April 2022

C-147 Permit Package for Gravitas Recycling Facility and AST Containment Section 2 T26S R27E, Eddy County Volume 1

Transmittal Letter, Siting Variance Requests, Closure Cost Estimate
C-147 Form
Design/Construction Plan
Engineering Drawings and Liner Specifications
Well Water Services Manual
Variances for AST Storage Containments
Applicability of Engineering Variances to Variety of Site Conditions in Permian Basin
Operations/Maintenance Plan and Closure Plan

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:
Solaris Water Midstream
Houston, Texas

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

R. T. HICKS CONSULTANTS, LTD.

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

April 11, 2022

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, Gravitas AST Containment Permit
Section 2, T26S, R27E, Eddy County
Volume 1C-147 and Volume 2 Siting Criteria Demonstration

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 on or about May 1, 2022. Please note that the siting criteria demonstration:

- Identifies groundwater at less than 50-feet below ground surface at the AST location. Data show this shallow groundwater is a localized. Data support a conclusion that the shallow water is perched within the Los Medaños Member of the Rustler Formation. A variance request is attached to this transmittal letter.
- Identifies the regional aquifer within large drainages as alluvium and the underlying gypsum of the lower Rustler Formation. Outside of the drainages, the regional aquifer is the gypsum of the lower Rustler.
- Demonstrates that the USGS erroneously mapped several wells near the AST location, and we have noted the correct locations in the text
- Demonstrates that the ground/strata underlying the recycling area is stable and does not exhibit any open fractures, caverns or solution conduits between ground surface and groundwater

Hicks Consultants has advised Solaris Water Midstream to proceed with construction and use of the AST in advance of OCD approval of the permit and variance request. We have spent considerable time collecting and evaluating data associated with the site and strongly believe that the additional design/construction safeguards identified in the variance request provide better protection of fresh water than adherence to the mandates in the Rule for locations where fresh water for beneficial use lie 51 feet below the base of the AST liner. Moreover, a delay in employing the AST for recycling could result in use of fresh water, a detriment to the environment.

The AST will be located in the northwest quadrant of the recycling area at least 500-feet from the windmill for stock that is identified in the submission. The AST is placed on an existing Chevron working pad that will be reclaimed by Chevron as part of the closure process associated the tank battery that is also on this pad. This working pad currently houses the Chevron recycling facility 2RF-120. Solaris will substantially upgrade the existing recycling facility as described in the Variance Request.

The produced water entering the recycling facility and AST Containment is 100% derived from Chevron wells. The recycled produced water from the AST and facility will be used exclusively for E&P operation of Chevron wells (e.g. drilling fluid, stimulation fluid). Solaris is listed as the operator of the recycling facility and AST as a convenience for their client, Chevron. Thus, the attached closure cost estimate considers only the removal of the AST and is provided as a DRAFT. We do not believe the Rule requires bonding under these circumstances, but it is the opinion of OCD that matters most.

Solaris will transmit the Siting Criteria Demonstration (Volume 2) and the permit application (Volume 1) to OCD via the OCD.Online portal.

Hicks Consultants affirms that:

- The location meets all siting criteria in the Rule and the location meets the specified setback criteria – except the depth to groundwater as identified above,
- We conducted a foot survey to check that all other setback criteria are met,
- The Design/Construction Plan, Operation and Maintenance Plan and Closure Plan are consistent with the Rule and previously approved by OCD.

The permit application 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 40,000 bbl. AST Containment are fully consistent with plans previously approved by OCD,
- The Design/Construction Plan verbatim from the approved North Olympus AST Containment
- The manual for AST set up from Well Water Services
- Variances for AST Storage Containments – all of which have been approved by OCD previously,
- A new variance request to provide an alternative to barbed wire fencing of the AST

In compliance with 19.15.34.10 of the Rule, this submission is copied to the owner of the surface upon which the containments will be constructed.

If you have any questions or concerns regarding this permit 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
NM State Land Office

DRAFT Closure Cost Estimate

R. T. HICKS CONSULTANTS, LTD.
901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Since 1996

GRAVITAS ABOVE-GROUND STORAGE TANK

DRAFT Financial Assurance Cost Estimate

Total estimated cost for closure, reclamation, and restoration of the facility (AST, fencing, etc.) pursuant to Rule 34 is **$32,500** based upon the work elements in the spreadsheet (below). We used the same estimate as the recently approved cost estimate for Mobley AST Containment. As described in the transmittal letter, the AST Containment will lie on an existing Chevron working pad associated with a Chevron tank battery and a registered Chevron recycling facility (2RF-120). Items shown with "0" units are costs recommended for certain agencies (e.g. 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
	Gravitas AST Containment				
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	0	1	$1,000.00	$0.00
	Facility Decommision Site Subtotal:				**$32,500.00**

DRAFT

Variance Request

Statement Explaining Why the Applicant Seeks a Variance

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

> 19.15.34.11 SITING REQUIREMENTS FOR RECYCLING CONTAINMENTS:
> A. An operator shall not locate a recycling containment:
> (1) where ground water is less than 50 feet below the bottom of the containment.

Currently, Chevron operates a recycling facility on the same pad as the proposed Gravitas AST Containment. Improving the facility with the proposed AST will increase the flow rate of treated produced water and increase the volume of produced water available for well stimulation. An increased flow rate is necessary to accommodate the existing well stimulation schedule.

The price of crude and the attendant cost of gasoline at the pump, partially due to the invasion of Ukraine, can be reduced by increased production in the Permian Basin. Adding the AST to the existing recycling facility is a small step in efforts to increase production.

As described in the attachment to this request, localized (perched) groundwater exists beneath the proposed AST at a depth of about 25 feet. This localized groundwater zone is above the regional aquifer, which is gypsum of the lower Rustler Formation and overlying alluvium within and adjacent to large drainages. Outside of the drainages, the regional aquifer is the gypsum of the lower Rustler Formation.

Southwest of the Gravitas AST location the driller reports static groundwater within gypsum about 35 feet below surface (elevation = 3177 feet asl) in the three borings (PODs 1-3 on inset map). The southern three borings northwest of the site (1, 4 and 5) encountered static groundwater in the Los Medaños Member of the Rustler at depths of about 26 feet (elevations = 3186 to 3195), None of the remaining five geologic logs record groundwater and all eight logs do not penetrate gypsum in the 40-45 feet deep. Boring Misc-417 at the Section 10 containments to the southwest did not encounter groundwater to a depth of 76 feet. The lithologic description of Misc-417 is poor, thus the presence or absence of gypsum cannot be ascertained.

Given the elevation of groundwater in the four nearest wells in Hay Hollow range from 3126 to 3175 (downstream to upstream), we conclude that this recharge area for the regional aquifer (gypsum) has a groundwater elevation of about 3150.

Because groundwater exists in the six borings nearest to the Gravitas AST Containment and the active windmill about 500 feet east and groundwater does not exist in the six borings more distant from the windmill and AST, we conclude that shallow groundwater beneath the AST location is localized.

Because the elevation of groundwater in the six borings described above is (3183-3150=) 33 feet higher than the recharge area of Hay Hollow, we conclude this localized groundwater body is perched in the sediments of the Los Medaños Member of the Rustler.

Finally, we conclude that the source of the perched groundwater is seepage from an unlined stock tank associated with a windmill, which was drilled in 1913 or slightly later. The unlined stock tank is present today and apparent in Google Earth images to 1996. The well is mapped in an air photo from the 1950s (in 1974 Eddy County Soil Survey). We believe that 100 years of seepage from the unlined stock tank could easily cause the observed shallow groundwater beneath the proposed Gravitas AST.

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

Solaris plans a substantial upgrade and expansion of the recycling facility's current secondary containment structure and will place the proposed AST within this secondary containment. As a result of this upgrade, the proposed AST design exceeds Rule 34 criteria for liners and leak detection.

Specifically, the portion of the pad that houses the proposed AST and steel tanks that compose the recycling facility will

- Lie within a 3-foot Musclewall secondary containment (see https://www.musclewall.com/secondary-containment)
- Employ a 60-mil HDPE liner for fluid retention
- Slope to a sump to facilitate removal of precipitation and any released fluids within the musclewall secondary containment

The proposed AST design (see design sketch) includes

- Two 30-mil LLDPE liners as the primary liner system
- A leak detection system between the two 30-mil liners
- Geotextile material beneath the primary liner system
- 200 mil geogrid beneath the geotextile that drains to a sump outside of the steel frame
- 60-mil HDPE beneath the geogrid

Thus, the AST design

1. meets the Rule 34 mandate of a 60-mil primary liner
2. exceeds the Rule 34 mandate of a 30-mil secondary liner
3. employs two (2) leak detection systems, which exceeds the mandate of Rule 34
4. calls for secondary containment to hold any fluids accidently released from fluid transfer

In addition to this robust design, Solaris will obtain water samples from the windmill on a quarterly basis and test these samples for conductance and chloride.

Finally, as described in Volume 2 of the C-147 permit, data support the following conclusions:

A. the water body beneath the proposed AST containment is localized and perched.
B. the groundwater beneath the proposed AST is probably subject to protection under New Mexico Rules,
C. the groundwater beneath the AST is not part of the regional aquifer system

We maintain that the AST design, secondary containment and proposed monitoring provide equal or better protection of fresh water, public health and the environment.

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): Gravitas AST Containment

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

U/L or Qtr/Qtr: N Section: 2 Township: 26S Range: 27E County: Eddy

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

2.

☒ **Recycling Facility:**

Location of (if applicable): Latitude: 32.0666862 N Longitude: 104.1649229 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: 32.0666862 N Longitude: 104.1649229 W approx. (NAD83)

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

☒ Lined ☐ Liner type: Thickness See Attached Engineer Drawings ☒ LLDPE ☐ HDPE ☐ PVC ☐ Other _____

☐ String-Reinforced

Liner Seams: ☐ Welded ☐ Factory ☐ Other Volume: 40,000 bbls See Attachment Drawings and Plans 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 $_32,500.00_ **(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: Secure Gate for Access Stairway .

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.

8.

Siting Criteria for Recycling Containment

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

General siting

Ground water is less than 50 feet below the bottom of the Recycling Containment. NM Office of the State Engineer - iWATERS database search; USGS; Data obtained from nearby wells FIGURES 1-2	☒ Yes ☐ No ☐ NA
Within incorporated municipal boundaries or within a defined municipal fresh water well field covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended. - Written confirmation or verification from the municipality; written approval obtained from the municipality FIGURE 3	☐ Yes ☒ No ☐ NA
Within the area overlying a subsurface mine. - Written confirmation or verification or map from the NM EMNRD-Mining and Minerals Division FIGURE 4	☐ Yes ☒ No
Within an unstable area. - 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). - 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. - 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 - 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 - 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: 4/12/2022.

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

11.

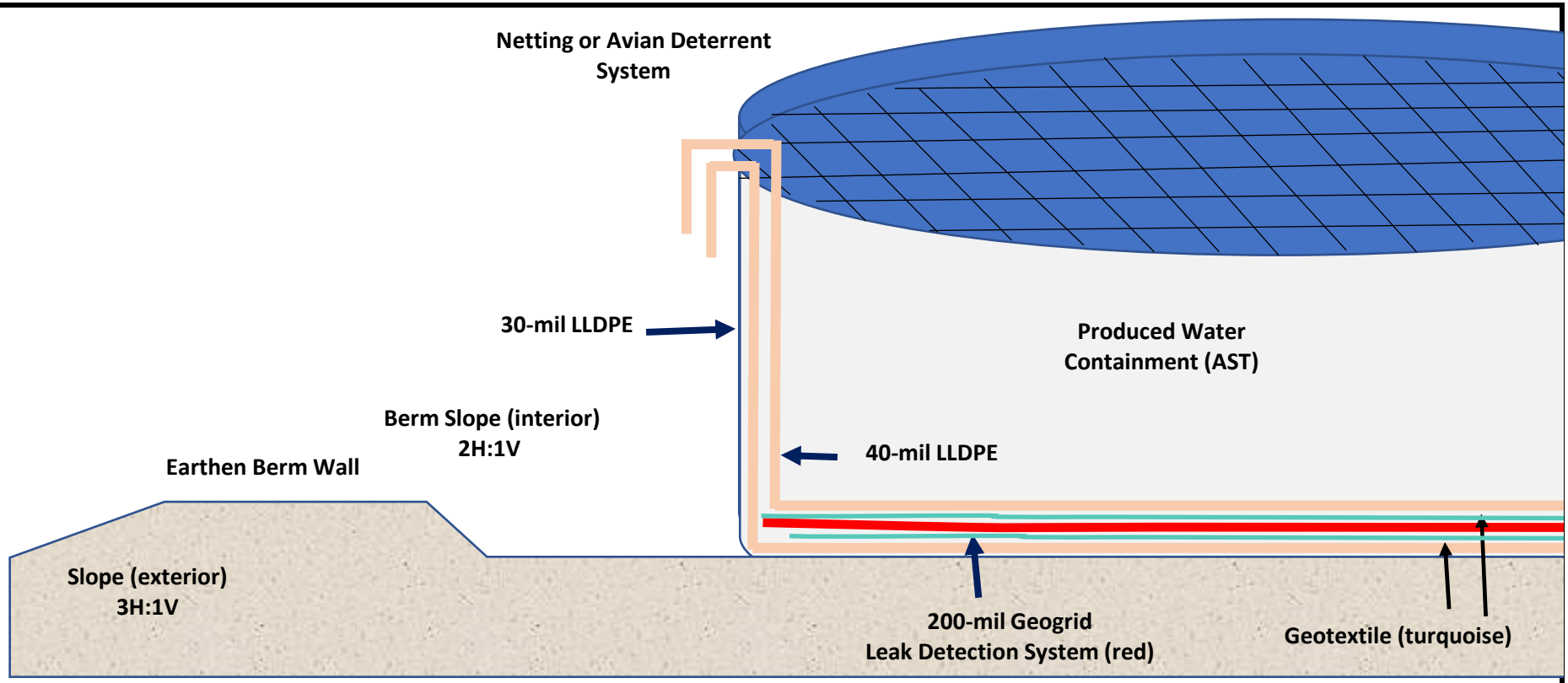
OCD Representative Signature: _____ **Approval Date:** _____

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

☐ OCD Conditions _____

☐ Additional OCD Conditions on Attachment

Released to Imaging: 5/4/2022 2:56:47 PM
Received by OCD: 4/13/2022 9:13:07 AM



Description of Leak Detection System

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

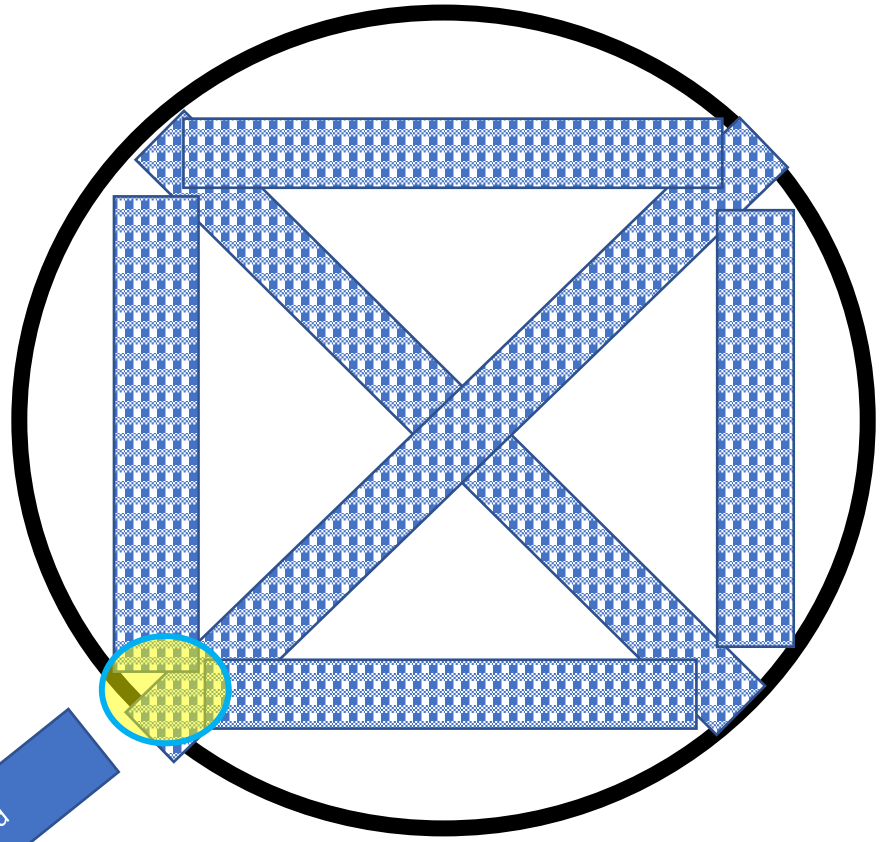
R.T. Hicks Consultants Albuquerque, NM	**Design Sketch**	**Plate 1**
	Well Water Solutions	**May-21**

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

200 mil geogrid placed
- above 8-oz geotextile and 60-mil secondary liner
- inside of AST after set up, before installation of primary liner
- below two (2) 30-mil primary liner system

geotextile is placed
- over the 60-mil HDPE liner inside the steel AST ring
- under the 60-mil primary liner system inside the AST

Sump at lowest point of the AST set up



Sump Location

0 50 100

R.T. Hicks Consultants Albuquerque, NM	**Gravitas AST Layout of Geogrid Drainage Mat**	**Plate 2**
	WWS - Gravitas AST	**April 2022**

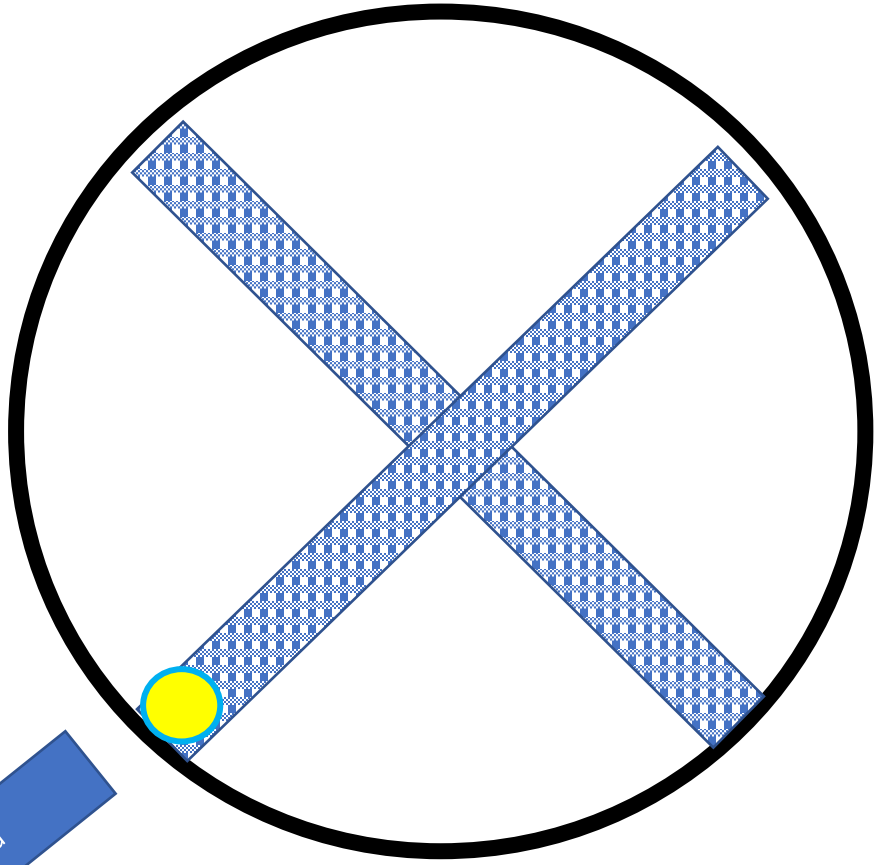
Released to Imaging: 5/4/2022 2:56:47 PM
Received by OCD: 4/13/2022 9:13:07 AM

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

200 mil geogrid placed
- above 8-oz geotextile and 30-mil secondary liner
- inside of AST after set up, before install of primary liner
- below 40-mil primary liner

8-oz geotextile is placed
- over the 30-mil LLDPE liner inside the steel AST ring
- under the 40-mil primary liner inside the AST

Sump at lowest point of the AST set up



Sump Location

0 50 100

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

Box 9

Design and Construction Plan

9.
Recycling Facility and/or Containment Checklist:
Instructions: Each of the following items must be attached to the application. Indicate, by a check mark in the box, that the documents are attached.

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

Design and Construction Plan
Above Ground Tank (AST) Containments

General

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

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

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 information: the operator's name, the location of the site by quarter-quarter or unit letter, section, township and range, and emergency telephone numbers.

19.15.34.12 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 the SOP. If the location of the AST Containment is on an existing pad, the operator has stripped and stockpiled the topsoil for use as the final cover or fill at the time of closure. If the pad is new construction, the operator will strip and stockpile the soil for reclamation upon cessation of site activities.

19.15.34.12 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.

©2021 R.T. Hicks Consultants, Ltd.

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.

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.

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 requested variance*.

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

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] approved by OCD pursuant to a 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 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.

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

©2021 R.T. HICKS CONSULTANTS, LTD.

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

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

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

Install Secondary Liner, Leak Detection System and Secondary Containment

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

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 design sketch).

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

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

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.

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.

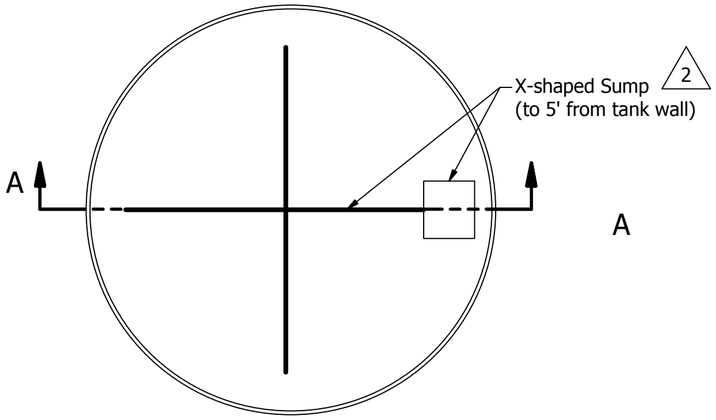
19.15.34.13 B
(3) The injection or withdrawal of fluids from the containment shall be accomplished through a header, diverter or other hardware that prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.

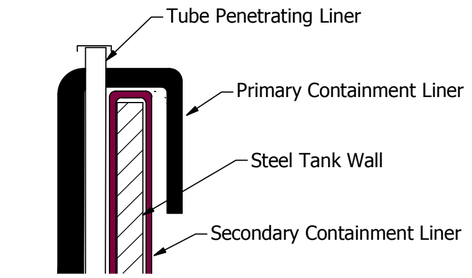
©2021 R.T. Hicks Consultants, Ltd.

C 147 – Box 3
Recycling Containment Design Drawings
Set Up SOP
Liner Specifications

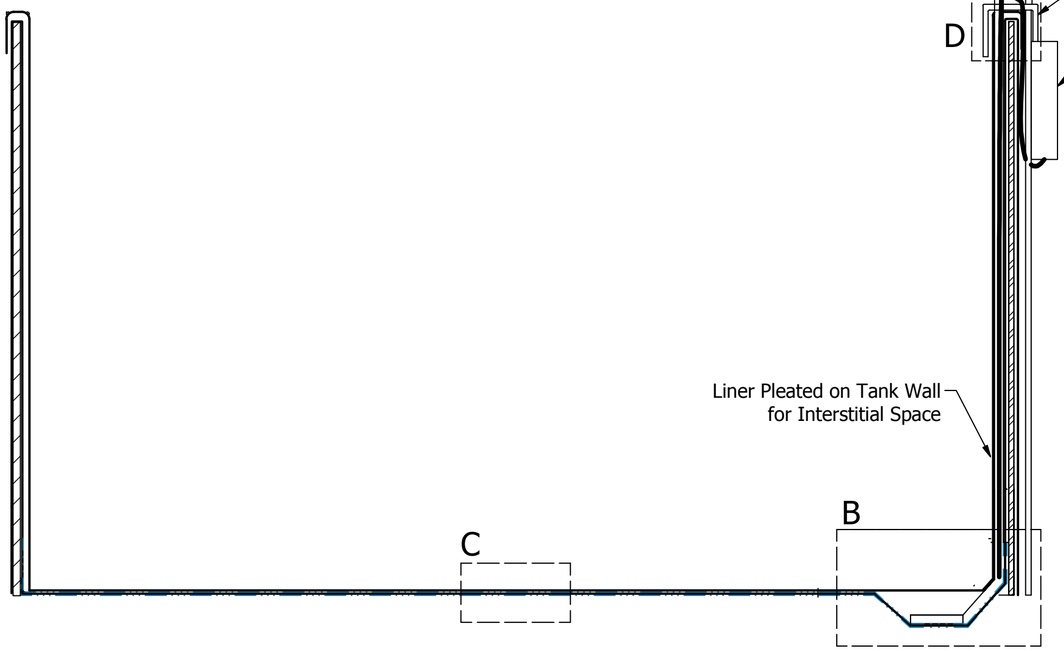
Received by OCD: 4/13/2022 9:13:07 AM

WWS DOUBLE-LINED FRAC WATER TANK SYSTEM

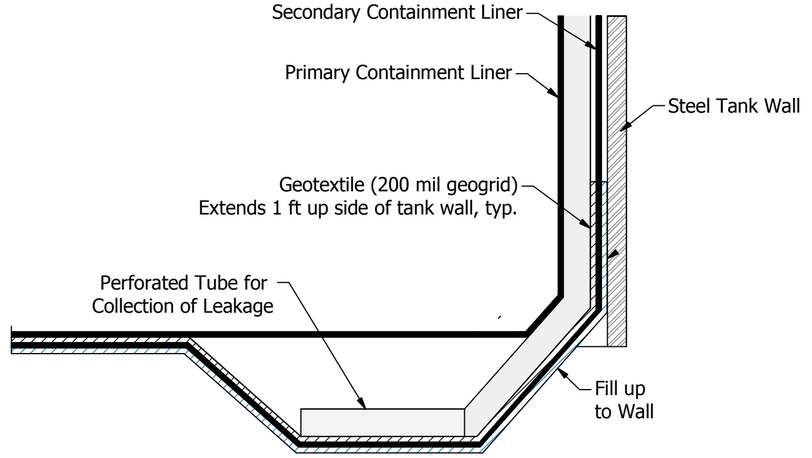




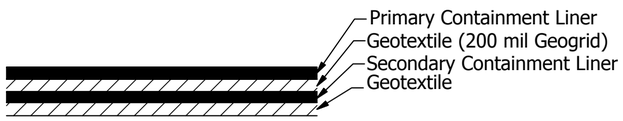
SECTION D
TUBE DETAIL
(Automated Leak Detection System Removed for Clarity)



VIEW A-A
TANK DETAIL



SECTION B
SUMP DETAIL



SECTION C
LINER DETAIL

LUCID
DRAFTING & DESIGN LLC
sarah@luciddrafting.com 307.752.7388

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

TITLE	Double-Lined Frac Tank System
CUSTOMER	
PROJECT/JOB	WWS Double-Lined Tank System
APPROVAL	
DRAFTER	SES
DATE	10/28/2015

THIS DOCUMENT IS THE PROPERTY OF WWS AND MAY NOT BE REPRODUCED OR DISTRIBUTED TO THIRD PARTIES WITHOUT THE PRIOR CONSENT OF WWS.

WELL WATER SOLUTIONS AND RENTALS, INC.

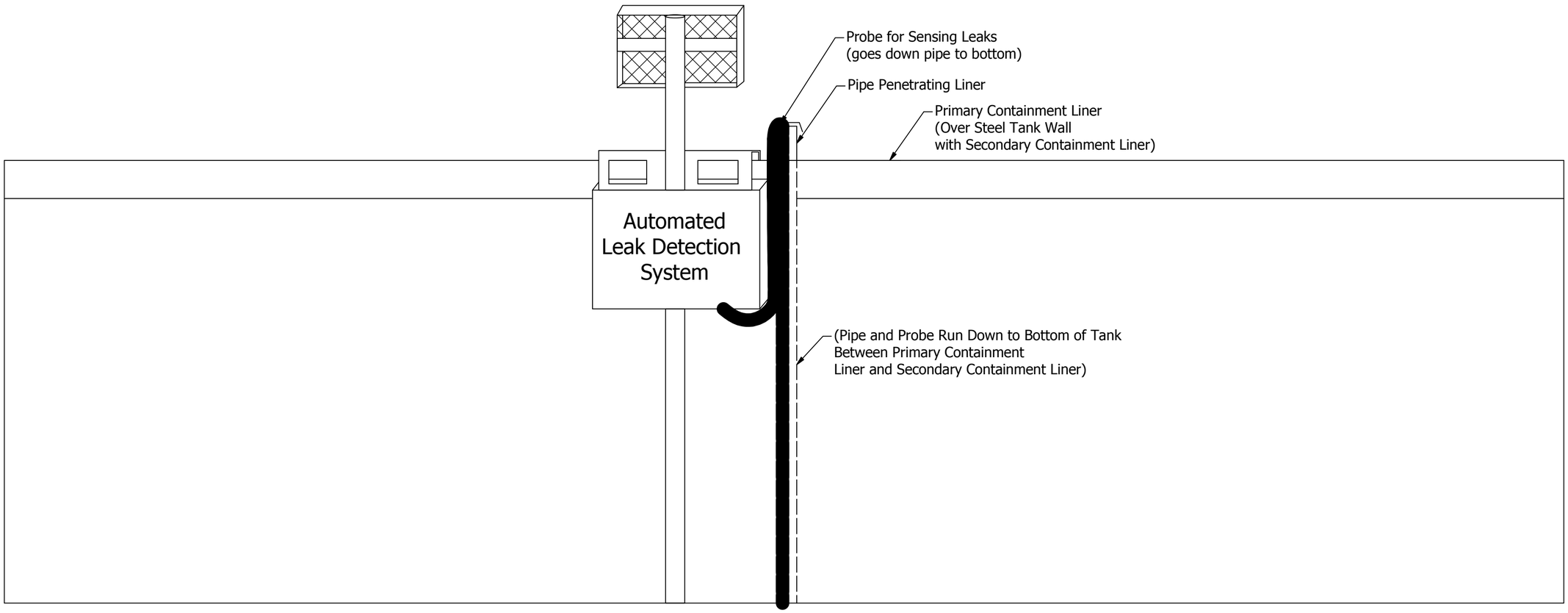
SIZE	DWG NO	REV
C	LDD15-WWS-02	3

SHEET 1 OF 2

Released to Imaging: 5/4/2022 2:56:47 PM

Received by OCD: 4/13/2022 9:13:07 AM

1 AUTOMATED LEAK DETECTION SYSTEM



TITLE	Double-Lined Frac Tank System
CUSTOMER	
PROJECT/JOB	WWS Double-Lined Tank System
APPROVAL	
DRAFTER	SES
DATE	10/28/2015
SIZE	C
DWG NO	LDD15-WWS-02
REV	3
SHEET	2 OF 2

THIS DOCUMENT IS THE PROPERTY OF WWS AND MAY NOT BE REPRODUCED OR DISTRIBUTED TO THIRD PARTIES WITHOUT THE PRIOR CONSENT OF WWS.

WELL WATER SOLUTIONS AND RENTALS, INC.

Released to Imaging: 5/4/2022 2:56:47 PM

2020

Well Water Solutions and Rentals Inc.

STANDARD OPERATING PROCEDURE (SOP)

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

TABLE OF CONTENTS

Section 1.01 Introduction

1) About

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

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

2) Background

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

3) SOP Purpose

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

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

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

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

4) EH&S Programs

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

5) Summary

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

Section 1.02 AST Planning and Preparations

1) Planning

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

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

2) Required AST Order Information

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

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

3) Site Meeting or Scheduling Call

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

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

KEY MEETING TOPICS:

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

4) Site Soil Preparation

Preparation of the soils on site is required to form a dependable base for the AST.
Preparation of the tank pad is solely the responsibility of the customer/operating company.
WWS Soil Requirements are:

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

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

5) Pre-Mobilization Onsite Meeting

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

6) CALL BEFORE YOU DIG "811"

Even though the customer or their subcontractor may have already called for utility locates for the sump hole, the WWS field supervisor should call the local or state underground utility location service again at least 3 days in advance before construction/digging begins. The ticket or reference number provided by the one-call service will then be documented.
The following web site has contacts for all the states and provinces.
http://www.call811.com/state-specific.aspx.
Call 811 in United States

7) AST Material Deliveries

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

Section 1.03 WWS AST Pre Rig Up Requirements

1) Loading Requirements

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

2) Job Safety Analysis (JSA)

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

3) Check Soil Conditions

Preparation of the tank pad is solely the responsibility of the customer.
However, bad weather such as wind, rain, and snow events can change the soil conditions quickly. If soil conditions change the WWS field supervisor will notify the proper customer contact.

4) Proper Tank Positioning

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

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

5) Equipment (WWS provided)

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

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

6) Hand Tools Recommended

All hand tools are subject to daily inspection.

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

Section 1.04 AST Tank Rig Up Procedure

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

1) Tank Layout

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

2) Initial Tank Erection Process

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

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

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

3) Secondary Containment Liners and Installation

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

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

4) Tank Wall Erection

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

ATTENTION:

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

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

5) Proper Liner Placement and Clamping

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

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

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

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

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

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

6) Installing Tank Accessories

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

7) AST Completion Steps

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

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

Section 1.05 AST In Use Operations

1) Inspections and Monitoring

weekly

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

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

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

2) Initial Leak Detection and Liner Repair

Notify BLM and NMOCD if leak reaches the ground

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

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

Section 1.06 WWS AST Rig Down Procedure

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

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

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

Section 1.07 WWS AST Engineering Stamps

PILLAR STRUCTURAL ENGINEERING

June 30, 2015

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

Re: Portable Frac Tank Certification – Pinned Seams

Dear Mr. Lovelace:

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

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

The following tanks sizes were included in the analysis:
- 10,000 BBL – Approximately 81'Ø
- 20,000 BBL – Approximately 108'Ø
- 30,000 BBL – Approximately 135'Ø
- 40,000 BBL – Approximately 156'Ø
- 50,000 BBL – Approximately 176'Ø
- 55,000 BBL – Approximately 183'Ø
- 60,000 BBL – Approximately 190'Ø

The tanks are constructed of the following materials:
- Tank Panels – ASTM A36, 36 ksi Steel Plate
- Horizontal & Vertical Framing – ASTM A500, Grade B, 46 ksi Structural Steel Tubing
- Connecting Pins - ASTM A36, 36 ksi Steel Round Bar

PILLAR STRUCTURAL ENGINEERING
1964 East 1st Street
Casper, WY 82601
PHONE (307) 265-3900
FAX (307) 265-3559
WEB SITE http://www.pillarse.com

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

Calculations of this analysis can be provided upon request.

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

Sincerely,

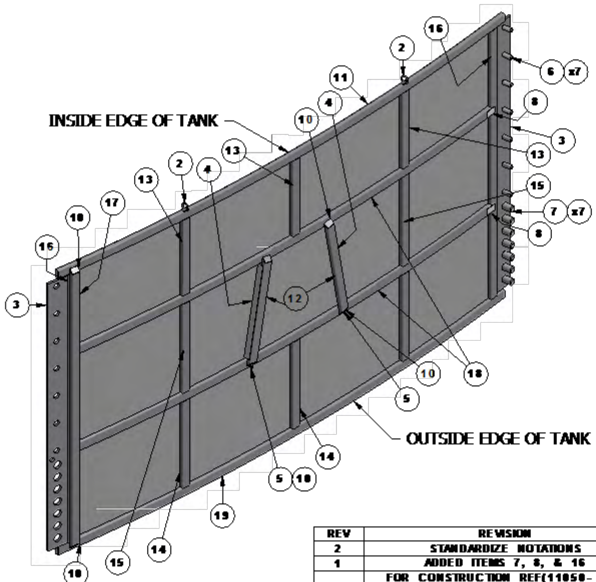
Bryan Prosinski, P.E., S.E.
Pillar Structural Engineering

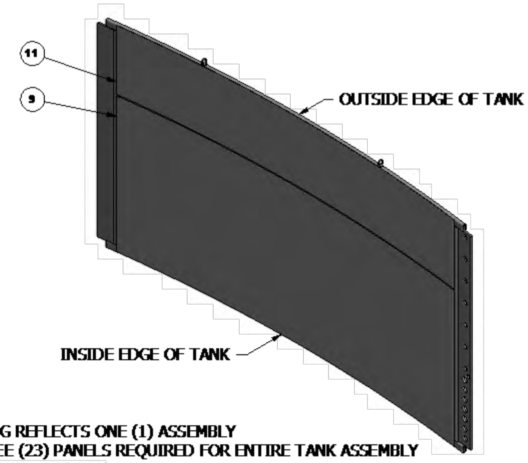
PILLAR
STRUCTURAL
ENGINEERING

Received by OCD: 4/13/2022 9:13:07 AM

Parts List

CK	ITEM	QTY	DESCRIPTION	WIDTH	LENGTH	MATERIAL	CLENGTH (in)	WEIGHT
	1	14	BAR, ROUND, 5/8" (LOCK PIN)		6 1/2 in	A36	6.50	
	2	2	D-RING, 1/2" B38, WORKING LOAD 4080 lbs			A29/A29M - 91 1045(C-1045), MODIFIED TO WELD DOWN		2
	3	2	FBAR, 1"	10 in	131 1/2 in	A36	131.50	373
	4	2	FBAR, 10GA	3 in	43 1/8 in	A36	86.25	99
	5	2	PAD EYE, #2			CROSBY GROUP, S-264		0
	6	7	PIN, 2" DIA		4 1/2 in	KUSTOM KONCEPTS, A1018	31.50	3
	7	7	PIN, 3 " DIA		4 1/2 in	KUSTOM KONCEPTS, A1018	31.50	8
	8	2	PLATE, 3/16"	3 in	5 in	A36	10.00	2
	9	1	PLATE, 3/16"	96 in	240 in	A36	240.00	156
	10	6	SHEET, 10GA	2 1/2 in	3 3/4 in	A36	22.50	3
	11	1	SHEET, 10GA	42 1/2 in	240 in	A36	240.00	50
	12	2	TUBE, 4" x 2" x 1/4" (MITER BOTH ENDS)		52 in	A500B CLEAN COAT	104.00	55
	13	3	TUBE, 4" x 2" x 3/16"		37 1/4 in	A500B CLEAN COAT	74.50	43
	14	3	TUBE, 4" x 2" x 3/16"		42 3/4 in	A500B CLEAN COAT	128.25	74
	15	2	TUBE, 4" x 2" x 3/16"		44 in	A500B CLEAN COAT	88.00	50
	16	2	TUBE, 4" x 2" x 3/16"		132 in	A500B CLEAN COAT	264.00	151
	17	1	TUBE, 4" x 2" x 3/16" (MITER BOTH ENDS)		137 1/2 in	A500B CLEAN COAT	137.50	78
	18	2	TUBE, 4" x 2" x 3/16", (ROLL TO 155'-6 7/8" I.D.)		236 3/8 in	A500B CLEAN COAT	472.75	271
	19	2	TUBE, 4" x 2" x 3/16", (ROLL TO 155'-6 7/8" I.D.)		253 7/8 in	A500B CLEAN COAT	507.75	291





NOTES:
-THIS DRAWING REFLECTS ONE (1) ASSEMBLY
-TWENTY THREE (23) PANELS REQUIRED FOR ENTIRE TANK ASSEMBLY

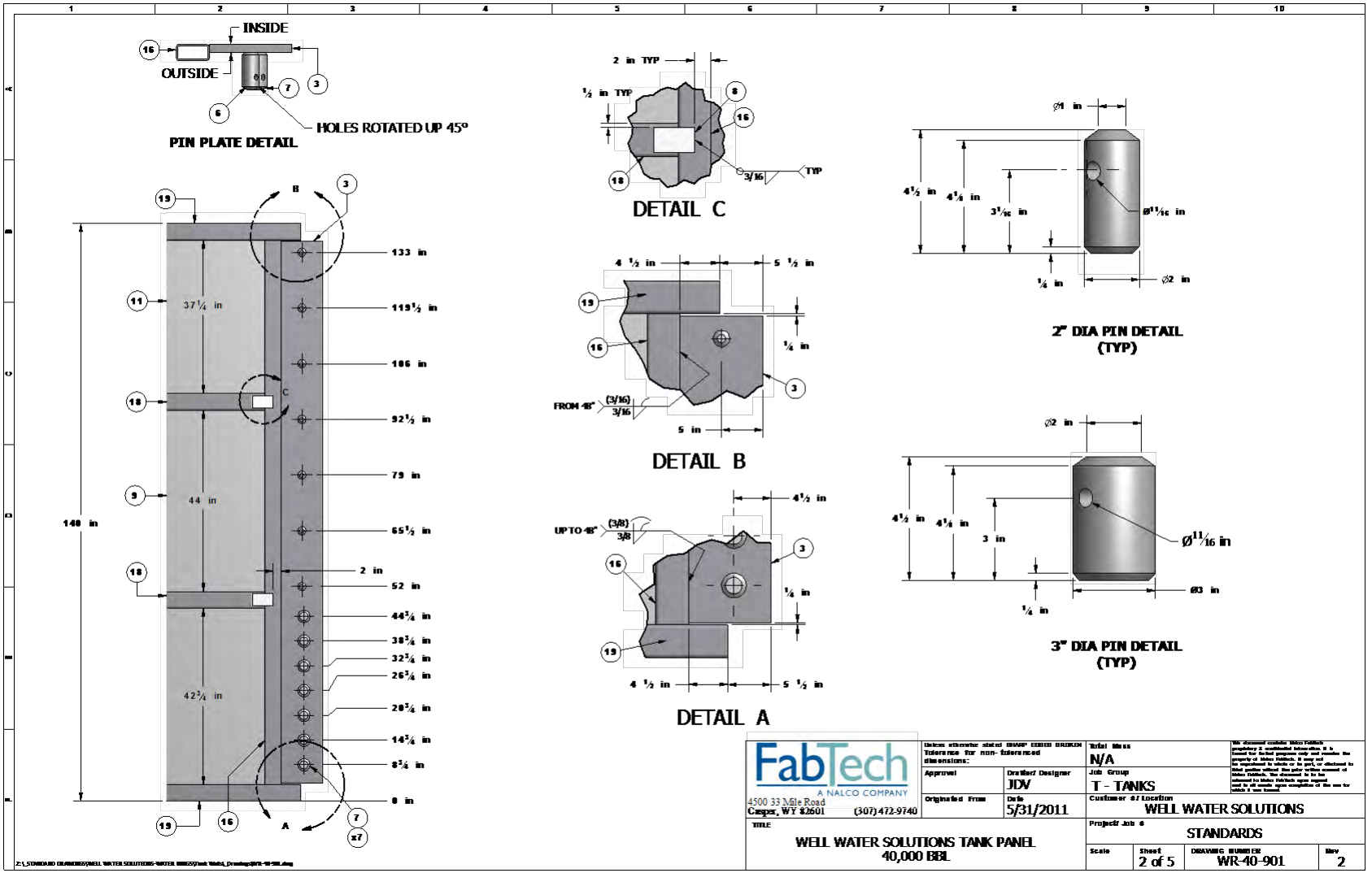
REV	REVISION	DATE	BY
2	STANDARDIZE NOTATIONS	1/17/2012	JDV
1	ADDED ITEMS 7, 8, & 16	12/09/11	DSG
0	FOR CONSTRUCTION REF(11050-901) CHANGED HEIGHT AND LOCATION OF PINS REF(11078-40-901)	9/1/2011	CJD

FabTech
A NALCO COMPANY
4500 33 Mile Road
Casper, WY 82601 (307) 472-9740

Unless otherwise stated SHARP EDGES BROKEN Tolerance for non-toleranced dimensions:		Total Mass: N/A	
Approval	Drafted Designer: JDV	Job Group: T - TANKS	
Originated From	Date: 5/31/2011	Customer of Location: WELL WATER SOLUTIONS	
TITLE: WELL WATER SOLUTIONS TANK PANEL 40,000 BBL		Project Job #: STANDARDS	
		Scale	Sheet: 1 of 5
		DRAWING NUMBER: WR-40-901	Rev: 2

Released to Imaging: 5/4/2022 2:56:47 PM

Page 39 of 164



FabTech
A NALCO COMPANY
4500 33 Mile Road
Casper, WY 82601 (307) 472-9740

Unless otherwise stated SHARP EDGES BROKEN
Tolerance for non- toleranced dimensions:

Approved
Drafter/ Designer JDV
Originated From
Date 5/31/2011

Total Mass N/A
Job Group T - TANKS
Customer or Location WELL WATER SOLUTIONS
Project/ Job # STANDARDS

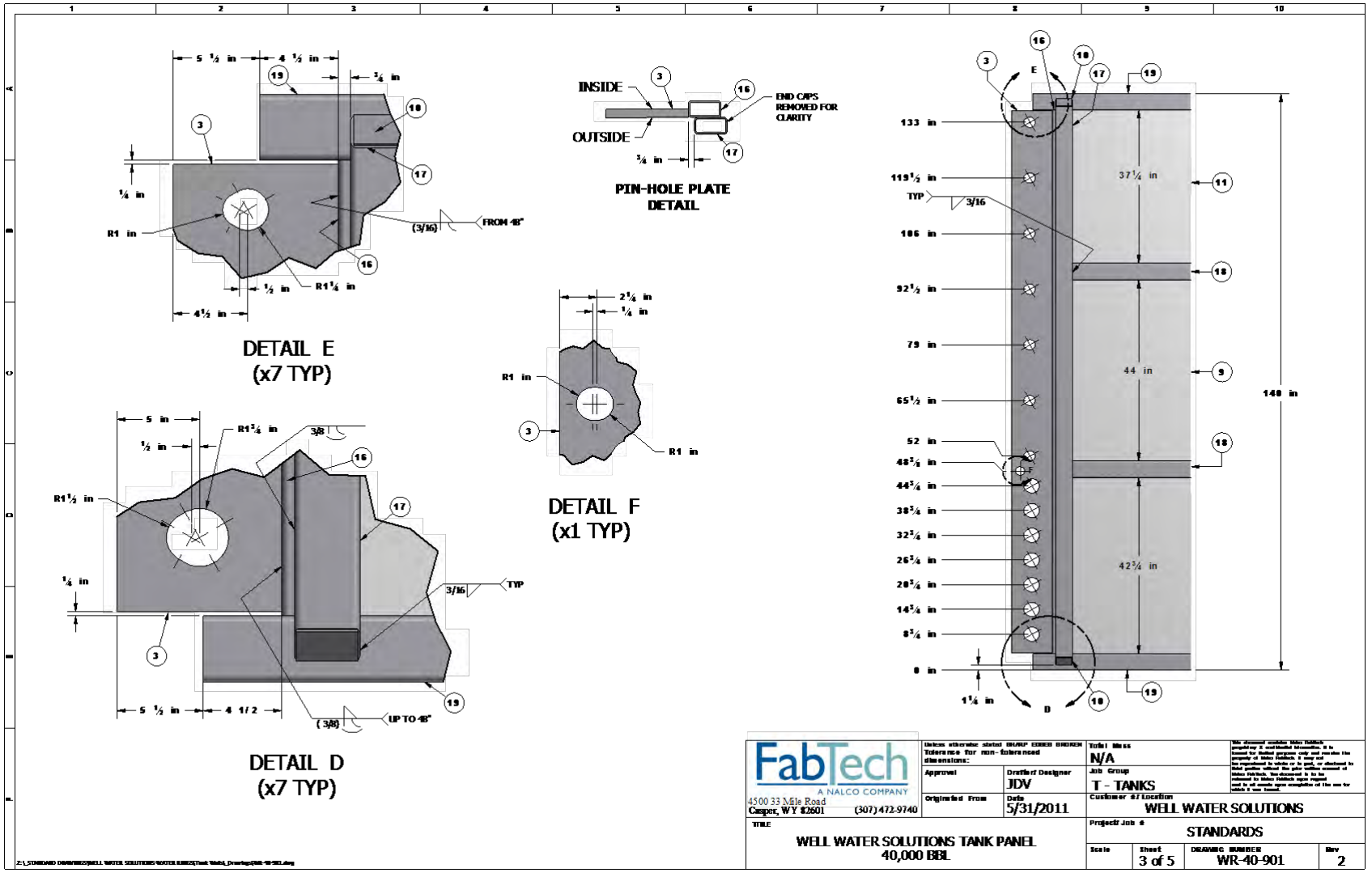
TITLE
WELL WATER SOLUTIONS TANK PANEL
40,000 BBL

Scale
Sheet 2 of 5
DRAWING NUMBER WR-40-901
Rev 2

This document contains Sharp Fabtech's proprietary & confidential information. It is issued for its best purposes only and remains the property of Sharp Fabtech. It may not be reproduced in whole or in part, or disclosed to third parties without the prior written consent of Sharp Fabtech. This document is to be returned to Sharp Fabtech upon request and in any event upon completion of the use for which it was loaned.

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 40 of 164



DETAIL E
(x7 TYP)

DETAIL F
(x1 TYP)

DETAIL D
(x7 TYP)

FabTech
A NALCO COMPANY
4500 33 Mile Road
Casper, WY 82601 (307) 472-9740

Unless otherwise stated SHARP EDGES BROKEN
Tolerance for non-toleranced dimensions:

Approval

Drafter/ Designer: JDV

Originated From

Date: 5/31/2011

Total Mass: N/A

Job Group: T - TANKS

Customer & Location: WELL WATER SOLUTIONS

Project/ Job #: STANDARDS

TITLE: WELL WATER SOLUTIONS TANK PANEL 40,000 BBL

Scale

Sheet: 3 of 5

DRAWING NUMBER: WR-40-901

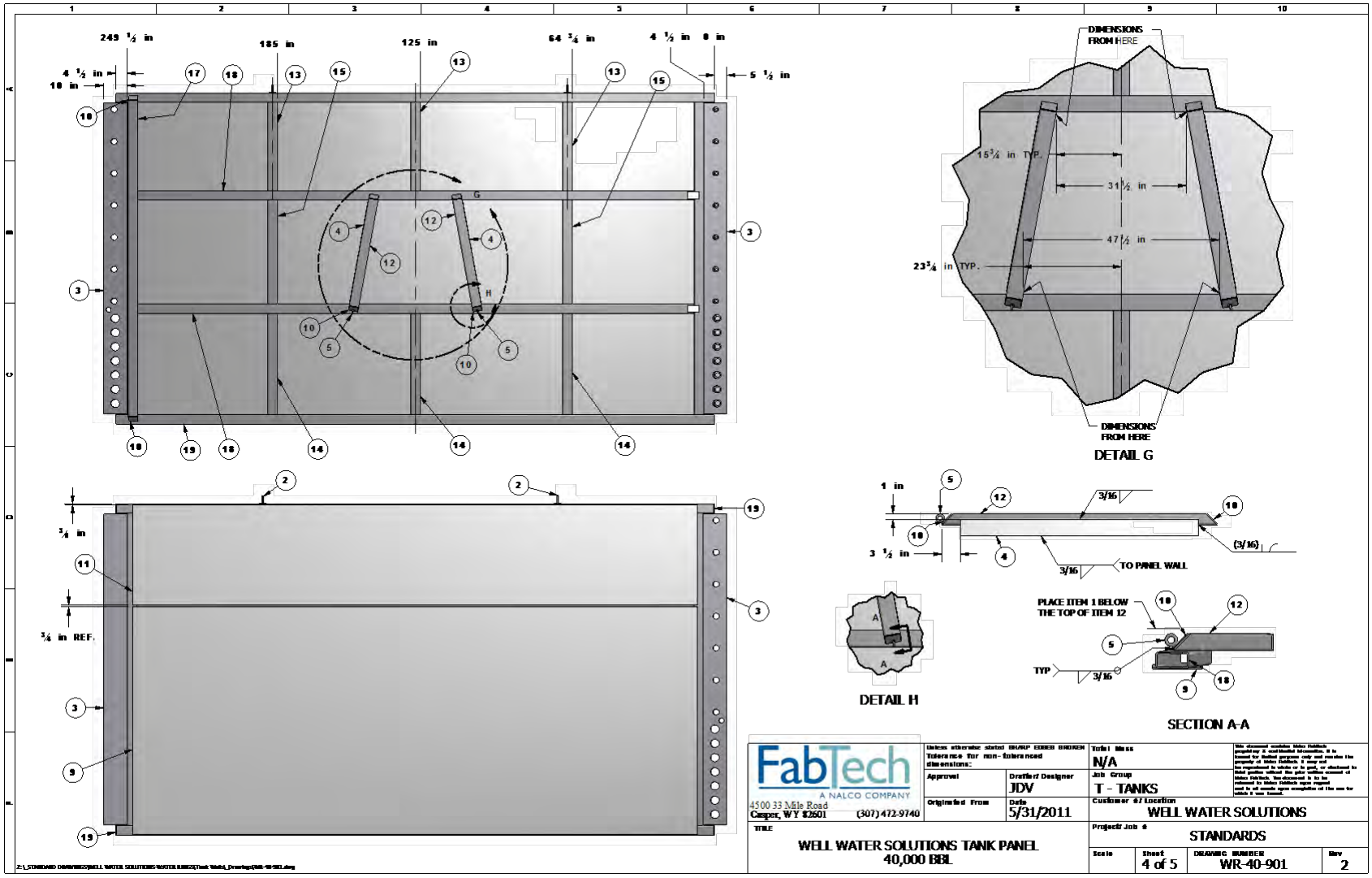
Rev: 2

Z:_STANDARD DRAWINGS\WELL WATER SOLUTIONS-WATER SURGE\Tank Walls_Drawings\WR-40-901.dwg

Received by OCD: 4/13/2022 9:13:07 AM

Released to Imaging: 5/4/2022 2:56:47 PM

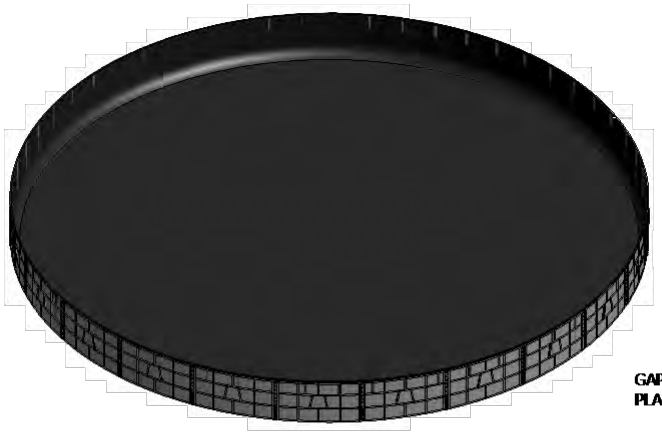
Page 41 of 164

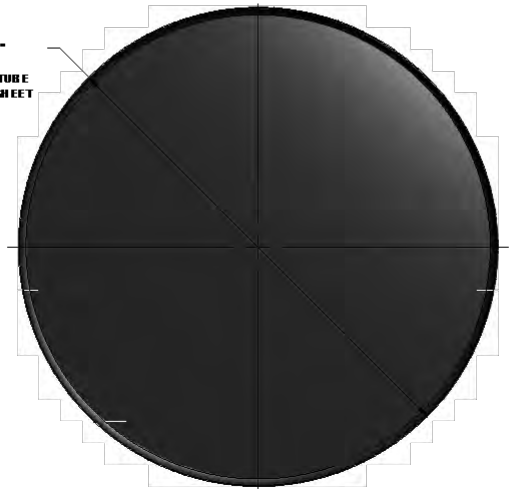


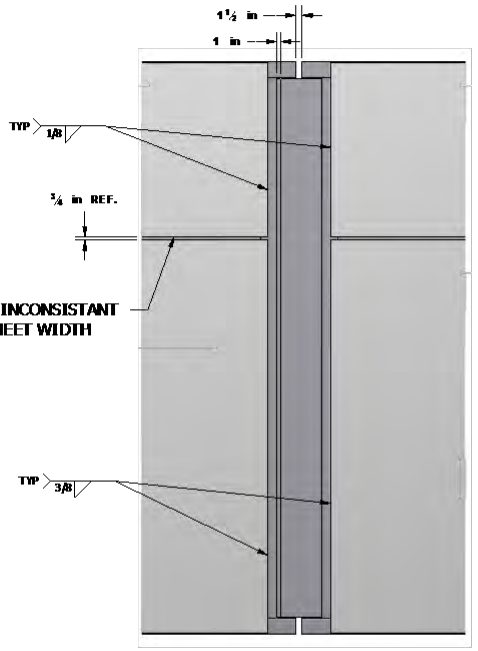
Received by OCD: 4/13/2022 9:13:07 AM

Released to Imaging: 5/4/2022 2:56:47 PM

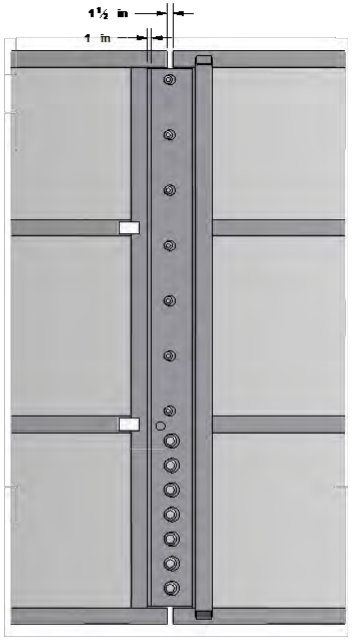
Page 42 of 164







SEAM DETAIL
(INSIDE-OUT)



SEAM DETAIL
(OUTSIDE-IN)

FabTech
A NALCO COMPANY
4500 33 Mile Road
Casper, WY 82601 (307) 472-9740

Unless otherwise stated GRIND EDGES BROKEN
Tolerance for non-toleranced dimensions:

Approved | Drafter/ Designer: JDV | Originated From | Date: 5/31/2011

Total Mass: N/A

Job Group: T - TANKS

Customer of location: WELL WATER SOLUTIONS

Project Job #: STANDARDS

TITLE: WELL WATER SOLUTIONS TANK PANEL
40,000 BBL

Scale | Sheet: 5 of 5 | DRAWING NUMBER: WR-40-901 | Rev: 2

This document contains Nalco FabTech proprietary & confidential information. It is issued for limited purposes only and remains the property of Nalco FabTech. It may not be reproduced in whole or in part, or disclosed to third parties without the prior written consent of Nalco FabTech. The document is to be returned to Nalco FabTech upon request and in all events upon completion of the use for which it was issued.

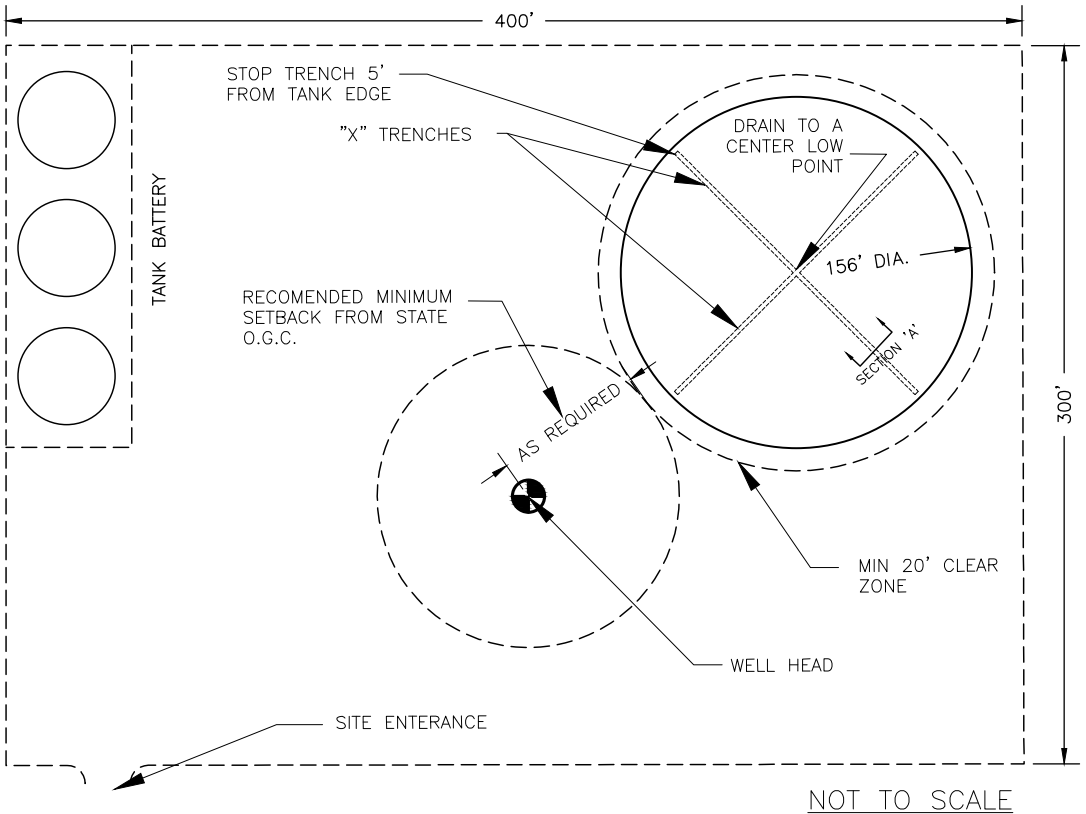
Z:_STANDARD DRAWINGS\WELL WATER SOLUTIONS-WATER BBLS\Tank Walls_Drawings\WR-40-901.dwg

Received by OCD: 4/13/2022 9:13:07 AM

Released to Imaging: 5/4/2022 2:56:47 PM

Section 1.09 Proper AST Setback and Location Sample

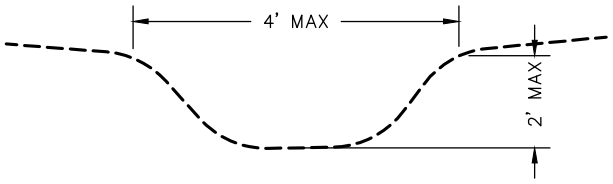
DATE: 06/30/14 DWG BY: MDW SHEET NO: 1 OF 1	MLVT LOCATION STANDARD MAP	FOR: WELL WATER SOLUTIONS & RENTALS ATTN: SEAN LOVELACE PO BOX 2105 CASPER, WYOMING 82602



TRENCH NOTES:

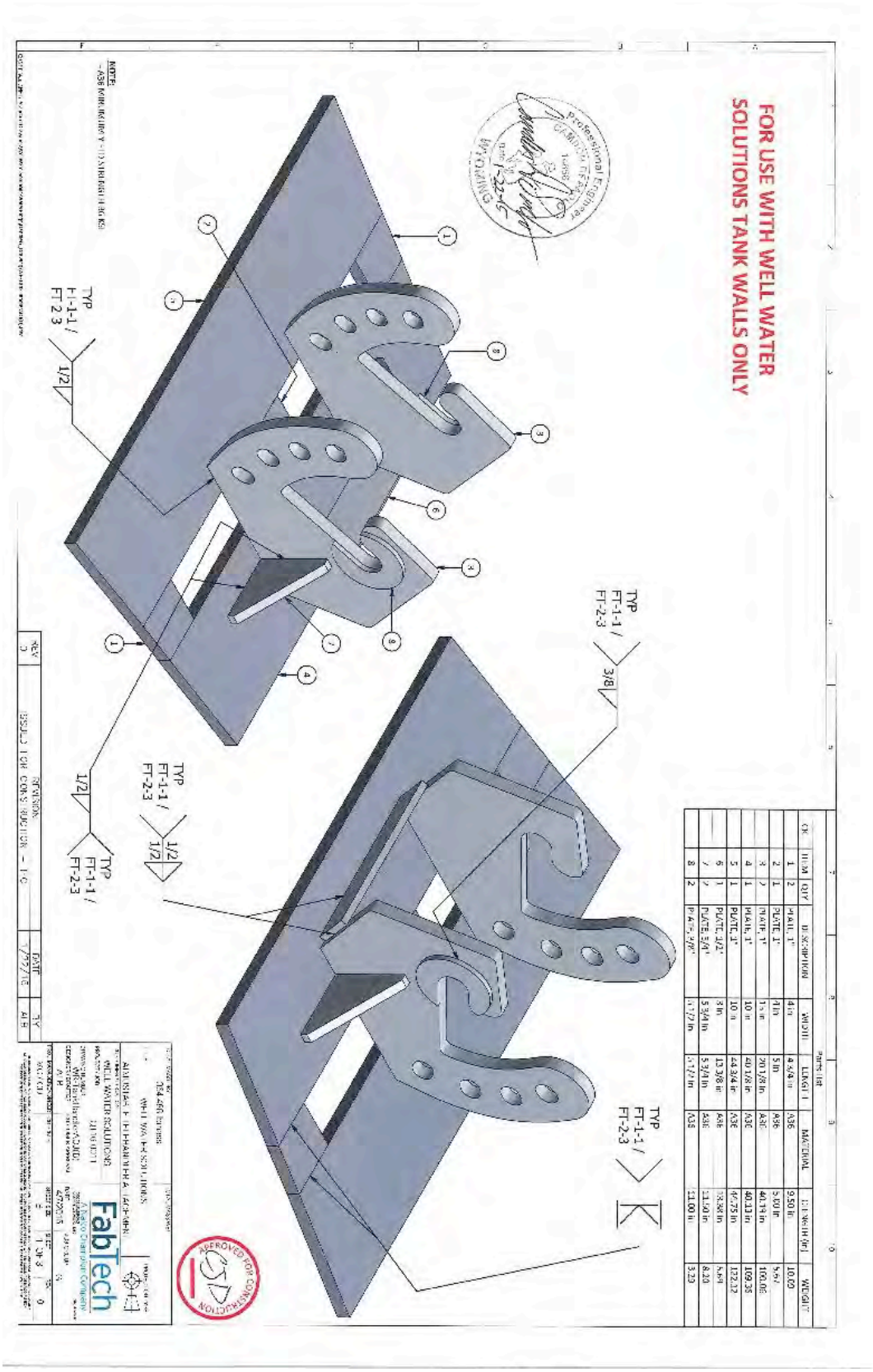
1. TRENCHES SHALL HAVE A MAXIMUM DEPTH OF 2' AND MAXIMUM WIDTH OF 4'.
2. TRENCHES SHALL BE CONSTRUCTED A MINIMUM DISTANCE OF 5' FROM TANK WALLS.
3. TRENCHES SHALL BE GRADED TO A COMMON CENTER SUCTION POINT.
4. TRENCH EDGES SHALL BE SMOOTH AND ROUNDED.

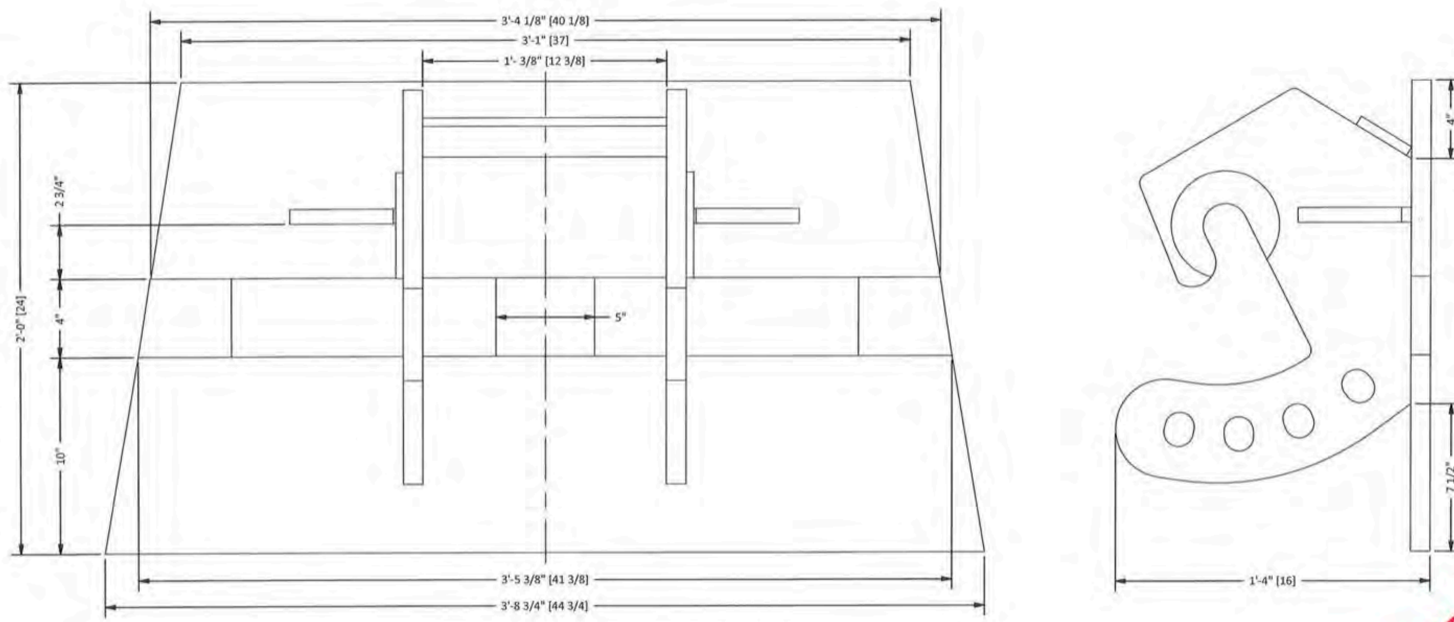
SECTION 'A'



WLC
ENGINEERING • SURVEYING • PLANNING
200 PRONGHORN, CASPER, WY. 82601

Section 1.10 JGL Approved Telehandler Attachment with Load Chart





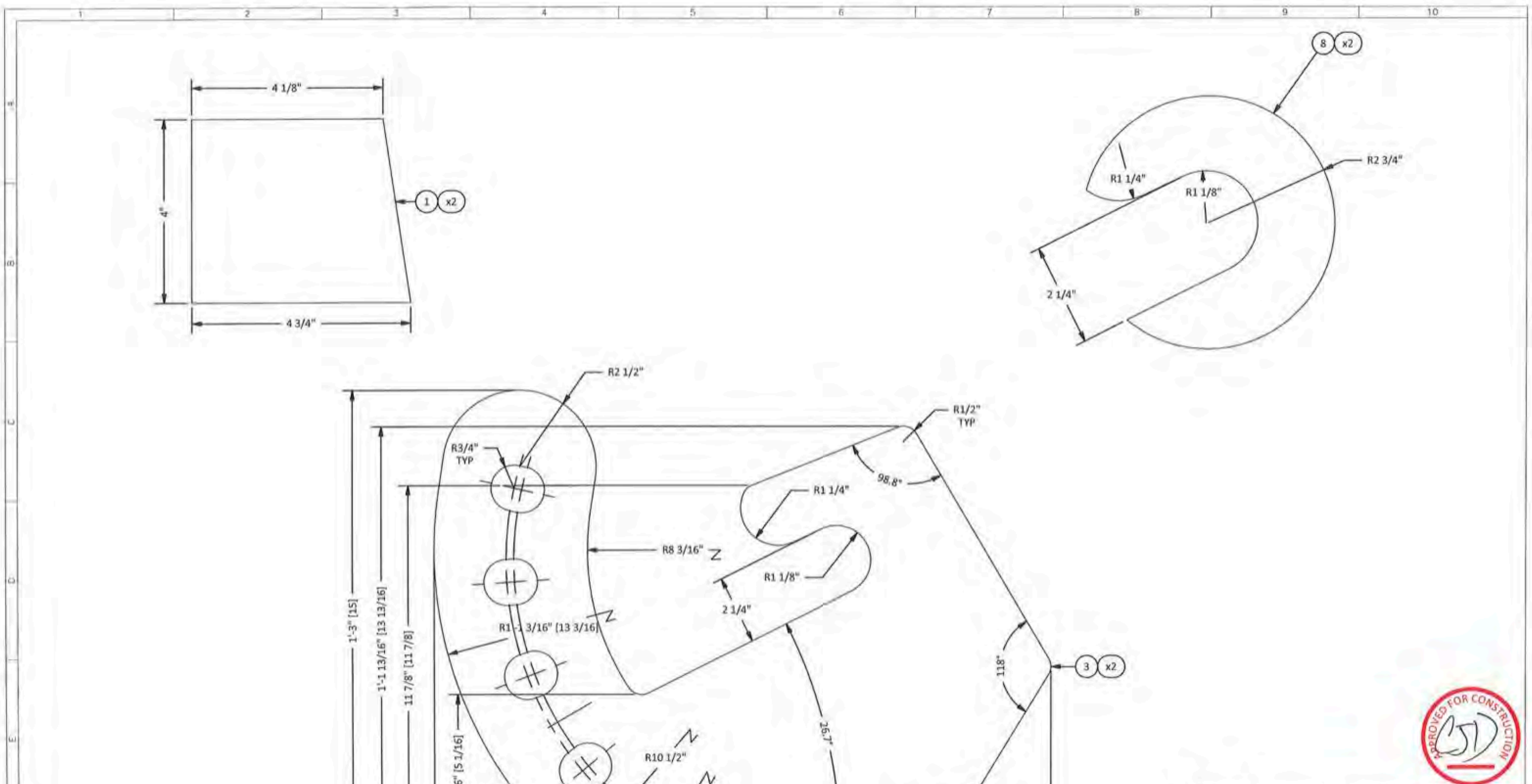
APPROVED FOR CONSTRUCTION

TOTAL MASS DRY	TOTAL MASS WET		
364.488 lbmass			
TITLE: WELL WATER SOLUTIONS ADJUSTABLE TELEHANDLER ATTACHMENT		PROJECTION TYPE	
CUSTOMER / LOCATION: WELL WATER SOLUTIONS	FabTech A Nalco Champion Company		
PROJECT / JOB: QT16-0011			
DRAWING NUMBER: WR-TankHandlerADJ(B)			
DESIGNER / DRAFTER: ALB	CUSTOMER APPROVAL	DATE: 4/7/2015	JOB GROUP: G
PROJ. MANAGER/ENGINEER: MC / CD	CHECKER	SHEET SIZE: B	SHEET: 2 OF 3 / REV. 0

Received by OCD: 4/13/2022 9:13:07 AM

Released to Imaging: 5/4/2022 2:56:47 PM

Page 46 of 164



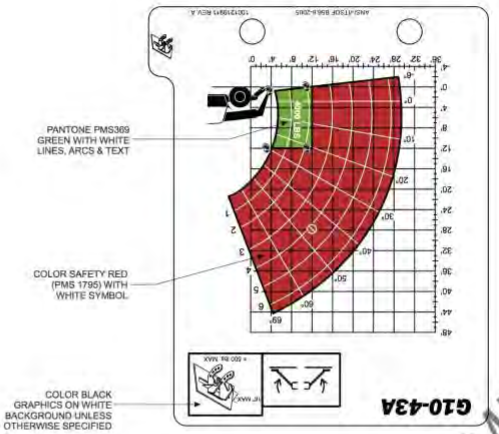
TOTAL MASS DRY: 364.488 lbmass		TOTAL MASS WET	
TITLE: WELL WATER SOLUTIONS ADJUSTABLE TELEHANDLER ATTACHMENT			PROJECTION TYPE
CUSTOMER / LOCATION: WELL WATER SOLUTIONS		FabTech A Nalco Champion Company	
PROJECT / JOB: QT16-0011			
DRAWING NUMBER: WR-TankHandlerADJ(B)			
DESIGNER / DRAFTER: ALB	CUSTOMER APPROVAL	DATE: 4/7/2015	JOB GROUP: G
PROJ. MANAGER/ENGINEER: MC / CD	CHECKER	SHEET SIZE: B	SHEET: 3 OF 3 — REV: 0

Received by OCD: 4/13/2022 9:13:07 AM

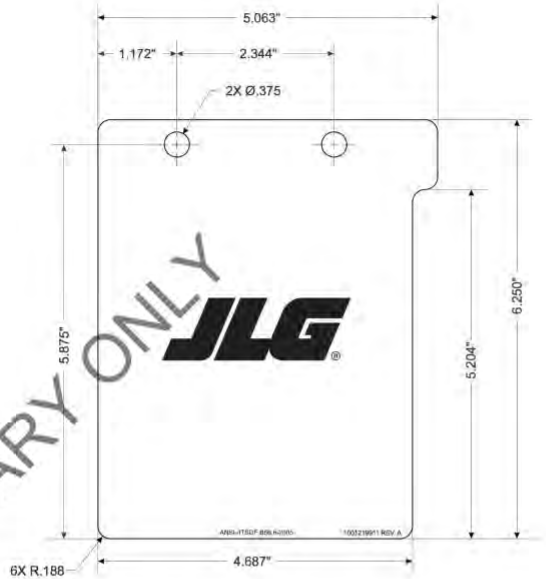
Released to Imaging: 5/4/2022 2:56:47 PM

Page 47 of 164

DRAWING NUMBER
1001219911



BACK



FRONT

PRELIMINARY ONLY

NOTES:

1. VENDOR TO OBTAIN ELECTRONIC ART FILE FROM JLG INDUSTRIES, INC.
2. DECAL TO BE WHITE BACKGROUND WITH BLACK OR COLOR PRINTING. ALL COLORS TO BE PER JLG SPEC.4150024, UNLESS OTHERWISE SPECIFIED.
3. MATERIAL - .030 THICK WHITE GLOSS VINYL.

DRAWINGS CREATED IN COREL.
UNLESS OTHERWISE SPECIFIED, ALL
DIMENSIONS ARE IN INCHES.

THIS PRINT IS THE PROPERTY OF JLG INDUSTRIES, INC. AND CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION OF JLG. IT MAY NOT BE COPIED OR DISCLOSED TO ANY THIRD PARTY WITHOUT JLG'S WRITTEN CONSENT AND IS PROVIDED FOR THE LIMITED PURPOSE OF REVIEW AND EVALUATION.

REV	ZONE	DATE	BY	DESCRIPTION	PAR	ER NO	CHKD

REVISIONS

SPECIFICATIONS	UNLESS OTHERWISE SPECIFIED ALL TOLERANCES ARE: ± .020	DRAWN BY : S. ORUMPATI	JLG
DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994		DATE : 14JUN16	TITLE: LOAD, WELL WATER ATTACH,G10-43A,DOWN
JLG TORQUE CHART 5000059 APPLIES TO ITEMS WITHIN	ALL ANGLES ±1° UNLESS OTHERWISE SPECIFIED	CHK'D. BY : J. BOYLAN	
		DATE : 14JUN16	
ALL WELDING TO STRUCTURAL WELD CODE-STEEL ANSI/AWS D1.1		E.R. NO. : 161657	MATERIAL: SEE NOTES
NEXT ASSY 1001219910	THIRD ANGLE PROJECTION	FINISH:	SIZE C | CAGE CODE: 1YHH8 | DWG NO. 1001219911 | REV A
DO NOT SCALE DRAWING		REF. DWG. :	SCALE: 1/1 | EST WT: .050 LB/.023 kg | SHEET: 1 OF 1
		MACH. SURF 125 MAX	

Received by OCD: 4/13/2022 9:13:07 AM

Released to Imaging: 5/4/2022 2:56:47 PM

Section 1.13 Geomembrane Fabrication Manual and Testing Chart

MLVT GEOMEMBRANE PANEL FABRICATION MANUAL

Well Water Solutions, Inc.

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

TERMINOLOGY

The following definitions will be used throughout this document.

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

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

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

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

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

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

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

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

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

MLVT – Modular Large Volume Tank

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

1.0 GENERAL

1.1 Products

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

1.2 Markings

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

2.0 Subgrade Preparation

A. The Earthwork Contractor shall be responsible for preparing and maintaining the subgrade in a condition suitable for installation of MLVT Geomembrane Panel. Any damage to the surface caused by weather conditions or other conditions must be repaired prior to MLVT Geomembrane Panel deployment. The installer will submit, prior to installing the MLVT Geomembrane Panel, written approval of the subgrade surface on which the MLVT Geomembrane Panel will be installed.

B. All surfaces in contact with the MLVT Geomembrane Panel must be free of sharp stones, stones over 3/8" in diameter, sticks and other debris that can puncture or tear the MLVT Geomembrane Panel. No standing water, mud, snow or excessive moisture should be on the subgrade when the MLVT Geomembrane Panel is deployed. Subgrade should be constructed of a firm stable material compacted to a 95% proctor.

3.0 Deployment of MLVT Geomembrane Panels

A. The MLVT Geomembrane Panel shall be placed at the edge of the tank layout and be lined up with the centerline of the tank layout. Unroll the MLVT Geomembrane Panel down the centerline of the tank layout. Verify the markings on the MLVT Geomembrane Panel line up with the tank layout. If needed adjust the placement of the MLVT Geomembrane Panel prior to proceeding with installation.

B. The MLVT Geomembrane Panel is then unfolded in the perpendicular direction to which it was unrolled in one direction. The next step is to unfold the MLVT Geomembrane Panel in the opposite direction of the first unfold direction.

C. See sketch at end of document for clarification of these steps.

4.0 MLVT Geomembrane Representative Welds

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

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

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

5.0 Seam Testing Criterion

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

A. Tensiometer Peel Strength Test:

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

B. Tensiometer Tensile Strength Test:

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

C. Shear and peel test results shall conform to either GRI GM 19 requirements or to the manufacturer's requirements.

D. All Field Seams shall be 100% tested by high pressure air lance in accordance with ASTM D 4437.

6.0 Field Thermal Wedge Weld Seaming Procedures

4 to 6 inches per NMOCD Rule

A. Adjacent MLVT Geomembrane Panels shall be overlapped by approximately 4" for fusion welding. Panel edges to be seamed shall be clean of all foreign matter or debris before seaming commences. Welding can occur once the sheets to be joined have been cleaned and brought into their exact position.

B. When starting a new weld, the machine shall be manually placed into the overlapped sheet of material.

C. Welder alignment and temperature shall be monitored during the seaming process and adjustments will be made as necessary. The welded seams must be 100% visually inspected as welding machinery advances.

D. All cross seams or "T" intersections caused by material roll splices where 3 layers of membrane material occur shall be patched where they intersect with 3" or larger diameter patches of the MLVT Geomembrane material. Patches shall be applied by use of a hand held heat gun and seam roller. All patches and repairs shall be 100% tested by high pressure air lance or vacuum box in accordance with ASTM D 4437 and ASTM D 5641.

E. Should a defective seam be found, welding shall be ceased until the cause of the defect is determined and rectified and the seam is repaired. Documentation of the defect and repair shall be recorded on the Seam Quality Control Form.

7.0 Fold back of MLVT Geomembrane Panels

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

8.0 MLVT Geomembrane Panel final deployment

A. Once the steel walls are assembled they need to be inspected for any sharp surfaces that could damage the MLVT Geomembrane Panels and there needs to be a support material placed as a chamfer at the transition from the wall to the subgrade to eliminate the possibility of stressing the MLVT Geomembrane panel at the 90 degree transition. This support material can be sand tubes, precut foam, etc.

B. Next the MLVT Geomembrane Panels need to be placed up and over the walls. This step is completed with the assistance of equipment used to lift the edge of the MLVT Geomembrane Panel up the height of the steel wall. Enough material should be lifted up and over the wall to create the proper overhang so the liner does not fall back off the wall while the clamping system is installed.

C. The MLVT Geomembrane Panels shall be protected at all times from damage and all equipment and methods used to lift, place and clamp shall not damage the MVLT GEomembrane Panel and shall not impart excess stress in the MVLT Geomembrane Panels and thermally welded seam areas.

D. ALL tank panel erection, assembly, placement and lifting of MVLT GEomembrane Panel is by others. CLI shall not be responsible for damages to the MVLT Geomembrane Panel after delivery / customer pickup or once installation is completed, if performed by CLI.

End of Specification

Page 53 of 164

Quality Control Air Testing

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

Date of Test	Start Time	End Time	Seam No.	Seam Length	A C	A L	V B	S T	Pass/Fail	Welding Technician	Welder No.	Welder Speed	Welder Temp.
AC=Air Channel Test AL=Air Lance Test VB=Vacuum Box Test ST=Spark Test													

COLORADO LINING INTERNATIONAL
1062 Singing Hills Road Parker, Colorado 80138 / 1-800-524-8672 / 303-841-2022 / Fax 303-841-5780 / www.coloradolining.com

Received by OCD: 4/13/2022 9:13:07 AM

Released to Imaging: 5/4/2022 2:56:47 PM

Section 1.14 Geomembrane Installation Manual

MLVT GEOMEMBRANE PANEL INSTALLATION MANUAL

Well Water Solutions, Inc.

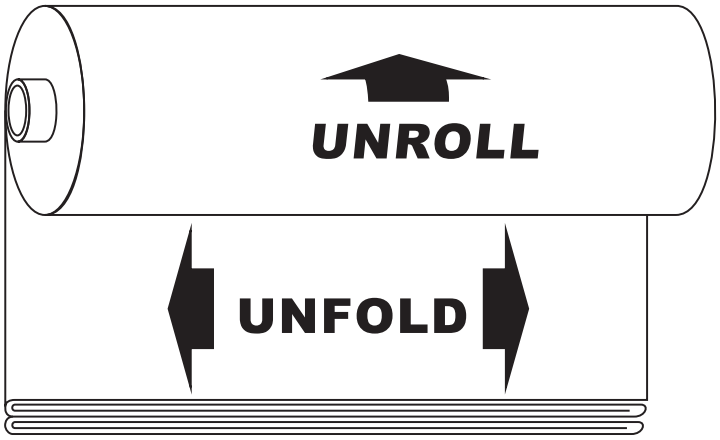
COLORADO LINING INTERNATIONAL

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

COLORADO LINING INTERNATIONAL
www.coloradolining.com

DEPLOYMENT OF DUAL DIRECTION ACCORDION FOLDED PANELS

(SHEET 1 OF 2)

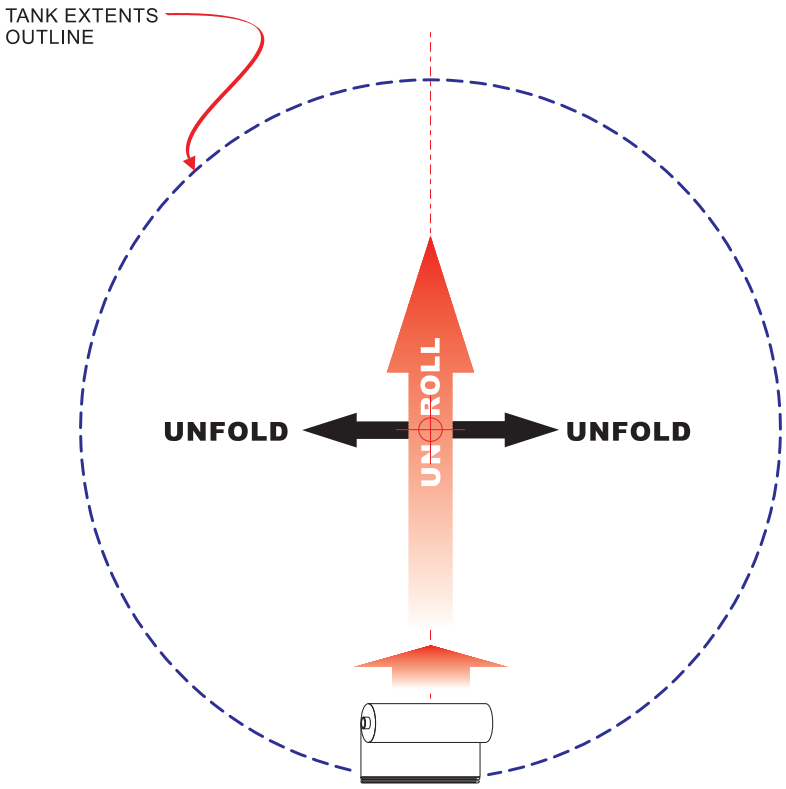


COLORADO LINING INTERNATIONAL
www.coloradolining.com

DEPLOYMENT OF DUAL DIRECTION ACCORDION FOLDED PANELS

(SHEET 2 OF 2)

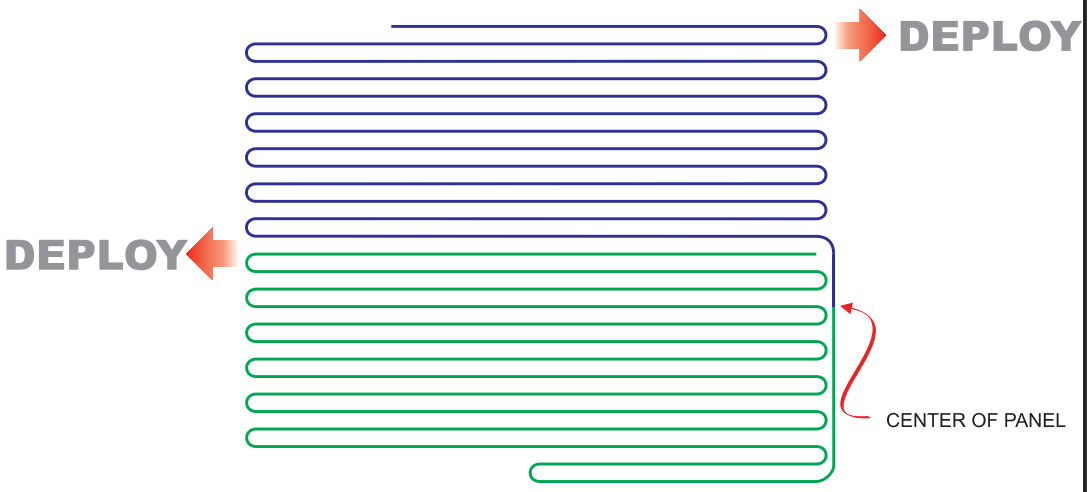
CLI FABRICATES FRAC TANK PANEL LINERS AND UNDERLAYMENTS IN A DUAL DIRECTION ACCORDION FOLDED MANNER SO THAT THE PANELS CAN BE DEPLOYED ON THE TANK'S CENTERLINE. AFTER THE INITIAL UN-ROLLING THE PANELS ARE THEN UN-FOLDED IN PERPENDICULAR DIRECTIONS



COLORADO LINING INTERNATIONAL
www.coloradolining.com

DOUBLE DIRECTION ACCORDION FOLDED PANEL SCHEMATIC

(SHEET 2 OF 2)



EXAMPLE OF A 26 SHEET B-40 TANK LINER

Section 1.15 WWS Preferred Liner Spec or Comparable Substitute

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

January 22, 2018

Western ProLine
184 Hwy 59 North
Miles City, MT 59301

RE: GSE LLDPE Geomembrane Permeability

Certification of Compliance

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

Sincerely,

Miguel Garcia
GSE Technical Support

MG18-0005

TECHNICAL NOTE

Chemical Resistance Chart

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

Medium	Concentration	Resistance at: 20° C (68° F)	20° C (140° F)
A			
Acetic acid	100%	S	L
Acetic acid	10%	S	S
Acetic acid anhydride	100%	S	L
Acetone	100%	L	L
Adipic acid	sat. sol.	S	S
Allyl alcohol	96%	S	S
Aluminum chloride	sat. sol.	S	S
Aluminum fluoride	sat. sol.	S	S
Aluminum sulfate	sat. sol.	S	S
Alum	sol.	S	S
Ammonia, aqueous	dil. sol.	S	S
Ammonia, gaseous dry	100%	S	S
Ammonia, liquid	100%	S	S
Ammonium chloride	sat. sol.	S	S
Ammonium fluoride	sol.	S	S
Ammonium nitratesat. sol.		S	S
Ammonium sulfate	sat. sol.	S	S
Ammonium sulfide	sol.	S	S
Amyl acetate	100%	S	L
Amyl alcohol	100%	S	L
B			
Barium carbonate	sat. sol.	S	S
Barium chloride	sat. sol.	S	S
Barium hydroxide	sat. sol.	S	S
Barium sulfate	sat. sol.	S	S
Barium sulfide	sol.	S	S
Benzaldehyde	100%	S	L
Benzene	—	L	L
Benzoic acid	sat. sol.	S	S
Beer	—	S	S
Borax (sodium tetraborate)	sat. sol.	S	S
Boric acid	sat. sol.	S	S
Bromine, gaseous dry	100%	U	U
Bromine, liquid	100%	U	U
Butane, gaseous	100%	S	S
1-Butanol	100%	S	S
Butyric acid	100%	S	L
C			
Calcium carbonate	sat. sol.	S	S
Calcium chlorate	sat. sol.	S	S
Calcium chloride	sat. sol.	S	S
Calcium nitrate	sat. sol.	S	S
Calcium sulfate	sat. sol.	S	S
Calcium sulfide	dil. sol.	L	L
Carbon dioxide, gaseous dry	100%	S	S
Carbon disulfide	100%	L	U
Carbon monoxide	100%	S	S
Chloracetic acid	sol.	S	S
Carbon tetrachloride	100%	L	U
Chlorine, aqueous solution	sat. sol.	L	U
Chlorine, gaseous dry	100%	L	U
Chloroform	100%	U	U
Chromic acid	20%	S	L
Chromic acid	50%	S	L
Citric acid	sat. sol.	S	S

Medium	Concentration	Resistance at: 20° C (68° F)	20° C (140° F)
Copper chloride	sat. sol.	S	S
Copper nitrate	sat. sol.	S	S
Copper sulfate	sat. sol.	S	S
Cresylic acid	sat. sol.	L	—
Cyclohexanol	100%	S	S
Cyclohexanone	100%	S	L
D			
Decahydronaphthalene	100%	S	L
Dextrine	sol.	S	S
Diethyl ether	100%	L	—
Dioctylphthalate	100%	S	L
Dioxane	100%	S	S
E			
Ethanediol	100%	S	S
Ethanol	40%	S	L
Ethyl acetate	100%	S	U
Ethylene trichloride	100%	U	U
F			
Ferric chloride	sat. sol.	S	S
Ferric nitrate	sol.	S	S
Ferric sulfate	sat. sol.	S	S
Ferrous chloride	sat. sol.	S	S
Ferrous sulfate	sat. sol.	S	S
Fluorine, gaseous	100%	U	U
Fluorosilicic acid	40%	S	S
Formaldehyde	40%	S	S
Formic acid	50%	S	S
Formic acid	98-100%	S	S
Furfuryl alcohol	100%	S	L
G			
Gasoline	—	S	L
Glacial acetic acid	96%	S	L
Glucose	sat. sol.	S	S
Glycerine	100%	S	S
Glycol	sol	S	S
H			
Heptane	100%	S	U
Hydrobromic acid	50%	S	S
Hydrobromic acid	100%	S	S
Hydrochloric acid	10%	S	S
Hydrochloric acid	35%	S	S
Hydrocyanic acid	10%	S	S
Hydrofluoric acid	4%	S	S
Hydrofluoric acid	60%	S	L
Hydrogen	100%	S	S
Hydrogen peroxide	30%	S	L
Hydrogen peroxide	90%	S	U
Hydrogen sulfide, gaseous	100%	S	S
Lactic acid	100%	S	S
Lead acetate	sat. sol.	S	—
Magnesium carbonate	sat. sol.	S	S
Magnesium chloride	sat. sol.	S	S
Magnesium hydroxide	sat. sol.	S	S
Magnesium nitrate	sat. sol.	S	S
Maleic acid	sat. sol.	S	S
Mercuric chloride	sat. sol.	S	S
Mercuric cyanide	sat. sol.	S	S
Mercuric nitrate	sol.	S	S

GSE ENVIRONMENTAL™

Section 1.16 Geo Grid Mesh Spec

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

SKAPS TRANSNET™ (TN)
HDPE GEONET 220

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

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

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

This information is provided for reference purposes only and is not intended as a warranty or guarantee. SKAPS assumes no liability in connection with the use of this information.

Section 1.17 Patents and Patent Protections


US008376167B2

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

(10) **Patent No.: US 8,376,167 B2**
(45) **Date of Patent: Feb. 19, 2013**

(54) **PORTABLE RESERVOIR FRAME**

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

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

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

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

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

(65) **Prior Publication Data**

US 2012/0223073 A1 Sep. 6, 2012

Related U.S. Application Data

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

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

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

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

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,875,666	A *	9/1932	Schwemlein	220/693
3,233,251	A *	2/1966	Barrera	52/245
3,648,303	A *	3/1972	Stewart et al.	52/5
4,124,907	A *	11/1978	Laven	52/169.7

FOREIGN PATENT DOCUMENTS

CA	2692016	7/2010

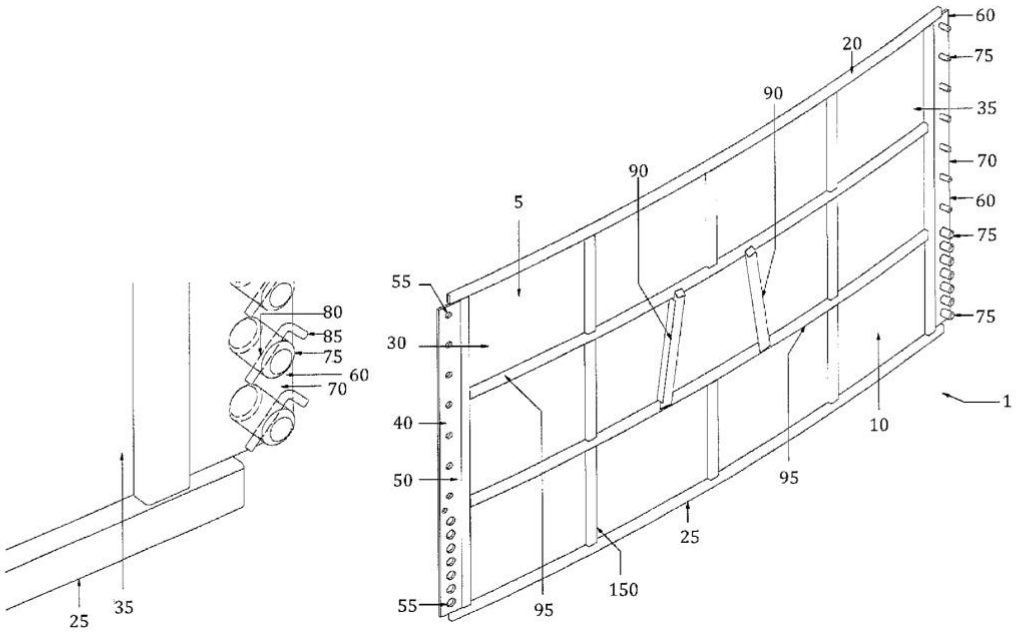
* cited by examiner

Primary Examiner — Anthony Stashick
Assistant Examiner — Christopher McKinley
(74) *Attorney, Agent, or Firm* — Gordon Silver, Ltd.; Ronald C. Gorsché

(57) **ABSTRACT**

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

16 Claims, 11 Drawing Sheets



US008365937B2

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

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

(54) **PORTABLE RESERVOIR FRAME**

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

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

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

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

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

(65) **Prior Publication Data**

US 2012/0234829 A1 Sep. 20, 2012

Related U.S. Application Data

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

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

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

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

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,076,382	A *	10/1913	Maloney	220/4.17
1,875,666	A *	9/1932	Schwemlein	220/693
2,123,035	A *	7/1938	Ashley	220/693
2,914,149	A *	11/1959	Walker	52/394
3,233,251	A *	2/1966	Barrera	52/245
3,562,822	A *	2/1971	Wall	52/245
3,648,303	A *	3/1972	Stewart et al.	52/5
3,736,599	A *	6/1973	Kessler et al.	52/169.7
3,793,651	A *	2/1974	Pitti et al.	52/169.7
3,819,079	A *	6/1974	Levens	220/4.13
4,048,773	A *	9/1977	Laven	52/169.7
4,124,907	A *	11/1978	Laven	52/169.7
4,223,498	A *	9/1980	Ventrice	52/249
4,240,562	A *	12/1980	Holschlag	220/565
4,860,914	A *	8/1989	Derni et al.	220/4.28
4,932,558	A *	6/1990	Katavolos	220/666
5,054,135	A *	10/1991	Dallaire et al.	4/506
5,161,264	A *	11/1992	Dugas	4/506
5,294,019	A *	3/1994	Looker	220/683
6,071,213	A *	6/2000	Raasch et al.	482/29
7,311,827	B2 *	12/2007	Clark et al.	210/232
7,766,184	B2 *	8/2010	Avery et al.	220/573.1
7,918,764	B2 *	4/2011	VanElverdinghe	482/27
2009/0127255	A1 *	5/2009	Rood, Jr.	220/1.5

FOREIGN PATENT DOCUMENTS

CA	2692016	7/2010

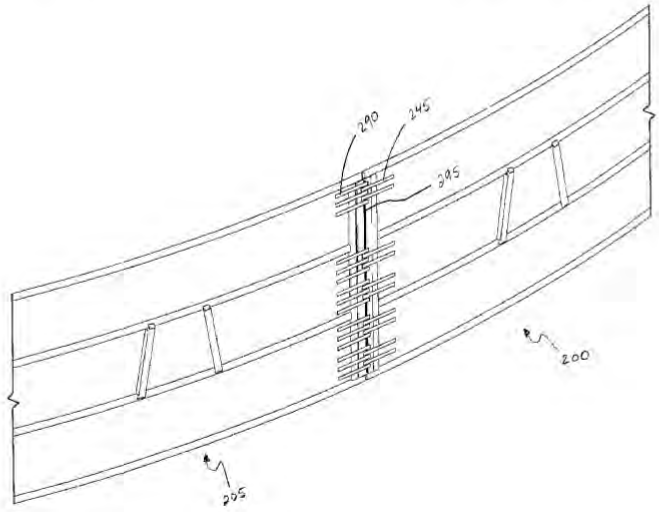
* cited by examiner

Primary Examiner — Anthony Stashick
Assistant Examiner — Christopher McKinley
(74) *Attorney, Agent, or Firm* — Gordon Silver Ltd.; Ronald C. Gorsché

(57) **ABSTRACT**

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

20 Claims, 20 Drawing Sheets



Inland TARP & LINER
4172 North Frontage Rd E Moses Lake, WA 98837
(800) 346-7744 (509) 766-7024 Fax (509) 766-0414
www.inlandtarp.com

TECHNICAL DATA SHEET
Geomembrane 40mil LLDPE

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

Note;

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

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

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

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

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

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:

R. K. Frobel C.V

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

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.

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

R.K. FROBEL & ASSOCIATES
Consulting Engineers

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

Sincerely Yours,

R K Frobel

Ronald K. Frobel, MSCE, PE

References:

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

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

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

Attachments:

R. K. Frobel C.V.

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

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

COLORADO REGISTERED RONALD KENNETH FROBEL 15742 PROFESSIONAL ENGINEER

References:

NMAC 19.15.34.13 OPERATIONAL REQUIREMENTS FOR RECYCLING CONTAINMENTS

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

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

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

Attachments:

R. K. Frobel C.V.

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

Assuming a freeboard of 0.5 ft (minimum modular impoundment freeboard requirement) the 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

32156 Castle Court / Suite 211 / Evergreen, CO 80439
Ph 303-679-0285 Fx 303-679-8955 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

ASTM Standards 2019

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

RONALD K. FROBEL, MSCE, P.E.

CIVIL ENGINEERING
GEOSYNTHETICS
EXPERT WITNESS
FORENSICS

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.

CONTACT DETAILS:

Ronald K. Frobel, MSCE, P.E.
R. K. Frobel & Associates
Consulting Civil/Geosynthetics Engineers
PO Box 2633
Evergreen, Colorado 80439 USA
Phone 720-289-0300
Email: geosynthetics@msn.com

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.

Operation and Maintenance 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

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

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

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

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

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

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

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

© 2020 R.T. HICKS CONSULTANTS, LTD.

order to prevent damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes during injection or withdrawal of liquids.

- Pursuant to an approved variance, the operator will maintain at least 2-feet of freeboard in each AST containment. Under extenuating circumstances, which will be noted on the inspection log as described below, the operator may temporarily exceed the freeboard mandate.
- If the liner develops a leak or if any penetration of the liner occurs above the liquid's surface, then the operator will repair the damage or initiate replacement of the liner within 48 hours of discovery or will seek a variance from the division district office within this time period.
- If visible inspection suggests that the liner developed a leak or if any penetration of the liner occurs below the liquid's surface, then the operator will remove all liquid above the damage or leak line within 48 hours of discovery. The operator will also notify the district division office within this same 48 hours of the discovery and repair the damage or replace the liner.
- In the event of a leak due to a hole in the liner, the following steps will be followed:
    1. If the source of the fluid is uncertain, comparative field tests may need to be performed on both the water in the containment and that which may have been released (e.g. pH, conductance, and chloride).
    2. If the fluid is found to be coming from the containment, determine the location from which the leak is originating.
    3. Mark the point where the water is coming out of the tank.
    4. Locate the puncture or hole in the liner.
    5. Empty the containment to the point of damage in liner.
    6. Clean area of liner that needs to be repaired.

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

19.5.34.13 B
(4) If the containment's primary liner is compromised above the fluid's surface, the operator shall repair the damage or initiate replacement of the primary liner within 48 hours of discovery or seek an extension of time from the division district office.
(5) If the primary liner is compromised below the fluid's surface, the operator shall remove all fluid above the damage or leak within 48 hours of discovery, notify the division district office and repair the damage or replace the primary liner.

© 2020 R.T. HICKS CONSULTANTS, LTD.

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

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

Monitoring, Inspections, and Reporting

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

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

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

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

© 2020 R.T. HICKS CONSULTANTS, LTD.

- Visually inspect the liner. If a liner's integrity is compromised, or if any penetration of the liner occurs below the water surface, then the operator will notify the appropriate Division district office within 48 hours (phone or email).
- Inspect the system for injection or withdrawal of liquids from the ASTs and document that the design prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes is working appropriately.
- Inspect the water surface for visible oil.
- Measure the freeboard.
- Inspect the secondary containment berm around the ASTs to check for erosion and collection of surface water run-on.
- If H2S is a documented potential issue with the containment, measure H2S concentrations on the down-wind side of the facility when produced water is present.
- Inspect the secondary containment for evidence of damage and monitor for leakage.
- Inspect the netting for damage or failure. If netting is jeopardized, repair of the netting shall occur within 48 hours.
- At least monthly, inspect netting (may not be used if Mega Blaster Pro avian deterrent is used) for dead wildlife, including migratory birds. Operator shall report the discovery of a dead animal to the appropriate wildlife agency and to the district within 30 days of discovery. Further prevention measures may be required.
- If observed conditions indicate a potential tank failure is imminent, the vicinity will be immediately cleared and the AST will be drained.

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.

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.

© 2020 R.T. HICKS CONSULTANTS, LTD.

Operations and Maintenance Plan
Above Ground Tank Containment (AST)

The operator will remove all fluids from the recycling facility within 60 days of cessation of operations. An extension, not to exceed 2 months, may be granted by the district division for the removal of fluids from the facility.
The breakdown of the containments follows the reverse order of the setup steps presented in the set-up manual

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

© 2020 R.T. Hicks Consultants, Ltd.

Inspection Form

Date: _____

Solaris Water Midstream - Gravitas AST Containment

Tank ID: _____

Weekly inspection/Fluid level must be maintained > 1 foot

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 (immediately if federally protected species, report dead birds or wildlife to the appropriate agency (USFWS, NMDGF) and to NMOCD district division office.			
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 division office, and repair. Immediately notify BLM of any leak			
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	
Signs of tank settlement	☐ None Observed	☐ Yes, Describe	

Gravitas AST Containment

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 division office and repair. Immediately notify BLM.		
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

Closure Plan

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

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

Excavation and Removal Closure Plan – Protocols and Procedures

1. Residual fluids in the containments will be sent to disposal at a division-approved facility.
2. The operator will remove all solid contents and transfer those materials to the following division-approved facility:
   Disposal Facility Name: R360
   Permit Number NM 01-0006
3. If possible, geomembrane textiles and liners that exhibit good integrity may be recycled for use as an under liner of tank batteries or other use as approved by OCD.
4. Disassemble the recycling containment infrastructure according to manufacturer's recommendations
5. After the disassemble of the containments and removal of the contents and liners, soils beneath the tanks will be tested as follows
   a. Collect a five-point (minimum) composite from beneath the liner to include any obviously stained or wet soils, or any other evidence of impact from the containments for laboratory analyses for the constituents listed in Table I of 19.15.34.14 NMAC.
   b. If any concentration is higher than the parameters listed in Table I, additional delineation may be required, and closure activities will not proceed without Division approval.
   c. If all constituents' concentrations are less than or equal to the parameters listed in Table I, then the operator will backfill the facility as necessary using non-waste containing, uncontaminated, earthen material and proceed to reclaim the surface to pre-existing conditions.

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

19.15.34.14 C
The operator shall test the soils beneath the containment for contamination with a five-point composite sample which includes stained or wet soils, if any, and that sample shall be analyzed for the constituents listed in Table I below.
(1) If any contaminant concentration is higher than the parameters listed in Table I, the division may require additional delineation upon review of the results and the operator must receive approval before proceeding with closure.
(2) If all contaminant concentrations are less than or equal to the parameters listed in Table I, then the operator can proceed to backfill with non-waste containing, uncontaminated, earthen material.

© 2020 R.T. HICKS CONSULTANTS, LTD.

Closure Plan
Above Ground Tank Containment (AST)

Closure Documentation

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

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

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.

Reclamation and Re-vegetation

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

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

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

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

Federal, state trust land, or tribal lands may impose alternate reclamation and re-vegetation obligations that provide equal or better protection of fresh water, human health, and the environment. Re-vegetation and reclamation plans imposed by the surface owner will be outlined in communications with the OCD.

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

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

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

19.15.34.14 F
Reclamation of all disturbed areas no longer in use shall be considered complete when all ground surface disturbing activities at the site have been completed, and a uniform vegetative cover has been established that reflects a life-form ratio of plus or minus fifty percent (50%) of pre-disturbance levels and a total percent plant cover of at least seventy percent (70%) of pre-disturbance levels, excluding noxious weeds.

© 2020 R.T. HICKS CONSULTANTS, LTD.

April 2022

C-147 Registration for Gravitas AST Containment

Section 2 T26S R27E, EDDY COUNTY

Volume 2:

Siting Criteria Demonstration and Appendices

View east-southeast from the approximate location of Hayhurst Section 2 geotechnical boring B2. This is one of three borings that encountered groundwater about 24 feet below surface. The existing recycling facility is on the right of the image and will be improved when the Gravitas AST is added.

Prepared for:
Solaris Water Midstream LLC
Houston, Texas

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

The site for the Gravitas Recycling Containment and AST Containment is located approximately 4.5 miles north of the Texas-New Mexico state line and about 5.5 miles west of Highway 285 on White City Road.

Hydrogeology

Summary from Variance Request

Southwest of the Gravitas AST location the driller reports static groundwater within gypsum about 35 feet below surface (elevation = 3177 feet asl) in the three borings (PODs 1-3 on inset map). The southern three borings northwest of the site (1, 4 and 5) encountered static groundwater in the Los Medaños Member of the Rustler at depths of about 26 feet (elevations = 3186 to 3195), None of the remaining five geologic logs record groundwater and all eight logs do not penetrate gypsum in the 40-45 foot deep interval. Boring Misc-417 at the Section 10 containments to the southwest did not encounter groundwater at its total depth of 76 feet. The lithologic description of Misc-417 is poor, thus the presence or absence of gypsum cannot be ascertained.

Given the elevation of groundwater in the four nearest wells in Hay Hollow range from 3126 to 3175 (downstream to upstream) and groundwater elevations southwest of the Gravitas site: we conclude that this recharge area for the regional aquifer (gypsum) in the Gravitas site area has a groundwater elevation of about 3150.

Because groundwater exists in the six borings nearest to the Gravitas AST Containment and the active windmill about 500 feet to the east and groundwater does not exist in the six borings more distant from the windmill and AST, we conclude that shallow groundwater beneath the AST location is localized.

The elevation of groundwater in the six borings described above is (3183-3150=) 33 feet higher than the recharge area of Hay Hollow. We conclude this localized groundwater body is perched in the sediments of the Los Medaños Member of the Rustler.
Finally, we conclude that the source of the perched groundwater is seepage from an unlined stock tank associated with a windmill, which was drilled in 1913 or slightly later. The unlined stock tank is present today and apparent in Google Earth images to 1996. The well is mapped in an air photo from the 1950s (in 1974 Eddy County Soil Survey). We believe that 100 years of seepage from the unlined stock tank could easily cause the observed shallow groundwater beneath the proposed Gravitas AST.

Data, Explanation and Conclusions

According to the State of New Mexico Geologic Map[1], Permian Age Rustler Formation (Pr) is exposed at the location of the proposed Gravitas AST Containment and throughout most of the mapped area displayed as the uncolored area of Figures 1a and 2. The underlying Permian Salado Formation crops out in the southern and western boundaries of the map. The southern boundary of Figure 1 is the Texas-New Mexico state line.

Figure 1a presents the State Geologic Map and includes an overlay of the Red Bluff 7.5-minute geologic map (OF-GM-284[2], last modified December 2020). Also plotted on Figure 1a are the locations of all wells in the area. Figure 1b identifies only the wells in the OSE database, as we use several driller's logs in the OSE files to present the geology of the area. Figure 2 presents the geology of the area via the state map as a base for clarity. Figure 2 also identifies several wells with well logs that are not part of the OSE database (Misc-416, Misc-417)

The Red Bluff Quadrangle in Figure 1a provides more detail than Figure 2 and our field survey confirms the higher accuracy of the eastern 1/3 of Figure 1a. Based upon our work at the White Containment, which lies about 3 miles southeast of the proposed Gravitas AST Containment, field examination of the Gravitas site, detailed well logs from the Section 10 and Section 2 recycling containments of Chevron and reading OF-GM-284, we conclude:

1. The Gravitas AST Containment shares the same subsurface conditions described for Chevron Section 2 Boring B4 (see Appendix Well Logs), which is
    a. Recent unconsolidated alluvium from surface to about 4 feet
    b. Bedrock of the Los Medaños Member of the Rustler Formation consisting of red clay, silt and silty-clayey sand to a depth of at least 40 feet
2. Underlying the 30+ feet of Los Medaños Member at the Gravitas site are the following units as described in OF-GM-284 and in
    a. Perhaps 30 feet of carbonates interbedded with thin siltstone and sandstone of the basal Rustler and
    b. Gypsum of the Salado Formation, which are hundreds of feet thick
3. Less detailed well logs from C-4573 (PODs 1, 2, and 3) provide a reasonable lithologic description
    a. 0-7 feet - recent alluvium t
    b. 0-24 feet dry red/brown silty or clayey sand (PODs 1 & 3)

[1] https://geoinfo.nmt.edu/publications/maps/geologic/state/home.cfml
[2] https://geoinfo.nmt.edu/publications/maps/geologic/ofgm/downloads/284/OFGM-284_RedBluff.pdf

water-bearing gypsum in POD 2
c. 25-55+ feet water bearing gypsum in all three borings
d. 55-104 feet water bearing red clay, gypsum and sandstone
e. 34-35 feet static groundwater level in all three borings

4. Because the windmill located about 500 feet east of Gravitas (Misc- 58/C-2474) in Figure 2 and described in Appendix Well Logs reports has a total depth of 100 feet; groundwater drawn by the windmill resides in solution channels/fractures within the gypsum of the lower Rustler or upper Salado that are hydraulically connected to Hay Hollow Draw, about 2.5 miles west. This gypsum unit and saturated alluvium in the various drainages compose the regional aquifer that is tapped by wells for beneficial use.

In addition to the boring logs nearest to the Gravitas AST described above, the Appendix Well Logs contains other useful data regarding the geology and hydrogeology of the area around the Gravitas site

- Misc- 417 is the Chevron Section 10 boring log, which is relatively worthless with respect to lithology. It records no groundwater to a depth of 70 feet.
- C-4078 is 2.5 miles northwest of Gravitas and lies within Hay Hollow Draw. This well encountered groundwater from near surface to a depth of 150 feet and records a static water level of 18.5 feet below surface. The driller's description suggests that dry anhydrite/gypsum bedrock exists at 150 feet.
- C-4269 is a monitoring well/boring associated with Incident Name: NAB1707636998 that is located 4.25 miles southwest of Gravitas and 1 mile from Hay Hollow. This log does not provide good lithologic detail but appears to be gypsum from 8-74 feet that is underlain by silty sand. The log records first water at 94 feet and no static water level. We examined the online record of this incident and found nothing about this 2-inch monitoring well. The plugging report records a static water level of 34.36 feet.

We believe all the data support our conclusions 1-4, above.

Distance to Groundwater

Figures 1 and 2, the associated legends, and the discussion below demonstrates that perched and/or localized groundwater (fresh water as defined by NMOCD Rules) is less than 50 feet beneath the containment. The regional gypsum aquifer that is recharged by seepage from Hay Hollow and other drainages appears to be 40-60 feet below surface at the Gravitas location and is confined or semi-confined.

Figure 1a is topographic map with the New Mexico state geologic map that shows:

1. The Gravitas Containment identified by the blue square.
2. Water wells from the OSE database as a triangle inside colored circles that indicate well depth (C representing the Carlsbad Basin). OSE wells are often miss-located in the WATERS database as older wells are plotted in the center of the quarter, quarter, quarter, of the Section Township and Range.
3. Water wells from the USGS database as large triangles color-coded to the formation from which the well draws water.
4. Water wells, which are not documented in the public databases but were identified by field inspection or other published reports as colored squares (MISC).

5. The depth-to-water from the most recent available measurement for each well is provided adjacent to the well symbol.

The most important data qualifications for Figure 1 are:

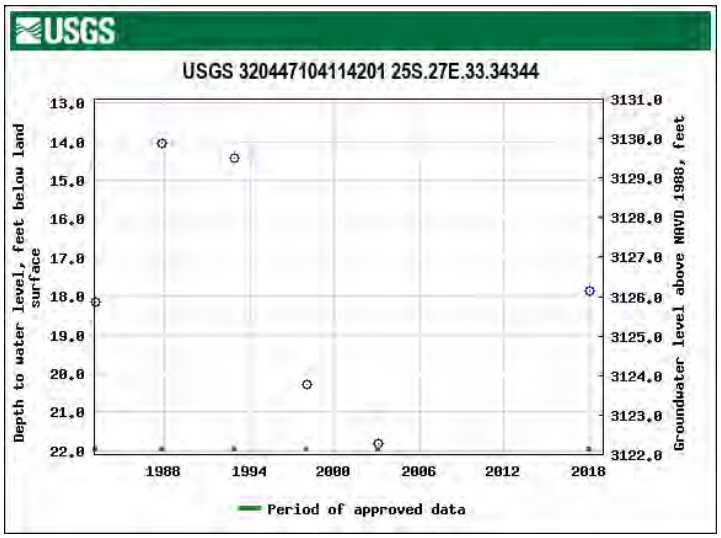
- Depth to water data for wells in the OSE database are obtained by drillers, typically immediately after drilling. These data are often inaccurate with respect to static water conditions.
- USGS-9490 is mis-located. This well plots about 3.6 miles southeast of the containment but is Misc-53, which is 2.5 miles southwest of Gravitas AST. Misc-53 employs the groundwater data from the USGS database.
- USGS-9442 is mis-located and is in Section 7 within Hay Hollow Draw (Forehand Ranch well/Misc 436). Google Earth shows the well about one mile west of the mapped location. Misc-436 employs the groundwater data from the USGS database.
- We found no evidence of well USGS-9476 in Google Earth images or during our field survey. This well is Misc-52 on Figure 2. This well lies in Hay Hollow about 2.25 miles west of Gravitas.
- Most wells that supply water for use (i.e., stock) are located within or adjacent to alluvial valleys such as Hay Hollow, Owl Draw or Red Bluff Draw.

The purpose of Figure 1b is to identify the locations of well logs in the OSE database and to provide a different view of the concentration of water supply wells within the drainages around the Gravitas AST Containment. The location of water supply wells in or adjacent to major drainages is not accidental. Within the hydrogeologic setting presented in Figures 1a and 2 and in similar areas south of the Black River, wells more distant from major drainages display a lower groundwater elevation. Borings of 125 feet are often dry. Figure 2 presents groundwater elevation data from wells measured by professionals.

USGS 320447104114201 25S.27E.33.34344 AKA USGS-9499

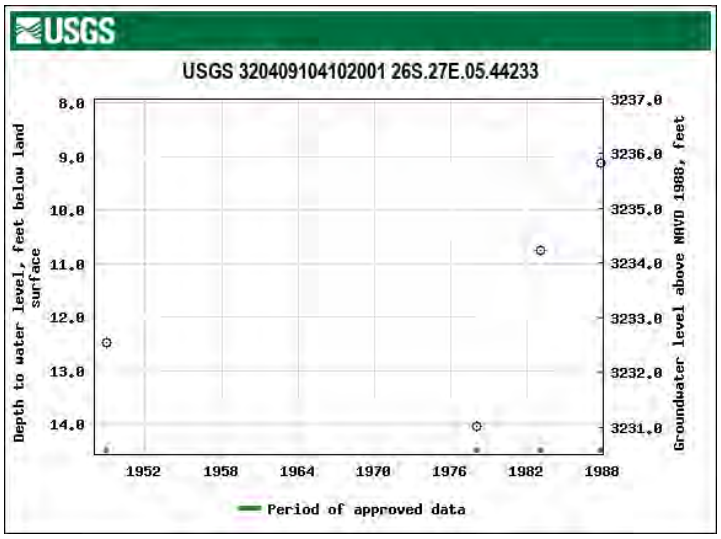
Eddy County, New Mexico
Hydrologic Unit Code 13060011
Latitude 32°04'47", Longitude 104°11'42" NAD27
Land-surface elevation 3,144 feet above NAVD88
This well is completed in the Other aquifers (N9999OTHER) national aquifer.
This well is completed in the Alluvium, Bolson Deposits and Other Surface Deposits (110AVMB) local aquifer.

This well is located in Hay Hollow, which is the principal recharge area for groundwater beneath the Gravitas Containment. Groundwater varies by less than 8 feet over the 30+ years of record, indicating that the groundwater elevation at this location is stable over time.



USGS 320409104102001 26S.27E.05.44233 AKA MISC-52

Eddy County, New Mexico
Hydrologic Unit Code 13060011
Latitude 32°04'09", Longitude 104°10'20" NAD27
Land-surface elevation 3,245 feet above NAVD88
This well is completed in the Other aquifers (N9999OTHER) national aquifer.
This well is completed in the Castile Formation (312CSTL) local aquifer.

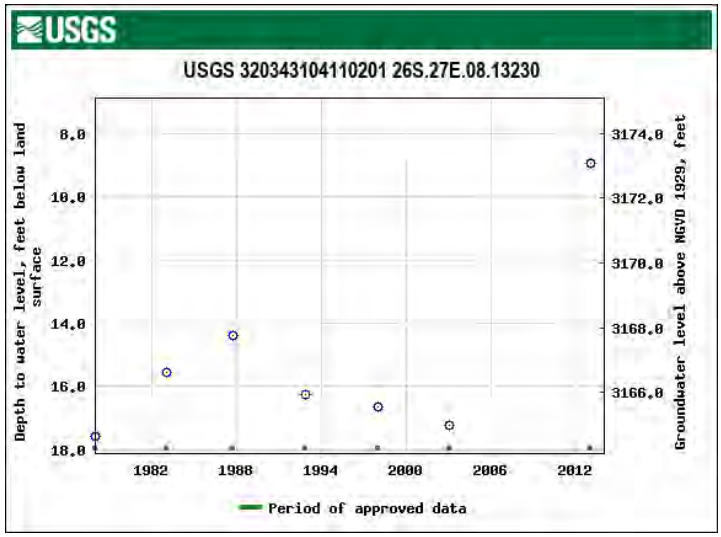


This well is mis-located in the USGS database by lat/long but the database provides the correct location using Section Township and Range. . This is Misc-52 with a surface elevation of 3155 resulting in a groundwater elevation of 3155-9= 3146, twenty feet higher than the elevation at USGS-9499, which is about 1 mile downstream.

Groundwater elevation in this well varies by 5 feet over the 35 year period of record.

USGS 320343104110201 26S.27E.08.13230 AKA USGS 9471

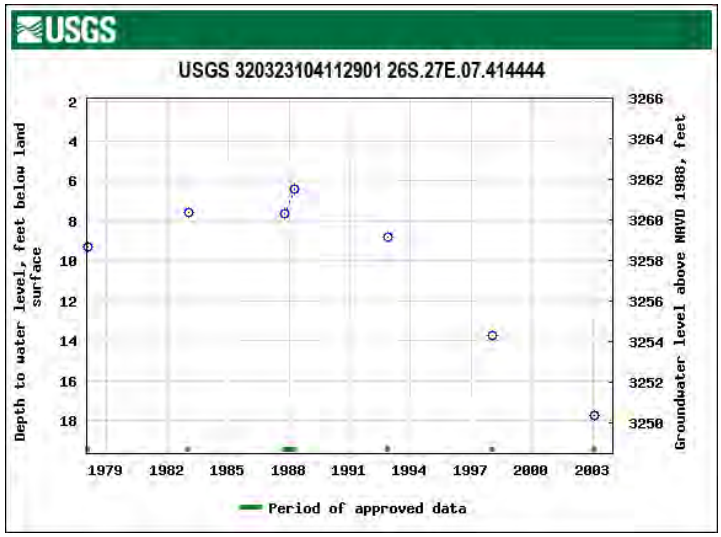
Eddy County, New Mexico
Hydrologic Unit Code 13060011
Latitude 32°03'32.4", Longitude 104°13'03.9" NAD83
Land-surface elevation 3,182.10 feet above NGVD29
This well is completed in the Other aquifers (N9999OTHER) national aquifer.
This well is completed in the Castile Formation (312CSTL) local aquifer.



This well is less than a mile upstream from Misc-52. Figure 2 presents no data for this well as it was obstructed in the 2018. The groundwater elevation varies by less than 8 feet over the 30+ year period of record. We have inserted an assumed elevation for groundwater at this well of 3170 on Figure 2. Note the 24 foot change of groundwater elevation between Misc-52 and this well.

USGS 320323104112901 26S.27E.07.414444 AKA Misc-436

Eddy County, New Mexico
Hydrologic Unit Code 13060011
Latitude 32°03'23", Longitude 104°11'29" NAD27
Land-surface elevation 3,268 feet above NAVD88
This well is completed in the Other aquifers (N9999OTHER) national aquifer.
This well is completed in the Castile Formation (312CSTL) local aquifer.



This well is also mis-located by lat/long in the USGS database but is correctly located by Section TR. It is the Forehand West Tank Windmill with a surface elevation is 3193 and groundwater elevation is 3193-18= 3175. The USGS graph (above) uses the elevation at the incorrect lat/long, the depth to groundwater is correct. Despite the errors in the database, we are confident that the depth to water data are correct. Thus, the groundwater elevation at this well varied by about 11 feet over the 35 years of record.

Water level data from borings at the two Chevron Hayhurst facilities are useful and, to us, demonstrate that a discontinuous perched groundwater zone is present beneath the Gravitas Containment site with a depth to water of about 25 feet. The sketch map presented above (Page 1 of the Siting Criteria) shows the locations of the borings described below.

Misc-416 is #1 on the sketch map. It is B1 of the Hayhurst Section 2 of Appendix Well Logs. This hollow stem auger boring encountered water at 32 feet. Static water in the 45-foot hole was 26 feet below surface 48 hours after termination of drilling.

Misc-437 (B4 in Appendix Well Logs) encountered groundwater at 26 feet and 48 hours after drilling, static groundwater was 26 feet below surface. Borehole 5 also encountered water similar to B1 and B$.

Misc-438 (B2 in Appendix Well Logs) is a dry boring with a total depth of 40 feet. Boreholes 3, 6, 7, and 8 are also dry to 40 feet.

Southwest of the Gravitas AST location are four borings, all of which are in the Appendix. PODs 1, 2 and 3 encountered groundwater in the uppermost gypsum unit, which lies less than 25 feet below land surface at each site. According to the driller's log, the static water level in the borings is about 35 feet below surface.

Misc-417 is a boring drilled by an auger rig to 76.5 feet in 2016. The transmittal of the log was stamped by a Professional Engineer and attests to no groundwater encountered. The log is also in the Appendix.

These data permit the following conclusions:

- Groundwater elevation is no higher than 3183 feet above sea level below the proposed Gravitas AST containment, which calculates to a depth to groundwater of about 25 feet.
- The uppermost regional aquifer is the gypsum horizon identified in many of the well logs in the area of Figure 2 and, near the Gravitas, the gypsum is clearly identified in the deep air-rotary wells PODs 1, 2 and 3
- Groundwater and gypsum are not present in wells Misc 417 or Borings 2, 3, 6, 7 and 8 discussed above and these borings did not encounter groundwater
- Gypsum was not encountered in auger drilled borings B1, B4 and B5, which were logged by a degreed hydrologist. Groundwater was observed in these 40 foot borings.
- Groundwater pumped from the nearby windmill, Misc-58, draws water from the gypsum regional aquifer.
- The regional aquifer in Hay Hollow is the gypsum of the lower Rustler plus the overlying alluvium in the drainage.
- Groundwater elevations in borings around the Gravitas AST range from 3180 to 3199 feet ASL, and static groundwater elevation in the windmill is 3183.
- Given that groundwater elevations in nearby wells within Hay Hollow, an obvious recharge area for the gypsum aquifer, are lower than the elevations observed in borings and the windmill near the Gravitas AST Containment, it is probable that perched water is influencing groundwater elevations.
- Figure SP5 of Appendix Site Photos shows an unlined stock pond near the windmill that is east of the proposed Gravitas location. The well was drilled in 1913 or soon thereafter and the pond is obvious in Google Earth images between present and 1996. Seepage from this stock pond for 30 years or possibly for more than 100 years could create a localized body of perched water.
- When the windmill is not pumping, seepage of perched water through the well casing to the gypsum regional aquifer is also probable.

Distance to Municipal Boundaries and Fresh Water Fields

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

- The closest municipality is Malaga, NM approximately 11 miles to the northeast.
- The closest public well is C-00906 and is located about 15 miles to the northwest at Whites City
- The closest freshwater well field is the City of Carlsbad's Sheep Draw well field, which is about 16 miles to the northwest.

Distance to Subsurface Mines

Figure 4 and our general reconnaissance of the area demonstrate the following proximities of mines to the containment.

- This location is not within an area overlying a subsurface mine.
- The nearest mapped surface mine is approximately 6 miles to the southeast of the site.
- We did not identify any unmapped gravel/caliche pits near the proposed containment.

Distance to High or Critical Karst Areas and Unstable Ground

Figures 5 and the discussion below demonstrate that the area of the Gravitas Containment lies within an area mapped as High Karst Potential by the BLM but does not meet the criteria of Rule 34 with respect to unstable ground. The ground at the Gravitas site is stable.

With the exception of a sink that is about 3 miles east of Gravitas containment, we found no evidence of solution features or unstable ground near the Gravitas containment area. Borings discussed above, found no voids or evidence of unstable ground. The presence of numerous producing oil and gas wells, SWDs exert significant pressure and vibration during drilling and there is no evidence of subsidence or instability near these wells. The Chevron Section 2 Containments, which are about 1500 feet north of the Gravitas AST site, are in the same geologic environment and mapped as high karst potential. The fact that OCD approved the Section 2 containments and several other recycling facilities in mapped High Karst areas shows that BLM mapped high karst does not define ground instability or the presence of voids and fractures that could rapidly transport fluid at the surface to groundwater.

Distance to 100-Year Floodplain

Figure 6 demonstrates that the location is not located in a 100-year floodplain.

- The nearest 100-year floodplain is located approximately 2 miles west in Hay Hollow.

Distance to Surface Water

Figure 7 demonstrates the proximity of the site to a continuously flowing watercourse, lakebed, sinkhole, playa lake (measured from the ordinary high-water mark), or spring.

- The nearest mapped body of surface water is a small lake/pond in Hay Hollow that is approximately 2.5 miles to the west.
- The closest USGS mapped intermittent stream is Hay Hollow, 2.25 miles west
- An intermittent stream that terminates at a mapped sink lies about 2.5 miles east.

Distance to Permanent Residence or Structures

Figure 8 and the site visit demonstrates that the location is not within 1000 feet from an occupied permanent residence, school, hospital, institution, or church, or other structure in existence at the time of initial application.

- No occupied permanent residences, schools, hospitals, institutions, churches, or other structures are located within 1000 feet of the site.
- The nearest structures are
    - A windmill (Misc- 58/unlabeled for clarity) used for stock that is about 500 feet due east of the Gravitas AST. The Gravitas AST will fill much of the northwest corner of the recycling AST area.

- Chevron Section 2 recycling containments are about 1200 feet north
- Chevron Section 10 recycling containments are about 1800 feet southwest
- Chevron Gravitas fresh water pond is about 500 feet south
- White City Road is about 175 feet north of the site

Distance to Non-Public Water Supply

Figures 1 and 7 demonstrates that the location is not within 500 horizontal feet of a spring or fresh water well used for domestic or stock watering purposes, in existence at the time of initial application.

- Figure 1 shows the locations of all area water wells, active or plugged.
- The nearest well is USGS-9490, which is mis-located as 1.01 miles southeast of the site. The actual location of this well is Misc-53, which is 1.5 miles southwest.
- There are no known domestic water wells located within 1,000 feet of the proposed pits.
- No springs were identified within the mapping area (see Figure 7)

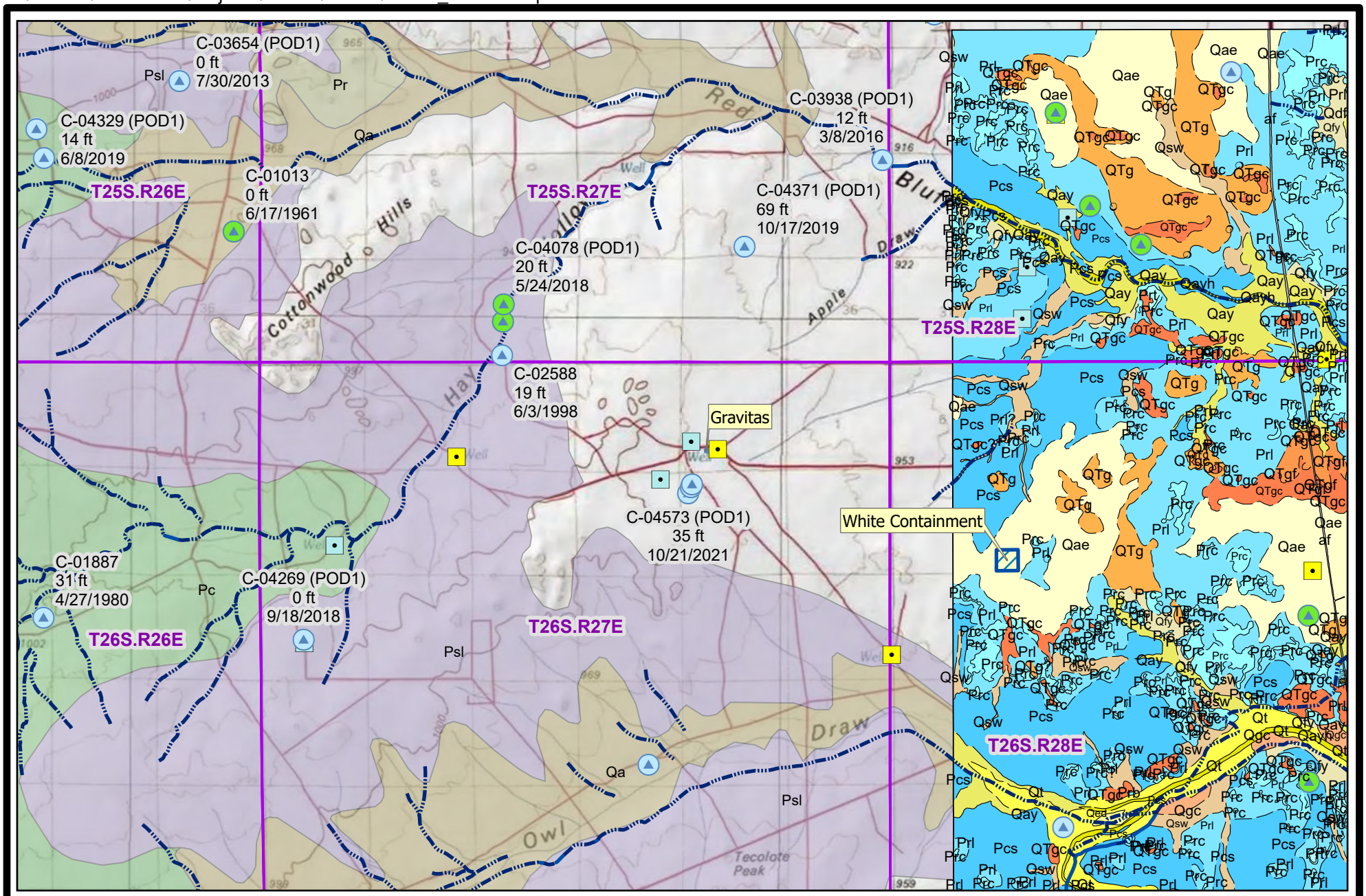
Distance to Wetlands

Figure 9 demonstrates the location is not within 300 feet of wetlands.

- The nearest designated wetland is a “freshwater pond”. It is approximately 1.31 miles due east of the site.

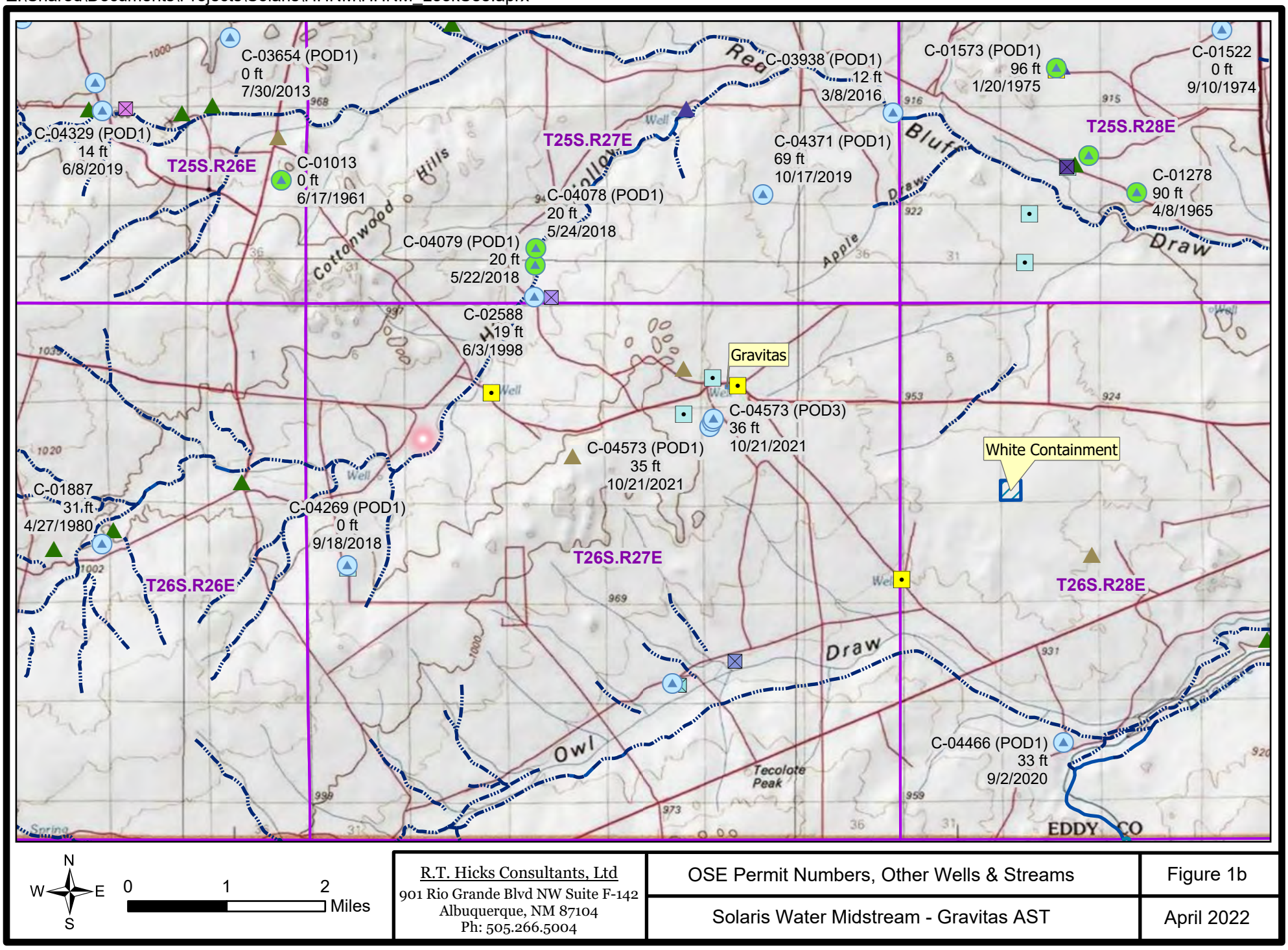
Site Specific Figures

Z:\Shared\Documents\Projects\Solaris\HHNM\HHNM_LookSee.aprx



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Geology, Water Well Locations & Streams	Figure 1a
	Solaris Water Midstream - Gravitas AST	April 2022

Z:\Shared\Documents\Projects\Solaris\HHNM\HHNM_LookSee.aprx

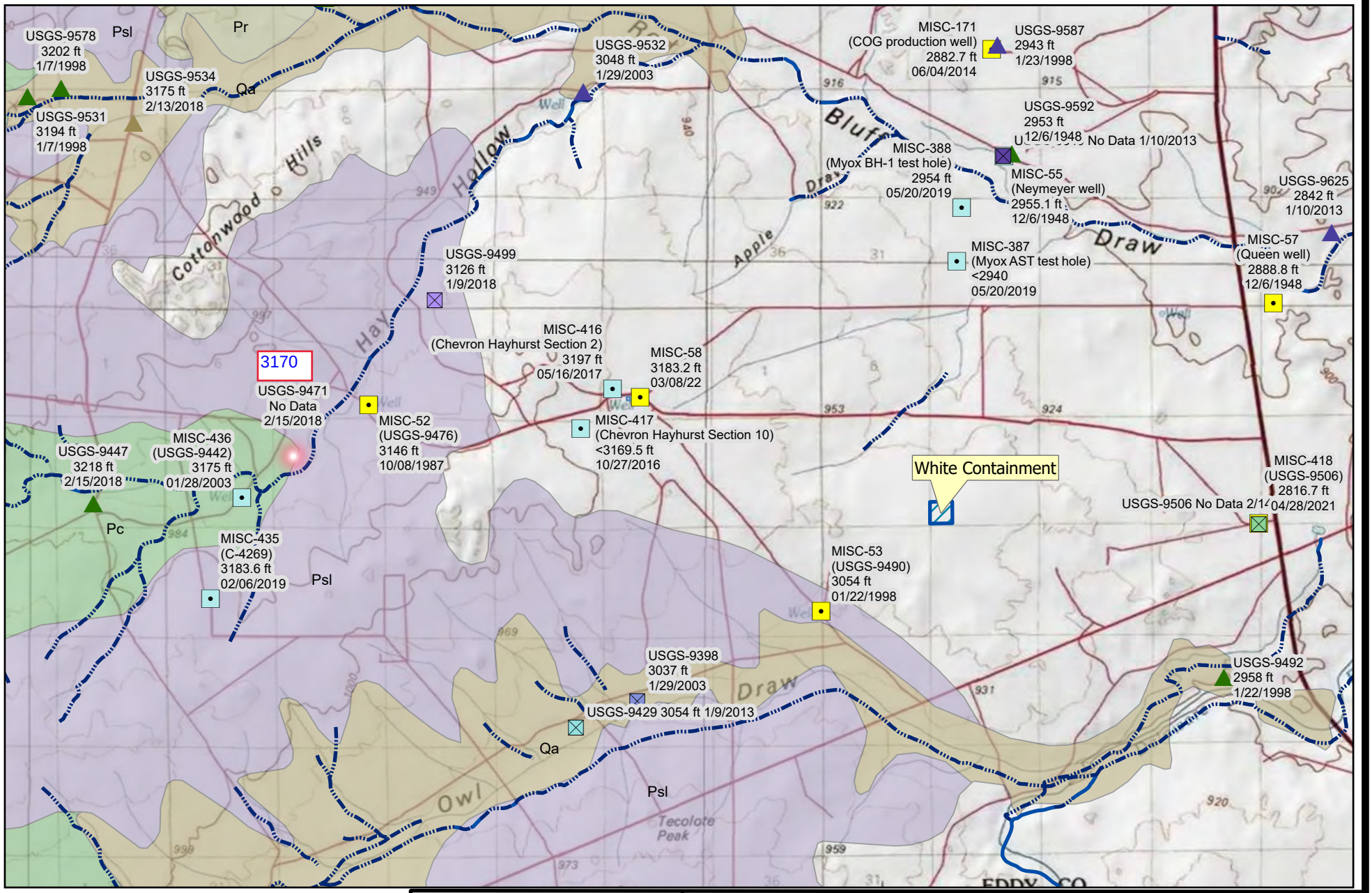


N W E S

0 1 2 Miles

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	OSE Permit Numbers, Other Wells & Streams	Figure 1b
	Solaris Water Midstream - Gravitas AST	April 2022

Z:\Shared\Documents\Projects\Solaris\HHNM\HHNM_LookSee.aprx

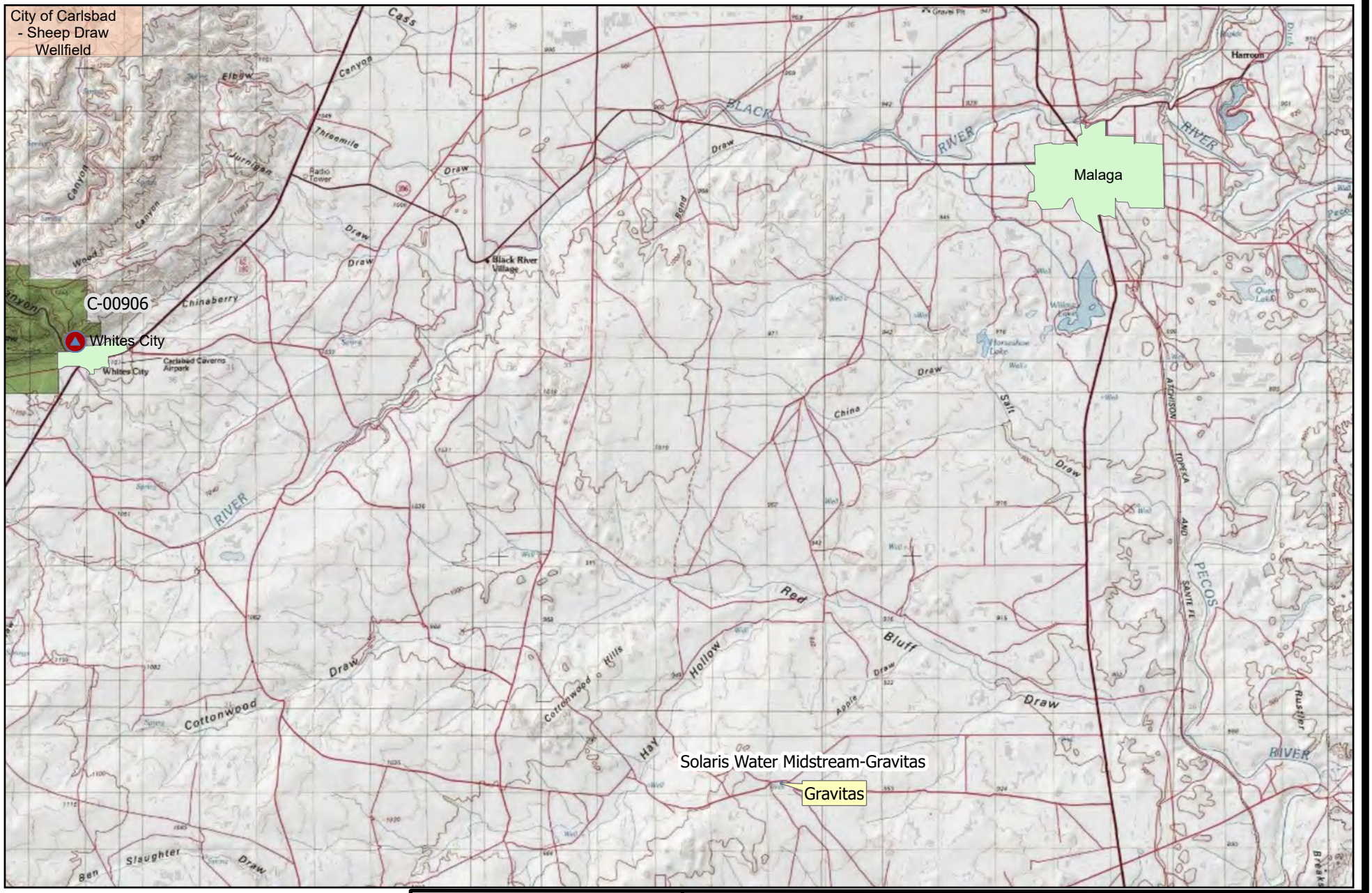


N
W E
S

0 0.5 1
Miles

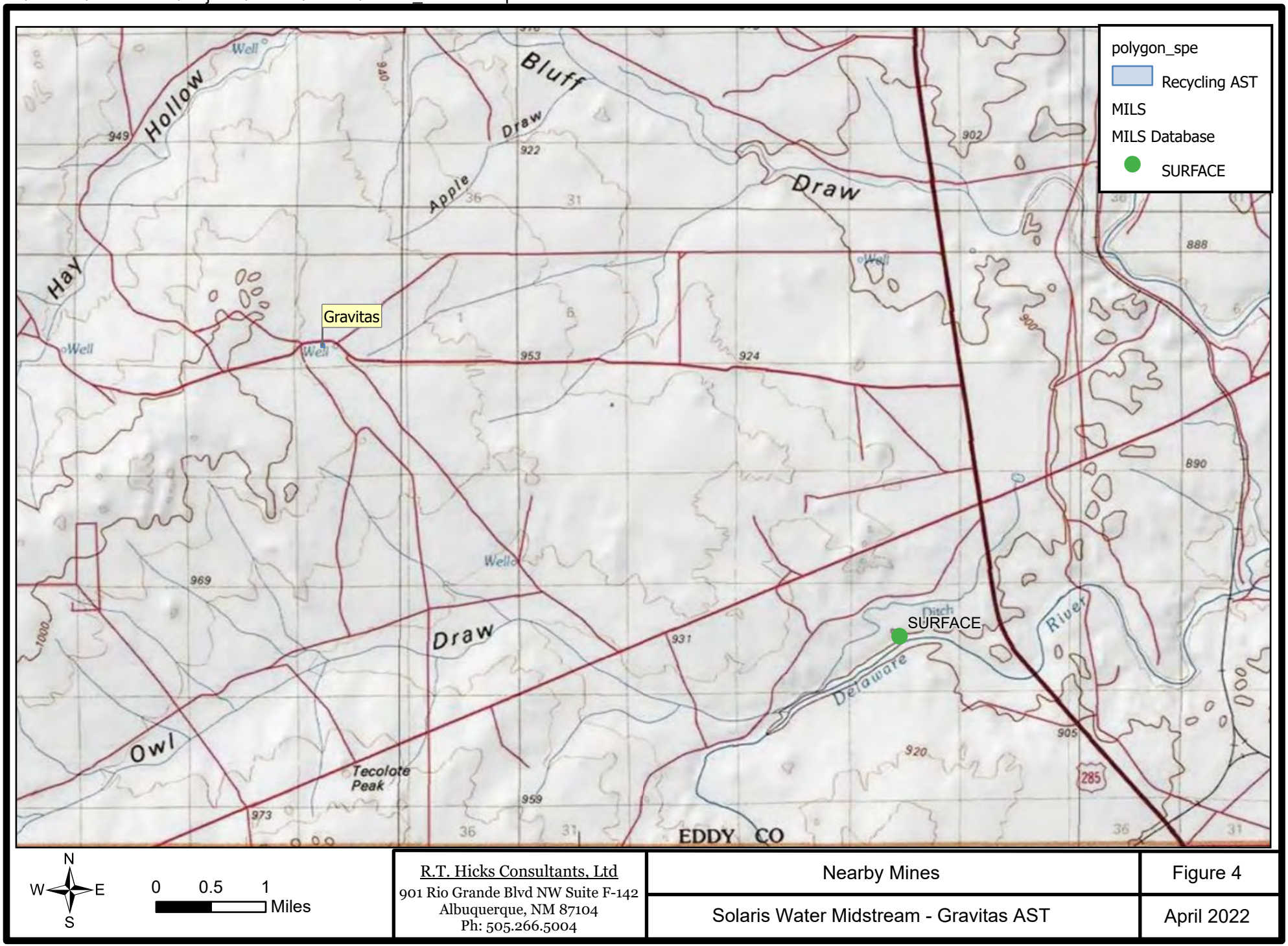
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Groundwater Elevation, Geology & Streams	Figure 2
	Solaris Water Midstream - Gravitas AST	April 2022

Z:\Shared\Documents\Projects\Solaris\HHNM\HHNM_LookSee.aprx



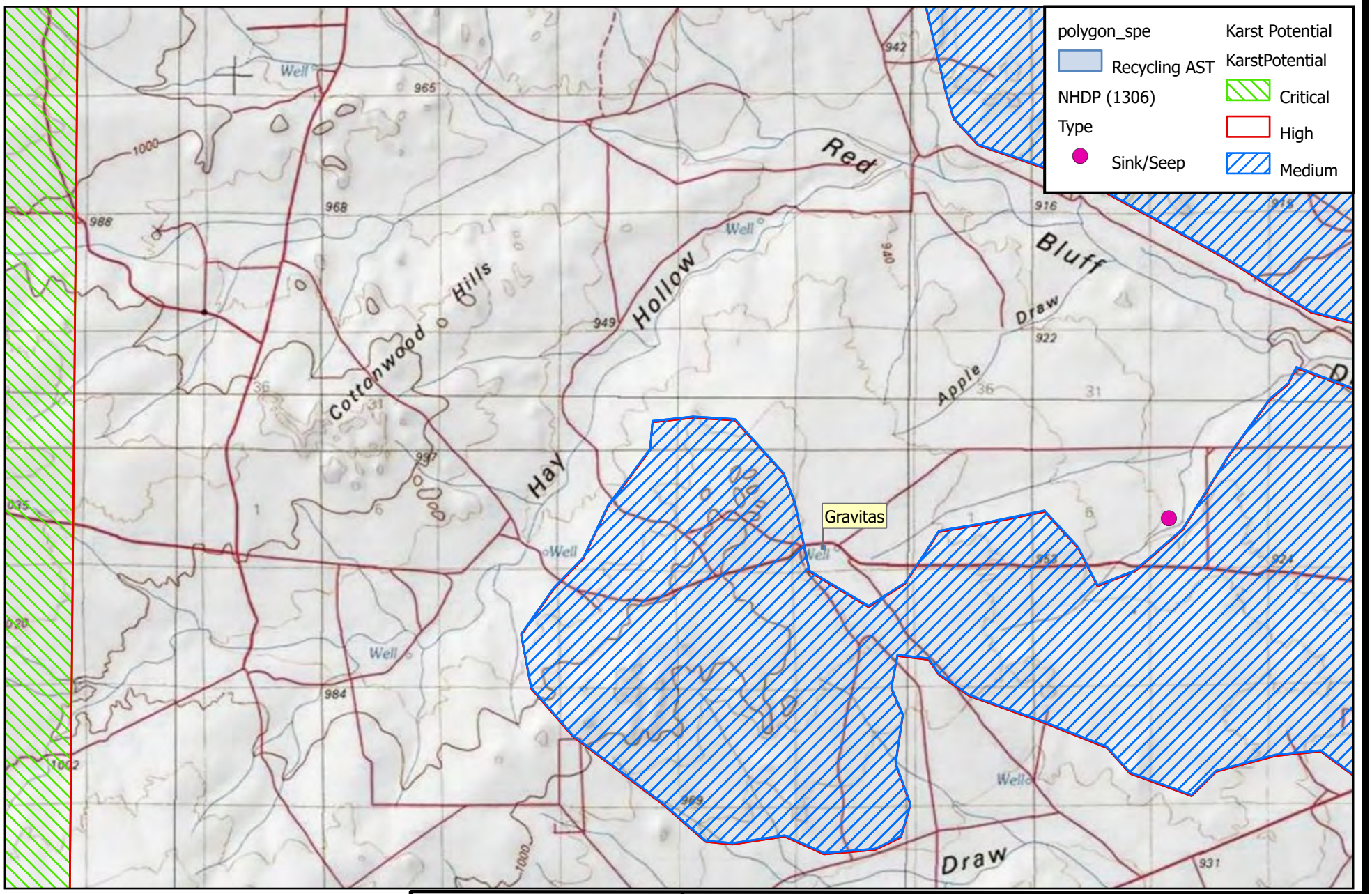
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Municipalities, Public Supply Wells, Well Fields	Figure 3
	Solaris Water Midstream - Gravitas AST	April 2022

Z:\Shared\Documents\Projects\Solaris\HHNM\HHNM_LookSee.aprx



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Nearby Mines	Figure 4
	Solaris Water Midstream - Gravitas AST	April 2022

Z:\Shared\Documents\Projects\Solaris\HHNM\HHNM_LookSee.aprx



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

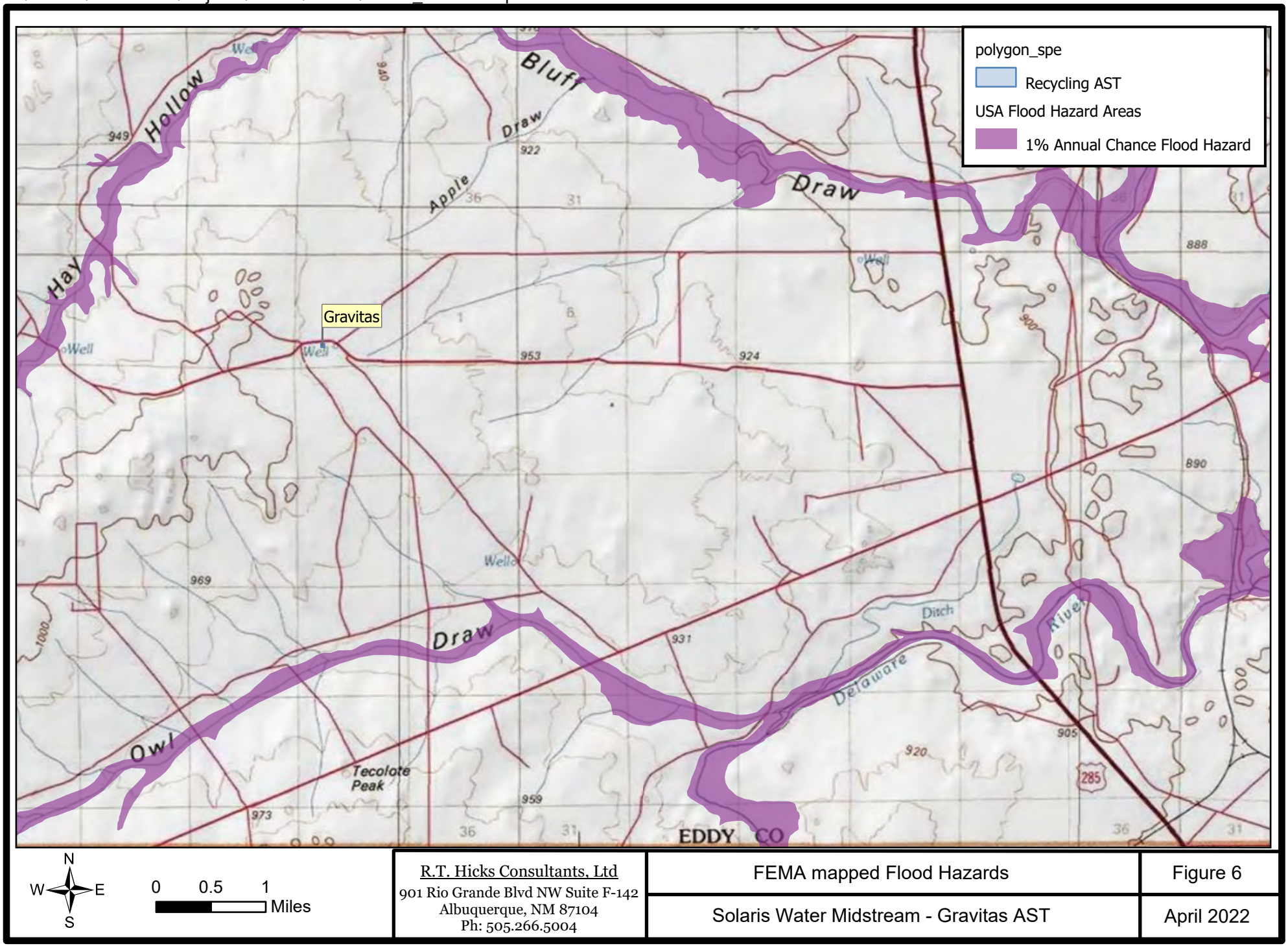
BLM Mapped Karst Potential and Sinks

Figure 5

Solaris Water Midstream - Gravitas AST

April 2022

Z:\Shared\Documents\Projects\Solaris\HHNM\HHNM_LookSee.aprx



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

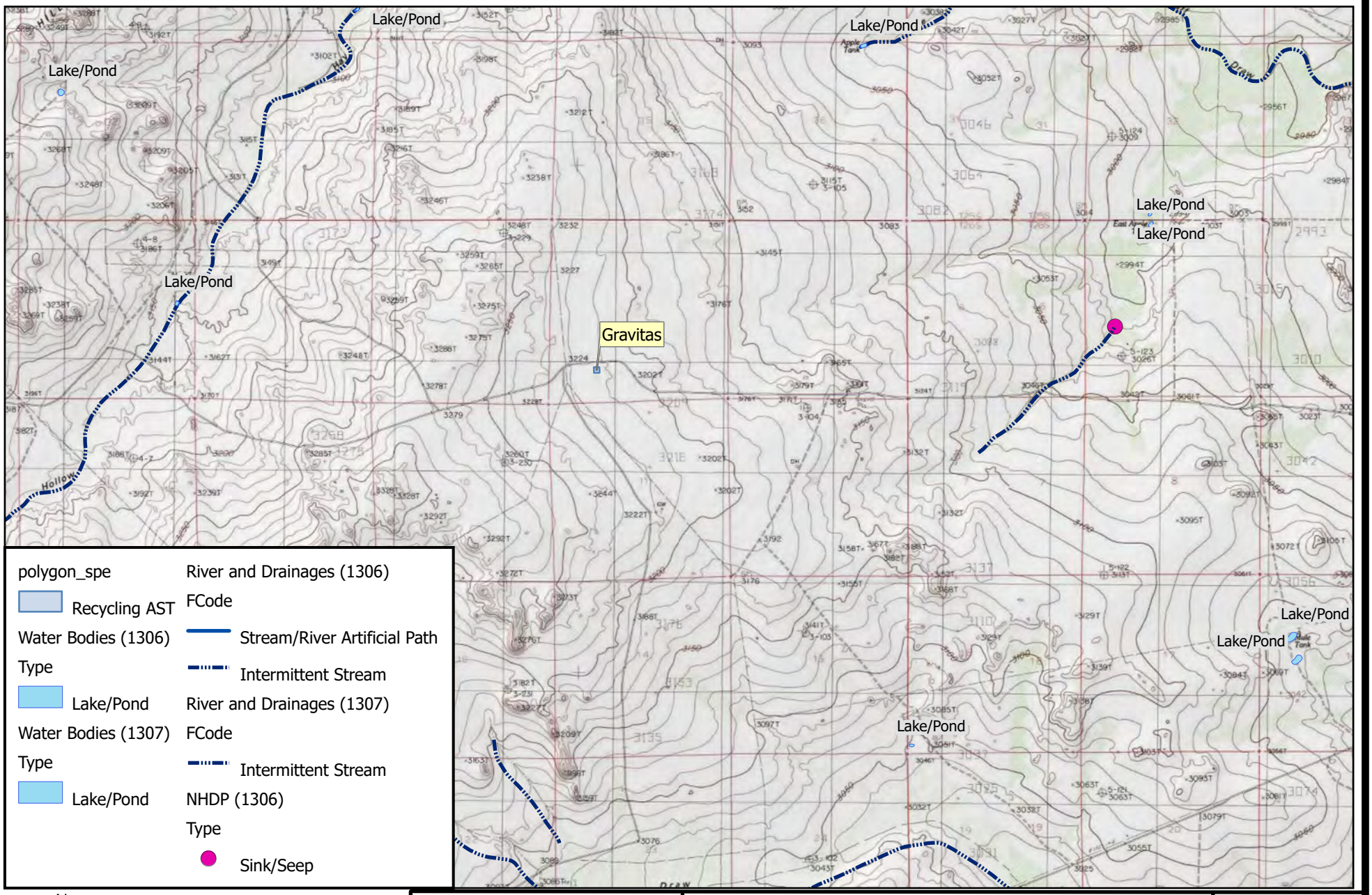
FEMA mapped Flood Hazards

Figure 6

Solaris Water Midstream - Gravitas AST

April 2022

Z:\Shared\Documents\Projects\Solaris\HHNM\HHNM_LookSee.aprx



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

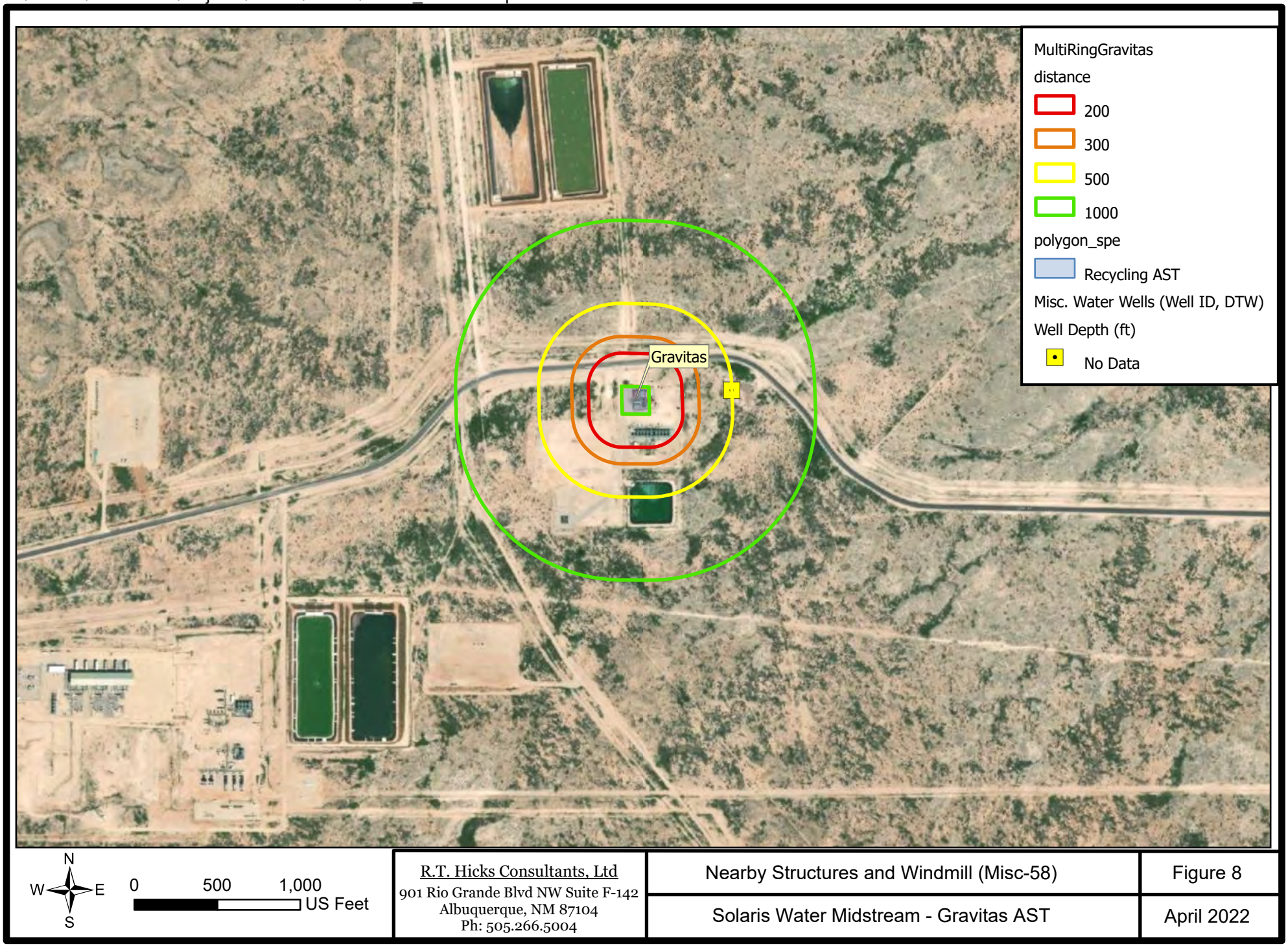
Mapped Surface Water

Figure 7

Solaris Water Midstream - Gravitas AST

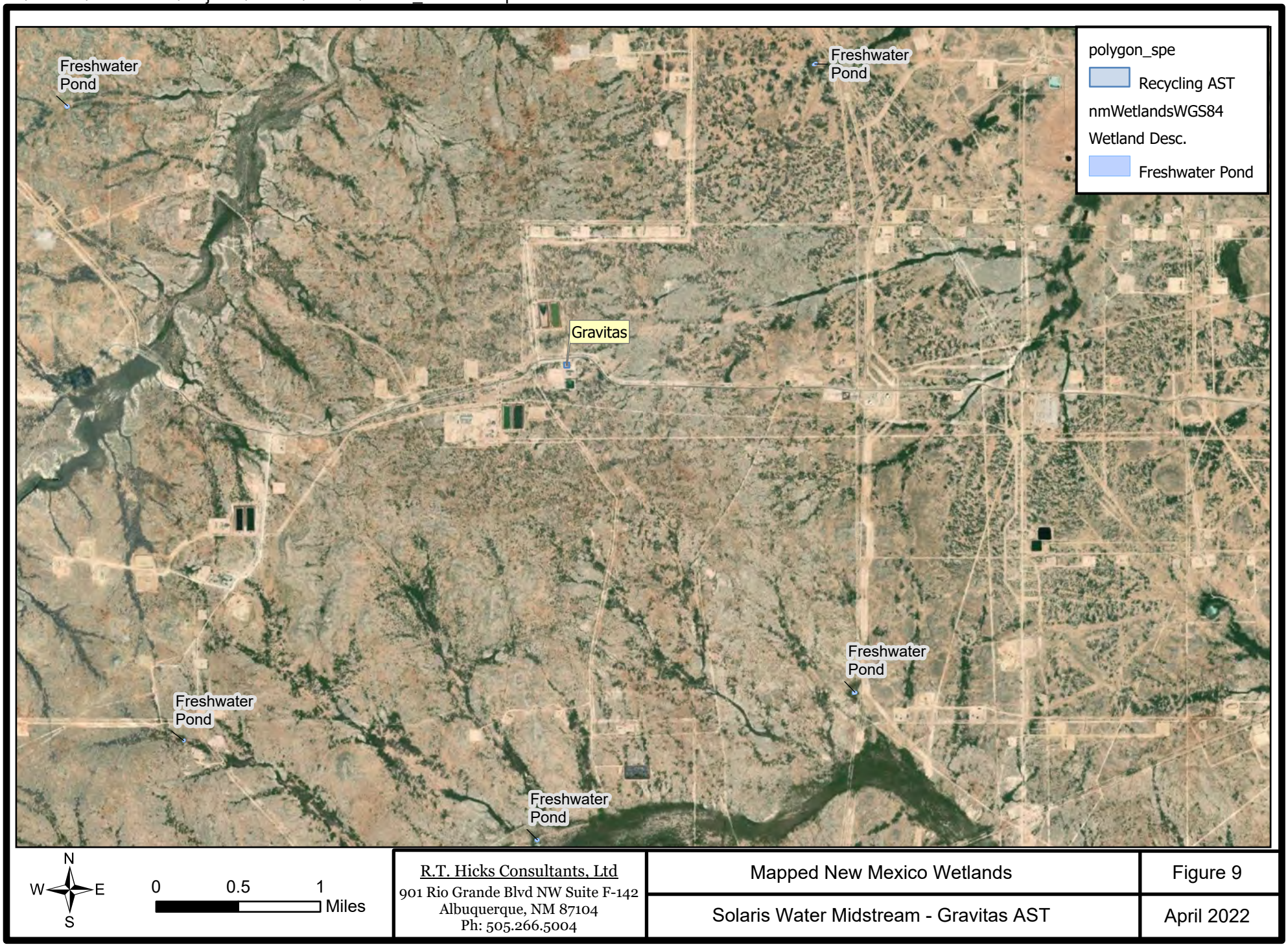
April 2022

Z:\Shared\Documents\Projects\Solaris\HHNM\HHNM_LookSee.aprx



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Nearby Structures and Windmill (Misc-58)	Figure 8
	Solaris Water Midstream - Gravitas AST	April 2022

Z:\Shared\Documents\Projects\Solaris\HHNM\HHNM_LookSee.aprx



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

Mapped New Mexico Wetlands

Figure 9

Solaris Water Midstream - Gravitas AST

April 2022

Appendix Well Logs

New Mexico Office of the State Engineer
Point of Diversion Summary

(quarters are 1=NW 2=NE 3=SW 4=SE)
(quarters are smallest to largest) (NAD83 UTM in meters)

Well Tag	POD Number	Q64	Q16	Q4	Sec	Twn	Rng	X	Y
	C 02474		4	3	02	26S	27E	578964	3548029*

x

Driller License: **Driller Company:**

Driller Name: HEPLER BROS

Drill Start Date: **Drill Finish Date:** 12/31/1913 **Plug Date:**

Log File Date: **PCW Rcv Date:** **Source:**

Pump Type: **Pipe Discharge Size:** **Estimated Yield:** 5 GPM

Casing Size: 6.00 **Depth Well:** 100 feet **Depth Water:**

x

***UTM location was derived from PLSS - see Help**

The data is furnished by the NMOSE/ISC and is accepted by the recipient with the expressed understanding that the OSE/ISC make no warranties, expressed or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the data.

Page 126 of 164

Appendix 3 – Recycling Containment Groundwater Boring Log

Received by OCD: 4/13/2022 9:13:07 AM

Released to Imaging: 5/4/2022 2:56:47 PM

Page 127 of 164

TETRA TECH

September 7, 2017

Mr. Ruben Kopara
Chevron North America Exploration and Production Company
6301 Deauville Blvd,
Midland, Texas 79706

Subject: **Addendum to Geotechnical Investigation Report**
Hayhurst Section 2 Hydraulic
Fracturing Ponds
Eddy County, New Mexico

Dear Mr. Kopara:

On August 2, 2017, Tetra Tech published a report of our geotechnical study for the referenced site where Chevron intends to construct two earthen impoundments with capacities of approximately 350,000 bbl each to service well drilling operations. Subsequent to that investigation and report, Chevron moved the location of the proposed pits to an adjacent area immediately north of the previous site. On August 17 and 18, 2017, Tetra Tech returned to the site and drilled three additional borings in the new area to investigate subsurface conditions. The locations of the borings are shown on the attached Figure 1. Previous borings are labeled B-1 through B-5; the more recent borings are labeled B-6 through B-8.

Borings B-6 through B-8 encountered 21 to 30 feet of medium dense to dense sand over hard clay with cemented lenses. Standard Penetration Tests (SPT) in the sand had values or blow counts (N) ranging from 23 blows per foot to 50 blows for 2 inches; blow counts in the clay ranged from 9 blows per foot (in B-8 at the contact with the overlying sand) to 50 blows for 2 inches. In general, the density of the soils increases with depth based on the SPT values. Free water was not encountered in the borings.

The additional borings indicate that the subsurface conditions on the northern part of the site are consistent with those encountered to the south. The soils to the south have a higher silt and clay content, but blow counts are similar. The borings to the north have a lesser degree of cementation at shallow depth, which may simplify earthwork. No voids or carbonate rocks or deposits were encountered.

Recommendations made in our geotechnical report for the original site remain valid for the revised pit location. Our report: *Hayhurst, Section 2 Hydraulic Fracturing Ponds, Eddy County New Mexico*, dated August 2, 2017, should be carefully reviewed in its entirety during design and construction of the pits at the proposed revised location. In particular, we reiterate that although evidence of voids or karst terrain were not encountered, the site is located in a karst-prone geologic area and voids that were not observed in our widely spaced borings could exist under portions of the site. We recommend Chevron consider geophysical investigation to more conclusively determine if voids could exist below portions of the site.

Tetra Tech
3801 Automation Way, Suite 100, Fort Collins, CO 80525
Tel 970.223.9600 Fax 970.223.7171 www. tetratech.com

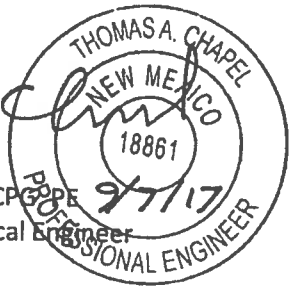
Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 128 of 164

Please contact the undersigned with any questions or comments you may have regarding this addendum letter or our recommendations for these sites.

Sincerely,

TETRA TECH, INC.



Thomas A. Chapel, CPG, PE
Principal Geotechnical Engineer

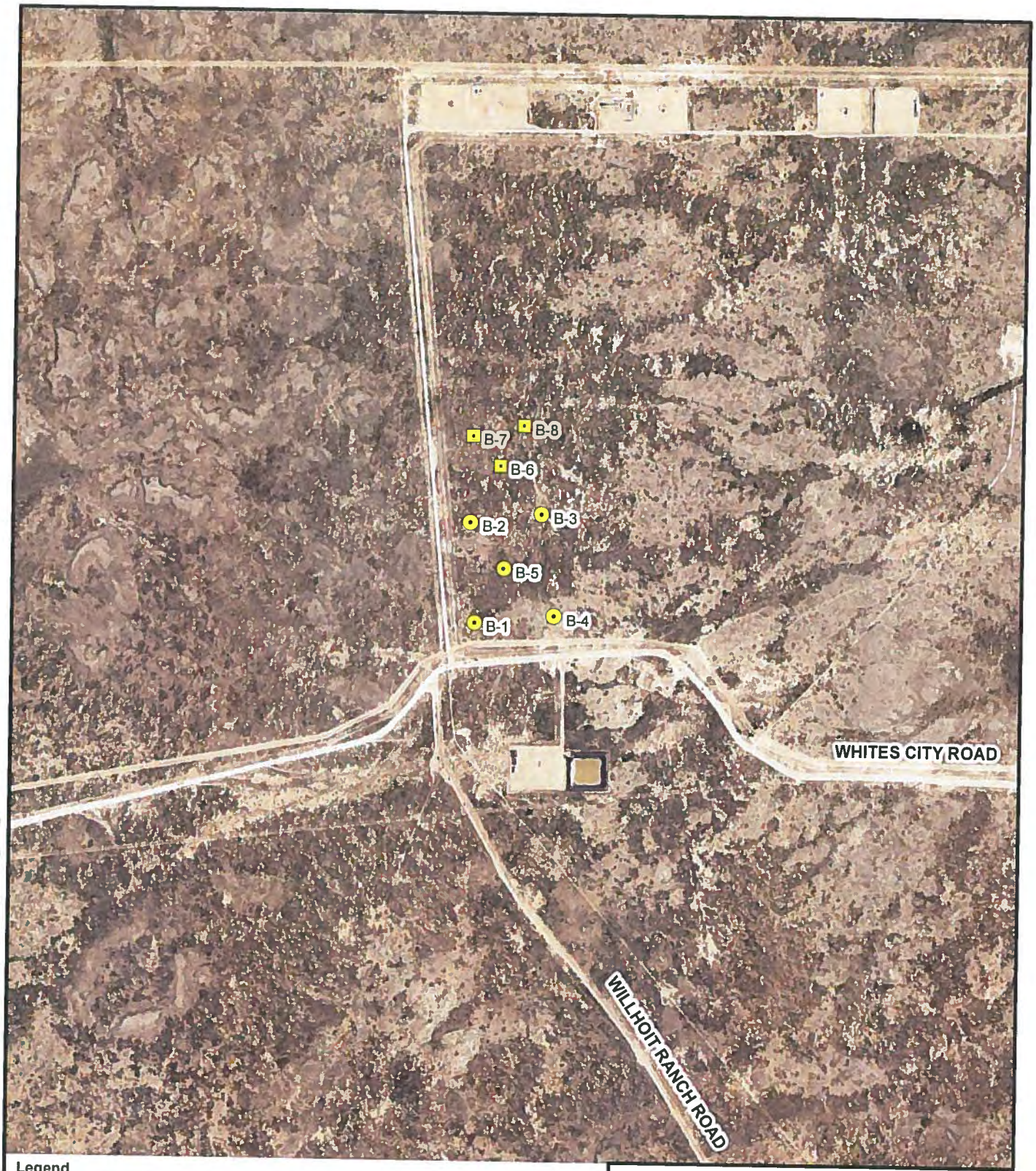
Reviewed by

Don Grahlherr, PE
Vice President

Received by OCD: 4/13/2022 9:13:07 AM

Released to Imaging: 5/4/2022 2:56:47 PM

Page 129 of 164



Legend

- Boring Location
- Additional Boring Location

N
W
E
S

0 500 1,000
Feet

SOURCE: MODIFIED FROM USDA NAIP IMAGERY, 2016

CHEVRON
HAYHURST
SEC. 2 FRAC POND
EDDY COUNTY, NEW MEXICO

FIGURE 1
AERIAL MAP

TETRA TECH

Date Saved: 9/5/2017 5:51:37 PM User: joel.peters Path: L:\CADD\P\212C-MD\00848\1000\Chevron_Hayhurst_212C_MD_00848_2A.mxd

Received by OCD: 4/13/2022 9:13:07 AM

Released to Imaging: 5/4/2022 2:56:47 PM

Page 130 of 164

ATTACHMENT A

BORING LOGS

Received by OCD: 4/13/2022 9:13:07 AM

Released to Imaging: 5/4/2022 2:56:47 PM

Page 131 of 164

TETRA TECH
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 Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/16/2017
CONSULTANT: Tetra Tech, Inc.
DRILLING CONTRACTOR: Enviro Drill
Notes: Not Recorded

GROUND ELEVATION: NA
LATITUDE: 32.067930 N
LONGITUDE: 104.167640 W

METHOD:
LOGGED BY: Clint Merritt and Raj Meruva
DRILLED BY: Juan Uribe

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
5	SS	62			3.5	Very Dense, Pink, Fine Grained **SAND**
10	SS	50/5"	MC = 19.8% Fines = 36.1%		8.5	Very Dense, Pink, Weakly Cemented Fine Grained **SAND**, with < 20% Fine Gravel, Calcareous, Moist
15	SS	50/4"				
20	SS	50/1"				
25	SS	50/3"	MC = 13.2% DD = 106.1 pcf LL = 37 Fines = 49.5%	SM	23.5	Very Dense to Medium Dense, Dark Brown, Moderately Cemented Fine Silty and Clayey **SAND**, Increasing Plasticity with Depth, Moist to Wet
30	SS	13				▼ Water depth 48 hours after drilling ▼ Water depth at the end of drilling
35	SS	15	MC = 18.8% DD = 102.3 pcf LL = 33 Fines = 47.4%	SC		▽ Water depth during drilling
40	SS	13				

BOREHOLE/TP/WELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

(Continued Next Page)

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 132 of 164

TETRA TECH
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 Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
						Very Dense to Medium Dense, Dark Brown, Moderately Cemented Fine Silty and Clayey **SAND**, Increasing Plasticity with Depth, Moist to Wet *(continued)*
45	SS	46	MC = 17.7% DD = 122.6 pcf LL = 29 Fines = 57.7%	CL		Stiff to Very Stiff, Dark Brown, Low Plasticity **CLAY** with Sand, Moist Stiff to Very Stiff, Dark Brown, Low Plasticity **CLAY** with Sand, Moist *(continued)*
						45.0 Borehole terminated at 45.0

BOREHOLE/TPWELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 133 of 164

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

BOREHOLE ID: B-2

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/18/2017
CONSULTANT: Tetra Tech, Inc.
DRILLING CONTRACTOR: Enviro Drill
Notes: Not Recorded

GROUND ELEVATION: NA
LATITUDE: 32.069966 N
LONGITUDE: 104.167700 W

METHOD:
LOGGED BY: Clint Merritt and Raj Meruva
DRILLED BY: Juan Uribe

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
3.5						
5	SS	50/5"	MC = 14.1% Fines = 41.9%			Very Dense, Pink, Strongly Cemented Medium Grained **SAND**, with <50% Quartz Fragments, Moist
5.0						Hard, Red, **SILT TO CLAY** Fines and Plasticity Increasing with Depth, with Sand, with <50% Quartz Fragments, Calcareous, Moist
10	SS	50/2"				
15	SS	50/3"	MC = 15.6% DD = 96.0 pcf LL = 44 Fines = 50.3%	ML		
20	SS	50/4"				
25	SS	50/3"				
30	SS	50/4"	MC = 20.4% DD = 93.1 pcf LL = 53 Fines = 59.2%	CH		
30.0						Very Dense, Pink, Strongly Cemented Medium Grained **SILTY SAND**, with >50% Quartz Fragments, Calcareous, Moist
35	SS	50/2"				
40	SS	50/4"	MC = 19.5% LL = 42 Fines = 38.8%	SM		
40.0						Borehole terminated at 40.0

BOREHOLE/TPWELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 134 of 164

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

BOREHOLE ID: B-3

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/18/2017
CONSULTANT: Tetra Tech, Inc.
DRILLING CONTRACTOR: Enviro Drill
Notes: Not Recorded

GROUND ELEVATION: NA
LATITUDE: 32.070140 N
LONGITUDE: 104.165980 W

METHOD:
LOGGED BY: Clint Merritt and Raj Meruva
DRILLED BY: Juan Uribe

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0					Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
3.5					
5	SS	50/5"	MC = 13.8% Fines = 52.9%		Very Dense, Pale Red, Weakly Cemented Medium Grained Sandy Silty **CLAY** with <10% Small Angular Limestone Fragments, Moist
10	SS	50/5"			
13.0					
15	SS	50/3"			Hard, Yellowish Brown, Strongly Cemented **SILTY CLAY**, with < 20% Small Angular Limestone Fragments, Slight odor, Calcareous, Slightly Moist
20	SS	50/4"	MC = 9.8% Fines = 85.6%		
25					
30					
35					
40					
40.0					Borehole terminated at 40.0

BOREHOLE/TP/WELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 135 of 164

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

BOREHOLE ID: B-4

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/17/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.068070 N
LOGGED BY: Clint Merritt and Raj Meruva
DRILLING CONTRACTOR: Enviro Drill
LONGITUDE: 104.165660 W
DRILLED BY: Juan Uribe
Notes: Not Recorded

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
5	SS	25	MC = 23.5% Fines = 54.8%			3.5 Medium Dense, Pink, Weakly Cemented Medium Grained **SILT**, Calcareous, Moist
10	SS	50/2"				8.5 Hard, Red, Strongly Cemented Low Plasticity **CLAY**, with Sand, Calcareous, Moist
15	SS	50/2"	MC = 16.5% DD = 96.1 pcf LL = 37 Fines = 61.9%	CL		
20	SS	50/2"				20.0 Very Dense, Red, Moderately Cemented Medium Grained Silty Clayey **SAND**, with < 20% Gypsum Fragments, Moist to Wet
25	SS	50/4"	MC = 10.0% Fines = 43.2%			▼ Water depth 48 hours after drilling
28.0						▽ Water depth during drilling
30	SS	20				Very Stiff to Hard, Red, Low Plasticity **CLAY**, with Sand, Moist
35	SS	26	MC = 15.5% DD = 113.9 pcf LL = 29 Fines = 92.1%	CL		
40	SS	35				Freestanding water

(Continued Next Page)

BOREHOLE/TP/WELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 136 of 164

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

BOREHOLE ID: B-4

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
						Very Stiff to Hard, Red, Low Plasticity CLAY, with Sand, Moist *(continued)*
45	SS	50/1"	MC = 15.1% LL = 30 Fines = 88.6%	CL		45.0
						Borehole terminated at 45.0

BOREHOLE/TP/WELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 137 of 164

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

BOREHOLE ID: B-5

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 05/17/2017
CONSULTANT: Tetra Tech, Inc.
DRILLING CONTRACTOR: Enviro Drill
Notes: Not Recorded

GROUND ELEVATION: NA
LATITUDE: 32.069030 N
LONGITUDE: 104.166890 W

METHOD:
LOGGED BY: Clint Merritt and Raj Meruva
DRILLED BY: Juan Uribe

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						Loose to Medium Dense, Brown, Sub Angular Medium Grained **SAND**
3.5						
5	SS	50/3"	MC = 17.0% Fines = 19.3%			Very Dense, Pink, Strongly Cemented Medium Grained **SAND**, Calcareous, Moist
8.5						
10	SS	50/4"	MC = 15.8% DD = 99.8 pcf LL = 42 Fines = 44.4%	SM		Very Dense, Pale Red, Strongly Cemented Medium Grained, Silty to Clayey **SAND** with > 40% Gypsum/Quartz Fragments, Calcareous, Moist
15	SS	50/4"				
20	SS	50/5"	MC = 15.9% DD = 114.2 pcf LL = 46 Fines = 49.7%	SC		
25	SS	50/4"	MC = 16.5% Fines = 25.9%			
25.0						
30	SS	50/3"	MC = 20.3% DD = 96.6 pcf LL = 62 Fines = 51.5%	CH		Hard, Pink, High Plasticity **CLAY** with Sand, Calcareous, Wet Water depth 22.5 hours after drilling Water depth during drilling
33.0						
35	SS	49				Very Dense to Medium Dense, Reddish Brown, Moderately Cemented Medium Grained **CLAYEY SAND** with > 30% Quartz Fragments, with Lenses of Clay, High Plasticity, Slightly Wet
40	SS	49				

BOREHOLE/TP/WELL - TT_HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

(Continued Next Page)

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 138 of 164

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

BOREHOLE ID: B-5

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
45						Very Dense to Medium Dense, Reddish Brown, Moderately Cemented Medium Grained **CLAYEY SAND** with > 30% Quartz Fragments, with Lenses of Clay, High Plasticity, Slightly Wet *(continued)*
50	SS	25	MC = 33.1% DD = 82.3 pcf LL = 83 Fines = 39.2%	SC		
55						
60	SS	50/3"	MC = 28.8% LL = 45 Fines = 56.3%	CL		60.0
65						Very Dense, Reddish brown, Clayey, Strongly Cemented Medium Grained **SAND**, with > 40% Quartz, Wet and Muddy
70	SS	50/1"				73.0
						Borehole terminated at 73.0

BOREHOLE/TP/WELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 139 of 164

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

BOREHOLE ID: B-6

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 08/17/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.071130 N
LOGGED BY: Not Recorded
DRILLING CONTRACTOR: Not Recorded
LONGITUDE: 104.166990 W
DRILLED BY: Not Recorded

Notes: No groundwater encountered. N values have been corrected for sampler diameter.

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0				Medium Dense, Brown, **SAND**, some Organics, No Odor, Dry
	CA	29		
3.0				Very Dense, Reddish Yellow, **SAND** with about 40% Small, Fine, Moderately Cemented Gravel Sandstone Fragments, No Organics, No Odor, Dry
5	CA	49		
7.0	CA	50/5"		Very Dense, Yellowish Brown, Fine **SAND**, with about 50%, Coarse Strongly Cemented Sandstone, Gravel, with Fine Moderately Cemented Quartz Gravel, No Odor, No Organics, Dry
10	ST			
15	CA	50/1"		
20	CA	50/3"		
25	CA	72		~ 10% Coarse Strongly Cemented Chert Gravel
30				
30.0	CA	19		Hard, Pale Red, **CLAY**, with about 20% Quartz, No Organics, No Odor, Dry
35	ST			
40	CA	50/1"		

BOREHOLE/TP/WELL - TT_HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

(Continued Next Page)

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 140 of 164

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

BOREHOLE ID: B-6

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
				Hard, Pale Red, **CLAY**, with about 20% Quartz, No Organics, No Odor, Dry *(continued)*
45				
50	ST			50.0
55				
60				
	CA	50/2"		
65				
70				
	CA	50/3"		
75				Borehole terminated at 76.5

BOREHOLE/TP/WELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 141 of 164

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

BOREHOLE ID: B-7

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 08/18/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.071740 N
LOGGED BY: Not Recorded
DRILLING CONTRACTOR: Not Recorded
LONGITUDE: 104.167650 W
DRILLED BY: Not Recorded

Notes: No groundwater encountered. N values have been corrected for sampler diameter.

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0				Dense to Very Dense, Reddish Brown **SAND**, No Organics, No Odor, Dry
	CA	27		
5	CA	50/5"		
	CA	50/3"		
	CA	50/2"		
7.0				Very Dense, Pink, **SAND**, with about 20% Weakly Cemented Quartz, No Odor, No Organics, Calcareous, Dry
10	CA	50/4"		
15	CA	50/3"		
20	CA	50/4"		
21.0				Hard, **CLAY**, with about 60% Moderately Cemented Quartz, No Odor, No Organics, Dry
25	ST			
30	CA	63		
35	CA	43		
40	ST			

BOREHOLE/TP/WELL - TT_HAYHURST.GPJ_LAB SUMMARY.GDT 8/24/17

(Continued Next Page)

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 142 of 164

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

BOREHOLE ID: B-7

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
41.5				Borehole terminated at 41.5

BOREHOLE/TP/WELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 143 of 164

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

BOREHOLE ID: B-8

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DATE(S) OF DRILLING: 08/18/2017
GROUND ELEVATION: NA
METHOD:
CONSULTANT: Tetra Tech, Inc.
LATITUDE: 32.071940 N
LOGGED BY: Not Recorded
DRILLING CONTRACTOR: Not Recorded
LONGITUDE: 104.166430 W
DRILLED BY: Not Recorded

Notes: No groundwater encountered. N values have been corrected for sampler diameter.

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0				Medium Dense to Very Dense, Reddish Brown, **SAND**, some Organics, No Odor, Dry
	CA	23		
5	CA	50/5"		
	CA	50/4"		
	CA	50/5"		
10	CA	50/5"		
15	CA	50/5"		
20	CA	50/6"		
25				25.0
	CA	9		Stiff, Red, **CLAY**, with 30% Quartz, No Odor, No Organics, Dry
30	ST			30.0
	CA	16		Very Stiff to Hard, Red, **CLAY**, with 30% Quartz, No Odor, No Organics, Moist
35	ST			
40	CA	50/4"		

BOREHOLE/TPWELL - TT HAYHURST.GPJ LAB SUMMARY.GDT 8/24/17

(Continued Next Page)

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Page 144 of 164

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

BOREHOLE ID: B-8

CLIENT Chevron
PROJECT NAME Hayhurst NM, Sec.2 Frac Pond
PROJECT NUMBER 212C-MD-00848
PROJECT LOCATION Eddy County, New Mexico

DEPTH (ft)	SAMPLE TYPE	BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION
41.5				Borehole terminated at 41.5

BOREHOLE/TP/WELL - TT HAYHURST GPJ LAB SUMMARY.GDT 8/24/17

Received by OCD: 4/13/2022 9:13:07 AM
Released to Imaging: 5/4/2022 2:56:47 PM

Appendix 5 – Section 10 Recycling Containment Groundwater Boring Report and Log

ENGINEERS

November 2, 2016

Mr. Christian Alvarado
Western Slope Oil Services
10201 W Hwy 158
Midland, TX. 79707

Re: Limited Subsurface Geotechnical Investigation
Section 10 East Pond
Hayhurst, New Mexico

Dear Mr. Alvarado:

We thank you for the opportunity to present the enclosed geotechnical exploration letter-report for the above referenced project. This report includes geotechnical field data. This report also describes the procedures utilized for our field investigation.

The project consists of the design and construction of a frac pond, in Section 10 East Pond, in Hayhurst , New Mexico.

Field Exploration

In our field exploration phase, we drilled one (1) exploratory boring to a depth of 75 feet, below ground surface. We drilled the soil boring in general accordance with ASTM D-6151 procedures using a truck-mounted CME-75 drill rig. The soil boring was located using GPS decvices and information provided by Western Slope Oil Services (Client). The boring plan is included in the Appendix of this report as Sheet A-1.

We also prepared a log of the soil boring to delineate the soil strata studied at the site. The boring log is included in the Appendix as Sheet A-1

Groundwater

Groundwater was **not** encountered in our soil boring at the time of our field exploration.

Limitations

We have performed our professional services, and have obtained the data presented in this report in accordance with generally accepted geotechnical

2101 E. Missouri Ave., Suite B
El Paso, TX 79903

www.loi-engineers.com
TBPE F-14023

TEL. (915) 781-1532
FAX. (915) 781-1190
TOLL FREE. 1.844.LOI.TEST

engineering principles and practices. The information in this report is based on the data obtained from one representative test boring and on our knowledge of the project conditions at the time of our geotechnical engineering investigation.

The data in this report reflects subsurface soil conditions only at the specific sampling location, time of sampling, and to the depths indicated in our report. We recommend the client to notify LOI ENGINEERS of any changes to the project conditions considered in this report, so that changes to our report can be made if necessary.

It was a pleasure to work with you on this phase of your project, and we look forward to assist you further during construction activities. If you have any questions regarding the information we present herein, please call us.

Respectfully submitted,

LOI ENGINEERS

BERNARDINO OLAGUE
NEW MEXICO
13301
REGISTERED PROFESSIONAL ENGINEER

Bernardino Olague, P.E.
Principal

11/2/16

Copies: Above (1, via e-mail)

LOG OF TEST BORING No. 1

Project name: Frac Pond at Hayhurst, New Mexico
File No.: LOI16-141
Boring location: Section 10 East Pond
Surface elevation: N/A
Date drilled: October 27, 2016

ENGINEERS

Elevation and Depth (Ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content, %	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	SPT N-Value: Blows per foot (N)	SPT N-Value: CURVE (10 30 50)
0			SAND, fine grained, silty, brown, lightly moist	SM							
5			- with traces of clayey material								
			SAND, fine grained, clayey, brown, lightly moist, with fine gravel	SC							
10			SAND, fine grained, silty, brown, lightly moist	SM							
15			- with traces of calcareous material								
20											
25			- light brown								
30			- brown								

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: SSA
Logger: LM

Sheet No. A-1

LOG OF TEST BORING No. 1

Project name: Frac Pond at Hayhurst, New Mexico
File No.: LOI16-141
Boring location: Section 10 East Pond
Surface elevation: N/A
Date drilled: October 27, 2016

ENGINEERS

Elevation and Depth (Ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	SPT N-Value: Blows per foot (N)	SPT N-Value: CURVE (10 30 50)
35											
40											
45			- light brown								
50			- moist								
55				SM							
60											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: SSA
Logger: LM

Sheet No. A-2

LOG OF TEST BORING No. 1

Project name: Frac Pond at Hayhurst, New Mexico
File No.: LOI16-141
Boring location: Section 10 East Pond
Surface elevation: N/A
Date drilled: October 27, 2016

ENGINEERS

Elevation and Depth (Ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content, %	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	SPT N-Value: Blows per foot (N)	SPT N-Value: CURVE (10 30 50)
65			- grey								
70											
75											
			Termination depth at 76.5 feet								
80											
85											
90											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: SSA
Logger: LM

Sheet No. A-3

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

1. GENERAL AND WELL LOCATION

OSE POD NO. (WELL NO.): C-4573 Pod-1 (B-1/SB-F)	WELL TAG ID NO.	OSE FILE NO(S).: C-4573
WELL OWNER NAME(S): Tetra Tech, Inc. on Behalf of Chevron N.A. E&P Co.		PHONE (OPTIONAL): 432-215-9426
WELL OWNER MAILING ADDRESS: 901 W. Wall St. Suite 100		CITY: Midland STATE: TX ZIP: 79701

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32	3	38.72	N
	LONGITUDE	-104	10	5.25	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS – PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE: SW.NW.NW 11-26S-27E

2. DRILLING & CASING INFORMATION

LICENSE NO.	NAME OF LICENSED DRILLER		NAME OF WELL DRILLING COMPANY
WD-1456	John W. White		White Drilling Company, Inc.
DRILLING STARTED	**DRILLING ENDED**	**DEPTH OF COMPLETED WELL (FT)**	**BORE HOLE DEPTH (FT)**	**DEPTH WATER FIRST ENCOUNTERED (FT)**
10/21/2021	10/21/2021		104.0	35.0

COMPLETED WELL IS: ☐ ARTESIAN ☐ DRY HOLE ☑ SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT): 35.0

DRILLING FLUID: ☑ AIR ☐ MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ☑ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY:

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE (add coupling diameter)	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 04/30/19)

FILE NO. C-4573	POD NO. 1	TRN NO. 709289
LOCATION 26S.27E.11.113	WELL TAG ID NO.	PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES **(attach supplemental sheets to fully describe all units)**	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	3.5	3.5	Brown silty sand	Y ✓ N	
3.5	6.5	3.0	Pink and yellow silty sand w/gravel	Y ✓ N	
6.5	23.5	17.0	Red, brown, gray and yellow sandy clay	Y ✓ N	
23.5	63.0	39.5	Gypsum	✓ Y N	
63.0	64.0	1.0	Red clay	✓ Y N	
64.0	72.0	8.0	Gypsum	✓ Y N	
72.0	87.0	15.0	Yellow brown sandstone w/gypsum and red clay mixed	✓ Y N	
87.0	104.0	17.0	Gypsum w/gray limestone mixed	✓ Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA:

☐ PUMP ☐ AIR LIFT ☐ BAILER ☐ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm): 0.00

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

William B. Atkins

6. SIGNATURE

BY SIGNING BELOW, I CERTIFY THAT TO THE BEST OF MY KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED WELL. I ALSO CERTIFY THAT THE WELL TAG, IF REQUIRED, HAS BEEN INSTALLED AND THAT THIS WELL RECORD WILL ALSO BE FILED WITH THE PERMIT HOLDER WITHIN 30 DAYS AFTER THE COMPLETION OF WELL DRILLING.

John White — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

11/17/2021 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 04/30/2019)

FILE NO.	POD NO.	TRN NO.	
LOCATION		WELL TAG ID NO.	PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

1. GENERAL AND WELL LOCATION

OSE POD NO. (WELL NO.): C-4573 Pod-2 (B-2/SB-B)	WELL TAG ID NO.	OSE FILE NO(S).: C-4573
WELL OWNER NAME(S): Tetra Tech, Inc. on Behalf of Chevron N.A. E&P Co.		PHONE (OPTIONAL): 432-215-9426
WELL OWNER MAILING ADDRESS: 901 W. Wall St. Suite 100		CITY: Midland STATE: TX ZIP: 79701

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32	3	41.59	N
	LONGITUDE	-104	10	3.69	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND

* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS – PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE: SW.NW.NW 11-26S-27E

2. DRILLING & CASING INFORMATION

LICENSE NO.	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1456	John W. White	White Drilling Company, Inc.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
10/20/2021	10/20/2021		104.0	34.5

COMPLETED WELL IS: ☐ ARTESIAN ☐ DRY HOLE ☑ SHALLOW (UNCONFINED)

STATIC WATER LEVEL IN COMPLETED WELL (FT): 34.5

DRILLING FLUID: ☑ AIR ☐ MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ☑ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY:

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE (add coupling diameter)	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

OSE DII NOV 19 2021 PM 12:55

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 04/30/19)

FILE NO. C-4573	POD NO. 2	TRN NO. 709289	
LOCATION 26S.27E.11.113		WELL TAG ID NO.	PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES **(attach supplemental sheets to fully describe all units)**	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	7.5	7.5	Pink silty sand	Y ✓ N	
7.5	55.0	47.5	Gypsum	✓ Y N	
55.0	60.0	5.0	Brown sand	✓ Y N	
60.0	80.0	20.0	Brown sand w/red clay and grvael	✓ Y N	
80.0	104.0	24.0	Yellow brown sandstone w/red clay and gravel mixed	✓ Y N	
			Caliche w/red clay	✓ Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA:

☐ PUMP ☐ AIR LIFT ☐ BAILER ☐ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm): 0.00

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

William B. Atkins

6. SIGNATURE

BY SIGNING BELOW, I CERTIFY THAT TO THE BEST OF MY KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED WELL. I ALSO CERTIFY THAT THE WELL TAG, IF REQUIRED, HAS BEEN INSTALLED AND THAT THIS WELL RECORD WILL ALSO BE FILED WITH THE PERMIT HOLDER WITHIN 30 DAYS AFTER THE COMPLETION OF WELL DRILLING.

John White — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

11/17/2021 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 04/30/2019)

FILE NO.	POD NO.	TRN NO.	
LOCATION		WELL TAG ID NO.	PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

1. GENERAL AND WELL LOCATION

OSE POD NO. (WELL NO.)	WELL TAG ID NO.	OSE FILE NO(S).
C-4573 Pod-3 (B-3/SB-B)		C-4573

WELL OWNER NAME(S)	PHONE (OPTIONAL)
Tetra Tech, Inc. on Behalf of Chevron N.A. E&P Co.	432-215-9426

WELL OWNER MAILING ADDRESS	CITY	STATE	ZIP
901 W. Wall St. Suite 100	Midland	TX	79701

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32	3	42.92	N
	LONGITUDE	-104	10	2.96	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND

* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS – PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

SW.NW.NW 11-26S-27E

2. DRILLING & CASING INFORMATION

LICENSE NO.	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1456	John W. White	White Drilling Company, Inc.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
10/21/2021	10/21/2021		100.0	35.5

COMPLETED WELL IS: ☐ ARTESIAN ☐ DRY HOLE ☑ SHALLOW (UNCONFINED)

STATIC WATER LEVEL IN COMPLETED WELL (FT): 35.5

DRILLING FLUID: ☑ AIR ☐ MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ☑ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY:

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE (add coupling diameter)	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

OSE DIT NOV 15 2021 PM1:00

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 04/30/19)

FILE NO. C-4573	POD NO. 3	TRN NO. 709289
LOCATION 26S.27E.11.114	WELL TAG ID NO.	PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES **(attach supplemental sheets to fully describe all units)**	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	3.5	3.5	Brown silty sand w/gravel	Y ✓ N	
3.5	6.5	3.0	Red brown gravel w/silty sand	Y ✓ N	
6.5	24.0	17.5	Red brown clayey sand	Y ✓ N	
24.0	50.0	26.0	Gypsum	✓ Y N	
50.0	53.0	3.0	Gravel w/sand	✓ Y N	
53.0	60.0	7.0	Caliche w/red clay	✓ Y N	
60.0	100.0	40.0	Gypsum w/limestone gravel and red clay mix	✓ Y N	
				✓ Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA:

☐ PUMP ☐ AIR LIFT ☐ BAILER ☐ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm): 0.00

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

William B. Atkins

6. SIGNATURE

BY SIGNING BELOW, I CERTIFY THAT TO THE BEST OF MY KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED WELL. I ALSO CERTIFY THAT THE WELL TAG, IF REQUIRED, HAS BEEN INSTALLED AND THAT THIS WELL RECORD WILL ALSO BE FILED WITH THE PERMIT HOLDER WITHIN 30 DAYS AFTER THE COMPLETION OF WELL DRILLING.

John White — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

11/17/2021 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 04/30/2019)

FILE NO.	POD NO.	TRN NO.	
LOCATION		WELL TAG ID NO.	PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

ID STATE ENGINEER OFFICE ROSWELL, NEW MEXICO

2019 FEB -7 AM 10: 23

1. GENERAL AND WELL LOCATION

OSE POD NO. (WELL NO.)	WELL TAG ID NO.	OSE FILE NO(S).
POD 1 (MW-1)		C-4269

WELL OWNER NAME(S)	PHONE (OPTIONAL)
Plains All American Pipeline, L.P.	

WELL OWNER MAILING ADDRESS	CITY	STATE	ZIP
P.O. Box 4648	Houston	TX	77002

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32	02	25.56	N
	LONGITUDE	104	13	51.03	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND

* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS – PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

K, Section 18, T 26 S, R 27 E, Eddy Co. NM

2. DRILLING & CASING INFORMATION

LICENSE NO.	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
1575	Shane Currie	Talon LPE

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
09/17/2018	09/18/2018	105	105	N/A

COMPLETED WELL IS: ☐ ARTESIAN ☑ DRY HOLE ☐ SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT)

DRILLING FLUID: ☑ AIR ☐ MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ☑ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY:

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE (add coupling diameter)	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	45	5.625	New Plastic PVC SCH. 40	Blank	2		
45	105	5.625	New Plastic PVC SCH. 40	Screen	2		0.010

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	3	5.625	Cement	0.45	Tremie
3	40	5.625	Bentonite	5.61	Tremie
40	105	5.625	8/16 Sand	9.86	Tremie

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/30/17)

FILE NO. C-4269	POD NO. 1	TRN NO. 628620
LOCATION Exp1 26S.27E.18.324	WELL TAG ID NO. —	PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES **(attach supplemental sheets to fully describe all units)**	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	8	8	Light Brown Silty Sand, Fine, Poorly Graded, Dry, Dense, Caliche	Y ✓ N	
8	16	8	Light Brown-Gray Limestone, Very Hard	Y ✓ N	
16	76	60	Light Brown Silty Sand, Fine, Poorly Graded, Damp, Dense, Calcareo	Y ✓ N	
76	94	18	Light Brown-Pink Silty Sand, Medium Grain, Poorly Grain, Damp	Y ✓ N	
94	98	4	Light Brown-Pink Silty Sand, Medium Grain, Poorly Grain, Moist, Loose	✓ Y N	
98	105	7	Light Brown Silty Sand, Fine, Poorly Grain, Damp, Dense	✓ Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA:

☑ PUMP ☐ AIR LIFT ☐ BAILER ☐ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm): 0.00

5. TEST; RIG SUPERVISION

WELL TEST: TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 30 DAYS AFTER COMPLETION OF WELL DRILLING:

Shane Currie — 2/4/19

SIGNATURE OF DRILLER / PRINT SIGNEE NAME — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/30/2017)

FILE NO. C-4269	POD NO. 1	TRN NO. 628620
LOCATION 26S.27E.18.324	WELL TAG ID NO. —	PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

1. GENERAL AND WELL LOCATION

OSE POD NO. (WELL NO.)	WELL TAG ID NO.	OSE FILE NO(S).
C-4078 RR9F		

WELL OWNER NAME(S)	PHONE (OPTIONAL)
David and LaVern Maley	575-236-6041

WELL OWNER MAILING ADDRESS	CITY	STATE	ZIP
PO Box 2459	Carlsbad	NM	88220

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32°	05'	13.3"	N
	LONGITUDE	104°	11'	53.4"	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS – PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

Section 33, T26S R27E

2. DRILLING & CASING INFORMATION

LICENSE NO.	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD 1690	Jason Maley	Vision Resources, Inc

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
5/23	5/24	156.7 BGS	180'	20'

COMPLETED WELL IS: ☐ ARTESIAN ☐ DRY HOLE ☒ SHALLOW (UNCONFINED)

STATIC WATER LEVEL IN COMPLETED WELL (FT): 18.5'

DRILLING FLUID: ☒ AIR ☐ MUD ADDITIVES – SPECIFY: – None

DRILLING METHOD: ☒ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY:

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE (add coupling diameter)	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	37.5	12 1/4"	SDR21 PVC 1120	Bell - 7.31"	6"	5/16	–
37.5	156.7	12 1/4"	SCH 40 PVC	Bell - 7.31"	6"	5/16	0.035

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	20	12 1/4"	Cement	22	Tremie
20	180	12 1/4"	Gravel	99	Gravity Pour

FOR OSE INTERNAL USE WR-20 WELL RECORD & LOG (Version 06/30/17)

FILE NO.	C-4078	POD NO.		TRN NO.	607491	
LOCATION	25S.27E.33.1.4.3 EXPL			WELL TAG ID NO.	N/A	PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	35	35	Clayey Silt, brown	(Y) N	Trace
35	85	50	Gravels, <10% nonplastic fines	(Y) N	30
85	110	25	Silty Gravels; reddish brown, 40%	(Y) N	30
			non to low plastic fines, 60% Gravels	Y N	
110	150	40	Gravels	(Y) N	30
150	180	30	Gypsum/Anhydrite bedrock	Y (N)	–
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA:

☐ PUMP ☒ AIR LIFT ☐ BAILER ☐ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm): 90 ~~0.00~~

5. TEST; RIG SUPERVISION

WELL TEST: TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

Jason Fine

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 30 DAYS AFTER COMPLETION OF WELL DRILLING:

Jason Maley — Jason Maley — 5/28/18

SIGNATURE OF DRILLER / PRINT SIGNEE NAME — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/30/2017)

FILE NO. C-4078	POD NO. 1	TRN NO. 607491
LOCATION 25S.27E.33.1.4.3	WELL TAG ID NO. N/A	PAGE 2 OF 2

Appendix Site Photographs

SITE PHOTOGRAPHS

SP1 View east showing existing Chevron recyling facility associated with Section 2 Containments. The proposed Gravitas AST will be placed on the northwest portion of the pad, which is the left edge of this image. Windmill (Misc-58) is beneath the red arrow.

SP2 View to southeast from approximate location of B1, a 45-foot boring that encountered groundwater during drilling at about 31 feet and resulted in a static water level of 26 feet below surface. The existing Chevron recycling facility is in the center of the image (red frac tanks).

Figure SP3 View east showing the windmill structure, water storage tank and unlined stock water hole in the center of the image. We believe an unlined stock watering "tank" existed at this site for about 100 years.

District I
1625 N. French Dr., Hobbs, NM 88240
Phone:(575) 393-6161 Fax:(575) 393-0720
District II
811 S. First St., Artesia, NM 88210
Phone:(575) 748-1283 Fax:(575) 748-9720
District III
1000 Rio Brazos Rd., Aztec, NM 87410
Phone:(505) 334-6178 Fax:(505) 334-6170
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505
Phone:(505) 476-3470 Fax:(505) 476-3462

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

CONDITIONS

Action 98144

CONDITIONS

Operator: SOLARIS WATER MIDSTREAM, LLC 907 Tradewinds Blvd, Suite B Midland, TX 79706	OGRID: 371643
	Action Number: 98144
	Action Type: [C-147] Water Recycle Long (C-147L)

CONDITIONS

Created By	Condition	Condition Date
vvenegas	NMOCD has reviewed and approved the recycling containment permit application and related documents, submitted by [371643] SOLARIS WATER MIDSTREAM LLC on April 13, 2022, for 2RF-173 - GRAVITAS AST CONTAINMENT FACILITY ID [fVV2212248165] in Unit Letter N, Section 02, Township 26S, Range 27E, Eddy County, New Mexico.	5/4/2022