**March 2021**

# Volume 1
# C-147 Registration Package for Dominator Above-Ground Storage Tank
## Section ςυ, T25S, R3σE, Lea County

*Existing pad for Dominator AST view is southwest.*

## Prepared for:
## Solaris Midstream LLC
## 9811 Katy Freeway Suite 900
## Houston, TX 77024

**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


March 31, 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: Solaris Water Midstream, Dominator AST Containment Permit
Section 25, T25S, R33E, Lea County
C-147 Volume 1 and Volume 2

Dear Mr. Bratcher and Ms. Venegas:

On behalf of Solaris Water Midstream, R.T. Hicks Consultants is pleased submit a permit for the above-referenced project. The current schedule calls for commencing to fill the AST Containment in the beginning of 2022. Please note that the siting criteria demonstration evaluates the area of the proposed AST Containment as well as an inactive fresh water frac pond constructed by COG Operating. In the future, Solaris may elect to submit a registration to reconstruct the fresh water frac pond as an in-ground containment in compliance with Rule 34.

Both Volumes will be transmitted to OCD via the OCD.Online portal.

Volume 1 contains:

- C-147 form signed by the operator,
- AST Operations and Closure Plans (verbatim from the approved Zia Hills AST Containments),
- 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 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 for the proposed 60,000 bbl. AST Containment are fully consistent with plans previously approved by OCD,
- The Design/Construction Plan verbatim from the approved Zia Hills AST Containment

- The manual for AST set up from New Wave Energy Services
- Variances for AST Storage Containments – all of which have been approved by OCD previously.

In compliance with 19.15.34.10 of the Rule, this submission is copied to BLM Carlsbad who is the representative of the owner of the surface upon which the containments will be constructed (i.e., the United States).

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

Randall T. Hicks PG
Principal

Copy: Solaris Water Midstream
BLM Carlsbad

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**DOMINATOR ABOVE-GROUND STORAGE TANK**

## Financial Assurance Cost Estimate

Total estimated cost for closure, reclamation, and restoration of the facility (AST, fencing, etc.) pursuant to Rule 34 is **$33,500** based upon the work elements in the spreadsheet (below). We used the same estimate as the recently approved cost estimate for Rodney Robinson SAT Containment with the exception of the cost for pad reclamation/restoration. As shown in the C-147 permit application, the AST Containment will lie on an existing, active tank battery pad. Reclamation and restoration of the tank battery pad on this Federal lease will be the responsibility of COG Operating when the tank battery is no longer needed. Items shown with "0" units are costs recommended by BLM but are not required in a closure cost estimate for compliance with Rule 34. The estimate was generated by Solaris with input from Hicks Consultants and is equivalent to contractor bids for other AST containments.

| ITEM NO. | ITEM DESCRIPTION | UNITS | QTY | UNIT PRICE | Rule 34 TOTAL PRICE |
|---|---|---|---|---|---|
| | Dominator | | | | |
| 1 | Site Containment | 0 | 1 | $1,000.00 | $0.00 |
| 2 | Removal of AST and Liner Disposal | 1 | 1 | $30,000.00 | $30,000.00 |
| 3 | Removal of Weir Tanks | 0 | 5 | $500.00 | $0.00 |
| 4 | Removal of Chemical Trailer | 0 | 1 | $50.00 | $0.00 |
| 5 | Removal of Filter Pods | 0 | 1 | $200.00 | $0.00 |
| 6 | Removal of pumps, generators, light towers | 0 | 4 | $200.00 | $0.00 |
| 8 | Clean Pumps, piping and equipment | 0 | 1 | $1,500.00 | $0.00 |
| 9 | Remove Pumps, piping, and equipment | 0 | 3 | $1,500.00 | $0.00 |
| 11 | Assess soil for impacts | 1 | 1 | $2,500.00 | $2,500.00 |
| 12 | Re-grade and Reclaim Site | 0 | 0 | $16,000.00 | $0.00 |
| 13 | Misc. disposal and removal of fencing and cattle guards | 1 | 1 | $1,000.00 | $1,000.00 |
| | **Facility Decommision and Reclaim Site Subtotal:** | | | | **$33,500.00** |

# 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: Solaris Midstream LLC OGRID #: 371643

Address: 9811 Katy Freeway, Suite 900, Houston, TX, 77024

Facility or well name (include API# if associated with a well): Dominator Above-Ground Storage Tank

OCD Permit Number: _____ (For new facilities the permit number will be assigned by the district office)

U/L or Qtr/Qtr: O Section: 25 Township: 25S Range: 33E County: Lea

Surface Owner: ☒ Federal ☐ State ☐ Private ☐ Tribal Trust or Indian Allotment

2.

☒ **Recycling Facility:**

Location of (if applicable): Latitude: 32.096648°N Longitude: 103.525092°W approximately (NAD83)

Proposed Use: ☒ Drilling* ☒ Completion* ☒ Production* ☒ Plugging *

******The re-use of produced water may NOT be used until fresh water 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 Containment (if applicable) Latitude: 32.096648°N Longitude: 103.525092°W approx. (NAD83)

☐ For multiple or additional recycling containments, attach design and location information of each containment

☒ Lined ☐ Liner type: Thickness See Attachment Plate 1 ☒ LLDPE ☐ HDPE ☐ PVC ☐ Other _____

☐ String-Reinforced

Liner Seams: ☐ Welded ☐ Factory ☐ Other Volume: See Attachment Plate 1 Dimensions _____.

☐ 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 $_$33,500_____ **(work on these facilities cannot commence until bonding amounts are approved)**

☒ Attach closure cost estimate and documentation on how the closure cost was calculated. (See Transmittal Letter)

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 for Variances***

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.**<br>NM Office of the State Engineer - iWATERS database search; USGS; Data obtained from nearby wells FIGURES 1-2 | ☐ Yes ☒ No<br>☐ 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.<br>- Written confirmation or verification from the municipality; written approval obtained from the municipality FIGURE 3 | ☐ Yes ☒ No<br>☐ NA |
| Within the area overlying a subsurface mine.<br>- Written confirmation or verification or map from the NM EMNRD-Mining and Minerals Division FIGURE 4 | ☐ Yes ☒ No |
| Within an unstable area.<br>- Engineering measures incorporated into the design; NM Bureau of Geology & Mineral Resources; USGS; NM Geological Society; topographic map FIGURE 5 | ☐ Yes ☒ No |
| Within a 100-year floodplain. FEMA map FIGURE 6 | ☐ 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).<br>- Topographic map; visual inspection (certification) of the proposed site FIGURE 7 | ☐ Yes ☒ No |
| Within 1000 feet from a permanent residence, school, hospital, institution, or church in existence at the time of initial application.<br>- Visual inspection (certification) of the proposed site; aerial photo; satellite image FIGURE 8 | ☐ Yes ☒ No |
| Within 500 horizontal feet of a spring or a fresh water well used for domestic or stock watering purposes, in existence at the time of initial application. FIGURES 1 and 7<br>- NM Office of the State Engineer - iWATERS database search; visual inspection (certification) of the proposed site | ☐ Yes ☒ No |
| Within 500 feet of a wetland. FIGURE 9<br>- US Fish and Wildlife Wetland Identification map; topographic map; visual inspection (certification) of the proposed site | ☐ Yes ☒ No |

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): Bradley Todd Carpenter Title: Operations Manager.

Signature: Todd Carpenter Date: 3/31/2021.

e-mail address todd.carpenter@solarismidstream.com Telephone: 432-413-0918.

11.

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

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

☐ OCD Conditions _____

☐ Additional OCD Conditions on Attachment

# O&M PLAN
# CLOSURE PLAN

# 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 though 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 was 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 order to prevent damage to the liner by erosion, fluid

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 containment
(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.

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jets or impact from installation and removal of hoses or pipes during injection or withdrawal of liquids.

- *Pursuant to a requested 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.

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

- 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.

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.

- 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.

**(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.

- 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.
  7. Cut out piece of material (patch or tape) to overlay liner.

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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 will 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" meeting the requirements according to NMAC 19.15.34 is to be filled out during these routine inspections. The form also 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.

Weekly inspections consist of:

- Reading and recording the fluid height of staff gauges and freeboard
- Recording any evidence of visible oil on surface
- Visually inspecting the containments exposed liners
- Checking the leak detection system for any evidence of a loss of integrity of the primary liner
- Inspect any diversion ditches and berms around the containment to check for erosion and collection of surface water run-on.
- Inspect the leak detection system for evidence of damage or malfunction and monitor for leakage.

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- Inspect netting (may not be used if Mega Blaster Pro avian deterrent is used) for damage or 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.

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.

Additional monitoring to identify hazards that may have developed, changes in site conditions, tank use, and to enable early detection of structural issues such as uneven tank panel settlement, soil settlement, liner damage, insufficient liner slack or leaks. If changes are noted the AST contractor should be notified

- If observed conditions indicate a potential tank failure is imminent, the vicinity will be immediately cleared and the AST will be drained.

Monthly, the operator will:

- Report to the division, the total volume of water received for recycling, with the amount of fresh water received listed separately, and the total volume of water leaving the facility for disposition by use on form C-148.
- Record sources and disposition of all recycled water.

## *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.

19.15.34.13 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.

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.

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.

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

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Solaris Water Midstream, LLC.

# Inspection Form

Date: _____

**Dominator AST**

(weekly inspection when fluids are present, monthly otherwise)

Tank ID: _____

Fluid Level: _____ Tank contents: _____

| Inspection Task | Results | | Remarks, Observations, and/or Remedial Actions |
|---|---|---|---|
| Visible Oil on Surface | ☐ None Observed | ☐ Yes, Describe Action | |
| | *An absorbent boom or similar device is located on site to remove visible oil from surface.* | | |
| At least 2 ft of freeboard | ☐ Yes | ☐ No, Measure Freeboard | |
| Evidence of surface water run-on | ☐ None Observed | ☐ Yes, Describe | |
| | *Check for excessive erosion of perimeter berms.* | | |
| Birds or wildlife in net or screen | ☐ None Observed | ☐ Yes, Describe | |
| | *Within 30 days of discovery, report dead birds or wildlife to the appropriate agency (USFWS, NMDGF) and to NMOCD District II.* | | |
| Damage to netting or screen | ☐ None Observed | ☐ Yes, Describe | |
| Rupture of Liner | ☐ None Observed | ☐ Yes, Describe | |
| | *If rupture is above fluid level, repair within 48 hours. If below fluid level, remove fluid above within 48 hours, notify NMOCD District II, and repair.* | | |
| Clips or clamps properly securing liner | ☐ Yes | ☐ No, Describe | |
| If low level, enough liner slack on panel wall | ☐ Yes | ☐ No, Describe | |
| Uneven gaps between panels | ☐ None Observed | ☐ Yes, Describe | |

Solaris Water Midstream, LLC.

| | | | |
|---|---|---|---|
| Signs of tank settlement | ☐ None Observed | ☐ Yes, Describe | |
| Erosion of soil surrounding tank (10 ft radius) | ☐ None Observed | ☐ Yes, Describe | |
| Running water on the ground | ☐ None Observed | ☐ Yes, Describe | |
| Unusual ponding of fluid inside berm | ☐ None Observed | ☐ 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 II and repair.* | |
| Rust or corrosion on panels, stairs, or hardware | ☐ None Observed | ☐ Yes, Describe | |
| Damage to any hardware | ☐ None Observed | ☐ Yes, Describe | |

Additional Observations or Actions: _____

_____

_____

_____

_____

_____

_____

_____

Inspected by: _____

## 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:
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.

### *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.

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.

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.

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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.

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.

## *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 substantially restore the surface to the condition that existed prior to the construction of the recycling containment:

1. Replace topsoils and subsoils to their original relative positions
2. Contour 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

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.

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.

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.

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.

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# GENERAL SITING CRITERIA DEMONSTRATION AND SITE SPECIFIC GROUNDWATER DATA

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.**<br>NM Office of the State Engineer - iWATERS database search; USGS; Data obtained from nearby wells FIGURES 1-2 | ☐ Yes ☒ No<br>☐ 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.<br>- Written confirmation or verification from the municipality; written approval obtained from the municipality FIGURE 3 | ☐ Yes ☒ No<br>☐ NA |
| Within the area overlying a subsurface mine.<br>- Written confirmation or verification or map from the NM EMNRD-Mining and Minerals Division FIGURE 4 | ☐ Yes ☒ No |
| Within an unstable area.<br>- Engineering measures incorporated into the design; NM Bureau of Geology & Mineral Resources; USGS; NM Geological Society; topographic map FIGURE 5 | ☐ Yes ☒ No |
| Within a 100-year floodplain. FEMA map FIGURE 6 | ☐ 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).<br>- Topographic map; visual inspection (certification) of the proposed site FIGURE 7 | ☐ Yes ☒ No |
| Within 1000 feet from a permanent residence, school, hospital, institution, or church in existence at the time of initial application.<br>- Visual inspection (certification) of the proposed site; aerial photo; satellite image FIGURE 8 | ☐ Yes ☒ No |
| Within 500 horizontal feet of a spring or a fresh water well used for domestic or stock watering purposes, in existence at the time of initial application. FIGURES 1 and 7<br>- NM Office of the State Engineer - iWATERS database search; visual inspection (certification) of the proposed site | ☐ Yes ☒ No |
| Within 500 feet of a wetland. FIGURE 9<br>- US Fish and Wildlife Wetland Identification map; topographic map; visual inspection (certification) of the proposed site | ☐ Yes ☒ No |

## Distance to Groundwater

Figure 1 and 1a, Figure 2, their associated legends, and the discussion presented below demonstrate that groundwater (fresh water, as defined by NMOCD Rules) at the location is greater than the required 50 feet below the proposed Dominator Above-Ground Storage Tank Containment (Dominator AST). Specifically, the estimated depth to water is greater than 100 feet.

### Hydrogeology of Dominator AST Containment

The proposed site for the Dominator AST is located approximately 18.3 miles east of Jal, New Mexico and 36 miles southwest of Loving, New Mexico. It lies 6.5 miles to the northwest of the Paduca Breaks and the Red Hills. The area near the proposed AST containment is relatively flat with a surface covering of sand with vegetation consisting of native grasses, mesquite, and yucca. According to the New Mexico State Geologic Map (Figures 1 and 2), the Dominator AST is in an area where the surface unit is Quaternary age piedmont deposits overlain by Quaternary age eolian deposits (Qe/Qp).

As shown in the southwest corner of Figures 1 and 2, the upper Chinle Formation, T(r)cu, crops out at an elevation of 1000 meters and the Ogallala Formation is mapped to the east of the Chinle outcrop and about 1 ½ miles south of the Dominator location. The USGS identifies wells 14753 (3 miles west of Dominator) and 14938 (1.5 miles east of Dominator) as drawing water from the Ogallala Aquifer. However, the USGS also identifies wells 14744 (slightly north of 14753) and wells 14973 and 14972 (about ½ mile south of 14938) as drawing water from the Chinle. Because well logs on the OSE website do not exist for any of the wells identified on Figure 1, we cannot verify if the shallowest groundwater unit is Ogallala or Chinle.

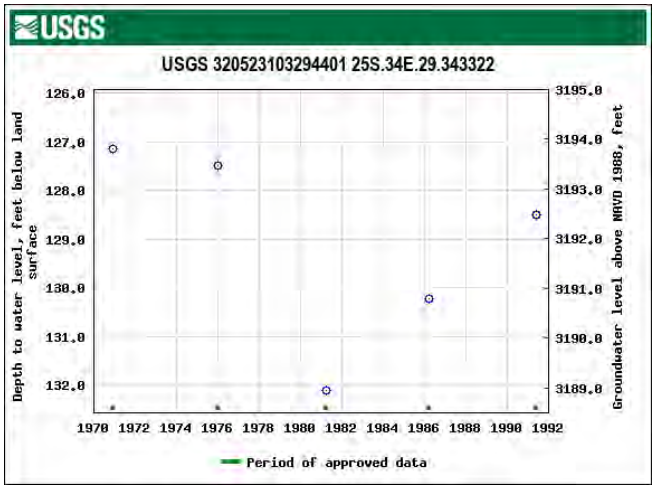
### Depth to Water Data and Nearby Wells

Figures 1 and 1a are topographic maps overlain by transparent geologic map of the state of New Mexico and associated legends that displays the following:

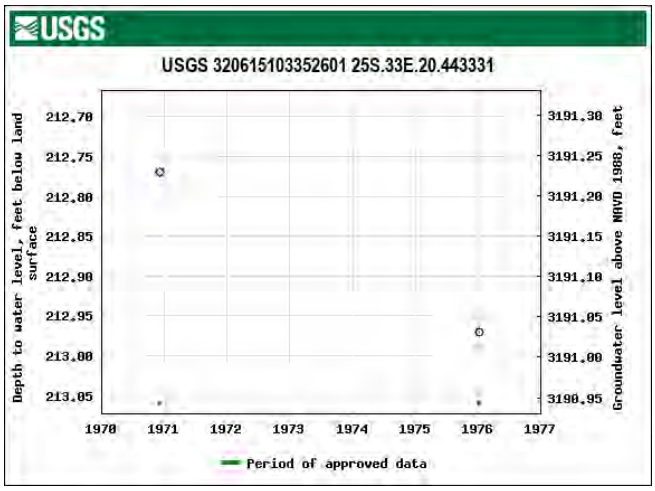
- A blue hatched rectangle in center of which is the Dominator AST is referred to in the remainder of the text as the Dominator site. With respect to the setbacks in the Rule, we are “clearing” this entire area because Solaris may wish to convert an existing fresh water frac pond to the north of the AST Containment (see Figure 5).
- Water wells from the USGS database as green, cyan, and purple triangles. The colors indicate the principal water-bearing unit for each well: Alluvium/Bolsom, Ogallala, and Chinle, respectively. The well number as defined in the database, recorded depth to water value, and the date the water level measurement was recorded is displayed next to the corresponding well point.
- Miscellaneous water wells from public and non-public databases were identified by field inspection or other published documents are represented by yellow, cyan, and green squares with black dots in the center. The colors correspond to the depth to water and date the depth to water value was recorded are also displayed.
- Water wells from the Office of the State Engineer WATERS database as light blue, green, dark blue, and beige circles with colored triangles in the center. These

symbols indicate the depth to water measured in the well. Well ID and documented in the OSE Waters database, depth to water value, and the date the value was recorded is displayed next to the corresponding well point.

USGS-14938, USGS-14753, and USGS-14973 are the nearest mapped USGS wells to the proposed AST. USGS-14938 is 1.77 miles to the southeast, USGS-14753 is 3.9 miles to the northwest, and USGS-14973 is 1.76 miles to the southeast. Historical depth to water measurements for USGS-14938 are presented in the graph below (USGS 3205…4401, below). The depth to water dropped by 4-feet in 1981 but recovered to about 128.5 feet by 1991. It did not recover to the shallowest depth to water level in 1971, approximately 127.1 feet, but depth to water was relatively stable over the 22-year period of record.




Historical depth to water measurements for USGS-14753 (USGS 3205…2601, below) are presented in the graph below. The two measurements over the 5-year period of record, from 1971 to 1976, show a change in the water table elevation of only 0.2 feet.




USGS-14973 (USGS 32041…2201, below) has more extensive historical data in addition to a measurement taken within the last decade. The historical data goes back to about 1954, where a depth to water of approximately 141 feet below the surface was recorded. From 1971 to 1991, the depth to water stays relatively static between 125 to 129 feet below the

surface and jumps to 177 feet below the surface in 2013. With a 36 feet variation in depth to water over a 59-year period, the depth to water is relatively stable.

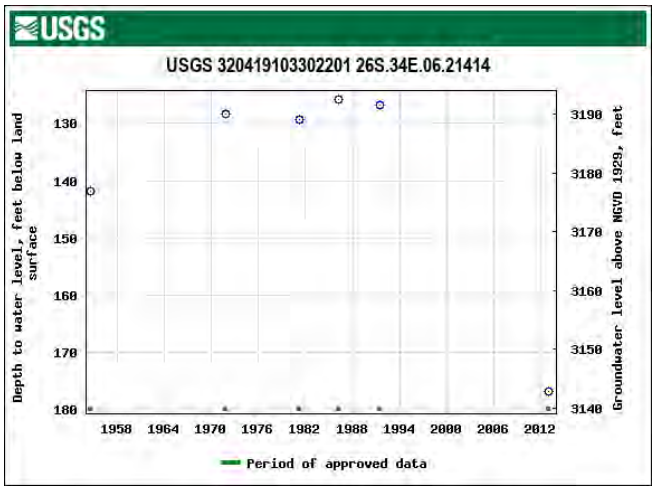



Figure 2 is a topographic map overlain by a transparent geologic map of the state of New Mexico and a potentiometric surface map and associated legend the displays the following:

- The Dominator Site is in the center of the blue hatched box..
- Water wells from the USGS database as green, cyan, and purple triangles. The colors indicate the principal water-bearing unit for each well: Alluvium/Bolsom, Ogallala, and Chinle, respectively. The well number as defined in the database, recorded depth to water value, and the date the groundwater elevation was recorded is displayed next to the corresponding well point.
- Miscellaneous water wells from public and non-public databases were identified by field inspection or other published documents are represented by yellow, cyan, and green squares with black dots in the center. The colors correspond to the depth to water and date the depth to water value was recorded are also displayed.
- Isocontours of a potentiometric surface are generated by RT Hicks Consultants, Ltd. USGS and Miscellaneous wells and their groundwater elevation values were used to create the potentiometric surface.

We used the USGS and MISC data to generate the potentiometric surface map. The water level data suggest that some wells draw groundwater from the Ogallala while other wells tap underlying Chinle sandstone units. The water table elevations within the 5-wells southeast of Dominator site range from 3142 to 3261 feet above mean sea level and may reflect water levels in the Ogallala versus the underlying Chinle. For the purpose of generating Figure 2, we assume that the Ogallala and Chinle are hydraulically connected to some degree. If our interpretation of the potentiometric surface is correct, the elevation of groundwater beneath the Dominator site is no higher than 3250 feet above mean sea level. Given the approximate elevation of the pad upon which the Dominator AST will rest is 3340, the depth to groundwater is greater than (3336-3250=) 86 feet.

The uncertainty of the depth to groundwater beneath the Dominator site is minimized by employing soil borings from nearby recycling containment sites (see Figure 1a for locations,

Well Log Appendix for boring logs). These sites specifically support a greater than-90-foot depth to groundwater:

- The Lomas Reuse Facility of EOG, which is 1.3 miles west-northwest of the Dominator site
    - The soil boring is75 ft deep and no water was encountered. Caliche extended from the surface to a depth of 30 feet. Beneath the caliche the lithologic description of medium to coarse sand to a depth of about 50 feet is probably the Ogallala or the alluvial fill material mapped at the surface. Below 50 feet might be the fine grained red-brown Chinle.
- The Bebop Recycling and Containment Facility, which is located 3.31 miles to the west of the Dominator site.
    - The soil boring at Bebop is 100 ft in depth and no water was encountered. Caliche extended from the surface to a depth of 22 feet.
- The Salado Draw Containment, which is located 5.09 miles to the southwest of the Dominator site.
    - The soil boring at the Salado Draw Containment is 100 feet in depth and no water was encountered. Similar to the Bebop Facility, caliche occurs from the surface down to 20 feet. Caliche is also mixed with sandstone in the 30 feet below the layer that is exclusively comprised of caliche.

From these data, we can conclude the depth to water at the Dominator AST site is greater than 80 feet.

## Distance to Municipal Boundaries and Freshwater Fields

Figure 3 demonstrates that the area of interest is not within incorporated municipal boundaries or within defined municipal freshwater well fields covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended.

- The nearest freshwater well field is 12.8 miles to the southeast and is owned by the City of Jal.
- The nearest municipality is the City of Jal, which is 18.3 miles due east.

## Distance to Subsurface Mines

Figure 4 and our general reconnaissance of the area demonstrate the absence of subsurface mines in the area.

- The Dominator site is not in an area where subsurface mines exist.
- The nearest surface mine is mapped in the MILS database .78 miles to the southeast. However, we believe this point is mislocated and is actually located at the “Gravel Pit” point .46 miles to the southeast of the site.

## Distance to High or Critical Karst Areas

Figure 5 illustrates the Dominator site absence of mapped areas of high or critical karst potential.

- The Dominator site is not located within high or critical karst potential areas.

- Our field investigation saw no evidence of karst features such as sinkholes

## Distance to 100-Year Floodplain

Figure 6 demonstrates the absence of 100-year flood plains with respect to the proposed location for the Dominator AST site.

- The nearest 100- year flood plain is 18.79 miles due east of the site, near the City of Jal.

## Distance to Surface Water

Figure 7 and the site visit demonstrate the that the Dominator AST site is outside of the setback distances for a continuously flowing watercourse or the next lower order tributary, lakebed, sinkhole, playa lake (measured from the ordinary high-water mark) or spring.

- The nearest surface water feature is a lake/pond that is located 2.39 miles to the southeast.
- No watercourses were observed near the site.

## Distance to Permanent Residences or Structures

Figure 8 demonstrates that the proposed site for the Dominator AST is not within the setback distances of an occupied permanent residence, school, hospital, institution, church, or other structure at the time of the initial application.

- The only structures near the proposed site are the well pads and pipelines.

## Distance to Non-Public Water Supply

Figures 1 and 7 demonstrate the Dominator location is not within the setback distances of a spring or freshwater well used for domestic or stock watering purposes, in existence at the time of initial application.

- Figure 1 shows the location of all area water wells. The nearest well, C-02313, is located approximately 1.37 miles to the west of the proposed site.
- No domestic water wells are located within 1,000 feet of the recycling area.
- No springs were identified in the area.
- The facility is not within 500 feet of a spring or freshwater well used for domestic or stock watering purposes, in existence at the time of initial application.

## Distance to Wetlands

Figure 9 demonstrates that the proposed site of the Dominator site is not within the 300-foot setback distance of a wetland.

- The nearest mapped wetland is a freshwater pond that is 2.39 miles to the southeast.

# Figures

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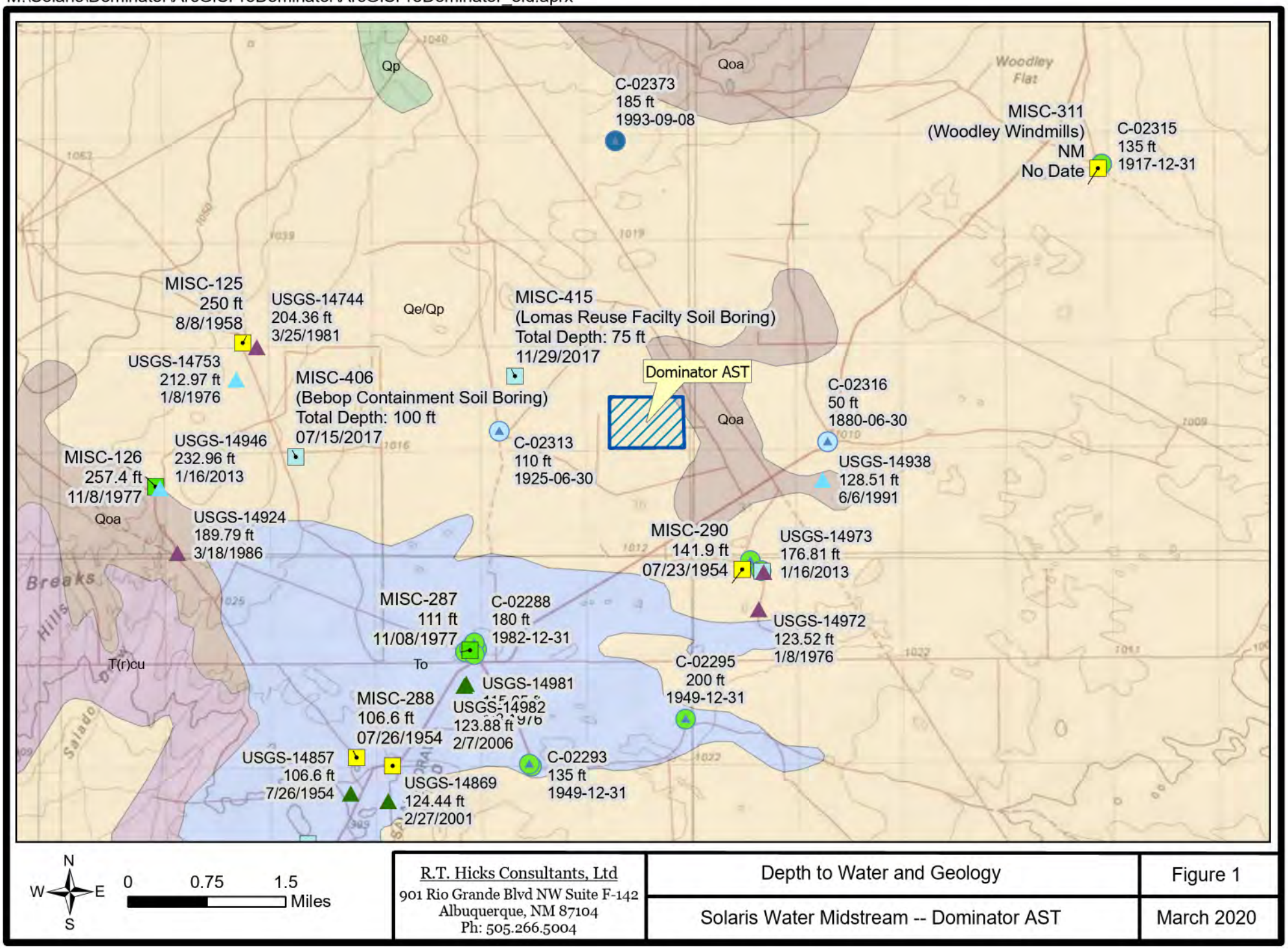


| | | |
|---|---|---|
| R.T. Hicks Consultants, Ltd<br>901 Rio Grande Blvd NW Suite F-142<br>Albuquerque, NM 87104<br>Ph: 505.266.5004 | Depth to Water and Geology | Figure 1 |
| | Solaris Water Midstream -- Dominator AST | March 2020 |

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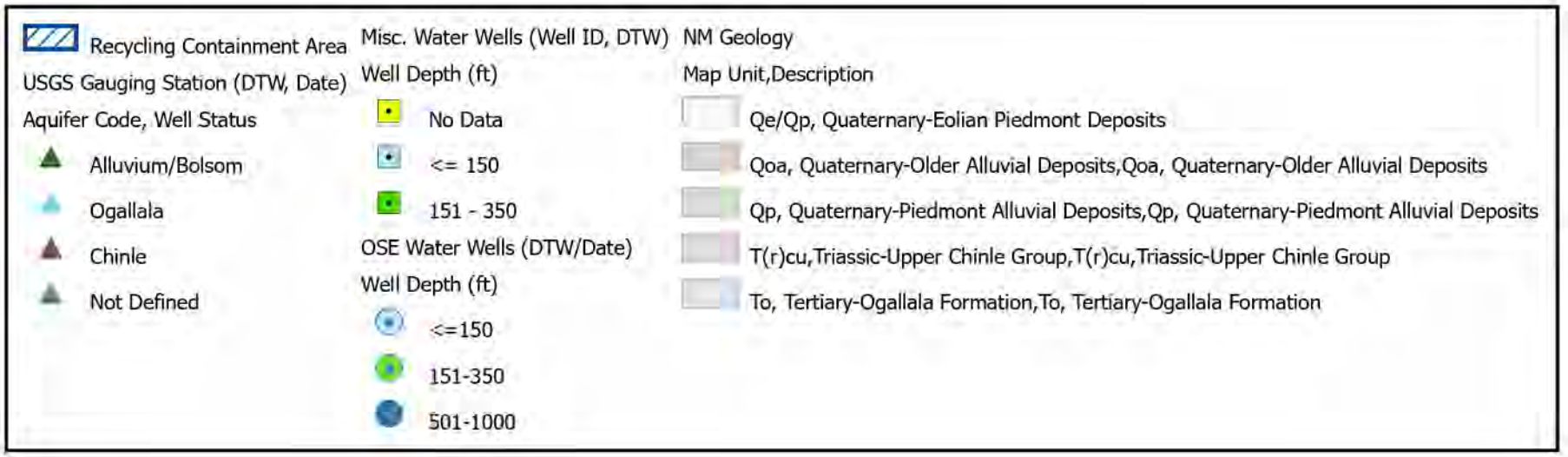


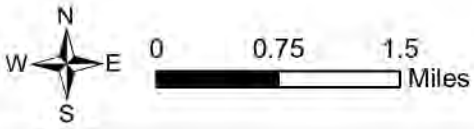


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| R.T. Hicks Consultants, Ltd<br>901 Rio Grande Blvd NW Suite F-142<br>Albuquerque, NM 87104<br>Ph: 505.266.5004 | Depth to Water and Geology Legend | Figure 1 |
| | Solaris Water Midstream -- Dominator AST | March 2020 |

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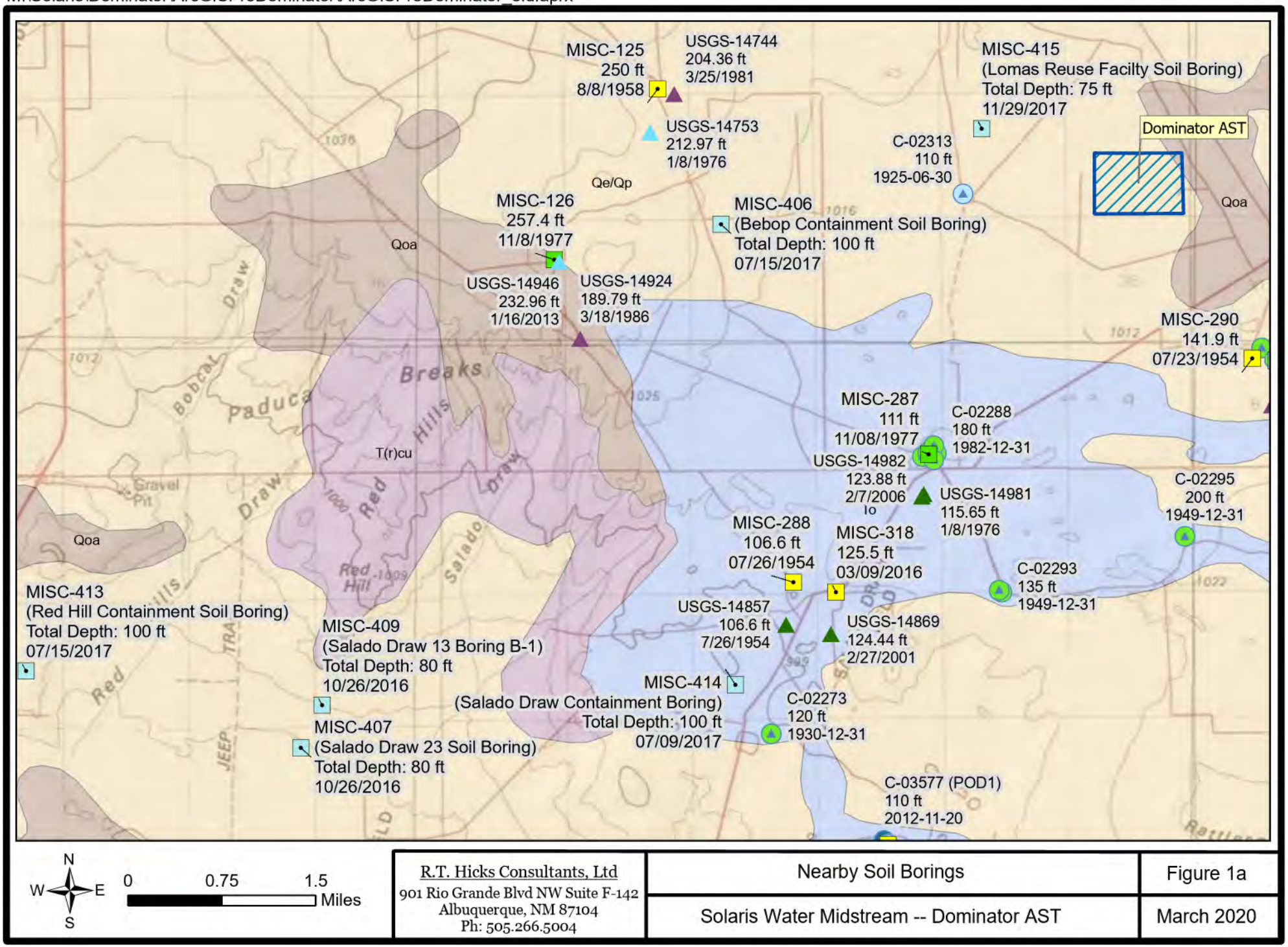


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| R.T. Hicks Consultants, Ltd<br>901 Rio Grande Blvd NW Suite F-142<br>Albuquerque, NM 87104<br>Ph: 505.266.5004 | Nearby Soil Borings | Figure 1a |
| | Solaris Water Midstream -- Dominator AST | March 2020 |

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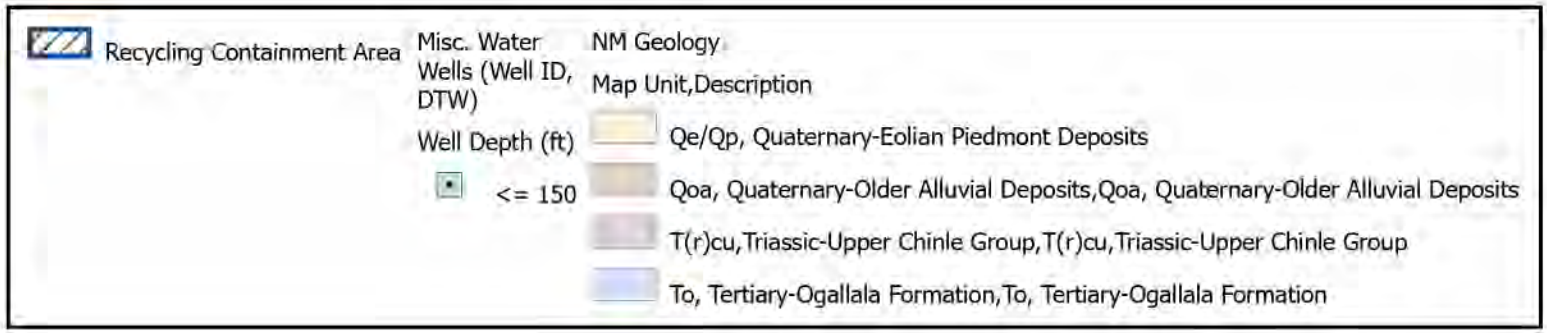


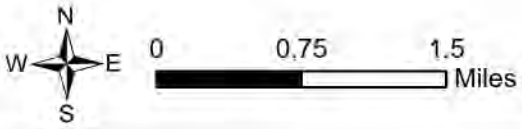


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Nearby Soil Borings Legend

Figure 1a

Solaris Water Midstream -- Dominator AST

March 2020

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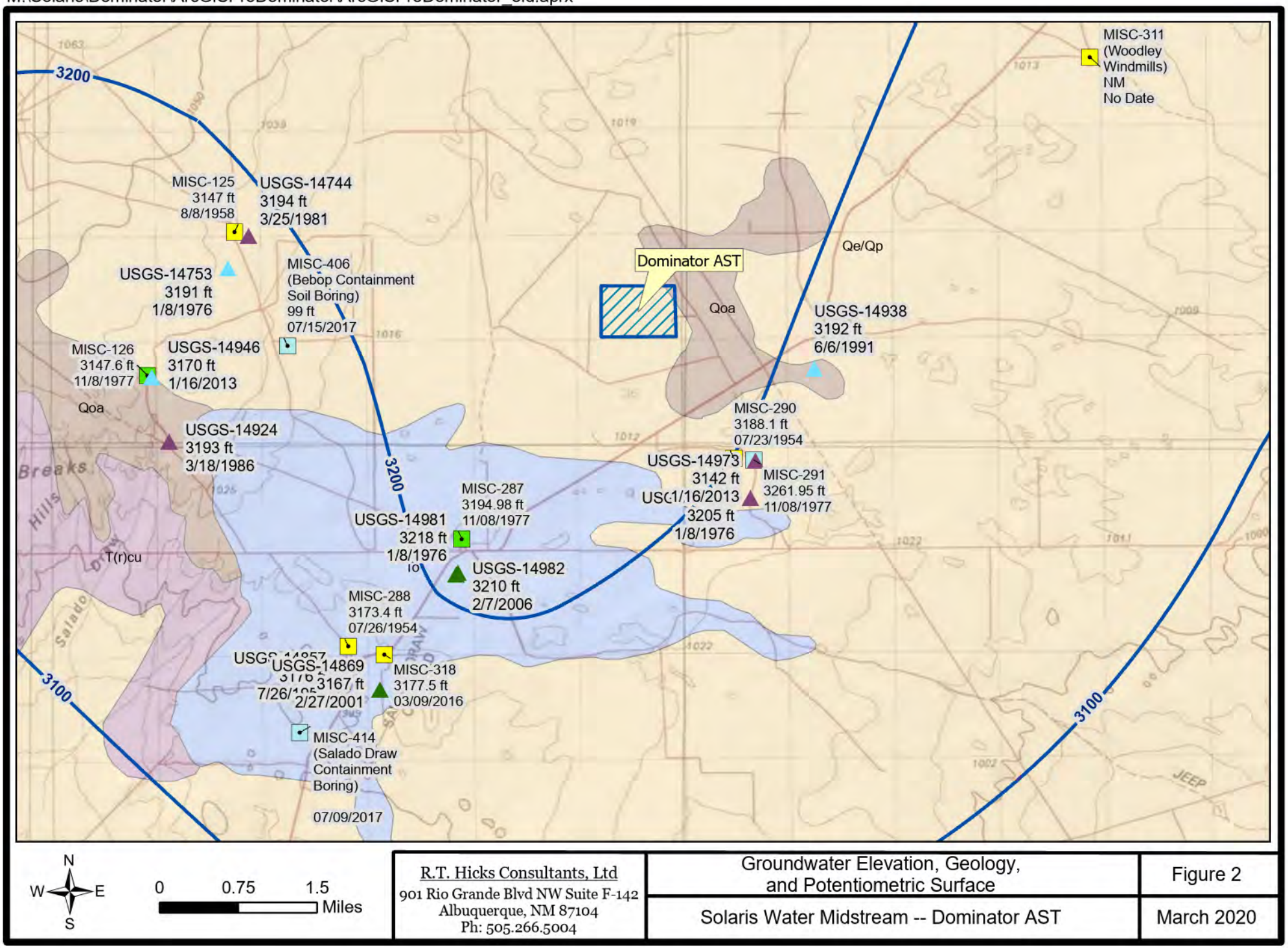


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| R.T. Hicks Consultants, Ltd<br>901 Rio Grande Blvd NW Suite F-142<br>Albuquerque, NM 87104<br>Ph: 505.266.5004 | Groundwater Elevation, Geology, and Potentiometric Surface | Figure 2 |
| | Solaris Water Midstream -- Dominator AST | March 2020 |

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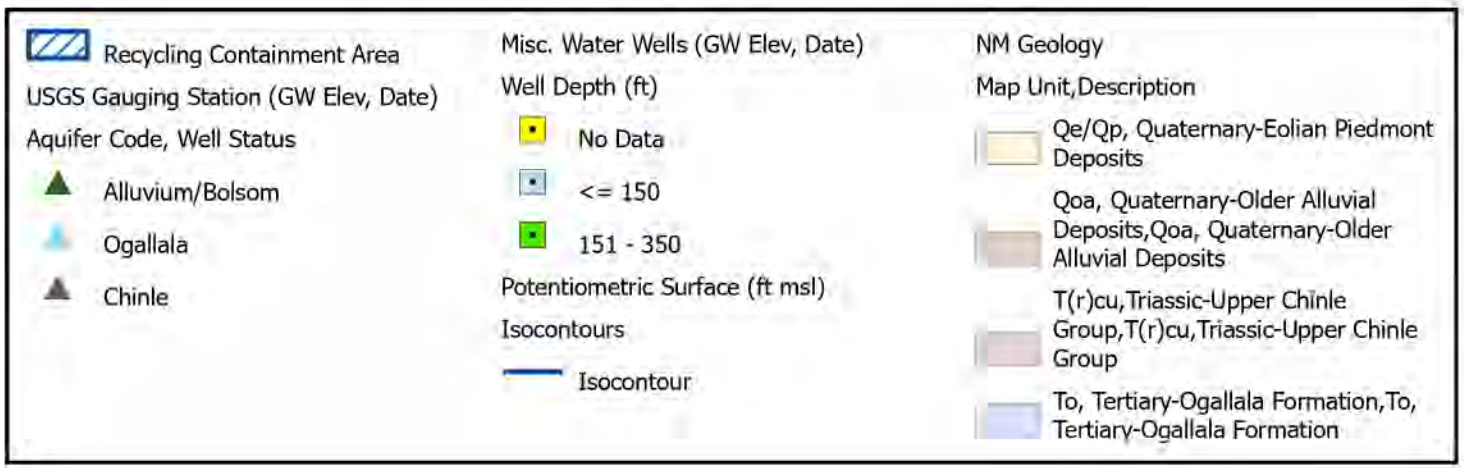



0 0.75 1.5 Miles

| | | |
|---|---|---|
| R.T. Hicks Consultants, Ltd<br>901 Rio Grande Blvd NW Suite F-142<br>Albuquerque, NM 87104<br>Ph: 505.266.5004 | Groundwater Elevation, Geology, and Potentiometric Surface Legend | Figure 2 |
| | Solaris Water Midstream -- Dominator AST | March 2020 |

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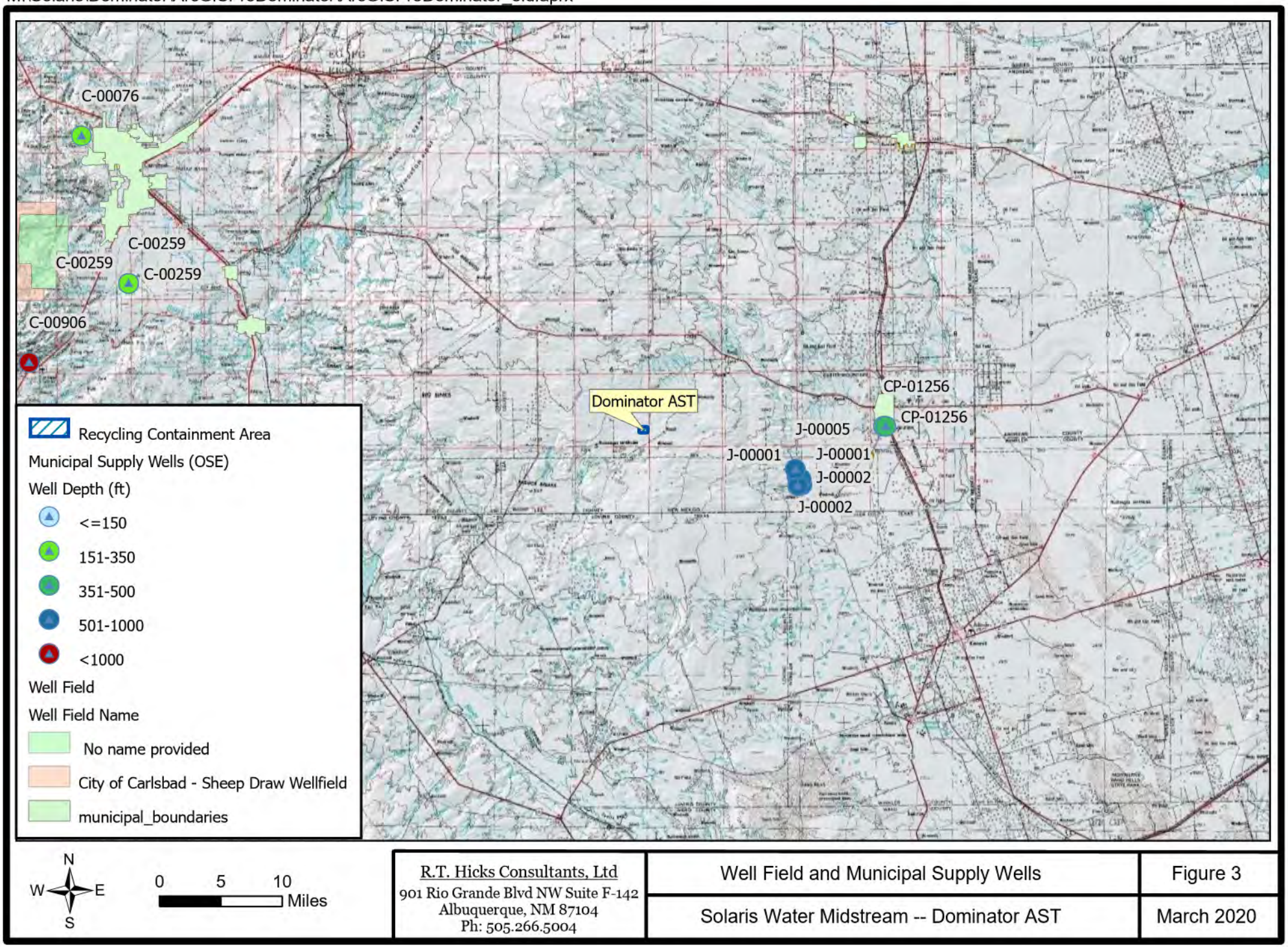


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| R.T. Hicks Consultants, Ltd<br>901 Rio Grande Blvd NW Suite F-142<br>Albuquerque, NM 87104<br>Ph: 505.266.5004 | Well Field and Municipal Supply Wells | Figure 3 |
| | Solaris Water Midstream -- Dominator AST | March 2020 |

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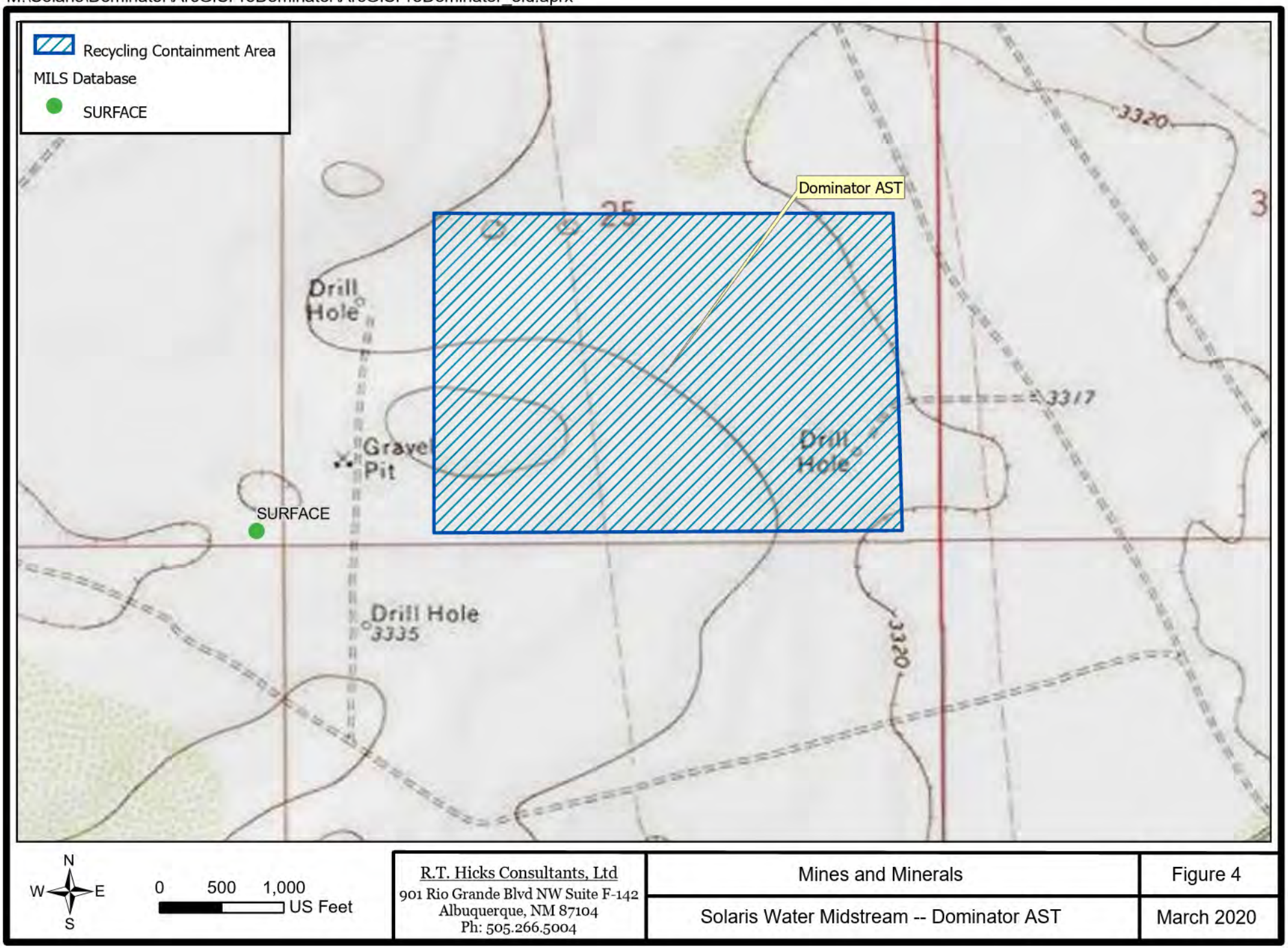


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| R.T. Hicks Consultants, Ltd<br>901 Rio Grande Blvd NW Suite F-142<br>Albuquerque, NM 87104<br>Ph: 505.266.5004 | Mines and Minerals | Figure 4 |
| | Solaris Water Midstream -- Dominator AST | March 2020 |

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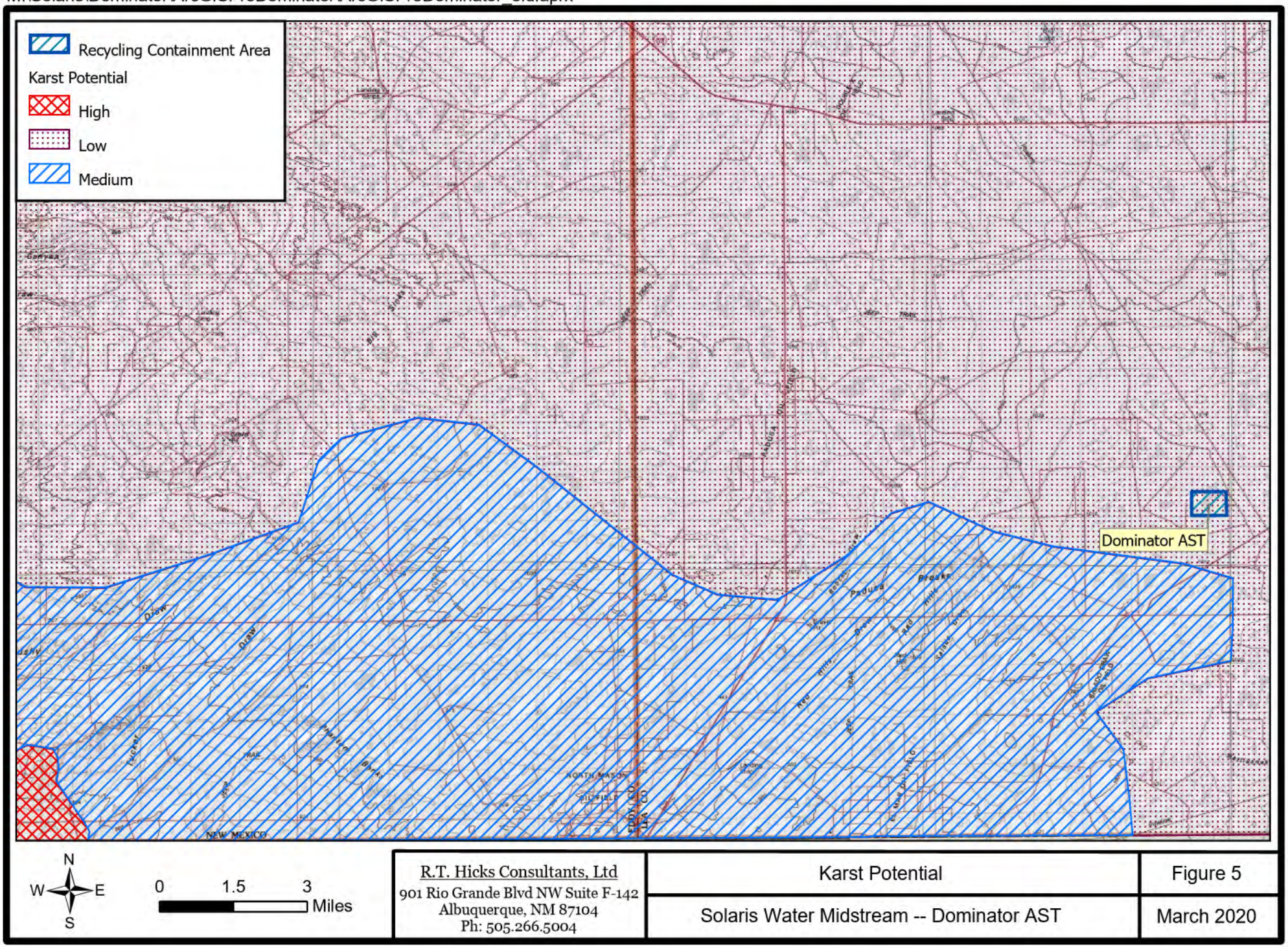


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| R.T. Hicks Consultants, Ltd<br>901 Rio Grande Blvd NW Suite F-142<br>Albuquerque, NM 87104<br>Ph: 505.266.5004 | Karst Potential | Figure 5 |
| | Solaris Water Midstream -- Dominator AST | March 2020 |

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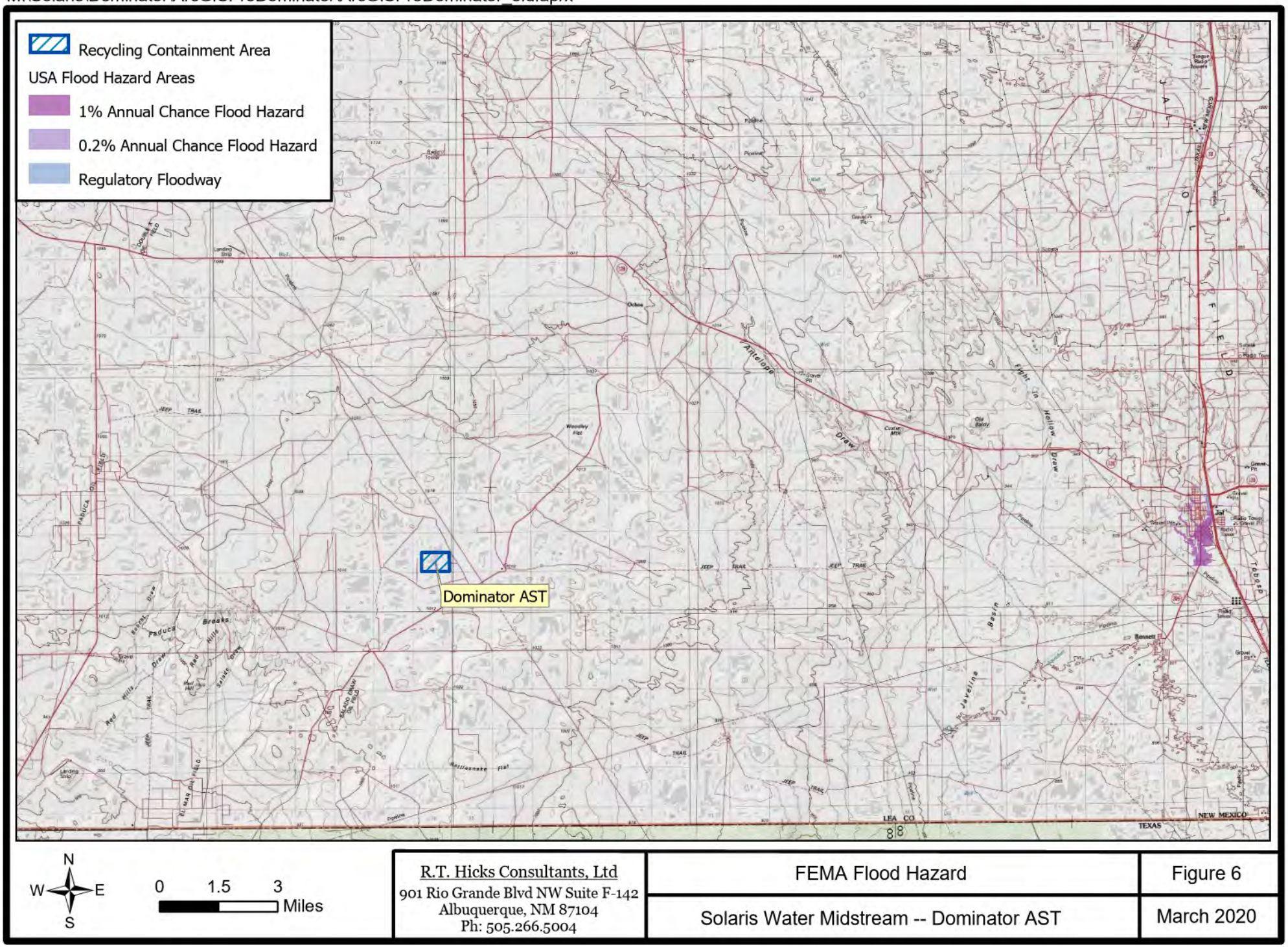


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| R.T. Hicks Consultants, Ltd<br>901 Rio Grande Blvd NW Suite F-142<br>Albuquerque, NM 87104<br>Ph: 505.266.5004 | FEMA Flood Hazard | Figure 6 |
| | Solaris Water Midstream -- Dominator AST | March 2020 |

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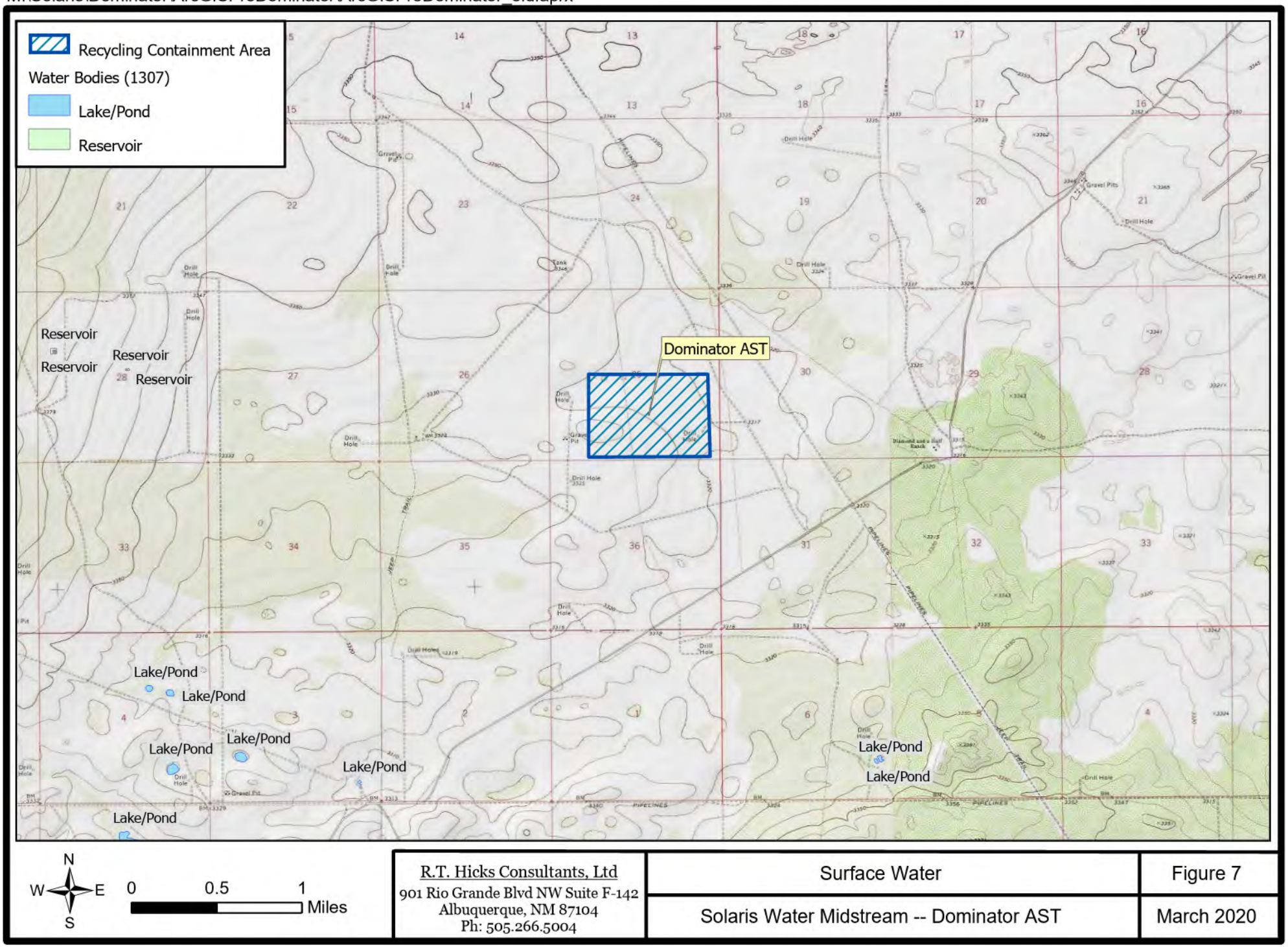


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| R.T. Hicks Consultants, Ltd<br>901 Rio Grande Blvd NW Suite F-142<br>Albuquerque, NM 87104<br>Ph: 505.266.5004 | Surface Water | Figure 7 |
| | Solaris Water Midstream -- Dominator AST | March 2020 |

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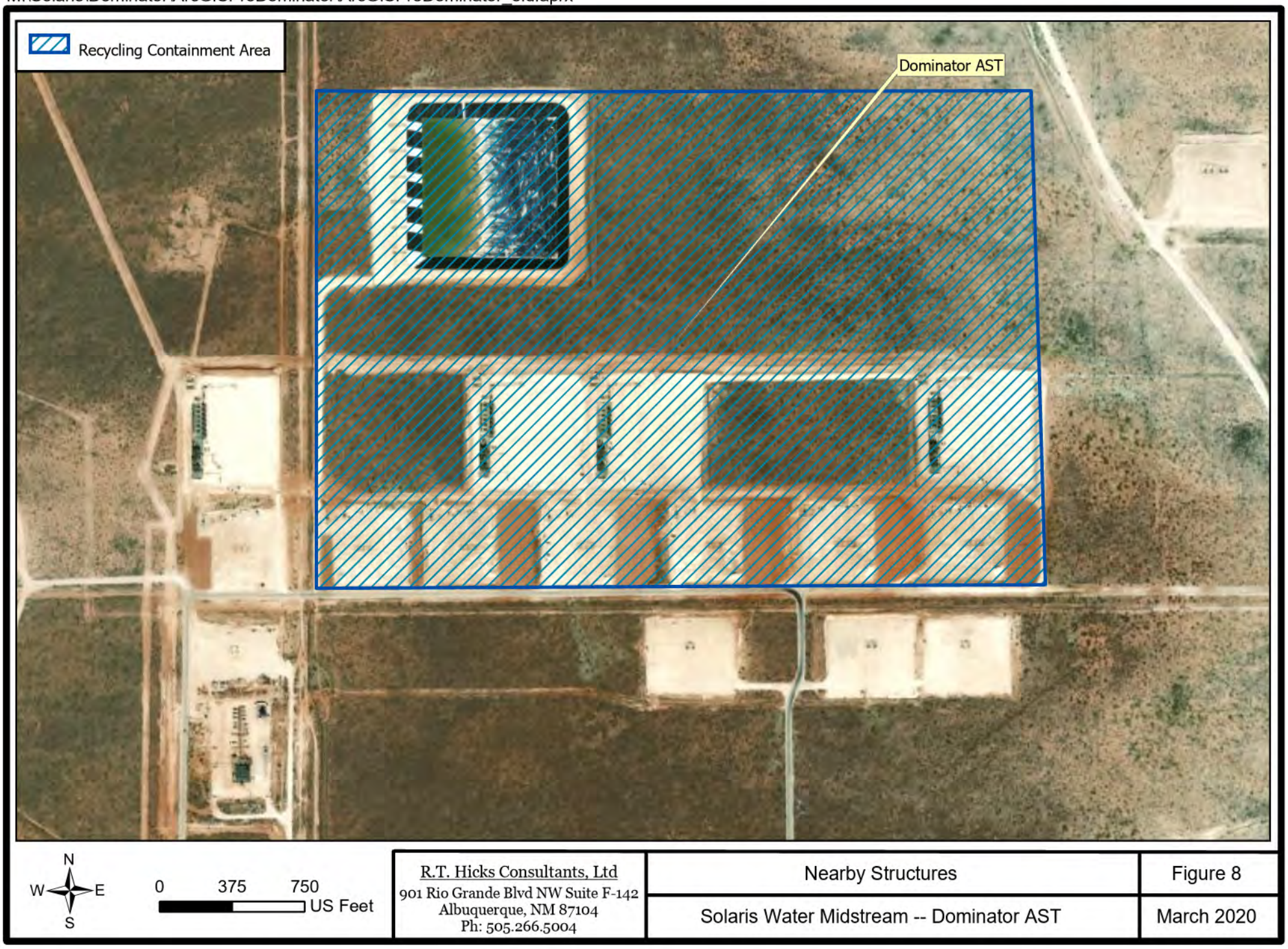


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| R.T. Hicks Consultants, Ltd<br>901 Rio Grande Blvd NW Suite F-142<br>Albuquerque, NM 87104<br>Ph: 505.266.5004 | Nearby Structures | Figure 8 |
| | Solaris Water Midstream -- Dominator AST | March 2020 |

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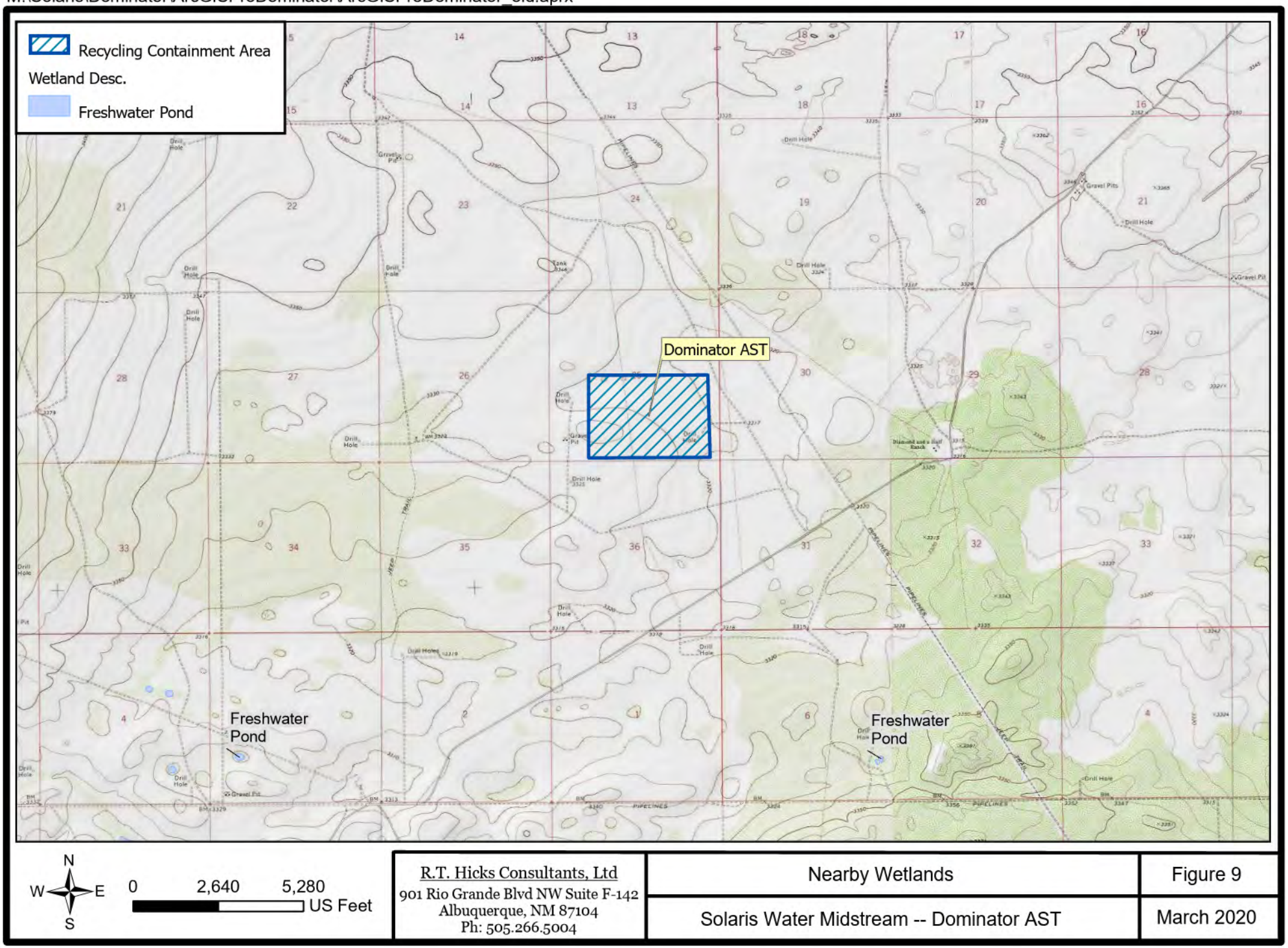


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| R.T. Hicks Consultants, Ltd<br>901 Rio Grande Blvd NW Suite F-142<br>Albuquerque, NM 87104<br>Ph: 505.266.5004 | Nearby Wetlands | Figure 9 |
| | Solaris Water Midstream -- Dominator AST | March 2020 |

# WELL LOGS APPENDIX

# SOIL BORING / MONITORING WELL LOG

PROJECT: Jal, NM - Pit Sites
PROJECT NUMBER: 700438.209.01
CLIENT: EOG Resources
BORING / WELL NUMBER: Lomas - SB1
TOTAL DEPTH: 75
SURFACE ELEVATION:
GEOLOGIST: Jason Hafliger
LATITUDE:

DRILLING COMPANY: Talon/LPE
DRILLER: Ronnie Rodriguez
DRILLING METHOD: Hollow Stem Auger/Continuous Core
BORE HOLE DIAMETER: 6 "
SCREEN: Diam. ___ Length _____ Slot Size _____
CASING: Diam. ____ Length _____ Type _____
DATE DRILLED: 11/29/2017
LONGITUDE:

PAGE 1 of 3

| DEPTH (FT.) | Soil Symbol | WELL CONSTRUCTION | Pt. Sample ID: | SAMPLES | SAMPLE INTERVAL | DESCRIPTION INTERVAL | DESCRIPTION OF STRATUM | DEPTH (FT.) |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | 0 |
| 5 | | | SB1-1' | | 0'-5' | | Silty/Sandy Top Soil<br>Dry - No Moisture<br>Light Reddish Brown | 5 |
| 10 | | | SB1-6' | | 5'-10' | | Caliche<br>Dry - No Moisture<br>Tan/White | 10 |
| 15 | | | SB1-11' | | 10'-15' | | Caliche - sign of sand @ 12'<br>Dry - No Moisture<br>Tan/White<br>SB1-11' | 15 |
| 20 | | | SB1-16' | | 15'-20' | | Caliche - Hard Pan<br>Dry - No Moisture<br>Tan/White | 20 |
| 25 | | | SB1-21' | | 20'-25' | | Caliche Hard Pan<br>Dry - No Moisture<br>Tan/White | 25 |
| 30 | | | SB1-26' | | 25'-30' | | Caliche - Showing Sand<br>Dry - Low Moisture<br>Tan to Light Yellow Brown<br>SB1-26' | 30 |
| | | | | | | | Sand/Stone/Silts - Med to Coarse | |

REMARKS:

THIS BORING LOG SHOULD NOT BE USED SEPERATE FROM THE ORIGINAL REPORT

# SOIL BORING / MONITORING WELL LOG

PROJECT: Jal, NM - Pit Sites
PROJECT NUMBER: 700438.209.01
CLIENT: EOG Resources
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TOTAL DEPTH: 75
SURFACE ELEVATION:
GEOLOGIST: Jason Hafliger
LATITUDE:

DRILLING COMPANY: Talon/LPE
DRILLER: Ronnie Rodriguez
DRILLING METHOD: Hollow Stem Auger/Continuous Core
BORE HOLE DIAMETER: 6 "
SCREEN: Diam. ___ Length _____ Slot Size _____
CASING: Diam. ____ Length _____ Type _____
DATE DRILLED: 11/29/2017
LONGITUDE:

PAGE 2 of 3

| DEPTH (FT.) | Soil Symbol | WELL CONSTRUCTION | Pt. Sample ID: | SAMPLES | SAMPLE INTERVAL | DESCRIPTION INTERVAL | DESCRIPTION OF STRATUM | DEPTH (FT.) |
|---|---|---|---|---|---|---|---|---|
| 35 | | | SB1-31' | | 30'-35' | | Low Moisture<br>Light Red to Tan | 35 |
| 40 | | | SB1-36'<br>SB1-37' | | 35'-40' | | Sand/Stone/Silts - Med to Coarse<br>Low Moisture<br>Light Red to Tan | 40 |
| 45 | | | SB1-41'<br>SB1-42' | | 40'-45' | | Sand/Stone/Silts - Med to Coarse<br>Low Moisture<br>Light Red to Tan | 45 |
| 50 | | | | | 45'-50' | | No Recovery | 50 |
| 55 | | | | | 50'-55' | | No Recovery | 55 |
| 60 | | | SB1-56' | | 55'-60' | | Sand - Fine Grain<br>Med Moisture<br>Red Brown | 60 |
| | | | | | | | Sand - Fine Grain<br>Med Moisture | |

REMARKS:

THIS BORING LOG SHOULD NOT BE USED SEPERATE FROM THE ORIGINAL REPORT

# SOIL BORING / MONITORING WELL LOG

PROJECT: Jal, NM - Pit Sites
PROJECT NUMBER: 700438.209.01
CLIENT: EOG Resources
BORING / WELL NUMBER: Lomas - SB1
TOTAL DEPTH: 75
SURFACE ELEVATION:
GEOLOGIST: Jason Hafliger
LATITUDE:

DRILLING COMPANY: Talon/LPE
DRILLER: Ronnie Rodriguez
DRILLING METHOD: Hollow Stem Auger/Continuous Core
BORE HOLE DIAMETER: 6 "
SCREEN: Diam. ___ Length _____ Slot Size _____
CASING: Diam. ____ Length _____ Type _____
DATE DRILLED: 11/29/2017
LONGITUDE:



| DEPTH (FT.) | Soil Symbol | WELL CONSTRUCTION | Pt. Sample ID: | SAMPLES | SAMPLE INTERVAL | DESCRIPTION INTERVAL | DESCRIPTION OF STRATUM | DEPTH (FT.) |
|---|---|---|---|---|---|---|---|---|
| 65 | | | SB1-61' | | 60'-65' | | Red Brown | 65 |
| 70 | | | SB1-66' | | 65'-70' | | Sand - Fine Grain<br>Med Moisture<br>Red Brown | 70 |
| 75 | | | | | 70'-75' | 75' | Sand - Fine Grain<br>Med Moisture<br>Red Brown | 75 |
| 80 | | | | | | | Bottom of Hole | 80 |
| 85 | | | | | | | | 85 |
| 90 | | | | | | | | 90 |

REMARKS:

THIS BORING LOG SHOULD NOT BE USED SEPERATE FROM THE ORIGINAL REPORT

# Figure 2: Borehole Log

HCI DRILLING

THE DRILLING PROFESSIONALS

Soil Boring Log

| | |
|---|---|
| Client | Phoenix Environmental LLC |
| Contractor | HCI Drilling |
| Date Completed | 07/15/2017 |
| Location | Bebop |
| Soil Boring Number | SB-1 |
| Lithology | |
| 0' – 22' | Caliche – White |
| 22' – 50' | Sand – Brown |
| 50' – 55' | Red Clay |
| 55' – 100' | Sand – Brown |
| GPS Coordinates | 32.093544, 103.58146 |

Copies: Email (Phoenix Env)

# Figure 2: Soil Boring Log

HCI DRILLING

THE DRILLING PROFESSIONALS

## Soil Boring Log

| | |
|---|---|
| Client | Phoenix Environmental LLC |
| Contractor | HCI Drilling |
| Date Completed | 07/09/2107 |
| Location | Jal, NM |
| Soil Boring Number | SB-1 |
| Lithology | |
| 0' – 20' | Caliche with Sand |
| 20' – 50' | Caliche with Sandstone |
| 50' – 100' | Red Clay with Sandstone Stringers |

Copies: Email (Phoenix Env)

HCI DRILLING / P.O. BOX 96 / WOLFFORTH, TX 79382-0096
806.866.4026 / HCIDRILL.COM

Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

# BOREHOLE ID: B-1



**CLIENT** Chevron **PROJECT NAME** Salado Draw Section 23 Frac Pond

**PROJECT NUMBER** 212C-MD-00649 **PROJECT LOCATION** Lea County, New Mexico

**DATE(S) OF EXCAVATION: 10/26/2016** **GROUND ELEVATION: N/** **METHOD: HSA/Air Rotary**

**CONSULTANT: Tetra Tech, Inc.** **A LATITUDE: 32.033156N** **LOGGED BY: James Kennedy**

**DRILLING CONTRACTOR: Yellow Jacket** **LONGITUDE: 103.639194W** **DRILLED BY: Jason**

**Notes: No groundwater encountered**

| DEPTH (ft) | SAMPLE TYPE | N Value | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|
| 0 | | | | |
| | SS | 1 | | Very Loose, Brown, Fine to Medium Grained **SAND** with Silt, Dry, with some roots |
| | SS | 8 | | |
| | | | | 3.5 |
| 5 | SS | 41 | | Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained **SAND**, Calcareous, with Limestone Fragments, Dry |
| | SS | 50/5" | | |
| 10 | SS | 50/1" | | |
| 15 | SS | 50/2" | | |
| 20 | SS | 50/2" | | |
| 25 | SS | 50/2" | | |
| 30 | SS | 50/3" | | |
| 35 | SS | 50/1" | | |
| 40 | SS | 50/1" | | |

BOREHOLE/TP/WELL - VECTOR SALADO - FRAC POND.GPJ LAB SUMMARY.GDT 11/28/16

(Continued Next Page)

Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

# BOREHOLE ID: B-1



**CLIENT** Chevron **PROJECT NAME** Salado Draw Section 23 Frac Pond

**PROJECT NUMBER** 212C-MD-00649 **PROJECT LOCATION** Lea County, New Mexico

| DEPTH (ft) | SAMPLE TYPE | N Value | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|
| 40 | | | | Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained **SAND**, Calcareous, with Limestone Fragments, Dry *(continued)* |
| 45 | | | | |
| 50 | SS | 50/0" | | |
| 55 | | | | |
| 60 | | | | |
| 65 | | | | |
| 70 | | | | |
| 75 | | | | |
| 80 | | | | 80.0 Borehole terminated at 80.0 feet. |

BOREHOLE/TP/WELL - VECTOR SALADO - FRAC POND.GPJ LAB SUMMARY.GDT 11/28/16

Tetra Tech Inc.
4000 N. Big Spring, Suite 401
Midland, TX, 79705
Telephone: 432-682-4559
Fax: 432-682-3946

# BOREHOLE ID: B-1



**CLIENT** Chevron **PROJECT NAME** Salado Draw Section 13 Frac Pond

**PROJECT NUMBER** 212C-MD-00649 **PROJECT LOCATION** Lea County, New Mexico

**DATE(S) OF EXCAVATION: 10/26/2016** **GROUND ELEVATION: N/A** **METHOD: HSA/Air Rotary**

**CONSULTANT: Tetra Tech, Inc.** **LATITUDE: 32.038060N** **LOGGED BY: James Kennedy**

**DRILLING CONTRACTOR: Yellow Jacket** **LONGITUDE: 103.636220W** **DRILLED BY: Jason**

**Notes: No groundwater encountered**

| DEPTH (ft) | SAMPLE TYPE | N Value | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|
| 0 | SS | 1 | | Very Loose, Brown, Fine to Medium Grained **SAND** with Silt, Dry, with some roots |
| | SS | 8 | | |
| 3.5 | | | | |
| 5 | SS | 41 | | Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained **SAND**, Calcareous, with Limestone Fragments, Dry |
| | SS | 50/5" | | |
| 10 | SS | 50/1" | | |
| 15 | SS | 50/2" | | |
| 20 | SS | 50/2" | | |
| 25 | SS | 50/2" | | |
| 30 | SS | 50/3" | | |
| 35 | SS | 50/1" | | |
| 40 | SS | 50/1" | | |

BOREHOLE/TP/WELL - VECTOR SALADO - FRAC POND.GPJ LAB SUMMARY.GDT 11/28/16

(Continued Next Page)

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Telephone: 432-682-4559
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# BOREHOLE ID: B-1



**CLIENT** Chevron **PROJECT NAME** Salado Draw Section 13 Frac Pond

**PROJECT NUMBER** 212C-MD-00649 **PROJECT LOCATION** Lea County, New Mexico

| DEPTH (ft) | SAMPLE TYPE | N Value | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|
| 40 | | | | Dense to Very Dense, Reddish Brown to Pink, Silty Fine to Medium Grained **SAND**, Calcareous, with Limestone Fragments, Dry *(continued)* |
| 45 | | | | |
| 50 | SS | 50/0" | | |
| 55 | | | | |
| 60 | | | | |
| 65 | | | | |
| 70 | | | | |
| 75 | | | | |
| 80 | | | | 80.0 Borehole terminated at 80.0 feet. |

BOREHOLE/TP/WELL - VECTOR SALADO - FRAC POND.GPJ LAB SUMMARY.GDT 11/28/16

March 2021

# Volume 2
## C-147 Registration Package for Dominator Containment & Recycling Facility Section 25, T25-S, R33-E, Lea County

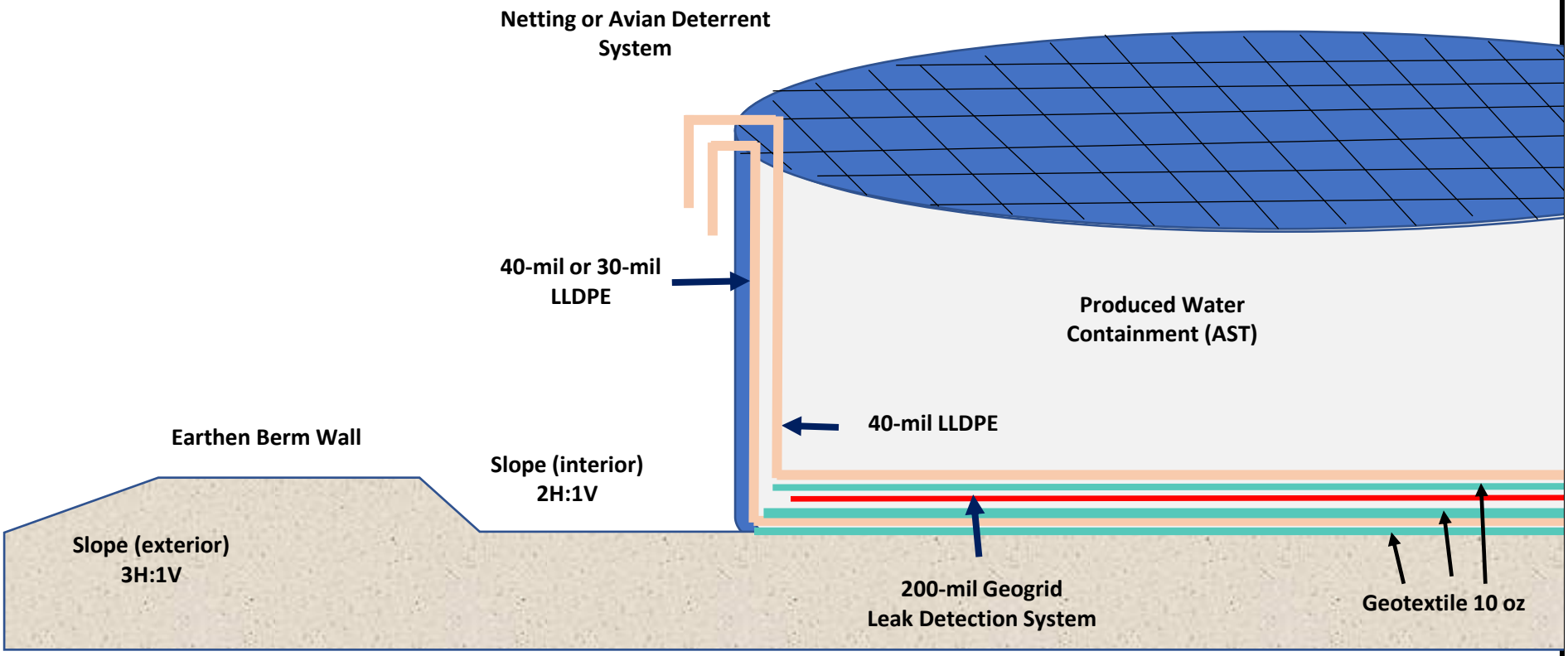
**Engineering Drawings and Liner Specifications**
**Design/Construction Plan**
**New Wave Manual**
**Variances for AST Storage Containments**
**Applicability of Engineering Variances to Variety of Site Conditions in Permian Basin**

*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:
## Chisholm Energy Operating, LLC
## Ft. Worth, Texas

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

# RECYCLING CONTAINMENT DESIGN DRAWINGS

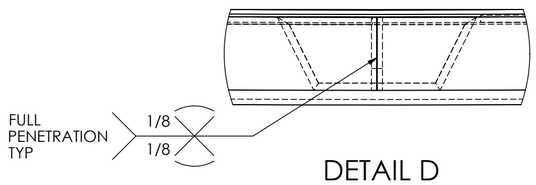



## Description of Leak Detection System

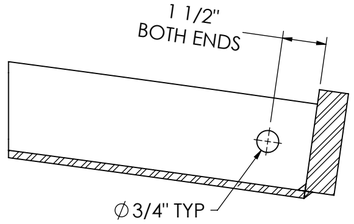
- 200-mil geogrid drainage layer lies between the primary and secondary liner
- Geotextile between the geogrid and the liners
- 2- to 3-inch deep sump excavated within the compacted caliche pad as a collection point for any seepage
- A ¾-inch aqua braid line runs from the collection sump between the liners and beneath the geogrid drainage system to the outside of the AST
- The leak detection pipe is fastened to the exterior of the AST and terminates at ground level.
- Every week, a portable self-priming peristaltic pump connects to the leak detection system.
- The self-priming pump discharges into a ¾" aqua braid line, through a turbine meter, and 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 (e.e. produced water or condensation)

| | | |
|---|---|---|
| **R.T. Hicks Consultants Albuquerque, NM** | **Design Sketch** | **Plate 1** |
| | **Solaris Water Midstream - Dominator AST** | **Mar-21** |

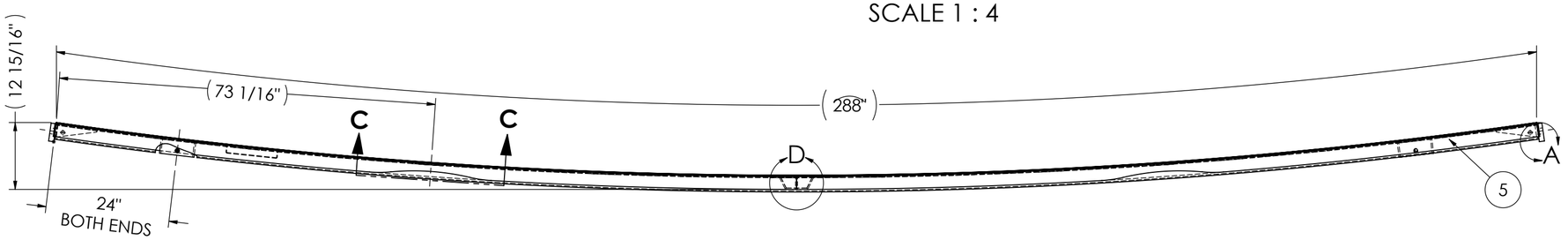
| ITEM | PART NUMBER | DESCRIPTION | LENGTH | QTY. |
|---|---|---|---|---|
| 1 | - | PLATE, 5/16 G40.21-44W | - | 4 |
| 2 | - | PLATE, 1 G40.21-44W | - | 2 |
| 3 | - | PLATE, 3/8 G40.21-44W | - | 22 |
| 4 | - | PLATE, 1/4 G40.21-44W | 10' X 24' | 1 |
| 5 | - | PLATE, 5/16 G40.21-44W | - | 2 |
| 6 | - | PLATE, 1/4 G40.21-44W | - | 2 |
| 7 | - | PLATE, 1/4 G40.21-44W | - | 3 |
| 8 | - | HSS, 6 X 3 X .188W G40.21-50W | 288" | 1 |
| 9 | - | PIPE, 6 SCH40 .280W A106B | 3" | 4 |
| 10 | - | ROUND BAR, 3/4 HR 40.21-44W | 6 1/2" | 4 |
| 11 | 600505 | BRACKET, IDENTIFICATION PLATE | - | 1 |
| 12 | 600178 | LUG, ROUND HEAD | - | 1 |

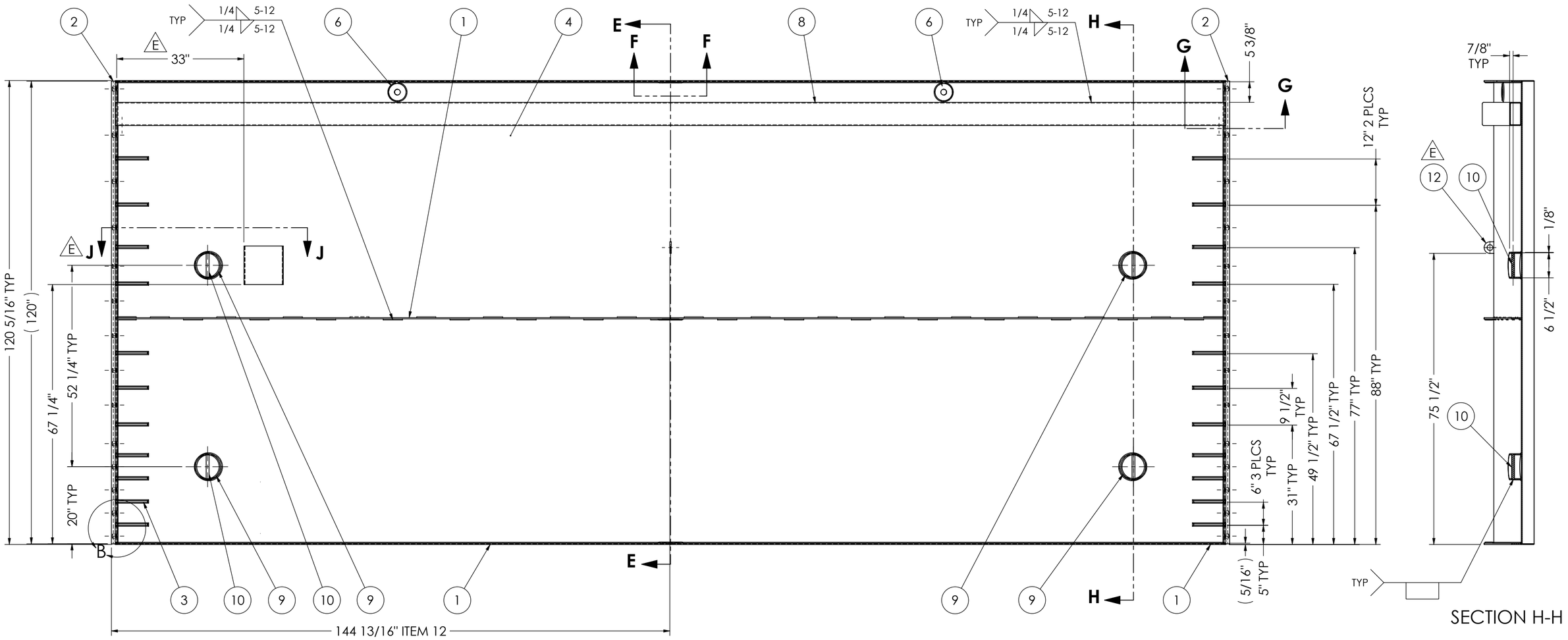



DETAIL D
SCALE 1 : 4




SECTION G-G
SCALE 1 : 4



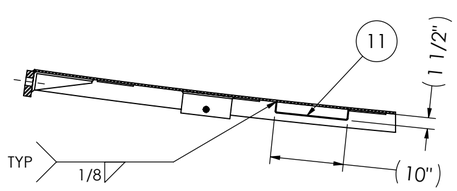




SECTION H-H

NOTES:
1. TO BE WELDED WITH 7018-1ELECTRODE OR FLUX-CORE EQUIVALENT
2. DETAIL "A", DETAIL "B", & SECTION C-C, SECTION E-E, SECTION F-F ON SHT 2 OF 3
3. ITEM DETAILS ON SHT 3 OF 3

| REV | DESCRIPTION | ECN # | DATE | APPR |
|---|---|---|---|---|
| | **REVISIONS** | | | |
| E | ITEM 11 WAS 600480; 33 WAS 18-5/8; 52-1/4WAS 89-1/4; ADDED ITEM 12 | | 10/1/2014 | GQH |
| D | ADDED ITEMS 9-11; INSERTED NEW BOM; ADDED DRAIN HOLES TO ITEM 8 | | 9/11/2014 | GQH |
| | ADDED SECTION G-G & H-H; ADDED DETAIL 10; ADDED IDENTIFICATION PLATE | | 9/11/2014 | GQH |
| 0 | ISSUED FOR MANUFACTURE | | | |




SECTION J-J
SCALE 1 : 16

UNLESS OTHERWISE SPECIFIED:
1. REMOVE BURRS AND SHARP EDGES.
2. INSIDE CORNER RADII = 0.031"
3. CHAMFER SIZE = 0.030" x 45°
4. CONCENTRICITY = 0.002" TIR
5. MACHINE FINISH = 125µin min.
6. INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL: ±1/16
ANGULAR: ±0.5°
X.X ±0.030
X.XX ±0.010
X.XXX ±0.005

DO NOT SCALE DRAWING

| | NAME | DATE |
|---|---|---|
| MODELLED | CDH | 28AUG12 |
| DRAWN | CDH | 28AUG12 |
| CHECKED | GQH | 29AUG12 |
| ENG APPR. | GQH | 29AUG12 |
| CONTACT | cholte@holtedesign.com | |

MATERIAL: MILD STEEL
FINISH/CONDITION:
SPECIFICATION: API 650
WEIGHT: 3189.90 lbs

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CUSTOMER: NEW WAVE ENERGY SERVICES LTD.

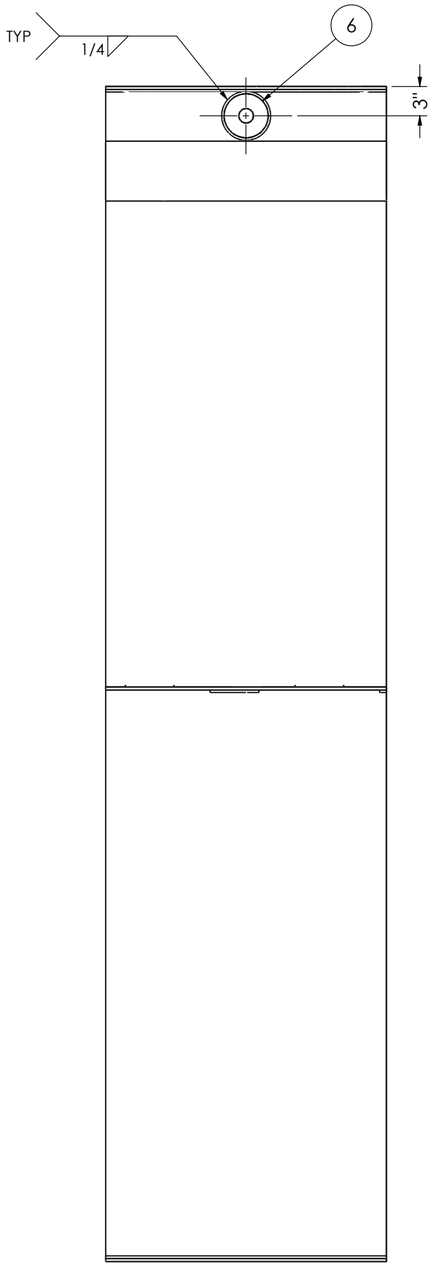
PROJECT/MODEL: CONTAINMENT RING

HOLTE DESIGN INC
- Mechanical Design
- 3D Conceptual Layouts
- Manufacturing Drawings
- Graphical Illustrations
- Sales Brochures

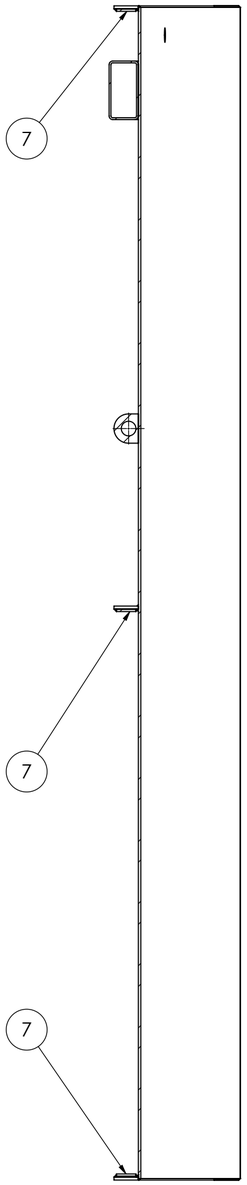
TITLE: CONTAINMENT RING, 10' X 24' - 40000 BBL - 6300 CUBIC METERS WLDMT

| SIZE | DWG. NO. | REV |
|---|---|---|
| C | 600144 | E |

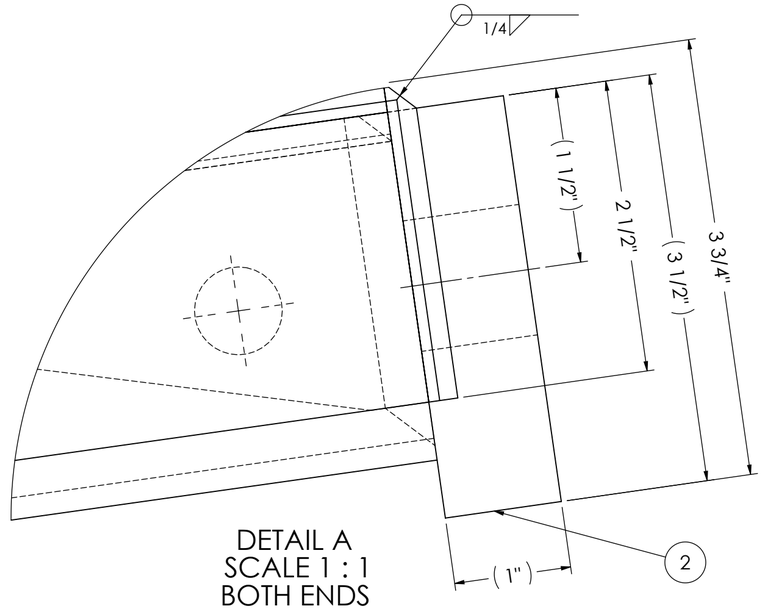
SCALE: 1:20 SHEET 1/3




SECTION C-C
2 PLCS



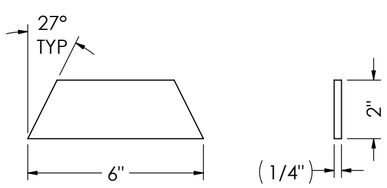

SECTION E-E



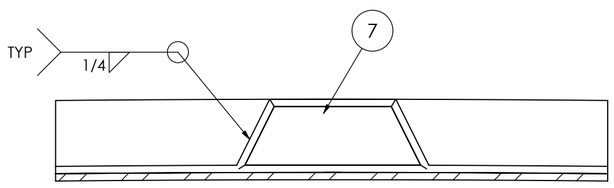

DETAIL A
SCALE 1 : 1
BOTH ENDS




DETAIL B
SCALE 1 : 2
BOTH ENDS




DETAIL ITEM 7
SCALE 1 : 4




SECTION F-F
SCALE 1 : 4

UNLESS OTHERWISE SPECIFIED:

1. REMOVE BURRS AND SHARP EDGES.
2. INSIDE CORNER RADII = 0.031
3. CHAMFER SIZE = 0.030" x 45°
4. CONCENTRICITY = 0.002" TIR
5. MACHINE FINISH = 125µin min.
6. INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL: ±1/16
ANGULAR: ±0.5°
X.X ±0.030
X.XX ±0.010
X.XXX ±0.005

DO NOT SCALE DRAWING

| | NAME | DATE |
|---|---|---|
| MODELLED | CDH | 28AUG12 |
| DRAWN | CDH | 28AUG12 |
| CHECKED | GQH | 29AUG12 |
| ENG APPR. | GQH | 29AUG12 |
| CONTACT | choltе@holtedesign.com | |

MATERIAL: MILD STEEL
FINISH/CONDITION:
SPECIFICATION: API 650
WEIGHT: 3189.90 lbs

CUSTOMER: NEW WAVE ENERGY SERVICES LTD.

PROJECT/MODEL: CONTAINMENT RING

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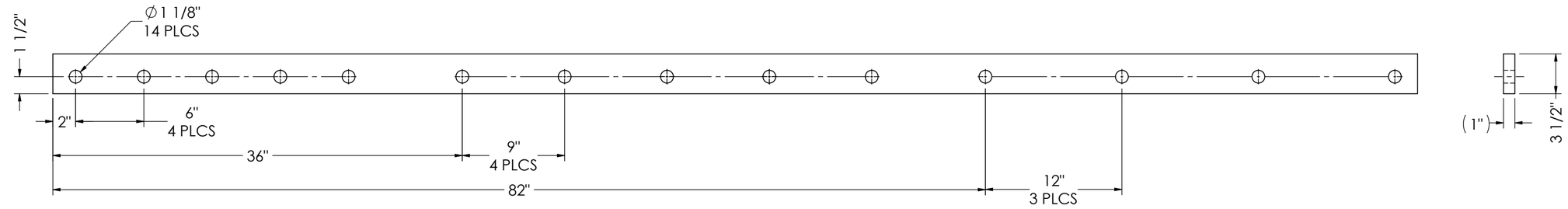
| SIZE | DWG. NO. | REV |
|---|---|---|
| C | 600144 | E |

SCALE: 1:12 SHEET 2/3

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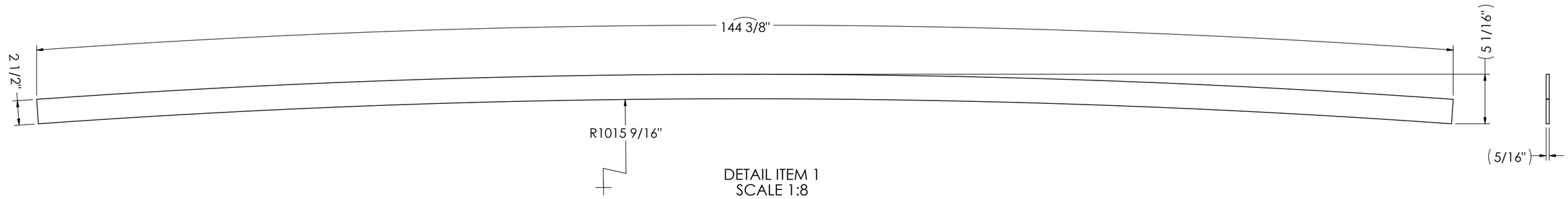
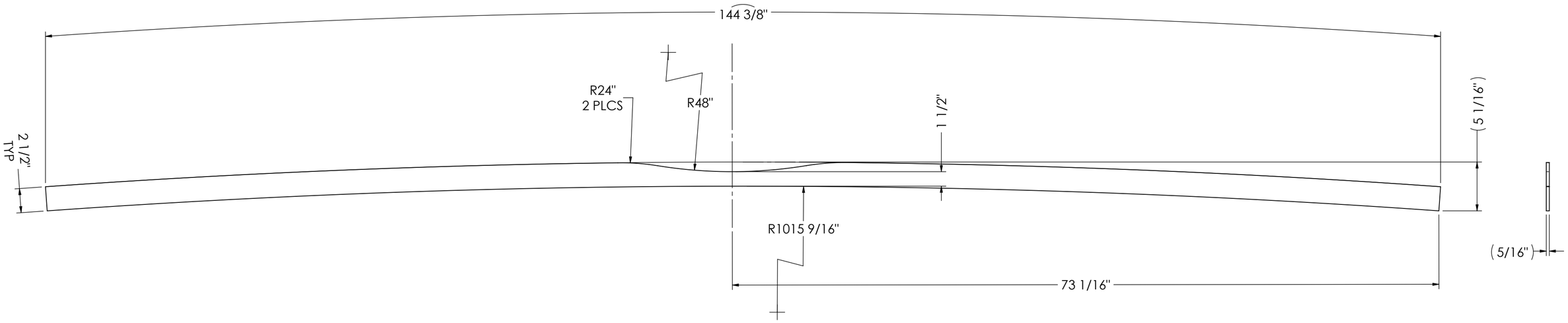
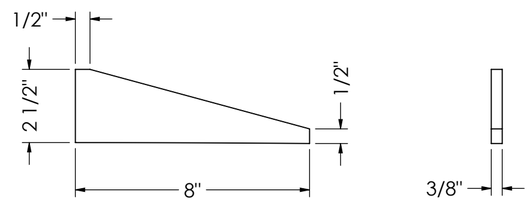
SCALE 1:8



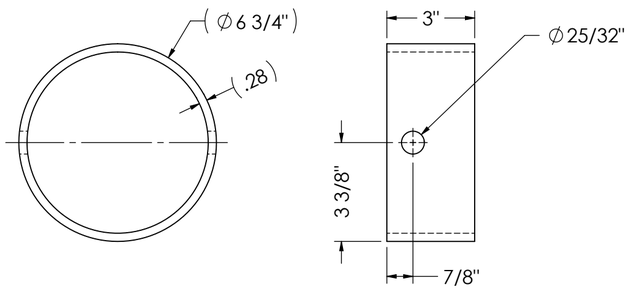

DETAIL ITEM 1
SCALE 1:8



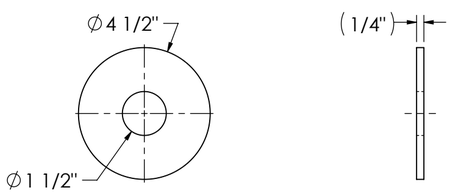

DETAIL ITEM 5
SCALE 1:12




DETAIL ITEM 3
SCALE 1:4




DETAIL ITEM 9
SCALE 1:4




DETAIL ITEM 6
SCALE 1:4

UNLESS OTHERWISE SPECIFIED:

1. REMOVE BURRS AND SHARP EDGES.
2. INSIDE CORNER RADII = 0.031"
3. CHAMFER SIZE = 0.030" x 45°
4. CONCENTRICITY = 0.002" TIR
5. MACHINE FINISH = 125µin min.
6. INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL: ±1/16
ANGULAR: ±0.5°
X.X ±0.030
X.XX ±0.010
X.XXX ±0.005

DO NOT SCALE DRAWING

| | NAME | DATE |
|---|---|---|
| MODELLED | CDH | 28AUG12 |
| DRAWN | CDH | 28AUG12 |
| CHECKED | GQH | 29AUG12 |
| ENG APPR. | GQH | 29AUG12 |
| CONTACT | cholte@holtedesign.com | |

MATERIAL: MILD STEEL
FINISH/CONDITION:
SPECIFICATION: API 650
WEIGHT: 3189.90 lbs

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- Sales Brochures

TITLE: CONTAINMENT RING, 10' X 24' - 40000 BBL - 6300 CUBIC METERS WLDMT

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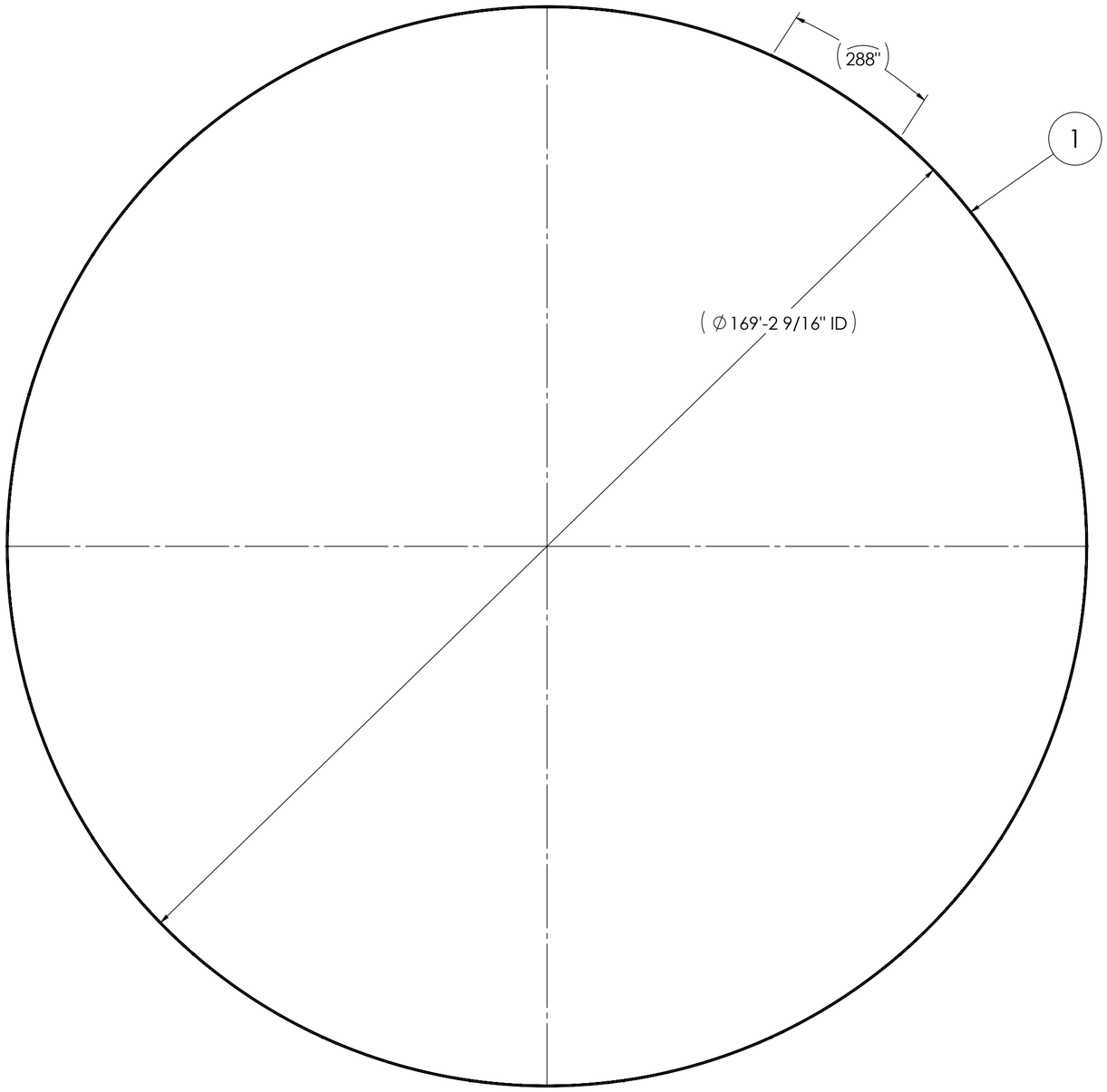
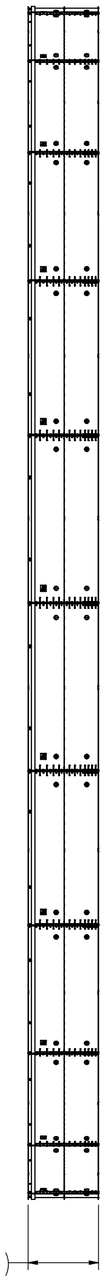
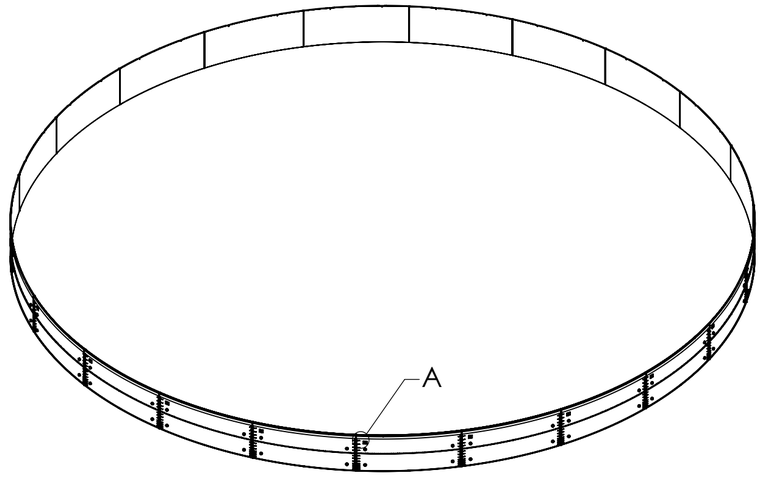
| SIZE | DWG. NO. | REV |
|---|---|---|
| C | 600144 | E |

SCALE: 1:12 SHEET 3/3

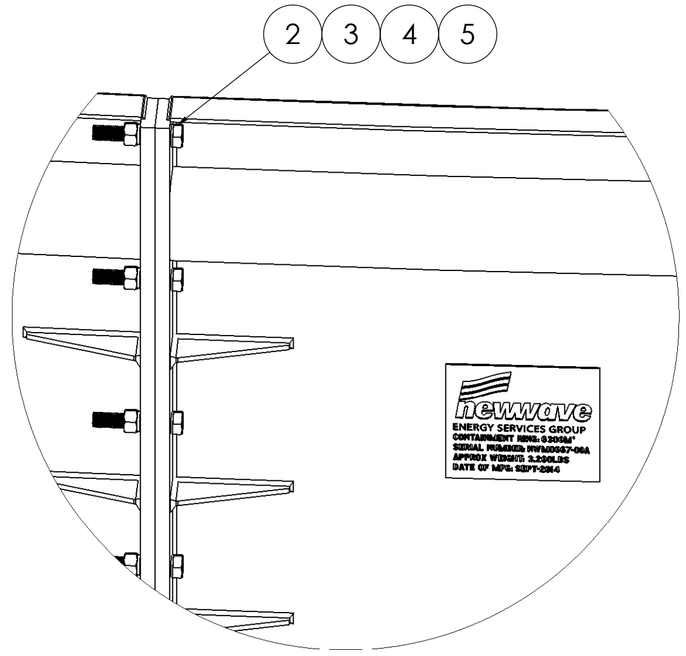
| ITEM | PART NUMBER | DESCRIPTION | QTY |
|---|---|---|---|
| 1 | 600144 | CONTAINMENT RING, 10' X 24' - 40000 BBL - 6300 CUBIC METERS WLDMT | 22 |
| 2 | 800113 | CAP SCREW, HEX 1-8 UNC X 4 GRADE 8 | 308 |
| 3 | 800156 | WASHER, FLAT 1 GRADE 8 | 616 |
| 4 | 800166 | WASHER, LOCK 1 GRADE 8 | 308 |
| 5 | 800146 | NUT, HEX 1 GRADE 8 | 308 |




ISOMETRIC VIEW
SCALE 1:280




DETAIL A
SCALE 1 : 8

NOTES:
1. CAP SCREW, HEX 1-8 UNC GRADE 8 , TORQUE TO 400 LBS/FT

| REV | DESCRIPTION | ECO # | DATE | APPR |
|---|---|---|---|---|
| 0 | ISSUED FOR MANUFACTURE | | | |

**REVISIONS**

UNLESS OTHERWISE SPECIFIED:
1. REMOVE BURRS AND SHARP EDGES.
2. INSIDE CORNER RADII = 0.031"
3. CHAMFER SIZE = 0.030" X 45°
4. CONCENTRICITY = 0.002" TIR
5. MACHINE FINISH = 125µin min.
6. INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL: ±1/16
ANGULAR: ±0.5°
X.X ±0.030
X.XX ±0.010
X.XXX ±0.005

DO NOT SCALE DRAWING

| | NAME | DATE |
|---|---|---|
| MODELLED | CDH | 28AUG12 |
| DRAWN | CDH | 28AUG12 |
| CHECKED | GQH | 29AUG12 |
| ENG APPR. | GQH | 29AUG12 |
| CONTACT | cholte@holtedesign.com | |

MATERIAL: MID STEEL
FINISH/CONDITION: –
SPECIFICATION: API 650
WEIGHT: 14084114 lbs

CUSTOMER: NEW WAVE ENERGY SERVICES LTD.

PROJECT/MODEL: CONTAINMENT RING

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HOLTE DESIGN INC
- Mechanical Design
- 3D Conceptual Layouts
- Manufacturing Drawings
- Graphical Illustrations
- Sales Brochures

TITLE: CONTAINMENT RING, 10' X 24' - 40000 BBL - 6300 CUBIC METERS ASSY

| SIZE | DWG. NO. | REV |
|---|---|---|
| C | 600143 | 0 |

SCALE: 1:200 SHEET 1/1

Cantech Oilfield Equipment Ltd.

April 30, 2015

Our Ref: CT-C022

New Wave Energy Services Group

#1955, 140 - 4th Ave, SW
Calgary, Alberta
Canada, T2P 3N3

**Water Container Ring 600143 (600144 individual panels)**

To whom it may concern:

This letter certifies that the above water container ring (600143) is engineered by Cantech Oilfield Equipment Ltd with the following specification

- Maximum Capacity: 40,000 BBL (6,300 cubic meter)
- Fluid Specific Density: 1,200 kg/$m^3$ maximum
- Design Safety Factor: 2.5 minimum

The ring consists of 22 individual panels (600144). Each individual panel is identical and made of G40.21-44W steel plates. The flange connections are MPI inspected. Individual panels are bolted together by using 1"-8UNC Grade 8 bolt with specified 400ft-lbs tightening torque.

Sincerely,

George Hu, P.Eng.
Cantech Oilfield Equipment Ltd
Permit Number: P10445

# TECHNICAL REPORT

# BY CanTech Oil


## Description

One panel study of the 10FT40000BBL frame stress and displacement evaluation

# Simulation of 10FT40000BBL

**Date:** September 16, 2012
**Study name:**Stress and Displacement
**Analysis type:**Static

## Table of Contents

July 15, 2015

Our Ref: CT-C029

New Wave Energy Services Group

#1955, 140 - 4th Ave, SW
Calgary, Alberta
Canada, T2P 3N3

**Ground Support Requirement and Design Safety Factor of New Wave Water Tank**

To whom it may concern:

All New Wave Tanks are engineered with a minimum design safety factor of 2.5 when the specific gravity of a fluid contained is 1.20 kg/m$^3$.

The flanged connections with 1" Gr. 8 bolts between individual panels are stronger than panel itself. The unleveled ground support will not affect the design safety factor provided that the grade is within 10" over 100ft span. Uneven ground support will not affect the design safety factor of the tank as long as the gap between the bottom flange of the tank and the ground does not exceed 2" in order to prevent liners from being stretched and extruded over the gap.

When the specific gravity of the fluid differ from 1.2 kg/m$^3$, the design safety factor can be calculated as follows:

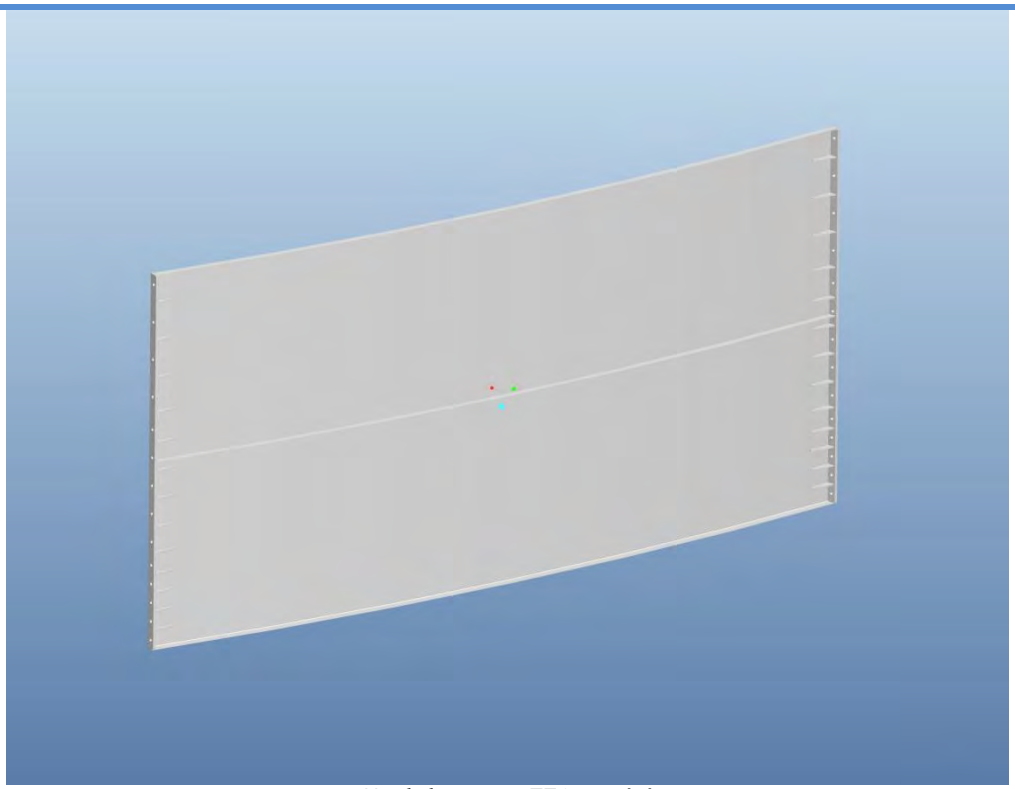
Achieved minimum safety factor = 2.5 X 1.2 / fluid specific gravity

For example, when the specific gravity is 1.25, the achieved minimum design safety factor will be 2.5 X 1.2 / 1.25 = 2.4.

Sincerely,

George Hu, P.Eng.
Cantech Oilfield Equipment Ltd
Permit Number: P10445

## Model Information



**Model name:** FEA model
**Current Configuration:** Default

| Solid Bodies | | | |
|---|---|---|---|
| | **Treated As** | **Volumetric Properties** | |
| | Solid Body | **Mass:2656.05 lb**<br>**Volume:9425.53 in^3**<br>**Density:0.281793 lb/in^3**<br>**Weight:2654.25 lbf** | |

## Study Properties

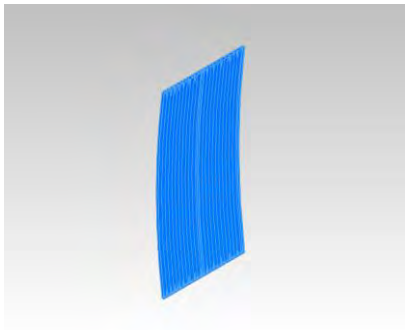
| | |
|---|---|
| **Study name** | Study 1 |
| **Analysis type** | Static |
| **Mesh type** | Solid Mesh |
| **Thermal Effect:** | On |
| **Thermal option** | Include temperature loads |
| **Zero strain temperature** | 298 Kelvin |
| **Include fluid pressure effects from SolidWorks Flow Simulation** | Off |
| **Solver type** | FFEPlus |

| | |
|---|---|
| **Inplane Effect:** | Off |
| **Soft Spring:** | Off |
| **Inertial Relief:** | Off |
| **Incompatible bonding options** | Automatic |
| **Large displacement** | Off |
| **Compute free body forces** | On |
| **Friction** | Off |
| **Use Adaptive Method:** | Off |
| **Result folder** | SolidWorks document (C:\Users\Ning\Desktop\10FT_40000BBL_22Panel\Bonded Connection) |

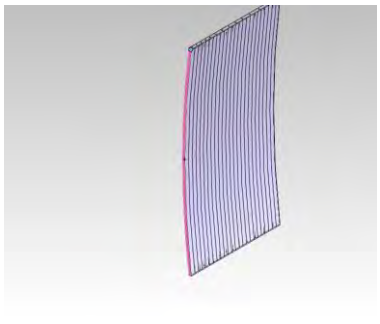
## Units

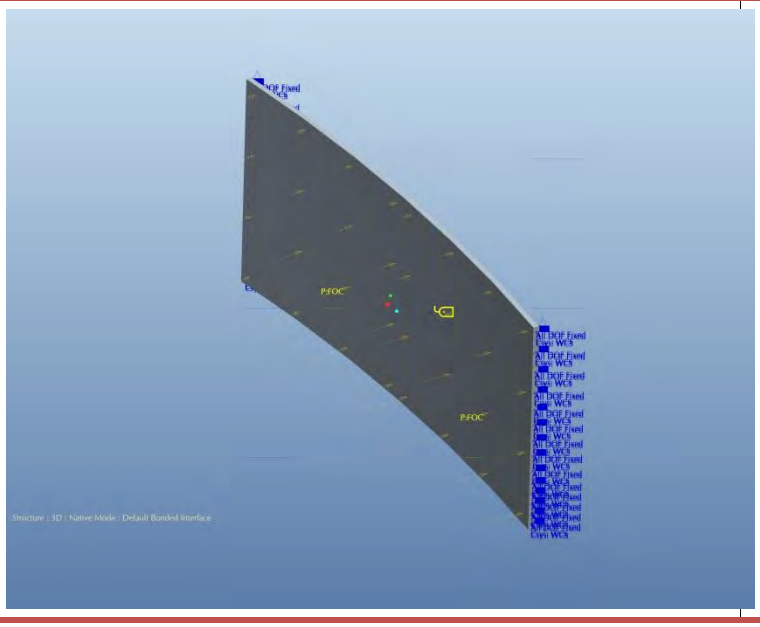
| | |
|---|---|
| **Unit system:** | SI (MKS) |
| **Length/Displacement** | mm |
| **Temperature** | Kelvin |
| **Angular velocity** | Rad/sec |
| **Pressure/Stress** | N/m^2 |

## Material Properties

| Model Reference | Properties | | Components |
|---|---|---|---|
|  | **Name:** | 44 W | SolidBody 1(Steel2)(FEA Linear) |
| | **Model type:** | Linear Elastic Isotropic | Linear Elastic Isotropic |
| | **Default failure criterion:** | Max von Mises Stress | Max von Mises Stress |
| | **Yield strength:** | 44000 PSI | 2.20594e+008 N/m^2 |
| | **Tensile strength:** | 65000PSI | 3.99826e+008 N/m^2 |
| | **Elastic modulus:** | 2.1e+011 N/m^2 | 2.1e+011 N/m^2 |
| | **Poisson's ratio:** | 0.28 | 0.28 |
| | **Mass density:** | 7800 kg/m^3 | 7800 kg/m^3 |
| | **Shear modulus:** | 7.9e+010 N/m^2 | 7.9e+010 N/m^2 |
| | **Thermal expansion coefficient:** | 1.3e-005 /Kelvin | 1.3e-005 /Kelvin |
| Curve Data:N/A | | | |

## Loads and Fixtures

| Fixture name | Fixture Image | Fixture Details |
|---|---|---|
| Circular Symmetry-1 | See Load Image | **Entities: 28 places of the mounting holes** |
| | | |
| Reference Geometry-1 |  | **Entities:** 1 vertex(s)<br>**Reference:** Face< 1 ><br>**Type:** Use reference geometry<br>**Translation:** ---, ---, 0<br>**Units:** mm |
| | | |

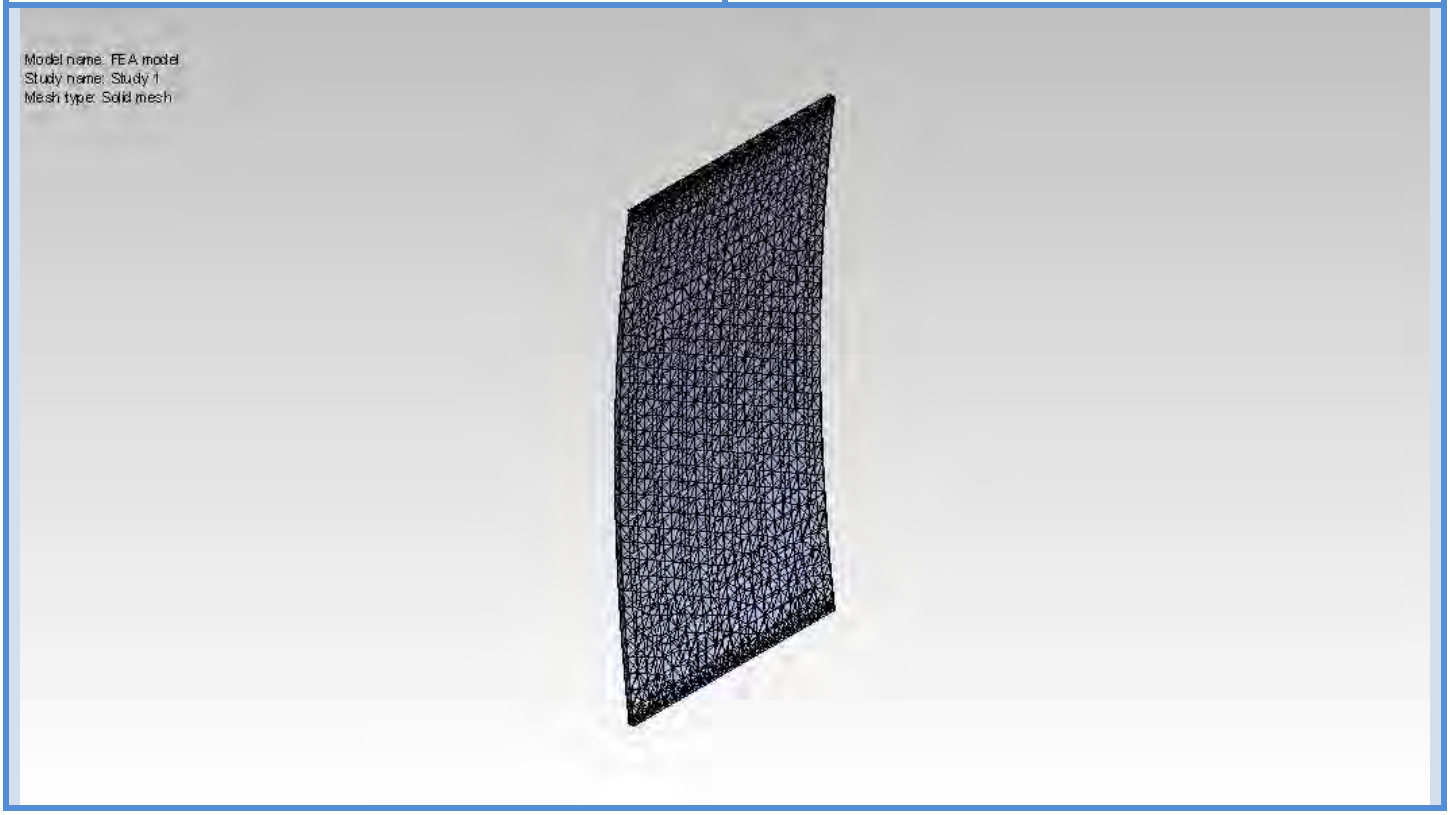
| Load name | Load Image | Load Details |
|---|---|---|
| Pressure-1 |  | **Entities:** 1 face(s)<br>**Type:** Normal to selected face<br>**Value:** A function of P=ρgh where P density kg/m^3 g gravity m/s^2 h depth m<br>**Units:** N/m^2 |

## Mesh Information

| | |
|---|---|
| **Mesh type** | Solid Mesh |
| **Mesher Used:** | Curvature based mesh |
| **Jacobian points** | 4 Points |
| **Maximum element size** | 7.54748 in |
| **Minimum element size** | 1.5095 in |
| **Mesh Quality** | High |

### Mesh Information - Details

| | |
|---|---|
| **Total Nodes** | 20520 |
| **Total Elements** | 9824 |
| **Maximum Aspect Ratio** | 164.85 |
| **% of elements with Aspect Ratio < 3** | 13.5 |
| **% of elements with Aspect Ratio > 10** | 64 |
| **% of distorted elements(Jacobian)** | 0 |
| **Time to complete mesh(hh;mm;ss):** | 00:00:05 |
| **Computer name:** | HP-PC |



## Study Results

| Name | Type | Min | Max |
|---|---|---|---|
| Stress1 | VON: von Mises Stress | 14.73 psi | 161900 psi |
| **Name** | **Type** | **Min** | **Max** |
| Displacement1 | URES: Resultant Displacement | 0 mm | 26.1 mm |

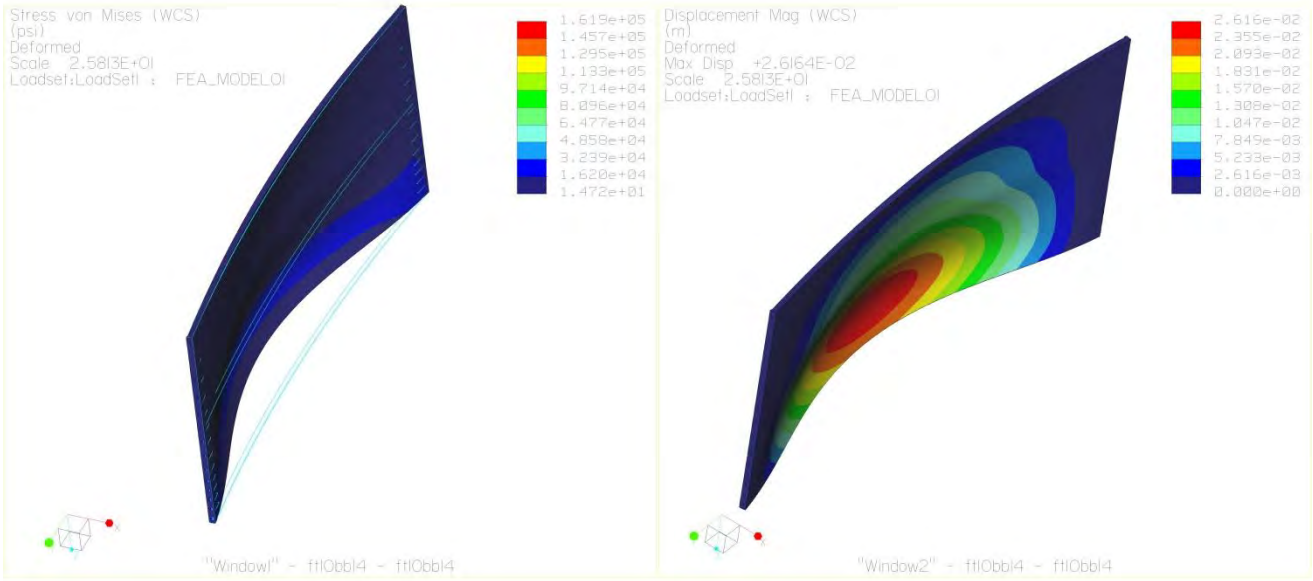
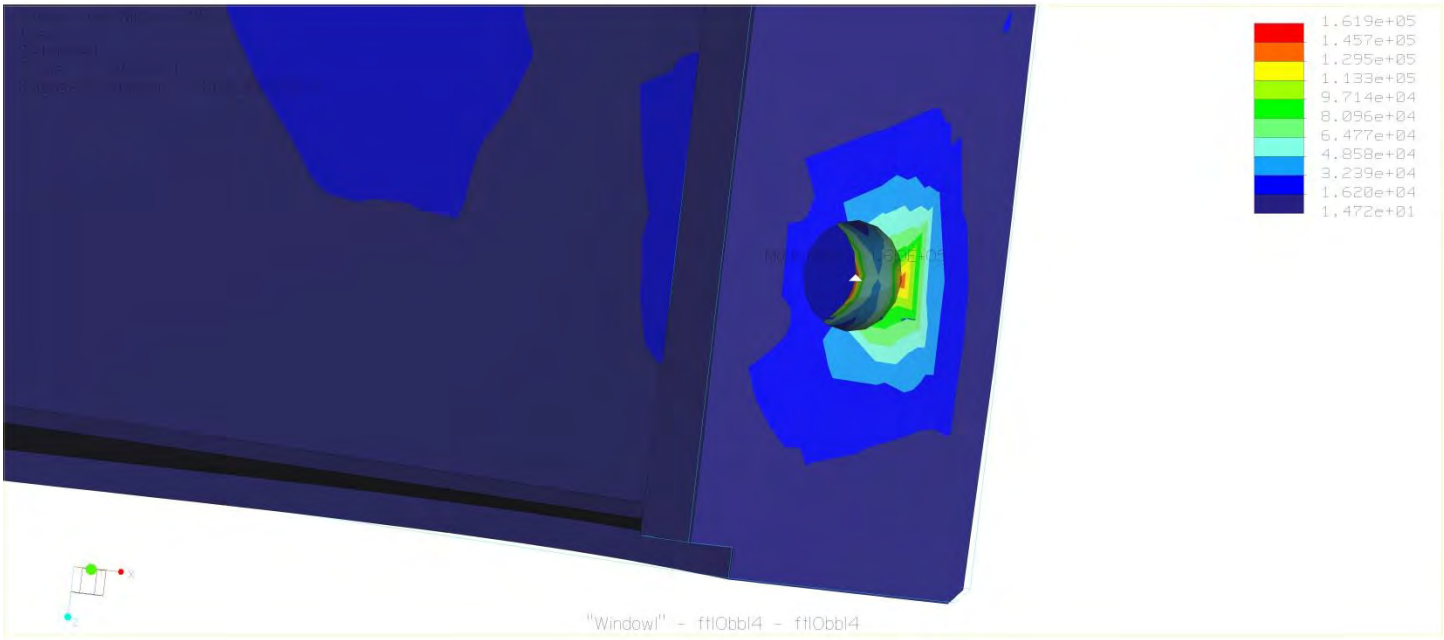



Image-1

## Local Stress Concentration Max



**US** 866-375-9749
**CAN** 800-841-0836

# Above Ground Tank Liner Systems - Geomembrane

## 1. Product Description

High capacity above ground tank liner systems are increasingly being used by the upstream oil & gas sector for containment of drilling fluids associated with hydraulic fracturing operations. Layfield is recognized as a leading manufacturer and fabricator of above ground storage liner systems in North America and internationally. Our Enviro Liner series of geomembranes are highly durable and flexible materials designed to contain the combination of brine fluids and chemicals used in the fracking process. A rapidly growing trend is the use of above ground engineered water storage systems designed to hold large volumes of water. As an example, many tank systems in the market can store from 750,000 to 2,000,000 gallons of frac fluids. Layfield provides one piece prefabricated liners designed for quick installation with no seaming required on site.

## 2. Technical Data

Materials information is on page 2.

## 3. Installation

Surface preparation is the key to a successful tank lining installation. When setting up a new tank on the ground, the prepared surface should be uniform, well compacted, and free of sharp rock fragments or stones. In a new frac tank installation (such as a storage tank used in hydraulic fracturing), we usually recommend that a non-woven geotextile be placed on the ground as the first step. Then the outline of the frac tank wall should be marked on the geotextile with spray paint. The liner is placed at the center of the marked geotextile before tank assembly starts. Then the tank is assembled. Once the tank is finished, the liner is unfolded, pulled up over the walls, and secured to the perimeter. Larger tanks, retrofits, and tanks that are field fabricated normally require additional installation details and would be quoted separately. Please contact your Layfield representative for additional details.

## 4. Availability and Cost

Available from Layfield or distributors. Call
425-254-1075 Pacific time
780-453-6731 Mountain time, or
905-761-9123 Eastern time

## 5. Warranty

Products sold will meet Layfield's published specifications. Any extended warranty required by the buyer must be negotiated at the time of order. Extended warranties may be available on this product and may be at extra cost. Full warranty details are available from Layfield.

## 6. Maintenance

Geomembranes should be inspected at least once per year for damage, stress, or any other detrimental condition. The entire containment area should be visually inspected annually. Layfield provides geomembrane maintenance services on request.

## 7. Filing Systems

**9.**

| 18 Oct 2016 | Enviro Liner® 1000 Properties | | | | |
|---|---|---|---|---|---|
| **Style** | **ASTM** | **EL 1020** | **EL 1030** | **EL 1040N** | **EL 1040** |
| Thickness | D5199 | 20 mil<br>0.5 mm | 30 mil<br>0.75 mm | 36 mil<br>0.91 mm | 40 mil<br>1.0 mm |
| Density (Typical) | D792 | 0.93 | 0.93 | 0.93 | 0.93 |
| Tensile Strength at Break | D6693 | 76 ppi<br>13 N/mm | 114 ppi<br>20 N/mm | 136 ppi<br>24 N/mm | 152 ppi<br>27 N/mm |
| Elongation | D6693 | 800% | 800% | 700% | 800% |
| Tear Resistance | D1004 | 11 lbs<br>49 N | 16 lbs<br>70 N | 19 lbs<br>84 N | 22 lbs<br>100 N |
| Puncture Resistance | D4833 | 28 lbs<br>120 N | 42 lbs<br>190 N | 54 lbs<br>240 N | 56 lbs<br>250 N |
| Carbon Black Content | D6370 | ≥ 2.0% | ≥ 2.0% | 2.0% | ≥ 2.0% |
| High Pressure OIT | D5885 | 400 min | 400 min | N/A | 400 min |
| Low Temperature Impact Resistance | D746 | -69°F<br>-56°C | -69°F<br>-56°C | -40°F<br>-40°C | -69°F<br>-56°C |
| Service Temperatures | Max Continuous Use | 140°F<br>60°C | 140°F<br>60°C | 140°F<br>60°C | 140°F<br>60°C |

WE PROTECT

www.LayfieldContainment.com
Containment@layfieldgroup.com

**From:** Gilbert Serrano <Gilbert.Serrano@layfieldgroup.com>
**Sent:** Thursday, March 25, 2021 12:15 PM
**To:** r@rthicksconsult.com
**Cc:** Jan Nichols <Jan.Nichols@layfieldgroup.com>
**Subject:** RE: PE-Stamped Demonstration of Equivalency of LLDPE and Enviro Liner - needed if the proposed AST will use Enviro Liner rather than 40-mil LLDPE (primary) and 30-mil LLDPE (secondary)

Hi Randy,

We fully confirm that EL1040 is in fact a LLDPE based geomembrane.

Best regards,

Gil Serrano

**Gil Serrano** | Engineering Business Manager | Geosynthetics
10038 Marathon Parkway | Lakeside, CA 92040
phone: (619) 771.6227 | mobile: (619) 509.6471 | www.layfieldgroup.com

## New Wave Energy Services

Health, Safety and Environmental Manual

## Safe Work Procedure – Tanks

| Title | Frac Tank Set Up SWP-Tanks-05 |
|---|---|
| **Description of Task** | Frac Tanks are installed to hold large amounts of liquids for use by our clients. |
| **Applicable Laws and Regulations** | Alberta: OHS Act, Regulation and Code<br>BC: OHS Act, Regulation and Code |
| **PPE and Protective Controls** | Hard Hat, CSA Approved Footwear, Safety Glasses/Goggles, Hi Visibility outerwear, Hearing Protection (ear plugs or ear muffs), H2S Monitor (if required), Cut Resistant Protective Gloves.<br><br>Training, Procedure, Programs & Policies, Inspections, Regulations, Pre-Job Meetings. |
| **Required Training:** | *Formal:* WHMIS, H2S Alive, CSO, First Aid/CPR, TDG<br><br>*Informal:* New Wave Orientation, Customer Orientation, Safe Working Procedures, Policies, Codes of Practice, On the Job Training, Competency Assessments, Mentoring |
| **Supervisor Responsibilities** | Supervisors are responsible to facilitate and/or provide proper instruction to their workers on site and make sure equipment/tool owner manuals are available on site. |
| **Job Steps** | 1. Hold a Pre-Job safety meeting before beginning this operation. This will include a review of procedures, hazard assessments, hand signals while performing lifts, emergency response procedures, and roles & responsibilities. Include everyone on site (workers, contractors, equipment operators, etc.).<br><br>2. Ensure everyone on site is experienced, trained and competent to perform their task (ex. Equipment operators).<br><br>3. Using the transit/laser level ensure that the grade of the site for the tank install is within acceptable specifications.<br><br>4. Mark the center of tank per location as appointed by client, keeping in mind that sufficient room is needed on the backsides of the tank for the hoe to pull liner.<br><br>5. Remove all debris including but not limited to: sticks, rocks or any foreign material capable of puncturing liner. Watch your footing and be mindful of slip/trip/fall hazards.<br><br>6. Mark the center of the tank by digging a shallow hole or using a disc and then measure 4 ways from center and mark with spray paint to reference the size of geo and the size of the liner per the size of the tank.<br><br>7. After examining the unroll instructions as marked on the geotextile proceed to unroll the geo.<br><br>8. Unfold the geo ensuring that it is square and equal on all four sides per the spray paint marks previously put on the outside of the tank. |

1

*The information in this Safe Work Procedure does not take precedence over applicable government legislation, with which all workers should be familiar.



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## Safe Work Procedure – Tanks

| | | |
|---|---|---|
| | 9. Finding the center of the tank using the hole dug or disc, mark the center of the tank with spray paint and then using a paint stick, mark the circumference of the tank per tank measurements set out in the measurement guide lines.<br><br>10. Using the liner bar and picker/excavator/hoe unroll the liner in the same fashion as the geo textile ensuring that the QC manual is removed from the outside of the roll.<br><br>11. While rolling out the liner (suspended load) do not put any body part under the suspended load without complete confirmation from the operator that the task is fully stopped, and all movements of equipment have been suspended. While loads are in motion, workers must never be under them.<br><br>12. Fold the liner towards the center from 8 points until the outside tank lines on the geo are exposed and in a neat and tidy fashion to ensure a uniform pull of the liner when the tank is erected.<br><br>13. While manually pulling the geo and liner, ensure proper communication is established between the crew and everyone pulls together on command. Ensure entire crew has a proper grip on the geo or liner, proper stance for balance and no excess force is used to pull either the geo or liner. Be mindful of slip/trip/fall hazards while pulling the geo and/or liner.<br><br>14. Mark the center of the tank again by finding the hole or disc by using spray paint and write the outside panel measurement on the floor of the liner with spray paint.<br><br>15. Ensure there is always minimal foot traffic on the surface of the liners. The liner is extremely slippery (especially when wet – rain, snow, ice). If a worker needs to walk on the liner, caution needs to be taken. Take slow small shuffling steps (like a penguin) and keep hands out of pockets for balance.<br><br>16. From the center point measure to the inside of both ends of the first panel and set in place with the picker and support one end with the A-arm or hoe. Use the hoe/picker to stabilize 7-8 panels before removing (first skid emptied).<br><br>17. While placing all the panels with the picker, workers must take extreme caution and must never go under a suspended load.<br><br>18. Skids holding the panels occasionally need to be moved and/or relocated. Only straps approved for towing/pulling can be used. Inspect straps prior to use.<br><br>19. Trim excess geo, ensuring there is approximately 18-24’ left on the outside of the tank to allow settling.<br><br>20. The excess geo that is trimmed off, must be put to the inside of the circumference mark on the geo to be used later to pack into the corner where the tank and geo meet. | 2 |

*The information in this Safe Work Procedure does not take precedence over applicable government legislation, with which all workers should be familiar.



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## Safe Work Procedure – Tanks

| | |
|---|---|
| | 21. Continue setting panels ensuring that each panel is measured from the center until the last 4 panels are ready to be set. The last 4 measurements of panels must be measured from panel to panel as set out in the measurement guidelines.<br><br>22. Refer to the Safe Work Procedure on Electric Torque Guns for torqueing procedure. Ensure the portable generator used to power the torque gun is placed downwind and/or position yourself so that the exhaust is away from your breathing zone.<br><br>23. Once the walls are in place, fold the liner out and secure with clamps and airplane cable.<br><br>24. While pulling the liner over the erected tank walls, ensure hoe/picker operator is familiar with the task and constant communication is established (radios). Watch for pinch points while putting the liner into the thumb of the hoe/picker.<br><br>25. Ensure that no excess liner is cut off until all the clamps and cable are secure.<br><br>26. Remove all excess liner in a neat and straight fashion using a tank ring support as a guideline ensuring that there is 18" below the airplane cable.<br><br>27. Install the suctions and equipment per the customer's request.<br><br>28. Remove all excess liner and secure on location in a hidden spot to be disposed of later.<br><br>29. Walk around the complete tank and check to make sure there is no tools, excess bolts or garbage left over.<br><br>30. Ensure all bolts and airplane cable are installed correctly.<br><br>31. Supervisor to check 3-4 bolts on every seam with the manual torque wrench while ensuring that the threads are fully exposed from the nut.<br><br>32. Ensure that all paperwork is reviewed with and signed by the client.<br><br>33. Tank Supervisor and Electric Torque Gun Operator must walk around the tank visually ensuring the bolts are torqued and then both must sign off on the Tank Installation Checklist.<br><br>34. Tank Supervisor and Liner Puller must sign off on the Liner Installation Form. |
| **Created By** | Workers, General & Operations Managers, Safety Department |
| **Manager Approval** | Karmen Hodgson – Tanks General Manager |

3

*The information in this Safe Work Procedure does not take precedence over applicable government legislation, with which all workers should be familiar.



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## New Wave Energy Services

Health, Safety and Environmental Manual

## Safe Work Procedure – Tanks

| Title | Bolt Up of Piping and Assemblies SWP-Tanks-02 |
|---|---|
| **Description of Task** | Equipment is prepared and requires fabrication before being used. |
| **Applicable Laws and Regulations** | Alberta: OHS Act, Regulation and Code<br>BC: OHS Act, Regulation and Code |
| **PPE and Protective Controls** | Hard Hat, CSA Approved Footwear, Safety Glasses/Goggles, Hi Visibility outerwear, Hearing Protection (ear plugs or ear muffs), H2S Monitor (if required), Protective Gloves.<br><br>Training, Procedure, Programs & Policies, Inspections, Regulations, Pre-Job Meetings. |
| **Required Training:** | *Formal:* WHMIS, H2S Alive, CSO, First Aid/CPR, TDG<br><br>*Informal:* New Wave Orientation, Customer Orientation, Safe Working Procedures, Policies, Codes of Practice, On the Job Training, Competency Assessments, Mentoring |
| **Supervisor Responsibilities** | Supervisors are responsible to facilitate and/or provide proper instruction to their workers on site and make sure equipment/tool owner manuals are available on site. |
| **Job Steps** | 1. All personnel involved in this task must attend a pre-job safety meeting. This will include role designation, review of procedures and hazard assessment/identification. Establish emergency response roles and procedures.<br><br>2. Obtain all applicable permits. Only certified/trained personnel can operate lifting equipment (crane, picker, etc.)<br><br>3. Ensure potential hazards are identified within the work area.<br><br>4. Communicate with all personnel involved of potential hazards.<br><br>5. Always watch for pinch points.<br><br>6. If using lifting devices, ensure operators are properly trained and all lifting equipment is inspected before use. Communicate with everyone involved the hand signals to be used and who will be giving them.<br><br>7. Ensure that all flange and sealing surfaces are cleaned before assembly.<br><br>8. Ensure proper gaskets and bolting materials are used.<br><br>9. Ensure that the flange alignment is accurate.<br><br>10. Ensure that bolting is tightened evenly around flange perimeters.<br><br>11. Ensure stud threads protrude thru stud nut at least one full thread.<br><br>12. Ensure that all welded threaded connections (i.e. TOL's) have had a thread chaser used on the threads prior to assembly. |

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*The information in this Safe Work Procedure does not take precedence over applicable government legislation, with which all workers should be familiar.



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## Safe Work Procedure – Tanks

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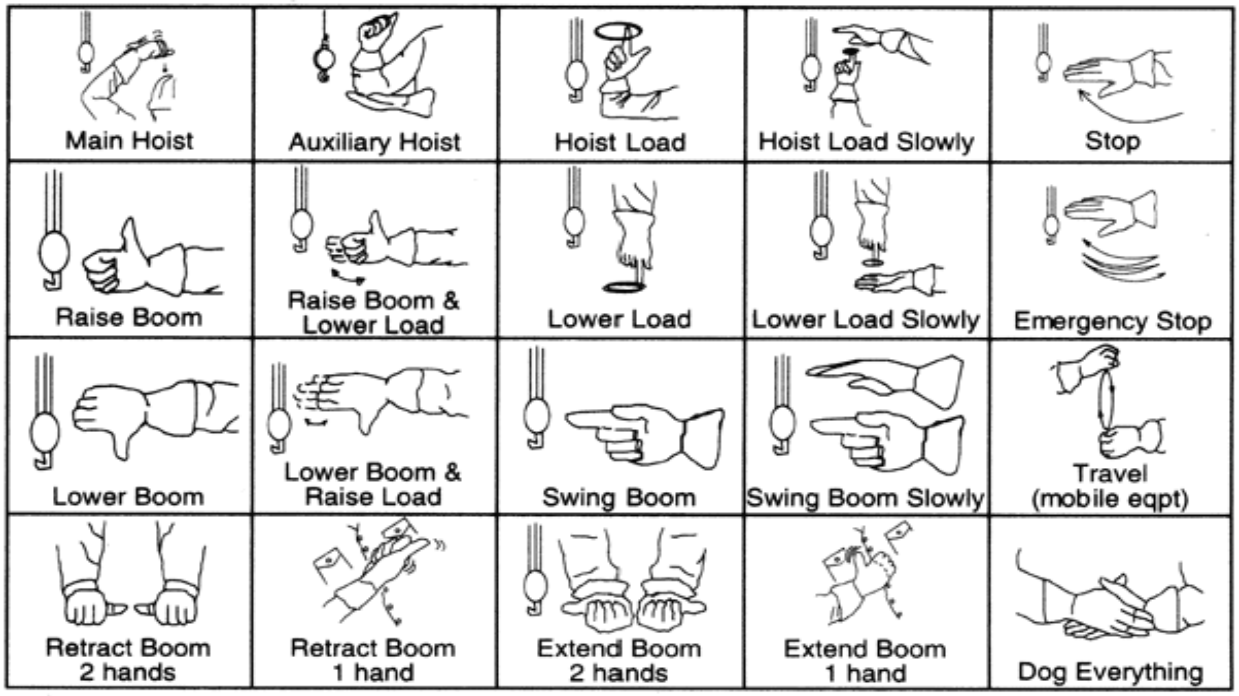
|---|---|
| | 13. Ensure that proper thread dope and Teflon tape is used on all threaded connections.<br><br>14. Perform post job clean up after task is completed. |
| **Created By** | Workers, General & Operations Managers, Safety Department |
| **Manager Approval** | Karmen Hodgson – Tanks General Manager |

**INTERNATIONAL HAND SIGNALS:**

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## New Wave Energy Services

Health, Safety and Environmental Manual

## Safe Work Procedure – Tanks

| Title | Setting Up a Bird Net SWP-Tanks-07 |
|---|---|
| **Description of Task** | This task consists of employees building and placing a bird net over top of a tank. |
| **Applicable Laws and Regulations** | Alberta: OHS Act, Regulation and Code<br>BC: OHS Act, Regulation and Code |
| **PPE and Protective Controls** | Hard Hat, CSA Approved Footwear, Safety Glasses, Fire Resistant Coveralls, Hi Visibility outerwear, Hearing Protection (ear plugs or ear muffs), H2S Monitor (if required), Protective Gloves.<br><br>Training, Procedure, Programs & Policies, Inspections, Regulations, Pre-Job Meetings, Body Placing and Spacing, Use proper lifting and pulling techniques. |
| **Required Training:** | *Formal:* WHMIS, H2S Alive, CSO, First Aid/CPR, TDG<br><br>*Informal:* New Wave Orientation, Customer Orientation, Safe Working Procedures, Policies, Codes of Practice, On the Job Training, Competency Assessments, Mentoring |
| **Supervisor Responsibilities** | Supervisors are responsible to facilitate and/or provide proper instruction to their workers on site and make sure equipment/tool owner manuals are available on site. |
| **Job Steps** | 1. All personnel involved in this task must attend a pre-job safety meeting. This will include role designation, review of procedures and hazard assessment/identification. Establish emergency response roles and procedures.<br><br>2. Construct bird net stands. Use proper lifting techniques and watch for pinch points.<br><br>3. Ensure all stands have 8 support legs.<br><br>4. Attach bolts in specified holes in stand.<br><br>5. Ensure all rubber mats on bases are secure and free of debris.<br><br>6. Set upright to required height and secure with bolts.<br><br>7. Mark out tank floor to indicate where bird net stands will sit.<br><br>8. Place the bird net stands with a picker on to the marks on the tank floor. (Picker may need to be moved to reach all marks). Never go under a suspended load. Always maintain eye contact and have constant communication with picker operator.<br><br>9. Around the outside of the tank, mark 8 equal points. |

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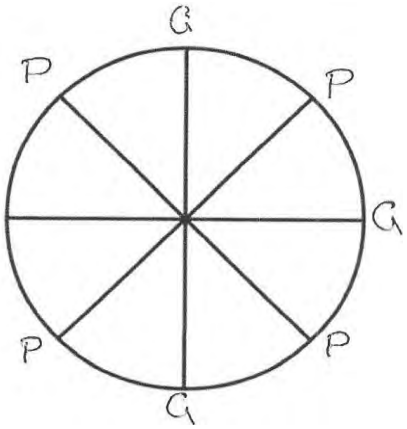
## Safe Work Procedure – Tanks




10. Mark every second one with a G (for green) and the remainder with a P (for pink). (Green= centre of edge of net. Pink= corner of net. The net is square).
11. Place bird net still in box next to a "G" and open box. DO NOT cut white string.
12. Place end of net over top of tank and pull net to the opposite side of the tank.
13. Ensure net does not get caught on bird net stands.
14. Open up net and secure 2' down on outside of tank. Denoted by green ribbon. On all 4 "G" marks.
15. Lift net over bird net stands using extendable pole.
16. Secure corner of bird net to letter "P"s pulling tight.
17. Work round tank securing bird net to ring clamps. Watch slip/trip/fall hazards.
18. Work around the tank a second time pulling net tight.
19. Use rope to secure net on every seam of tank.
20. Tie up all spare netting on the floor.

2

| | |
|---|---|
| **Created By** | Workers, General & Operations Managers, Safety Department |
| **Manager Approval** | Karmen Hodgson – Tanks General Manager |

*The information in this Safe Work Procedure does not take precedence over applicable government legislation, with which all workers should be familiar.



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## New Wave Energy Services

Health, Safety and Environmental Manual

## Safe Work Procedure – Tanks

| Title | Setting Up a Rescue Platform SWP-Tanks-08 |
|---|---|
| **Description of Task** | Setting up and assembling a rescue platform. |
| **Applicable Laws and Regulations** | Alberta: OHS Act, Regulation and Code<br>BC: OHS Act, Regulation and Code |
| **PPE and Protective Controls** | Hard Hat, CSA Approved Footwear, Safety Glasses/Goggles, Fire Resistant Coveralls, Hi Visibility outerwear, Hearing Protection (ear plugs or ear muffs), H2S Monitor (if required), Protective Gloves, Full Body Harness, Lanyard<br><br>Training, Procedure, Programs & Policies, Inspections, Regulations, Pre-Job Meetings, Body Placing and Spacing, Use proper lifting and pulling techniques. |
| **Required Training:** | *Formal:* WHMIS, H2S Alive, CSO, First Aid/CPR, TDG, Crane/picker/Rigging certification, Fall Protection certification.<br>*Informal:* New Wave Orientation, Customer Orientation, Safe Working Procedures, Policies, Codes of Practice, On the Job Training, Competency Assessments, Mentoring |
| **Supervisor Responsibilities** | Supervisors are responsible to facilitate and/or provide proper instruction to their workers on site and make sure equipment/tool owner manuals are available on site. |
| **Job Steps** | **Note:** This platform is a prototype platform and may change or be amended by New Wave site supervisor or client representative, all revisions must be approved by New Wave safety advisor.<br><br>1. All personnel involved in this task must attend a pre-job safety meeting. This will include role designation, review of procedures and hazard assessment/identification. Establish emergency response roles and procedures.<br><br>2. Ensure level compact ground where rescue platform will be set.<br><br>3. Place rig mat along tank where platform will be placed.<br><br>4. While rescue platform is in collapsed position remove pins 1&2 colored white from frame to free structure so it can be raised to standing position. Watch for pinch points. (NOTE: do not remove any other pins than the ones mentioned above.)<br><br>5. Inspect slings and clevises. Hook up slings and clevises to four lifting lugs located on handrails, raise platform to fully erected position with telehandler or picker. Ensure employees are free from the area and do not allow anyone to go under a suspended load.<br><br>6. Once platform is raised, insert pins 3 & 4 color white into holes. Be sure that safety keeper is in place on each pin. Watch for pinch points.<br><br>7. Once platform is fully pinned, have your New Wave site supervisor inspect platform. Once site supervisor has approved that all pins are in place, you can don safety harness and double lanyard and proceed up platform to unhook slings from telehandler or picker. 100% tie off is mandatory when climbing this platform. |

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## Safe Work Procedure – Tanks

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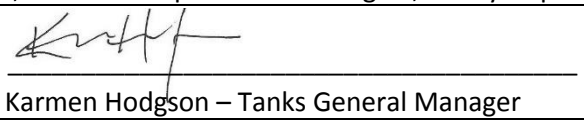
| | 8. Use picker and ladders to install supports for the safety jib and insert pins marked 5 & 6 colored white.<br><br>9. Use telehandler or picker to place/hang rescue jib crane into jib crane pocket. (NOTE: rescue jib crane is marked "A")<br><br>10. Use ladder winch marked "B" to lower ladder into tank.<br><br>11. Before operation, New Wave site supervisor must inspect rescue platform. |
| **Created By** | Workers, General & Operations Managers, Safety Department |
| **Manager Approval** |  <br>Karmen Hodgson – Tanks General Manager |



*The information in this Safe Work Procedure does not take precedence over applicable government legislation, with which all workers should be familiar.



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

## General

Examination of the engineering drawings and the SOP for set-up (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.

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.

These AST Containments are constructed of 12-foot high steel panels, are netted (netting no larger than 1.5 inch per square per BLM COA) ~~and 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 or better. 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.

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.

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 infom1ation: 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 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.

## 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 NMAC 19.15.34 and the SOP and is the responsibility of the operating company. 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 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.

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The foundation soils must be roller compacted Compaction characteristics must meet or exceed 95% of Standard Proctor Density in accordance with ASTM D 698 or modified Proctor Test (ASTM Standard D1557).

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: IV). The vertical steel walls of the AST Containment are the subject of *a variance included in Volume 3* of this submission. OCD.

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.

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.

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.

## *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] and are pursuant to a requested variance.* The liner system is presented in an earlier section of this submission.

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

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

hydraulic conductivity no greater than 1 x 10-9 cm/sec. Liner compatibility shall meet or exceed the EPA SW-846 method 9090A or subsequent relevant publications.

*Variance request for liner system (two 40 mil LLDPE for primary and secondary liners) included in Volume 3.*

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 pursuant to a requested variance.*

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.

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).

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 x 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.

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.

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.

## 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.

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Factory welded seams shall be used where possible. AST Containment contractor will employ field seams in 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.

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 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.

*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.

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.

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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 x 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 x 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.

**32156 Castle Court / Suite 211 / Evergreen, CO 80439**
**Ph 303-679-0285 Fx 303-679-8955 geosynthetics@msn.com**

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.

- 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. 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 LLDPEr (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 5 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

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.

32156 Castle Court / Suite 211 / Evergreen, CO 80439
Ph 303-679-0285 Fx 303-679-8955 geosynthetics@msn.com

## 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 x 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

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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 LLDPEr (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

Sincerely Yours,

R K Frobel

Ronald K. Frobel, MSCE, PE

COLORADO REGISTERED
RONALD KENNETH FROBEL
15742
PROFESSIONAL ENGINEER

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:

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# *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.

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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

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:

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# *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

Sincerely Yours,

*R K Frobel*

Ronald K. Frobel, MSCE, PE

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**References:**

NMAC 19.15.34.13 OPERATIONAL REQUIREMENTS FOR RECYCLING CONTAINMENTS

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

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

Attachments:

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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 Hyrdo Pressure (p) of water is 718 pounds per square foot (psf), where

$$p = Design\ Density\ X\ Height$$

$$= 62.4\ PCF * 11.5\ ft$$

$$(design\ density = 8.34\ \frac{lb}{gal}\ X\ 7.48\ \frac{ft^3}{gal})$$

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 Hyrdo Pressure (p) of conditioned produced water is 626 psf, where

$$p = Design\ Density\ X\ Height$$

$$= 69.64\ PCF * 9\ ft$$

$$(design\ density = 9.3\ \frac{lb}{gal}\ X\ 7.48\ \frac{ft^3}{gal})$$

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

$$p = Design\ Density\ X\ Height$$

$$= 69.64\ PCF * 10\ ft$$

$$(design\ density = 9.3\ \frac{lb}{gal}\ X\ 7.48\ \frac{ft^3}{gal})$$

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

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Sincerely Yours,

RK Frobel

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References:

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

ASTM Standards 2019


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

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**FIRM:** R. K. FROBEL & ASSOCIATES
Consulting Civil / Geosynthetics Engineers

**TITLE:** Principal and Owner

**PROFESSIONAL AFFILIATIONS:**

American Society for Testing and Materials (ASTM) -
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
EPA Advisory Committee on Geosynthetics (Past Member)
Association of State Dam Safety Officials (ASDSO) – Member
U. S. Committee on Irrigation and Drainage (USCID) - Member
Technical Advisory Committee - Geosynthetics Magazine
Editorial Board - Geotextiles and Geomembranes Journal
Fabricated Geomembrane Institute (FGI) – Board of Directors
Co-Chairman International Conference on Geomembranes
Co-Chairman ASTM Symposium on Impermeable Barriers
U.S. Naval Reserve Officer (Inactive)
Registered Professional Engineer – Civil (Colorado)
Mine Safety Health Administration (MSHA) Certified

**ACADEMIC BACKGROUND:**

University of Arizona: M.S. - Civil Engineering - 1975
University of Arizona: B. S. - Civil Engineering – 1969
Wentworth Institute of Technology: A.S. Architecture – 1966

**PROFESSIONAL EXPERIENCE:**

R. K. Frobel & Associates - Consulting Engineers
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

Engineering Experiment Station, University of Arizona
Tucson, AZ, Research Assistant, 1974 - 1975

United States Navy, Commissioned Naval Officer, 1970 - 1973

**REPRESENTATIVE EXPERIENCE:**

R.K. Frobel & Associates: Civil engineering firm specializing in the fields of geotechnical, geo-environmental and geosynthetics. Expertise is provided to full service civil/geotechnical engineering firms, federal agencies, municipalities or owners on a direct contract, joint venture or sub-consultant basis. Responsibilities are primarily devoted to specialized technical assistance in design and application for foreign and domestic projects such as the following:
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.

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 liason 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 22415

## CONDITIONS

| | |
|---|---|
| Operator:<br>SOLARIS WATER MIDSTREAM, LLC<br>907 Tradewinds Blvd, Suite B<br>Midland, TX 79706 | OGRID:<br>371643 |
| | Action Number:<br>22415 |
| | Action Type:<br>[C-147] Water Recycle Long (C-147L) |

**CONDITIONS**

| Created By | Condition | Condition Date |
|---|---|---|
| vvenegas | NMOCD has reviewed the recycling containment permit application and related documents, submitted by [371643] SOLARIS WATER MIDSTREAM, LLC on March 31, 2021 for the proposed Dominator Above-Ground Storage Tank in Unit Letter O, Section 25, Township 25S, Range 33E, Lea County, New Mexico. The application has been assigned the OCD Administrative Order number 1RF-469 - Dominator Above-Ground Storage Tank, Facility ID fVV2117939365 The form C-147 and related documents for 1RF-469 - is approved with conditions of approval. | 6/28/2021 |