkbox"/> TURBINE <input type="checkbox"/> CYLINDER <input type="checkbox"/> OTHER - SPECIFY:						
	ANNULAR SEAL AND GRAVEL PACK	DEPTH (FT)		BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	VOLUME (CUBIC FT)	METHOD OF PLACEMENT
		FROM	TO				
		NA	NA				
6. GEOLOGIC LOG OF WELL	DEPTH (FT)		THICKNESS (FT)	COLOR AND TYPE OF MATERIAL ENCOUNTERED (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)		WATER BEARING?	
	FROM	TO					
	0	20	20	Caliche		<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
	20	55	35	Gutuna Fm. - red siltstones and sandstones		<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
	55	1227	1181	Dewey Lake Fm. Red siltstones and mudstones, gray/green mottling		<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
	1227	1262	35	Rustler Fm./A-5, white anhydrite		<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
	1262	1295	33	H-4 sub-mbr. - milky white halite		<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
	1295	1310	15	A-4 sub-mbr. - white anhydrite		<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
	1310	1330	20	Magenta Dolomite		<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
	1330	1375	45	A-3 sub-mbr. white anhydrite		<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
	1375	1479	112	H-3 sub-mbr. - milky halite		<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
	1479	1489	10	Ore zone, anhydrite and white polyhalite		<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
	1489	1533	44	Halite, with some anhydrite		<input type="checkbox"/> YES <input type="checkbox"/> NO	
						<input type="checkbox"/> YES <input type="checkbox"/> NO	
	ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL						
7. TEST & ADDITIONAL INFO	WELL TEST		METHOD: <input type="checkbox"/> BAILER <input type="checkbox"/> PUMP <input type="checkbox"/> AIR LIFT <input type="checkbox"/> OTHER - SPECIFY: NA TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.				
	ADDITIONAL STATEMENTS OR EXPLANATIONS:						
8. SIGNATURE	THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING: <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">               SIGNATURE OF DRILLER           </div> <div style="text-align: center;">             12-10-12              DATE           </div> </div>						

FOR USE INTERNAL USE

WELL RECORD &amp; LOG (Version 6/9/08)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		PAGE 2 OF 2





# WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE  
ROSWELL, NEW MEXICO


1 2012 DEC 11 P 4: 02

1. GENERAL AND WELL LOCATION	POD NUMBER (WELL NUMBER) ICP-085				OSE FILE NUMBER(S) C-3565 POD 3			
	WELL OWNER NAME(S) Intercontinental Potash (USA)				PHONE (OPTIONAL) 575-942-2799			
	WELL OWNER MAILING ADDRESS 600 West Bender Boulevard				CITY Hobbs		STATE NM	
					ZIP 88240			
2. OPTIONAL	WELL LOCATION (FROM GPS)		DEGREES LATITUDE 32	MINUTES 13	SECONDS 39.75 N	* ACCURACY REQUIRED: ONE TENTH OF A SECOND		
			LONGITUDE 103	35	27.62 W	* DATUM REQUIRED: WGS 84		
	DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS							
3. DRILLING INFORMATION	(2.5 ACRE) 1/4	(10 ACRE) 1/4	(40 ACRE) 1/4	(160 ACRE) 1/4	SECTION 8	TOWNSHIP 24	RANGE 33	<input type="checkbox"/> NORTH <input checked="" type="checkbox"/> SOUTH <input checked="" type="checkbox"/> EAST <input type="checkbox"/> WEST
	SUBDIVISION NAME				LOT NUMBER	BLOCK NUMBER	UNIT/TRACT	
	HYDROGRAPHIC SURVEY				MAP NUMBER		TRACT NUMBER	
4. WATER BEARING STRATA	LICENSE NUMBER WD #331		NAME OF LICENSED DRILLER Phillip Stewart			NAME OF WELL DRILLING COMPANY Stewart Brothers Drilling Co.		
	DRILLING STARTED 9/27/2012		DRILLING ENDED 10/21/2012		DEPTH OF COMPLETED WELL (FT) NA	BORE HOLE DEPTH (FT) 1533 FT		DEPTH WATER FIRST ENCOUNTERED (FT) NA
	COMPLETED WELL IS: <input type="checkbox"/> ARTESIAN <input checked="" type="checkbox"/> DRY HOLE <input type="checkbox"/> SHALLOW (UNCONFINED)					STATIC WATER LEVEL IN COMPLETED WELL (FT) NA		
	DRILLING FLUID: <input type="checkbox"/> AIR <input checked="" type="checkbox"/> MUD <input type="checkbox"/> ADDITIVES - SPECIFY: ETH GEL, PLATINUM PAC, BI-CARB, SODA ASH,							
	DRILLING METHOD: <input checked="" type="checkbox"/> ROTARY <input type="checkbox"/> HAMMER <input type="checkbox"/> CABLE TOOL <input type="checkbox"/> OTHER - SPECIFY: TACKLE, MYLOGEL, NaCl							
	DEPTH (FT)		BORE HOLE DIA. (IN)	CASING MATERIAL	CONNECTION TYPE (CASING)	INSIDE DIA. CASING (IN)	CASING WALL THICKNESS (IN)	SLOT SIZE (IN)
	FROM	TO						
	0	1250	12.625	J-55 #36 steel	threaded	8.921	0.302	
	1250	1533	8.75	NA				
5. FORMATION DESCRIPTION	DEPTH (FT)		THICKNESS (FT)	FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)			YIELD (GPM)	
	FROM	TO						
	NA		NA	NA			NA	
METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA Bypass flow					TOTAL ESTIMATED WELL YIELD (GPM) na			

FOR OSE INTERNAL USE

WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION	PAGE 1 OF 2	

5. SEAL AND PUMP	TYPE OF PUMP: <input type="checkbox"/> SUBMERSIBLE <input type="checkbox"/> JET <input checked="" type="checkbox"/> NO PUMP - WELL NOT EQUIPPED						
	<input type="checkbox"/> TURBINE <input type="checkbox"/> CYLINDER <input type="checkbox"/> OTHER - SPECIFY:						
	ANNULAR SEAL AND GRAVEL PACK	DEPTH (FT)		BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	AMOUNT (CUBIC FT)	METHOD OF PLACEMENT
		FROM	TO				
	NA		NA	NA	NA	NA	
6. GEOLOGIC LOG OF WELL	DEPTH (FT)		THICKNESS (FT)	COLOR AND TYPE OF MATERIAL ENCOUNTERED (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	WATER BEARING?		
	FROM	TO			<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
	0	20	20	Caliche	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
	20	55	35	Gutuna Fm. - red siltstones and sandstones	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
	55	1227	1181	Dewey Lake Fm. Red siltstones and mudstones, gray/green mottling	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
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	1262	1295	33	H-4 sub-mbr. - milky white halite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
	1295	1310	15	A-4 sub-mbr. - white anhydrite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
	1310	1330	20	Magenta Dolomite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
	1330	1375	45	A-3 sub-mbr. white anhydrite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
	1375	1479	112	H-3 sub-mbr. - milky halite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
	1479	1489	10	Ore zone, anhydrite and white polyhalite	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
	1489	1533	44	Halite, with some anhydrite	<input type="checkbox"/> YES <input type="checkbox"/> NO		
					<input type="checkbox"/> YES <input type="checkbox"/> NO		
					<input type="checkbox"/> YES <input type="checkbox"/> NO		
	ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL.						
	7. TEST & ADDITIONAL INFO	WELL TEST					
METHOD: <input type="checkbox"/> BAILER <input type="checkbox"/> PUMP <input type="checkbox"/> AIR LIFT <input type="checkbox"/> OTHER - SPECIFY: NA							
TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.							
ADDITIONAL STATEMENTS OR EXPLANATIONS:							
8. SIGNATURE	THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:						
	 SIGNATURE OF DRILLER			12-10-12 DATE			

FOR USE INTERNAL USE		WELL RECORD & LOG (Version 6/9/08)	
FILE NUMBER	POD NUMBER	TRN NUMBER	
LOCATION			PAGE 2 OF 2

STATE ENGINEER OFFICE  
ROSWELL, NEW MEXICO

**Venegas, Victoria, EMNRD**

---

**From:** Venegas, Victoria, EMNRD  
**Sent:** Wednesday, August 4, 2021 2:59 PM  
**To:** 'Philip Churchwell'; bramsey@taprk.com; r@rthicksconsult.com; madison@rthicksconsult.com; rmann@slo.state.nm.us  
**Cc:** Enviro, OCD, EMNRD  
**Subject:** 1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID fVV2121451913  
**Attachments:** C-147 - 1RF-147 North Olympus 08.04.2021.pdf

**1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID [fVV2121451913](#)**

Mr. Churchwell,

NMOCD has reviewed the recycling containment permit application and related documents, submitted by [372043] TAP ROCK OPERATING, LLC on July 19, 2021 for **1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID [fVV2121451913](#)** in Unit Letter K, Section 16, Township 24S, Range 33E, Lea County, New Mexico.

[372043] TAP ROCK OPERATING, LLC requested variances from 19.15.34 NMAC for 1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID [fVV2121451913](#) related to 19.15.34. NMAC

The following variances have been approved.

- The variance to 19.15.34.14 NMAC Table I for the use of alternate analytical method 8015/8015M for total petroleum hydrocarbons (TPH) is approved.
- The variance to 19.15.34.14 NMAC Table I for the use of alternate analytical method EPA 300.0 or SM4500 for the analysis of chloride is approved.
- The variance to 19.15.34.12.A (2) NMAC for the no side-slope requirement for the AST containment with vertical walls is approved.
- The variance to 19.15.34.12.A (3) NMAC for the liners to be anchored to the top of the AST steel walls and no anchor trenches is approved.
- The variance to 19.15.34.12 A (4) NMAC for the installation on the AST containment of a 40-mil non-reinforced LLDPE primary liner and a 30-mil non-reinforced LLDPE secondary liner with a 200-mil geogrid drainage layer is approved.
- The variance to 19.15.34.12 A (4) NMAC for the installation on the AST containment of a 40-mil non-reinforced LLDPE primary liner and a 40-mil non-reinforced LLDPE secondary liner with a 200-mil geogrid drainage layer is approved.

The following variance has been denied.

- The variance to 19.15.34.13 B (2) NMAC for a 2-feet freeboard has been denied. 1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID [fVV2121451913](#) must operate with the 3-feet freeboard as specified by rule.

The form C-147 and related documents 1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID [fVV2121451913](#) is approved with the following conditions of approval:

- [372043] TAP ROCK OPERATING, LLC shall construct, operate, maintain, close, and reclaim 1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID [fVV2121451913](#) in compliance with 19.15.34 NMAC.
- 1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID [fVV2121451913](#) is approved for five years of operation from the date of permit application. 1RF-471 - NORTH OLYMPUS RECYCLING FACILITY

AND CONTAINMENT FACILITY ID [fVV2121451913](#) permit expires on July 19, 2026. If [372043] TAP ROCK OPERATING, LLC wishes to extend operations past five years, an annual permit extension request must be submitted using an OCD form C-147 through [OCD Online](#) by June 19, 2026.

- Water reuse and recycling from 1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID [fVV2121451913](#) is limited to wells owned or operated by [372043] TAP ROCK OPERATING, LLC.
- [372043] TAP ROCK OPERATING, LLC shall notify OCD when construction of 1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID [fVV2121451913](#) commences.
- [372043] TAP ROCK OPERATING, LLC shall notify OCD when recycling operations commence and cease at 1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID [fVV2121451913](#).
- A minimum of 3-feet freeboard must be maintained at 1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID [fVV2121451913](#), at all times during operations.
- [372043] TAP ROCK OPERATING, LLC shall provide OCD with the calculations for the operational total fluid capacity of each of the containments within 30 days of receiving produced water in the containment. The operational fluid capacity is the total volume of the containment, minus the volume not utilized due to the freeboard.
- If less than 20% of the total fluid capacity is utilized every six months, beginning from the first withdrawal, operation of the facility is considered ceased and notification of cessation of operations should be sent electronically to [OCD.Enviro@state.nm.us](mailto:OCD.Enviro@state.nm.us). An extension to extend the cessation of operation, not to exceed six months, may be submitted using a C-147 form through [OCD Online](#).
- [372043] TAP ROCK OPERATING, LLC shall submit monthly reports of recycling and reuse of produced water, drilling fluids, and liquid oil field waste on OCD form C-148 through [OCD Online](#) even if there is zero activity.
- [372043] TAP ROCK OPERATING, LLC shall comply with 19.15.29 NMAC Releases in the event of any release of produced water or other oil field wastes at 1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID [fVV2121451913](#).

Please reference number 1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID [fVV2121451913](#) in all future communications.

Please let me know if you have any questions or concerns.

Regards,

**Victoria Venegas** • Environmental Specialist

Environmental Bureau

EMNRD - Oil Conservation Division

811S. First St. | Artesia, NM 88210

(575) 909-0269 | [Victoria.Venegas@state.nm.us](mailto:Victoria.Venegas@state.nm.us)

<http://www.emnrd.state.nm.us/OCD/>





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-147  
Revised April 3, 2017

## Recycling Facility and/or Recycling Containment

**Type of Facility:** ☒ Recycling Facility ☒ Recycling Containment\*  
**Type of action:** ☒ Permit ☐ Registration  
☐ Modification ☐ Extension  
☐ Closure ☐ Other (explain) \_\_\_\_\_

\* At the time C-147 is submitted to the division for a Recycling Containment, a copy shall be provided to the surface owner.

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: Tap Rock Operating, LLC OGRID #: 372043  
Address: 523 Park Point Drive Suite 200, Golden, CO, 80401  
Facility or well name (include API# if associated with a well): North Olympus Recycling Facility and Containment  
OCD Permit Number: 1RF-471 (For new facilities the permit number will be assigned by the district office)  
U/L or Qtr/Qtr K Section 16 Township 24S Range 33E County: Lea  
Surface Owner: ☐ Federal ☒ State ☐ Private ☐ Tribal Trust or Indian Allotment

2.

☒ **Recycling Facility:**  
Location of (if applicable): Latitude 32.2155056° Longitude -103.5790828° NAD83 (Approximate)  
Proposed Use: ☐ Drilling\* ☒ Completion\* ☐ Production\* ☐ Plugging\*  
*\*The re-use of produced water may NOT be used until freshwater zones are cased and cemented.*  
☐ Other, *requires permit for other uses. Describe use, process, testing, volume of produced water and ensure there will be no adverse impact on groundwater or surface water.*  
☒ Fluid Storage  
☒ Above ground tanks ☐ Recycling containment ☐ Activity permitted under 19.15.17 NMAC explain type \_\_\_\_\_  
☐ Activity permitted under 19.15.36 NMAC explain type: \_\_\_\_\_ ☐ Other explain \_\_\_\_\_  
☐ For multiple or additional recycling containments, attach design and location information of each containment  
☐ **Closure Report (required within 60 days of closure completion):** ☐ Recycling Facility Closure Completion Date: \_\_\_\_\_

3.

☒ **Recycling Containment:**  
☐ Annual Extension after initial 5 years (attach summary of monthly leak detection inspections for previous year)  
Center of Recycling **See Attachment (adjacent):** (if applicable) Latitude 32.2155056° Longitude -103.5790828° NAD83 (Approximate)  
☐ For multiple or additional recycling containments, attach design and location information of each containment:  
☒ Lined ☐ Liner type: Thickness: SEE DRAWINGS ☒ LLDPE ☐ HDPE ☐ PVC ☐ Other  
Primary liner 30 mil LLDPE ; Secondary liner 40 mil LLDPE . SEE DRAWINGS ☐ String-Reinforced  
Liner Seams: ☒ Welded ☐ Factory ☐ Other \_ Volume: SEE DRAWINGS Dimensions: (Inside dimensions) SEE DRAWINGS  
☐ Recycling Containment Closure Completion Date: \_\_\_\_\_

4.

**Bonding:**

- ☒ Covered under bonding pursuant to 19.15.8 NMAC per 19.15.34.15(A)(2) NMAC (These containments are limited to only the wells owned or operated by the owners of the containment.)
- ☐ Bonding in accordance with 19.15.34.15(A)(1). Amount of bond \$\_\_\_\_\_ (work on these facilities cannot commence until bonding amounts are approved)
- ☐ Attach closure cost estimate and documentation on how the closure cost was calculated.

5. **Fencing:**

- ☒ Four-foot height, four strands of barbed wire evenly spaced between one and four feet.
- ☐ Alternate. Please specify \_\_\_\_\_

6. **Signs:**

- ☐ 12"x 24", 2" lettering, providing Operator's name, site location, and emergency telephone numbers
- ☒ Signed in compliance with 19.15.16.8 NMAC

7. **Variances:**

Justifications and/or demonstrations that the proposed variance will afford reasonable protection against contamination of fresh water, human health, and the environment.

**Check the below box only if a variance is requested:**

- ☒ Variance(s): Requests must be submitted to the appropriate division district for consideration of approval. If a Variance is requested, include the variance information on a separate page and attach it to the C-147 as part of the application.

**If a Variance is requested, it must be approved prior to implementation. See Volume 2**

8. **Siting Criteria for Recycling Containment**

**Instructions: The applicant must provide attachments that demonstrate compliance for each siting criteria below as part of the application. Potential examples of the siting attachment source material are provided below under each criteria**

**General siting****Ground water is less than 50 feet below the bottom of the Recycling Containment.**

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

☐ Yes ☒ No  
☐ NA

- Written confirmation or verification from the municipality; written approval obtained from the municipality **FIGURE 5**

Within the area overlying a subsurface mine.

☐ Yes ☒ No

- Written confirmation or verification or map from the NM EMNRD-Mining and Minerals Division **FIGURE 7**

Within an unstable area.

☐ Yes ☒ No

- Engineering measures incorporated into the design; NM Bureau of Geology & Mineral Resources; USGS; NM Geological Society; topographic map **FIGURE 8**

Within a 100-year floodplain. FEMA map **FIGURE 9**

☐ Yes ☒ No

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).

☐ Yes ☒ No

- Topographic map; visual inspection (certification) of the proposed site **FIGURE 3**

Within 1000 feet from a permanent residence, school, hospital, institution, or church in existence at the time of initial application.

☐ Yes ☒ No

- Visual inspection (certification) of the proposed site; aerial photo; satellite image **FIGURE 4**

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. **FIGURES 1 and 3**

☐ Yes ☒ No

- NM Office of the State Engineer - iWATERS database search; visual inspection (certification) of the proposed site

Within 500 feet of a wetland. **FIGURE 6**

☐ Yes ☒ No

- US Fish and Wildlife Wetland Identification map; topographic map; visual inspection (certification) of the proposed site

9.

**Recycling Facility and/or Containment Checklist:**

Instructions: Each of the following items must be attached to the application. Indicate, by a check mark in the box, that the documents are attached.

- ☒ Design Plan - based upon the appropriate requirements.
- ☒ Operating and Maintenance Plan - based upon the appropriate requirements.
- ☒ Closure Plan - based upon the appropriate requirements.
- ☒ Site Specific Groundwater Data -
- ☒ Siting Criteria Compliance Demonstrations -
- ☒ Certify that notice of the C-147 (only) has been sent to the surface owner(s)

10.

**Operator Application Certification:**

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

Name (Print): Phil Churchwell Title: Completions Engineer  
Signature: [Signature] Date: 6-22-21  
e-mail address: pchurchwell@taprk.com Telephone: 661-303-5085

11.

OCD Representative Signature: Victoria Venegas Approval Date: 08/04/2021

Title: Environmental Specialist OCD Permit Number: RF-471

- ☒ OCD Conditions FACILITY ID fVV2121451913  
☒ Additional OCD Conditions on Attachment

June 2021

# **Volume 2**

## **C-147 Registration Package for North Olympus AST Containment & Recycling Facility**

**Section 15 T24S R33E, Lea County**

**Design/Construction Plan  
Engineering Drawings and Liner Specifications  
Well Water Services Manual  
Variances for AST Storage Containments  
Applicability of Engineering Variances to Variety of  
Site Conditions in Permian Basin**



*Aerial view showing in-ground containments designed by Magrym Consulting and permitted by Hicks Consultants. Also shown are two 60,000 bbl above-ground storage tank containments permitted by Hicks Consultants. Photograph by permission from Magrym Consulting.*

**Prepared for:**  
**Tap Rock Operating LLC**  
**Golden, Colorado**

**Prepared by:**  
**R.T. Hicks Consultants, Ltd.**  
**901 Rio Grande NW, Ste F-142**  
**Albuquerque, New Mexico 87104**



## Box 9

### DESIGN AND CONSTRUCTION PLAN

9.

**Recycling Facility and/or Containment Checklist:***Instructions: Each of the following items must be attached to the application. Indicate, by a check mark in the box, that the documents are attached.*

- ☒ Design Plan - based upon the appropriate requirements.
- ☒ Operating and Maintenance Plan - based upon the appropriate requirements.
- ☒ Closure Plan - based upon the appropriate requirements.
- ☒ Site Specific Groundwater Data -
- ☒ Siting Criteria Compliance Demonstrations –
- ☒ Certify that notice of the C-147 (only) has been sent to the surface owner(s)

## Design and Construction Plan Above Ground Tank (AST) Containments

### General

Examination of the engineering drawings and the SOP for set-up (Appendix Engineering Drawings, Liner Specifications, Set Up) plus the history of solid performance of these AST Containments demonstrates that the AST Containment is designed and will be assembled to ensure the confinement of produced water, to prevent releases and to prevent overtopping due to wave action or rainfall. As the AST Containments are generally less than 190 feet in diameter, wave action is not a meaningful consideration.

These AST Containments are constructed of 12-foot high steel panels and are netted or employ the Mega Blaster Pro avian deterrent system to prevent ingress of migratory birds. AST Containments will be enclosed by a 4-strand barbed wire fence. Thus, complies with the Rule to fence or enclose a recycling containment in a manner that deters unauthorized wildlife and human access and shall maintain the fences in good repair.

The operator shall post an upright sign no less than 12 inches by 24 inches with lettering not less than two inches in height in conspicuous places surrounding the containment. The operator shall post the sign in a manner and location such that a person can easily read the legend. The sign shall provide the following information: the operator's name, the location of the site by quarter-quarter or unit letter, section, township and range, and emergency telephone numbers.

### Site Preparation

#### *Foundation for AST Containment*

Preparation of the soils on site is required to form a dependable base for the AST Containment in accordance with the SOP. If the location of the AST Containment is on an existing pad, the operator has stripped and stockpiled the topsoil for use as the final cover or fill at the time of closure. If the pad is new construction, the operator will strip and stockpile the soil for reclamation upon cessation of site activities.

#### 19.15.34.12 A

(1) The operator shall design and construct a recycling containment to ensure the confinement of produced water, to prevent releases and to prevent overtopping due to wave action or rainfall.

#### 19.15.34.12 D

(1) The operator shall fence or enclose a recycling containment in a manner that deters unauthorized wildlife and human access and shall maintain the fences in good repair. The operator shall ensure that all gates associated with the fence are closed and locked when responsible personnel are not onsite.

#### 19.15.34.12 C

Signs. The operator shall post an upright sign no less than 12 inches by 24 inches with lettering not less than two inches in height in a conspicuous place on the fence surrounding the containment. The operator shall post the sign in a manner and location such that a person can easily read the legend. The sign shall provide the following information: the operator's name, the location of the site by quarter-quarter or unit letter, section, township and range, and emergency telephone numbers.

#### 19.15.34.12 B

Stockpiling of topsoil. Prior to constructing containment, the operator shall strip and stockpile the topsoil for use as the final cover or fill at the time of closure.

## Design and Construction Plan Above Ground Tank (AST) Containments

The foundation soils must be roller compacted smooth and free of loose aggregate over ½ inch. Compaction characteristics must meet or exceed 95% of Standard Proctor Density in accordance with ASTM D 698.

Examination of the SOP shows that the AST Containment contractor will conform to the following mandates of the Rule:

- the AST Containment will have a properly constructed compacted earth foundation and interior slopes (vertical steel) consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear.
- Geotextile will be placed under the liner where needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity.
- If the AST Containment is within a levee, the inside grade is no steeper than two horizontal feet to one vertical foot (2H: 1V) and the outside grade no steeper than three horizontal feet to one vertical foot (3H: 1V). The vertical steel walls of the AST Containment are the *subject of a requested variance*.

The Operator will ensure that at a point of discharge into or suction from the recycling containment, the liner is protected from excessive hydrostatic force or mechanical damage and external discharge or suction lines shall not penetrate the liner.

### *Liner and Leak Detection Materials*

The liner and geotextile specifications show that all primary (upper) liners in a recycling containment shall be geomembrane liners composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. All primary liners shall be *an equivalent liner [to that stated in Rule 34] approved by OCD pursuant to a variance*. The liner system is presented in an earlier section of this submission.

All secondary liners shall be *an equivalent liner [to that stated in Rule 34] or approved by OCD pursuant to a*

19.15.34.12 A

(2) A recycling containment shall have a properly constructed foundation and interior slopes consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear. Geotextile is required under the liner when needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity. The operator shall construct the containment in a levee with an inside grade no steeper than two horizontal feet to one vertical foot (2H:1V). The levee shall have an outside grade no steeper than three horizontal feet to one vertical foot (3H:1V). The top of the levee shall be wide enough to install an anchor trench and provide adequate room for inspection and maintenance.

19.15.34.12 A

(6) At a point of discharge into or suction from the recycling containment, the operator shall insure that the liner is protected from excessive hydrostatic force or mechanical damage. External discharge or suction lines shall not penetrate the liner.

19.15.34.12 A

(4) All primary (upper) liners in a recycling containment shall be geomembrane liners composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. All primary liners shall be 30-mil flexible PVC, 45-mil LLDPE string reinforced or 60-mil HDPE liners. Secondary liners shall be 30-mil LLDPE string reinforced or equivalent with a hydraulic conductivity no greater than  $1 \times 10^{-9}$  cm/sec. Liner compatibility shall meet or exceed the EPA SW-846 method 9090A or subsequent relevant publications.

## Design and Construction Plan Above Ground Tank (AST) Containments

variance. The liner system is presented in an earlier section of this submission.

Liner compatibility shall meet or exceed the EPA SW-846 method 9090A or subsequent relevant publications.

The AST Containment will have a leak detection system between the upper and lower geomembrane liners that shall consist of 200-mil geonet to facilitate drainage.

### *Install Secondary Liner, Leak Detection System and Secondary Containment*

All AST containments holding produced water will have a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions. The rule states that the edges of all secondary liners shall be anchored in the bottom of a compacted earth-filled trench. The anchor trench shall be at least 18 inches deep. *The lack of an anchor trench with an AST Containment is also the subject of requested variance.*

The AST Containment Contractor will cause the recycling containment will have a leak detection system between the upper and lower geomembrane liners that shall consist of 200-mil geonet to facilitate drainage. The leak detection system shall consist of a properly designed drainage and collection and removal system placed above the lower geomembrane liner in depressions and sloped to facilitate the earliest possible leak detection (see attached design sketch).

The presence of the secondary containment levee or pre-fabricated secondary containment meets the OCD Rule mandate that a recycling containment shall design the containment to prevent run-on of surface water. The containment shall be surrounded by a berm, ditch or other diversion to prevent run-on of surface water.

### **AST Containment Setup**

As with the secondary liner, AST Containment contractor will minimize liner seams and orient them up and down, as much as possible, not across, a slope. Factory welded seams shall be used where possible. AST Containment contractor will employ field seams in

19.15.34.12 A

(3) Each recycling containment shall incorporate, at a minimum, a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions. The edges of all liners shall be anchored in the bottom of a compacted earth-filled trench. The anchor trench shall be at least 18 inches deep.

19.15.34.12 A

(7) The operator of a recycling containment shall place a leak detection system between the upper and lower geomembrane liners that shall consist of 200-mil geonet or two feet of compacted soil with a saturated hydraulic conductivity of  $1 \times 10^{-5}$  cm/sec or greater to facilitate drainage. The leak detection system shall consist of a properly designed drainage and collection and removal system placed above the lower geomembrane liner in depressions and sloped to facilitate the earliest possible leak detection.

19.15.34.12 A

(8) The operator of a recycling containment shall design the containment to prevent run-on of surface water. The containment shall be surrounded by a berm, ditch or other diversion to prevent run-on of surface water.

19.15.34.12 A

(5) The operator of a recycling containment shall minimize liner seams and orient them up and down, not across, a slope of the levee. Factory welded seams shall be used where possible. The



## Design and Construction Plan Above Ground Tank (AST) Containments

geosynthetic material that are thermally seamed. Prior to field seaming, AST Containment contractor shall overlap liners four to six inches and minimize the number of field seams and corners and irregularly shaped areas. There shall be no horizontal seams within five feet of the AST Containment bottom. Qualified personnel shall perform field welding and testing.

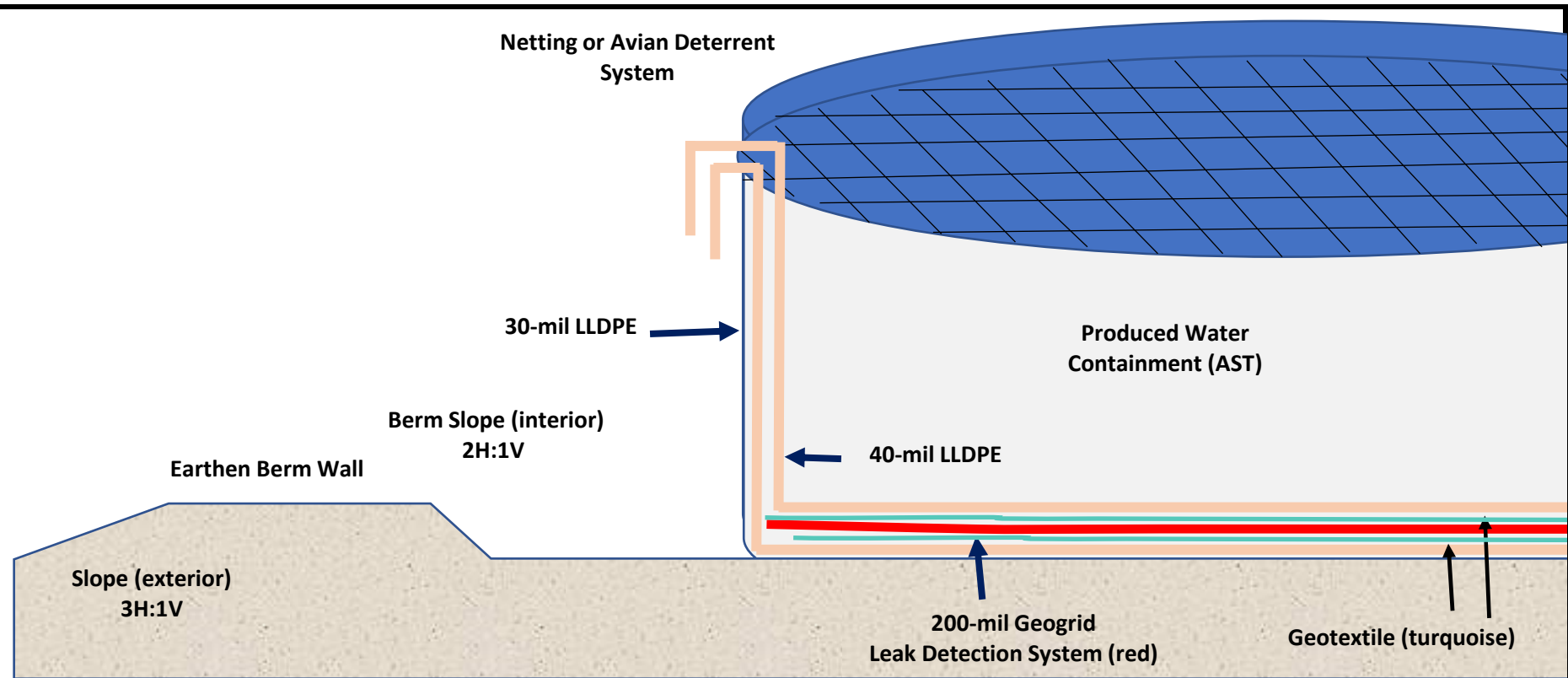
### *Fluid Injection/Withdrawal Flow Diverter*

The injection or withdrawal of fluids from the containment shall be accomplished through a header, diverter or other hardware that prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.

operator shall ensure field seams in geosynthetic material are thermally seamed. Prior to field seaming, the operator shall overlap liners four to six inches. The operator shall minimize the number of field seams and corners and irregularly shaped areas. There shall be no horizontal seams within five feet of the slope's toe. Qualified personnel shall perform field welding and testing.

19.15.34.13 B

(3) The injection or withdrawal of fluids from the containment shall be accomplished through a header, diverter or other hardware that prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.



### Description of Leak Detection System

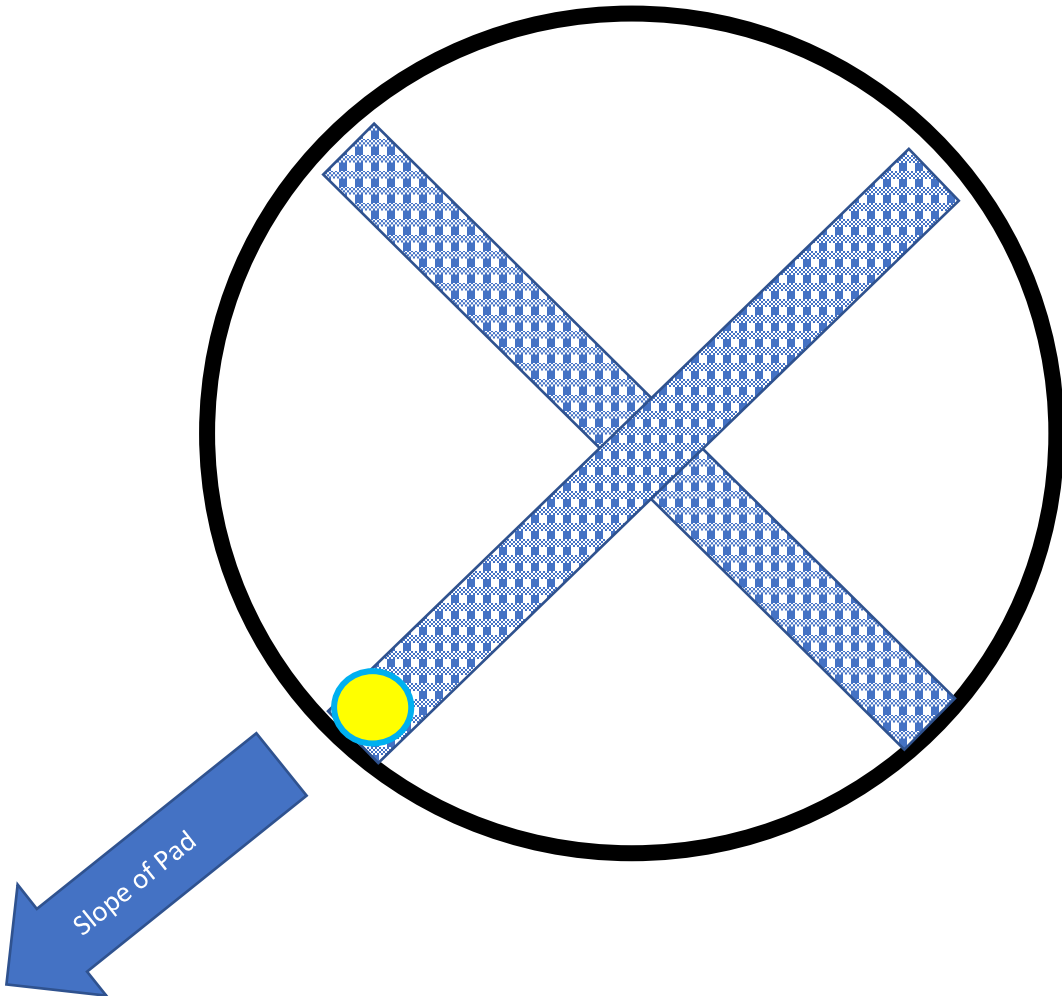
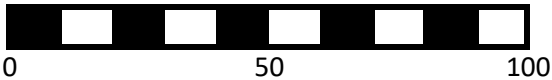
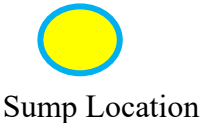
- 40-mil LLDPE comprise primary liner and 30-mil LLDPE comprise the secondary liner
- 200-mil geogrid drainage layer lies between the primary and secondary liner per Plate 2
- Geotextile between the geogrid and each liner
- > 3-inch deep sump excavated on down slope side of AST per Sump Design Drawing
- A small hose runs from the collection sump to top of AST via tube (see Section D)
- Every week, a portable self-priming peristaltic pump connects to the leak detection system.
- The self-priming pump discharge hose runs back into the AST, on top of the primary liner
- If fluid is detected, it is tested for conductance to determine the origin of the water (i.e. produced water or condensation)

R.T. Hicks Consultants Albuquerque, NM	Design Sketch	Plate 1
	Well Water Solutions	May-21

Use laser level to determine slope of pad and low point of AST

- 200 mil geogrid placed
  - above 8-oz geotextile and 30-mil secondary liner
  - inside of AST after set up, before install of primary liner
  - below 40-mil primary liner
- 8-oz geotextile is placed
  - over the 30-mil LLDPE liner inside the steel AST ring
  - under the 40-mil primary liner inside the AST

Sump at lowest point of the AST set up

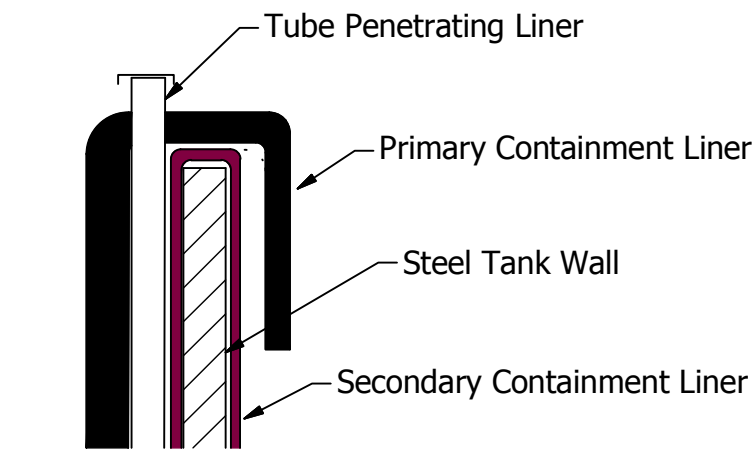
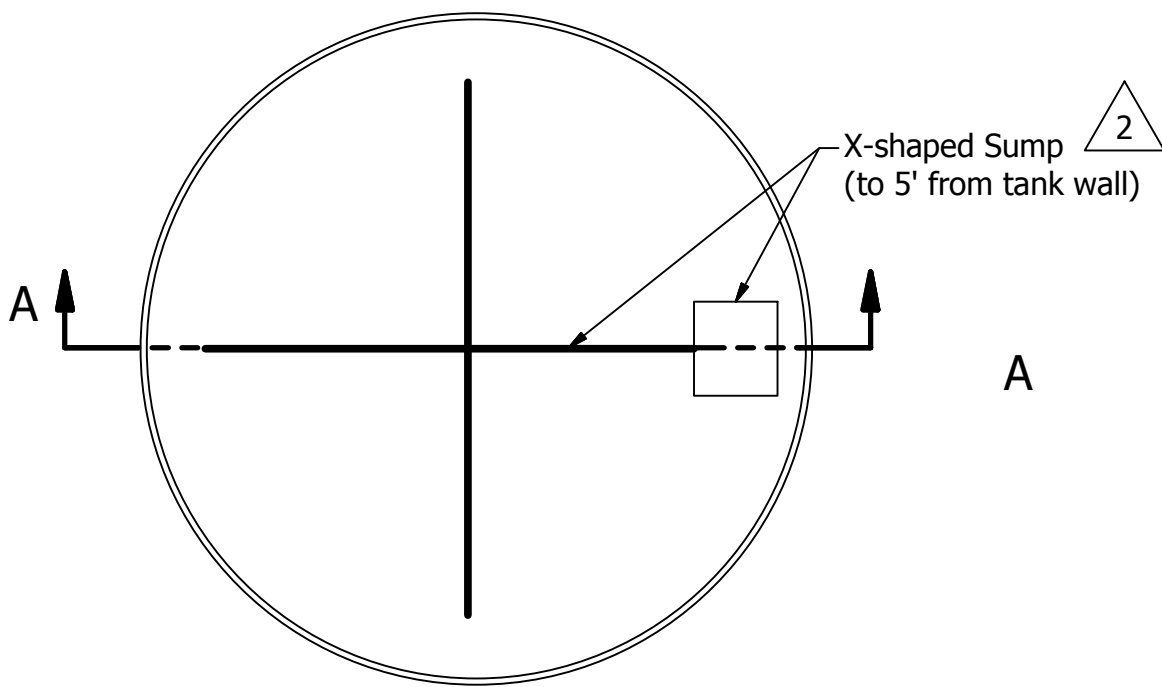


R.T. Hicks Consultants Albuquerque, NM	Layout of Geogrid Drainage Mat	Plate 1
	WWS - North Olympus AST	June 2021

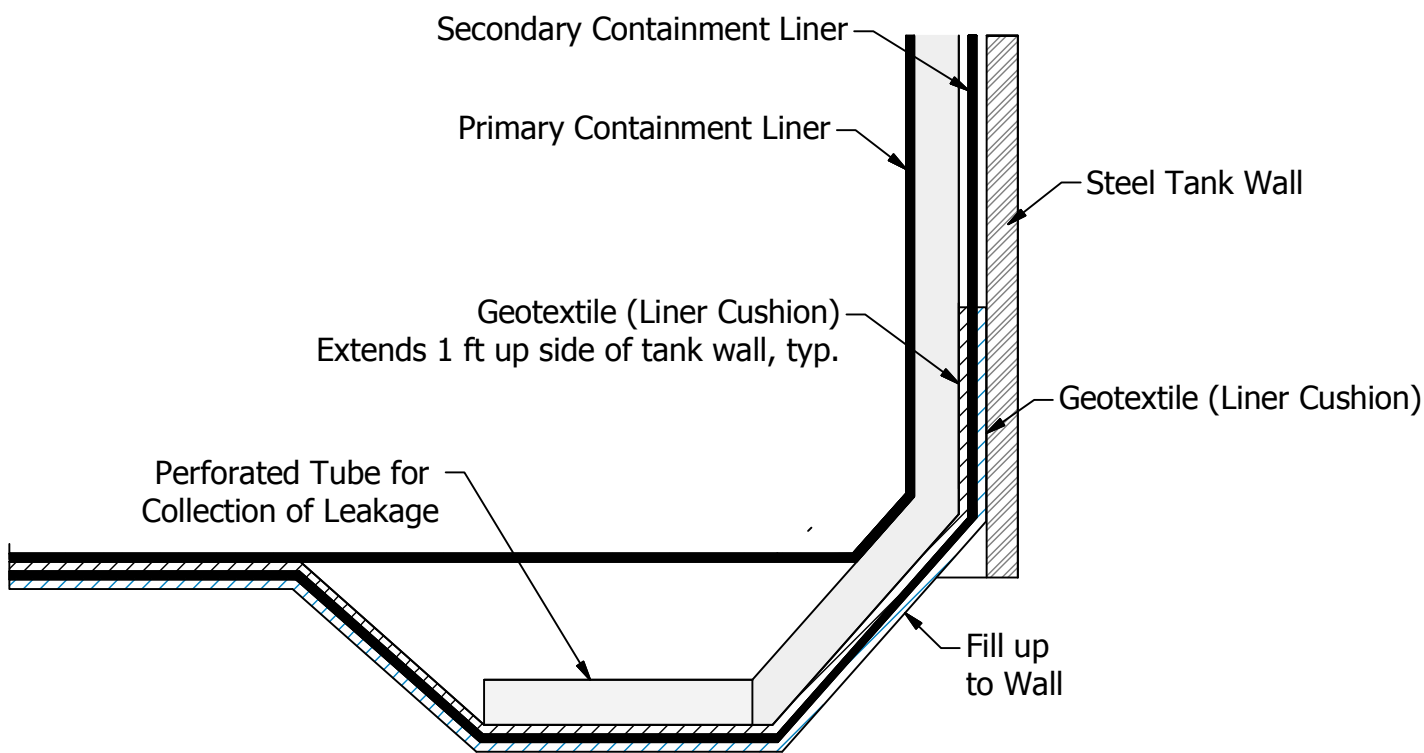
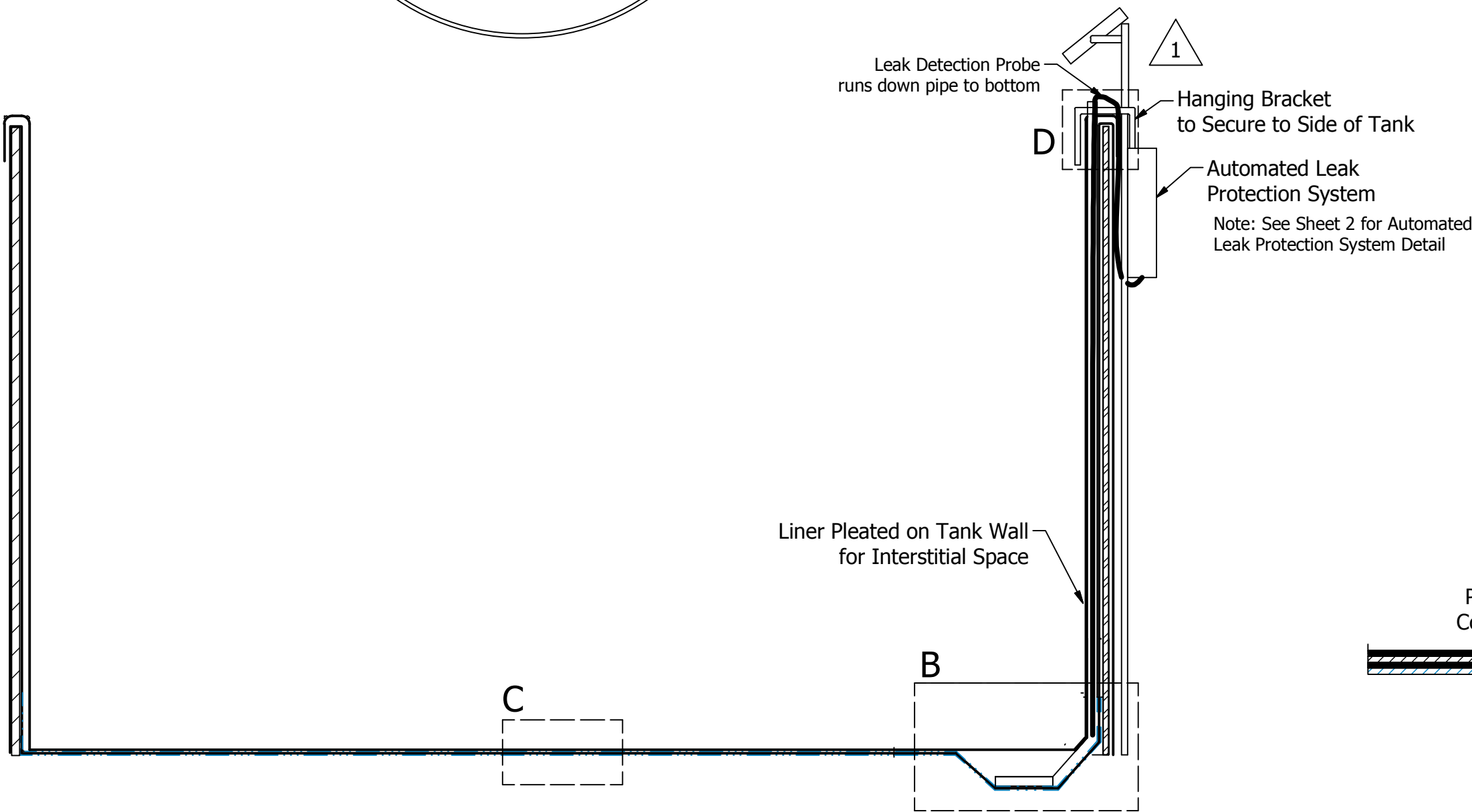
**C 147 – Box 3**  
**RECYCLING CONTAINMENT DESIGN DRAWINGS**  
**SET UP SOP**  
**LINER SPECIFICATIONS**



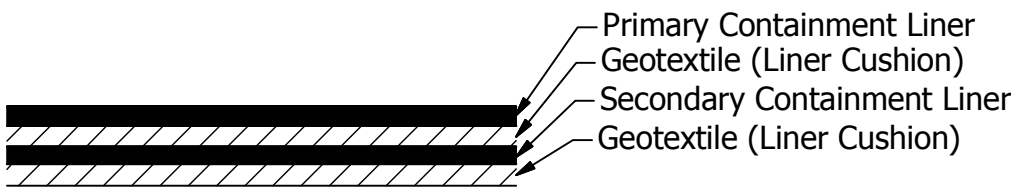
WWS DOUBLE-LINED  
FRAC WATER TANK SYSTEM



SECTION D  
TUBE DETAIL  
(Automated Leak Detection  
System Removed for Clarity)



SECTION B  
SUMP DETAIL



VIEW A-A  
TANK DETAIL

SECTION C  
LINER DETAIL



**LUCID**  
DRAFTING & DESIGN LLC  
sarah@luciddrafting.com 307.752.7388

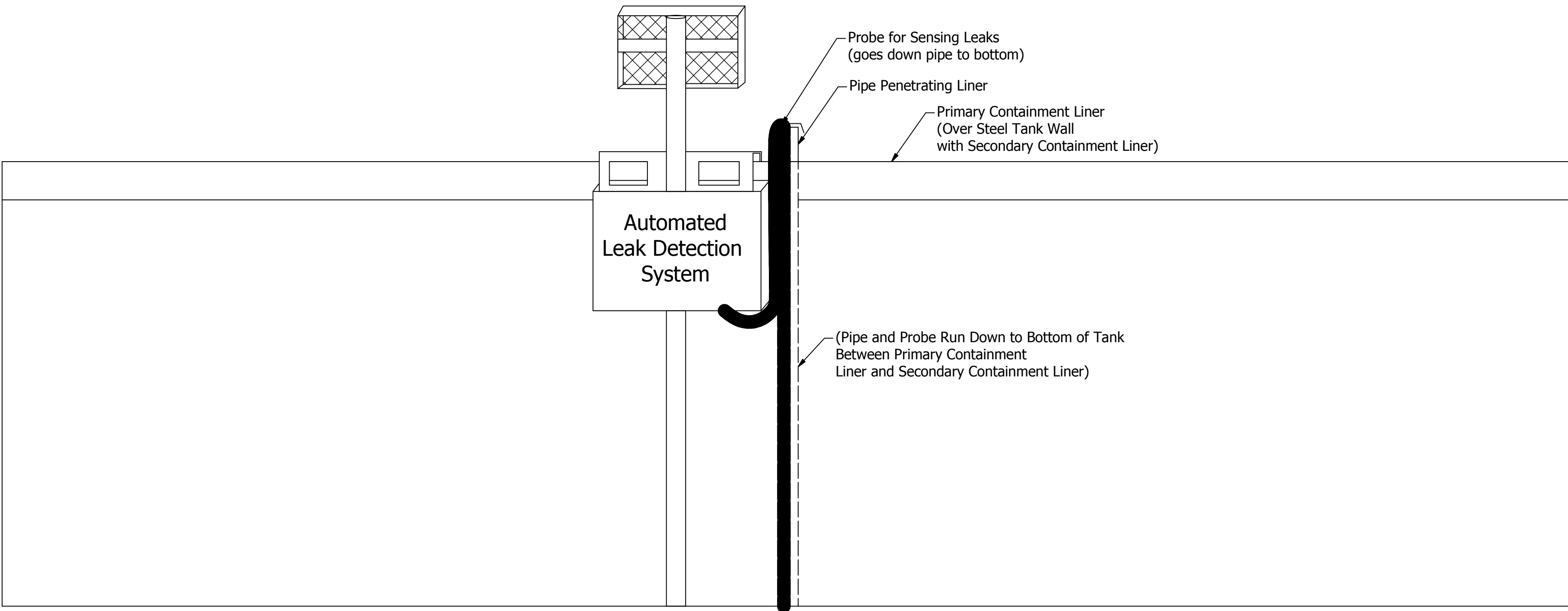
REVISION HISTORY				
REV	DESCRIPTION	DATE	BY	
0	INITIAL DWG	10/29/2015	SES	
1	ADDED LEAK DETECTION SYSTEM	11/6/2015	SES	
2	REVISED SUMP	11/6/2015	SES	
3	ADDED GEOTEXTILE UNDER AND BETWEEN LINERS	11/24/15	SES	


TITLE	
Double-Lined Frac Tank System	
CUSTOMER	
PROJECT/JOB	
WWS Double-Lined Tank System	
APPROVAL	
DRAFTER	DATE
SES	10/28/2015
THIS DOCUMENT IS THE PROPERTY OF WWS AND MAY NOT BE REPRODUCED OR DISTRIBUTED TO THIRD PARTIES WITHOUT THE PRIOR CONSENT OF WWS.	



SIZE	DWG NO	REV
C	LDD15-WWS-02	3
SHEET 1 OF 2		

1 AUTOMATED LEAK DETECTION SYSTEM



TITLE						
Double-Lined Frac Tank System						
CUSTOMER						
PROJECT/JOB						
WWS Double-Lined Tank System						
APPROVAL						
DRAFTER		DATE		SIZE	DWG NO	REV
SES		10/28/2015				
				C	LDD15-WWS-02	3
THIS DOCUMENT IS THE PROPERTY OF WWS AND MAY NOT BE REPRODUCED OR DISTRIBUTED TO THIRD PARTIES WITHOUT THE PRIOR CONSENT OF WWS.				SHEET 2 OF 2		

2020



**Well Water Solutions and Rentals Inc.**

## **STANDARD OPERATING PROCEDURE (SOP)**

WELL WATER SOLUTIONS AND RENTALS INC | 1150 Coyote Bar Nunn, WY 82601

## TABLE OF CONTENTS

### SECTION 1.01 INTRODUCTION

- 1) ABOUT
- 2) BACKGROUND
- 3) SOP PURPOSE
- 4) EH&S PROGRAMS
- 5) SUMMARY

### SECTION 1.02 AST PLANNING AND PREPARATIONS

- 1) PLANNING
- 2) REQUIRED AST ORDER INFORMATION
- 3) SITE MEETING OR SCHEDULING CALL
- 4) SITE SOIL PREPARATION
- 5) PRE-MOBILIZATION ON-SITE MEETING
- 6) CALL BEFORE YOU DIG "811"
- 7) AST MATERIAL DELIVERIES

### SECTION 1.03 WWS AST PRE RIG UP REQUIREMENTS

- 1) LOADING REQUIREMENTS
- 2) JOB SAFETY ANALYSIS (JSA)
- 3) CHECK SOIL CONDITIONS
- 4) PROPER TANK POSITIONING
- 5) EQUIPMENT (WWS PROVIDED)
- 6) HAND TOOLS RECOMMENDED

### SECTION 1.04 WWS AST RIG UP PROCEDURE

- 1) TANK LAYOUT
- 2) INITIAL TANK ERECTION PROCESS
- 3) SECONDARY CONTAINMENT LINERS AND INSTALLATION
- 4) TANK WALL ERECTION
- 5) PROPER LINER PLACEMENT AND CLAMPING
- 6) INSTALLING TANK ACCESSORIES
- 7) AST COMPLETION STEPS

### SECTION 1.05 AST IN USE OPERATIONS

- 1) INSPECTIONS AND MONITORING
- 2) INITIAL LEAK DETECTION AND LINER REPAIR

### SECTION 1.06 WWS AST RIG DOWN PROCEDURE

### SECTION 1.07 WWS AST ENGINEERING STAMPS

### SECTION 1.08 WWS AST ENGINEERING SPECS

### SECTION 1.09 PROPER AST SETBACK AND LOCATION SAMPLE

### SECTION 1.10 JLG APPROVED TELEHANDLER ATTACHMENT AND LOAD CHART

### SECTION 1.11 WWS MAN BASKET UPDATED ENGINEERING DRAWINGS

### SECTION 1.12 WWS MAN BASKET STAMP AND SOP

### SECTION 1.13 GEOMAMBRANE FABRICATION MANUAL AND TESTING CHART

### SECTION 1.14 GEOMEMBRANE INSTALLATION

### SECTION 1.15 WWS PREFERRED LINER SPEC OR COMPARABLE SUBSTITUTE

### SECTION 1.16 PATENTS AND PATENT PROTECTIONS



## Section 1.01 Introduction

### 1) About

Well Water Solutions and Rentals Inc. aka (WWS), is the original pioneer of the portable Above Ground Storage Tank industry. The above ground storage tanks or AST's have become an integral part in saving cost in the oil and gas and industrial industries. WWS has been supplying and servicing these portable tanks for longer than any other company in the USA. We have focused our time and experience on providing the best tank products at the highest safety standards. We continue to learn and adapt every-day in our industry to make sure our employees are safe and our customers are happy.

**Standard Operating Procedures** or (SOPs) are a staple for safety and quality here at WWS. Our SOP for our above ground storage tank (AST) systems including planning, rig up, operations, and rig down. This SOP will discuss steps to be taken to promote the safest process, as well as list the potential hazards that should be identified and reviewed during our JSA prior to beginning the work process.

### 2) Background

WWS has over 170 AST's that are used for a variety of oil field and industrial applications within the fluid management operations. AST's can be used in place of traditional 500 BBL trailer tank farms and in-ground water impoundments, and are suitable for fresh water as well as production water. WWS tanks have standard sizes, ranging from 6,000 barrel (bbl) capacity to 60,000 bbl capacities. Through intensive design criteria WWS secured a patented design on the strongest possible design for an AST tank. We analyzed many methods to secure the panels together and all other methods failed our criteria. We have also set a standard in the industry for safe movement of the panels with our patented adaptor plate for a quick attach telehandler. We were able to successfully submit engineering documentation to the Oshkosh Corporation, which owns JLG and they have stamped and approved our adaptor plate.

### 3) SOP Purpose

WWS will extensively review this SOP with all new hire employees to assure proper understanding of all procedures. This SOP will also be reviewed with an employee if his/her responsibilities change under the plan. An electronic copy of this plan will be available at all WWS regional offices.

Training our employees to follow our SOP is the first step to a safe and successful work environment. We also need all our employees to treat everyone with respect and follow the lead of their supervisor to make sure every day is safe.

**STOP WORK** authority and who has the power to use it is another tool we use to help everyone stay involved in the safety process. We highly encourage all employees to feel comfortable in raising awareness of any unsafe situation happening or providing suggestions to help make any task safer as well. This helps everyone grow to be a stronger team.

This SOP may also be used to inform customers about WWS's typical equipment and procedures for setting up an AST system. This SOP will be reviewed and revised on an ongoing basis to keep pace with best oilfield and industrial practices and applicable OSHA regulations.

#### 4) EH&S Programs

This SOP recognizes that oil and gas operating companies have developed their own health, safety, and environmental (HSE) programs that contractors who work at customer's sites like WWS, must comply with. In addition to this SOP, WWS personnel will strictly observe the policies and procedures of each operating company they are to do work with.

#### 5) Summary

This SOP recognizes that oil and gas operating companies have developed their own health, safety, and environmental (HSE) programs that contractors who work at customer's sites like WWS, must comply with. In addition to this SOP, WWS personnel will strictly observe the policies and procedures of each operating company they are to do work with.

### Section 1.02      **AST Planning and Preparations**

#### 1) Planning

Proper planning and documentation will help assure a successful AST rig up and rig down. The following steps can be utilized to fully, safely, and accurately perform the tank rig up or rig down:

- AST Order Information
- Customer Meeting
- Soil Conditions and Pad Preparation (Completed by Customer)
- Pre-Mobilization and On-site Meeting
- Notifications
- Job Safety Analysis (JSA)
- AST material requirements for delivery

#### 2) Required AST Order Information

WWS Manager or Field Supervisor will record general AST order information including the following:

- Site location directions and coordinates
- Customer Contact Name, Phone, and Email
- Emergency Medical Contacts
- Special Safety Requirements
- Tank Utilization Dates
- Tank size and Accessories
- Special piping requests

#### 3) Site Meeting or Scheduling Call

Prior to finalizing the delivery schedule, a meeting or conference call is held with WWS and our customers required personnel to make sure all parties are coordinating well and have the same and accurate information.

This meeting is best done in person, but must at least be covered in a phone call, followed up by a brief email confirming the AST order details, delivery schedule, and noting special conditions, safety requirements, verification of pad preparation, etc.

## KEY MEETING TOPICS:

- Introduce all WWS key personnel to our customer's key personnel
- Review what tanks are needed and what use they will be needing them for
- Review AST scope of work, what is normally included, what is not
- Confirm AST size(s) to be used
- Assure a 20' working space around each tank for safe working area
- Permitting for AST (as needed)
- Current site conditions and soil preparation requirements
- Site access and truck route requirements, and any weather-related issues that could affect them
- Time line for rig up and rig down of the AST
- Detailed drawings of the location layout for tank and piping placement
- Details on "Fresh Water" source to fill the tank on the day of the set up
- Assure a minimum of 24" of water the day of the setup to quickly and safely complete the job
- Identify what other charges could be incurred by the customer and result in standby time or additional charges
- Confirm customer is responsible for the used liner, residual solids left in the tank, removal of all radioactive NORM materials, and site reclamation
- Review any and all additional safety requirements the customer may have
- WWS to follow up with an email to review all changes made

#### 4) Site Soil Preparation

Preparation of the soils on site is required to form a dependable base for the AST.

Preparation of the tank pad is solely the responsibility of the customer/operating company.

WWS Soil Requirements are:

- Minimum soil compaction of 95% compaction
- Soil testing results shall be shared with WWS if requested
- Site must be cleared and free of debris such as sticks, sharp rocks, and trash etc.
- WWS recommends soil compaction testing to be conducted via Standard Proctor Test (American Society for Testing and Materials {ASTM} Standard D698) or Modified Proctor Test (ASTM Standard D1557)
- Compaction test results must be provided to WWS prior to the commencement of AST construction upon request
- Proof roll testing maybe be used if there is doubt of site compaction standards
- Grade of the inner AST area to be a maximum of .25% or 3" drop per 100' towards sump location
- Site shall be graveled and rolled prior to tank installation, utilizing gravel size 2B or smaller. (3/4" road grade preferred, or coarse sand with minimum thickness of 4 inches)
- \*Do Not Use\* crushed rock as sharp edges could puncture the tank liner

Completions of all these steps will assure a smooth, safe, and seamless tank set up.

#### 5) Pre-Mobilization Onsite Meeting

WWS's AST team will conduct a pre-mobilization onsite meeting with the customer that documents the customer requirements for the specific pad location and AST system.

## 6) CALL BEFORE YOU DIG "811"

Even though the customer or their subcontractor may have already called for utility locates for the sump hole, the WWS field supervisor should call the local or state underground utility location service again at least 3 days in advance before construction/digging begins. The ticket or reference number provided by the one-call service will then be documented.

The following web site has contacts for all the states and provinces.

<http://www.call811.com/state-specific.aspx>.

**Call 811** in United States

## 7) AST Material Deliveries

Once the delivery route and schedule are established and the pre-project onsite inspection is completed, the AST materials can be delivered. Updates and notifications will be made as agreed to during the customer meeting. WWS delivery personnel will use a spotter for the equipment driver and should unload all materials safely taking extra care to avoid damage to liners, plates, and all other AST components. Should any problem arise during the scope of operations the WWS field supervisor will notify to correct customer contact to remedy the issue.

# Section 1.03 WWS AST Pre Rig Up Requirements

## 1) Loading Requirements

WWS will have the field supervisor complete a **"Dispatch Load In Load Out Sheet"** before and after the set-up and rig down of the AST system. This sheet will identify all the needed parts and accessories to complete the AST Rig Up. During Rig Down the "Dispatch load in load out sheet" is also filled out to ensure all parts and accessories are accounted for and in good working condition. In the event parts or accessories are missing and/or damaged the customer will assume full responsibility and be billed back for the parts and accessories.

## 2) Job Safety Analysis (JSA)

A job safety analysis (JSA) must be completed on-site prior to the beginning of any work. The JSA will be completed according to WWS protocol and safety programs. Customer's safety requirements will also be communicated during the JSA. All personnel, third party contractors, and customer representatives are expected to participate and sign the JSA when the JSA is completed.

## 3) Check Soil Conditions

**Preparation of the tank pad is solely the responsibility of the customer.**

However, bad weather such as wind, rain, and snow events can change the soil conditions quickly. If soil conditions change the WWS field supervisor will notify the proper customer contact.

## 4) Proper Tank Positioning

- Check proposed AST site to confirm that a 20' clear work area around the perimeter of the tank is possible to provide access for equipment and laydown area for AST materials and erection equipment



- Check that the minimum setback distances to existing wells, power lines, etc. are met
- Mark out the tank location using WWS marking equipment
- Establish and mark out final location for the fill and suction tube(s) and stairs

## 5) Equipment (WWS provided)

All equipment is subject to daily inspection. (Check condition, rigging, oil, water, fuel and cleanliness.) Here is a list of the recommended equipment needed to set a tank. Actual equipment used will vary among region and specific projects.

- One 40' and/or 60' extending straight or z boom man-lift
- 10,000 lb. or greater capacity, rough terrain forklift (JGL 10-43A is preferred telehandler)
- Backhoe or small excavator with bucket
- Skid steer

## 6) Hand Tools Recommended

All hand tools are subject to daily inspection.

- Two 16' ladders
- Four 4 lb. sledgehammers
- 100' or 200' tape measure
- 1 case of marking paint – minimum
- Set of wrenches ¼" – 1 ½"
- Set of sockets ¼" – 1 ½"
- One small pry bar
- 8' rock bar (digging bar)
- Five safety harnesses with retractable tethers
- Five retractable lanyards
- Duct tape
- Covered hook bladed knife
- Three 40' lifting straps (minimum of 5,000 lb capacity)
- Three 20' 3/8" chains (must have visible certification tags)
- Two rolling head pry bars
- Two ½" impact guns
- Two sets of rigging chains
- Patch tape
- Rubbing alcohol
- Patch roller
- Leather gloves
- Wire brush or wheel with 4" angle grinder
- Generator
- Steel toed rubber boots
- All personnel must have Fire retardant clothing (FRs) Safety Hard Hats, Safety Glasses, crush resistant gloves and any safety requirements from customer

## Section 1.04 AST Tank Rig Up Procedure

WWS Field Supervisor will double check all paper work and location prior to setup to assure everything is correct and ready to set the AST.

### 1) Tank Layout

- Determine center of tank and mark with paint. Place a non-abrasive item on the center point; preferably a sandbag. This will be used to find the center of tank after liners have been placed
- Measure and double check minimum distance from tank center to existing wells or other set backs
- Measure and paint a line to mark the circumference of tank for panel placement using WWS special design marking tool
- Also mark 15' outside the tank circumference as this will show where the liner should reach once fully stretched flat. This will assure enough liner is present to go over tank walls once placed

### 2) Initial Tank Erection Process

- Determine where suction pipe is to be located in the tank
- Dig at least 4' wide x 6' long x 16" deep sump hole for over the wall suction pipe to set into and taper the edges so there are no sharp corners of the excavation. Or dig 3' wide x 12' long x 10" deep sump hole for undermount suction pipe
- Remove any sharp stones and debris for the digging process
- If multiple suction manifolds are required, the sumps should have a minimum of 15' of separation

#### **Attention:**

Barricade any sump pit with appropriate cones, tape, equipment, and/or have a hole watch if left open.

- All tank set-ups will utilize a standard 10oz geotextile that will be laid on the grounds surface to act as a padded protector for the liner
- A Standard LLDPE 30 mil or 40 mil liner will then be used as the primary containment, but may also be used as a secondary containment within the tank upon request.
- Check customer specifications and regulatory permitting to assure proper liner and containment requirements are met for ASTs
- Organized crew inspection walks for the entire tank base area will be performed to pick up any sharp stones or other sharp debris that could damage the liner
- The geotextile pad can now be deployed out fully at this point. It should reach beyond the tank circumference paint lines by 1'-4'
- Once geotextile is completed the liner can be fully deployed. Crews will double check that the liner will reach to the 15' marks beyond the tank circumference
- Crews will then perform a visual inspection of the liner and repair any defects as necessary
- Fold the liner towards the middle of the tank until tank circumference paint line is fully exposed

### 3) Secondary Containment Liners and Installation

- If tank system requires a secondary liner and leak detection system this will be installed on top of the first liner
- WWS Field Supervisor will direct the installation of the various parts and layers of the secondary containment system

- For example, a 220-mil geo grid mesh (Reference Section 1.16 for Spec) or other suitable approved spacer material can be installed between the top and bottom liner layers to provide a separation for to water flow. Installation of inspection pipes into to the designed low points of the tank will later be used for leak inspections
- Install any other customer required components for the leak inspections if needed
- Unroll top liner over geo grid to completed the secondary containment system
- Follow the same setup guidelines for a one liner system for the two-liner system, and make sure to complete the components installation fully once the first liner is clamped.

#### 4) Tank Wall Erection

- Field Supervisor will complete a visual inspection of each panel as it is prepared to be placed
- The first tank panel will be placed and secured using the backhoe bucket
- Once backhoe fully secures the panel the telehandler can then get the next panel. Crews will continuously provide operators with spotters during all operations
- If higher winds exist crews are cautioned to pay special close attention to all operations
- Crews will repeat the panel placement process until entire tank is erected
- Personnel secured on man lift or using a ladder (depending on customer policies) then secure the panels in place with 14 retainer pins per panel.

##### ATTENTION:

Proper hand and foot placement is crucial when connecting AST panels. Keep hands and feet a safe distance from pinch points. Discuss where these pinch points are located when reviewing the JSA. Keep the joints in mid-range; i.e. palms are located between waist and shoulders. Create an awareness that never goes away and designate one individual to enforce the awareness when setting panels.

- Roll up excess geo pad into minimum 6" diameter cylinders around the inside of the tank ring to help support the liner at the base of the tank wall as the tank is being filled.
- Prior to lifting liner into place against inside panel, add geo strips over all panel connections points and use spray glue to secure in place
- Prior to covering sump with the geo pad or liner, confirm sump excavation has smooth sides and corners, and that no sharp stones are present.

#### 5) Proper Liner Placement and Clamping

- After 3 or more panels are set, and all liner protections are complete, crews inside the tank can begin to hand liner up to crews outside the tank that are in the manlift
- Crew of 2 inside the tank wall unfolds and pulls the liner toward each panel (final connection of last panel will not be made until all liner to that point is pulled and secured to avoid confined space, all personnel must be out of tank before walls are closed)
- The inside crew of 2 works with the manlift crew of 2 located outside to pull the liner up and over the top of each panel. The man lift crew lifts the liner using ropes/straps gently lowered and attached (by the inside crew). The man lift crew lifts a small liner section to

the top of the panel and folds it over the top of the panel, being sure there is enough slack in the liner inside the panel wall

- Proper slack or excess liner on the vertical wall can be tested by the inside crew. The crew will pin the liner to the bottom of the wall with their boot and pull liner at chest level outwards away from the wall. There should be about 3' from wall to liner when being pulled. This is the appropriate amount of slack. If crew ever has doubt that the liner slack may not be enough WWS's experience has proven more slack the better, so just give it a little more slack if needed

NOTE: The crew must allow sufficient slack in the liner at the wall to allow for liner movement during filling and draining.

**ATTENTION: Never place hands on the railing of the man basket that faces the AST panel. Proper hand placement would be the side or back rail.**

- Once a section of liner is positioned properly (with liner slack inside the tank) and over the top of each panel wall, the man lift crew secures the top of the liner with clamps. (Tools in basket secured with tool lanyards) NOTE: Each clamp is notched where D-rings on the top of each panel are located. This notch acts as an added safety retainer once clamps are fully tightened. Each panel will receive 2 liner clamps
- Crews will continue to clamp until they have reached the final panel. Crews will leave this small area of liner down until all internal piping is completed

## 6) Installing Tank Accessories

- Install safety stair system, fill piping, and suction piping. Ensure that stair system and piping are appropriately secured to the tank walls with ratchet straps or chains
- Assemble all interior piping and assure any connections or sharp points are fully wrapped in geo material for protection

## 7) AST Completion Steps

- Close final panel and secure with pins
- Lift liner and secure at the closure point to finish clamping process
- Trim liner and allow approximately 2' of liner to hang over edge of tank.
- Begin to fill the tank with water and monitor filling process
- Inspect all connections and equipment, confirming at least 2 liner clamps are in place on top of each panel
- Have a minimum of 24 inches of water put in the tank to hold liner in place
- Fill tank and monitor
- Perform periodic inspections of the tank to ensure everything is in proper working order
- Every time a tank is fully emptied and refilled, an inspection must be performed
- Water should NEVER go below 12 inches at the LOWEST level in the tank. (Mark liner as a caution).

NOTE: Filling process may begin as early as ¾ of the tank wall panels are set. Only fresh water can be used if filling while personnel is in the tank. Reasons for early filling is to assist with windy days as the water weight help to hold liner in place. It is recommended no personnel be in the tank with more than 6" of water.



## Section 1.05 AST In Use Operations

### 1) Inspections and Monitoring

weekly

AST Operation Phase includes periodic AST monitoring, leak detection, and identifying potential hazards that may have developed, change on-site conditions or tank use. If the tank is drained, it should be secured from wind impacts and the liner inspected and re-positioned (to provide sufficient slack during filling) prior to refilling. Specifically, it may be necessary to rearrange the liner folds at the walls prior to refilling if the wind has shifted the liner folds when the tank was empty.

If changes are noted, they should be communicated to the WWS Manager/Field Supervisor.

**CAUTION** – If conditions are observed that could indicate an imminent tank failure, clear the area immediately. Advise others in the vicinity to do so also and contact the customer to drain the tank.

### 2) Initial Leak Detection and Liner Repair

Notify BLM and NMOCD if leak reaches the ground

In the event of a leak in the tank due to a hole in the liner, the following steps should be followed.

- If there is a question that it is in fact a leak from the AST, a dye test or a pH balance test may need to be performed on both the water in the tank and on the ground using approved dye or a properly calibrated pH meter. Third party test results are recommended.
- If the leak is found to be coming from the tank, narrow down from which panel the leak is originating.
- Use a strap or rope to mark the point where the water is coming out of the tank.
- Determine if the water is coming out high or low on the tank.
- Locate the puncture or hole in the liner.
- Empty the tank to the point of damage in liner if necessary.
- Clean area of liner that needs to be repaired.
- Cut out piece of material (patch or tape) to overlay liner.
- Either weld the patch to the injured area in the liner or stick the tape (2 types – dry or underwater) over the leak.
- Make sure puncture is completely covered.
- Monitor as needed.

## Section 1.06 WWS AST Rig Down Procedure

The AST breakdown follows the reverse order of the setup steps presented in the AST Rig Up Procedure above. The sump will be filled in with the same material taken out during excavation.

The customer is responsible for draining and disposing of all liquids and residual solids that have accumulated in the tank. Additionally, the customer is responsible for proper off-site management or recycling of the liner and geo pad materials, and final grading and/or reclamation of AST site.

Customer is responsible for any removal of radioactive NORM materials before WWS crews can rig down any tank.

## Section 1.07 WWS AST Engineering Stamps

**PILLAR STRUCTURAL ENGINEERING**

June 30, 2015

Well Water Solutions and Rental, Inc.  
2130 W. 40<sup>th</sup>  
Casper, WY 82604  
Attn: Sean Lovelace

Re: Portable Frac Tank Certification – Pinned Seams

Dear Mr. Lovelace:

Per your request our office has performed a structural analysis of the portable frac tanks as well as the associated accessories. This analysis was performed to determine that the tanks meet the required strength criteria under operating conditions according to the AISC Manual of Steel Construction.

The tanks range in diameter from approximately 81 to 190 feet and are 11 feet, 8 inches in height and are designed to store water. They are constructed of individual steel reinforced panels that are connected together with a patent pending steel pin system.

The following tanks sizes were included in the analysis:

- ⌚ 10,000 BBL – Approximately 81'Ø
- ⌚ 20,000 BBL – Approximately 108'Ø
- ⌚ 30,000 BBL – Approximately 135'Ø
- ⌚ 40,000 BBL – Approximately 156'Ø
- ⌚ 50,000 BBL – Approximately 176'Ø
- ⌚ 55,000 BBL – Approximately 183'Ø
- ⌚ 60,000 BBL – Approximately 190'Ø

The tanks are constructed of the following materials:

- ⌚ Tank Panels – ASTM A36, 36 ksi Steel Plate
- ⌚ Horizontal & Vertical Framing – ASTM A500, Grade B, 46 ksi Structural Steel Tubing
- ⌚ Connecting Pins - ASTM A36, 36 ksi Steel Round Bar



1964 East 1<sup>st</sup> Street  
Casper, WY 82601

PHONE (307) 265-3900  
FAX (307) 265-3559  
WEB SITE <http://www.pillarse.com>

June 30, 2015

Page 2 of 2

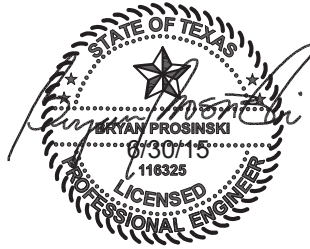
Our office has determined that the portable frac tanks, as described herein, are capable of supporting the operating load conditions in conformance with the AISC Manual of Steel Construction.

Calculations of this analysis can be provided upon request.

If you have any questions or require additional information please contact our office.

Sincerely,

Bryan Prosinski, P.E., S.E.  
Pillar Structural Engineering



June 30, 2015

Page 2 of 2

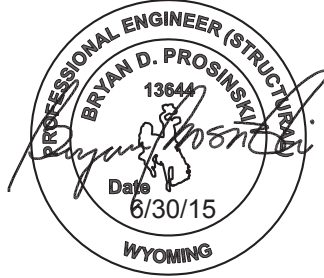
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Bryan Prosinski, P.E., S.E.  
Pillar Structural Engineering





June 30, 2015

Page 2 of 2

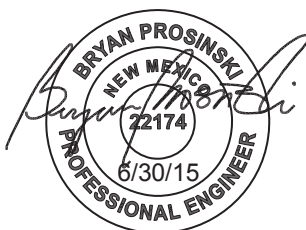
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If you have any questions or require additional information please contact our office.

Sincerely,

Bryan Prosinski, P.E., S.E.  
Pillar Structural Engineering



June 30, 2015

Page 2 of 2

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Calculations of this analysis can be provided upon request.

If you have any questions or require additional information please contact our office.

Sincerely,

J. Brendan Bummer, P.E.  
Pillar Structural Engineering



June 30, 2015  
Page 2 of 2

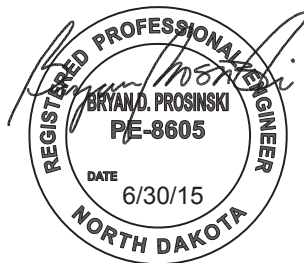
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Calculations of this analysis can be provided upon request.

If you have any questions or require additional information please contact our office.

Sincerely,

Bryan Prosinski, P.E., S.E.  
Pillar Structural Engineering





Box 7866 5014 Industrial Road, Drayton Valley, Ab. T7A 1L5 Ph: (780) 542-3096 Fax: (780) 542-6405

## Engineering Compliance

July 6, 2015

KFE Project #151055

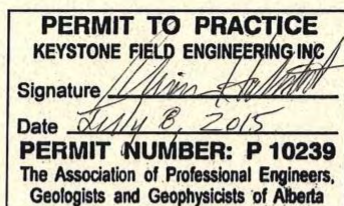
Water Well Solutions and Rentals, Inc.  
Attn: Scott Sandler  
2130 W. 40<sup>th</sup>  
Casper, Wyoming (USA) 82604

Attention: Mr. Scott Sandler

Re: Portable Frac Tank Engineering Review and Compliance – Pinned Seams  
Sizes: 10K, 20K, 30K, 40K, 50K, 55K and 60K Tanks

A structural engineering review was conducted by Peter Vann (P. Eng) of Keystone Field Engineering Inc. for the above noted tank sizes. It was determined that the 'pinned' tank panel connections are capable of supporting the operating load conditions; and the panel lift points are of suitable construction according to the Canadian Handbook of Steel Construction (latest addition). The certified liner for the tanks shall have a minimum bonded seam strength of 40 ppi.

If you have any questions, please contact the office at 780-542-3096.

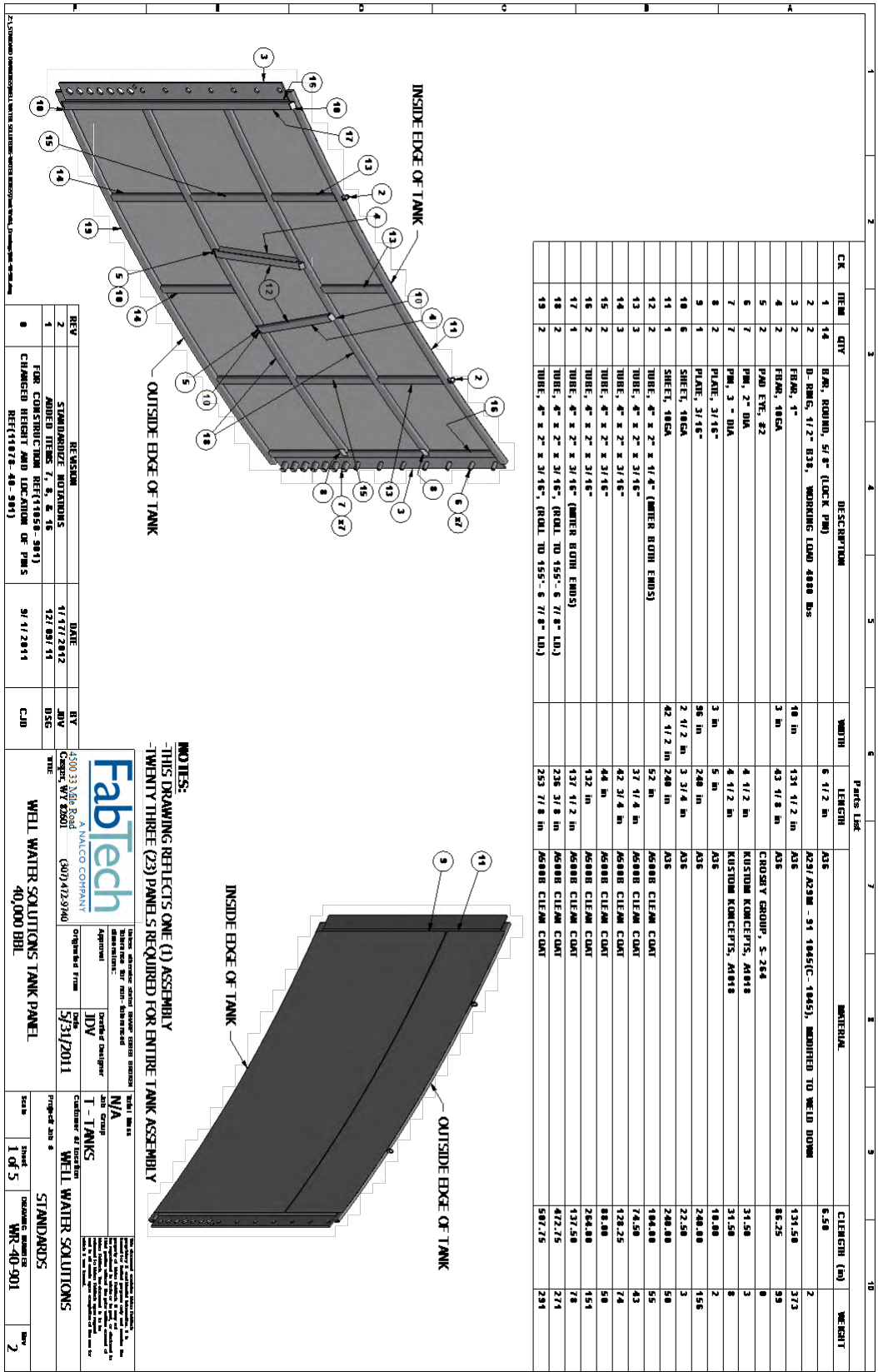


Peter Vann, P. Eng  
Structural Engineer

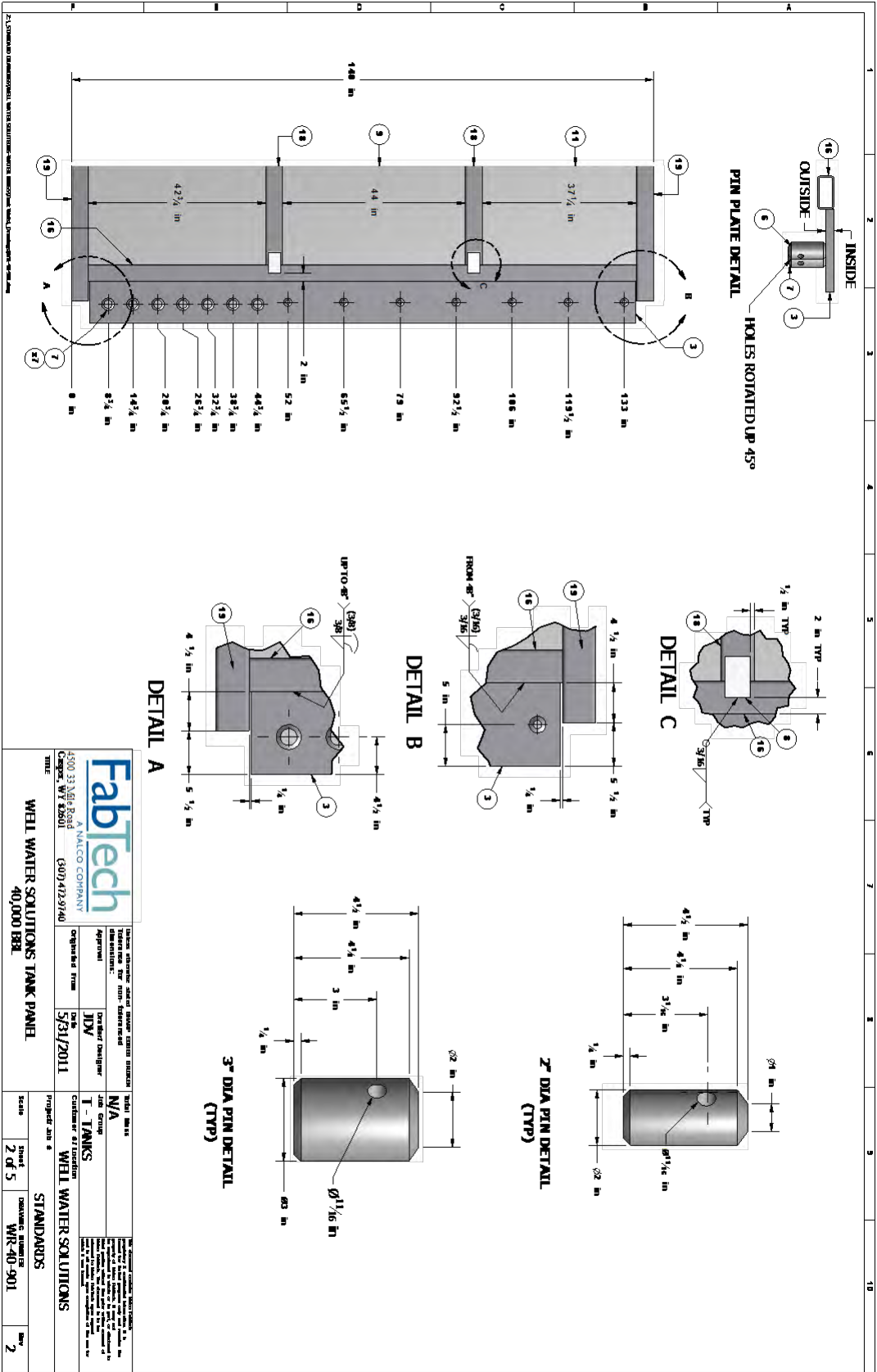
KEYSTONE FIELD ENGINEERING INC.  
PV/ kj  
Reference:  
Drawings completed by Nalco FabTech

[www.keystonefieldeng.com](http://www.keystonefieldeng.com)

Section 1.08 WWS AST Engineering Specs





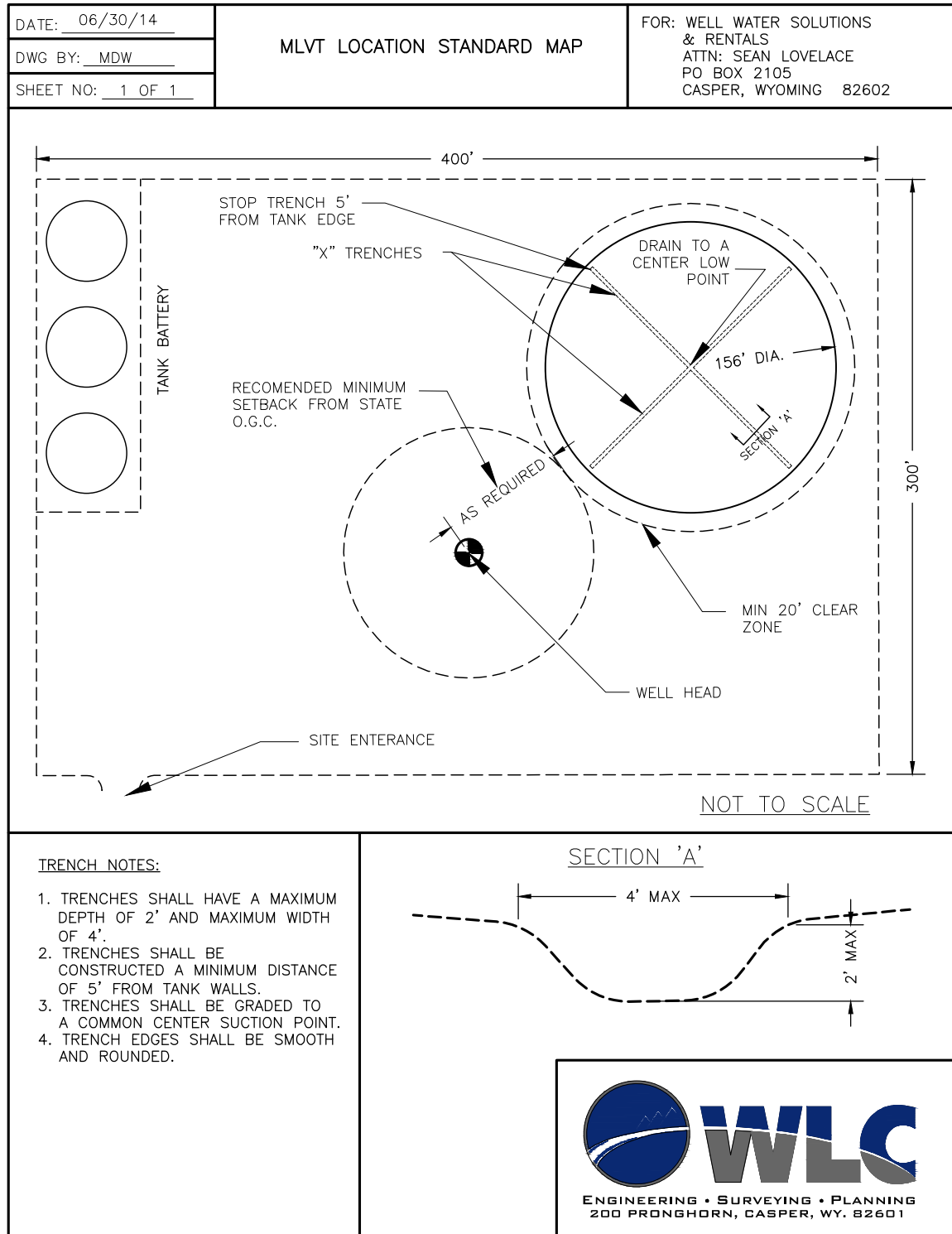








## Section 1.09 Proper AST Setback and Location Sample





Case	Material	Displacement	Width	Length	Mass	Max. Force	1st Natural Freq.	WCCF
1	Steel, 1"	4 in.	4.64 in.	5.56	9.50 lb.	5.97	10.02	
2	Aluminum, 1"	4 in.	5 in.	6.96	5.00 lb.	5.97		
3	Aluminum, 1"	3 in.	3.00 in.	4.44 in.	10.06			
4	Aluminum, 1"	10 in.	4.01 in.	5.36	40.73 in.	109.35		
5	Aluminum, 1"	10 in.	4.34 in.	5.36	49.73 in.	123.37		
6	Aluminum, 2"	3 in.	13.98 in.	3.40	13.40 in.	8.81		
7	Aluminum, 2"	5 in.	5.36 in.	5.36	8.40	8.81		
8	Aluminum, 2"	1.77 in.	3.77 in.	5.36	11.00 in.	33.32		







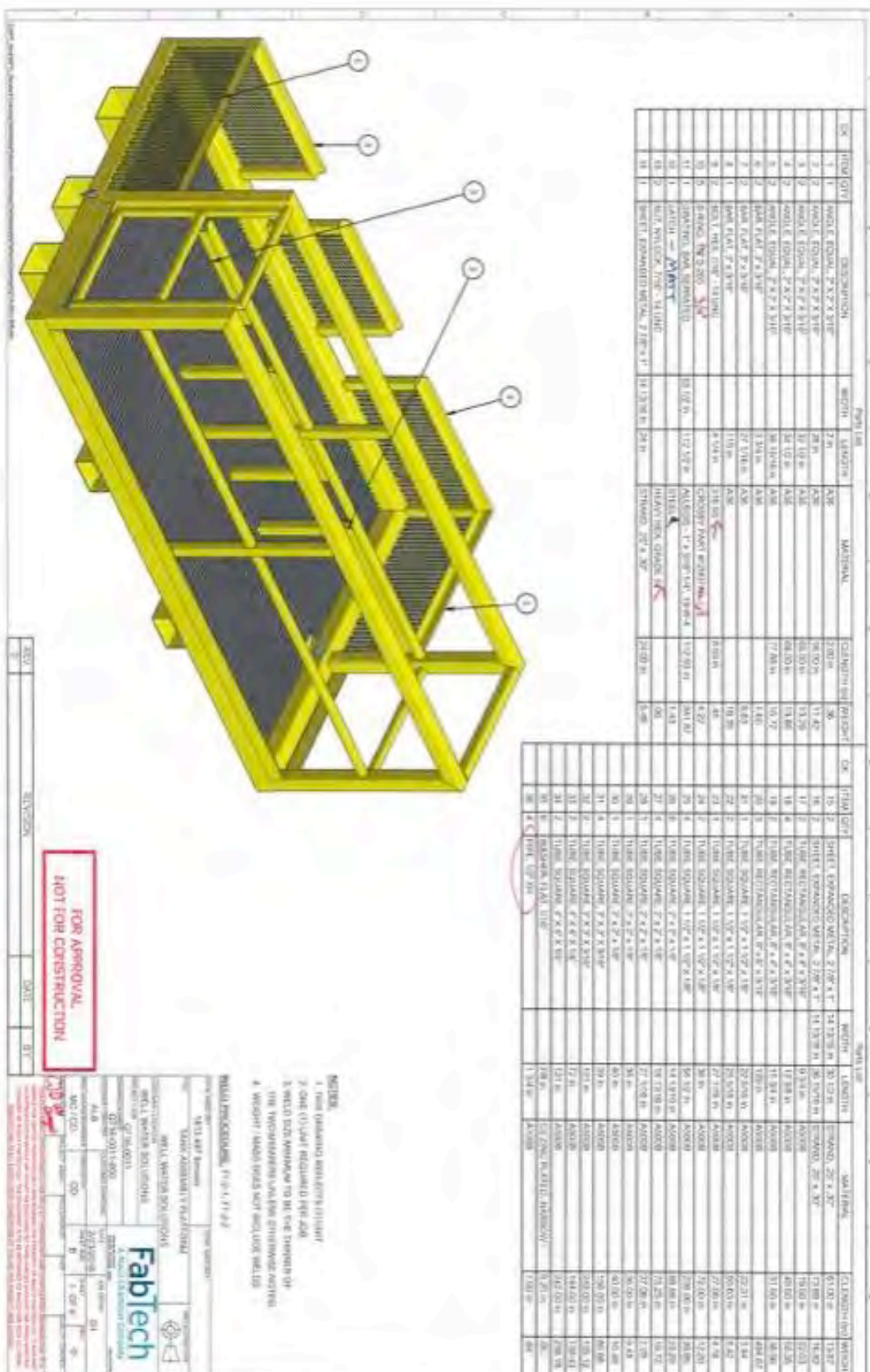














Section 1.12 WWS Man Basket Stamp and SOP

MAN BASKET LOAD RATING

Prepared for: Well Water Solutions and Rental, Inc.  
2130 W. 40<sup>th</sup> Street  
Casper, WY 82604

Prepared by: Pillar Structural Engineering



February 3, 2014



1964 E. 1<sup>st</sup> St.  
Casper, WY 82601  
P: (307) 265.3900  
F: (307) 265.3559

## Summary

The purpose of this report is to present the maximum load ratings that resulted from the structural analysis of an existing steel man basket which is currently employed by Well Water Solutions and Rentals, Inc. The man basket is utilized to perform various tasks aiding in the erection of frac tanks and the installation of liner clips on said tanks. The man basket consists of two basket components; the liner clip basket which handles and stores the liner clips, and the man basket which supports the liner clip basket and the human operators. It is our understanding that there are a maximum of two operators allowed to work in the man basket at any given time. The liner clip and man baskets are hoisted and transported with heavy equipment such as a tele-handler or front end loader.

This analysis was performed in accordance with the *American Institute of Steel Construction Inc. – Manual of Steel Construction – Thirteenth Edition*. To complete this analysis, assumptions were made and are listed below.

### Scope of Work:

1. Field measure the liner clip and man basket.
2. Perform structural analysis of the liner clip and man basket to determine a safe operating load rating.

### Assumptions:

1. Rolled structural steel shapes are assumed to conform to the following specifications:
  - a. Channels, Angles & Plates (C, L, Plate) ASTM A36, 36 ksi yield stress
  - b. Hollow Structural Sections (HSS) ASTM A500, Grade B, 46 ksi yield stress
2. HSS Shapes are assumed to have a constant wall thickness throughout its length. Assumed wall thicknesses and shapes, which were not able to be measured, are listed in the body of the report.
3. For all welded members the provided maximum load ratings are based on all connected members being welded with a minimum of a 3/16" fillet weld, fully welded with an E70 electrode or equivalent submerged arc weld. A certified weld inspector should be consulted to fully verify the properties and quality of these welds.
4. The basket floor and sides consist of flattened expanded metal. Our office was unable to determine the grade and size of the flattened metal. It is assumed that this flattened expanded metal floor is capable of supporting the maximum load rating specified herein.

### Limitations and Quality Control:

1. All heavy equipment utilized to hoist and transport the man basket must be capable of safely supporting the weight of the man baskets in addition to the maximum safe operating load.
2. All structural steel must be protected from corrosion by either galvanizing or painting.
3. The man basket shall be periodically inspected for signs of corrosion, defects, overloading and anything else that may indicate a reduction of the load-carrying capacity of the man basket.
4. The baskets have been analyzed to account for a minimum factor of safety of 1.5.







### Liner Clip and Man Basket:

**Field Label:** N.A.

**Style:** Welded Structural Steel

**Maximum Liner Clip Basket Load:** 1,200 lbs

**Maximum Man Basket Load:** 40 psf = 1,100 lbs

**Approximate Man Basket Weight:** 1,600 lbs

**Description:** Refer to picture above for clarification.

**Primary Vertical Members:** HSS 1 ½ x 1 ½ x 1/8

**Primary Horizontal Members:** Railing - HSS 1 ½ x 1 ½ x 1/8, Floor Support – HSS 1 x 2 x 1/8

**Additional Members:** Man Basket Floor Perimeter - Angle 3 x 4 x ¼ (LLH), Liner Clip Basket Floor Perimeter – HSS 2 x 2 x 3/16, Man Basket Fork Slots – HSS 10 x 6 x ¼, Liner Clip Basket Fork Slots – HSS 8 x 4 x ¼, Basket Floors and Sides - Flattened Expanded Metal

**Member Layout:** (All Dimensions are Approximate) The overall length, width and height of the Man Basket is 10'-0" x 6'-0" x 3'-8", respectively. The overall length, width and height of the Liner Basket is 10'-0" x 3'-2" x 30", respectively. Member spacing; primary vertical members = 30", floor supports = 15" (Man Basket), 30" (Liner Clip Basket)

**Comments:** The quality of construction, based on visual observations only, appears to be good.

#### Additional Recommendations:

**Attachment of Liner Clip Basket to Man Basket:** The Liner Clip Basket must be fastened to the Man Basket while in operation. Our office recommends fastening along the intersection of the HSS 1 ½ x 1 ½ x 1/8 railings with 4 bolted steel clamps (placed 1 at each end and spaced equally between).

**Attachment of Man Basket to hoisting/transporting equipment:** The Man Basket must be fastened to the hoisting/transporting equipment with a steel chain attached to the welded "D-rings". The chain must be rated for a minimum safe working load limit not less than 8,000 lbs. The chain must be secured and tightened with a lever or ratchet chain binder with a minimum safe working load limit not less than 8,000 lbs.



Section 1.13

Geomembrane Fabrication Manual and Testing Chart

# MLVT GEOMEMBRANE PANEL FABRICATION MANUAL

**Well Water Solutions, Inc.**

---



Colorado Lining International  
Parker CO 80138  
800-524-8672/303-841-2022  
Fax: 303-841-5780  
[www.coloradolining.com](http://www.coloradolining.com)

## TERMINOLOGY

The following definitions will be used throughout this document.

**Geomembrane Manufacturer-** The party responsible for compounding resin into geomembrane roll goods.

**Geomembrane Fabricator-** The party who is responsible for welding the geomembrane roll goods, through factory fabrication using controlled welding methods, into geomembrane panels. **Colorado Lining International – 800-524-8672**

**Geomembrane Installer** -The party responsible for placing and/or joining geomembrane panels in the field or on the job site.

**Geomembrane Sheet** -The product of the Geomembrane manufacturer, provided on rolls to the fabricator.

**Geomembrane or Panels or Geomembrane Panels** -The term applied to multiple geomembrane sheets that have been welded together, through factory fabrication, under controlled conditions. The actual size of the panels will depend upon weight, mil thickness, and design configurations.

**Sample** -The piece of liner or seam section taken for testing. It is usually large enough to contain specimens for a series of tests.

**Seam** -The completed process of welding two geomembrane sheets together.

**Specimen** -The term applied to an individual part of a sample. Specimens are used to test peel and shear values of a welded seam.

**Welding** -The process whereby two sheets or panels of geomembrane are joined together.

**MLVT** – Modular Large Volume Tank

**MLVT Geomembrane Liner** – One or more factory fabricated Geomembrane Panel(s) for placement inside an engineered containment ring.

**1.0 GENERAL****1.1 Products**

- A. The geomembrane material shall be 30 to 60 mils thick, as specified. The geomembrane shall be manufactured consisting of first quality ingredients. The finished compound shall be uniform in color, thickness, size and surface texture.

**1.2 Markings**

- A. In the case of round tanks, panels shall include a highly visible "cross hair" style marking denoting the center point of the panel to coincide with the center point of the tank. Radial spoke-like markings will be painted on the panel surface to assist with field measures to assure vertical alignment up the tank walls.

**2.0 Subgrade Preparation**

- A. The Earthwork Contractor shall be responsible for preparing and maintaining the subgrade in a condition suitable for installation of MLVT Geomembrane Panel. Any damage to the surface caused by weather conditions or other conditions must be repaired prior to MLVT Geomembrane Panel deployment. The installer will submit, prior to installing the MLVT Geomembrane Panel, written approval of the subgrade surface on which the MLVT Geomembrane Panel will be installed.
- B. All surfaces in contact with the MLVT Geomembrane Panel must be free of sharp stones, stones over 3/8" in diameter, sticks and other debris that can puncture or tear the MLVT Geomembrane Panel. No standing water, mud, snow or excessive moisture should be on the subgrade when the MLVT Geomembrane Panel is deployed. Subgrade should be constructed of a firm stable material compacted to a 95% proctor.

**3.0 Deployment of MLVT Geomembrane Panels**

- A. The MLVT Geomembrane Panel shall be placed at the edge of the tank layout and be lined up with the centerline of the tank layout. Unroll the MLVT Geomembrane Panel down the centerline of the tank layout. Verify the markings on the MLVT Geomembrane Panel line up with the tank layout. If needed adjust the placement of the MLVT Geomembrane Panel prior to proceeding with installation.
- B. The MLVT Geomembrane Panel is then unfolded in the perpendicular direction to which it was unrolled in one direction. The next step is to unfold the MLVT Geomembrane Panel in the opposite direction of the first unfold direction.
- C. See sketch at end of document for clarification of these steps.

**4.0 MLVT Geomembrane Representative Welds**

- A. At the start of each day's work and once every 4 hours thereafter, before any welding machine shall be deployed on a liner panel, a sample of a representative seam shall be produced and evaluated for each welding machine to be utilized.

Representative welds shall also be required if there is a change in environmental conditions. Representative samples shall be prepared non-destructively using strips of geomembrane cut from excess sheets of liner being seamed. Peel and shear samples are to be tested with a calibrated tensiometer. Field seam welding shall commence only after successful representative seam test results are achieved by each machine.

- B. Test results shall be representative of subsequently made seams on an actual liner fabricated after the test. There shall be one representative seam evaluation made every four hours and on each machine utilized. Representative welds shall be recorded on the CLI Seam Quality Control Form which shall be available to customers upon request.

## 5.0 Seam Testing Criterion

Samples shall be non-destructive, not requiring patching of fabricated panels. Four test specimens (2 shear and 2 peel) shall be cut from each seam sample and tensiometer tested for bonded seam strength and peel adhesion. All test results shall be recorded in the Seam Quality Control Form.

- A. Tensiometer Peel Strength Test:

Peel adhesion shall be in accordance with ASTM D 7747. In seam samples when tested in peel, failure shall occur resulting in a Film Tearing Bond (or "FTB"). The tensiometer peel test provides a numerical value for the peel strength achieved in addition to visually inspection for film tearing bonds. Samples should be 1" wide centered over the seam.

- B. Tensiometer Tensile Strength Test:

Samples shall be tested with a tensiometer and evaluated for bonded seam strength (shear) using method ASTM D 7749.

- C. Shear and peel test results shall conform to either GRI GM 19 requirements or to the manufacturer's requirements.
- D. All Field Seams shall be 100% tested by high pressure air lance in accordance with ASTM D 4437.

## 6.0 Field Thermal Wedge Weld Seaming Procedures

4 to 6 inches per NMOCD Rule

- A. Adjacent MLVT Geomembrane Panels shall be overlapped by approximately 4" for fusion welding. Panel edges to be seamed shall be clean of all foreign matter or debris before seaming commences. Welding can occur once the sheets to be joined have been cleaned and brought into their exact position.
- B. When starting a new weld, the machine shall be manually placed into the overlapped sheet of material.



- C. Welder alignment and temperature shall be monitored during the seaming process and adjustments will be made as necessary. The welded seams must be 100% visually inspected as welding machinery advances.
- D. All cross seams or "T" intersections caused by material roll splices where 3 layers of membrane material occur shall be patched where they intersect with 3" or larger diameter patches of the MLVT Geomembrane material. Patches shall be applied by use of a hand held heat gun and seam roller. All patches and repairs shall be 100% tested by high pressure air lance or vacuum box in accordance with ASTM D 4437 and ASTM D 5641.
- E. Should a defective seam be found, welding shall be ceased until the cause of the defect is determined and rectified and the seam is repaired. Documentation of the defect and repair shall be recorded on the Seam Quality Control Form.

#### **7.0 Fold back of MLVT Geomembrane Panels**

- A. Once all field seaming is completed the outer limits of the MLVT Geomembrane Panels need to be folded back on top of themselves far enough to provide enough room for assembly of the steel tank sections without damage to the system.

#### **8.0 MLVT Geomembrane Panel final deployment**

- A. Once the steel walls are assembled they need to be inspected for any sharp surfaces that could damage the MLVT Geomembrane Panels and there needs to be a support material placed as a chamfer at the transition from the wall to the subgrade to eliminate the possibility of stressing the MLVT Geomembrane panel at the 90 degree transition. This support material can be sand tubes, precut foam, etc.
- B. Next the MLVT Geomembrane Panels need to be placed up and over the walls. This step is completed with the assistance of equipment used to lift the edge of the MLVT Geomembrane Panel up the height of the steel wall. Enough material should be lifted up and over the wall to create the proper overhang so the liner does not fall back off the wall while the clamping system is installed.
- C. The MLVT Geomembrane Panels shall be protected at all times from damage and all equipment and methods used to lift, place and clamp shall not damage the MLVT Geomembrane Panel and shall not impart excess stress in the MLVT Geomembrane Panels and thermally welded seam areas.
- D. ALL tank panel erection, assembly, placement and lifting of MLVT Geomembrane Panel is by others. CLI shall not be responsible for damages to the MLVT Geomembrane Panel after delivery / customer pickup or once installation is completed, if performed by CLI.

End of Specification



## Quality Control Air Testing

**Project:**  
**Owner:**  
**Engineer:**  
**Contractor:**  
**Supervisor:**  
**Material:**

[illegible]

**COLORADO LINING INTERNATIONAL**  
1062 Singing Hills Road Parker, Colorado 80138 / 1-800-524-8672 / 303-841-2022 / Fax 303-841-5780 / [www.coloradolining.com](http://www.coloradolining.com)

Section 1.14 Geomembrane Installation Manual

# MLVT GEOMEMBRANE PANEL INSTALLATION MANUAL

**Well Water Solutions, Inc.**

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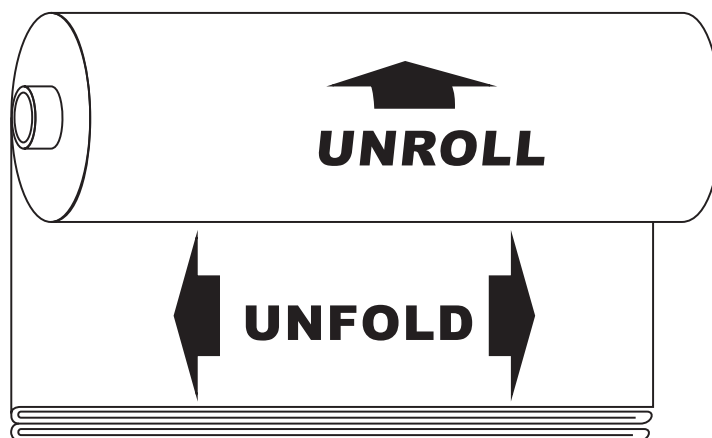


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## DEPLOYMENT OF DUAL DIRECTION ACCORDION FOLDED PANELS

(SHEET 1 OF 2)



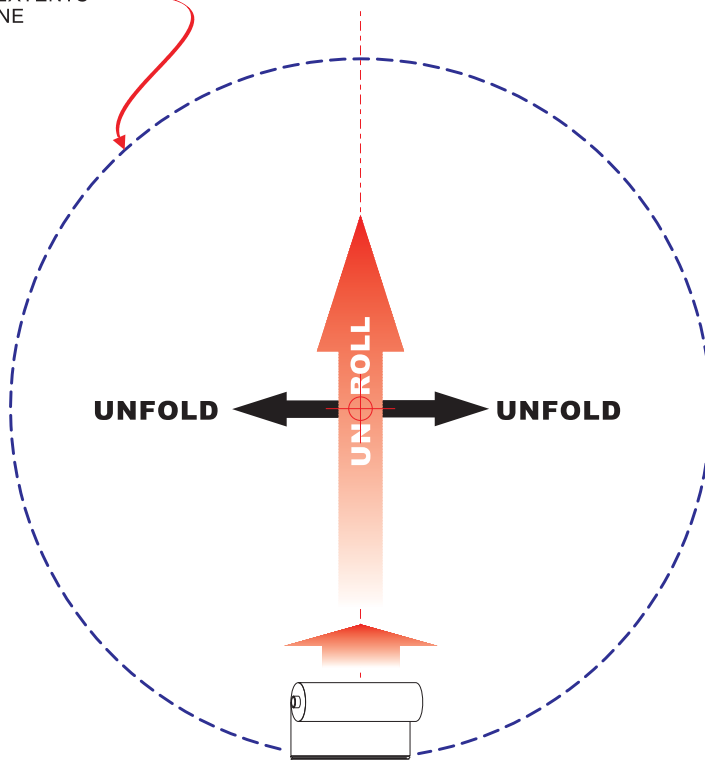


## DEPLOYMENT OF DUAL DIRECTION ACCORDION FOLDED PANELS

(SHEET 2 OF 2)

CLI FABRICATES FRAC TANK PANEL LINERS AND UNDERLAYMENTS IN A DUAL DIRECTION ACCORDION FOLDED MANNER SO THAT THE PANELS CAN BE DEPLOYED ON THE TANK'S CENTERLINE. AFTER THE INITIAL UN-ROLLING THE PANELS ARE THEN UN-FOLDED IN PERPENDICULAR DIRECTIONS

TANK EXTENTS  
OUTLINE



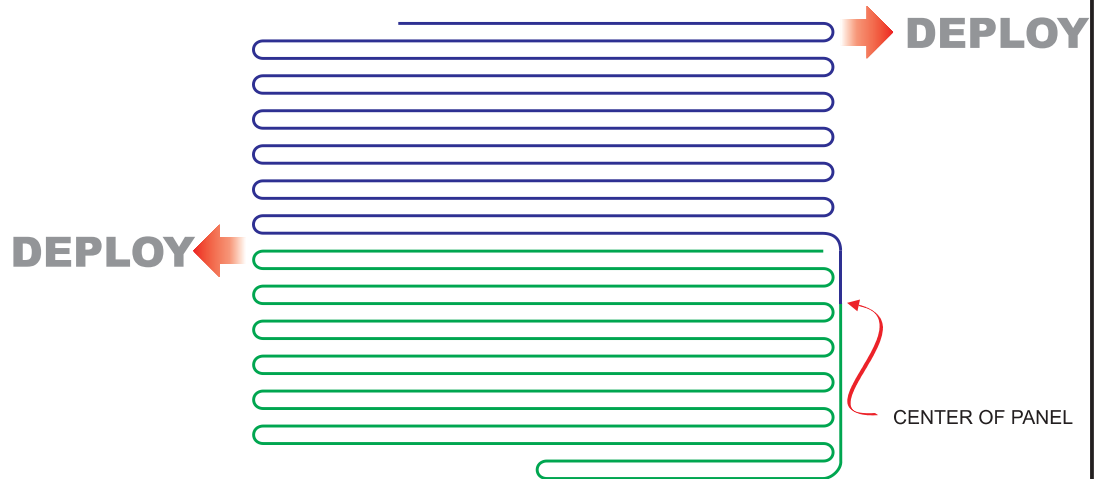
UNROLL PANEL  
ON TANK'S  
CENTERLINE  
PRIOR TO WALLS  
GOING UP





# DOUBLE DIRECTION ACCORDION FOLDED PANEL SCHEMATIC

(SHEET 2 OF 2)



**EXAMPLE OF A 26 SHEET B-40 TANK LINER**

## Section 1.15 WWS Preferred Liner Spec or Comparable Substitute



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19103 Gundle Road  
Houston, TX 77073  
281 230 8650 Fax  
www.gseworld.com

January 22, 2018

Western ProLine  
184 Hwy 59 North  
Miles City, MT 59301

RE: GSE LLDPE Geomembrane ~~CP~~ Permeability

### Certification of Compliance

The undersigned, being qualified and authorized to do so, hereby certifies that GSE High Performance 30 mil Nominal and GSE High Performance 40 mil Nominal UltraFlex LLDPE Geomembranes will meet a permeability of  $1 \times 10^{-12}$  cm/s when tested per ASTM E96.

Sincerely,

A handwritten signature in black ink that reads "Miguel Garcia". The signature is fluid and cursive, with the first name "Miguel" and last name "Garcia" clearly distinguishable.

Miguel Garcia  
GSE Technical Support

MG18-0005

## TECHNICAL NOTE

## Chemical Resistance Chart

GSE is the world's leading supplier of high quality, polyethylene geomembranes. GSE polyethylene geomembranes are resistant to a great number and combinations of chemicals. Note that the effect of chemicals on any material is influenced by a number of variable factors such as temperature, concentration, exposed area and duration. Many tests have been performed that use geomembranes and certain specific chemical mixtures. Naturally, however, every mixture of chemicals cannot be tested for, and various criteria may be used to judge performance. Reported performance ratings may not apply to all applications of a given material in the same chemical. Therefore, these ratings are offered as a guide only.

Medium	Concentration	Resistance at:		Medium	Concentration	Resistance at:	
		20° C (68° F)	20° C (140° F)			20° C (68° F)	20° C (140° F)
A				Copper chloride	sat. sol.	S	S
Acetic acid	100%	S	L	Copper nitrate	sat. sol.	S	S
Acetic acid	10%	S	S	Copper sulfate	sat. sol.	S	S
Acetic acid anhydride	100%	S	L	Cresylic acid	sat. sol.	L	—
Acetone	100%	L	L	Cyclohexanol	100%	S	S
Adipic acid	sat. sol.	S	S	Cyclohexanone	100%	S	L
Allyl alcohol	96%	S	S	D			
Aluminum chloride	sat. sol.	S	S	Decahydronaphthalene	100%	S	L
Aluminum fluoride	sat. sol.	S	S	Dextrine	sol.	S	S
Aluminum sulfate	sat. sol.	S	S	Diethyl ether	100%	L	—
Alum	sol.	S	S	Dioctylphthalate	100%	S	L
Ammonia, aqueous	dil. sol.	S	S	Dioxane	100%	S	S
Ammonia, gaseous dry	100%	S	S	E			
Ammonia, liquid	100%	S	S	Ethanedial	100%	S	S
Ammonium chloride	sat. sol.	S	S	Ethanol	40%	S	L
Ammonium fluoride	sol.	S	S	Ethyl acetate	100%	S	U
Ammonium nitrate sat. sol.	S	S		Ethylene trichloride	100%	U	U
Ammonium sulfate	sat. sol.	S	S	F			
Ammonium sulfide	sol.	S	S	Ferric chloride	sat. sol.	S	S
Amyl acetate	100%	S	L	Ferric nitrate	sol.	S	S
Amyl alcohol	100%	S	L	Ferric sulfate	sat. sol.	S	S
B				Ferrous chloride	sat. sol.	S	S
Barium carbonate	sat. sol.	S	S	Ferrous sulfate	sat. sol.	S	S
Barium chloride	sat. sol.	S	S	Fluorine, gaseous	100%	U	U
Barium hydroxide	sat. sol.	S	S	Fluorosilicic acid	40%	S	S
Barium sulfate	sat. sol.	S	S	Formaldehyde	40%	S	S
Barium sulfide	sol.	S	S	Formic acid	50%	S	S
Benzaldehyde	100%	S	L	Formic acid	98-100%	S	S
Benzene	—	L	L	Furfuryl alcohol	100%	S	L
Benzoic acid	sat. sol.	S	S	G			
Beer	—	S	S	Gasoline	—	S	L
Borax (sodium tetraborate)	sat. sol.	S	S	Glacial acetic acid	96%	S	L
Boric acid	sat. sol.	S	S	Glucose	sat. sol.	S	S
Bromine, gaseous dry	100%	U	U	Glycerine	100%	S	S
Bromine, liquid	100%	U	U	Glycol	sol.	S	S
Butane, gaseous	100%	S	S	H			
1-Butanol	100%	S	S	Heptane	100%	S	U
Butyric acid	100%	S	L	Hydrobromic acid	50%	S	S
C				Hydrobromic acid	100%	S	S
Calcium carbonate	sat. sol.	S	S	Hydrochloric acid	10%	S	S
Calcium chlorate	sat. sol.	S	S	Hydrochloric acid	35%	S	S
Calcium chloride	sat. sol.	S	S	Hydrocyanic acid	10%	S	S
Calcium nitrate	sat. sol.	S	S	Hydrofluoric acid	4%	S	S
Calcium sulfate	sat. sol.	S	S	Hydrofluoric acid	60%	S	L
Calcium sulfide	dil. sol.	L	L	Hydrogen	100%	S	S
Carbon dioxide, gaseous dry	100%	S	S	Hydrogen peroxide	30%	S	L
Carbon disulfide	100%	L	U	Hydrogen peroxide	90%	S	U
Carbon monoxide	100%	S	S	Hydrogen sulfide, gaseous	100%	S	S
Chloroacetic acid	sol.	S	S	Lactic acid	100%	S	S
Carbon tetrachloride	100%	L	U	Lead acetate	sat. sol.	S	—
Chlorine, aqueous solution	sat. sol.	L	U	Magnesium carbonate	sat. sol.	S	S
Chlorine, gaseous dry	100%	L	U	Magnesium chloride	sat. sol.	S	S
Chloroform	100%	U	U	Magnesium hydroxide	sat. sol.	S	S
Chromic acid	20%	S	L	Magnesium nitrate	sat. sol.	S	S
Chromic acid	50%	S	L	Maleic acid	sat. sol.	S	S
Citric acid	sat. sol.	S	S	Mercuric chloride	sat. sol.	S	S
				Mercuric cyanide	sat. sol.	S	S
				Mercuric nitrate	sol.	S	S

GSEworld.com



## Section 1.16 Geo Grid Mesh Spec



SKAPS Industries  
571 Industrial Parkway  
Commerce, GA 30529 (U.S.A.)  
Phone (706) 336-7000 Fax (706) 336-7007  
e-mail: [info@skaps.com](mailto:info@skaps.com)

### SKAPS TRANSNET™ (TN) HDPE GEONET 220

**SKAPS TRANSNET™ Geonet consists of SKAPS GeoNet made from HDPE resin.**

Property	Test Method	Unit	Required Value	Qualifier
<b>Geonet</b>				
Thickness	ASTM D 5199	mil.	220±20	Range
Carbon Black	ASTM D 4218	%	2 to 3	Range
Tensile Strength	ASTM D 7179	lb/in	45	Minimum
Melt Flow	ASTM D 1238 <sup>3</sup>	g/10 min.	1	Maximum
Density	ASTM D 1505	g/cm <sup>3</sup>	0.94	Minimum
Transmissivity <sup>1</sup>	ASTM D 4716	m <sup>2</sup> /sec.	2x10 <sup>-3</sup>	MARV <sup>2</sup>

#### Notes:

1. Transmissivity measured using water at 21 ± 2°C (70 ± 4°F) with a gradient of 0.1 and a confining pressure of 10000 psf between stainless steel plates after 15 minutes. Values may vary between individual labs.
2. MARV is statistically defined as mean minus two standard deviations and it is the value which is exceeded by 97.5% of all the test data.
3. Condition 190/2.16

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## Section 1.17 Patents and Patent Protections



US008376167B2

(12) **United States Patent**  
**Lovelace et al.**

(10) **Patent No.:** **US 8,376,167 B2**

(45) **Date of Patent:** **Feb. 19, 2013**

(54) **PORTABLE RESERVOIR FRAME**

(75) Inventors: **Sean Michael Lovelace**, Casper, WY (US); **Christopher Jason Songe**, Casper, WY (US)

(73) Assignee: **Energy Innovations, LLC**, Casper, WY (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/469,883**

(22) Filed: **May 11, 2012**

(65) **Prior Publication Data**

US 2012/0223073 A1 Sep. 6, 2012

**Related U.S. Application Data**

(63) Continuation of application No. 13/245,492, filed on Oct. 21, 2011.

(51) **Int. Cl.**  
**B65D 6/00** (2006.01)

(52) **U.S. Cl.** ..... **220/4.17; 220/4.16; 220/693; 220/567; 220/4.12**

(58) **Field of Classification Search** ..... 220/1.6, 220/4.12, 4.16, 4.17, 9.4, 23.9, 495.06, 495.08, 220/567, 681, 693  
See application file for complete search history.

(56) **References Cited**

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CA 2692016 7/2010

\* cited by examiner

*Primary Examiner* — Anthony Stashick

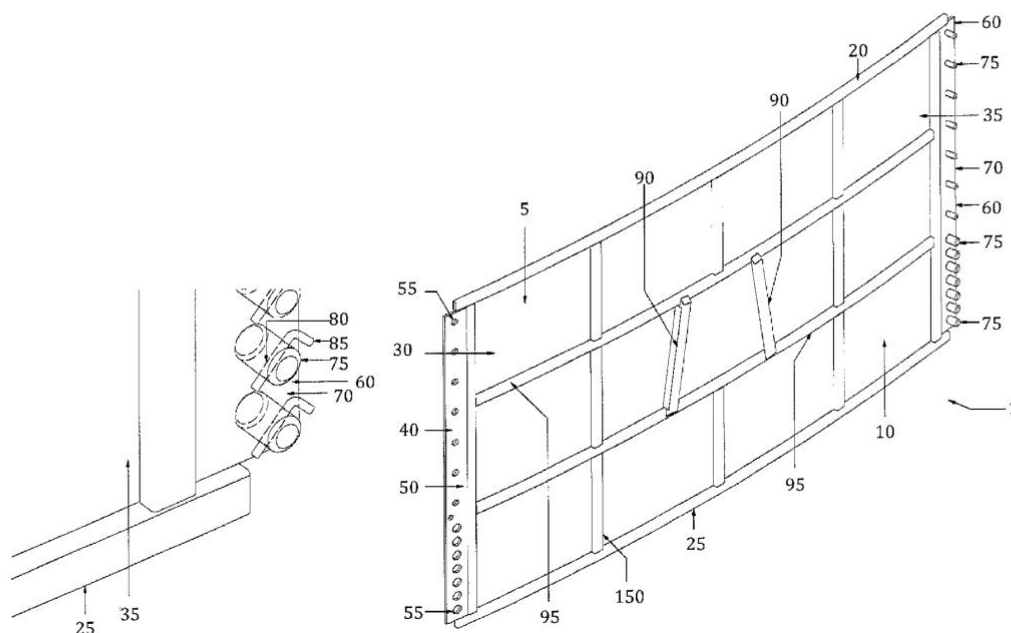
*Assistant Examiner* — Christopher McKinley

(74) *Attorney, Agent, or Firm* — Gordon Silver, Ltd.; Ronald C. Gorsché

(57) **ABSTRACT**

A portable reservoir frame composed of interlocking panels secured by a series of flanges having holes and pegs. An inner liner to hold liquid inside the reservoir frame is presented.

**16 Claims, 11 Drawing Sheets**







US008365937B2

(12) **United States Patent**  
**Lovelace et al.**

(10) **Patent No.:** **US 8,365,937 B2**  
(45) **Date of Patent:** **Feb. 5, 2013**

(54) **PORTABLE RESERVOIR FRAME**

(75) Inventors: **Sean Michael Lovelace**, Casper, WY (US); **Christopher Jason Songe**, Casper, WY (US)

(73) Assignee: **Energy Innovations, LLC**, Casper, WY (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/469,845**

(22) Filed: **May 11, 2012**

(65) **Prior Publication Data**

US 2012/0234829 A1 Sep. 20, 2012

**Related U.S. Application Data**

(63) Continuation of application No. 13/426,286, filed on Mar. 21, 2012, which is a continuation-in-part of application No. 13/245,492, filed on Oct. 21, 2011.

(51) **Int. Cl.**  
**B65D 6/00** (2006.01)

(52) **U.S. Cl.** ..... **220/4.17**; 220/4.16; 220/693; 220/567; 220/4.12

(58) **Field of Classification Search** ..... 220/565, 220/567, 1.6, 4.16, 4.12, 9.4, 495.06, 495.08, 220/23.9, 4.17, 693, 681

See application file for complete search history.

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**FOREIGN PATENT DOCUMENTS**

CA 2692016 7/2010

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*Primary Examiner* — Anthony Stashick

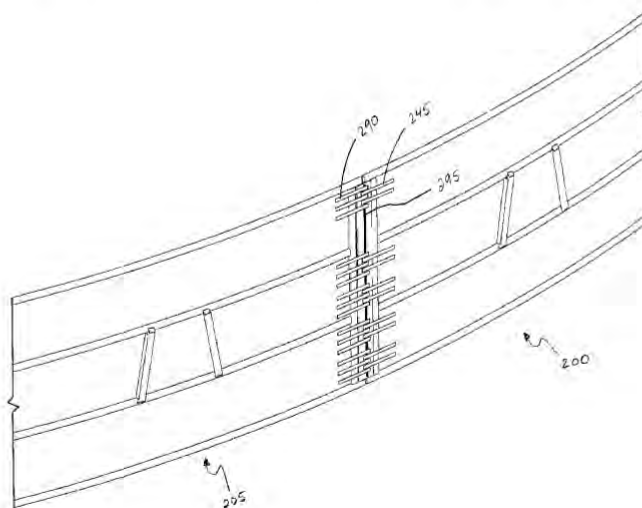
*Assistant Examiner* — Christopher McKinley

(74) *Attorney, Agent, or Firm* — Gordon Silver Ltd.; Ronald C. Gorsché

(57) **ABSTRACT**

A portable reservoir frame having a number of interlocking panels secured by a plurality of interleaved knuckle members is provided.

**20 Claims, 20 Drawing Sheets**





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## TECHNICAL DATA SHEET

### Geomembrane 40mil LLDPE

Property	Test Method	Frequency (A)	Unit Metric	Solmax 140-7000
Thickness (Nominal +/- 10%) (E)	ASTM D 5199	Every roll	mm	1.00
Resin Density	ASTM D 1505	1/Batch	g/cc	<0.926
Melt Index-190/2.16(max)	ASTM D 1238	1/Batch	g/10min	1.0
Sheet Density (C)	ASTM D 1505	Every 2 rolls	g/cc	<0.939
Carbon Black Content (D)	ASTM D 4218	Every 2 rolls	%	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	Every 6 rolls	Category	Cat. 1 / Cat. 2
Oxidative Induction Time (min. avg)	ASTM D3895	1/Batch	min	100
Tensile Properties (min. avg)(B)	ASTM D 6693	Every 2 rolls		
Strength as Break			kN/m	23
Elongation at Break			%	800
2% Modulus (max.)	ASTM D 5323	PerFormulation	kN/m	420
Tear Resistance (min. avg.)	ASTM D 1004	Every 6 rolls	N	85
Puncture Resistance (min. avg.)	ASTM D 4833	Every 6 rolls	N	215
Dimensional Stability	ASTM D 1204	Every 6 rolls	%	+/- 2
Multi-Axial Tensile (min.)	ASTM D 5617	PerFormulation	%	90
Oven Aging-% retained after 90 days	ASTM D 5721	PerFormulation		
STD OIT (min. avg.)	ASTM D 3895		%	35
HP OIT (min. avg.)	ASTM D 5885		%	60
UV Resistance-% retained after 1600 hr	GRI-GM-11	PerFormulation		
HP-OIT (min. avg.)	ASTM D 5885		%	35

**Note;**

- (A) Testing frequency based on standard roll dimensions and one batch is approximately 180,000 lbs (or one railcar).  
 (B) Machine Direction (MD) and Cross Machine Direction (XMD or TD) average values should be on the basis of 5 specimens each direction.  
 (C) Correlation table is available for ASTM D792 vs. ASTM D1505. Both methods give the same results.  
 (D) Correlation table is available for ASTM D1603 vs. ASTM D4218. Both methods give the same results.  
 (E) The minimum average thickness is +/- 10% of the nominal value.

\*All values are nominal test results, except when specified as minimum of maximum.

\* The information contained herein is provided for reference purposes only and is not intended as warranty of guarantee. Final determination of suitability for use contemplated is the sole responsibility of the user. Solmax along with Inland Tarp & Liner assumes no liability in connection with the use of this information.

**Manufacture & Distribution of Hay Tarps, Truck Tarps, Industrial Liners, Building & Athletic Field Covers.**  
**1-800-346-7744**

March 2020

**Variances and/or Equivalency Demonstrations for  
Above Ground Steel Tank Modular Recycling  
Storage Containments (AST) Primary and  
Secondary Liners**

***40-mil Non-reinforced LLDPE Liner as Alternate  
Primary and 30-mil Non-reinforced LLDPE as Secondary  
Liner for Above Ground Steel Tank Modular Recycling  
Storage Containments***

**STATEMENT EXPLAINING WHY THE APPLICANT SEEKS A VARIANCE FOR 40 MIL NON-REINFORCED LLDPE GEOMEMBRANE AS AN ALTERNATIVE PRIMARY AND 30 MIL NON-REINFORCED AS ALTERNATIVE SECONDARY LINER FOR MODULAR STEEL AST CONTAINMENT**

**The prescriptive mandates of the Rule that are the subject of this variance request are the following subsections of 19.15.34.12**

**NMAC 19.15.34.12 A DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT**

**(4)** All primary (upper) liners in a recycling containment shall be geomembrane liners composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. *All primary liners shall be 30-mil flexible PVC, 45-mil LLDPE string reinforced or 60-mil HDPE liners. Secondary liners shall be 30-mil LLDPE string reinforced or equivalent with a hydraulic conductivity no greater than  $1 \times 10^{-9}$  cm/sec. Liner compatibility shall meet or exceed the EPA SW-846 method 9090A or subsequent relevant publications.*

**The applicant proposes one layer of 40-mil LLDPE non-reinforced as a primary liner and a secondary liner comprised of one layer of 30-mil LLDPE non-reinforced material**

Rule 34 did not consider Above Ground Steel Storage Tanks that employ liners as a primary and secondary containment method.

This material is more readily available than the prescribed liners in the Rule and provides superior flexibility and conformity characteristics. Due to the vertical steel walls, 60-mil HDPE, 45 or 30-mil LLDPE string reinforced liners and 30-mil PCV liners are not sufficiently flexible for use in these modular containments.

*All liners will have a hydraulic conductivity no greater than  $1 \times 10^{-9}$  cm/sec and meet or exceed EPA SW-846 method 9090A.*

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

The following technical documents provide supportive data to demonstrate that this liner system (*with integrated leak detection system*) provides equal or better protection of fresh water, public health and the environment by providing the requisite containment and protection. Attached is a technical comparison of the proposed material is compared to what is advised through Rule 34. A second memorandum provides clarification that the engineering requirements for site preparation, which ensures functionality of the liner system, is crosscutting to varied locations/sites within the Permian Basin. Liner specifications are also included in submission.



**R.K. FROBEL & ASSOCIATES**  
*Consulting Engineers*

**Technical Memorandum: 40-mil LLDPE as Alternative Primary with 30-mil LLDPE as Alternative Secondary Liner System for Modular Steel AST Recycling Containment**  
**NMAC 19.15.34.12 A (4)**

In consideration of the liner application for modular AST impoundments, size and depth of the AST, design details for modular tanks as well as estimated length of at least five years of service time, it is my professional opinion that a 40 mil LLDPE (non-reinforced) and a 30 mil LLDPE (non-reinforced) geomembrane system will provide the requisite barrier against produced water loss as an alternative primary and secondary liner system. *The two proposed liners, 40 mil LLDPE as Primary liner and 30 mil LLDPE Secondary liner, will function equal to or better than 45 mil String Reinforced LLDPE, 30 mil PVC, or 60 mil HDPE liners as a primary liner and 30 mil LLDPE string reinforced as a secondary liner system. Additionally, this two-layer system with integrated leak detection system, will provide requisite protection for the environment that is equal to or better than the above primary and secondary liner systems referenced in OCD rule 34.* The following are discussion points that will exhibit the attributes of a 40 mil/30 mil LLDPE lining system:

The nature and formulation of LLDPE resin is very similar to HDPE. The major difference is that LLDPE is lower density, lower crystallinity (more flexible and less chemical resistant). However, LLDPE will resist aging and degradation and remain intact for many years in exposed conditions. The LLDPE resin is virtually the same for non-reinforced 30 or 40 mil LLDPE and string reinforced 30 or 45 mil LLDPE geomembranes and both will provide requisite containment and be equally protective for this application, enduring UV and chemical degradation in the produced water environment.

Flexibility Requirements. Non-reinforced LLDPE geomembranes are less stiff and far more flexible than string reinforced geomembranes as well as 60 mil HDPE and in this regard are preferred for installations in vertical wall tanks such as this proposed installation. LLDPE provides a very flexible sheet that enables it to be fabricated into large panels, folded for shipping and installed on vertical walls transitioned to flat bottom. Non-reinforced LLDPE sheet will conform better than a string reinforced LLDPE to the tank dimensions under hydrostatic loading and will exhibit less wrinkling and creasing during and after installation.

Thermal Fusion Seaming Requirements. Thermal seaming and QC seam test requirements for geomembranes are product specific and usually prescribed by the sheet manufacturer. Both dual wedge and single wedge thermal fusion welding is commonly used on LLDPE and QC testing by air channel (ASTM D 5820) or High Pressure Air Lance (ASTM D 4437) is fully acceptable and recognized as industry standards. In this regard, either non-reinforced LLDPE or string-reinforced LLDPE will be acceptable as far as QC and thermal fusion seaming methods are concerned.

**R.K. FROBEL & ASSOCIATES**  
*Consulting Engineers*

Potential for Leakage through the Primary and Secondary Liners. Leakage through geomembrane liners is directly a function of the height of liquid head above any hole or imperfection. The geonet drainage media between the primary and secondary LLDPE geomembranes at the base of the AST in this application provides immediate drainage to a low point or outside the Modular AST Impoundment and thus no hydrostatic head or driving gradient is available to push leakage water through a hole in the Secondary LLDPE liner .

Leakage through any Primary geomembrane is driven by size of hole and depth and will be detected by the increase of water in the drainage system and the volume being pumped out of the secondary containment. In this regard and for this variance, the Primary consists of 40 mil LLDPE geomembrane which will perform equal to or better than a single layer of string reinforced LLDPE for potential leakage. Thus, if a leak occurs through the top layer, it will be effectively contained by the second layer of 30 mil LLDPE geomembrane. If required, location of holes in the Primary can be found by Electrical Leak Location Survey (ELLS) using a towed electrode (ASTM D 7007). Holes found can then be repaired and thus water seepage into the leakage collection and drainage system will be kept to a minimum. Dependent on OCR requirements for Action Leakage Rate (ALR), the leakage volumes may only be monitored. For example, a typical ALR is < 20 gpad whereas a rapid and large leak (RLL) may be > 100 gpad. Most states specify maximum ALR values for waste and process water impoundments usually in the range of 100 to 500 gpad. However, New Mexico does not specify an ALR for waste or process water impoundments (GRI Paper No. 15).

LLDPE (and string reinforced LLDPE) can be prefabricated into large panels and thus both types offer the following for Containment:

- Prefabrication in factory-controlled conditions into very large panels (up to 30,000 sf) results in ease of installation, less thermal fusion field seams and less on site QC and CQA. (It should be noted that HDPE cannot be prefabricated into panels and requires considerably more on-site welding and QC).
- Large prefabricated panels will provide better control of thermal fusion welding in a factory environment that will improve the liner system integrity for the long term. Ease of installation of large prefabricated custom size panels results in a greater reduction of installation time and associated installation and QC costs
- The Non-reinforced LLDPE geomembrane provides superior lay flat characteristics and conformability which allows for more intimate contact with the underlying soil, geonet, or geotextile and tank walls as well as overlying materials thus providing better flow characteristics for drainage of water. String reinforced LLDPE exhibits more wrinkling and when overlaid or in contact with a geonet drain, wrinkles tend to form pockets and dams affecting drainage of any leakage water to the exterior of the Modular AST Impoundment.

**R.K. FROBEL & ASSOCIATES**  
Consulting Engineers

- Both types of LLDPE geomembrane are easily repaired using the same thermal fusion bonding method without the need for special surface grading preparation for extrusion welding as is typically used in repair of HDPE geomembranes. However, string reinforced LLDPE requires that all cut edges with exposed scrim must be encapsulated with extrusion bead. No encapsulation is required on non-reinforced LLDPE.

*In summary, it is my professional opinion that the liner system of 40 mil non-reinforced LLDPE geomembrane as Primary liner and 30 mil non reinforced LLDPE Secondary liner, with integrated leak detection system, will provide protection that is equal to or better than 45 mil string reinforced LLDPE, 30 mil PVC, 60 mil HDPE (primary liner) and 35 mil LLDPE (secondary liner) and meets requirements as defined by the rule as an alternative liner system (resistance to UV and chemical exposure and required hydraulic conductivity). Additionally, this liner system will provide a superior installation in the AST environment and function better than liners referenced in the OCD rule and will provide the requisite protection of fresh water, public health and the environment for at least 3 years in the produced water recycling environment.*

If you have any questions on the above technical memorandum or require further information, give me a call at 720-289-0300 or email [geosynthetics@msn.com](mailto:geosynthetics@msn.com)

Sincerely Yours,

*RK Frobel*

Ronald K. Frobel, MSCE, PE



References:

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

Geosynthetic Research Institute (GRI) Published Standards and Papers 2018

ASTM Standards 2018

Attachments:

R. K. Frobel C.V.

## **STATEMENT EXPLAINING WHY THE APPLICANT SEEKS A VARIANCE FOR 40 MIL NON-REINFORCED LLDPE GEOMEMBRANE AS AN ALTERNATIVE PRIMARY AND SECONDARY LINER FOR MODULAR STEEL AST CONTAINMENT**

**The prescriptive mandates of the Rule that are the subject of this variance request are the following subsections of 19.15.34.12**

### **NMAC 19.15.34.12 A DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT**

**(4)** All primary (upper) liners in a recycling containment shall be geomembrane liners composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. *All primary liners shall be 30-mil flexible PVC, 45-mil LLDPE string reinforced or 60-mil HDPE liners. Secondary liners shall be 30-mil LLDPE string reinforced or equivalent with a hydraulic conductivity no greater than  $1 \times 10^{-9}$  cm/sec.* Liner compatibility shall meet or exceed the EPA SW-846 method 9090A or subsequent relevant publications.

**The applicant proposes one layer of 40-mil LLDPE as a primary liner and a secondary liner comprised of one layer of 40-mil LLDPE material.**

Rule 34 did not consider Above Ground Steel Storage Tanks that employ liners as a primary and secondary containment method.

This material is more readily available than the prescribed liners in the Rule and provides superior flexibility and conformity characteristics. Due to the vertical steel walls, 60-mil HDPE, 45 or 30-mil LLDPE string reinforced liners and 30-mil PCV liners are not sufficiently flexible for use in these modular containments.

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

The following technical documents provide supportive data to demonstrate equal or better protection of fresh water, public health and the environment by providing the requisite containment and protection. Technical comparison of the proposed material is compared to what is advised through Rule 34 is discussed. A second memorandum provides clarification that the engineering requirements for site preparation, which ensures functionality of the liner system, is crosscutting to varied locations within the Permian Basin. Stamped plans from design engineer confirm applicability of this liner system to this specific site.

**R.K. FROBEL & ASSOCIATES**  
*Consulting Engineers*

**Technical Memorandum: 40-mil LLDPE as Alternative  
Primary/Secondary Liner System for Modular Steel AST Recycling  
Containment**

NMAC 19.15.34.12 A (4)

In consideration of the Primary lining application (modular AST impoundment), size of the AST and depth, design details for modular tanks as well as estimated length of up to five years of service time, it is my professional opinion that a 40 mil LLDPE geomembrane will provide the requisite barrier against processed water loss. It should be noted that the 40 mil LLDPE exceeds the OCD mandate for a Secondary lining system. *The two proposed 40 mil LLDPE liners will function equal to or better than 45 mil String Reinforced LLDPE, 30 mil PVC, or 60 mil HDPE liners as a primary liner and 30 mil LLDPE string reinforced as a secondary liner system. Additionally, the 40 mil LLDPE in a two-layer system will provide requisite protection for the environment that is equal to or better than the above primary and secondary liner systems referenced in OCD rule 34.* The following are discussion points that will exhibit the attributes of a 40 mil LLDPE lining system:

The nature and formulation of LLDPE resin is very similar to HDPE. The major difference is that LLDPE is lower density, lower crystallinity (more flexible and less chemical resistant). However, LLDPE will resist aging and degradation and remain intact for many years in exposed conditions. The LLDPE resin is virtually the same for non-reinforced 40 mil LLDPE and string reinforced 45 mil LLDPE geomembranes and both will provide requisite containment and be equally protective for this application.

Flexibility Requirements. Non-reinforced LLDPE geomembranes are less stiff and far more flexible than string reinforced geomembranes as well as 60 mil HDPE and in this regard are preferred for installations in vertical wall tanks such as this proposed installation. LLDPE provides a very flexible sheet that enables it to be fabricated into large panels, folded for shipping and installed on vertical walls transitioned to flat bottom. Non-reinforced LLDPE sheet will conform better than a string reinforced LLDPE to the tank dimensions under hydrostatic loading and will exhibit less wrinkling and creasing during and after installation.

Thermal Fusion Seaming Requirements. Thermal seaming and QC seam test requirements for geomembranes are product specific and usually prescribed by the sheet manufacturer. Both dual wedge and single wedge thermal fusion welding is commonly used on LLDPE and QC testing by air channel (ASTM D 5820) or High Pressure Air Lance (ASTM D 4437) is fully acceptable and recognized as industry standards. In this regard, either non-reinforced LLDPE or string-reinforced LLDPE will be acceptable as far as QC and thermal fusion seaming methods are concerned.

Potential for Leakage through the Primary and Secondary Liners. Leakage through geomembrane liners is directly a function of the height of liquid head above any hole or imperfection. The geonet drainage media between the primary and secondary LLDPE



**R.K. FROBEL & ASSOCIATES**  
*Consulting Engineers*

geomembranes at the base of the AST in this application provides immediate drainage to a low point or outside the Modular AST Impoundment and thus no hydrostatic head or driving gradient is available to push leakage water through a hole in the Secondary LLDPE liner .

Leakage through any Primary geomembrane is driven by size of hole and depth and will be detected by the increase of water in the drainage system and the volume being pumped out of the secondary containment. In this regard and for this variance, the Primary consists of 40 mil LLDPE geomembrane which will perform equal to or better than a single layer of string reinforced LLDPE for potential leakage. Thus, if a leak occurs through the top layer, it will be effectively contained by the second layer of 40 mil LLDPE geomembrane. If required, location of holes in the Primary can be found by Electrical Leak Location Survey (ELLS) using a towed electrode (ASTM D 7007). Holes found can then be repaired and thus water seepage into the leakage collection and drainage system will be kept to a minimum. Dependent on OCR requirements for Action Leakage Rate (ALR), the leakage volumes may only be monitored. For example, a typical ALR is < 20 gpad whereas a rapid and large leak (RLL) may be > 100 gpad. Most states specify maximum ALR values for waste and process water impoundments usually in the range of 100 to 500 gpad. However, New Mexico does not specify an ALR for waste or process water impoundments (GRI Paper No. 15).

Both non-reinforced LLDPE and string reinforced LLDPE can be prefabricated into large panels and thus both types offer the following for Containment:

- Prefabrication in factory-controlled conditions into very large panels (up to 30,000 sf) results in ease of installation, less thermal fusion field seams and less on site QC and CQA. (It should be noted that HDPE cannot be prefabricated into panels and requires considerably more on-site welding and QC).
- Large prefabricated panels will provide better control of thermal fusion welding in a factory environment that will improve the liner system integrity for the long term. Ease of installation of large prefabricated custom size panels results in a greater reduction of installation time and associated installation and QC costs
- The Non-reinforced LLDPE geomembrane provides superior lay flat characteristics and conformability which allows for more intimate contact with the underlying soil, geonet, or geotextile and tank walls as well as overlying materials thus providing better flow characteristics for drainage of water. String reinforced LLDPE exhibits more wrinkling and when overlaid or in contact with a geonet drain, wrinkles tend to form pockets and dams affecting drainage of any leakage water to the exterior of the Modular AST Impoundment.
- Both types of LLDPE geomembrane are easily repaired using the same thermal fusion bonding method without the need for special surface grinding/preparation for extrusion welding as is typically used in repair of HDPE geomembranes.

**R.K. FROBEL & ASSOCIATES**  
*Consulting Engineers*

However, string reinforced LLDPE requires that all cut edges with exposed scrim must be encapsulated with extrusion bead. No encapsulation is required on non-reinforced LLDPE.

*In summary, it is my professional opinion that the two layers of 40 mil non-reinforced LLDPE geomembranes will provide a Primary/Secondary liner system that is equal to or better than 45 mil string reinforced LLDPE, 30 mil PVC, 60 mil HDPE (primary liner) and 35 mil LLDPE (secondary liner). Additionally, the two layers of 40 mil LLDPE will provide a superior installation and function better than liners referenced in the OCD rule. The two layers of 40 mil non-reinforced LLDPE will provide the requisite protection of fresh water, public health and the environment for at least 5 years in the frack water environment.*

If you have any questions on the above technical memorandum or require further information, give me a call at 720-289-0300 or email [geosynthetics@msn.com](mailto:geosynthetics@msn.com)

Sincerely Yours,

*R K Frobel*

Ronald K. Frobel, MSCE, PE



References:

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

Geosynthetic Research Institute (GRI) Published Standards and Papers 2018

ASTM Standards 2018

Attachments:

R. K. Frobel C.V

***Slope and Anchor Variance Request for Above Ground  
Steel Tank Modular Recycling Storage Containments***

## STATEMENT EXPLAINING WHY THE APPLICANT SEEKS A VARIANCE FOR SLOPE AND ANCHOR FOR MODULAR STEEL AST CONTAINMENT

### 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 subsections of NMAC 19.15.34.12.**

**NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT:**

A. An operator shall design and construct a recycling containment in accordance with the following specifications.

(2) A recycling containment shall have a properly constructed foundation and interior slopes consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear. Geotextile is required under the liner when needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity. *The operator shall construct the containment in a levee with an inside grade no steeper than two horizontal feet to one vertical foot (2H:1V). The levee shall have an outside grade no steeper than three horizontal feet to one vertical foot (3H:1V).* The top of the levee shall be wide enough to install an anchor trench and provide adequate room for inspection and maintenance.

(3) Each recycling containment shall incorporate, at a minimum, a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions. *The edges of all liners shall be anchored in the bottom of a compacted earth-filled trench. The anchor trench shall be at least 18 inches deep.*

### **The applicant requests a variance to prescribed slope and anchor in the setting of above ground modular steel containments.**

With respect to storage of produced water for use in lieu of fresh water, Rule 34 is written for earthen, lined pits, not free-standing modular impoundments that employ liners as their primary fluid containment system. A modular impoundment consists of a professionally designed steel tank ring with vertical walls. There is no slope to consider as the segmental steel sections are set vertical.

There is no anchor trench as envisioned by the Rule, liners are anchored to the top of the steel walls with clips, no anchor trench is required.

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

The following technical memorandum provides supportive data to demonstrate equal or better protection of fresh water, public health and the environment by providing the requisite containment and protection.

**R.K. FROBEL & ASSOCIATES**  
*Consulting Engineers*

**Technical Memorandum: Slope and Anchor Trench Variance for Above Ground Steel Modular Containments**

**NMAC 19.15.34.12 A (2), (3)**

**Side Slope**

The design of soil side slope (inclination) is a geotechnical engineering design consideration. Liquid impoundments such as fresh water or process water containments are usually built within an excavation or with raised earthen embankments. For a liquid impoundment with an exposed liner system, the slope soils and construction dictate slope inclination and very detailed slope stability analysis may be required to determine if slope failure within the embankment will occur once loaded with impounded water. Slope failure may also occur during construction or when the impoundment is empty. A maximum slope is usually specified and is dependent on soil type and cohesive strength, saturated or unsaturated conditions, etc. Detailed analysis for slope stability can be found in "Designing with Geosynthetics" by R.M Koerner as well as many geotechnical books.

A modular impoundment, on the other hand, consists of a professionally designed steel tank ring with vertical walls. *There is no slope to consider as the segmental steel sections are set vertical.* Design of steel tanks, in regard to hydrostatic loading, wind loading, seismic loads, etc. are thoroughly referenced with detailed procedures in the design code - American Petroleum Institute (API) 650-98 "Welded Steel Tanks for Oil Storage". *There are no requirements for maximum slope inclination other than perhaps 90 degrees or vertical wall.*

**Anchor Trench**

All earthen impoundments with a geomembrane lining system require some form of top of slope anchor, the most common of which is an excavated and backfilled anchor trench usually set back at least 3 ft from the top of slope. Again, there are detailed procedures for anchor trench design in "Designing with Geosynthetics" by R.M Koerner.

*A Modular Impoundment requires mechanical anchoring of the geomembrane at the top of the vertical steel wall using standard liner clips that prevent the geomembrane or geomembrane layers from slipping down the side wall.* These are detailed in the Tank Installation Manual. *There are no requirements for an "anchor trench" as this is not an in-ground impoundment.*

*In summary, based on the design and specifications of a modular steel impoundment, there is no requirement for a maximum interior slope angle of 2H:1V due to the fact that this impoundment is a steel tank with vertical walls. Additionally, there is no requirement for an anchor trench as the geomembrane is attached to the top of the Modular Impoundment vertical walls with large steel clips.* This provides the requisite protection of fresh water, public health and the environment for many years.



**R.K. FROBEL & ASSOCIATES**  
*Consulting Engineers*

If you have any questions on the above technical memorandum or require further information, give me a call at 303-679-0285 or email [geosynthetics@msn.com](mailto:geosynthetics@msn.com)

Sincerely Yours,

*R K Frobel*

Ronald K. Frobel, MSCE, PE



**References:**

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

American Petroleum Institute (API) 650-98 "Welded Steel Tanks for Oil Storage"

Koerner, R.M., 2005 "Designing With Geosynthetics" Prentice Hall Publishers

**Attachments:**

R. K. Frobel C.V.

***Freeboard Variance Request for Above Ground Steel Tank  
Modular Recycling Storage Containments***

## **STATEMENT EXPLAINING WHY THE APPLICANT SEEKS A VARIANCE FOR FREEBOARD FOR MODULAR STEEL AST CONTAINMENT**

### **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 subsections of NMAC 19.15.34.13**

#### **19.15.34.13 OPERATIONAL REQUIREMENTS FOR RECYCLING CONTAINMENTS:**

**B.** The operator shall maintain and operate a recycling containment in accordance with the following requirements.

**(2)** The operator *shall maintain at least three feet of freeboard at each containment.*

**The applicant requests variance to allow for a freeboard of 2 feet as opposed to the prescribed 3 feet in the setting of an above ground steel tank modular system.**

Rule 34 did not take into consideration above ground steel tank modular containment systems. With respect to lined earthen impoundments that may hold 25-acre feet of produced water, a 3-foot freeboard stipulation makes sense. For example, wave action and other factors could focus stress on the upper portion of the levee or the liner system in these large impoundments. The smaller diameter steel tank (modular impoundment) does not share the same characteristics as these large earthen pits.

We believe 3-feet of freeboard is not necessary – especially during active hydraulic stimulation of wells when maximum storage volume provides the highest value. Moreover, meeting the 3-foot freeboard requirement at all times significantly reduces the storage capacity of a single modular impoundment – negatively impacting the economics of using produced water in lieu of fresh water for E&P activities.

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

The attached technical memorandum by Ron Frobel, PE, describes how the proposed 2-foot freeboard limit in the permit application for the modular impoundment provides the same protection afforded by the 3-foot freeboard mandate for a large earthen pit. The attached equations and supporting email from Mr. Jason Henderson, PE, shows that a 2-foot freeboard limit on the steel impoundment meets the manufacturer's design criteria.

**R.K. FROBEL & ASSOCIATES**  
Consulting Engineers

**Freeboard Requirements for Above Ground Steel Tank Modular  
Recycling Storage Containments**  
**NMAC 19.15.34.13 B (2)**

Liquid impoundments such as fresh water or process water containments are usually built within an excavation or with raised earthen embankments. For a liquid impoundment with an exposed liner system, the slope soils and construction dictate slope inclination and very detailed slope stability analysis may be required to determine if slope failure within the embankment will occur once loaded with impounded water. Freeboard or the vertical height between the maximum water surface elevation and the top of slope is important for earthen impoundments. Specified freeboard requirements take into consideration high precipitation events and prevent wave run-up on slopes that result in over-topping and potential saturation of embankments. This is particularly important on large earthen impoundments. Detailed design considerations including freeboard requirements for lined earthen impoundments can be found in "Designing with Geosynthetics" by R.M Koerner as well as other publications on reservoir design.

A modular impoundment, on the other hand, consists of a professionally designed steel tank ring with vertical walls. There is no slope to consider as the segmental steel sections are set vertical. Design of steel tanks as regards hydrostatic loading, wind loading, seismic loads, etc. are thoroughly referenced with detailed procedures in the design code - American Petroleum Institute (API) 650-98 "Welded Steel Tanks for Oil Storage". There are requirements for operational freeboard to prevent over-topping but due to the relatively small surface area and fetch of cylindrical tanks, wave heights are much less than large earthen impoundments. Thus, freeboard is usually within the range of 0.5 to 2 ft. I have reviewed the Tank Design Calculation Summary and regarding the structural stability of the tank walls, a freeboard of 0.5 ft was assumed. Thus, the variance request of 2.0 ft for a Modular Impoundment is well within the Tank Design requirements.

*In summary, it is my professional opinion that the design freeboard of 2.0 ft will provide requisite storage volume and prevent overtopping due to wind and wave action, potential seismic events and high precipitation.*

If you have any questions on the above technical memorandum or require further information, give me a call at 303-679-0285 or email [geosynthetics@msn.com](mailto:geosynthetics@msn.com)

Sincerely Yours,

*R K Frobel*

Ronald K. Frobel, MSCE, PE

**References:**

NMAC 19.15.34.13 OPERATIONAL REQUIREMENTS FOR RECYCLING CONTAINMENTS



***R.K. FROBEL & ASSOCIATES***  
***Consulting Engineers***

American Petroleum Institute (API) 650-98 "Welded Steel Tanks for Oil Storage"

Koerner, R.M., 2005 "Designing With Geosynthetics" Prentice Hall Publishers

Attachments:

R. K. Frobel C.V.



The modular impoundment is designed for use with fluids that are 8.34 pounds/gallon (62.4 pounds per cubic foot) or lighter. Exceeding this specification for fluid weight at full tank capacity (12') could lead to failure at the connection plate(s).

Assuming a freeboard of 0.5 ft (minimum modular impoundment freeboard requirement) the Hydro Pressure (p) of water is 718 pounds per square foot (psf), where

$$\begin{aligned}
 p &= \text{Design Density} \times \text{Height} \\
 &= 62.4 \text{ PCF} \times 11.5 \text{ ft} \\
 (\text{design density} &= 8.34 \frac{\text{lb}}{\text{gal}} \times 7.48 \frac{\text{ft}^3}{\text{gal}})
 \end{aligned}$$

The density of the conditioned produced water is 9.3 pounds/gallon. Assuming a freeboard of 3-ft (19.15.17.12.F(3) NMAC) , the Hydro Pressure (p) of conditioned produced water is 626 psf, where

$$\begin{aligned}
 p &= \text{Design Density} \times \text{Height} \\
 &= 69.64 \text{ PCF} \times 9 \text{ ft} \\
 (\text{design density} &= 9.3 \frac{\text{lb}}{\text{gal}} \times 7.48 \frac{\text{ft}^3}{\text{gal}})
 \end{aligned}$$

Using conditioned produced water with the Pit Rule freeboard requirements of 3-feet results in a Hydro Pressure 92 psf less than the engineered design.

The operator asks the District Division to allow for a 2-foot freeboard, which yields a Hydro Pressure (p) of 696.4 psf, where

$$\begin{aligned}
 p &= \text{Design Density} \times \text{Height} \\
 &= 69.64 \text{ PCF} \times 10 \text{ ft} \\
 (\text{design density} &= 9.3 \frac{\text{lb}}{\text{gal}} \times 7.48 \frac{\text{ft}^3}{\text{gal}})
 \end{aligned}$$

January 2020

***Applicability of Variances for Modular AST Containments  
in the Permian Basin of New Mexico***

**R.K. FROBEL & ASSOCIATES**  
*Consulting Engineers*

**Technical Memorandum: Applicability of Variances for Modular AST Containments in the Permian Basin of New Mexico**  
**NMAC 19.15.34.12 A (2)**

I have reviewed the most recent historical variances for AST Containments in the document titled "Variances for C-147 Registration Packages Permian Basin of New Mexico" (January 2020) and examined the applicable design drawings and permits for the following modular AST containments located in the Permian Basin of New Mexico.

- C-147 Registration Package for Myox Above Ground Storage Tank Section 32, T25S, R28E, Eddy County (January 20, 2020)
- C-147 Registration Package for Fez Recycling Containment and Recycling Facility Area (100+ acres) Section 8, T25-S, R35-E, Lea County, Volume 2 – Above-Ground Storage Tank Containments
- Hackberry 16 Recycling Containments and Recycling Facility Section 16, T19S, R31E, Eddy County

Locations of the modular containments range from west of the Pecos River to slightly west of Jal, NM. All locations exhibit different surface and subsurface geology, different topography and are of various sizes and volumes. *However, in regard to structural integrity of the base soils that support the AST and in particular the geomembrane containment system, the specification requirements are the same.* The foundation soils must be roller compacted smooth and free of loose aggregate over ½ inch. Compaction characteristics must meet or exceed 95% of Standard Proctor Density in accordance with ASTM D 698. This specification requirement is specific and causes the general or earthworks contractor to meet this standard regardless of the site- specific geology or topography. Provided that the design drawings and associated specifications call out the minimum requirements for subsoils compaction (i.e., 95% Standard Proctor Density – ASTM D 698), the design engineer or owners representative will carry out soils testing on the foundation materials to provide certainty to the AST containment owner that the earthworks contractor has met these obligations.

*Thus, provided that the contractor meets the minimum specified requirements for foundation soils preparation and density, the location, geology or depth to groundwater will make no difference in regard to geomembrane liner equivalency as demonstrated by the AST variances presented in this volume and are considered valid for meeting NMOCD Rule 34 requirements for all locations within the Permian Basin of New Mexico.*

If you have any questions on the above technical memorandum or require further information, give me a call at 720-289-0300 or email [geosynthetics@msn.com](mailto:geosynthetics@msn.com)

**R.K. FROBEL & ASSOCIATES**  
*Consulting Engineers*

Sincerely Yours,

*R.K. Frobel*

Ronald K. Frobel, MSCE, PE

References:

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A  
RECYCLING CONTAINMENT

ASTM Standards 2019



**RONALD K. FROBEL, MSCE, P.E.**

**CIVIL ENGINEERING  
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Founding member of Committee D 35 on Geosynthetics  
Chairman ASTM D35 Subcommittee on Geomembranes 1985-2000  
ASTM Award of Merit Recipient/ASTM Fellow - 1992  
ASTM D18 Soil and Rock - Special Service Award - 2000  
Transportation Research Board (TRB) of The National Academies  
Appointed Member A2K07 Geosynthetics 2000 - 2003  
National Society of Professional Engineers (NSPE) - Member  
American Society of Civil Engineers (ASCE) - Member  
Colorado Section - ASCE - Member  
International Society of Soil Mechanics and Foundation Engineers  
(ISSMFE) - Member  
International Geosynthetics Society (IGS) - Member  
North American Geosynthetics Society (NAGS) - Member  
International Standards Organization (ISO) - Member TC 221  
Team Leader - USA Delegation Geosynthetics 1985 - 2001  
European Committee for Standardization (CEN) - USA Observer  
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Association of State Dam Safety Officials (ASDSO) – Member  
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University of Arizona: B. S. - Civil Engineering – 1969  
Wentworth Institute of Technology: A.S. Architecture – 1966



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**Page 2**

**PROFESSIONAL**

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Evergreen, Colorado, Principal and Owner, 1988 - Present

Chemie Linz AG and Polyfelt Ges.m.b.H., Linz, Austria  
U. S. Technical Manager Geosynthetics, 1985 - 1988

U.S. Bureau of Reclamation, Engineering and Research Center  
Denver, Colorado, Technical Specialist in Construction  
Materials Research and Application, 1978 - 1985

Water Resources Research Center (WRRC), University of Arizona  
Tucson, AZ, Associate Research Engineer, 1975 - 1978

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United States Navy, Commissioned Naval Officer, 1970 - 1973

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Forensics investigations into geotechnical and geosynthetics failures; providing expert report and testimony on failure analysis; providing design and peer review on landfill lining and cover system design, mine waste reclamation, water treatment facilities, hydro-technical canal, dam, reservoir and mining projects, floating reservoir covers; oil and gas waste containment; design of manufacturers technical literature and manuals; development and presentation of technical seminars; new product development and testing; MQA/CQA program design and implementation.

Polyfelt Ges.m.b.H., Linz, Austria and Denver Colorado: As U.S. technical manager, primary responsibilities included technical development for the Polyfelt line of geosynthetics for the U.S. civil engineering market as well as worldwide applications.

**RONALD K. FROBEL, MSCE, P.E.****Page 3**

U.S. Bureau of Reclamation, Denver, Colorado: As technical specialist, responsibilities included directing laboratory research, design and development investigations into geosynthetics and construction materials for use on large western water projects such as dams, canals, power plants and other civil structures. Included were material research, selection and testing, specification writing, large scale pilot test programs, MQA/CQA program design and supervision of site installations. Prime author or contributor to several USBR technical publications incorporating geosynthetics.

University of Arizona, Tucson, Arizona: As research engineer at the Water Resources Research Center, responsibilities included research, design and development of engineering materials and methods for use in construction of major water projects including potable water reservoirs, canals and distribution systems. Prime author or contributor to several WRRC technical publications.

Northeast Utilities, Hartford, Connecticut: As field engineer for construction at Northeast Utilities, responsibilities included liaison for many construction projects including additions to power plants, construction of substations, erection of fuel oil pipelines and fuel oil storage tanks. Responsibilities also included detailed review, inspection and reporting on numerous construction projects.

U.S. Navy: Commissioned Naval Officer – Nuclear Program

**PUBLICATIONS:** Over 85 published articles, papers and books.

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## **Additional VARIANCE FOR RECYCLING STORAGE CONTAINMENTS (Inground and AST)**

- **Alternative Testing Methods**

## Request for OCD Approval of Alternative Test Methods to Analyze Concentrations of TPH and Chloride

The prescriptive mandates of the Rule that are the subject of this request are the following subsections of NMAC 19.15.17.13 [emphasis added], 19.15.34.14 and 19.15.29. 12 D

### 19.15.17.13 CLOSURE AND SITE RECLAMATION REQUIREMENTS:

**D.(5)** The operator shall collect, at a minimum, a five point composite of the contents of the temporary pit or drying pad/tank associated with a closed-loop system to demonstrate that, after the waste is solidified or stabilized with soil or other non-waste material at a ratio of no more than 3:1 soil or other non-waste material to waste, the concentration of any contaminant in the stabilized waste is not higher than the parameters listed in Table II of 19.15.17.13 NMAC.

The referenced Table II, which is reproduced in part below, notes the Method with asterisk signifying: “\*Or other test methods approved by the division”.

Table II Closure Criteria for Burial Trenches and Waste Left in Place in Temporary Pits			
Depth below bottom of pit to groundwater less than 10,000 mg/l TDS	Constituent	Method*	Limit**
25-50 feet	Chloride	EPA Method 300.0	20,000 mg/kg
	TPH	EPA SW-846 Method 418.1	100 mg/kg

### 19.15.34.14 CLOSURE AND SITE RECLAMATION REQUIREMENTS FOR RECYCLING CONTAINMENTS:

**C.** The operator shall test the soils beneath the containment for contamination with a five-point composite sample which includes stained or wet soils, if any, and that sample shall be analyzed for the constituents listed in Table I below.

**(1)** If any contaminant concentration is higher than the parameters listed in Table I, the division may require additional delineation upon review of the results and the operator must receive approval before proceeding with closure.

The referenced Table I, which is reproduced in part below, notes the Method with asterisk signifying: “\*Or other test methods approved by the division”.

Table I Closure Criteria for Recycling Containments			
Depth below bottom of containment to groundwater less than 10,000 mg/l TDS	Constituent	Method*	Limit**
51 feet - 100 feet	Chloride	EPA 300.0	10,000 mg/kg
	TPH (GRO+DRO+MRO)	EPA SW-846 Method 8015M	2,500 mg/kg

After sampling solids of more than 50 drilling pits in the Permian Basin, we have observed and reported to OCD on numerous occasions significant problems with non-petroleum drilling additives (e.g. starch) interfering with the laboratory method 418.1. It is not surprising that in many instances we found no correlation between the laboratory results using 418.1 and the results using Method 8015.

We request approval of Method 8015 (GRO + DRO + MRO) for Method 418.1.

**19.15.29.12 D. CLOSURE REQUIREMENTS.** The responsible party must take the following action for any major or minor release containing liquids.

**(1)** The responsible party must test the remediated areas for contamination with representative five-point composite samples from the walls and base, and individual grab samples from any wet or discolored areas. The samples must be analyzed for the constituents listed in Table I of 19.15.29.12 NMAC or constituents from other applicable remediation standards.

The referenced Table I, is reproduced in part below.

Table I Closure Criteria for Soils Impacted by a Release			
Minimum depth below any point within the horizontal boundary of the release to ground water less than 10,000 mg/l TDS	Constituent	Method*	Limit**
≤ 50 feet	Chloride***	EPA 300.0 or SM4500 Cl B	600 mg/kg
	TPH (GRO+DRO+MRO)	EPA SW-846 Method 8015M	100 mg/kg
	BTEX	EPA SW-846 Method 8021B or 8260B	50 mg/kg
	Benzene	EPA SW-846 Method 8021B or 8260B	10 mg/kg

We request approval of EPA 300.0 or SM4500 for the analysis of chloride.

### **Demonstration that OCD Approval Will Provide Equal or Better Protection of Fresh Water, Public Health and the Environment**

The purpose of TPH analyses in the Pit Rule is to measure total petroleum hydrocarbons not all non-polar compounds, such as starch or cellulose that can interfere with Method 418.1. While Method 418.1 may provide some useful data for transportation of crude oil or condensate spills to disposal, the addition of non-polar organic materials in drilling fluids, especially for horizontal wells, renders Method 418.1 highly problematic to determine compliance with the Rule. Using Method 8015 for TPH (GRO+DRO+MRO) provides a better measurement of what we believe the Commission intended operators to measure.

In hearings before the Oil Conservation Commission technical arguments were presented regarding the use of SM4500 in lieu of EPA 300.00 for chloride analysis for Rule 29. The Division and the Commission agreed that these two methods provide equal or better protection of fresh water, public health and the environment.



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**District IV**  
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**State of New Mexico**  
**Energy, Minerals and Natural Resources**  
**Oil Conservation Division**  
**1220 S. St Francis Dr.**  
**Santa Fe, NM 87505**

CONDITIONS  
  
Action 36905

CONDITIONS

Operator: TAP ROCK OPERATING, LLC 523 Park Point Drive Golden, CO 80401	OGRID: 372043
	Action Number: 36905
	Action Type: [C-147] Water Recycle Long (C-147L)

CONDITIONS

Created By	Condition	Condition Date
vvenegas	NMOCD has reviewed and approved the recycling containment permit application and related documents, submitted by [372043] TAP ROCK OPERATING, LLC on July 19, 2021 for 1RF-471 - NORTH OLYMPUS RECYCLING FACILITY AND CONTAINMENT FACILITY ID FVV2121451913 in Unit Letter K, Section 16, Township 24S, Range 33E, Lea County, New Mexico.	8/5/2021