



QUALITY ACTIONS FOR QUALITY CLIENTS

LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
C-147 FLUID RECYCLING FACILITY APPLICATION

SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST

LEA COUNTY, NEW MEXICO

SEPTEMBER 2025



9.24.2025

025281-00

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: Legion Water Services II, LLC. (For multiple operators attach page with information) OGRID #: 333437
 Address: 1515 Wynkoop Street Suite 700, Denver, CO 80202
 Facility or well name (include API# if associated with a well): Paloma East, Inflow Containment
 OCD Permit Number: 1RF-542 (For new facilities the permit number will be assigned by the district office)
 U/L or Qtr/Qtr Section 15 Township 20 South Range 34 East County: Lea
 Surface Owner: ☐ Federal ☐ State ☒ Private ☐ Tribal Trust or Indian Allotment

2.
☒ **Recycling Facility:**
 Location of recycling facility (if applicable): Latitude 32.568345 Longitude -103.548482 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 32.568390 Longitude -103.547569 NAD83
☐ For multiple or additional recycling containments, attach design and location information of each containment
☐ Lined ☐ Liner type: Thickness 60/40 mil ☐ LLDPE ☒ HDPE ☐ PVC ☐ Other _____
☐ String-Reinforced
 Liner Seams: ☒ Welded ☐ Factory ☐ Other _____ Volume: 12,191 bbl Dimensions: L 300 x W 75 x D 12
☐ 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 \$ 1,825,076.01 (work on these facilities cannot commence until bonding amounts are approved)
- ☒ Attach closure cost estimate and documentation on how the closure cost was calculated.

5.

Fencing:

- ☐ Four foot height, four strands of barbed wire evenly spaced between one and four feet
- ☒ Alternate. Please specify 8-ft Tall Wire Mesh Game Fence

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

☐ 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

☐ Yes ☒ No
☐ NA

Within the area overlying a subsurface mine.

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

☐ Yes ☒ No

Within an unstable area.

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

☐ Yes ☒ No

Within a 100-year floodplain. FEMA map

☐ Yes ☒ No

Within 300 feet of a continuously flowing watercourse, or 200 feet of any other significant watercourse, or lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark).

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

☐ Yes ☒ No

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

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

☐ Yes ☒ No

Within 500 horizontal feet of a spring or a fresh water well used for domestic or stock watering purposes, in existence at the time of initial application.

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

☐ Yes ☒ No

Within 500 feet of a wetland.

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

☐ Yes ☒ No

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): Sarah Ferreyros Title: VP - Regulatory & Environmental Affairs
Signature: *Sarah Ferreyros* Date: 9/30/2025
e-mail address: sarah@avantr.com Telephone: 720-854-9020

11.

OCD Representative Signature: *Victoria Venegas* Approval Date: 10/08/2025

Title: Environmental Specialist OCD Permit Number: 1RF-542

- ☒ OCD Conditions _____
- ☐ Additional OCD Conditions on Attachment _____

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

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☒ **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 32.569625 Longitude -103.546087 NAD83
☐ For multiple or additional recycling containments, attach design and location information of each containment
☐ Lined ☐ Liner type: Thickness 60/40 mil ☐ LLDPE ☒ HDPE ☐ PVC ☐ Other _____
☐ String-Reinforced
Liner Seams: ☒ Welded ☐ Factory ☐ Other _____ Volume: 1,009,412 bbl Dimensions: L 750 x W 675 x D 20
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Signature: *Sarah Ferreyros* Date: 9/30/2025
e-mail address: sarah@avanti-nr.com Telephone: 720-854-9020

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OCD Representative Signature: *Victoria Venegas* Approval Date: 10/08/2025

Title: Environmental Specialist OCD Permit Number: 1RF-542

- ☒ OCD Conditions _____
- ☐ Additional OCD Conditions on Attachment _____



September 23, 2025

Ms. Victoria Venegas
New Mexico EMNRD
Oil Conservation Division

RE: Rule 34 Variance Request –Produced Water Impoundment Bird Netting

Ms. Venegas:

Legion Water Services is requesting a variance to Rule 34-Part 12(E) Netting to ensure the recycling facility is protected from wildlife. Based on our experience from previous projects, we believe audible bird deterrents provide equal or better protection when compared to netting. In addition, they require less inspection, maintenance, and repair over the life of the facility.

Legion is proposing to use the "Bird-X Mega Blaster Pro" system. This system will replace the netting required by the current rule. It should be noted that this variance has been granted on previous sites.

Should you have any questions or require additional information, please contact me by phone at 580-234-8780 or by email at mratke@envirotechconsulting.com at your convenience.

Thank you for your consideration.
Best regards,

ENVIROTECH ENGINEERING & CONSULTING, INC.



Mitchell Ratke, P.E.
Senior Project Engineer, Energy Infrastructure



September 23, 2025

Ms. Victoria Venegas
New Mexico EMNRD
Oil Conservation Division

RE: Rule 34 Variance Request –Produced Water Impoundment Fencing

Ms. Venegas:

Legion Water Services is requesting a variance to C-147 Fencing requirement for requiring a fence four foot in height, with four strands of barbed wire evenly spaced between one and four feet. Legion is requesting approval to a wire mesh, game fence, eight (8) feet in height. Based on our experience, we feel that the requested fencing will provide greater security to the facility for excluding animals and unauthorized individual access. Details for this type of fence can be found on Sheet 14 of 16 in Attachment B Engineering Drawings.

The proposed fencing has been approved for other C-147 facilities and used extensively on similar projects in New Mexico and Texas with outstanding success in deterring unauthorized entry by both humans and wildlife. It should be noted that this variance request has been approved on previous sites.

Should you have any questions or require additional information, please contact me by phone at 580-234-8780 or by email at mratke@envirotechconsulting.com at your convenience.

Thank you for your consideration.
Best regards,

ENVIROTECH ENGINEERING & CONSULTING, INC.



Mitchell Ratke, P.E.
Senior Project Engineer, Energy Infrastructure



September 23, 2025

Ms. Victoria Venegas
New Mexico EMNRD
Oil Conservation Division

RE: Rule 34 Variance Request –Produced Water Recycling Containment Secondary Liner

Ms. Venegas:

Legion Water Services is requesting a variance to Rule 34 Part 12(A)(4) requiring secondary liners to be 30-mil string reinforced LLDPE. Legion is requesting approval to use 40-mil HDPE in place of the specified material in the proposed Recycle Containment. Based on our experience, we feel that the requested material will allow us to provide equal environmental protection in our impoundments.

Due to the construction of the 30-mil reinforced LLDPE material, nondestructive QA/QC testing cannot be performed. The proposed 40-mil HDPE will be seamed in a manner that will allow nondestructive pressure testing of the seams to ensure proper sealing.

The proposed HDPE is appropriate material for the proposed use in the impoundment and is compatible with the material that will be stored. This material will provide equal or better environmental protection as the specified 30-mil reinforced LLDPE.

The proposed new liner system cross-section for the earthen containments is as follows: prepared subgrade, 10 oz. geotextile, 40-mil HDPE, 200-mil geonet, 60-mil HDPE. This will replace the cross-section required by the current rule. It should also be noted that this variance has been granted on past sites.

Should you have any questions or require additional information, please contact me by phone at 580-234-8780 or by email at mratke@envirotechconsulting.com at your convenience.

Thank you for your consideration.
Best regards,

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9-24-2025

Mitchell Ratke, P.E.
Senior Project Engineer, Energy Infrastructure



LEGION PALOMA EAST RECYCLE FACILITY
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO
025281-00

TABLE OF CONTENTS

1.0	LOCATION.....	1
2.0	DISTANCE TO GROUNDWATER.....	1
2.1	GROUNDWATER WELLS	1
2.2	AQUIFERS	1
2.3	GEOLOGY	2
3.0	DISTANCE TO MUNICIPALITIES AND FRESHWATER FIELDS	2
4.0	DISTANCE TO SUBSURFACE MINES.....	2
5.0	DISTANCE TO HIGH OR CRITICAL KARST AREAS (UNSTABLE AREAS)	2
6.0	DISTANCE TO 100-YEAR FLOOD PLAIN.....	2
7.0	DISTANCE TO SURFACE WATER	3
8.0	DISTANCE TO PERMANENT RESIDENCE OR STRUCTURES	3
9.0	DISTANCE TO NON-PUBLIC WATER SUPPLY	3
10.0	DISTANCE TO WETLANDS	3

ATTACHMENTS:

ATTACHMENT A	BANKS WATER WELL REPORT
ATTACHMENT B	ENGINEERING DRAWINGS
ATTACHMENT C	DESIGN AND CONSTRUCTION PLANS
ATTACHMENT D	MATERIAL SPECIFICATION
ATTACHMENT E	OPERATING AND MAINTENANCE PLAN
ATTACHMENT F	CLOSURE PLAN

FIGURES:

FIGURE 1	SITE MAP
FIGURE 2	GROUNDWATER WELLS MAP
FIGURE 3	NEW MEXICO AQUIFERS MAP
FIGURE 4	NEW MEXICO GEOLOGICAL MAP
FIGURE 5	MUNICIPALITIES & FRESHWATER FIELDS MAP
FIGURE 6	NEW MEXICO REGISTERED MINES MAP
FIGURE 7	KARST AND CAVE MAP
FIGURE 8	FEMA FLOOD MAP
FIGURE 9	SURFACE WATER MAP
FIGURE 10	PERMANENT RESIDENCES AND STRUCTURES MAP
FIGURE 11	NON-PUBLIC WATER SUPPLY MAP
FIGURE 12	NWI WETLANDS MAP



SITE CRITERIA FOR RECYCLING CONTAINMENT

1.0 LOCATION

Legion Water Services is proposing to construct a recycle containment, Paloma East Recycle Facility, located in Section 15, Township 20 South, Range 34 East, in Lea County, New Mexico. An aerial photographic map, *Figure 1*, shows the location of the proposed facility. This report was generated for the proposed location to evaluate that the proposed facility location would be in accordance with the 19.15.34.11 NMAC Siting Requirements for Recycling Containments.

2.0 DISTANCE TO GROUNDWATER

2.1 GROUNDWATER WELLS

Banks Environmental Data (Banks) was contracted to search the New Mexico Office of State Engineers (OSE) records for water wells within a 1.0-mi. radius of the proposed facility location. According to Banks, there are four (4) groundwater wells within a 1.0-mi. radius of the proposed facility. The Banks Water Well Report is included as *Attachment A*, and *Figure 2* illustrates that there four (4) water wells located within the 1.0-mi. radius of the proposed facility.

The New Mexico Oil and Gas Division (NMOCD) requires that groundwater (freshwater as defined by NMOCD rules) at the location be greater than 50-ft below the containment bottom. *Figure 2* demonstrates the following to meet these criteria:

1. The location of the proposed facility shown on the United States Geologic Survey (USGS) Laguna Gatuna Quadrangle, NM 7.5 Minute Series Topographic Map.
2. A 1.0-mile radius from the site, and location of water wells in comparison to that radius. It should be noted, OSE wells can be mis-located as older wells are plotted in the center of the quarter, quarter, quarter section, township, and range.
3. The Banks search of the OSE records show there were four (4) groundwater wells located within a 1.0-mi radius from the boundary of the proposed containment. The closest water well (USGS 323409103321301) with a reported depth to groundwater is located approx. 2,000-ft northeast of the proposed facilities northeast corner. Based on the latest data reported by the United States Geological Survey database, the depth to water at this well is reported to be 145.2-ft below ground surface on February 2nd, 1996.

2.2 AQUIFERS

Information reviewed from the Bureau of Land Management (BLM) Carlsbad Field Office shows the proposed facility is located within an aquifer system labeled "Other." *Figure 3* shows the site location in reference to Bureau of Land Management Declared Aquifers in the State of New Mexico.



2.3 GEOLOGY

A geological map of New Mexico was obtained from the United States Geological Survey (USGS) to review the geologic setting for the proposed containment location. Based on the review of the geologic map, the proposed facility lies within the Eolian and Piedmont deposits. Interlayered eolian sands and piedmont slope deposits along the eastern flank of the Pecos River valley, primarily between Roswell and Carlsbad. Typically capped by thin eolian deposits.

Figure 4 is reproduction of the USGS New Mexico Geologic Map. Figure 4 shows the following:

1. Location of the proposed Containment
2. Geologic setting of the Containment

3.0 DISTANCE TO MUNICIPALITIES AND FRESHWATER FIELDS

Figure 5 demonstrates that the location is not located within incorporated municipal boundaries or within a defined municipal freshwater field covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3. Figure 5 illustrates the following:

1. The closest municipality to the proposed facility is Monument, New Mexico, located approximately 15.3-mi. to the northeast.
2. The closest freshwater field to the proposed facility is the Monument MDWCA Water Supply System located approximately 16-mi. to the northeast.

4.0 DISTANCE TO SUBSURFACE MINES

According to the New Mexico Mining and Minerals Division there are no subsurface mines near the proposed facility. The proposed facility location is not within an area overlying a subsurface mine. Figure 6 illustrates the following:

1. The nearest registered subsurface mine is Pit C0-1110-0, an active mining site for industrial minerals. The mine is located approximately 3.5-mi. southwest of the proposed facility location.

5.0 DISTANCE TO MEDIUM, HIGH, OR CRITICAL KARST AREAS (UNSTABLE AREAS)

The Bureau of Land Management Carlsbad Field Office Cave Potential map was reviewed for the proposed facility. Figure 7 illustrates the following:

1. The proposed facility is located in a "low" karst potential area.

6.0 DISTANCE TO 100-YEAR FLOOD PLAIN

The Federal Emergency Management Agency (FEMA) Flood Map Service Center was utilized to review the flood map for the proposed facility location. The proposed facility is located on FEMA flood map



panel number 35025C1450D, "Zone D" and was effective on 12/16/2008. *Figure 8* demonstrates the area of the site is located on a "Not Printed" panel.

1. The proposed facility is located within "Zone D." FEMA defines Zone D as an area undetermined flood hazard. The proposed facility is not within a mapped 100-year flood plain.

7.0 DISTANCE TO SURFACE WATER

After review of the Laguna Gatuna Quadrangle, NM, USGS 7.5-Minute Series Topographic map, *Figure 9*, there is no continuously flowing surface waters located on or near the proposed facility. *Figure 9* illustrates the following:

1. No continuously flowing surface waters or other water bodies defined by NMOCD are located on the proposed facility.
2. The closest surface waterbody is located approximately 3,800-ft to the southwest.

8.0 DISTANCE TO PERMANENT RESIDENCE OR STRUCTURES

The aerial image provided in *Figure 10*, demonstrates:

1. The proposed facility is not within 1,000-ft. of an occupied permanent residence, school, hospital, institution, church, or other permanent structure. The only items of interest found were existing oil and gas infrastructure. No churches, schools, or residential structures were identified.
2. *Figure 10* and *Figure 1 (Site Map)* show that the nearest permanent structure is a residence approximately 4.2-mi southeast of the facility boundary.

9.0 DISTANCE TO NON-PUBLIC WATER SUPPLY

The proposed facility must not be within 500-ft. horizontally of a spring or freshwater well used for domestic or stock watering purposes, in existence at the time of initial application. *Figure 11* demonstrates the following:

1. The proposed facility is not located within 500-ft. horizontally of a spring or freshwater well.
2. No springs were identified within the proposed facility location.
3. The closest water well (CP-02063-POD1) to the facility is approximately 4,250-ft. to the southeast of the facilities southeastern corner.

In addition, *Figure 2 (Groundwater Wells Map)* illustrates that the proposed facility location is not located within 500-ft. of known domestic water wells and that there are four (4) groundwater or domestic water wells located within 1.0-mi. of the proposed facility.

10.0 DISTANCE TO WETLANDS

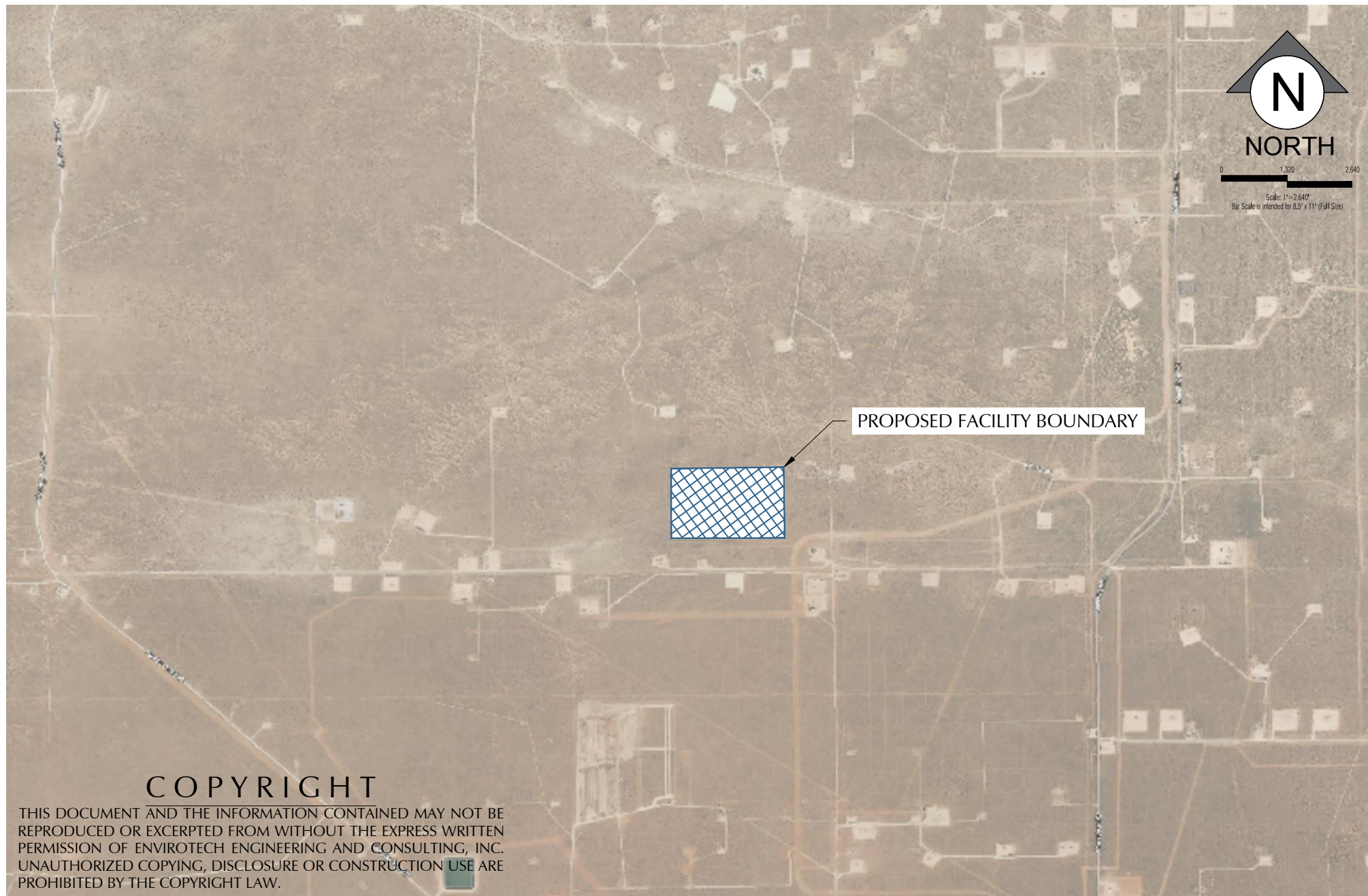
The United States Fish and Wildlife National Wetlands Inventory Maps were reviewed for the area of the proposed facility. *Figure 12* confirms the proposed facility is not located within an area of a potential wetland. In addition, *Figure 12* illustrates the following:



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LEGION PALOMA EAST RECYCLE FACILITY
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO
025281-00

1. The nearest potential wetland is located approximately 3.5-mi to the northeast of the proposed facility boundary. The potential wetland closest to the proposed facility is labeled as a "freshwater pond" with a wetland code "PUSJ."
2. The National Wetlands Inventory Maps do not show a potential wetland located within 500-ft. of the proposed facility location.

It should be noted the United States Fish and Wildlife Service generates the NWI maps through infrared aerial imagery and aerial photograph interpretation; no actual field reconnaissance was conducted in the making of the maps. As such, the NWI maps do not always accurately identify wetlands or the extent of those wetlands; therefore, the maps are used for preliminary analysis only.



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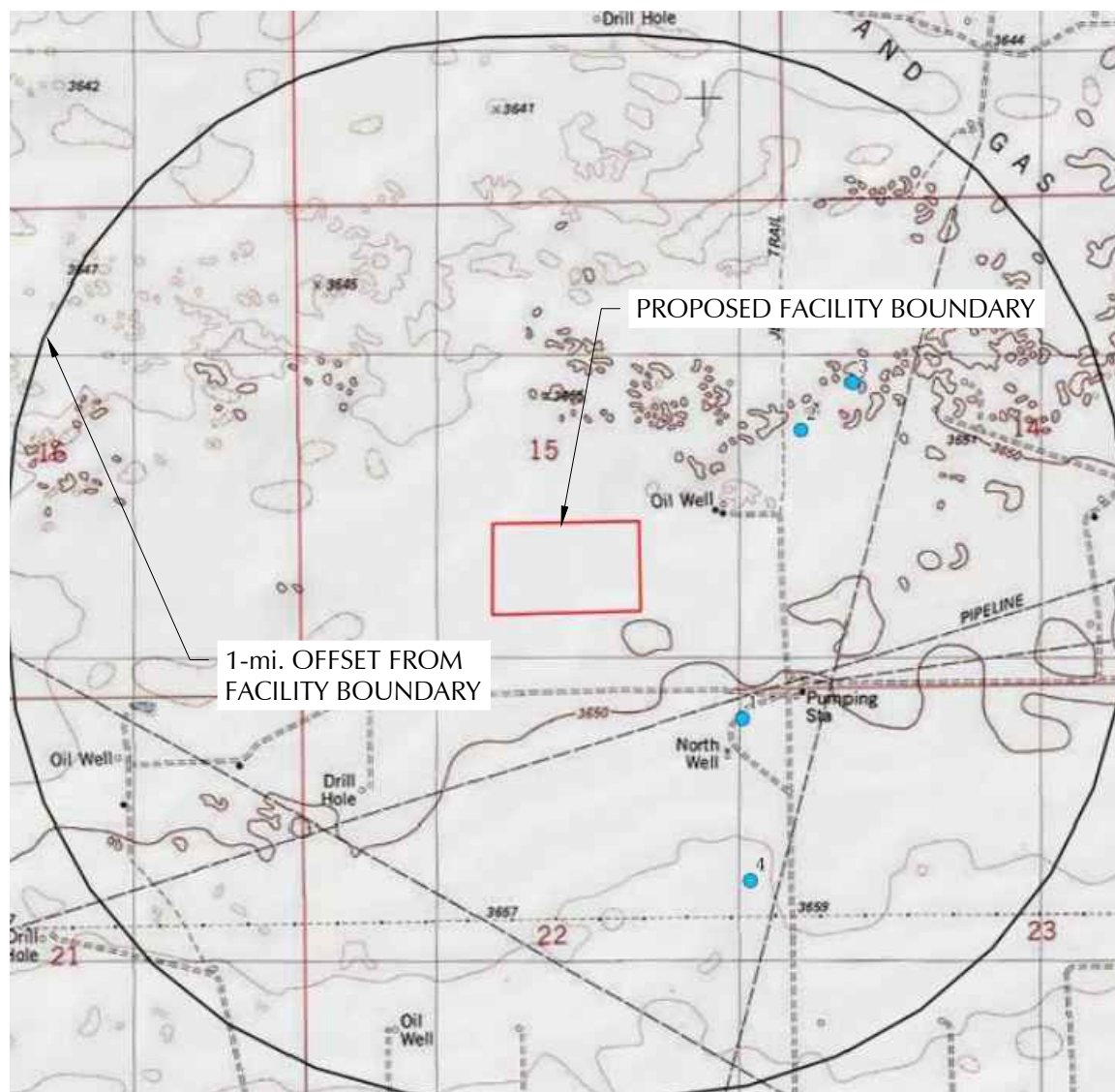
SITE MAP

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Figure 1



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Paloma East Recycle Facility

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● Single Water Well ● Water Well Cluster

US 39W, NM 19W

■ Subject Site

□ Search Buffer



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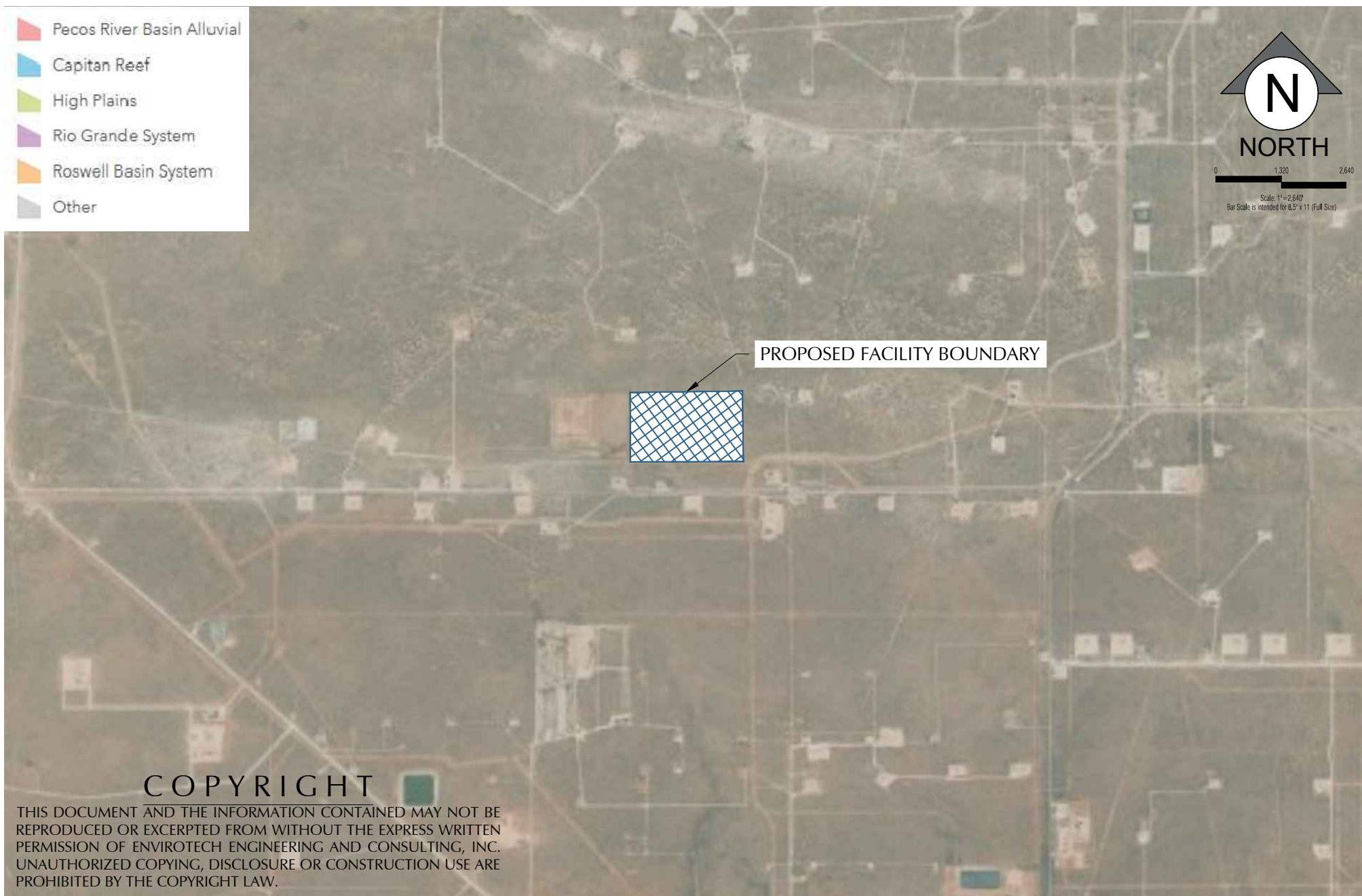
GROUNDWATER WELLS MAP

LEGION PALOMA EAST RECYCLE FACILITY
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO



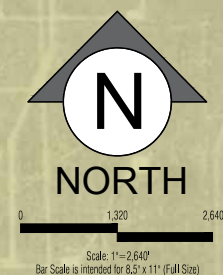
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Figure 2

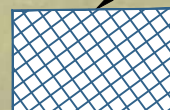


NEW MEXICO AQUIFERS MAP

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SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO



PROPOSED FACILITY BOUNDARY



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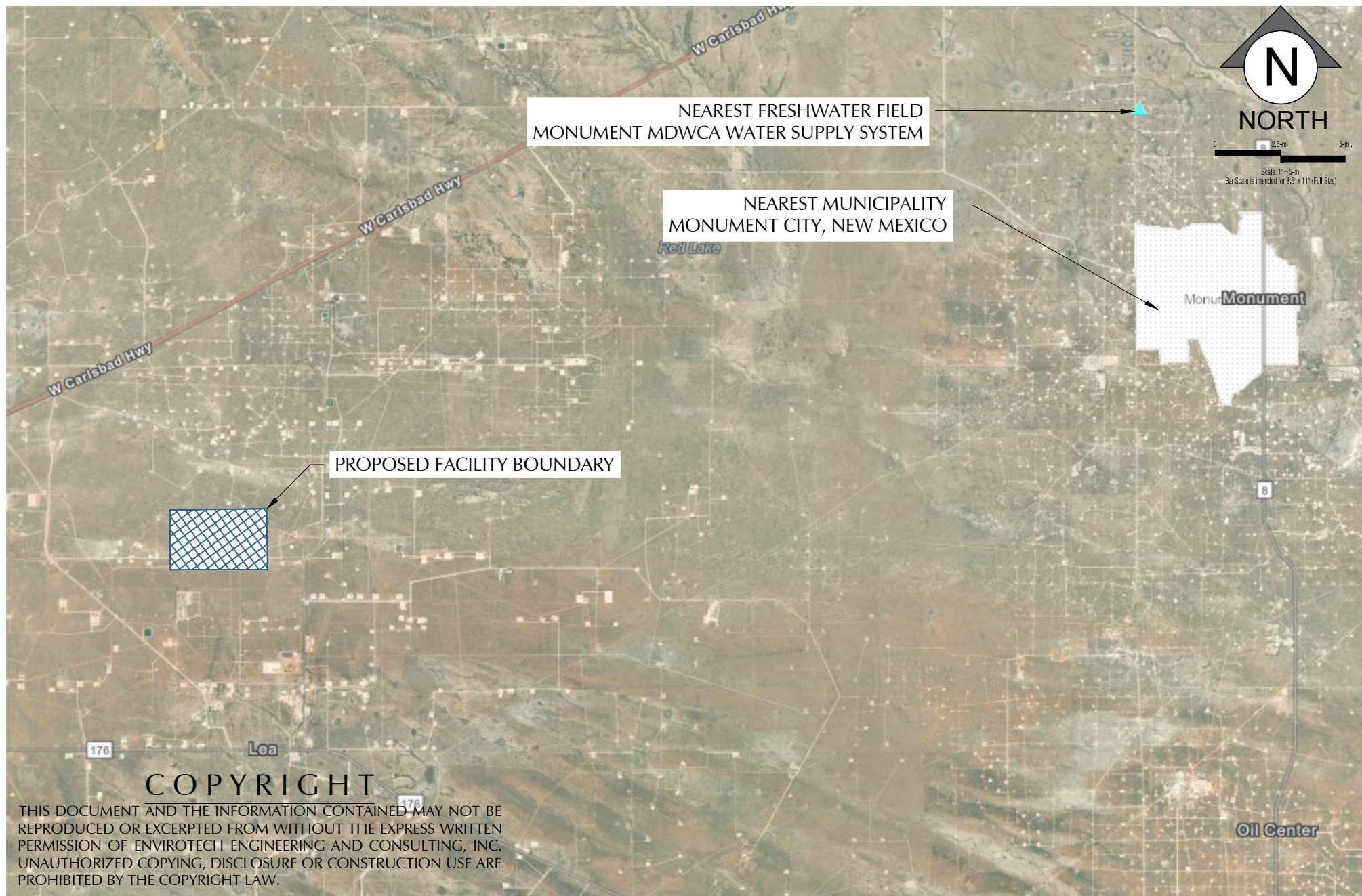
NEW MEXICO GEOLOGICAL MAP

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SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
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Figure 4



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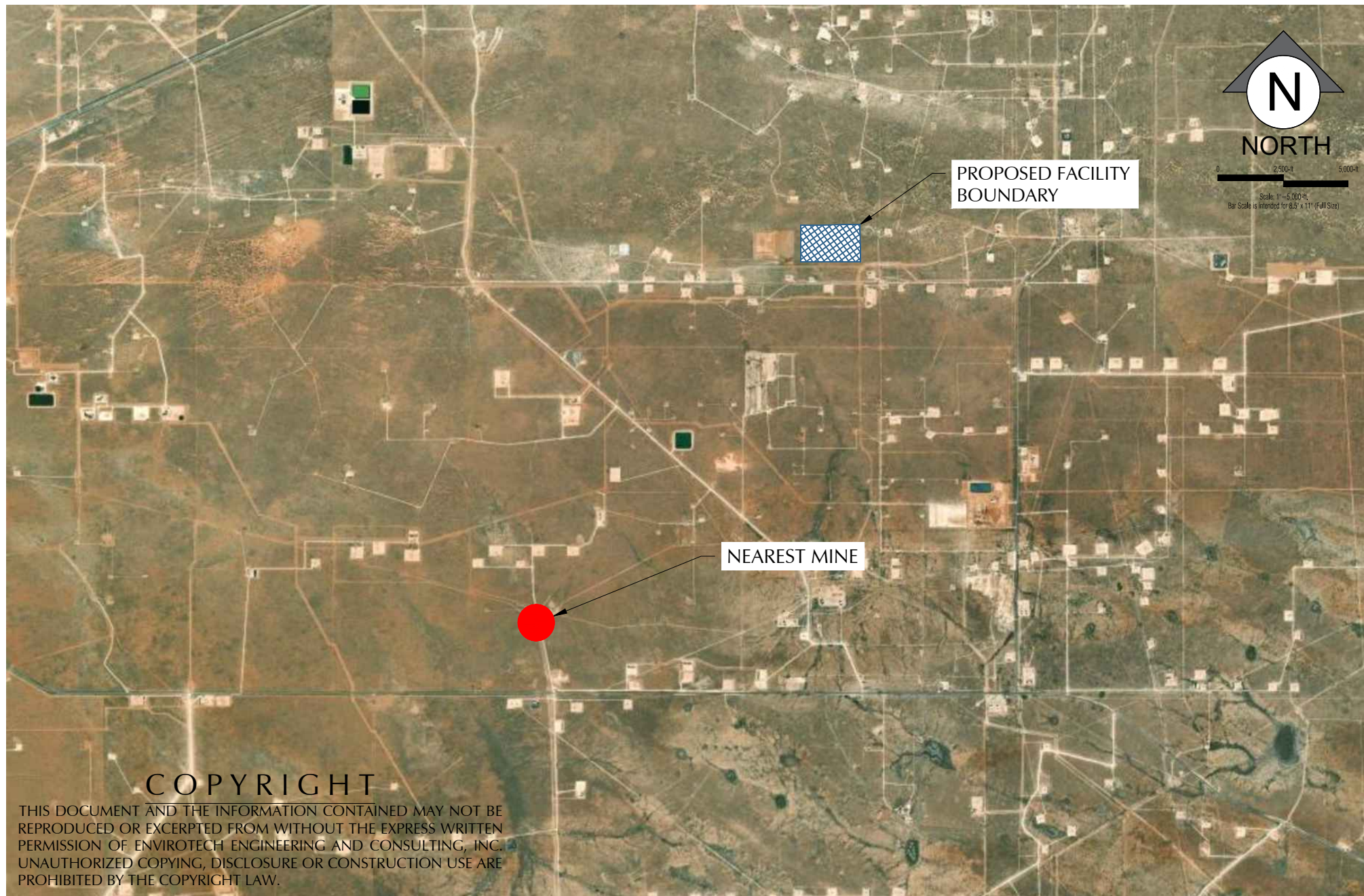
MUNICIPALITIES & FRESHWATER FIELDS MAP

LEGION PALOMA EAST RECYCLE FACILITY
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO



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Figure 3



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**NEW MEXICO REGISTERED
MINES MAP**
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SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

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Figure 6



KARST AND CAVE POTENTIAL MAP

LEGION PALOMA EAST RECYCLE FACILITY
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

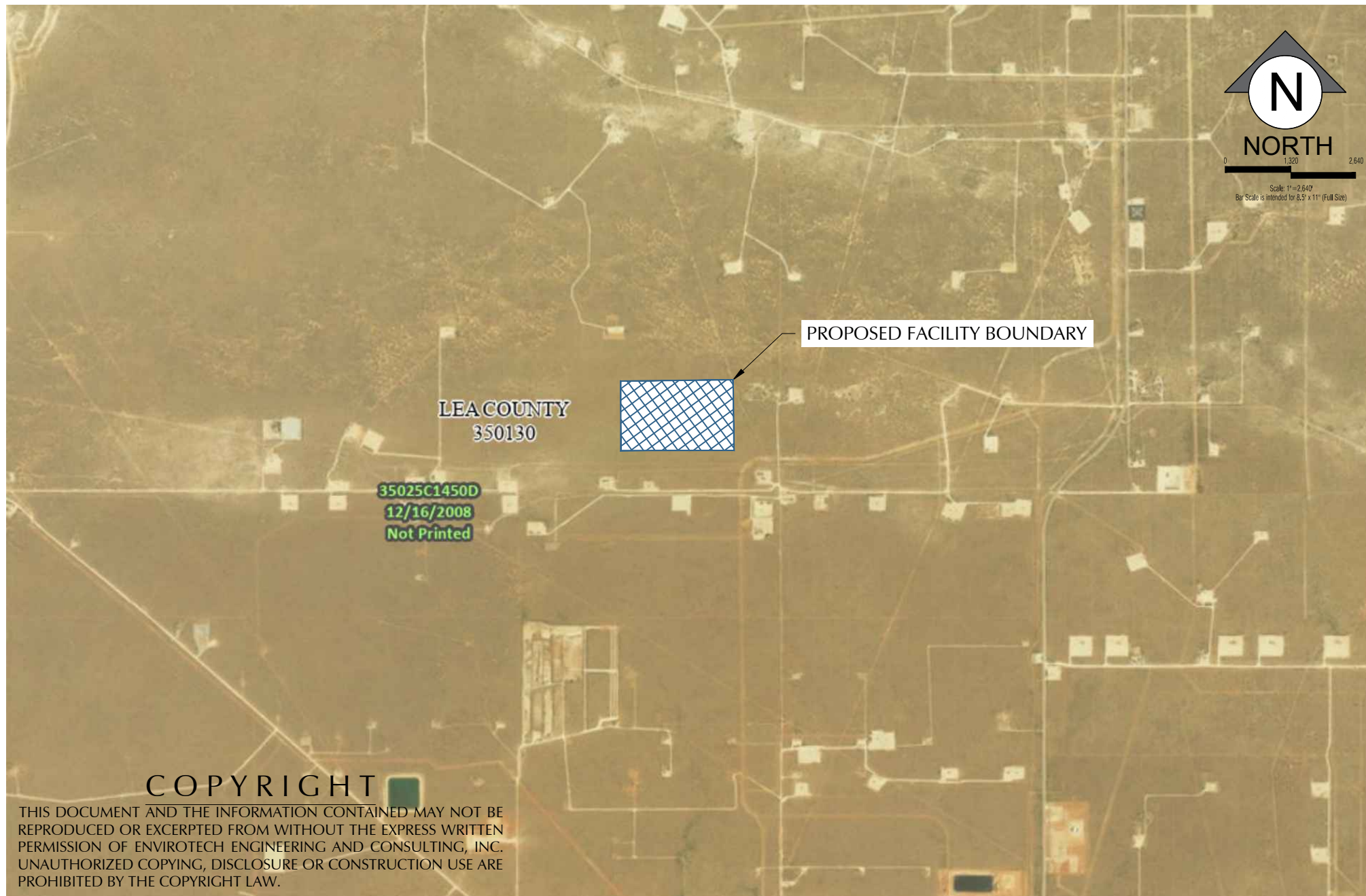


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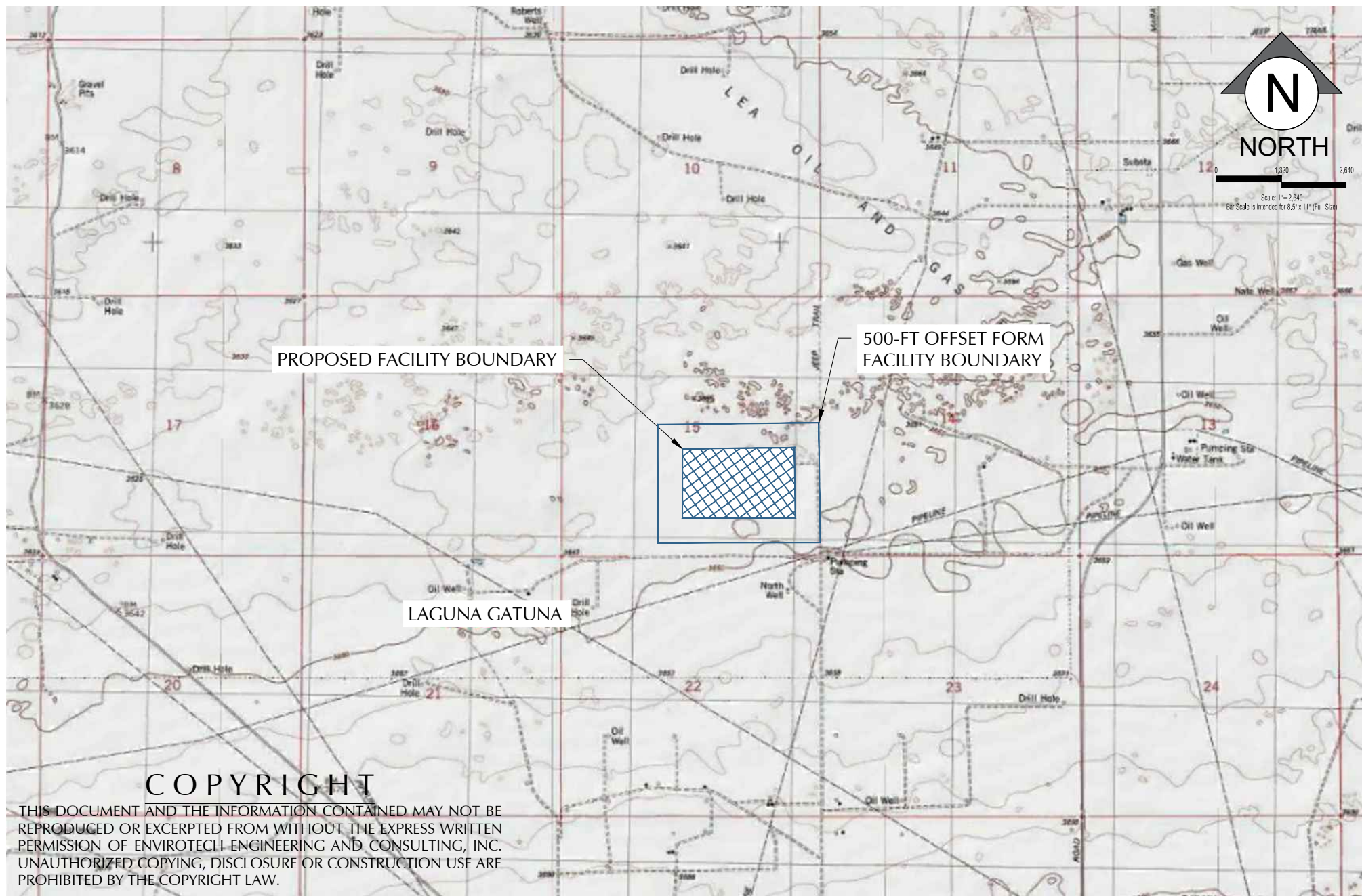
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Figure 7



FEMA FLOOD MAP

LEGION PALOMA EAST RECYCLE FACILITY
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO



SURFACE WATER MAP

LEGION PALOMA EAST RECYCLE FACILITY
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

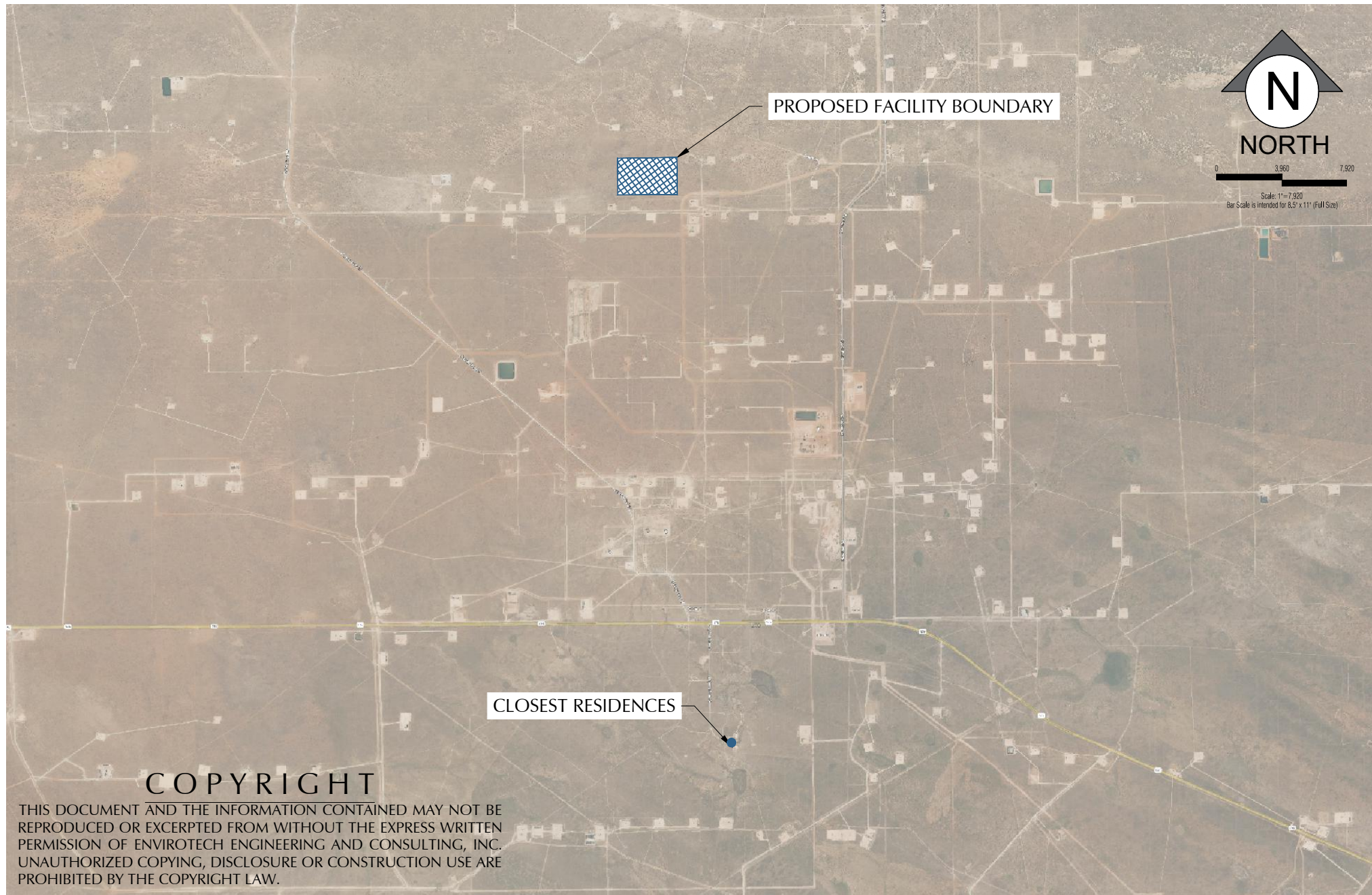


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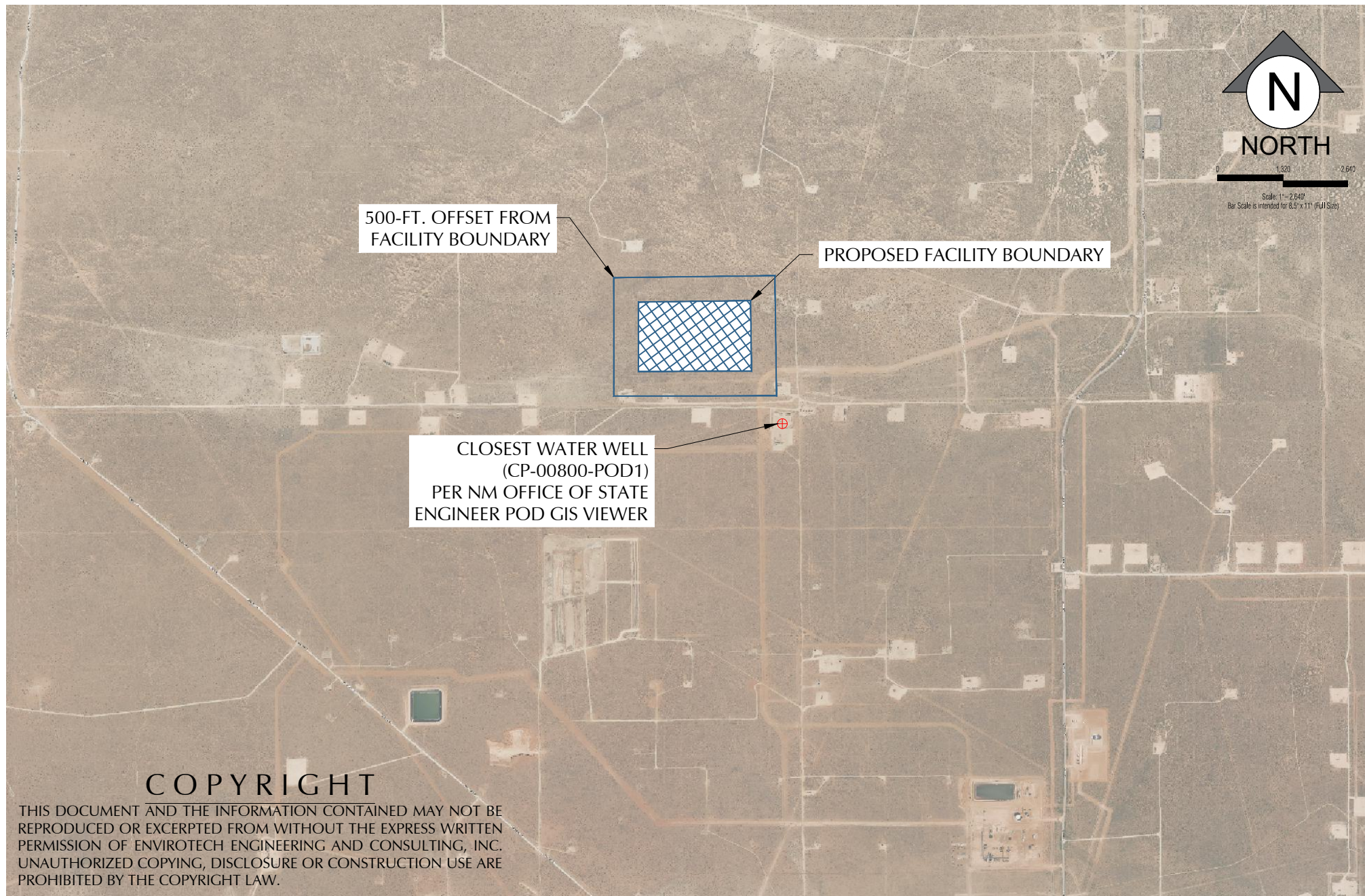


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Figure 9



09/30/2025 1:31:50 PM
C:\Projects\2025\025281-00\0000 Legion Paloma East design and permitting\permit package\aa\application figures\CAD\FIGURE 8 - PERMANENT RESIDENCE AND STRUCTURES MAP.dwg



NON-PUBLIC WATER SUPPLY MAP

LEGION PALOMA EAST RECYCLE FACILITY
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

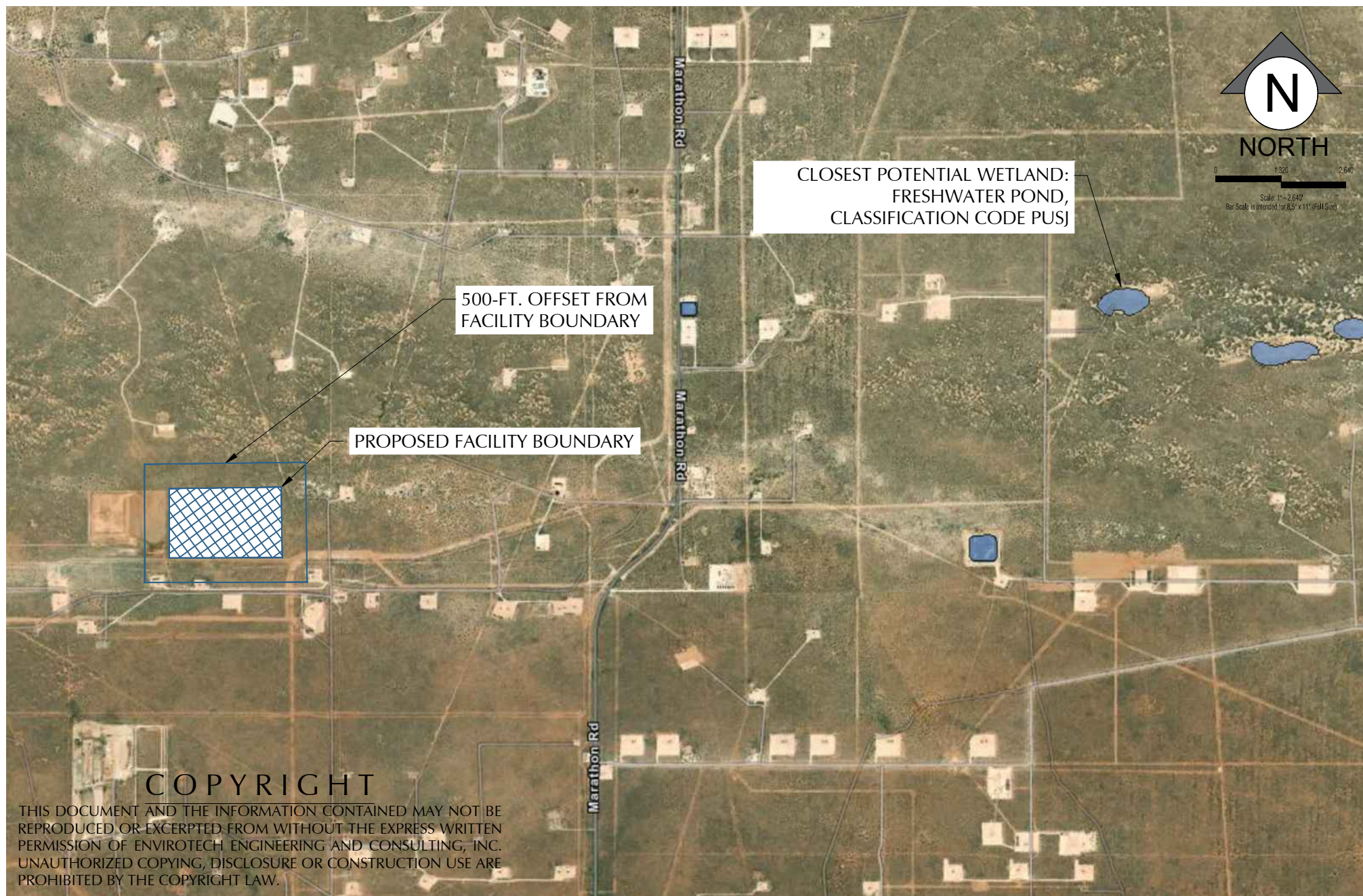
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Figure 11





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LEA COUNTY, NEW MEXICO
025281-00

ATTACHMENT A

BANKS WATER WELL REPORT



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LEGION PALOMA EAST RECYCLE FACILITY
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO
025281-00

ATTACHMENT B

ENGINEERING DRAWINGS

PALOMA EAST RECYCLE FACILITY

LEGION WATER SERVICES

SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

32° 34' 6.0420" N, 103° 32' 54.5352" W
32.568345°, -103.548482°



INDEX TO DRAWINGS	
SHEET NO.	DESCRIPTION
1	COVER
2	PROJECT LOCATION
3	EXISTING SITE FEATURES
4	SITE PLAN
5	INFLOW CONTAINMENT SITE PLAN
6	PIT CAPACITIES
7	RUBSHEET & FENCE PLAN
8	CROSS SECTION A
9	CROSS SECTIONS B & C
10	CROSS SECTIONS D & E
11	TRANSFER PIPE DETAIL
12	SUMP DETAILS
13	LINER DETAILS
14	FENCE DETAILS
15	SWPPP
16	SWPPP DETAILS

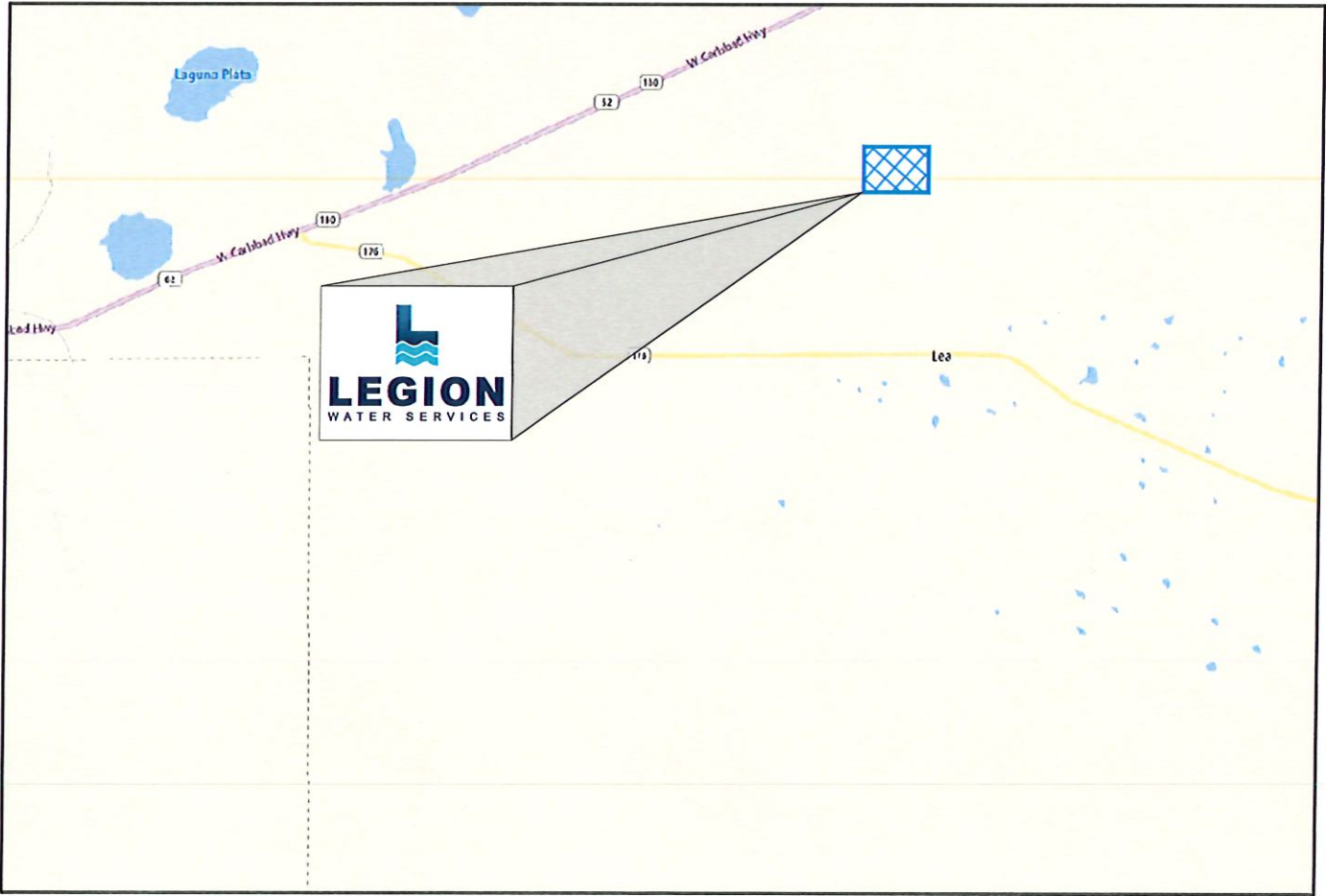
CONTACTS

MIKE FEAGA - LEGION WATER SERVICES - (713)-882-0485
ENVIROTECH ENGINEERING & CONSULTING - ROSHAN MOHAN (580)-234-8780 (DESIGN ENGINEER)
ENVIROTECH ENGINEERING & CONSULTING - MITCHELL RATKE, PE (580)-234-8780 (SUPERVISING ENGINEER)

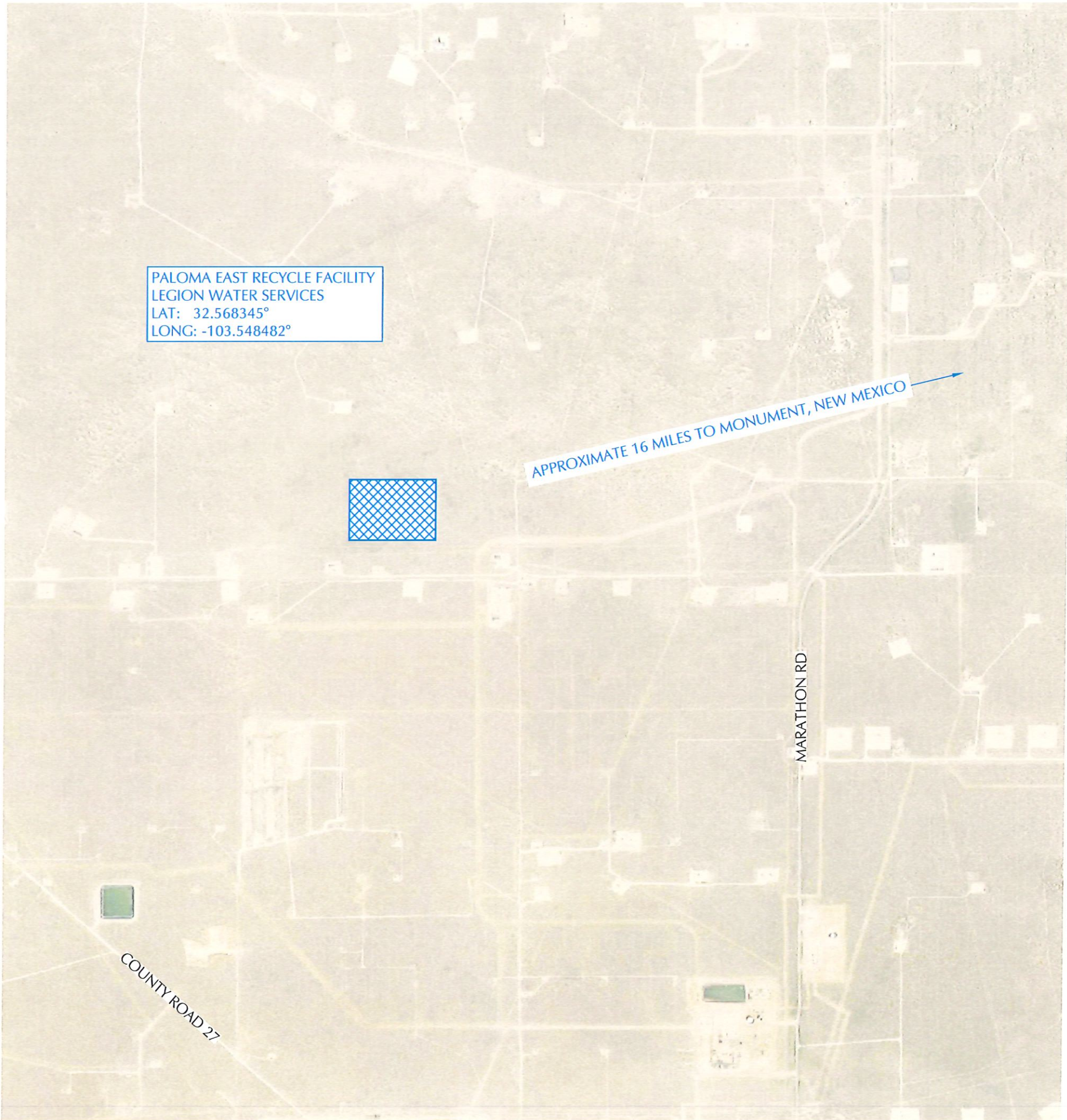


UTILITY CAUTION

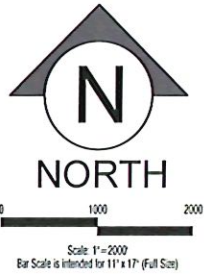
THE CONTRACTOR IS CAUTIONED THE LOCATION AND DEPTH OF EXISTING UTILITIES AS SHOWN ON THESE PLANS ARE BASED ON PUBLICLY AVAILABLE RECORDS OF THE VARIOUS UTILITY COMPANIES AND FIELD MEASUREMENTS. THE INFORMATION PROVIDED IS NOT TO BE RELIED ON AS BEING PRECISE OR COMPLETE. THE CONTRACTOR MUST CONTACT THE LOCAL UTILITY LOCATION CENTER AT LEAST 72 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATIONS OF THE UTILITIES.

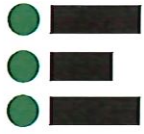


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PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
LAT: 32.568345°
LONG: -103.548482°



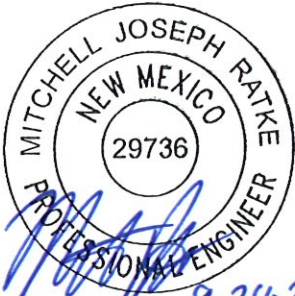

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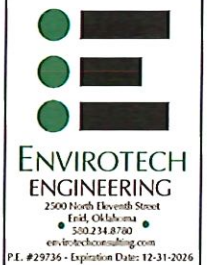
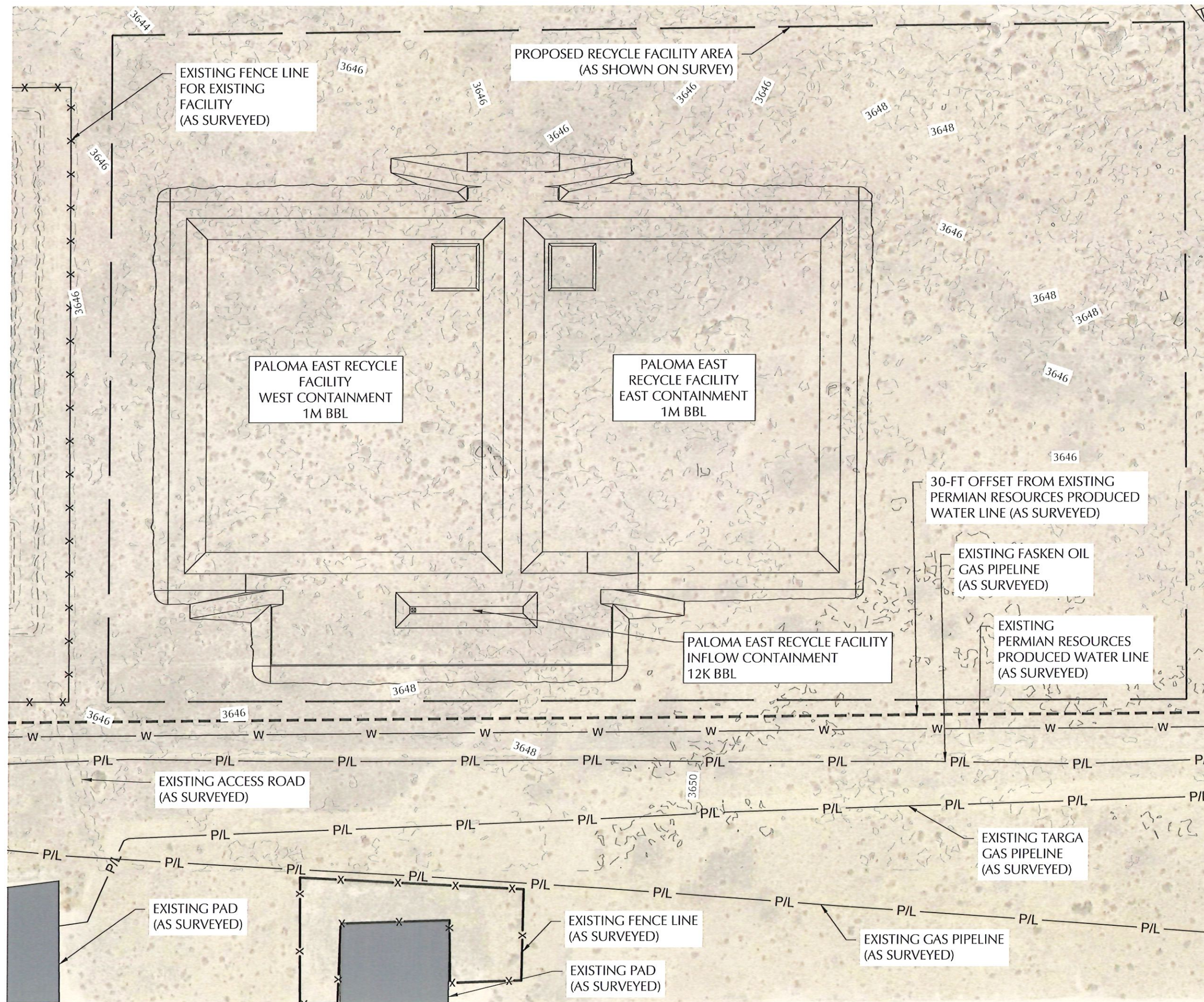
NO.	DATE	DESCRIPTION


LEGION
WATER SERVICES

PROJECT LOCATION
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO



DATE:	SEPTEMBER 2025
SCALE:	1" = 2000
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	2 OF 16



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NO.	DATE	DESCRIPTION



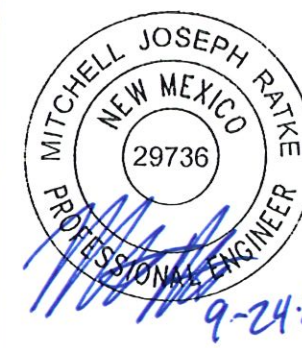
EXISTING SITE FEATURES

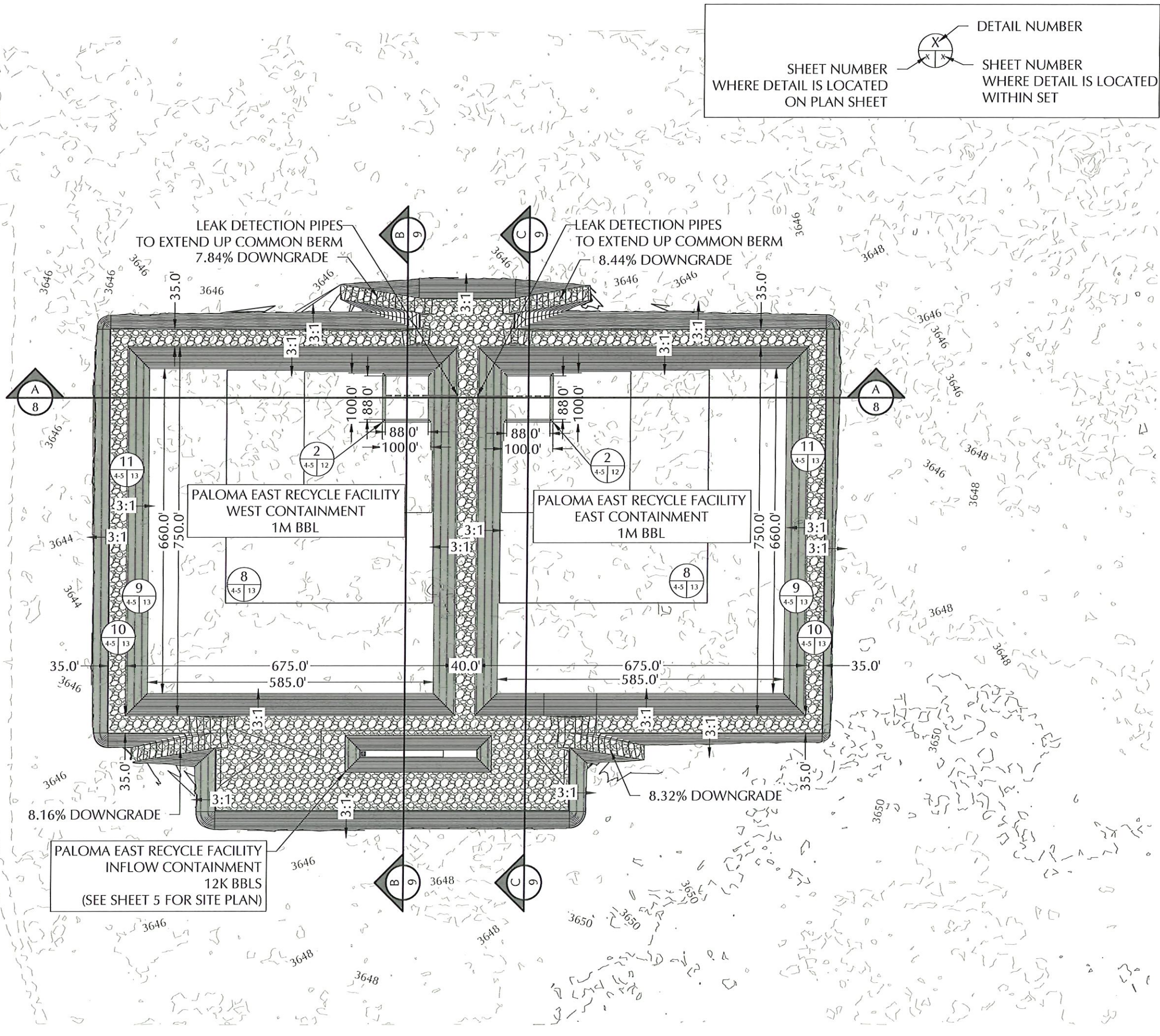
PALOMA EAST RECYCLE FACILITY

LEGION WATER SERVICES

SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	1" = 200'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	3 OF 16





SHEET NUMBER
WHERE DETAIL IS LOCATED
ON PLAN SHEET



DETAIL NUMBER

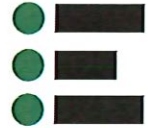
SHEET NUMBER
WHERE DETAIL IS LOCATED
WITHIN SET



NORTH

0 100 200

Scale: 1"=200'
Bar Scale is intended for 11"x17" (Full Size)



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DETAILS KEY MAP

-  SUMP OVERVIEW
DETAIL
-  LINER SYSTEM
FLOOR DETAIL
-  LINER SYSTEM
SIDE SLOPE DETAIL
-  TYPICAL BERM CRES
DETAIL
-  ANCHOR TRENCH
DETAIL

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WATER SERVICES

SITE PLAN

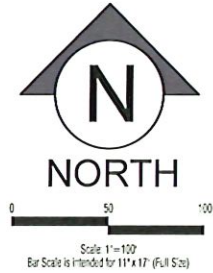
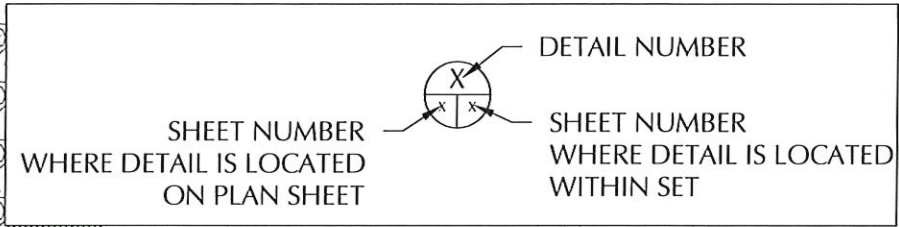
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO



JOSEPH RATKE
NEW MEXICO
29736
PROFESSIONAL ENGINEER

9-24-2025

DATE:	SEPTEMBER 2025
SCALE:	1" = 200'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	4 OF 16



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-

SUMP OVERVIEW
DETAIL
-

LINER SYSTEM
FLOOR DETAIL
-

LINER SYSTEM
SIDE SLOPE DETAIL
-

TYPICAL BERM CREST
DETAIL
-

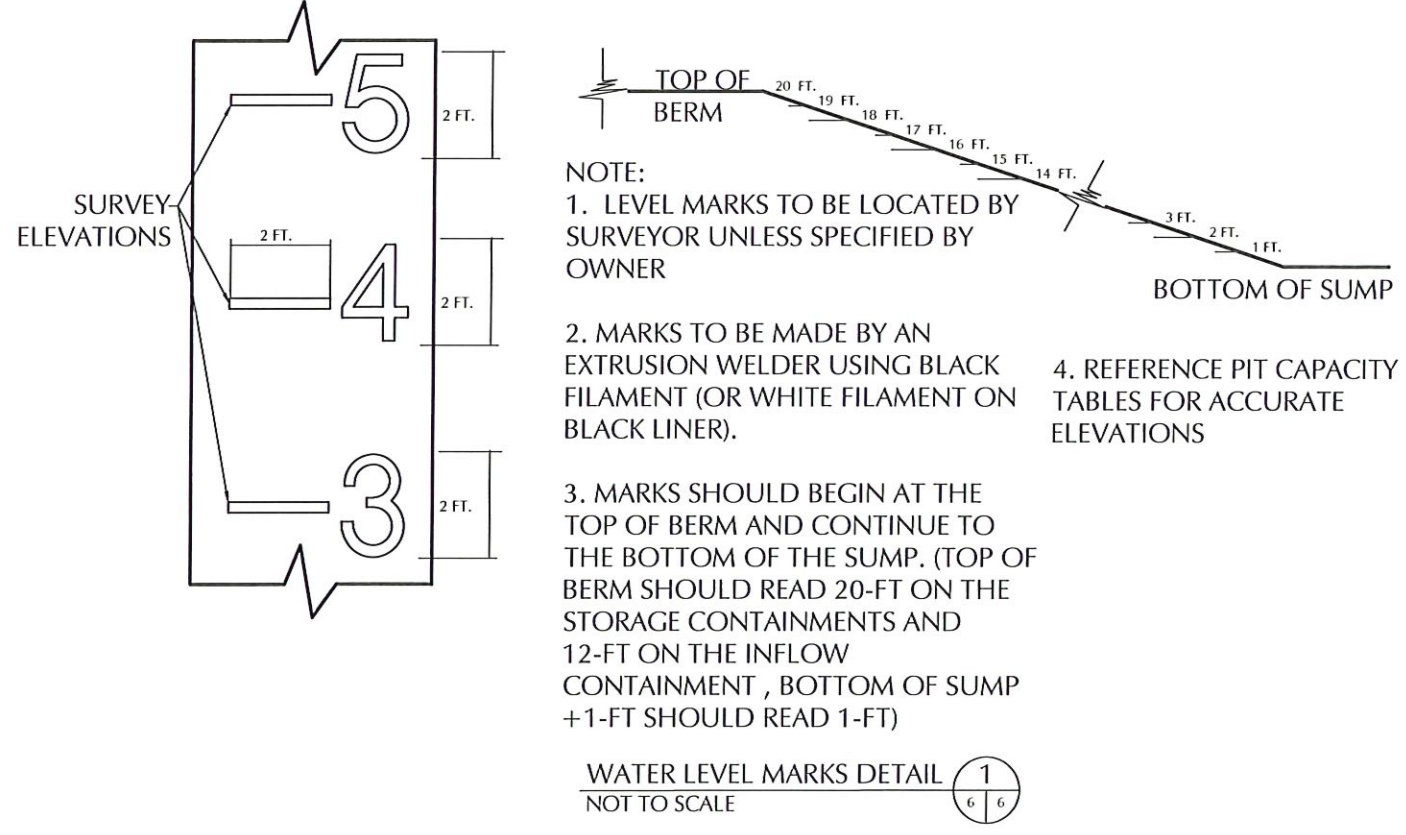
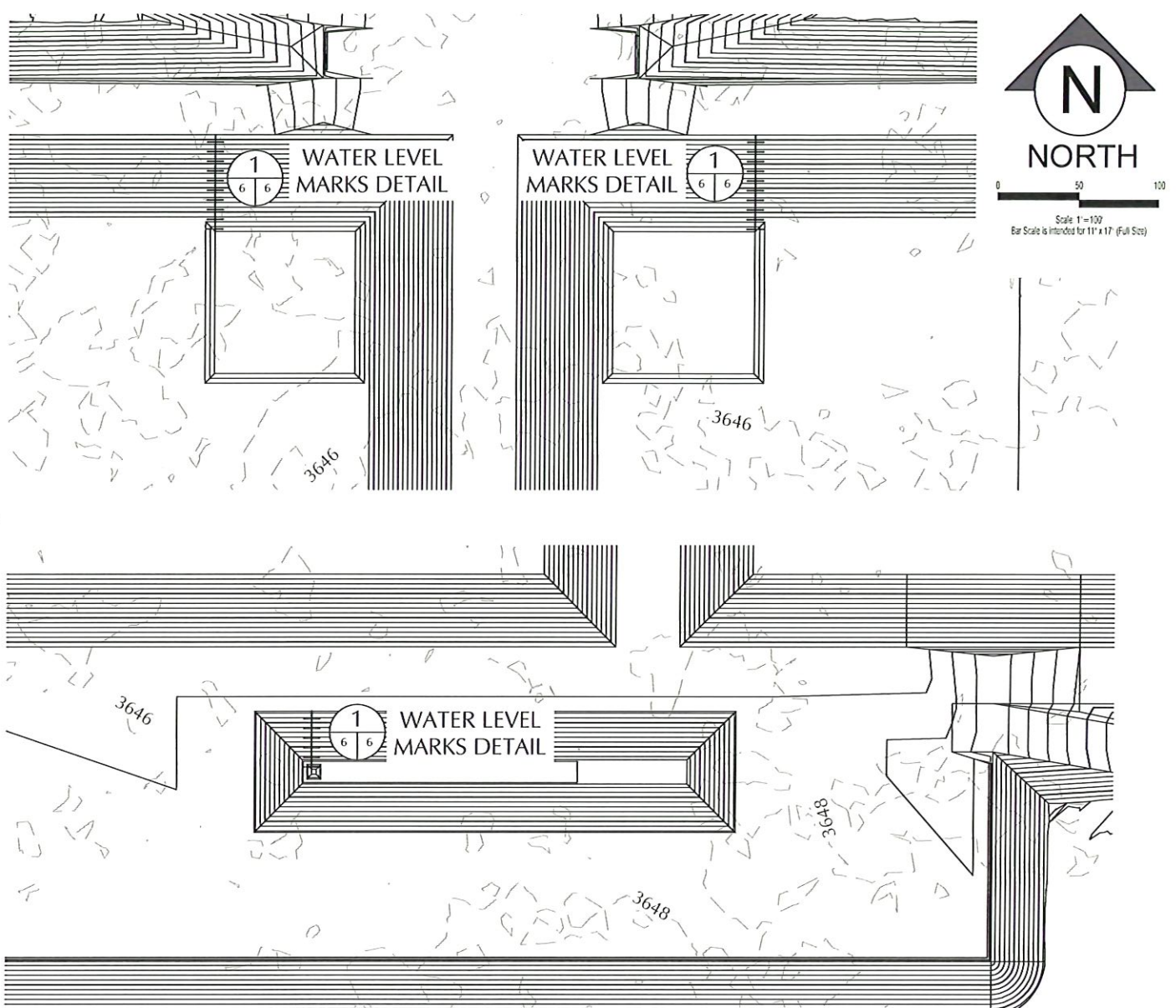
ANCHOR TRENCH
DETAIL



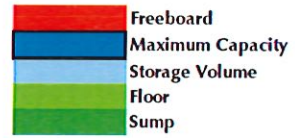
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE: SEPTEMBER 2025	
TIME: 1 st = 100'	
DESIGNED BY: R. MOHAN	
OWN BY: S. JOSSELYN	
CHECKED BY: M. RATKE	
PROJECT NO. 025281-00	
NO. 5 OF 16	



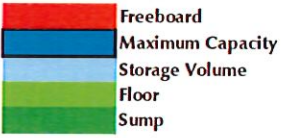


Owner	LEGION WATER SERVICES		
Site Name	PALOMA EAST RECYCLE CONTAINMENTS		
Lagoon Features	Top	Bottom	Max
Side slope Ratio	3		3
Maximum Depth (ft)	20.0		17.0
Lagoon Top Width (ft)	675	585	657
Lagoon Top Length (ft)	750	660	732
Maximum Total Vol (ft³)	7,147,465		5,667,064
Maximum Total Vol (bbls)	1,273,100		1,009,412



Elevation	Lagoon Liq	Storage	Remaining	Gallons	BBLs	Percent of	Vol	Gallons	Vol	Vol	Percent
ft	Depth	ft	Stor Vol	Storage	Storage	Total Volume	in lagoon	Storage	in Lagoon	in Lagoon	Total Vol
	ft		ft³	gal	bbls	%	ft³	gal	bbls	ac-ft	%
3656.00	20.0	0.0	-	-	-	0.0%	7,147,465	51,470,188	1,273,100	164.08	100%
3655.00	19.0	1.0	501,920	3,754,863	89,401	7.0%	6,645,545	49,715,326	1,183,698	152.56	93%
3654.00	18.0	2.0	995,363	7,446,310	177,293	13.9%	6,152,102	46,023,879	1,095,807	141.23	86%
3653.00	17.0	3.0	1,480,401	11,074,881	263,688	20.7%	5,667,064	42,395,308	1,009,412	130.10	79%
3652.00	16.0	4.0	1,957,106	14,641,112	348,598	27.4%	5,190,359	38,829,076	924,502	119.15	73%
3651.00	15.0	5.0	2,425,551	18,145,545	432,037	33.9%	4,721,915	35,324,644	841,063	108.40	66%
3650.00	14.0	6.0	2,885,806	21,588,716	514,017	40.4%	4,261,659	31,881,472	759,083	97.83	60%
3649.00	13.0	7.0	3,337,945	24,971,164	594,552	46.7%	3,809,521	28,499,024	678,548	87.45	53%
3648.00	12.0	8.0	3,782,038	28,293,429	673,653	52.9%	3,365,427	25,176,760	599,447	77.26	47%
3647.00	11.0	9.0	4,218,159	31,556,048	751,334	59.0%	2,929,306	21,914,140	521,765	67.25	41%
3646.00	10.0	10.0	4,646,379	34,759,560	827,609	65.0%	2,501,087	18,710,629	445,491	57.42	35%
3645.00	9.0	11.0	5,066,770	37,904,503	902,488	70.9%	2,080,696	15,565,685	370,612	47.77	29%
3644.00	8.0	12.0	5,479,403	40,991,417	975,986	76.7%	1,668,062	12,478,771	297,114	38.29	23%
3643.00	7.0	13.0	5,884,352	44,020,839	1,048,115	82.3%	1,263,113	9,449,349	224,984	29.00	18%
3642.00	6.0	14.0	6,281,688	46,993,309	1,118,888	87.9%	865,777	6,476,879	154,211	19.88	12%
3641.00	5.0	15.0	6,671,483	49,909,365	1,188,318	93.3%	475,982	3,560,823	84,782	10.93	7%
3640.00	4.0	16.0	6,959,654	52,065,169	1,239,647	97.4%	187,812	1,405,020	33,453	4.31	3%
3639.00	3.0	17.0	7,092,301	53,057,503	1,263,274	99.2%	55,164	412,685	9,826	1.27	1%
3638.00	2.0	18.0	7,129,772	53,337,822	1,269,948	99.8%	17,694	132,367	3,152	0.41	0%
3637.00	1.0	19.0	7,139,183	53,408,225	1,271,624	99.9%	8,283	61,963	1,475	0.19	0%
3636.00	0.0	20.0	7,147,465	53,470,188	1,273,100	100.0%	-	-	-	-	0%

Owner	LEGION WATER SERVICES		
Site Name	PALOMA EAST RECYCLE INFLOW CONTAINMENT		
Lagoon Features	Top	Bottom	Max
Side slope Ratio	3		3
Maximum Depth (ft)	12.0		9.0
Lagoon Top Width (ft)	75	15	57
Lagoon Top Length (ft)	300	240	282
Maximum Total Vol (ft³)	126,132		68,440
Maximum Total Vol (bbls)	22,466		12,191



Elevation	Lagoon Liq	Storage	Remaining	Gallons	BBLs	Percent of	Vol	Gallons	Vol	Vol	Percent
ft	Depth	ft	Stor Vol	Storage	Storage	Total Volume	in lagoon	Storage	in Lagoon	in Lagoon	Total Vol
	ft		ft³	gal	bbls	%	ft³	gal	bbls	ac-ft	%
3657.30	12.0	0.0	-	-	-	0.0%	126,132	943,591	22,466	2.90	100%
3656.30	11.0	1.0	21,384	159,975	3,809	17.0%	104,748	783,617	18,658	2.40	83%
3655.30	10.0	2.0	40,591	303,659	7,210	32.2%	85,541	639,932	15,236	1.96	68%
3654.30	9.0	3.0	57,691	431,589	10,276	45.7%	68,440	512,003	12,191	1.57	54%
3653.30	8.0	4.0	72,758	544,304	12,960	57.7%	53,373	399,287	9,507	1.23	42%
3652.30	7.0	5.0	85,864	642,346	15,294	68.1%	40,268	301,246	7,173	0.92	32%
3651.30	6.0	6.0	97,079	726,248	17,292	77.0%	29,053	217,343	5,175	0.67	23%
3650.30	5.0	7.0	106,477	796,552	18,966	84.4%	19,655	147,039	3,501	0.45	16%
3649.30	4.0	8.0	114,129	853,798	20,329	90.5%	12,003	89,793	2,138	0.28	10%
3648.30	3.0	9.0	120,107	898,520	21,393	95.2%	6,025	45,071	1,073	0.14	5%
3647.30	2.0	10.0	124,483	931,260	22,173	98.7%	1,648	12,332	294	0.04	1%
3646.30	1.0	11.0	126,093	943,301	22,466	100.0%	39	291	7	0.00	0%
3645.30	0.0	12.0	126,132	943,591	22,466	100.0%	-	-	-	-	0%



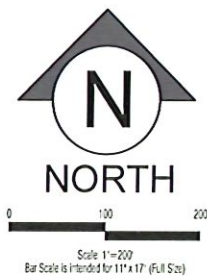
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LEGION WATER SERVICES

PIT CAPACITIES
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE: SEPTEMBER 2025
SCALE: 1" = 100'
DESIGNED BY: R. MOHAN
DRAWN BY: S. JOSSELYN
CHECKED BY: M. RATKE
PROJECT NO. 025281-00
SHEET NO. 6 OF 16



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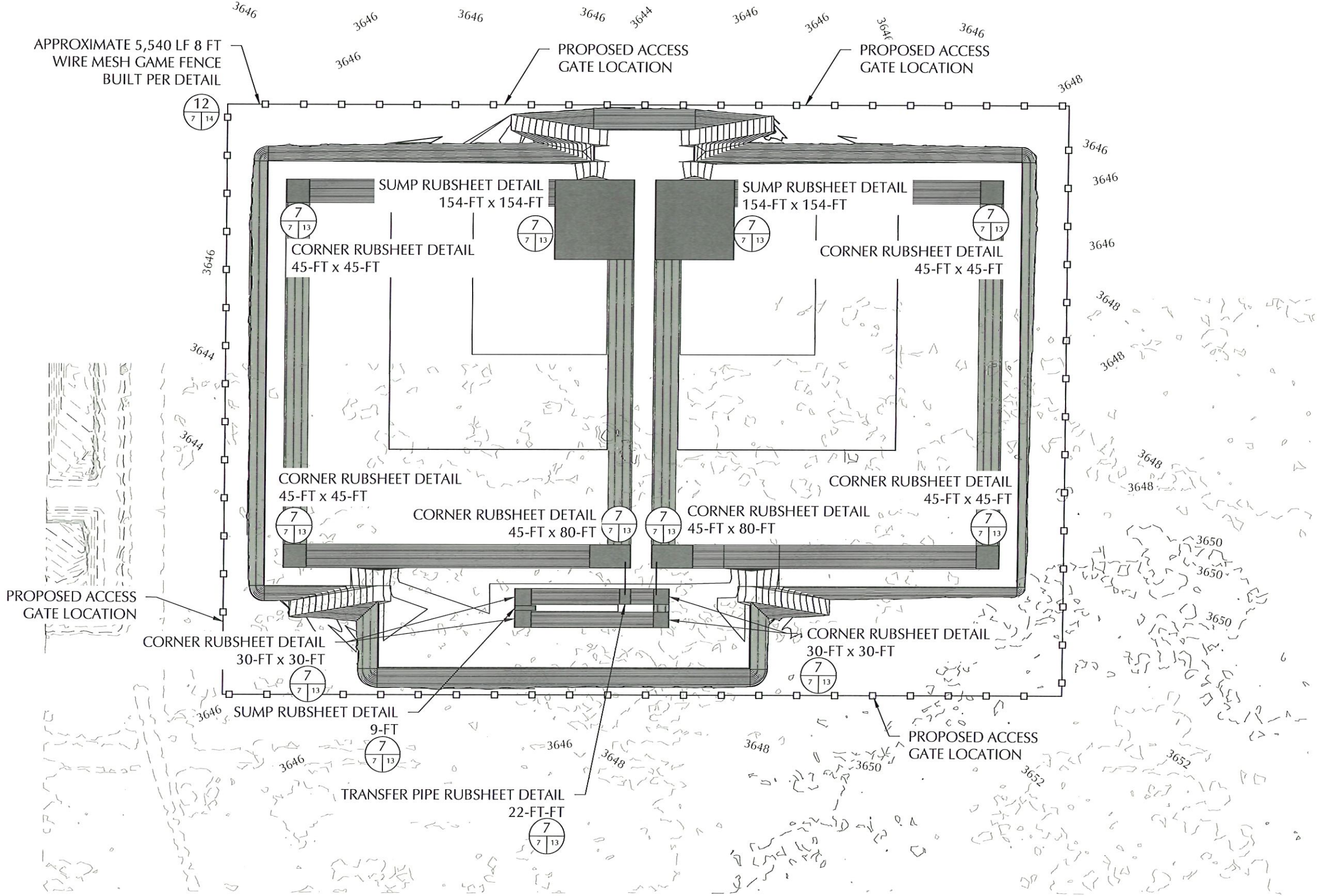
NO.	DATE	DESCRIPTION

**LEGION
WATER SERVICES**

RUBSHEET & FENCE PLAN
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

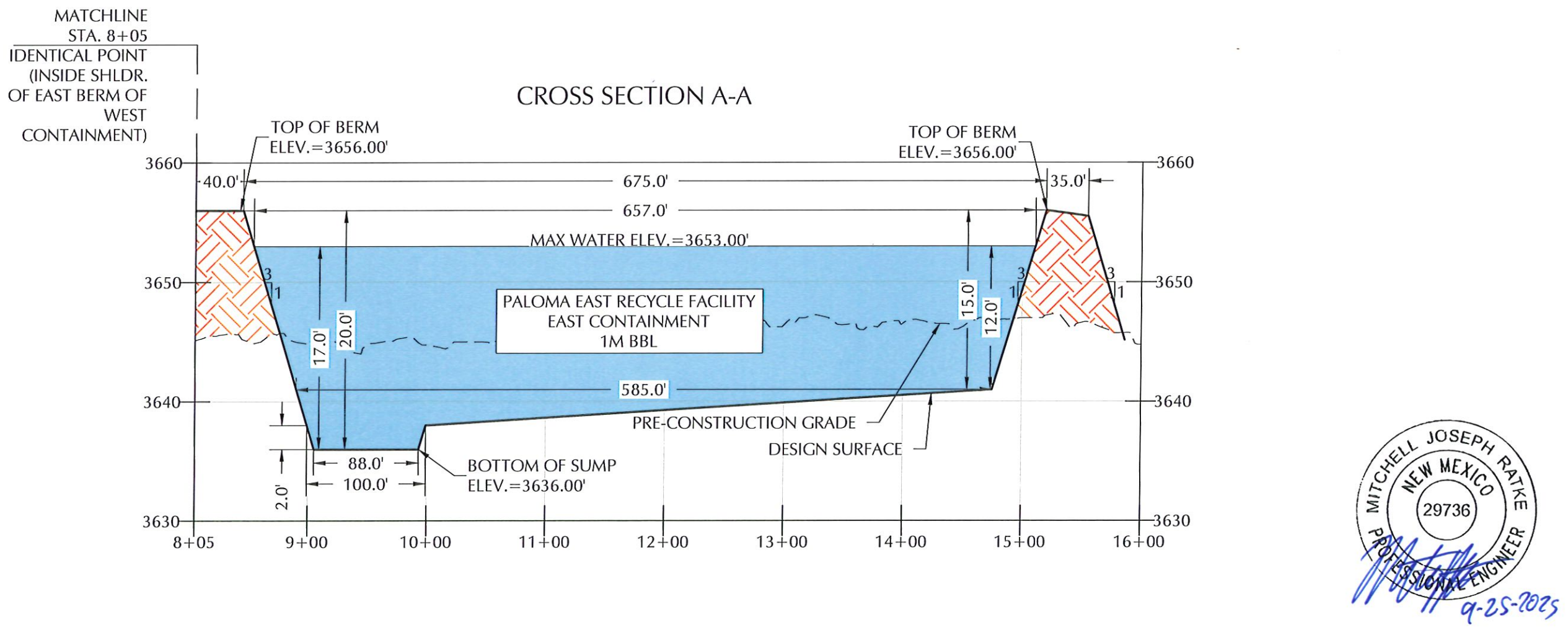
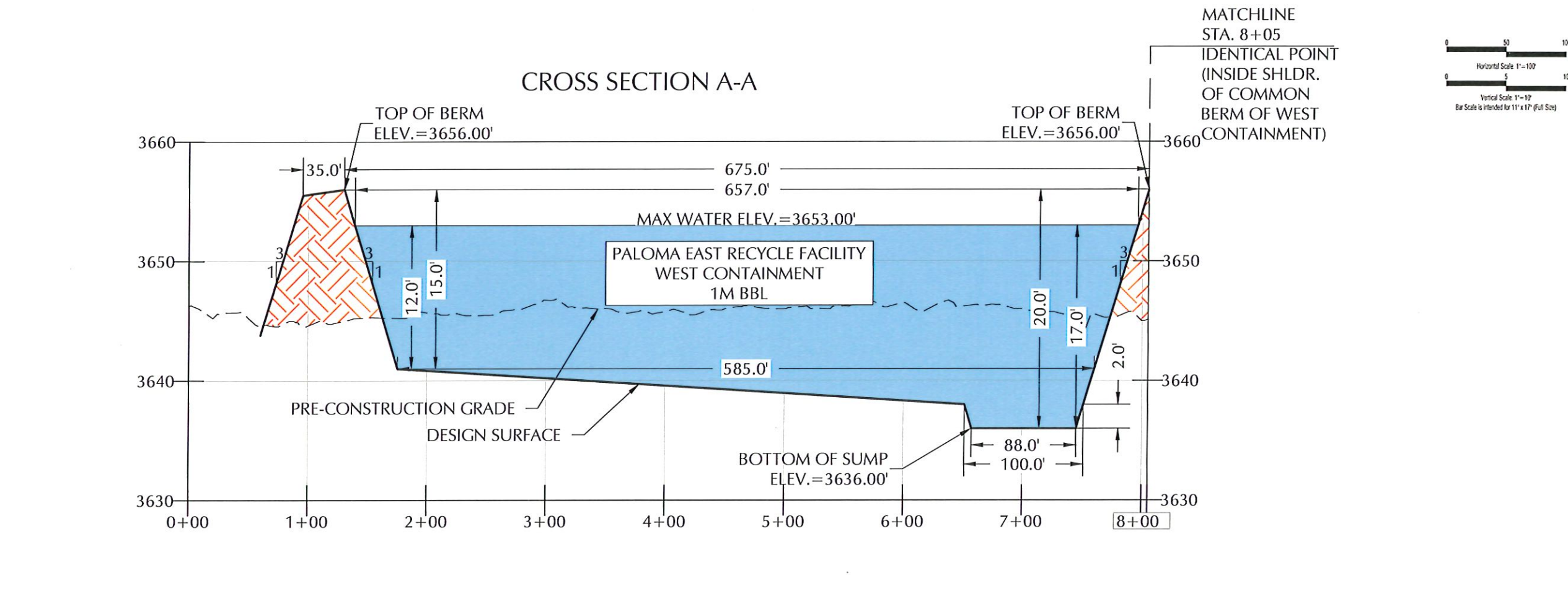
DATE:	SEPTEMBER 2025
SCALE:	1" = 200'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	7 OF 16

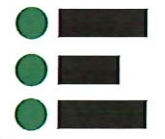
NOTE:
RUBSHEET DIMENSIONS
ARE TAKEN AT THE
ANCHOR TRENCH.



MITCHELL JOSEPH RATKE
NEW MEXICO
29736
PROFESSIONAL ENGINEER

9-24-2025





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NO.	DATE	DESCRIPTION



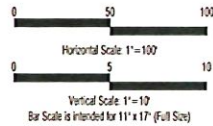
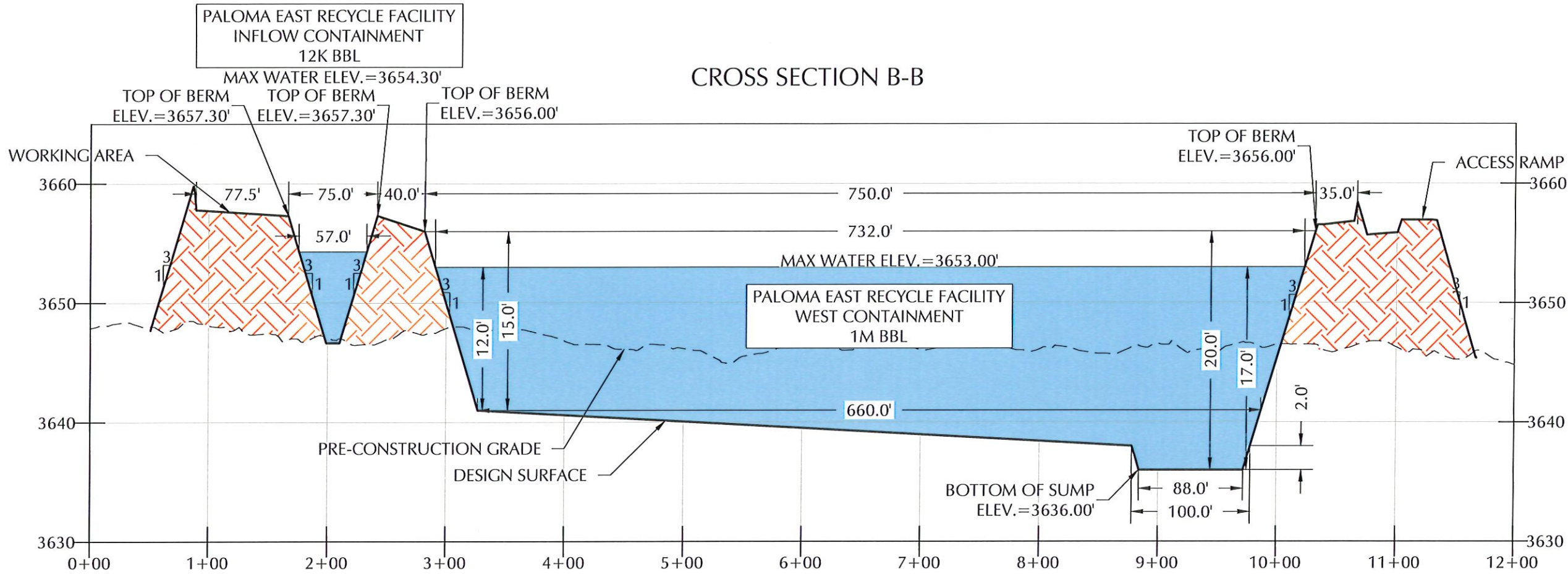
LEGION WATER SERVICES

CROSS SECTION A
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE: SEPTEMBER 2025
SCALE: HORIZONTAL 1"=100'
VERTICAL 1"=10'
DESIGNED BY: R. MOHAN
DRAWN BY: S. JOSSELYN
CHECKED BY: M. RATKE
PROJECT NO. 025281-00
SHEET NO. 8 OF 16



9-25-2025

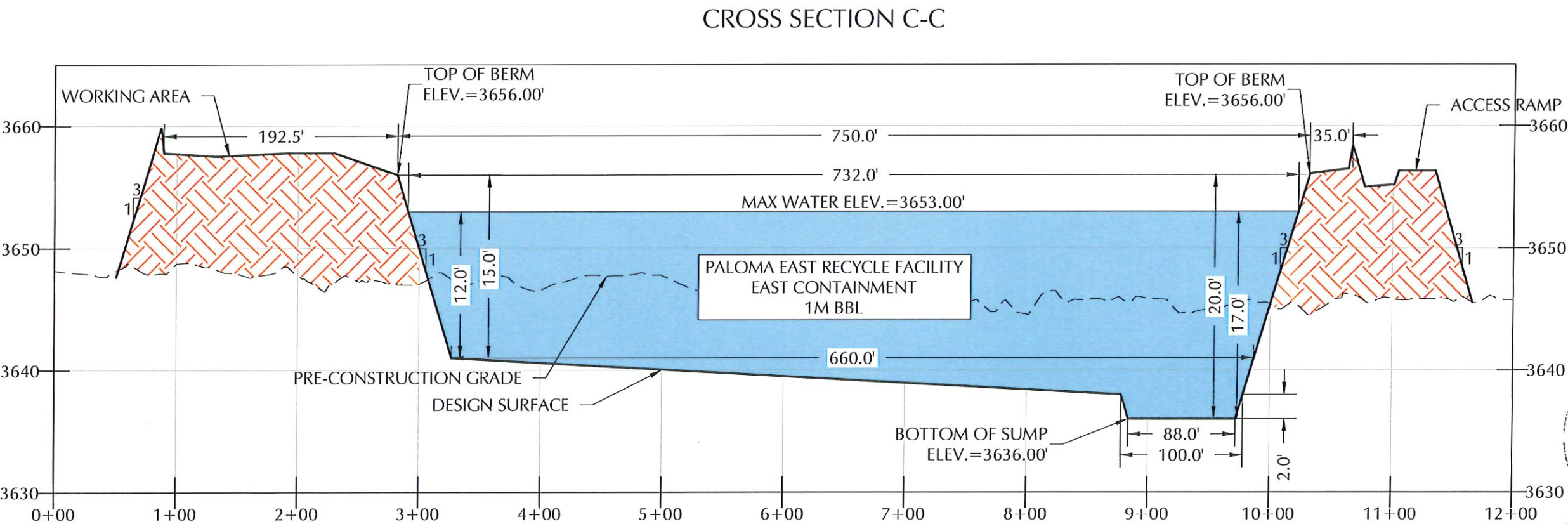


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NO.	DATE	DESCRIPTION

**LEGION
WATER SERVICES**

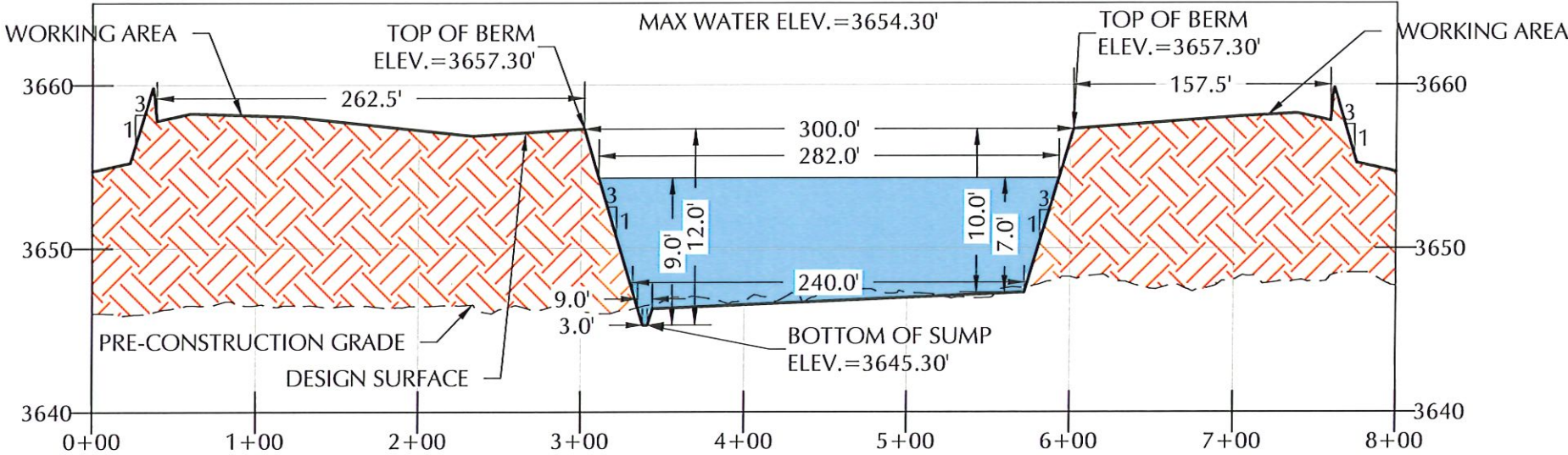


CROSS SECTIONS B & C
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE HORIZONTAL:	1"=100'
SCALE VERTICAL:	1"=10'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	9 OF 16

CROSS SECTION D-D

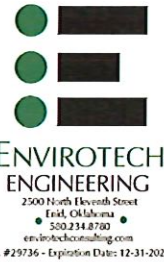
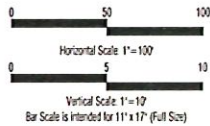
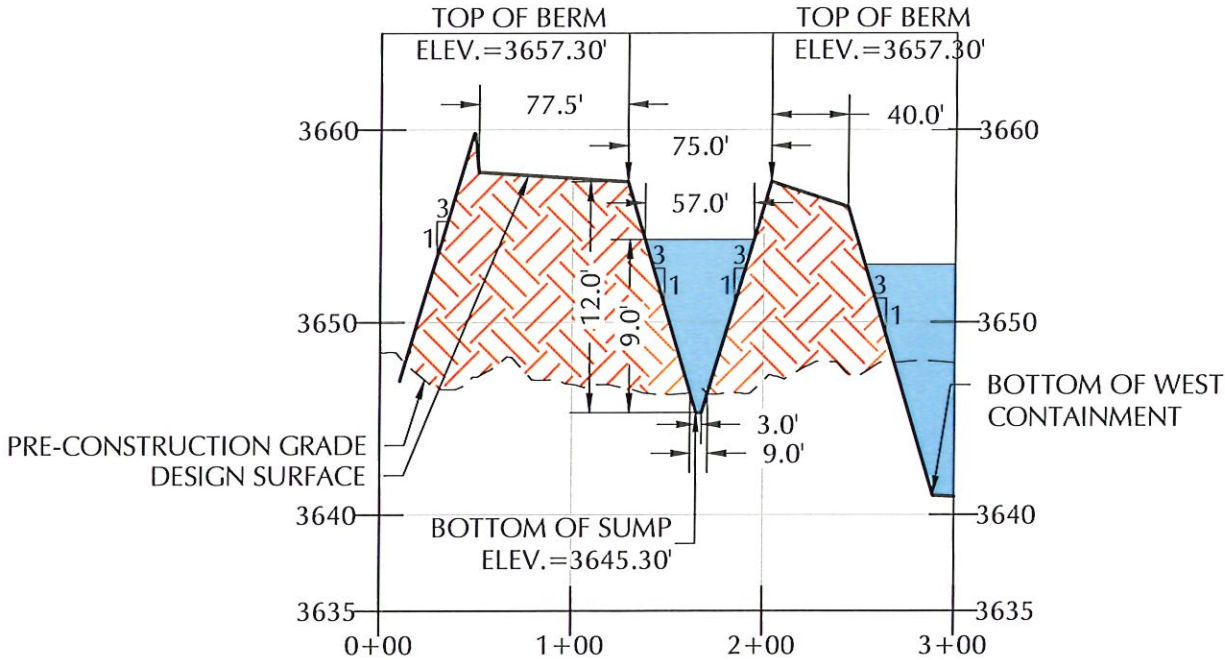
PALOMA EAST RECYCLE FACILITY
INFLOW CONTAINMENT
12K BBL



CROSS SECTION E-E

PALOMA EAST RECYCLE FACILITY
INFLOW CONTAINMENT
12K BBL

MAX WATER ELEV.=3654.30'



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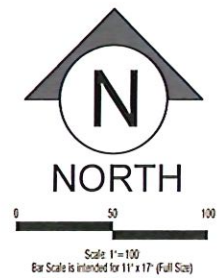
NO.	DATE	DESCRIPTION



CROSS SECTIONS D & E
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

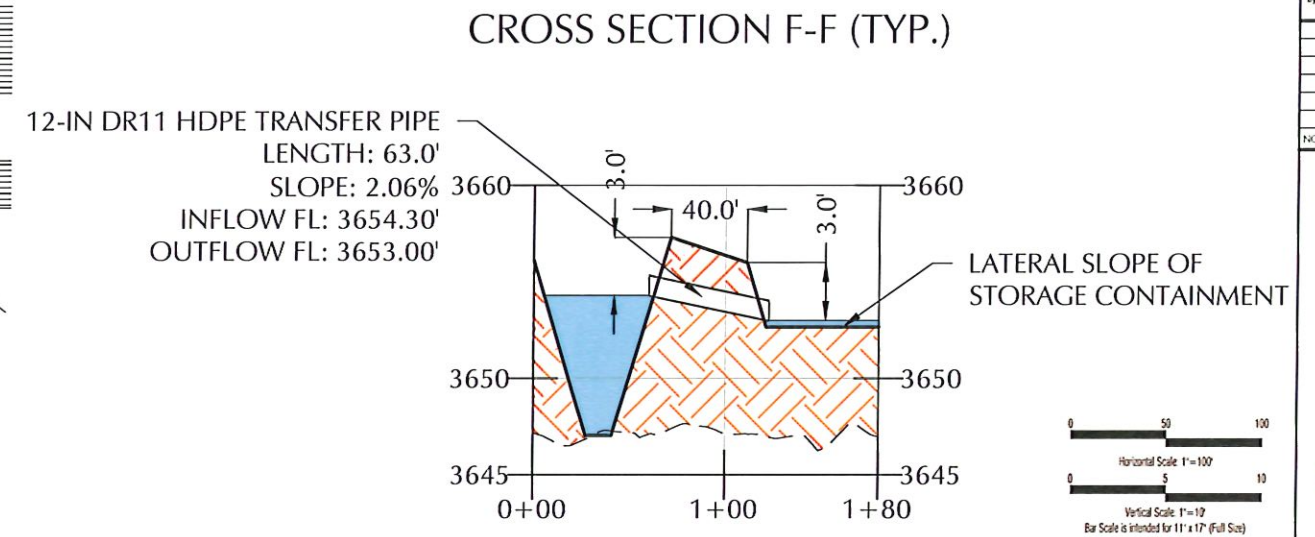


DATE:	SEPTEMBER 2025
SCALE:	HORIZONTAL 1"=100' VERTICAL 1"=10'
DESIGNED BY:	R. MOHAY
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	10 OF 16

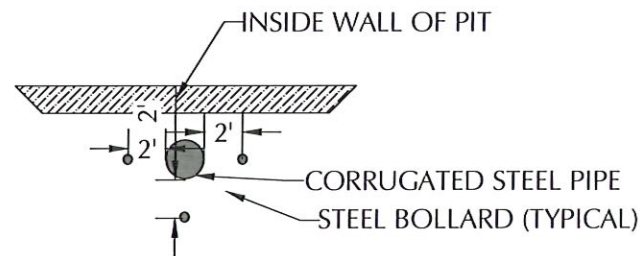


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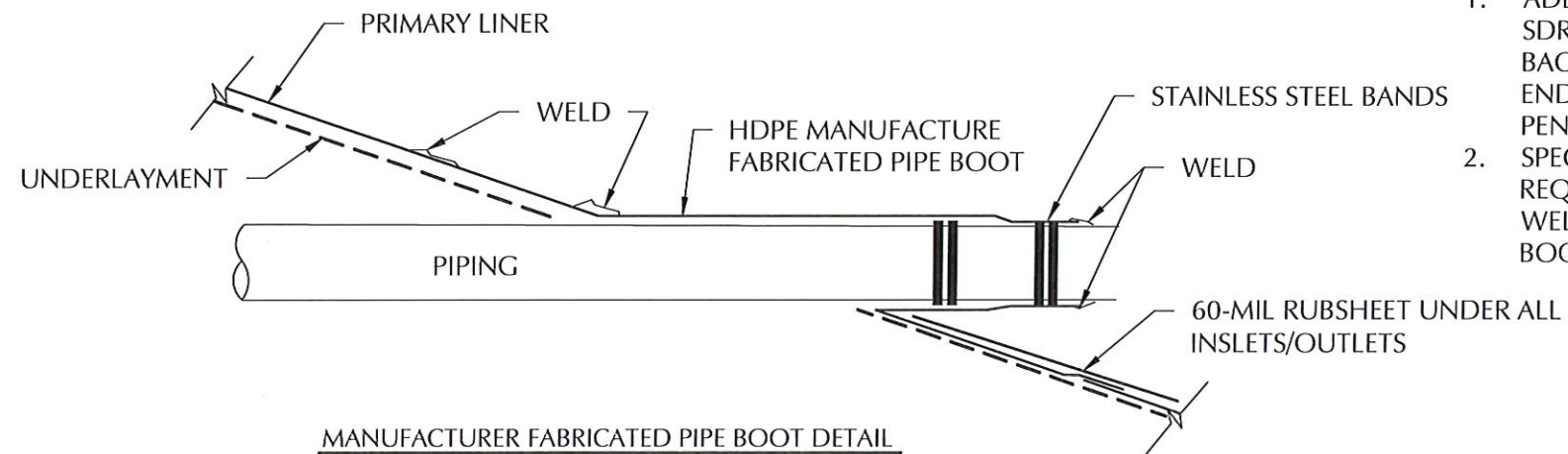
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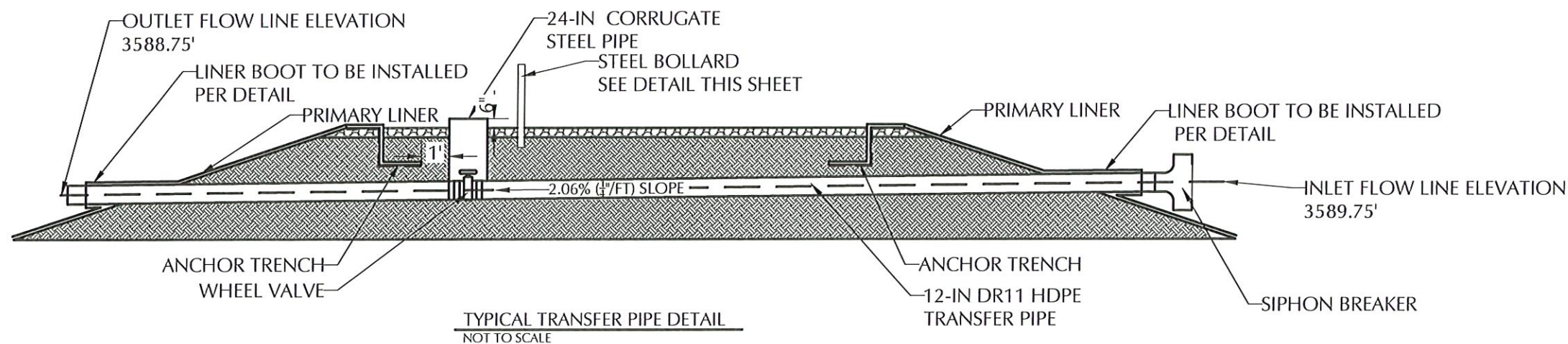
- NOTES:
1. ADD A 150 SERIES HDPE SDR 17 FLANGE WITH BACKING RING TO THE END OF EACH PIPE PENETRATION.
 2. SPECIAL ATTENTION REQUIRED WHEN WELDING AT ALL PIPE BOOTS.



BOLLARD TOP DOWN SCHEMATIC
NOT TO SCALE



MANUFACTURER FABRICATED PIPE BOOT DETAIL
NOT TO SCALE



9-24-2025

TRANSFER PIPE DETAIL

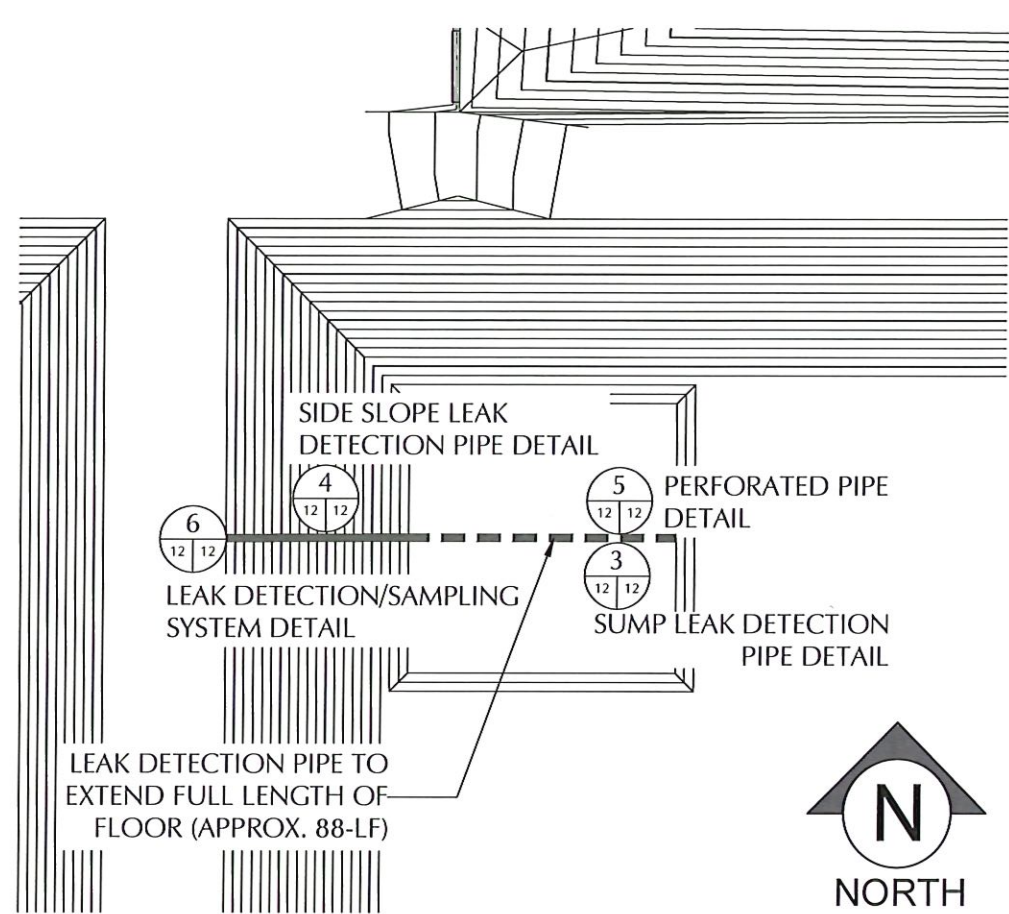
PALOMA EAST RECYCLE FACILITY

LEGION WATER SERVICES

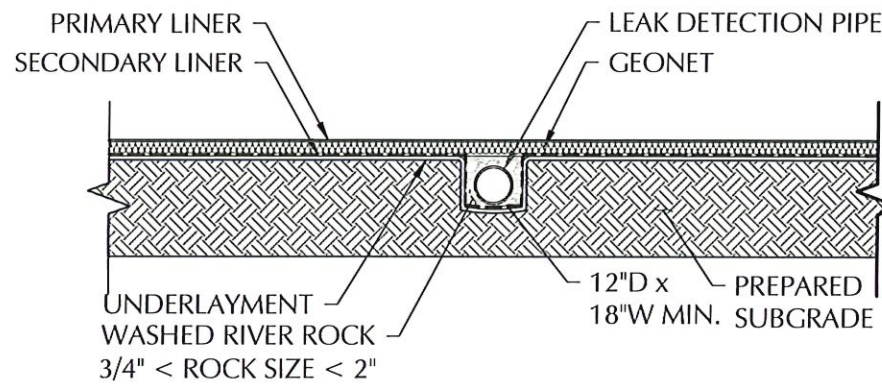
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST

LEA COUNTY, NEW MEXICO

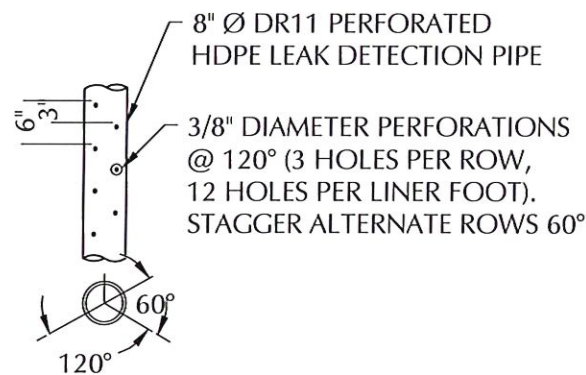
DATE:	SEPTEMBER 2025
SCALE:	VARIES
SIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	11 OF 16



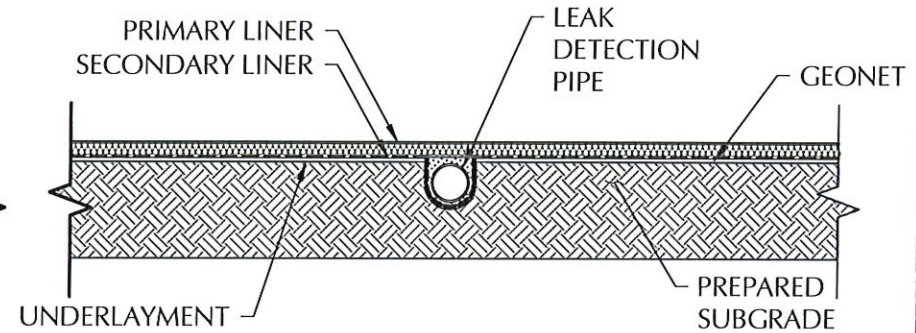
SUMP OVERVIEW DETAIL 2
NOT TO SCALE



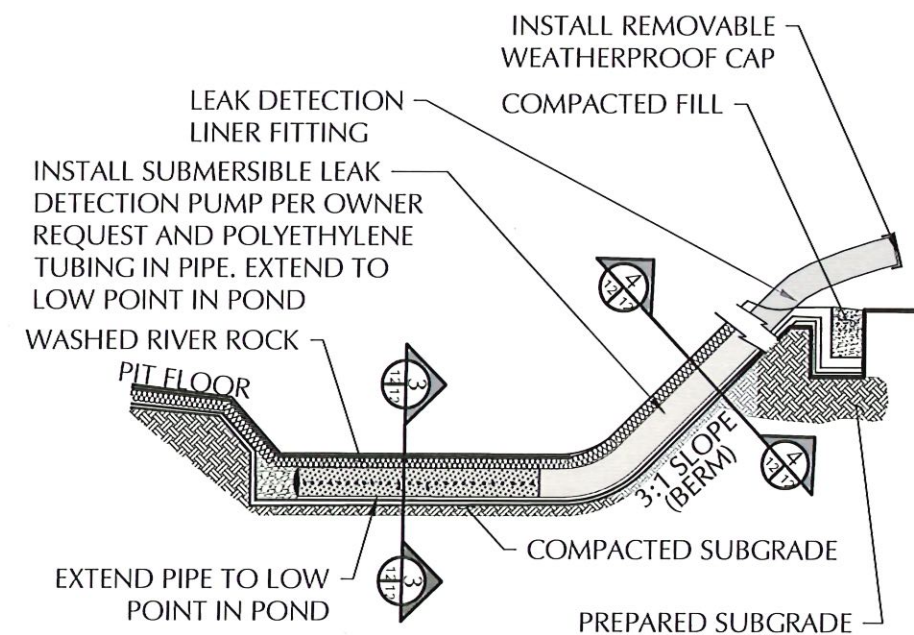
SUMP LEAK DETECTION PIPE DETAIL 3
NOT TO SCALE



PERFORATED PIPE DETAIL 5
NOT TO SCALE



SIDE SLOPE LEAK DETECTION PIPE DETAIL 4
NOT TO SCALE



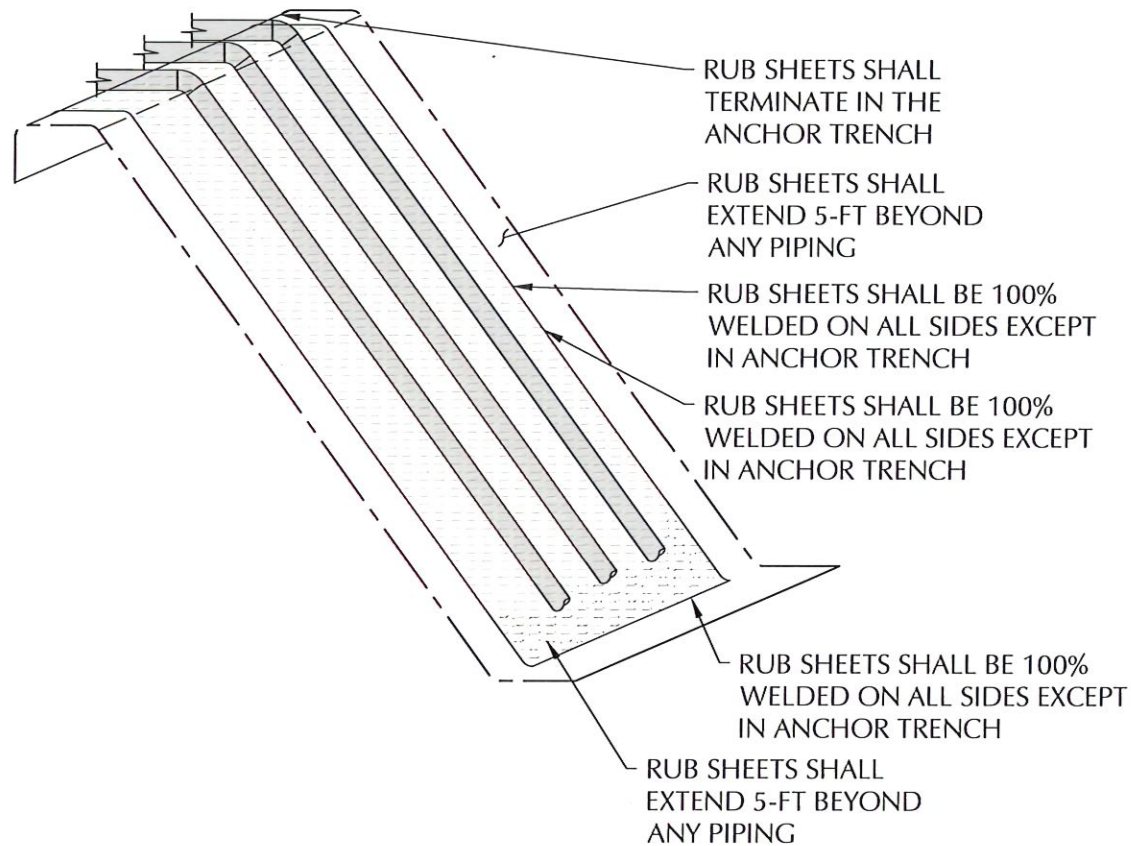
LEAK DETECTION/SAMPLING SYSTEM DETAIL 6
NOT TO SCALE

PROPOSED PIT REFERENCE TABLE	
DETAIL	DESCRIPTION
PRIMARY LINER	60- MIL HDPE SMOOTH LINER
LEAK DETECTION	200-MIL GEONET
SECONDARY LINER	40-MIL HDPE SMOOTH LINER
UNDERLAYMENT	10 OZ GEOTEXTILE
INFLOW CONTAINMENT SUMP	3645.30-FT ELEVATION
STORAGE CONTAINMENT SUMP	3636.00-FT ELEVATION
INFLOW CONTAINMENT BERM (ROAD CREST)	DESIGN ELEV. 3657.30 FT- RD CREST (VARIES)
STORAGE CONTAINMENT BERM (ROAD CREST)	DESIGN ELEV. 3656.00 FT- RD CREST (VARIES)
LEAK DETECTION PIPING	8-IN DR11.X PERFORATED HDPE LEAK DETECTION PIPE

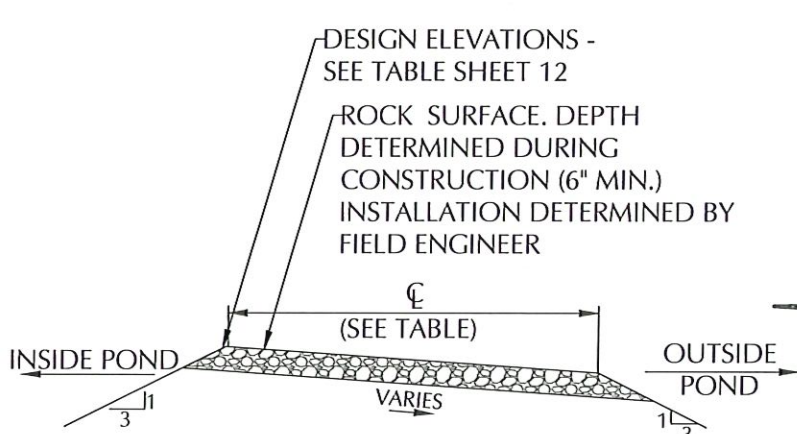
NOTES:

1. LEAK DETECTION SYSTEM TO BE INSTALLED BY OWNER.
2. PERFORATED PIPE TO BE ALONG THE BOTTOM OF THE POND. SOLID PIPE ON THE SIDE SLOPE.
3. CONSTRUCT COMPACTED SUBGRADE TO 95% STANDARD PROCTOR AS PER ASTM D-698.
4. EXTEND 60 MIL. RUB SHEET 1.0-FT PAST TOP OF SHOULDER OF SUMP.
5. WASH RIVER ROCK SHALL BE 3/4" MIN. & 2" MAX.

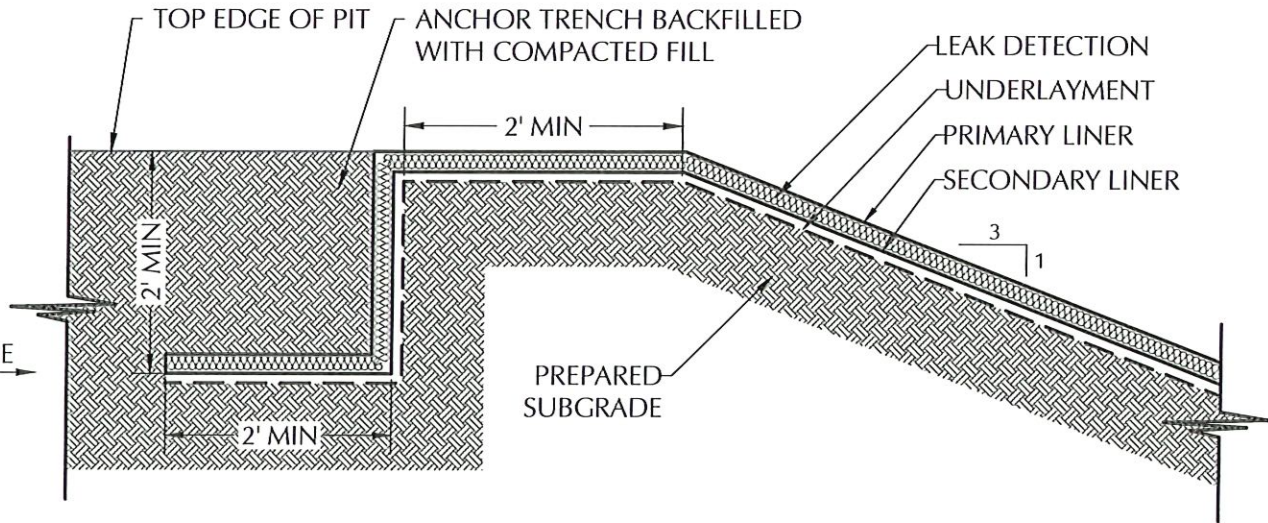




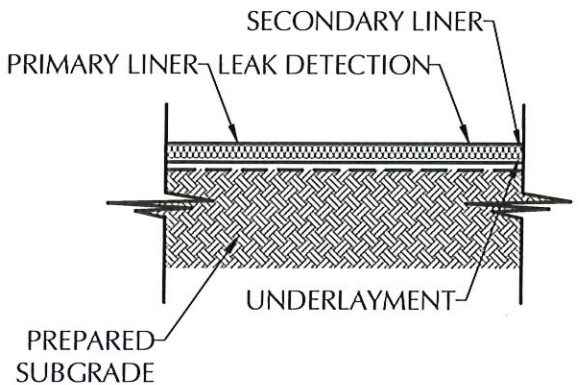
SUMP/CORNER RUB SHEET DETAIL 7
NOT TO SCALE



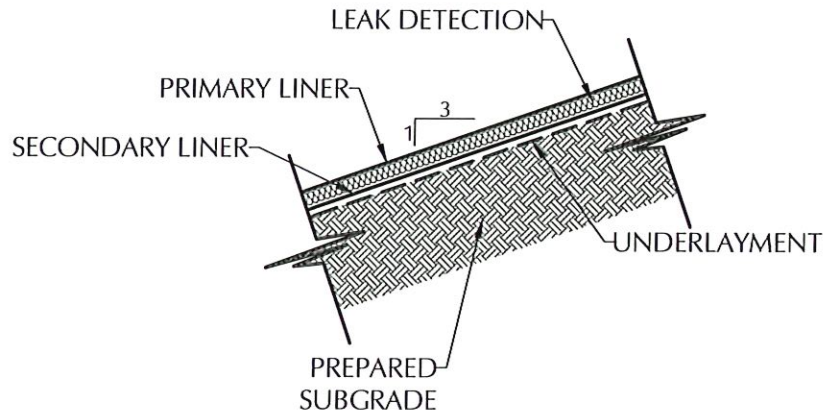
TYPICAL BERM CREST DETAIL 10
NOT TO SCALE



ANCHOR TRENCH DETAIL 11
NOT TO SCALE



LINER SYSTEM FLOOR DETAIL 8
NOT TO SCALE



LINER SYSTEM SIDE SLOPE DETAIL 9
NOT TO SCALE

GENERAL NOTES:

1. SEE REFERENCE TABLES SHEET 12 FOR LINER SPECIFICATIONS
2. PREPARED SUBGRADE MEANS COMPACTED SMOOTH SUBGRADE FREE OF ROCK, ROOTS, WOOD DEBRIS, CONCRETE RUBBLE AND ANY SHARP OBJECTS THAT MIGHT PUNCTURE THE HDPE LINER.
3. ALL INTERIOR SLOPES AND TOP OF BERMS TO BE SMOOTH DRUM ROLLED.
4. ALL EMBANKMENT SLOPES SHALL HAVE A RATIO OF 3:1, COMPACTED EARTH EMBANKMENTS TO BE CONSTRUCTED WITH 8 INCH (MAXIMUM LOOSE LIFTS), COMPACTED TO 95% STANDARD PROCTOR DENSITY (ASTM D698), AND MOISTURE CONDITIONS TO +/- 2% OPTIMUM MOISTURE (ASTM D698)
5. PERFORM GEOTECHNICAL ANALYSIS ON EXISTING SOIL TO CONFIRM SOIL IS SUITABLE FOR USE IN THE LEVEE.
6. ALL BOTTOM OF PITS SHALL SLOPE TO THE SUMP.

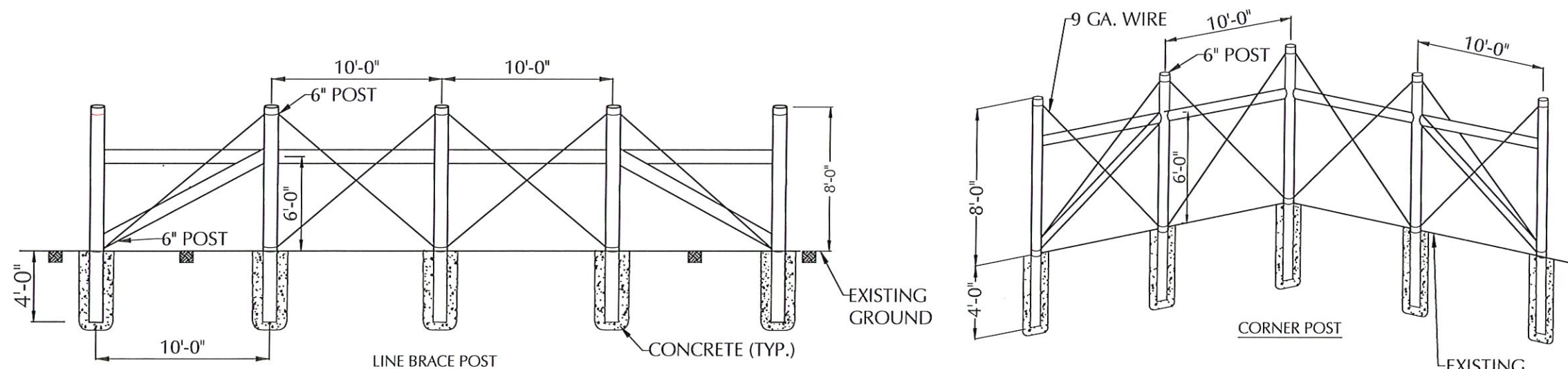


PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	NOT TO SCALE
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	13 OF 16

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8-FT GAME FENCE DETAIL

Not to Scale

12
7 14

1. AT EACH LOCATION WHERE AN ELECTRIC TRANSMISSION, DISTRIBUTION OR SECONDARY LINE CROSSES A BARRIER FENCE, THE CONTRACTOR SHALL FURNISH AND INSTALL A GROUND CONFORMING TO ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE- THE GROUND ROD SHALL BE A MINIMUM DIAMETER OF 1½-IN. AND 8-FT. IN LENGTH, AND DRIVEN AT LEAST 7 1/2 FT. INTO THE GROUND. THE ROD SHALL BE CONNECTED TO EACH WIRE WITH A MINIMUM AWG NO. 8 STRANDED COPPER WIRE. GROUNDING WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
2. LINE BRACE POSTS SHALL BE SPACED AT 400 FT. INTERVALS, WHERE FENCING IS CONTINUOUS AND WHERE END, CORNER AND LINE BRACE POSTS ARE NOT SPECIFIED.
3. ALL LINE POSTS SHALL BE 5 IN. MIN. DIAMETER AND 12 FT. LONG. ALL END, CORNER AND LINE BRACE POSTS SHALL BE 6 IN. MIN. DIAMETER AND 12 FT. LONG.
4. BARBED WIRE SHALL BE DOUBLE WRAPPED AND TIED OFF AT END POSTS, CORNER POSTS AND LINE BRACE POSTS.
5. WOVEN WIRE SHALL BE SINGLE WRAPPED AND TIED OFF. FENCE TO BE CONTINUED, SHALL BE RESTARTED IN LIKE MANNER. WOVEN WIRE FENCE FABRIC SHALL CONFORM TO AASHTO M 279 (ASTM A 116) DESIGN NO. 1047-6-11 WITH CLASS I COATING.
6. STEEL BARBED WIRE SHALL CONFORM TO AASHTO M 200 (ASTM A 121) 12-1/2 GAGE WITH CLASS 1 COATING.
7. ALL FENCE WIRE TIES, BRACE WIRES, STAPLES AND OTHER WIRE APPURTENANCES SHALL BE GALVANIZED IN CONFORMANCE WITH AASHTO M 232.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RE-ESTABLISHING DISTURBED OR DESTROYED SURVEY MONUMENTS TO THE APPROPRIATE ACCURACY.
9. ALL MISCELLANEOUS HARDWARE SHALL BE FURNISHED GALVANIZED OR ALUMINUM COATED. ALL METAL PIPE POSTS SHALL BE CAPPED.
10. READY MIX CONCRETE MAY BE USED AS A SUBSTITUTE FOR CLASS "A" CONCRETE FOR THE CONCRETE FOOTING IF APPROVED BY THE ENGINEER.



FENCE DETAILS

PALOMA EAST RECYCLE FACILITY

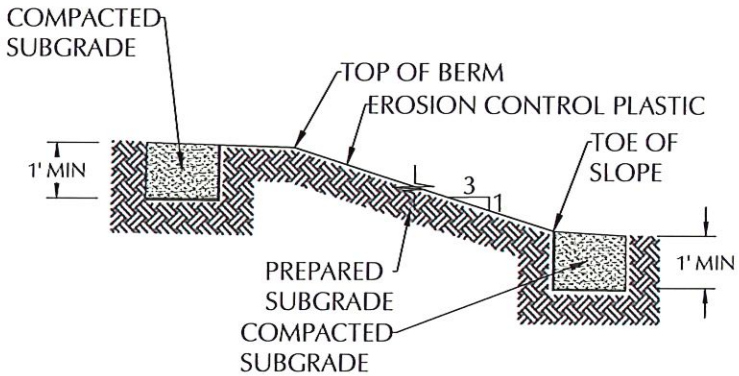
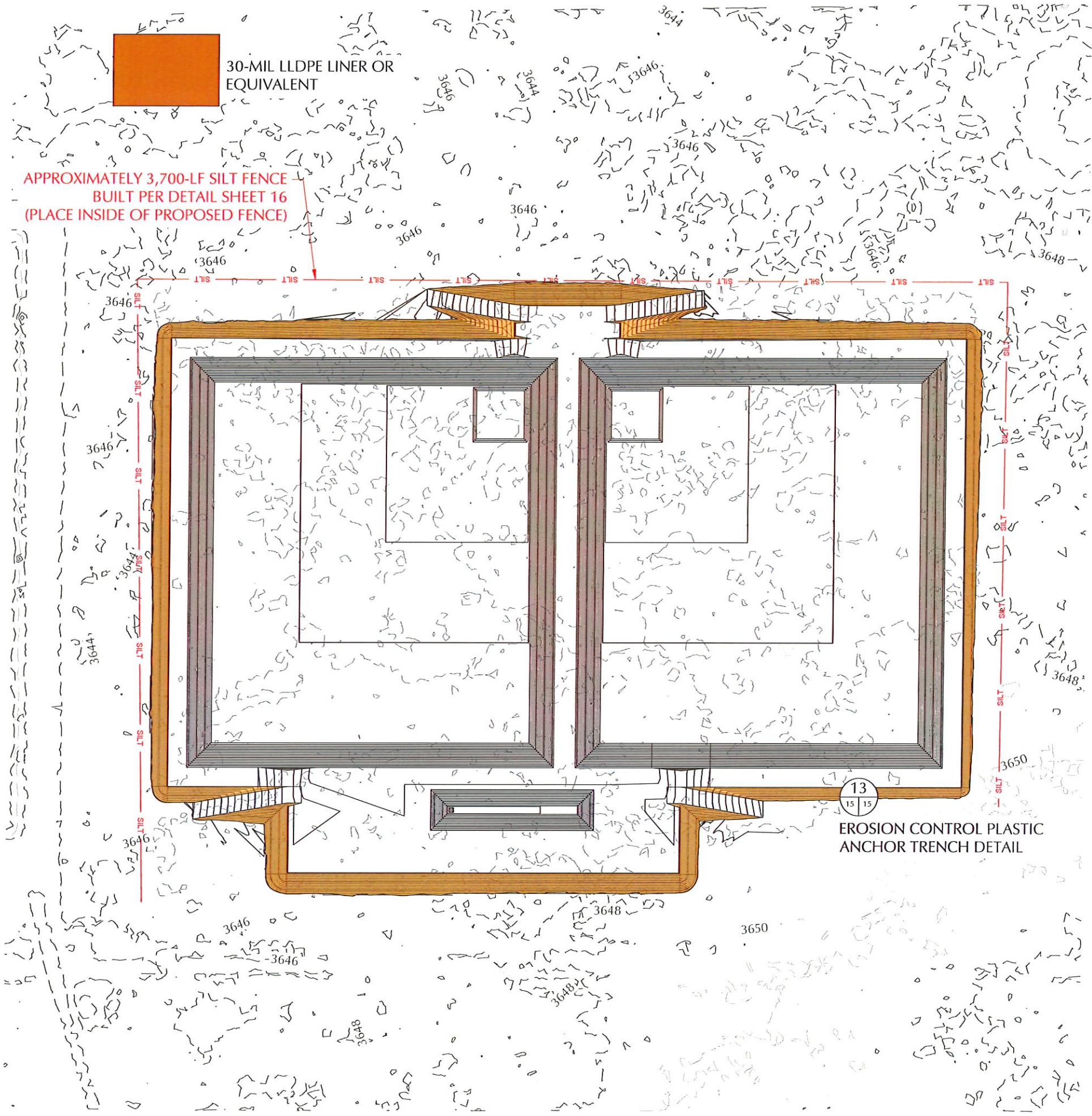
LEGION WATER SERVICES

SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST

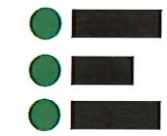
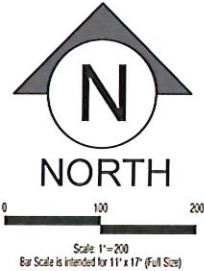
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	NOT TO SCALE
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	14 OF 16

Released to Imaging: 10/8/2025 2:45:07 PM



EROSION CONTROL PLASTIC ANCHOR TRENCH DETAIL
NOT TO SCALE



ENVIROTECH
ENGINEERING
2500 North Eleventh Street
Enid, Oklahoma
500.234.8700
envirotechconsulting.com
P.E. #29736 - Expiration Date: 12-31-2026

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NO.	DATE	DESCRIPTION



SWPPP
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	1" = 200'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	15 OF 16

DAILY	WEEKLY AND/OR WITHIN 24HRS OF 0.5 STORM EVENT OR GREATER	MONTHLY AND/OR UNTIL NOTICE OF TERMINATION
CONSTRUCTION EXIT STORAGE AREAS FOR POTENTIAL POLLUTANTS: PETROLEUM FERTILIZER PAINT CONCRETE DETERGENTS CLEANING SOLVENTS WOOD/MASONRY/ROOFING MATERIAL TAR METAL STUDS OTHER HAZARDOUS MATERIALS	ALL EROSION CONTROL MEASURES CONSTRUCTION EXIT SILT FENCE- SEDIMENT SHALL BE REMOVED FROM SILT FENCE WHEN IT REACHES 1/2 THE HEIGHT OF THE FENCE. INSPECT SILT FENCE FOR TEARS, SEE THAT FABRIC IS FIRMLY IN PLACE AND ALL POSTS SECURE. SEDIMENT BASIN- INSPECT FOR DEPTH OF SEDIMENT, REMOVE WHEN SEDIMENT REACHES 10% OF DESIGN CAPACITY DIVERSION DIKES- INSPECT AND REPAIR ANY BREACHES ACCESSIBLE DISCHARGE POINTS- ENSURE THAT EROSION CONTROL MEASURES ARE EFFECTIVE IN PREVENTING SIGNIFICANT IMPACTS TO RECEIVING WATERS TEMPORARY AND PERMANENT SEEDING- INSPECT FOR BARE SPOTS, WASHOUTS AND HEALTHY GROWTH.	ALL AREAS WHICH HAVE UNDERGONE FINAL STABILIZATION ALL EROSION CONTROL MEASURES INSPECT FOR EVIDENCE OF OR POTENTIAL FOR POLLUTANTS ENTERING THE DRAINAGE SYSTEM AND THE RECEIVING WATER ACCESSIBLE DISCHARGE POINTS- ENSURE THAT EROSION CONTROL MEASURES ARE EFFECTIVE IN PREVENTING SIGNIFICANT IMPACTS TO RECEIVING WATER.
A MAINTENANCE REPORT WILL BE MADE AFTER EACH INSPECTION. A COPY OF THE REPORT FORM TO BE COMPLETED IS ATTACHED TO PLANS.		
INSPECTIONS SHALL BE CONDUCTED UNDER THE SUPERVISION OF THE PRIMARY PERMITEE BY "QUALIFIED PERSONNEL". QUALIFIED PERSONNEL MEANS A PERSON WHO HAS SUCCESSFULLY COMPLETED AN EROSION AND SEDIMENT CONTROL SHORT COURSE ELIGIBLE FOR CONTINUING EDUCATION UNITS, OR AN EQUIVALENT COURSE APPROVED BY EPD.		
RECORD KEEPING- A REPORT SHALL BE MADE AFTER EACH INSPECTION SUMMARIZING THE RESULTS. THE INSPECTOR MUST RECORD ANY DAMAGE OR DEFICIENCIES IN THE CONTROL MEASURES ON THE PROVIDED REPORT FORM. THE OPERATOR SHALL REPAIR ANY DAMAGE AS SOON AS PRACTICAL AND NO LATER THAN (7) SEVEN DAYS AFTER THE INSPECTION. THE PLANS MUST BE KEPT CURRENT. IT IS THE RESPONSIBILITY OF THE PRIMARY PERMITEE TO REVISE THE METHODS USED TO CONTROL EROSION AND SEDIMENTS ONSITE.		

MAJOR SOIL DISTURBANCE ACTIVITY

CONSTRUCTION ACTIVITY	SOIL DISTURBANCE	BMP
CLEARING AND GRUBBING TOPSOIL REMOVAL TREE REMOVAL - AS NECESSARY	TOPSOIL REMOVAL STOCKPILING	FILTER FABRIC RIP-RAP CHECK DAM
SEDIMENTATION PONDS AS REQUIRED UTILITY LINES GRADING	EARTHWORK CUT AND FILL ACTIVITY	FILTER FABRIC RIP-RAP CHECK DAM
CONCRETE CHANNEL FOUNDATIONS	FINISH GRADING	MAINTAIN AND MONITOR EROSION CONTROL PERMANENT GRASSING
WALKWAYS PERMANENT GRASSING AND LANDSCAPING		REMOVAL OF TEMPORARY SEDIMENT CONTROL AND TREE PROTECTION

SEEDING REQUIREMENTS

AREA	SOWING SEASON	SPECIES	SEED
CHANNEL AND EMBANKMENTS PERMANENT	SPRING-SUMMER	BERMUDA SPRIGGING	BUSHEL/ACRE

FERTILIZER LBS/ACRE
450 lbs. (10-20-10)

* APPROVED EQUALS INCLUDES FRIO COUNTY SANDY SOIL AND CLAY SOILS MIXES FROM TEXAS NATIVE SEED PROJECT

PETROLEUM PRODUCTS:
ALL ONSITE VEHICLES WILL BE MONITORED FOR LEAKS AND RECEIVE REGULAR PREVENTATIVE MAINTENANCE TO REDUCE THE CHANCE OF LEAKAGE. PETROLEUM PRODUCTS WILL BE STORED IN TIGHTLY SEALED CONTAINERS WHICH ARE CLEARLY LABELED. ANY PETROLEUM TO BE STORED IN TANKS WILL BE SURROUNDED BY AN EARTHEN BERM AS A SECONDARY PROTECTIVE MEASURE. ANY ASPHALT SUBSTANCES USED ONSITE WILL BE APPLIED ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS.

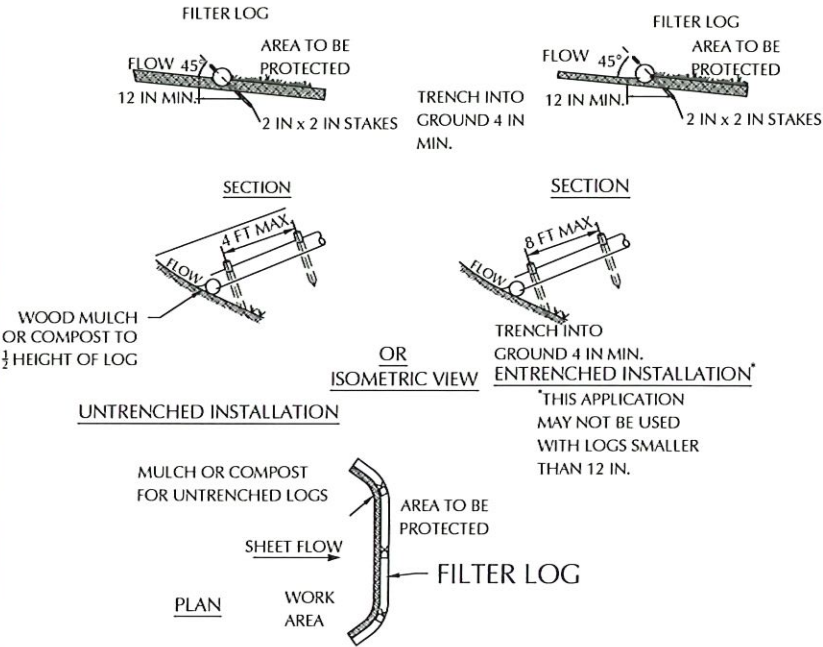
PAINTS:
ALL CONTAINERS WILL BE TIGHTLY SEALED AND STORED WHEN NOT REQUIRED FOR USE. EXCESS PAINT WILL NOT BE DISCHARGED TO THE STORM SEWER SYSTEM, BUT WILL BE DISPOSED OF PROPERLY ACCORDING TO MANUFACTURER'S INSTRUCTIONS OR STATE AND LOCAL REGULATIONS.

CONCRETE TRUCKS:
CONCRETE TRUCKS WILL NOT BE ALLOWED TO WASHOUT OR DISCHARGE SURPLUS CONCRETE OR DRUM WASH TRUCK ON SITE.

FERTILIZERS:
FERTILIZER USED WILL BE APPLIED ONLY IN THE MINIMUM AMOUNTS RECOMMENDED BY THE MANUFACTURER. ONCE APPLIED, FERTILIZER WILL BE WORKED INTO THE SOIL TO LIMIT EXPOSURE TO STORM WATER. STORAGE WILL BE IN A COVERED SHED. THE CONTENTS OF ANY PARTIALLY USED BAGS OF FERTILIZER WILL BE TRANSFERRED TO A SEALABLE PLASTIC BIN TO AVOID SPILLS.

WASTE DISPOSAL:
KEEP PORTA-JOHN'S AWAY FROM STORM DRAIN INLETS AND RECEIVING BODIES OF WATER OR RINSING OF PORTA-JOHN'S INTO STORM INLETS OR RECEIVING BODIES OF WATER. RUNOFF FROM PORTA-JOHN'S INTO WATER SYSTEMS IS A VIOLATION OF FEDERAL, STATE AND LOCAL ORDINANCES.

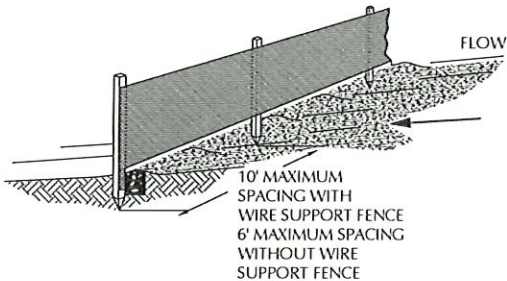
MULCH:
MULCH STORAGE MUST COMPLY WITH THE FOLLOWING SECTION OF THE STANDARD FIRE PREVENTION CODE. SECTION 502.3.1 - NO PERSON SHALL STORE IN ANY BUILDING OR UPON ANY PREMISES IN EXCESS OF 2,500 CU.FT. GROSS VOLUME OF COMBUSTIBLE EMPTY PACKING CASES, BOXES, BARRELS OR SIMILAR CONTAINERS OR RUBBER TIRES, OR RUBBER OR OTHER SIMILARLY COMBUSTIBLE MATERIALS WITHOUT A PERMIT.



CONSTRUCTION SPECIFICATIONS

1. PRIOR TO INSTALLATION, CLEAR ALL OBSTRUCTIONS INCLUDING ROCKS, CLODS, AND DEBRIS GREATER THAN ONE INCH THAT MAY INTERFERE WITH PROPER FUNCTION OF FILTER LOG.
2. FILL LOG NETTING UNIFORMLY WITH COMPOST (IN ACCORDANCE WITH SECTION H-1 MATERIALS), OR OTHER APPROVED BIODEGRADABLE MATERIAL TO DESIRED LENGTH SUCH THAT LOGS DO NOT DEFORM.
3. INSTALL FILTER LOGS PERPENDICULAR TO THE FLOW DIRECTION AND PARALLEL TO THE SLOPE WITH THE BEGINNING AND END OF THE INSTALLATION POINTING SLIGHTLY UP THE SLOPE CREATING A "J" SHAPE AT EACH END TO PREVENT BYPASS.
4. FOR UNTRENCHED INSTALLATION BLOW OR HAND PLACE MULCH OR COMPOST ON UPHILL SIDE OF THE SLOPE ALONG LOG.
5. STAKE FILTER LOG EVERY 4 FEET OR CLOSER ALONG ENTIRE LENGTH OF LOG OR TRENCH LOG INTO GROUND A MINIMUM OF 4 INCHES AND STAKE LOG EVERY 8 FEET OR CLOSER.
6. USE STAKES WITH A MINIMUM NOMINAL CROSS SECTION OF 2X2 INCH AND OF SUFFICIENT LENGTH TO ATTAIN A MINIMUM OF 12 INCHES INTO THE GROUND AND 3 INCHES PROTRUDING ABOVE LOG.
7. WHEN MORE THAN ONE LOG IS NEEDED, OVERLAP ENDS 12 INCHES MINIMUM AND STAKE.
8. REMOVE SEDIMENT WHEN IT HAS ACCUMULATED TO A DEPTH OF 1/2 THE EXPOSED HEIGHT OF LOG AND REPLACE MULCH. REPLACE FILTER LOG IF TORN. REINSTALL FILTER LOG IF UNDERMINING OR DISLODGING OCCURS. REPLACE CLOGGED FILTER LOGS. FOR PERMANENT APPLICATIONS, ESTABLISH AND CONTINUOUSLY MEET REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT IN ACCORDANCE WITH SECTION B-4 VEGETATIVE STABILIZATION.

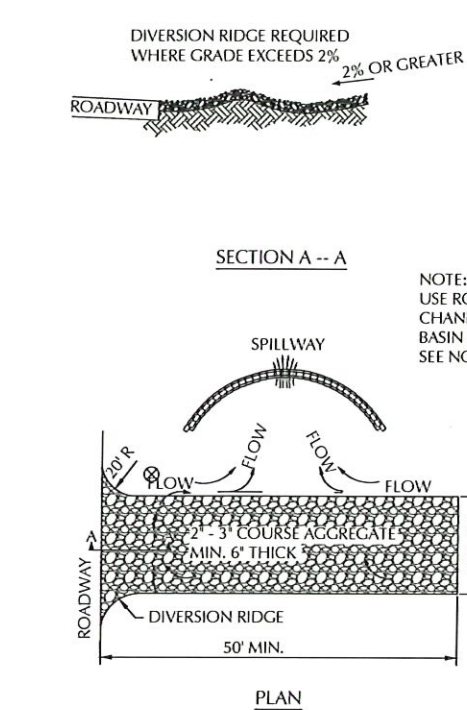
WADDLE FILTER LOG
(AS NEEDED FOR LOCALIZED WASHES)



SILT FENCE DETAILS

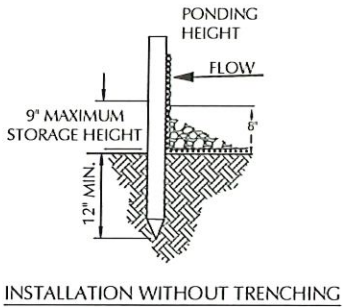
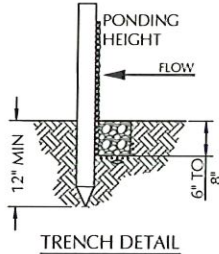
NOTES:

1. MUST BE INSTALLED PROPERLY TO AVOID NOTICE OF VIOLATION.
2. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE POUNDING EFFICIENCY.
3. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY. 9" MAXIMUM RECOMMENDED STORAGE HEIGHT.
4. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE TO SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.



NOTES:

1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.
4. ROCK BAGS OR SANDBAGS SHALL BE PLACED SUCH THAT NO GAPS ARE EVIDENT. SEE NOTES ERO-03.



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**LEGION
WATER SERVICES**

SWPPP DETAILS
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE: SEPTEMBER 2025
SCALE: NOT TO SCALE
DESIGNED BY: R. MOHAN
DRAWN BY: S. JOSSELYN
CHECKED BY: M. RATKE
PROJECT NO. 025281-00
SHEET NO. 16 OF 16



C147L APPLICATION PACKAGE
LEGION PALOMA EAST RECYCLE FACILITY
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO
025281-00

ATTACHMENT C

DESIGN AND CONSTRUCTION PLANS



Legion Water Services is proposing to construct three (3) storage containments in Section 15, Township 20 South, Range 34 East in Lea County, New Mexico. Paloma East Recycle Facility shall consist of three (3) containments with a total operational volume of approximately 2,031,015-bbl.

OPERATION AND MAINTENANCE PROCEDURES

Applicable mandates in Rule 34 are underlined. This plan addresses construction of lined earthen containments. *Attachment B* presents Engineering Design Plans. *Attachment D* provides liner and geotextile specifications.

Field conditions may create the need for minor modification of the containment design (e.g. changing the length, width, or depth). Any significant changes to the design will be submitted to the state for permit modification and as-built documentation will be provided.

Dike Protection and Structural Integrity

Design elements are addressed in the section of this submission containing the foundation recommendations. The recommendations are based on site-specific data. The operator, engineer, and selected contractor will review the recommendations prior to beginning the earthwork and adhere to the specific recommendations.

The design and operation provide for the confinement of produced water to prevent releases and to prevent overtopping due to wave action or rainfall. Additionally, the design prevents run-on of surface water as the containment is surrounded by an above-grade levee (berm) and diversion ditch to prevent run-on of surface water.

Stockpile Topsoil

Where topsoil is present, prior to constructing containment, the operator will strip and stockpile the topsoil for use as the final cover or fill at the time of closure. The topsoil will be stockpiled adjacent to perimeter fence surrounding the containment or incorporated into the levee.

Signage

The design calls for an upright sign no less than 12-in by 24-in with lettering not less than two inches in height in a conspicuous place on the fence surrounding the containment. The sign is posted in a manner and location such that a person can easily read the legend. The sign will provide the following information:

1. The operator's name,
2. The location of the site by quarter-quarter or unit letter, section, township and range, and
3. Emergency telephone numbers.



Fencing

The design provides for a fence to enclose the Recycling Containment in a manner that deters unauthorized wildlife and human access. The design calls for a 8-ft tall wire mesh game fence around the containment to exclude wildlife (see detail contained in engineering design drawings). This fence provides greater wildlife (and human) deterrence than the minimum required barbed wire fence with four strands evenly spaced in the interval between one foot and four feet above ground level. The fence will be gated to provide access for maintenance and placement of pumps and other necessary equipment. As stated in the O&M plan, the operator will ensure that all gates associated with the fence are closed and locked when responsible personnel are not onsite.

Netting and Protection of Wildlife

The game fence around the containment will be effective in excluding antelope, deer, coyotes, and most other terrestrial wildlife.

The Recycling Containment is otherwise protective of wildlife, including migratory birds. The containment will contain treated produced water that has not shown to be a material threat to birds due to hydrogen sulfide gas or floating, free-phase hydrocarbons. The O&M plan calls for the operator to 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.

The containment will 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 may be placed under the liner when needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity.

Attachment B shows for earthen containments;

1. The levee has an inside grade no steeper than three horizontal feet to one vertical foot (3H:1V).
2. The levee outside grade is no steeper than three horizontal feet to one vertical foot (3H:1V).
3. The top of the levee is wide enough to install an anchor trench and provide adequate room for inspection and maintenance.
4. The caliche gravel placed on the outside levee provides additional erosion control.

Field conditions may create the need for changes to the design. Any changes to the construction or grade requirements due to unforeseen conditions will be reviewed and approved prior to initiating installation of the liner system. Any design change that does not conform to the NMOCD Rule will be the subject of a variance request and will be submitted to the OCD for review and approval.



LINER AND DRAINAGE GEOTEXTILE INSTALLATION

The containment has a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions.

The primary (upper) liner is a geomembrane liner composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. It is 60-mil HDPE. The secondary liner is 40-mil HDPE. Liner compatibility meets or exceeds a subsequent relevant publication to EPA SW-846 method 9090A.

The Recycling Containment design has a leak detection system between the upper and lower geomembrane liners of 200-mil geonet to facilitate drainage. The leak detection system consists 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 containment floor design calls for a slope toward the sump. This slope, combined with the highly transmissive geonet drainage layer, provides for the earliest possible leak detection.

The liners and drainage material will be installed consistent with the manufacture's specifications (See *Attachment D*). In addition to any specifications of the manufacturer, protocols for liner installation include measures to:

1. Minimize liner seams and orient them up and down, not across, a slope of the levee.
2. Use factory welded seams where possible.
3. Field seams in geosynthetic material are thermally seamed; prior to field seaming, overlap liner four to six inches.
4. Minimize the number of field seams and corners and irregularly shaped areas.
5. Provide for no horizontal seams within five feet of the slope's toe.
6. Use qualified personnel to perform field welding and testing.
7. Avoid excessive stress-strain on the liner.
8. The edges of all liners are anchored in the bottom of a compacted earth-filled trench that is at least 18-in deep.

At points of discharge into the lined earthen containment, the pipe configuration effectively protects the liner from excessive hydrostatic force or mechanical damage during filling. The design shows that at any point of discharge into or suction from the recycling containment, the liner is protected from excessive hydrostatic force or mechanical damage. External discharge or suction lines do not penetrate the liner.

Pumping from the containment to hydraulic fracturing operations is the responsibility of stimulation contractors. Typically, numerous lines are permanently placed in the containment with floats attached to prevent damage to the liner system. The containment may be equipped with permanent HDPE stinger (supported by a sacrificial liner or geotextile) for withdrawal of fluid during operations, if the owner deems necessary. External discharge or suction lines do not penetrate the liner.



LEAK DETECTION AND FLUID REMOVAL SYSTEM INSTALLATION

The leak detection system, contains the following design elements:

1. The 200-mil geonet drainage material between the primary and secondary liner is sufficiently permeable to allow the transport of fluids to the observation ports (*Attachment B*).
2. The containment floor, sloped towards the monitoring riser pipe, facilitates the earliest possible leak detection of the containment bottom. A pump may be placed in an observation port to provide for fluid removal.
3. Piping will withstand chemical attack from any seepage, structural loading from stresses and disturbances from overlying water, cover materials, equipment operation, and expansion or contraction (see *Attachment B*).
4. The slope of the interior subgrade should be great enough to facilitate drainage.



C147L APPLICATION PACKAGE
LEGION PALOMA EAST RECYCLE FACILITY
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO
025281-00

ATTACHMENT D

MATERIAL SPECIFICATIONS



Legion Water Services is proposing to construct three (3) storage containments in Section 15, Township 20 South, Range 34 East in Lea County, New Mexico. Paloma East Recycle Facility shall consist of three (3) containments with a total operational volume of approximately 2,031,015-bbl.

GEOMEMBRANE SPECIFICATION

This specification covers the technical requirements for the Manufacturing and Installation of the geomembrane. All materials meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications.

1.1 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheet
 - 2. D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
 - 3. D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
 - 4. D 1603 Test Method for Carbon Black in Olefin Plastics
 - 5. D 3895 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
 - 6. D 4218 Standard Test Method for Determination of Carbon Black in Polyethylene Compounds
 - 7. D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
 - 8. D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
 - 9. D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
 - 10. D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
 - 11. D 5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes
 - 12. D 6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
 - 13. D 6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
 - 14. D 7240 Standard Practice for Leak Location using Geomembranes with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive Geomembrane Spark Test)
- B. Geosynthetic Research Institute
 - 1. GRI GM 13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
 - 2. GRI GM 17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes



1.2 DEFINITIONS

- A. Lot - A quantity of resin (usually the capacity of one rail car) used in the manufacture of geomembranes. Finished roll will be identified by a roll number traceable to the resin lot used.
- B. Construction Quality Assurance Consultant (CONSULTANT) – The Party, independent from MANUFACTURER and INSTALLER, that is responsible for observing and documenting activities related to quality assurance during the lining system construction.
- C. ENGINEER- The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.
- D. Geomembrane Manufacturer (MANUFACTURER) - The party responsible for manufacturing the geomembrane rolls.
- E. Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY) – The Party, independent from the OWNER, MANUFACTURER, and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER.
- F. INSTALLER- The Party responsible for field handling, transporting, storing, deploying, seaming, and testing of the geomembrane seams.
- G. Panel- Unit area of geomembrane that will be seamed in the field that is larger than 100-ft².
- H. Patch - Unit area of geomembrane that will be seamed in the field that is less than 100-ft².
- I. Subgrade Surface - Soil layer surface which immediately underlies the geosynthetic material(s).

1.3 SUBMITTALS POST-AWARD

- A. Furnish the following product data, in writing, to ENGINEER prior to installation of the geomembrane material:
 - 1. Resin Data shall include the following:
 - a. Certification stating that the resin meets the specification requirements (see *Table 1.9B*).
 - 2. Geomembrane Roll
 - a. Statement certifying no recycled polymer and no more than 10% rework of the same type of material is added to the resin (product run may be recycled).
- B. The INSTALLER shall furnish the following information to the ENGINEER and OWNER prior to installation:
 - 1. Installation layout drawings
 - 2. Must show proposed panel layout including field seams and details
 - 3. Must be approved prior to installing the geomembrane
 - 4. Approved drawings will be for concept only; actual panel placement will be determined by site conditions
 - 5. Installer's Geosynthetic Field Installation Quality Assurance Plan



- C. The INSTALLER will submit the following to the ENGINEER upon completion of installation:
1. Certificate stating the geomembrane has been installed in accordance with the Contract Documents
 2. Material and installation warranties
 3. As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail

1.4 QUALITY ASSURANCE

- A. The OWNER will engage and pay for the services of a Geosynthetic Quality Assurance Consultant and Laboratory to monitor geomembrane installation.

1.5 QUALIFICATIONS

A. MANUFACTURER

1. Geomembrane shall be manufactured by the following:
 - a. GSE Lining Technology, LLC
 - b. approved equal
2. MANUFACTURER shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane during the last year.

B. INSTALLER

1. Installation shall be performed by one of the following installation companies (or approved equal)
 - a. GSE Lining Technology, LLC
 - b. GSE Approved Installers
2. INSTALLER shall have installed a minimum of 5,000,000-ft² of HDPE geomembrane during the last two years.
3. INSTALLER shall have worked in a similar capacity on at least 5 projects similar in complexity to the project described in the contract documents, and with at least 500,000-ft² of HDPE geomembrane installation on each project.
4. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.
5. The INSTALLER shall provide a minimum of one Master Seamer for work on the project.
6. Must have completed a minimum of 1,000,000-ft² of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

1.6 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

- A. LABELING - Each roll of geomembrane delivered to the site shall be labeled by the MANUFACTURER. The label will identify:
1. manufacturer's name
 2. product identification
 3. thickness
 4. length
 5. width
 6. roll number



- B. DELIVERY - Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.
- C. STORAGE - The on-site storage location for geomembrane material, provided by the CONTRACTOR to protect the geomembrane from punctures, abrasions and excessive dirt and moisture, should have the following characteristics:
 - 1. level (no wooden pallets)
 - 2. smooth
 - 3. dry
 - 4. protected from theft and vandalism
 - 5. adjacent to the area being lined
- D. Handling- Materials are to be handled so as to prevent damage.

1.7 WARRANTY

- A. Material shall be warrantied, on a pro-rata basis, against Manufacturer's defects for a period of 5 years from the date of geomembrane installation.
- B. Installation shall be warrantied against defects in workmanship for a period of 1 year from the date of geomembrane completion.

1.8 GEOMEMBRANE PROPERTIES

- A. Material shall be smooth/textured polyethylene geomembrane as shown on the drawings.
- B. Resin
 - 1. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.
 - 2. Natural resin (without carbon black) shall meet the following requirements:

Table 1.9B RAW MATERIAL PROPERTIES			
Property	Test Method	HDPE	LLDPE
Density (g/cm ³)	ASTM D 1505	≥ 0.932	≥ 0.915
Melt Flow Index (g/10 min)	ASTM D 1238 (190/2.16)	≤ 1.0	≤ 1.0
OIT (minutes)	ASTM D 3895 (1 atm/200°C)	≥ 100	≥ 100

- C. Geomembrane Rolls
 - 1. Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.
 - 2. Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.
 - 3. Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating roll number, thickness, length, width, and MANUFACTURER.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
 025281-00

4. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in section 1.09 D and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.
- D. Smooth surfaced geomembrane shall meet the requirements shown in the following data sheets below:
 1. *Table 1.1* for Black HDPE
 2. *Table 1.2* for Green HDPE
 3. *Table 1.3* for White HDPE
 - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
 - b. The white surface shall be installed upwards.
 4. *Table 1.4* for Smooth Leak Location Liner HDPE
 - a. The geomembrane shall have a coextruded, electrically conductive layer.
 - b. The conductive layer is installed downward.
 - c. Electrical testing shall be performed after liner installation by the INSTALLER.
 5. *Table 1.5* for Smooth White Leak Location Liner HDPE
 - a. The geomembrane shall have a coextruded, electrically conductive layer.
 - b. The conductive layer is installed downward.
 - c. The geomembrane shall be a white-surfaced, coextruded geomembrane.
 - d. The white surface shall be installed upwards.
 - e. Electrical testing shall be performed after liner installation by the INSTALLER.
 6. *Table 1.6* for Black LLDPE
 7. *Table 1.7* for White-surfaced LLDPE
 - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
 - b. The white surface shall be installed upwards.
 8. *Table 1.8* for Leak Location Liner LLDPE
 - a. The geomembrane shall have a coextruded, electrically conductive layer.
 - b. The conductive layer is installed downward.
 - c. Electrical testing shall be performed after liner installation by the INSTALLER.
 9. *Table 1.9* for White Leak Location Liner LLDPE
 - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
 - b. The white surface shall be installed upwards.
 - c. The geomembrane shall have a coextruded, electrically conductive layer.
 - d. The conductive layer is installed downward.
 - e. Electrical testing shall be performed after liner installation by the INSTALLER.



**MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00**

TABLE 1.1: GSE HD SMOOTH GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimum Average Values				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm ³ , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	114 63 700 12	152 84 700 12	228 126 700 12	304 168 700 12	380 210 700 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	54	72	108	144	180
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100	>100
Typical Roll Dimensions							
Roll Length ⁽²⁾ , ft			1,120	870	560	430	340
Roll Width ⁽²⁾ , ft			22.5	22.5	22.5	22.5	22.5
Roll Area, ft ²			25,200	19,575	12,600	9,675	7,650

- NOTES:
 - ⁽¹⁾Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽²⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE HD Smooth is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

TABLE 1.2: GSE GREEN SMOOTH GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimum Average Values				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm ³ , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	114 63 700 12	152 84 700 12	228 126 700 12	304 168 700 12	380 210 700 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	54	72	108	144	180
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100	>100
Typical Roll Dimensions							
Roll Length ⁽³⁾ , ft			1,120	870	560	430	340
Roll Width ⁽³⁾ , ft			22.5	22.5	22.5	22.5	22.5
Roll Area, ft ²			25,200	19,575	12,600	9,675	7,650



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

- NOTES:
 - ⁽¹⁾GSE Green Smooth may have an overall ash content of 3.0% due to the green layer. These values apply to the black layer only.
 - ⁽²⁾Dispersion applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽³⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE Green Smooth is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.

TABLE 1.3: GSE WHITE SMOOTH GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimum Average Values				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm ³ , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	114 63 700 12	152 84 700 12	228 126 700 12	304 168 700 12	380 210 700 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	54	72	108	144	180
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100	>100
Typical Roll Dimensions							
Roll Length ⁽³⁾ , ft			1,120	870	560	430	340
Roll Width ⁽³⁾ , ft			22.5	22.5	22.5	22.5	22.5



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

Roll Area, ft ²	25,200	19,575	12,600	9,675	7,650
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- NOTES:
 - ⁽¹⁾GSE White Smooth may have an overall ash content of 3.0% due to the white layer. These values apply to the black layer only.
 - ⁽²⁾Dispersion applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽³⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE White Smooth is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.

TABLE 1.4: GSE LEAK LOCATION SMOOTH GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm ³ , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	152 84 700 12	228 126 700 12	304 168 700 12	380 210 700 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	72	108	144	180
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length ⁽³⁾ , ft			870	560	430	340
Roll Width ⁽³⁾ , ft			22.5	22.5	22.5	22.5



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
 025281-00

Roll Area, ft ²	19,575	12,600	9,675	7,650
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- NOTES:
 - ⁽¹⁾GSE Leak Location Smooth may have an overall ash content of 3.0% due to the conductive layer. These values apply to the non-conductive black layer only.
 - ⁽²⁾Dispersion applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽³⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE Leak Location Smooth is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D746.
 - *Modified.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

TABLE 1.5: GSE LEAK LOCATION WHITE SMOOTH GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm ³ , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	152 84 700 12	228 126 700 12	304 168 700 12	380 210 700 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	72	108	144	180
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length ⁽³⁾ , ft			870	560	430	340
Roll Width ⁽³⁾ , ft			22.5	22.5	22.5	22.5
Roll Area, ft ²			19,575	12,600	9,675	7,650

- NOTES:
 - ⁽¹⁾GSE Leak Location White Smooth may have an overall ash content of 3.0% due to the white and conductive layers. These values apply to the black layer only.
 - ⁽²⁾Dispersion applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽³⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE Leak Location White Smooth is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

TABLE 1.6: GSE ULTRAFLEX SMOOTH GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Value			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm ³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	152 800	228 800	304 800	380 800
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	56	84	112	140
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length ⁽²⁾ , ft			870	560	430	340
Roll Width ⁽²⁾ , ft			22.5	22.5	22.5	22.5
Roll Area, ft ²			19,575	12,600	9,675	7,650

- NOTES:
 - ⁽¹⁾Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽²⁾Roll lengths and widths have a tolerance of ± 1 %.
 - GSE UltraFlex is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of ± 2 % when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

TALBE 1.7: GSE ULTRAFLEX WHITE SMOOTH GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Value			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm ³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	152 800	228 800	304 800	380 800
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	56	84	112	140
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length ⁽³⁾ , ft			870	560	430	340
Roll Width ⁽³⁾ , ft			22.5	22.5	22.5	22.5
Roll Area, ft ²			19,575	12,600	9,675	7,650

- NOTES:
 - ⁽¹⁾GSE UltraFlex White Smooth may have an overall ash content greater than 3.0% due to the white layer. These values apply to the black layer only.
 - ⁽²⁾ Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽³⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE UltraFlex White Smooth is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

TABLE 1.8: GSE ULTRAFLEX LEAK LOCATION LINER SMOOTH GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Value			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm ³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	152 800	228 800	304 800	380 800
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	56	84	112	140
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length ⁽³⁾ , ft			870	560	430	340
Roll Width ⁽³⁾ , ft			22.5	22.5	22.5	22.5
Roll Area, ft ²			19,575	12,600	9,675	7,650

- NOTES:
 - ⁽¹⁾GSE UltraFlex Leak Location Smooth may have an overall ash content greater than 3.0% due to the conductive layer. These values apply to the non-conductive black layer only.
 - ⁽²⁾Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽³⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE UltraFlex Leak Location Smooth is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

TABLE 1.9: GSE ULTRAFLEX LEAK LOCATION LINER WHITE SMOOTH GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Value			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm ³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	152 800	228 800	304 800	380 800
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	56	84	112	140
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length ⁽³⁾ , ft			870	560	430	340
Roll Width ⁽³⁾ , ft			22.5	22.5	22.5	22.5
Roll Area, ft ²			19,575	12,600	9,675	7,650

- NOTES:
 - ⁽¹⁾GSE UltraFlex Leak Location White Smooth may have an overall ash content greater than 3.0% due to the white and conductive layers. These values apply to the non-conductive black layer only.
 - ⁽²⁾Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽³⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE UltraFlex Leak Location White Smooth is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
 025281-00

- E. Textured surfaced geomembrane shall meet the requirements shown in the following data sheets below.
1. Table 2.1 for Black coextruded textured HDPE
 2. Table 2.2 for Green coextruded textured HDPE
 3. Table 2.3 for White coextruded textured HDPE
 - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
 - b. The white surface shall be installed upwards.
 4. Table 2.4 for Leak Location Liner coextruded textured HDPE
 - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
 - b. The white surface shall be installed upwards.
 5. Table 2.5 for White Leak Location Liner coextruded textured HDPE
 - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
 - b. The white surface shall be installed upwards.
 6. Table 2.6 for Black coextruded textured LLDPE
 7. Table 2.7 for White coextruded textured LLDPE
 - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
 - b. The white surface shall be installed upwards.
 8. Table 2.8 for Leak Location Liner coextruded textured LLDPE
 - a. The geomembrane shall have a coextruded, electrically conductive layer.
 - b. The conductive layer is installed downward.
 - c. Electrical testing shall be performed after liner installation by the INSTALLER.
 9. Table 2.9 for White Leak Location Liner coextruded textured LLDPE
 - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
 - b. The white surface shall be installed upwards.
 - c. The geomembrane shall have a coextruded, electrically conductive layer.
 - d. The conductive layer is installed downward.
 - e. Electrical testing shall be performed after liner installation by the INSTALLER.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

TABLE 2.1: GSE HD TEXTURED GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimum Average Values				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm ³ , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	45 63 100 12	60 84 100 12	90 126 100 12	120 168 100 12	150 210 100 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	45	60	90	120	150
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾
Asperity Height, mil	ASTM D 7466	second roll	16	18	18	18	18
Notch Constant Tensile Load ⁽²⁾ , hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100	>100
Typical Roll Dimensions							
Roll Length ⁽³⁾ , ft	Double-Sided	Textured	830	700	520	400	330
	Single-Sided	Textured	1,010	780	540	410	330
Roll Width ⁽³⁾ , ft			22.5	22.5	22.5	22.5	22.5
Roll Area, ft ²	Double-Sided	Textured	18,675	15,750	11,700	9,000	7,425
	Single-Sided	Textured	22,725	17,550	12,150	9,225	7,425



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

- NOTES:
 - ⁽¹⁾Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽²⁾NCTL for GSE HD Textured is conducted on representative smooth geomembrane samples.
 - ⁽³⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE HD Textured is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.

TABLE 2.2 GSE GREEN TEXTURED GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimum Average Values				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm ³ , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	45 63 100 12	60 84 100 12	90 126 100 12	120 168 100 12	150 210 100 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	45	60	90	120	150
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾
Asperity Height, mil	ASTM D 7466	second roll	16	18	18	18	18
Notch Constant Tensile Load ⁽³⁾ , hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100	>100
Typical Roll Dimensions							
Roll Length ⁽⁴⁾ , ft	Double-Sided Single-Sided Textured	Textured	830 1,010	700 780	520 540	400 410	330 330
Roll Width ⁽⁴⁾ , ft			22.5	22.5	22.5	22.5	22.5



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
 025281-00

Roll Area, ft ²	Double-Sided	Textured	18,675	15,750	11,700	9,000	7,425
	Single-Sided Textured		22,725	17,550	12,150	9,225	7,425

- NOTES:
 - ⁽¹⁾GSE Green may have an overall ash content greater than 3.0% due to the green layer. These values apply to the black layer only.
 - ⁽²⁾Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽³⁾NCTL for GSE Green Textured is conducted on representative smooth geomembrane samples.
 - ⁽⁴⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE Green Textured is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

TABLE 2.3: GSE WHITE TEXTURED GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimum Average Values				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm ³ , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	45 63 100 12	60 84 100 12	90 126 100 12	120 168 100 12	150 210 100 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	45	60	90	120	150
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾
Asperity Height, mil	ASTM D 7466	second roll	16	18	18	18	18
Notch Constant Tensile Load ⁽³⁾ , hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100	>100
Typical Roll Dimensions							
Roll Length ⁽⁴⁾ , ft	Double-Sided Textured Single-Sided Textured		830 1,010	700 780	520 540	400 410	330 330
Roll Width ⁽⁴⁾ , ft			22.5	22.5	22.5	22.5	22.5
Roll Area, ft ²	Double-Sided Textured Single-Sided Textured		18,675 22,725	15,750 17,550	11,700 12,150	9,000 9,225	7,425 7,425



**MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00**

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- NOTES:
 - ⁽¹⁾GSE White may have an overall ash content greater than 3.0% due to the white layer. These values apply to the black layer only.
 - ⁽²⁾Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽³⁾NCTL for GSE White Textured is conducted on representative smooth geomembrane samples.
 - ⁽⁴⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE White Textured is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

TABLE 2.4: GSE LEAK LOCATION LINER TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	40 36	60 54	80 72	100 90
Density, g/cm ³ , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in- width Strength at Yield, lb/in- width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	60 84 100 12	90 126 100 12	120 168 100 12	150 210 100 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	60	90	120	150
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Notch Constant Tensile Load ⁽³⁾ , hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length ⁽⁴⁾ , ft	Double-Sided	Textured	700	520	400	330
	Single-Sided	Textured	780	540	410	330
Roll Width ⁽⁴⁾ , ft			22.5	22.5	22.5	22.5
Roll Area, ft ²	Double-Sided	Textured	15,750	11,700	9,000	7,425
	Single-Sided	Textured	17,550	12,150	9,225	7,425



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

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- NOTES:
 - ⁽¹⁾GSE Leak Location may have an overall ash content greater than 3.0% due to the conductive layer. These values apply to the non-conductive layer only.
 - ⁽²⁾Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽³⁾NCTL for GSE Leak Location Textured is conducted on representative smooth geomembrane samples.
 - ⁽⁴⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE Leak Location Textured is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

TABLE 2.5: GSE LEAK LOCATION LINER WHITE TEXTURED GEOMEMBRANE

Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil	ASTM D 5994	every roll	40	60	80	100
Lowest individual reading			36	54	72	90
Density, g/cm ³ , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940
Tensile Properties (each direction)	ASTM D 6693, Type IV	20,000 lbs				
Strength at Break, lb/in-width	Dumbbell, 2 ipm		60	90	120	150
Strength at Yield, lb/in-width			84	126	168	210
Elongation at Break, %	G.L. 2.0 in		100	100	100	100
Elongation at Yield, %	G.L. 1.3 in		12	12	12	12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	60	90	120	150
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Notch Constant Tensile Load ⁽²⁾ , hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length ⁽⁴⁾ , ft	Double-Sided	Textured	700	520	400	330
	Single-Sided Textured		780	540	410	330
Roll Width ⁽⁴⁾ , ft			22.5	22.5	22.5	22.5
Roll Area, ft ²	Double-Sided	Textured	15,750	11,700	9,000	7,425
	Single-Sided Textured		17,550	12,150	9,225	7,425



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

- NOTES:
 - ⁽¹⁾GSE Leak Location White may have an overall ash content greater than 3.0% due to the conductive and white layers. These values apply to the non-conductive black layer only.
 - ⁽²⁾Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽³⁾NCTL for GSE Leak Location White Textured is conducted on representative smooth geomembrane samples.
 - ⁽⁴⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE Leak Location White Textured is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.

TABLE 2.6: GSE ULTRAFLEX TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm ³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	60 250	90 250	120 250	150 250
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	44	66	88	110
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾	Note ⁽¹⁾
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length ⁽²⁾ , ft	Double-Sided Textured Single-Sided Textured		700 650	520 420	400 320	330 250
Roll Width ⁽²⁾ , ft			22.5	22.5	22.5	22.5
Roll Area, ft ²	Double-Sided Textured Single-Sided Textured		15,750 14,625	11,700 9,450	9,000 7,200	7,425 5,625



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

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- NOTES:
 - ⁽¹⁾Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽²⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE UltraFlex Textured is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

TABLE 2.7: GSE ULTRAFLEX WHITE TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm ³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	60 250	90 250	120 250	150 250
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	44	66	88	110
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length ⁽³⁾ , ft	Double-Sided	Textured	700	520	400	330
	Single-Sided	Textured	650	420	320	250
Roll Width ⁽³⁾ , ft			22.5	22.5	22.5	22.5
Roll Area, ft ²	Double-Sided	Textured	15,750	11,700	9,000	7,425
	Single-Sided	Textured	14,625	9,450	7,200	5,625

• NOTES:

- ⁽¹⁾GSE UltraFlex White Textured may have an overall ash content greater than 3.0% due to the white layer. These values apply to the black layer only.
- ⁽²⁾Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- ⁽³⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
- GSE UltraFlex White Textured is available in rolls weighing approximately 4,000 lb.
- All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
- *Modified.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

TABLE 2.8: GSE ULTRAFLEX LEAK LOCATION TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm ³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	60 250	90 250	120 250	150 250
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	44	66	88	110
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length ⁽³⁾ , ft	Double-Sided	Textured	700	520	400	330
	Single-Sided	Textured	650	420	320	250
Roll Width ⁽³⁾ , ft			22.5	22.5	22.5	22.5
Roll Area, ft ²	Double-Sided	Textured	15,750	11,700	9,000	7,425
	Single-Sided	Textured	14,625	9,450	7,200	5,625

- NOTES:
 - ⁽¹⁾GSE UltraFlex Leak Location Textured may have an overall ash content greater than 3.0% due to the conductive layer. These values apply to the non-conductive black layer only.
 - ⁽²⁾Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
 - ⁽³⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
 - GSE UltraFlex Leak Location Textured is available in rolls weighing approximately 4,000 lb.
 - All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTb of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
 - *Modified.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

TABLE 2.9: GSE ULTRAFLEX LEAK LOCATION WHITE TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm ³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in- width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	60 250	90 250	120 250	150 250
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	44	66	88	110
Carbon Black Content ⁽¹⁾ , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾	Note ⁽²⁾
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Oxidative Induction Time, min	ASTM D 3895, 200°C; O ₂ , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length ⁽³⁾ , ft	Double-Sided	Textured	700	520	400	330
	Single-Sided	Textured	650	420	320	250
Roll Width ⁽³⁾ , ft			22.5	22.5	22.5	22.5
Roll Area, ft ²	Double-Sided	Textured	15,750	11,700	9,000	7,425
	Single-Sided	Textured	14,625	9,450	7,200	5,625

• NOTES:

- ⁽¹⁾GSE UltraFlex Leak Location White Textured may have an overall ash content greater than 3.0% due to the white and conductive layers. These values apply to the non-conductive black layer only.
- ⁽²⁾Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- ⁽³⁾Roll lengths and widths have a tolerance of $\pm 1\%$.
- GSE UltraFlex Leak Location White Textured is available in rolls weighing approximately 4,000 lb.
- All GSE geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^{\circ}\text{C}$ when tested according to ASTM D 746.
- *Modified.



- F. Extrudate Rod or Bead
 - 1. Extrudate material shall be made from same type resin as the geomembrane.
 - 2. Additives shall be thoroughly dispersed.
 - 3. Materials shall be free of contamination by moisture or foreign matter.

1.9 EQUIPMENT

- A. Welding equipment and accessories shall meet the following requirements:
 - 1. Gauges showing temperatures in apparatus such as extrusion welder or fusion welder shall be present.
 - 2. An adequate number of welding apparatus shall be available to avoid delaying work.
 - 3. Power source must be capable of providing constant voltage under combined line load.

1.10 DEPLOYMENT

- A. Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.
- B. Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.
- C. Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:
 - 1. Geomembranes shall be installed according to site-specific specifications, and GSE Conductive should be installed with the Conductive layer down.
 - i. *Note: A spark tester or ohm meter can be used to determine Conductive layer.*
 - 2. Unroll geomembrane using methods that will not damage geomembrane and will protect underlying surface from damage (spreader bar, protected equipment bucket).
 - 3. Place ballast (commonly sandbags) on geomembrane which will not damage geomembrane to prevent wind uplift.
 - 4. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it. Smoking will not be permitted on the geomembrane.
 - 5. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 8 psi.
 - 6. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.
- D. Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

1.11 FIELD SEAMING

- A. Seams shall meet the following requirements:



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
 025281-00

1. To the maximum extent possible, orient seams parallel to the line of the slope, i.e., down and not across slope.
 2. Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.
 3. Slope seams (panels) shall extend a minimum of 5-ft beyond the grade break into the flat area.
 4. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the CONSULTANT and INSTALLER.
 5. Align seam overlaps consistent with the requirements of the welding equipment being used. A 6-in overlap is commonly suggested.
- B. During Welding Operations
1. Provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.
- C. Extrusion Welding
1. Hot-air tack adjacent pieces together using procedures that do not damage the geomembrane.
 2. Clean geomembrane surfaces by disc grinder or equivalent.
 3. Purge welding apparatus of heat-degraded extrudate before welding.
- D. Hot Wedge Welding
1. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.
 2. Clean seam area of dust, mud, moisture and debris immediately ahead of hot wedge welder.
 3. Protect against moisture build-up between sheets.
- E. Trial Welds
1. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.
 2. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
 3. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.
 4. Cut four, one-inch wide by six-inch long test strips from the trial weld.
 5. Quantitatively test specimens for peel adhesion, and then for shear strength.
 6. Trial weld specimens shall pass when the results shown in the following tables for HDPE and LLDPE are achieved in both peel and shear test.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

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TABLE 1.12.6A: MINIMUM WELD VALUES FOR HDPE GEOMEMBRANES							
Property	Test Method	30	40	60	80	100	120
Peel Strength (fusion), ppi	ASTM D 6392	49	65	98	130	162	196
Peel Strength (extrusion), ppi	ASTM D 6392	39	52	78	104	130	157
Shear Strength (fusion & ext.), ppi	ASTM D 6392	61	81	121	162	203	242

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TABLE 1.2.6B: MINIMUM WELD VALUES FOR LLDPE GEOMEMBRANES						
Property	Test Method	30	40	60	80	100
Peel Strength (extrusion), ppi	ASTM D 6392	36	48	72	96	120
Peel Strength (fusion), ppi	ASTM D 6392	38	50	75	100	125
Shear Strength (fusion & ext.), ppi	ASTM D 6392	45	60	90	120	150

7. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).
 8. The break is ductile.
 9. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.
 10. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.
- F. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. INSTALLER shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.
- G. Defects and Repairs
1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
 2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.



1.12 FIELD QUALITY ASSURANCE

- A. MANUFACTURER and INSTALLER shall participate in and conform to all terms and requirements of the Owner's quality assurance program. CONTRACTOR shall be responsible for assuring this participation.
- B. Quality assurance requirements are as specified in this Section and in the Field Installation Quality Assurance Manual if it is included in the contract.
- C. Field Testing
 - 1. Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.
 - b. Vacuum Testing
 - 1) Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
 - b. Air Pressure Testing
 - 1) Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.
 - c. Spark Testing
 - 1. Shall be performed accordance with ASTM D 7240 Standard Practice for Leak Location using Geomembranes with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive Geomembrane Spark Test).
 - d. Other approved methods.
 - 2. Destructive Testing (performed by CONSULTANT with assistance from INSTALLER)
 - b. Location and Frequency of Testing
 - 1) Collect destructive test samples at a frequency of one per every 500 lineal feet of seam length.
 - 2) Test locations will be determined after seaming.
 - 3) Exercise Method of Attributes as described by GRI GM-14 (Geosynthetic Research Institute, <http://www.geosynthetic-institute.org>) to minimize test samples taken.
 - c. Sampling Procedures are performed as follows:
 - 1) INSTALLER shall cut samples at locations designated by the CONSULTANT as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.
 - 2) CONSULTANT will number each sample, and the location will be noted on the installation as-built.
 - a) Samples shall be 12-in wide by minimal length with the seam centered lengthwise.
 - b) Cut a 2-in wide strip from each end of the sample for field-testing.
 - c) Cut the remaining sample into two parts for distribution as follows:
 - d) One portion for INSTALLER, 12-in by 12-in



- e) One portion for the Third-Party laboratory, 12-in by 18-in
- f) Additional samples may be archived if required.
- 3) Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
 - a) INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling.
- 4) Repair and test the continuity of the repair in accordance with these Specifications.
- 3. Failed Seam Procedures
 - a. If the seam fails, INSTALLER shall follow one of two options:
 - 1) Reconstruct the seam between any two passed test locations.
 - 2) Trace the weld to intermediate location at least 10-ft minimum or where the seam ends in both directions from the location of the failed test.
 - b) The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than 10-ft long.
 - c) If sample passes, then the seam shall be reconstructed or capped between the test sample locations.
 - d) If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

1.13 REPAIR PROCEDURES

- A. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.
- B. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.
- C. INSTALLER shall be responsible for repair of defective areas.
- D. Agreement upon the appropriate repair method shall be decided between
 - 1. CONSULTANT and INSTALLER by using one of the following repair methods:
 - a. Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
 - b. Abrading and Re-welding- Used to repair short section of a seam.
 - c. Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
 - d. Capping- Used to repair long lengths of failed seams.
 - e. Flap Welding- Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.
 - 1) Remove the unacceptable seam and replace with new material.
- E. The following procedures shall be observed when a repair method is used:
 - 1. All geomembrane surfaces shall be clean and dry at the time of repair.
 - 2. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

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3. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.
- F. Repair Verification
1. Number and log each patch repair (performed by CONSULTANT).
 2. Non-destructively test each repair using methods specified in this Specification.



1.1 SCOPE

This specification covers the technical requirements for the Manufacturing and Installation of the nonwoven geotextile. All materials meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D 5261, Standard Test Method for Measuring Mass per Unit Area of Geotextiles
 - 2. ASTM D 4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
 - 3. ASTM D 4533, Standard Test Method for Index Trapezoidal Tearing Strength of Geotextiles
 - 4. ASTM D 4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
 - 5. ASTM D 4491, Standard Test Method for Water Permeability of Geotextiles by Permittivity
 - 6. ASTM D 4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile
 - 7. ASTM D 4354, Standard Practice for Sampling of Geosynthetics for Testing
 - 8. ASTM D 4759, Standard Practice for Determining the Specifications Conformance of Geosynthetics

1.3 SUBMITTALS

- A. Prior to material delivery to project site, the contractor shall provide the engineer with a written certification or manufacturers quality control data which displays that the geotextile meets or exceeds minimum average roll values (MARV) specified herein.
- B. The contractor shall submit, if required by the engineer, manufacturer's quality control manual for the geotextile to be delivered to the site.

2. PRODUCT

2.1 GEOTEXTILE

- A. The nonwoven needle-punched geotextile specified herein shall be made from staple fiber.
- B. The geotextile shall be manufactured from prime quality virgin polymer.
- C. The geotextile shall be able to withstand direct exposure to ultraviolet radiation from Sun for up to 30 days without any noticeable effect on index or performance properties.
- D. Geotextile shall meet or exceed all material properties listed in *Table 1*.



TABLE 1: GEOTEXTILE PROPERTIES			
Property	Test Method	Test Frequency	Value
Mass per Unit Area, oz/yd ²	ASTM D 5261	90,000-ft ²	12
Grab Tensile Strength, lb	ASTM D 4632	90,000-ft ²	320
CBR Puncture Strength, lb	ASTM D 6241	540,000-ft ²	925
Grab Elongation, %	ASTM D 4632	90,000-ft ²	50
Trapezoidal Tear Strength, lb	ASTM D 4533	90,000-ft ²	125
UV Resistance, % retained after 500 hours	ASTM D 4355	per formulation	70

2.2 MANUFACTURE

- A. All rolls of the geotextile shall be identified with permanent marking on the roll or packaging, with the manufacturers name, product identification, roll number, and roll dimensions.

2.3 TRANSPORT

- A. Transportation of the geotextile shall be the responsibility of the contractor.
- B. During shipment, the geotextile shall be protected from ultraviolet light exposure, precipitation, mud, dirt, dust, puncture, or other damaging or deleterious conditions.
- C. Upon delivery at the job site, the contractor shall ensure that the geotextile rolls are handled and stored in accordance with the manufacturer's instructions as to prevent damage.

3. EXECUTION

3.1 QUALITY ASSURANCE

- A. The engineer shall examine the geotextile rolls upon delivery to the site and report any deviations from project specifications to the contractor.

3.2 INSTALLATION



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

- A. The geotextile shall be handled in such a manner as to ensure that it is not damaged in any way. Should the contractor damage the geotextile to the extent that it is no longer usable as determined by these specifications or by the engineer, the contractor shall replace the geotextile at his own cost.
- B. The geotextile shall be installed to the lines and grades as shown on the contract drawings and as described herein.
- C. The geotextile shall be rolled down the slope in such a manner as to continuously keep the geotextile in tension by self-weight. The geotextile shall be securely anchored in an anchor trench where applicable, or by other approved or specified methods.
- D. In the presence of wind, all geotextiles shall be weighted by sandbags or approved equivalent. Such anchors shall be installed during placement and shall remain in place until replaced with cover material.
- E. The contractor shall take necessary precautions to prevent damage to adjacent or underlying materials during placement of the geotextile. Should damage to such material occur due to the fault of the contractor, the latter shall repair the damaged materials at his own cost and to the satisfaction of the engineer.
- F. During placement of the geotextile, care shall be taken not to entrap soil, stones or excessive moisture that could hamper subsequent seaming of the geotextile as judged by the engineer.
- G. The geotextile shall not be exposed to precipitation prior to being installed and shall not be exposed to direct sunlight for more than 15 days after installation.
- H. The geotextile shall be seamed using heat seaming or stitching methods as recommended by the manufacturer and approved by the engineer. Sewn seams shall be made using polymeric thread with chemical resistance equal to or exceeding that of the geotextile. All sewn seams shall be continuous. Seams shall be oriented down slopes perpendicular to grading contours unless otherwise specified. For heat-seaming, fusion welding techniques recommended by the manufacturer shall be used.
- I. The contractor shall not use heavy equipment to traffic above the geotextile without approved protection.
- J. The geotextile shall be covered as soon as possible after installation and approval. Installed geotextile shall not be left exposed for more than 15 days.
- K. Material overlying the geotextile shall be carefully placed to avoid wrinkling or damage to the geotextile.



SINGLE SIDED GEOCOMPOSITE

1.1 SCOPE

This specification covers the technical requirements for the manufacturing and installation of the geocomposite drainage layer. All materials meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM D 1238 Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
2. D 1505-98 Standard Test Method for Density of Plastics by the Density-Gradient Technique
3. ASTM D 4218, Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle Furnace Technique D 1603-94 Standard Test Method for Carbon Black in Olefin Plastics
4. D 4355-02 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
5. D 4491-99 Standard Test Method for Water Permeability of Geotextiles by Permittivity
6. D4533 Standard Test Method for Trapezoid Tearing Strength of Geotextiles
7. D 4716-00 Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
8. D 4751-99 Standard Test Method for Determining Apparent Opening Size of a Geotextile
9. D 6241 Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile- Related Products Using a 50-mm Probe D 4833-88 (1996) Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
10. D 5261-92 (1996) Standard Test Method for Measuring the Mass Per Unit Area of Geotextiles
11. D7005-03 Determining The Bond Strength (Ply-Adhesion) of Geocomposites
12. D 7179 Standard Test Method for Determining Geonet Breaking Force

B. Relevant publications from the Environmental Protection Agency (EPA):

1. Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.



1.3 DEFINITIONS

- A. Construction Quality Assurance Consultant (CONSULTANT) – The Party, independent from MANUFACTURER and INSTALLER, that is responsible for observing and documenting activities related to quality assurance during the lining system construction.
- B. ENGINEER - The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.
- C. Geocomposite Manufacturer (MANUFACTURER) - The party responsible for manufacturing the geocomposite rolls.
- D. Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY) -The Party, independent from the MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER.
- E. INSTALLER- Party responsible for field handling, transporting, storing and deploying the geocomposite.
- F. Lot- A quantity of resin (usually the capacity of one rail car) used to manufacture polyethylene geocomposite rolls. The finished rolls will be identified by a roll number traceable to the resin lot.

1.4 QUALIFICATIONS

- A. MANUFACTURER
 - 1. Geocomposite shall be manufactured by the following:
 - a. GSE Lining Technology, Inc.
 - b. Approved Equal
 - 2. MANUFACTURER shall have manufactured a minimum of 10,000,000-ft² of polyethylene geocomposite material during the last year.
- B. INSTALLER
 - 1. INSTALLER shall have installed a minimum of 500,000 square feet of geocomposite in the last 3 years.
 - 2. INSTALLER shall have worked in a similar capacity on at least 5 projects similar in complexity to the project described in the contract documents, and within at least 50,000 square feet of geonet installation on each project.
 - 3. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.

1.5 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

- A. Labeling- Each roll delivered to the site shall be wrapped and labeled by the MANUFACTURER. The label will identify:
 - 1. Manufacturer's name
 - 2. Product identification
 - 3. Length
 - 4. Width
 - 5. Roll number



- C. Delivery- Rolls will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.
- D. Storage- The on-site storage location provided by the CONTRACTOR to protect the geonet from abrasions, excessive dirt and moisture, shall have the following characteristics:
 - 1. Level (no wooden pallets)
 - 2. Smooth
 - 3. Dry
 - 4. Protected from theft and vandalism
 - 5. Adjacent to the area being lined
- E. Handling
 - 1. The CONTRACTOR and INSTALLER shall handle all rolls in such a manner to ensure they are not damaged in any way.
 - 2. The INSTALLER shall take any necessary precautions to prevent damage to underlying layers during placement of the drainage material.

1.6 WARRANTY

- A. Material shall be warranted, on a pro-rata basis against defects for a period of 1-year from the date of the geocomposite installation.
- B. Installation shall be warranted against defects in workmanship for a period of 1-year from the date of geocomposite completion.

2. PRODUCTS

2.1 GEOCOMPOSITE PROPERTIES

- A. A geocomposite shall be manufactured by extruding two crossing strands to form a bi-planar drainage net structure with a non-woven geotextile bonded to one or both sides.
- B. The geocomposite specified shall have properties that meet or exceed the values listed in the following data sheets below.



MATERIAL SPECIFICATIONS
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

TABLE 1: GEOCOMPOSITE PROPERTIES			
Property	Test Method	Frequency	Value
Geocomposite			
Transmissivity (1), gal/min/ft (m ² /sec) Single-Sided Composite	ASTM D 4716	1/540,000-ft ²	6.2 (1.3 x 10 ⁻³)
Ply Adhesion, lb/in	ASTM D 7005	1/50,000-ft ²	0.5
Geonet			
Geonet Core Thickness, mil (1)	ASTM D 5199	1/50,000-ft ²	270
Transmissivity (2), gal/min/ft (m ² /sec)	ASTM D 4716	1/540,000-ft ²	19 (4 x 10 ⁻³)
Compressive Strength, lbs/ft	ASTM D 6364	1/540,000-ft ²	40,000
Density, g/cm ³	ASTM D 1505	1/50,000-ft ²	0.94
Tensile Strength (MD), lb/in	ASTM D 7179	1/50,000-ft ²	100
Carbon Black Content, %	ASTM D 4218	1/50,000-ft ²	2.0
8 oz. Geotextile (prior to lamination)			
Mass per Unit Area, oz/yd ²	ASTM D 5261	1/90,000-ft ²	8
Grab Tensile Strength, lb	ASTM D 4632	1/90,000-ft ²	220
Grab Elongation	ASTM D 4632	1/90,000-ft ²	50%
CBR Puncture Strength, lb	ASTM D 6241	1/540,000-ft ²	575
Trapezoidal Tear Strength, lb	ASTM D 4533	1/90,000-ft ²	90
AOS, US Sieve (mm)	ASTM D 4751	1/540,000-ft ²	80 (0.180)
Permittivity, sec-1	ASTM D 4491	1/540,000-ft ²	1.3
Water Flow Rate, gpm/ft ²	ASTM D 4491	1/540,000-ft ²	95
UV Resistance, % Retained	ASTM D 4355 (after 500 hours)	per formulation	70

- Note: The design engineer shall prepare the table above based on the GSE product data sheet and then delete this note



C. Resin

1. Resin shall be new first quality, compounded polyethylene resin.
2. Natural resin (without carbon black) shall meet the following additional
 - a. minimum requirements:

TABLE 2: RAW MATERIAL PROPERTIES		
Property	Test Method ⁽¹⁾	Value
Density (g/cm ³)	ASTM D 1505	>0.94
Melt Flow Index (g/10 min)	ASTM D 1238	≤ 1.0

¹GSE utilizes test equipment and procedures that enable effective and economical confirmation that the product will conform to specifications based on the noted procedures. Some test procedures have been modified for application to geosynthetics. All procedures and values are subject to change without prior notification.

2.2 MANUFACTURING QUALITY CONTROL

The geocomposite shall be manufactured in accordance with the Manufacturer's Quality Control Plan submitted to and approved by the ENGINEER.

The geocomposite shall be tested according to the test methods and frequencies listed on Table 1 which has been prepared based on product data sheets.

3. EXECUTION

3.1 FAMILIARIZATION

A. Inspection

1. Prior to implementing any of the work in the Section to be lined, the INSTALLER shall carefully inspect the installed work of all other Sections and verify that all Work is complete to the point where the installation of the Section may properly commence without adverse impact.
2. If the INSTALLER has any concerns regarding the installed work of other Sections, he shall notify the Project ENGINEER.

3.2 MATERIAL PLACEMENT

- A. The geocomposite roll should be installed in the direction of the slope and in the intended direction of flow unless otherwise specified by the ENGINEER.
1. If the project contains long, steep slopes, special care should be taken so that only full length rolls are used at the top of the slope.



- B. In the presence of wind, all geocomposites shall be weighted down with sandbags or the equivalent. Such sandbags shall be used during placement and remain until replaced with cover material.
- C. If the project includes an anchor trench at the top of the slopes, the geocomposite shall be properly anchored to resist sliding. Anchor trench compacting equipment shall not come into direct contact with the geocomposite.
- D. In applying fill material, no equipment can drive directly across the geocomposite. The specified fill material shall be placed and spread utilizing vehicles with a low ground pressure.
- E. The cover soil shall be placed in the geocomposite in a manner that prevents damage to the geocomposite. Placement of the cover soil shall proceed immediately following the placement and inspection of the geocomposite.

3.3 SEAMS AND OVERLAPS

- A. Each component of the geocomposite will be secured or seamed to the like component at overlaps.
- B. Geonet Components
 - 1. Adjacent edges of the geonet along the length of the geocomposite roll shall be placed with the edges of each geonet butted against each other.
 - 2. The overlaps shall be joined by tying the geonet structure with cable ties. These ties shall be spaced every 5-ft along the roll length.
 - 3. Adjoining geocomposite rolls (end to end) across the roll width should be shingled down in the direction of the slope, with the geonet portion of the top overlapping the geonet portion of the bottom geocomposite a minimum of 12-in across the roll width.
 - 4. The geonet portion should be tied every 6-in in the anchor trench or as specified by the ENGINEER.

3.4 REPAIR

- A. Prior to covering the deployed geocomposite, each roll shall be inspected for damage resulting from construction.
- B. Any rips, tears or damaged areas on the deployed geocomposite shall be removed and patched. The patch shall be secured to the original geonet by tying every 6-in with the approved tying devices. If the area to be repaired is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be cut out and the two portions of the geonet shall be joined in accordance with *Subsection 3.03*.



C147L APPLICATION PACKAGE
LEGION PALOMA EAST RECYCLE FACILITY
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO
025281-00

ATTACHMENT E

OPERATING AND MAINTENANCE PLAN



Legion Water Services is proposing to construct three (3) storage containments in Section 15, Township 20 South, Range 34 East in Lea County, New Mexico. Paloma East Recycle Facility shall consist of three (3) containments with a total operational volume of approximately 2,031,015-bbl.

OPERATION AND MAINTENANCE PROCEDURES

In this plan, the underlined text represents the language of the Rule.

The operator will operate and maintain the lined earthen containments to contain liquids and solids (blow sand and minimal precipitates from the treated produced water) and maintain the integrity of the liner system in a manner that prevents contamination of fresh water and protects public health and the environment as described below. The purpose of the lined earthen containment is to facilitate recycling, reuse, and reclamation of produced water derived from nearby oil and gas wells. During periods when water for E&P operations is not needed, produced water will discharge to one of the injection wells in the operator's SWD system. The containment will not be used for the disposal of produced water or other oilfield waste.

The operation of the Recycling Containment is summarized below:

1. Via pipeline, produced water generated from nearby oil and gas wells is delivered to a treatment system located as indicated in the C-147.
2. After treatment, the produced water discharges into the containment.
3. When required, treated produced water is removed from the containment for E&P operations. At this time, treated produced water will be used for drilling beneath the fresh water zones (beneath surface casing), for well stimulation (e.g. hydraulic fracturing) and other E&P uses as approved by OCD.
4. Whenever the maximum fluid capacity of the containment is reached, treatment and discharge to the containment ceases (see Freeboard and Overtopping Prevention Plan, below).
5. The operator will keep accurate records and shall report monthly to the division the total volume of water received for recycling, with the amount of fresh water received listed separately, and the total volume of water leaving the facility for disposition by use on form C-148.
6. The operator will maintain accurate records that identify the sources and disposition of all recycled water that shall be made available for review by the division upon request.
7. The 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 will report cessation of operations to the appropriate division district office. The appropriate division district office may grant an extension to this determination of cessation of operations not to exceed six months.

The operation of the lined earthen containment will follow the mandates listed below:

1. The operator will not discharge into or store any hazardous waste (as defined by 40 CFR 261 and NMAC 19.15.2.7.H.3) in the containments.
2. If the containment's primary liner is compromised above the fluid's surface, the operator will 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.



3. If the primary liner is compromised below the fluid's surface, the operator will remove all fluid above the damage or leak within 48 hours of discover, notify the division district office, and repair the damage or replace the primary liner.
4. If any penetration of the containment liner is confirmed by sampling of fluid in the leak detection system (see Inspection and Monitoring Plan), the operator will:
 - a. Begin and maintain fluid removal from the leak detection/pump-back system,
 - b. Notify the District office within 48 hours (phone or email) of the discovery,
 - c. Identify the location of the leak, and
 - d. Repair the damage or, if necessary, replace the containment liner.
5. The operator will install, or maintain onsite, an oil absorbent boom or other device to contain an unanticipated release and the operator will remove any visible layer of oil from the surface of the recycling containment.
6. The operator will report releases of fluid in a manner consistent with NMAC 19.15.29.
7. The containment will be operated to prevent the collection of surface water run-on.
8. The operator will maintain the containment free of miscellaneous solid waste or debris.
9. The operator will maintain at least 3-ft of freeboard for the containment and will use a welded ladder gauge to allow easy determination of the required 3-ft of freeboard.
10. As described in the design/construction plan, the injection or withdrawal of fluids from the containment is accomplished through hardware that prevents damage to the liner by erosion, fluid jets, or impact from installation and removal of hoses or pipes.
11. The operator shall ensure that all gates associated with the fence are closed and locked when responsible personnel are not onsite.
12. The operator will maintain the fences in good repair.

MONITORING, INSPECTION, AND REPORTING PLAN

The operator will inspect the recycling containment and associated leak detection systems weekly while it contains fluids. The operator shall maintain a current log of such inspections and make the log available for review by the division upon request.

Weekly inspections consist of:

1. Reading and recording the fluid height of staff gauges,
2. Recording any evidence that the pond surface shows visible oil,
3. Visually inspecting the containment's exposed liners, and
4. Checking the leak detection system for any evidence of a loss of integrity of the primary liner.

As stated above, if a liner's integrity is compromised, or if any penetration of the liner occurs above the water surface, then the operator will notify the District office within 48 hours (phone or email).

Monthly, the operator will:

1. Inspect diversion ditches and berms around the containment to check for erosion and collection of surface water run-on.
2. Inspect the leak detection system for evidence of damage or malfunction and monitor for leakage.
3. Inspect the containment for migratory birds and other wildlife. 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.
4. Report to the division the total volume of water received for recycling, with the amount of fresh water received listed separately, and the total volume of water leaving the facility for disposition by use on form C-148.
 5. Record sources and disposition of all recycled water.

The operator will maintain a log of all inspections and make the log available for the appropriate Division District office's review upon request.

FREEBOARD AND OVERTOPPING PREVENTION PLAN

The method of operation of the containment allows for maintaining freeboard with very few potential problems. When the capacity of the containment is reached (3-ft of freeboard), the discharge of treated produced water ceases and the produced water generated by nearby oil and gas wells is managed by disposing of fluid at a local injection well.

If rising water levels suggest that 3-ft of freeboard will not be maintained, the operator will implement one or more of the following options:

1. Cease discharging treated produced water to the containment.
2. Accelerate re-use of the treated produced water for purposes approved by the Division.
3. Transfer treated produced water from the containment to a Division approved injection well.

The reading of the staff gauge typically occurs daily when treatment operations are ongoing and weekly when discharge to the containment is not occurring.

PROTOCOL FOR LEAK DETECTION MONITORING, FLUID REMOVAL, AND REPORTING

As shown in *Attachment B*, the leak detection system includes a monitoring system. Any fluid released from the primary liner will flow to the collection sump, where fluid level monitoring is possible at the monitoring riser pipe associated with the leak detection system.

Staff may employ a portable electronic water level meter to determine if fluid exists in the monitoring riser pipe. Obtaining accurate readings of water levels in a sloped pipe beneath a containment can be a challenge. An electrician's wire snake may be required to push the probe to the bottom of the port and the probe may be fixed in a 2-in pipe "dry housing" to avoid false readings due to water condensation on the pipe. There are many techniques to determine the existence of water in the sumps, including low-flow pumps and a simple small bailer affixed to an electrician's snake. The operator will use the method that works best for this containment.

If seepage from the containment into the leak detection system is suspected by a positive fluid level measurement, the operator will:

1. Re-measure fluid levels in the monitoring riser pipe on a daily basis for one week to determine the rate of seepage.
2. Collect a water sample from the monitoring riser pipe to confirm the seepage is treated produced water from the containment via field conductivity and chloride measurements.



OPERATION & MAINTENANCE PLAN
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
025281-00

3. Notify NMOCD of a confirmed positive detection in the system within 48 hours of sampling (initial notification).
4. Install a pump into the monitoring riser pipe sump to continually (manually on a daily basis or via automatic timers) remove fluids from the leak detection system into the containment until the liner is repaired or replaced.
5. Dispatch a liner professional to inspect the portion of the containment suspected of leakage during a "low water" monitoring event.
6. Provide NMOCD a second report describing the inspection and/or repair within 20 days of the initial notification.

If the point of release is obvious from a low water inspection, the liner professional will repair the loss of integrity. If the point of release cannot be determined by the inspection, the liner professional will develop a more robust plan to identify the point(s) of release. The inspection plan and schedule will be submitted to OCD with the second report. The operator will implement the plan upon OCD approval.



C147L APPLICATION PACKAGE
LEGION PALOMA EAST RECYCLE FACILITY
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO
025281-00

ATTACHMENT F

CLOSURE PLAN



CLOSURE PLAN
LEGION WATER SERVICES
PALOMA EAST RECYCLE FACILITY
LEA COUNTY, NEW MEXICO
 025281-00

Legion Water Services is proposing to construct three (3) storage containments in Section 15, Township 20 South, Range 34 East in Lea County, New Mexico. Paloma East Recycle Facility shall consist of three (3) containments with a total operational volume of approximately 2,031,015-bbl.

CLOSURE PLAN

In this plan, the underlined text represents the language of the Rule.

After operations cease, the operator will 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 operator shall substantially restore the impacted surface area to

1. The condition that existed prior to the construction of the recycling containment or
2. To a condition imposed by federal, state trust land, or tribal agencies on lands managed by those agencies as these provisions govern the obligations of any operator subject to those provisions.

EXCAVATION AND REMOVAL CLOSURE PLAN - PROTOCOLS AND PROCEDURES

The operator will remove all liquids from the pits and either:

- a. Dispose of the liquids in a division-approved facility, or
- b. Recycle, reuse, or reclaim the water for reuse in drilling and stimulation

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

After the removal of the pit contents and liners, soils beneath the pit will be tested by collection of a five-point (minimum) composite sample, which includes stained or wet soils, if any. That sample shall be analyzed for the constituents listed in Table 1 of 19.15.34.14.

After review of the laboratory results:

- a. If any contaminant concentration is higher than the parameters listed in Table 1, additional delineation may be required, and the operator must receive approval before proceeding with closure.
- b. If all contaminant concentrations are less than or equal to the parameters listed in Table 1, then the operator will proceed to:
 - i. Backfill with non-waste containing, uncontaminated earthen material or
 - ii. Undertake an alternative closure process pursuant to a variance request after approval by OCD.

The operator will 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.



CLOSURE DOCUMENTATION

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.

The operator shall notify the division when reclamation and re-vegetation are complete. Specifically, the notice will document that 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.

**Legion Water Services
Legion Paloma East Recycle Facility
Closure Cost Estimate**

Item	Units	Quantity	\$/Unit	Estimate Cost
Facility Closure				
1 Vac truck (final fluid removal)	hrs	80	\$ 125.00	\$ 10,000.00
2 Liner removal (fold-in-place)				
East Containment removal and disposal	SF	2,158,363	\$ 0.18	\$ 388,505.34
West Containment removal and disposal	SF	2,158,363	\$ 0.18	\$ 388,505.34
Inflow Containment removal and disposal	SF	119,982	\$ 0.18	\$ 21,596.76
Exterior berm erosion control liner	SF	173,424	\$ 0.18	\$ 31,216.32
3 Equipment removal				
Pit clean-out and residue haul-off	LS	1	\$ 20,000.00	\$ 20,000.00
Equipment removal (tanks, gun barrel, FWKO)	LS	1	\$ 7,500.00	\$ 7,500.00
Electrical decommissioning (pumps and panels)	LS	1	\$ 10,000.00	\$ 10,000.00
Misc equipment clean-up and removal	hr	200	\$ 135.00	\$ 27,000.00
4 Site Restoration				
Paloma East Recycle Facility	CY	201,577	\$ 4.25	\$ 856,702.25
Dozer - push in berms (bid)				
and final grading of the site				
Re-vegetation	AC	42.7	\$ 1,500.00	\$ 64,050.00
Estimated Total				\$ 1,825,076.01

Assumptions

No Remediation will be necessary

Pit is full at time of closure

Pit berms above natural grade will be used to fill voids below natural grade



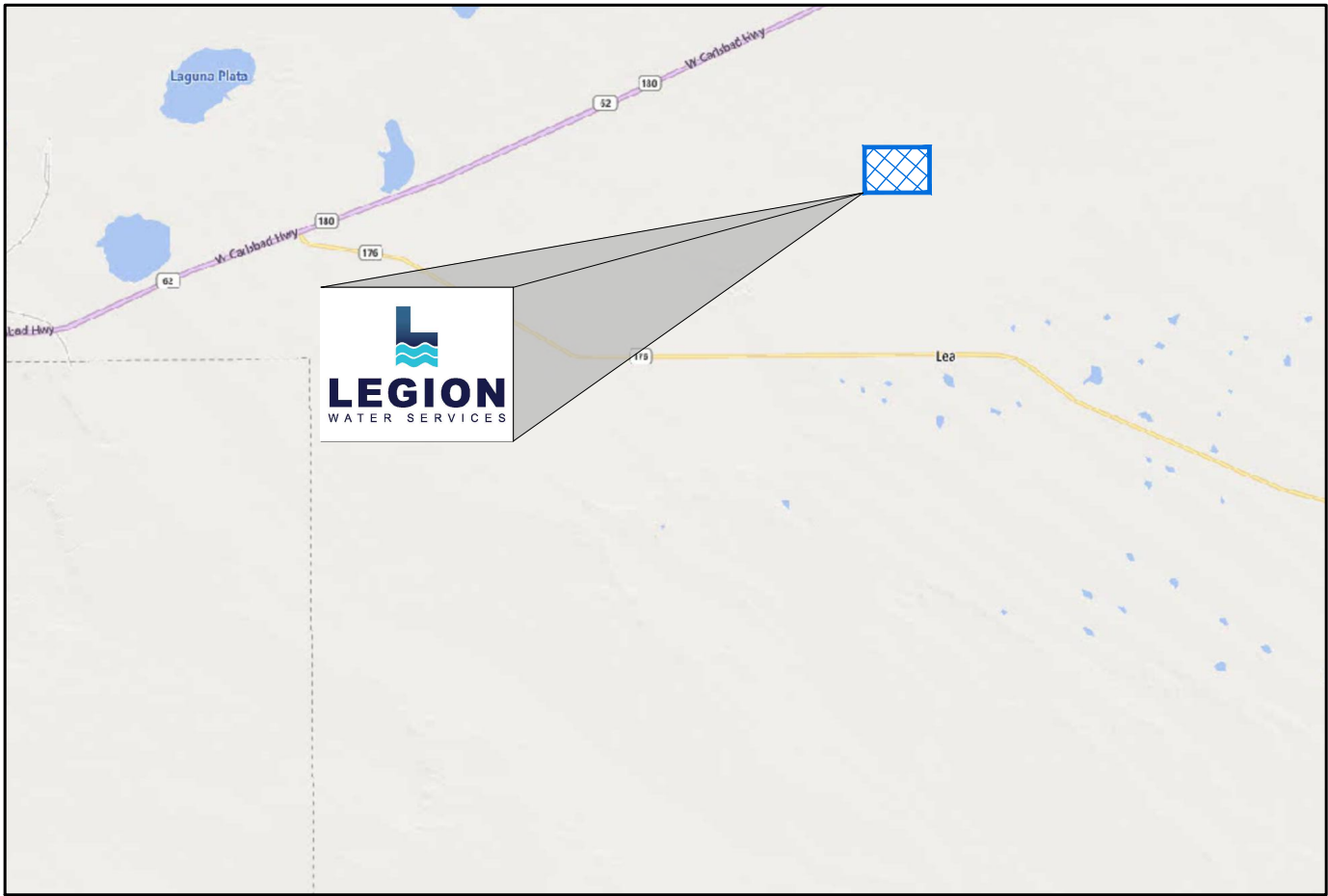
9-24-2025

PALOMA EAST RECYCLE FACILITY

LEGION WATER SERVICES

SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

32° 34' 6.0420" N, 103° 32' 54.5352" W
32.568345°, -103.548482°



INDEX TO DRAWINGS	
SHEET NO.	DESCRIPTION
1	COVER
2	PROJECT LOCATION
3	EXISTING SITE FEATURES
4	SITE PLAN
5	INFLOW CONTAINMENT SITE PLAN
6	PIT CAPACITIES
7	RUBSHEET & FENCE PLAN
8	CROSS SECTION A
9	CROSS SECTIONS B & C
10	CROSS SECTIONS D & E
11	TRANSFER PIPE DETAIL
12	SUMP DETAILS
13	LINER DETAILS
14	FENCE DETAILS
15	SWPPP
16	SWPPP DETAILS
17	SITE STAKING PLAN
18	INFLOW STAKING PLAN
19	WEST CONTAINMENT STAKING PLAN
20	EAST CONTAINMENT STAKING PLAN
21	INFLOW CONTAINMENT CUT & FILL MAP
22	STORAGE CONTAINMENTS CUT & FILL MAP
23	BID QUANTITIES & NOTES

CONTACTS

MIKE FEAGA - LEGION WATER SERVICES - (713)-882-0485
ENVIROTECH ENGINEERING & CONSULTING - ROSHAN MOHAN (580)-234-8780 (DESIGN ENGINEER)
ENVIROTECH ENGINEERING & CONSULTING - MITCHELL RATKE, PE (580)-234-8780 (SUPERVISING ENGINEER)



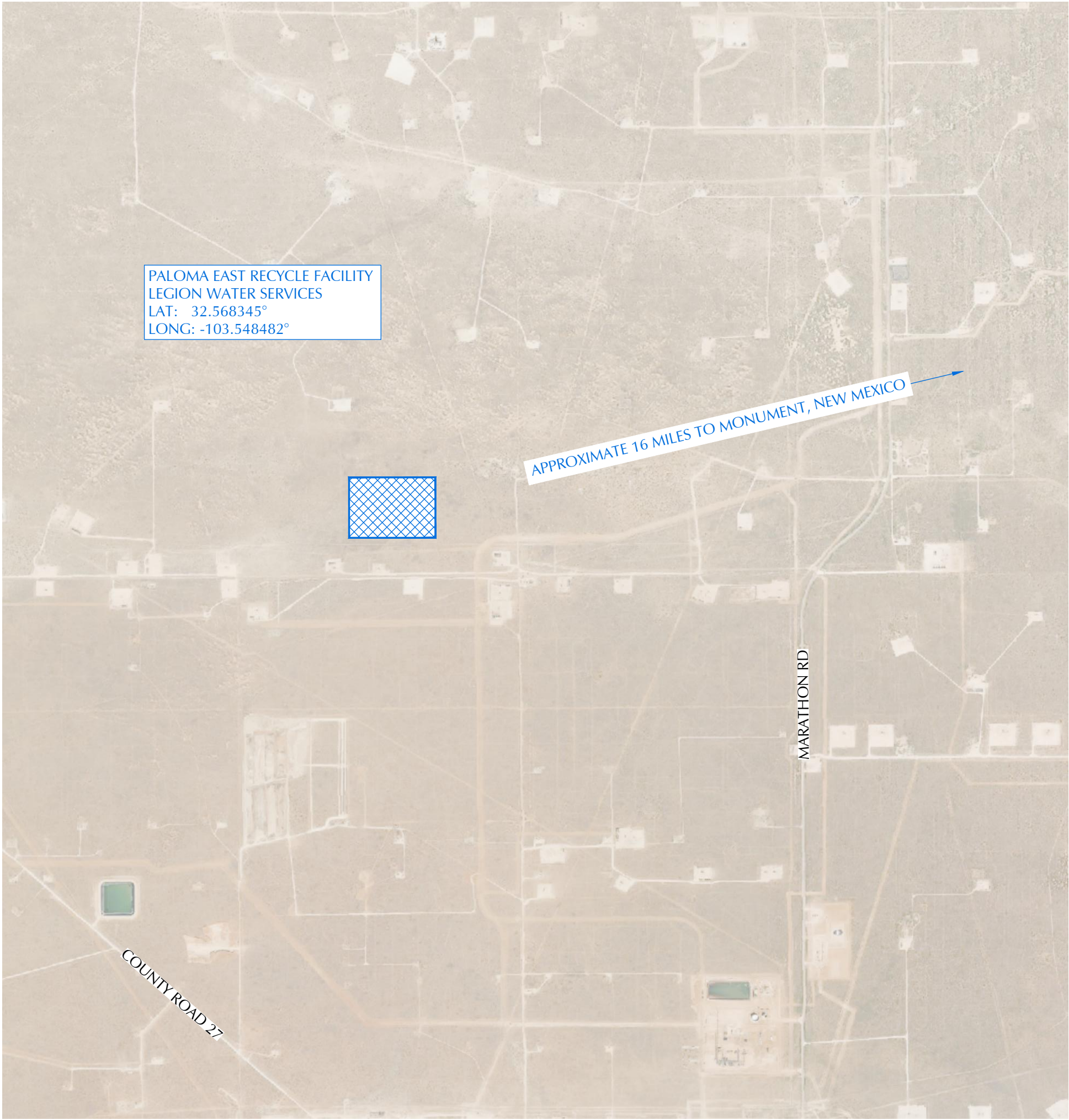
UTILITY CAUTION

THE CONTRACTOR IS CAUTIONED THE LOCATION AND DEPTH OF EXISTING UTILITIES AS SHOWN ON THESE PLANS ARE BASED ON PUBLICLY AVAILABLE RECORDS OF THE VARIOUS UTILITY COMPANIES AND FIELD MEASUREMENTS. THE INFORMATION PROVIDED IS NOT TO BE RELIED ON AS BEING PRECISE OR COMPLETE. THE CONTRACTOR MUST CONTACT THE LOCAL UTILITY LOCATION CENTER AT LEAST 72 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATIONS OF THE UTILITIES.

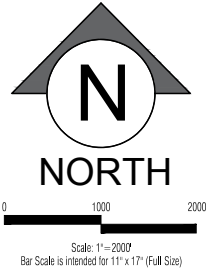
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PE #29736 - Expiration Data: 12-31-2026



PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
LAT: 32.568345°
LONG: -103.548482°



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ENGINEERING**
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Enid, Oklahoma
580.234.8780
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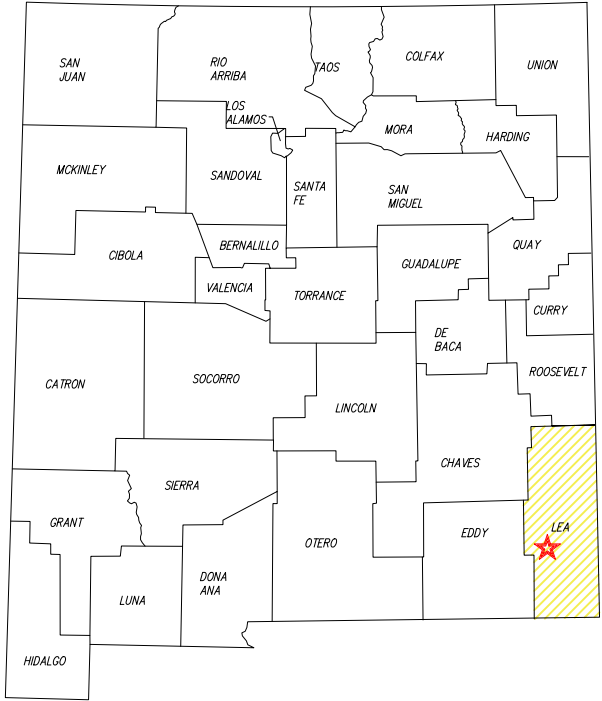
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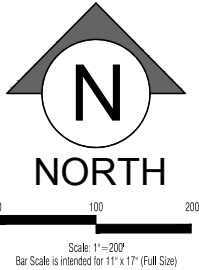
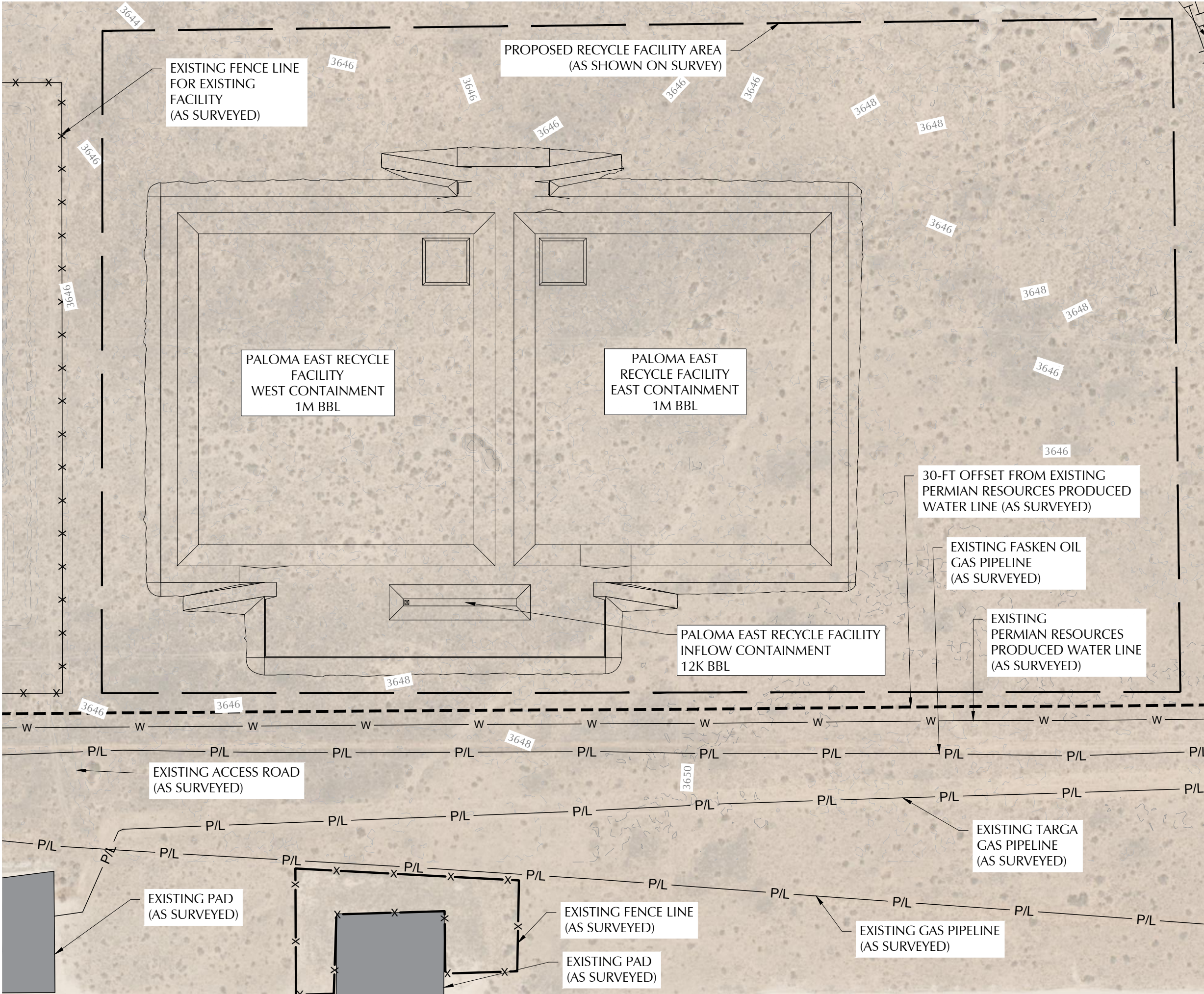
PROJECT LOCATION

PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	1" = 2000
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	2 OF 23

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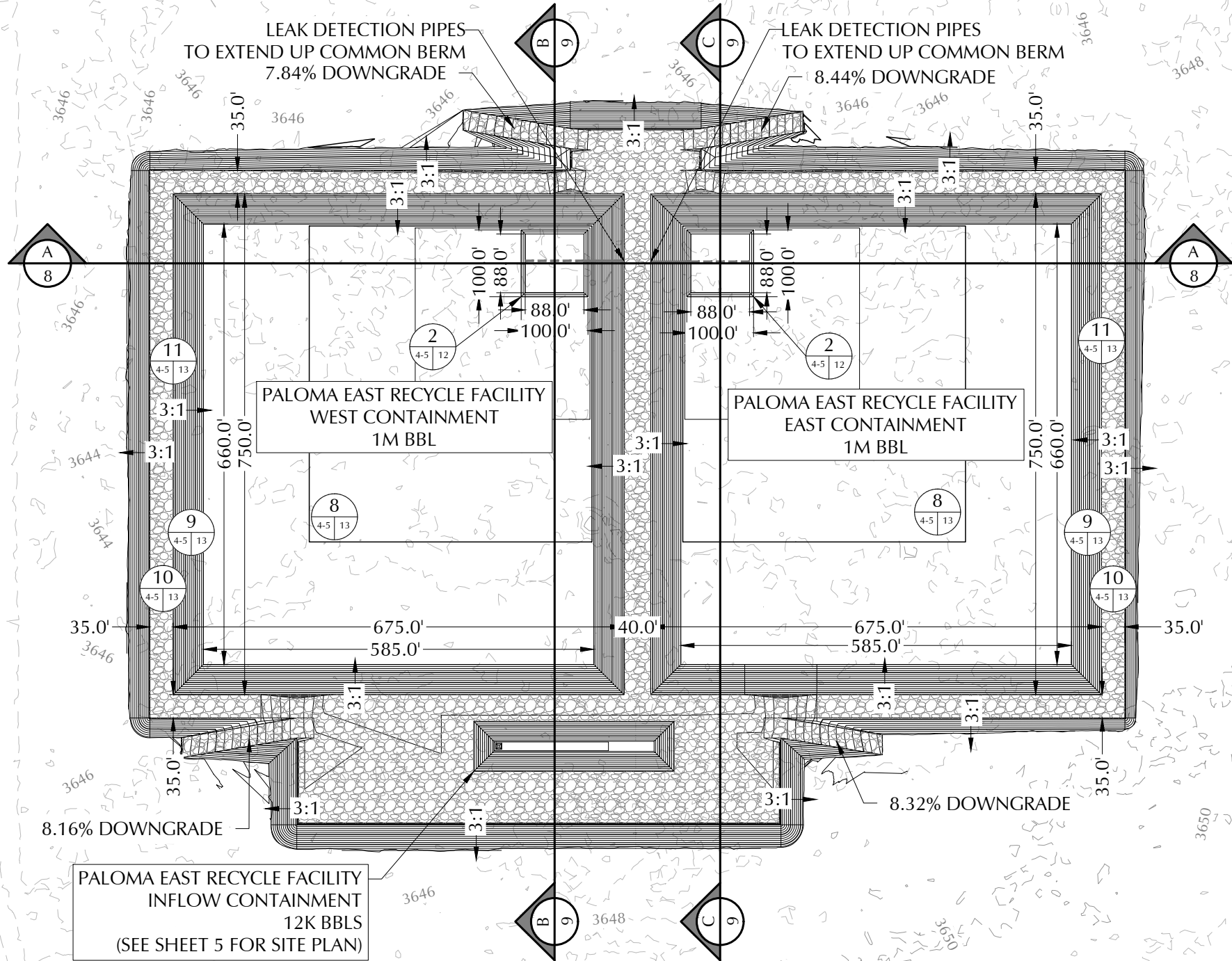
**LEGION
WATER SERVICES**

EXISTING SITE FEATURES

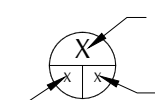
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	1" = 200'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	3 OF 23

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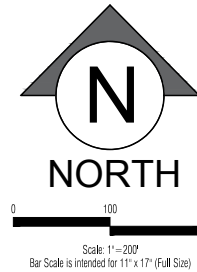


SHEET NUMBER
WHERE DETAIL IS LOCATED
ON PLAN SHEET



DETAIL NUMBER

SHEET NUMBER
WHERE DETAIL IS LOCATED
WITHIN SET



DETAILS KEY MAP

- 2** SUMP OVERVIEW
DETAIL
- 8** LINER SYSTEM
FLOOR DETAIL
- 9** LINER SYSTEM
SIDE SLOPE DETAIL
- 10** TYPICAL BERM CRES
DETAIL
- 11** ANCHOR TRENCH
DETAIL

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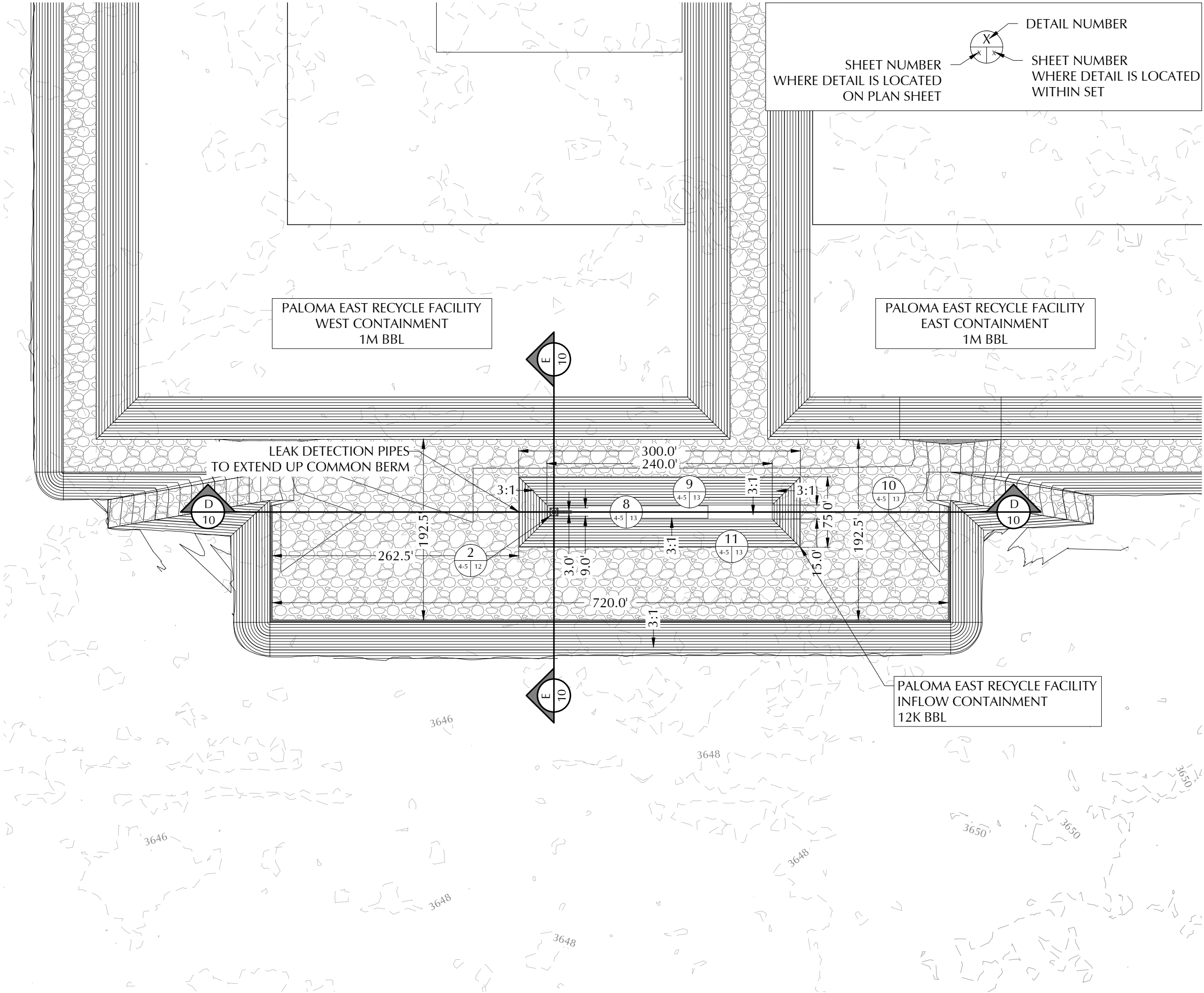
NO.	DATE	DESCRIPTION

LEGION
WATER SERVICES

SITE PLAN
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	1" = 200'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	4 OF 23

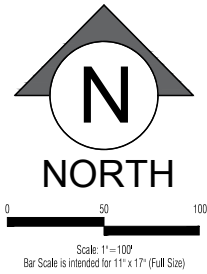
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CONSTRUCTION



SHEET NUMBER
WHERE DETAIL IS LOCATED
ON PLAN SHEET

DETAIL NUMBER

SHEET NUMBER
WHERE DETAIL IS LOCATED
WITHIN SET



DETAILS KEY MAP

-  SUMP OVERVIEW
DETAIL
-  LINER SYSTEM
FLOOR DETAIL
-  LINER SYSTEM
SIDE SLOPE DETAIL
-  TYPICAL BERM CREST
DETAIL
-  ANCHOR TRENCH
DETAIL



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NO.	DATE	DESCRIPTION



LEGION
WATER SERVICES

INFLOW CONTAINMENT SITE PLAN

PALOMA EAST RECYCLE FACILITY

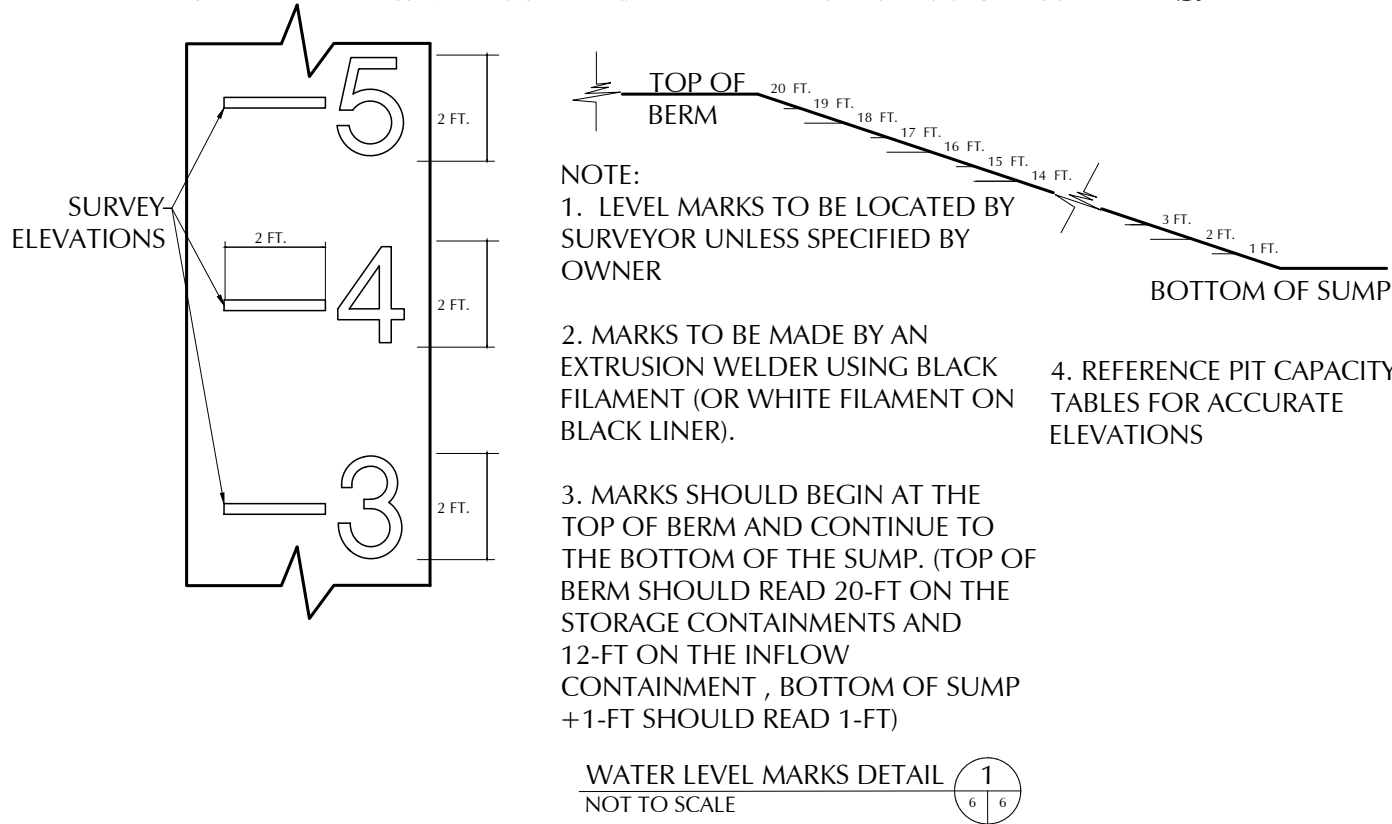
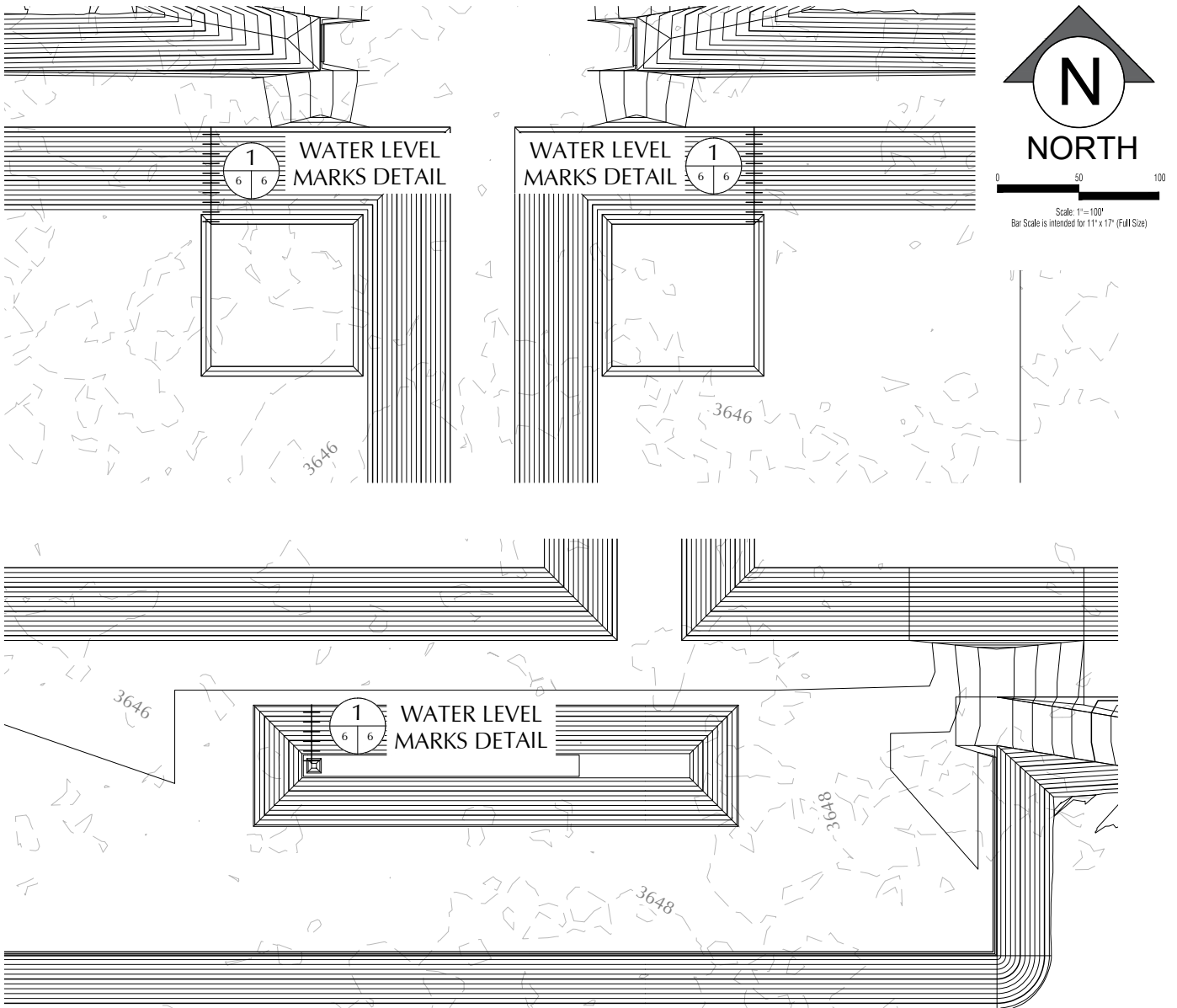
LEGION WATER SERVICES

SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST

LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	1" = 100'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	5 OF 23

ISSUED FOR
CONSTRUCTION



Owner	LEGION WATER SERVICES		
Site Name	PALOMA EAST RECYCLE CONTAINMENTS		
Lagoon Features	Top	Bottom	Max Liq. Level
Side slope Ratio	3		3
Maximum Depth (ft)	20.0		17.0
Lagoon Top Width (ft)	675	585	657
Lagoon Top Length (ft)	750	660	732
Maximum Total Vol (ft³)	7,147,465		5,667,064
Maximum Total Vol (bbls)	1,273,100		1,009,412

	Freeboard
	Maximum Capacity
	Storage Volume
	Floor
	Sump

Elevation ft	Lagoon Liq Depth ft	Storage ft	Remaining Stor Vol ft³	Gallons Storage gal	BBLS Storage bbls	Percent of Total Volume %	Vol in lagoon ft³	Gallons Storage gal	Vol in Lagoon bbls	Vol in Lagoon ac-ft	Percent Total Vol %
3656.00	20.0	0.0	-	-	-	0.0%	7,147,465	53,470,188	1,273,100	164.08	100%
3655.00	19.0	1.0	501,920	3,754,863	89,401	7.0%	6,645,545	49,715,326	1,183,698	152.56	93%
3654.00	18.0	2.0	995,363	7,446,310	177,293	13.9%	6,152,102	46,023,879	1,095,807	141.23	86%
3653.00	17.0	3.0	1,480,401	11,074,881	263,688	20.7%	5,667,064	42,395,308	1,009,412	130.10	79%
3652.00	16.0	4.0	1,957,106	14,641,112	348,598	27.4%	5,190,359	38,829,076	924,502	119.15	73%
3651.00	15.0	5.0	2,425,551	18,145,545	432,037	33.9%	4,721,915	35,324,644	841,063	108.40	66%
3650.00	14.0	6.0	2,885,806	21,588,716	514,017	40.4%	4,261,659	31,881,472	759,083	97.83	60%
3649.00	13.0	7.0	3,337,945	24,971,164	594,552	46.7%	3,809,521	28,499,024	678,548	87.45	53%
3648.00	12.0	8.0	3,782,038	28,293,429	673,653	52.9%	3,365,427	25,176,760	599,447	77.26	47%
3647.00	11.0	9.0	4,218,159	31,556,048	751,334	59.0%	2,929,306	21,914,140	521,765	67.25	41%
3646.00	10.0	10.0	4,646,379	34,759,560	827,609	65.0%	2,501,087	18,710,629	445,491	57.42	35%
3645.00	9.0	11.0	5,066,770	37,904,503	902,488	70.9%	2,080,696	15,565,685	370,612	47.77	29%
3644.00	8.0	12.0	5,479,403	40,991,417	975,986	76.7%	1,668,062	12,478,771	297,114	38.29	23%
3643.00	7.0	13.0	5,884,352	44,020,839	1,048,115	82.3%	1,263,113	9,449,349	224,984	29.00	18%
3642.00	6.0	14.0	6,281,688	46,993,309	1,118,888	87.9%	865,777	6,476,879	154,211	19.88	12%
3641.00	5.0	15.0	6,671,483	49,909,365	1,188,318	93.3%	475,982	3,560,823	84,782	10.93	7%
3640.00	4.0	16.0	6,959,654	52,065,169	1,239,647	97.4%	187,812	1,405,020	33,453	4.31	3%
3639.00	3.0	17.0	7,092,301	53,057,503	1,263,274	99.2%	55,164	412,685	9,826	1.27	1%
3638.00	2.0	18.0	7,129,772	53,337,822	1,269,948	99.8%	17,694	132,367	3,152	0.41	0%
3637.00	1.0	19.0	7,139,183	53,408,225	1,271,624	99.9%	8,283	61,963	1,475	0.19	0%
3636.00	0.0	20.0	7,147,465	53,470,188	1,273,100	100.0%	-	-	-	-	0%

Owner	LEGION WATER SERVICES		
Site Name	PALOMA EAST RECYCLE INFLOW CONTAINMEN		
Lagoon Features	Top	Bottom	Max Liq. Level
Side slope Ratio	3		3
Maximum Depth (ft)	12.0		9.0
Lagoon Top Width (ft)	75	15	57
Lagoon Top Length (ft)	300	240	282
Maximum Total Vol (ft³)	126,132		68,440
Maximum Total Vol (bbls)	22,466		12,191

	Freeboard
	Maximum Capacity
	Storage Volume
	Floor
	Sump

Elevation ft	Lagoon Liq Depth ft	Storage ft	Remaining Stor Vol ft³	Gallons Storage gal	BBLS Storage bbls	Percent of Total Volume %	Vol in lagoon ft³	Gallons Storage gal	Vol in Lagoon bbls	Vol in Lagoon ac-ft	Percent Total Vol %
3657.30	12.0	0.0	-	-	-	0.0%	126,132	943,591	22,466	2.90	100%
3656.30	11.0	1.0	21,384	159,975	3,809	17.0%	104,748	783,617	18,658	2.40	83%
3655.30	10.0	2.0	40,591	303,659	7,230	32.2%	85,541	639,932	15,236	1.96	68%
3654.30	9.0	3.0	57,691	431,589	10,276	45.7%	68,440	512,003	12,191	1.57	54%
3653.30	8.0	4.0	72,758	544,304	12,960	57.7%	53,373	399,287	9,507	1.23	42%
3652.30	7.0	5.0	85,864	642,346	15,294	68.1%	40,268	301,246	7,173	0.92	32%
3651.30	6.0	6.0	97,079	726,248	17,292	77.0%	29,053	217,343	5,175	0.67	23%
3650.30	5.0	7.0	106,477	796,552	18,966	84.4%	19,655	147,039	3,501	0.45	16%
3649.30	4.0	8.0	114,129	853,798	20,329	90.5%	12,003	89,793	2,138	0.28	10%
3648.30	3.0	9.0	120,107	898,520	21,393	95.2%	6,025	45,071	1,073	0.14	5%
3647.30	2.0	10.0	124,483	931,260	22,173	98.7%	1,648	12,332	294	0.04	1%
3646.30	1.0	11.0	126,093	943,301	22,460	100.0%	39	291	7	0.00	0%
3645.30	0.0	12.0	126,132	943,591	22,466	100.0%	-	-	-	-	0%

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NO. DATE DESCRIPTION

LEGION
WATER SERVICES

PIT CAPACITIES

PALOMA EAST RECYCLE FACILITY

LEGION WATER SERVICES

SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE: SEPTEMBER 2025

SCALE: 1" = 100'

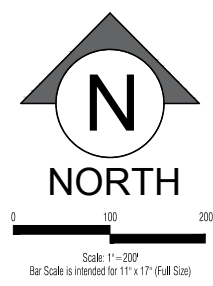
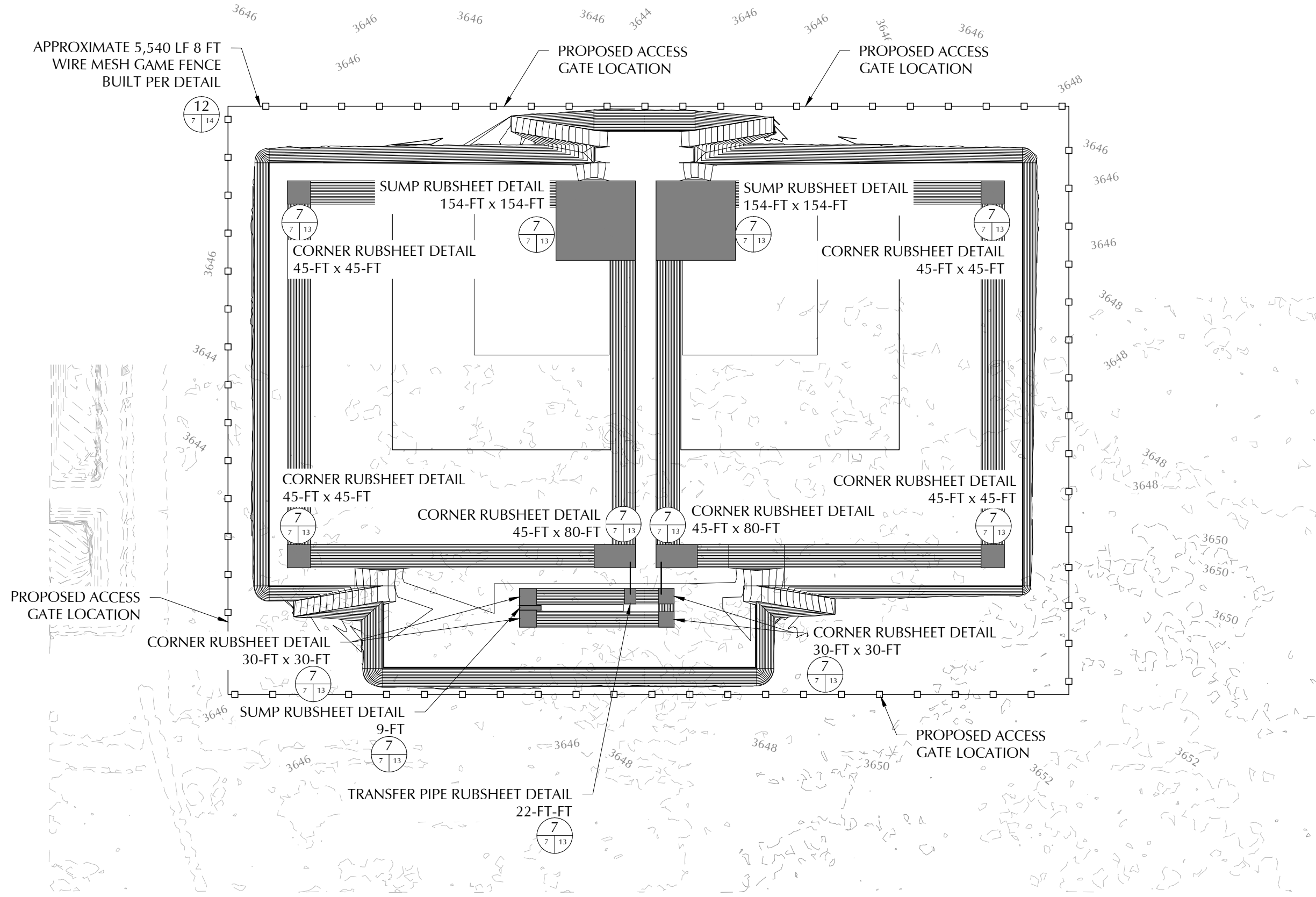
DESIGNED BY: R. MOHAN

DRAWN BY: S. JOSSELYN

CHECKED BY: M. RATKE

PROJECT NO. 025281-00

SHEET NO. 6 OF 23



NOTE:
RUBSHEET DIMENSIONS
ARE TAKEN AT THE
ANCHOR TRENCH.



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NO.	DATE	DESCRIPTION



**LEGION
WATER SERVICES**

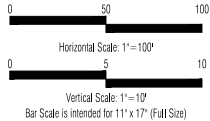
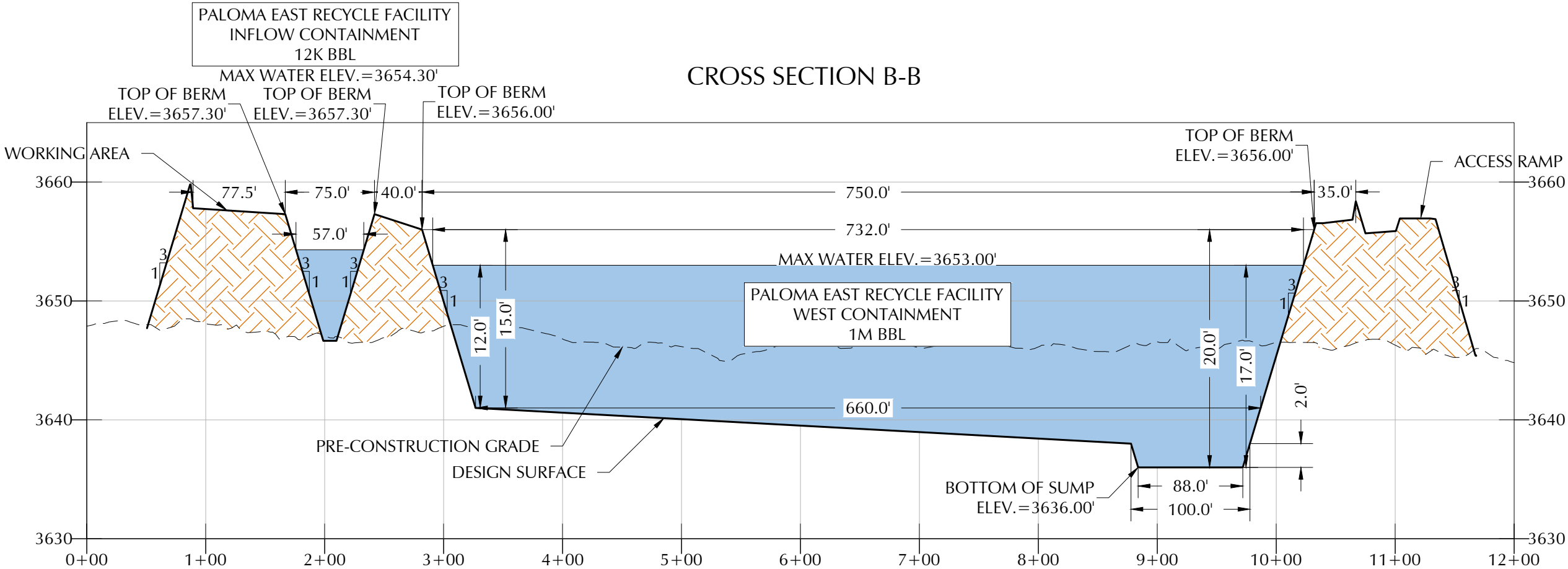
RUBSHEET & FENCE PLAN
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	1" = 200'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	7 OF 23

ISSUED FOR
CONSTRUCTION



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CONSTRUCTION

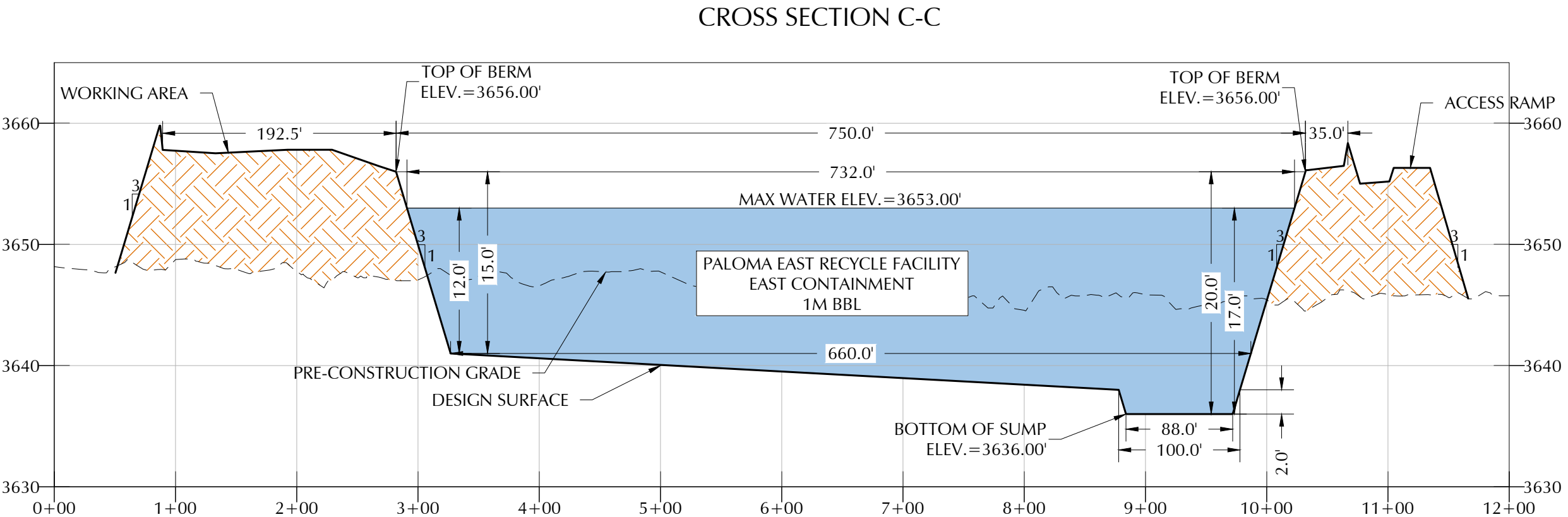


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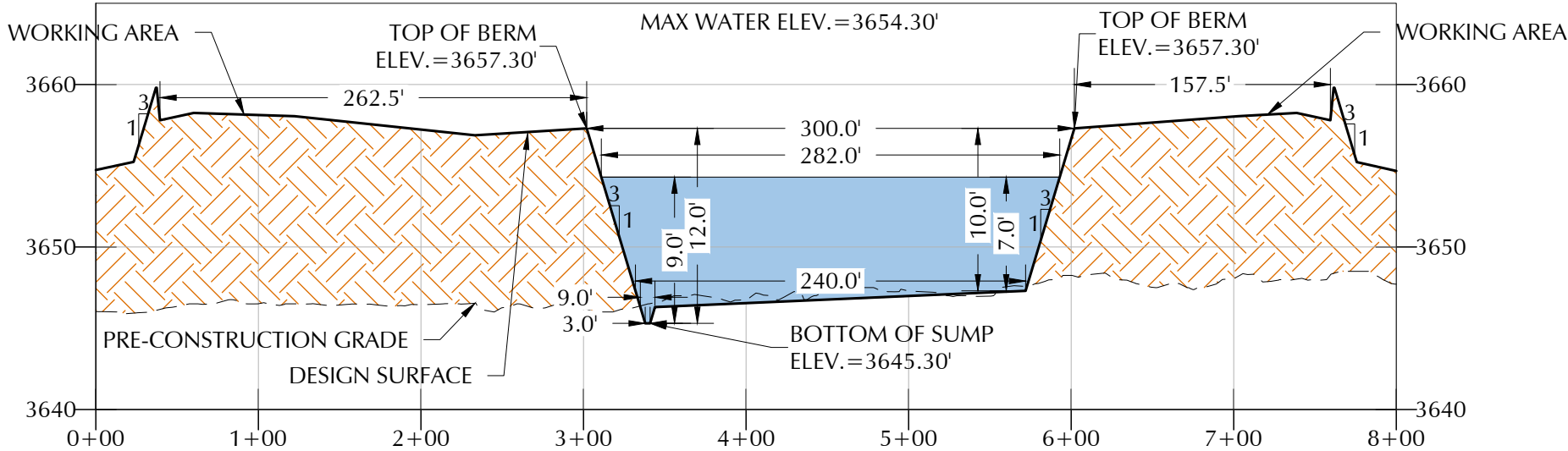
CROSS SECTIONS B & C

PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	HORIZONTAL 1"=100' VERTICAL 1"=10'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	9 OF 23

CROSS SECTION D-D

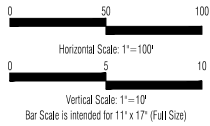
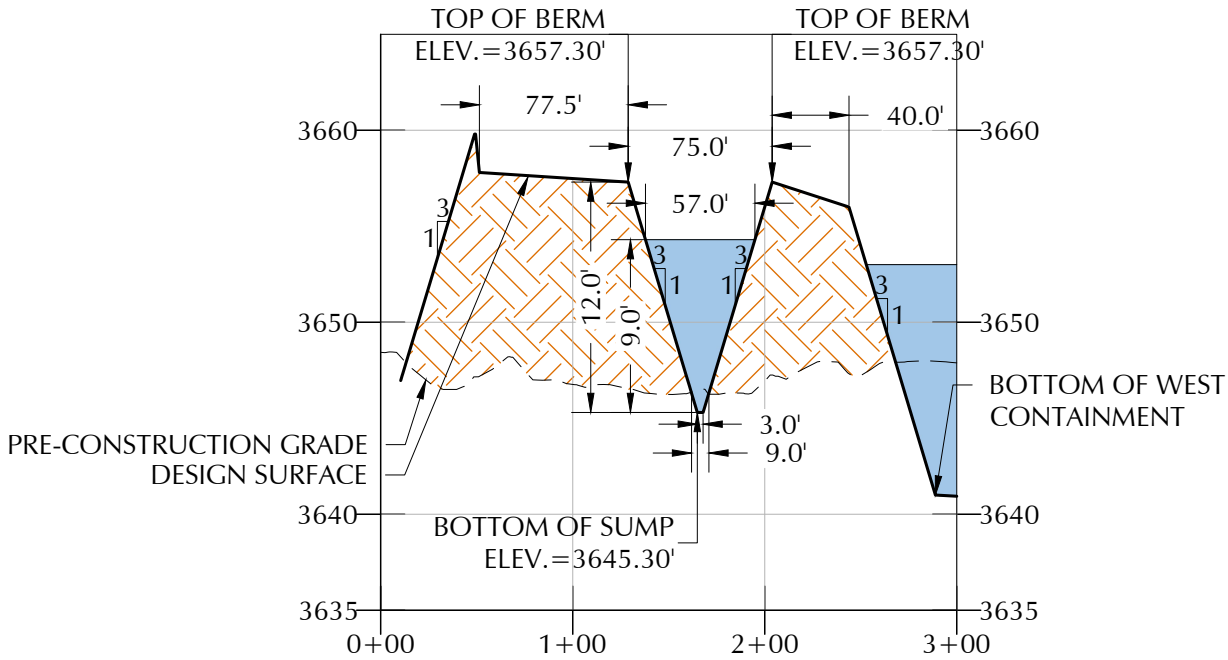
PALOMA EAST RECYCLE FACILITY
INFLOW CONTAINMENT
12K BBL



CROSS SECTION E-E

PALOMA EAST RECYCLE FACILITY
INFLOW CONTAINMENT
12K BBL

MAX WATER ELEV.=3654.30'



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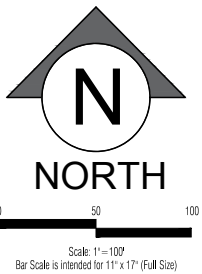
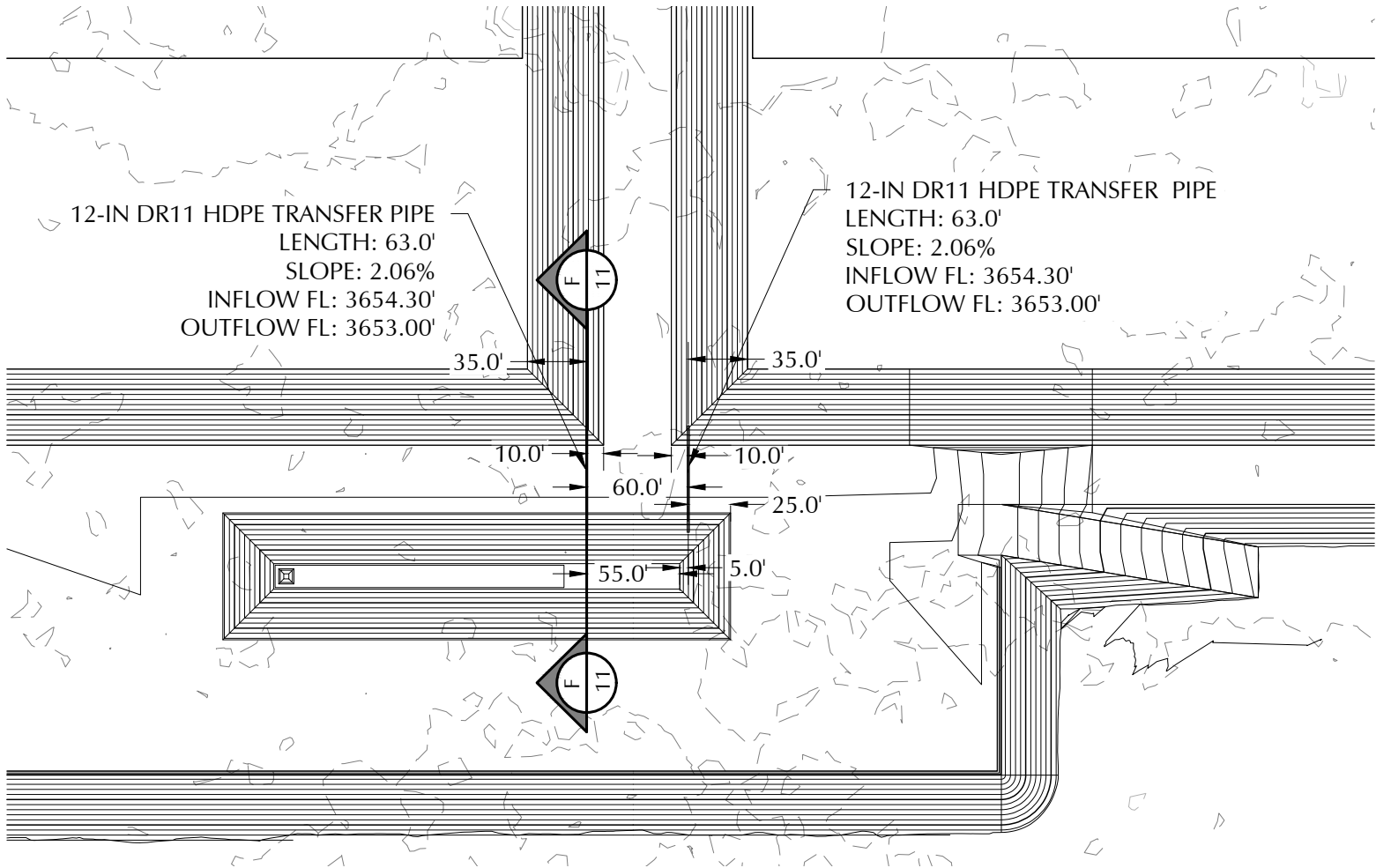
NO.	DATE	DESCRIPTION



CROSS SECTIONS D & E
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	HORIZONTAL 1"=100' VERTICAL 1"=10'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	10 OF 23

ISSUED FOR
CONSTRUCTION



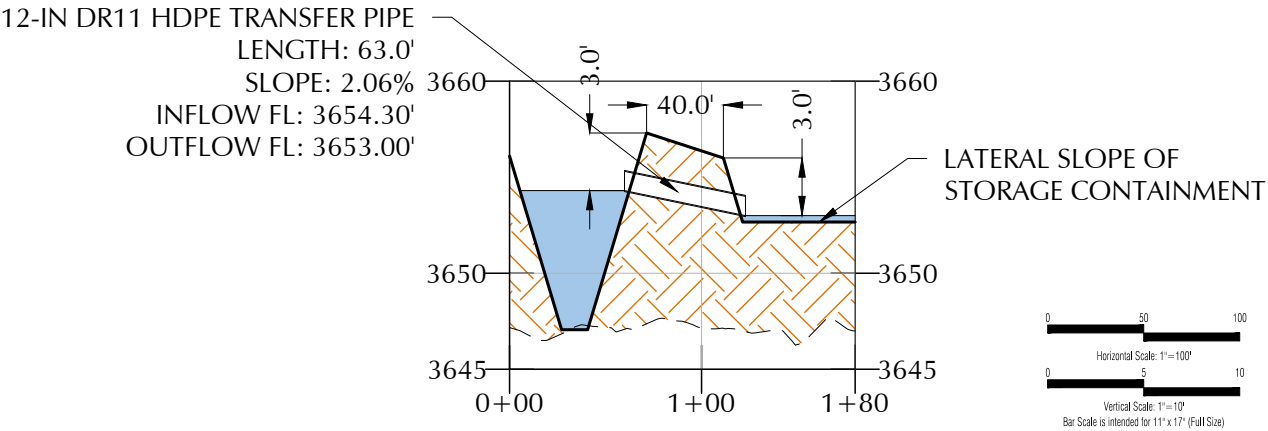


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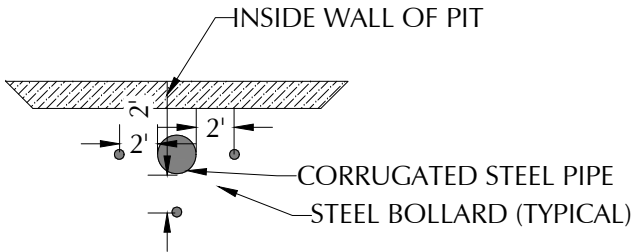
NO.	DATE	DESCRIPTION

CROSS SECTION F-F (TYP.)

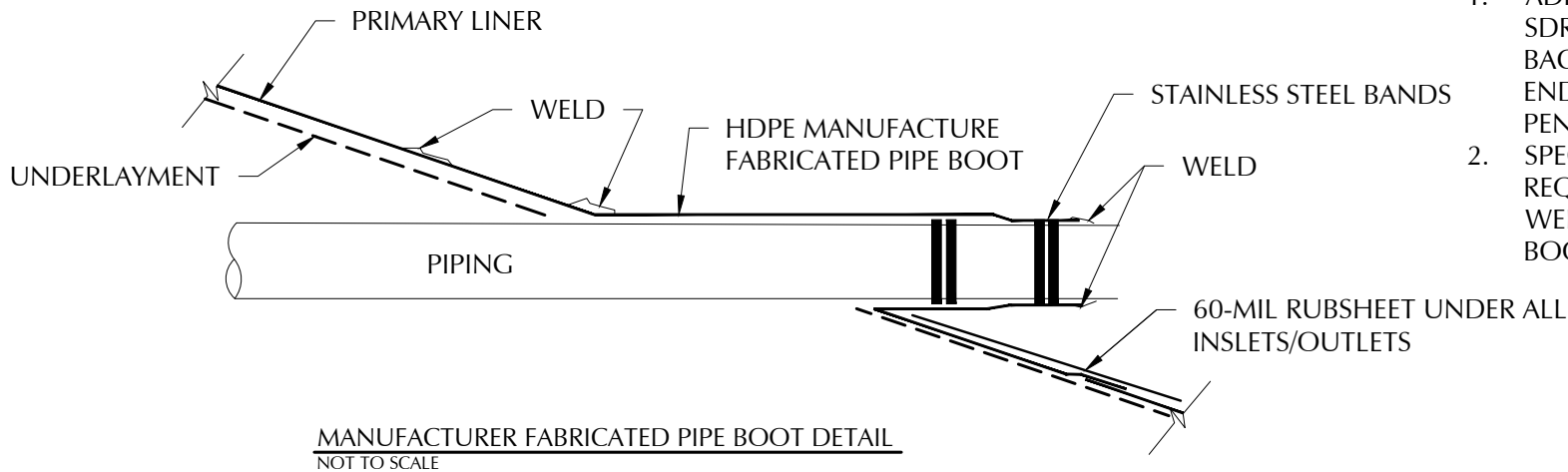


NOTES:

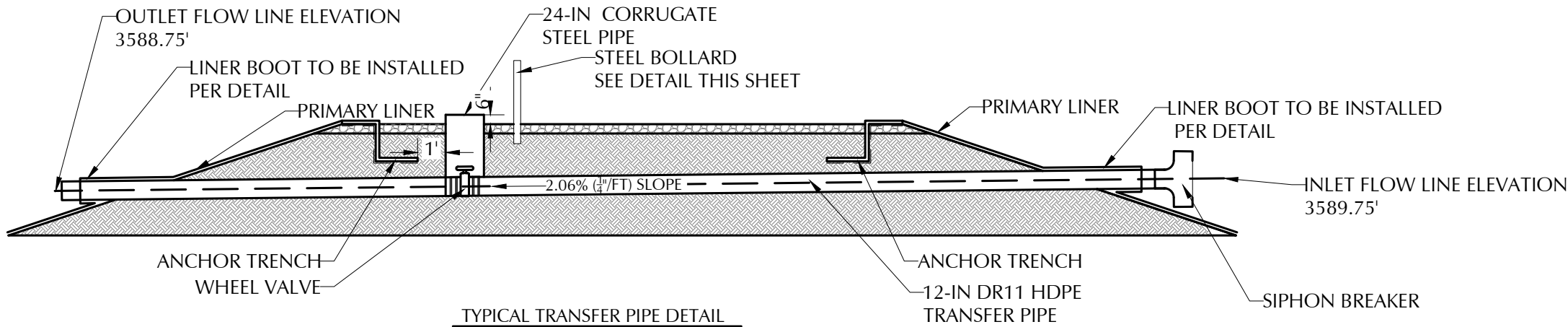
1. ADD A 150 SERIES HDPE SDR 17 FLANGE WITH BACKING RING TO THE END OF EACH PIPE PENETRATION.
2. SPECIAL ATTENTION REQUIRED WHEN WELDING AT ALL PIPE BOOTS.



BOLLARD TOP DOWN SCHEMATIC
NOT TO SCALE



MANUFACTURER FABRICATED PIPE BOOT DETAIL
NOT TO SCALE



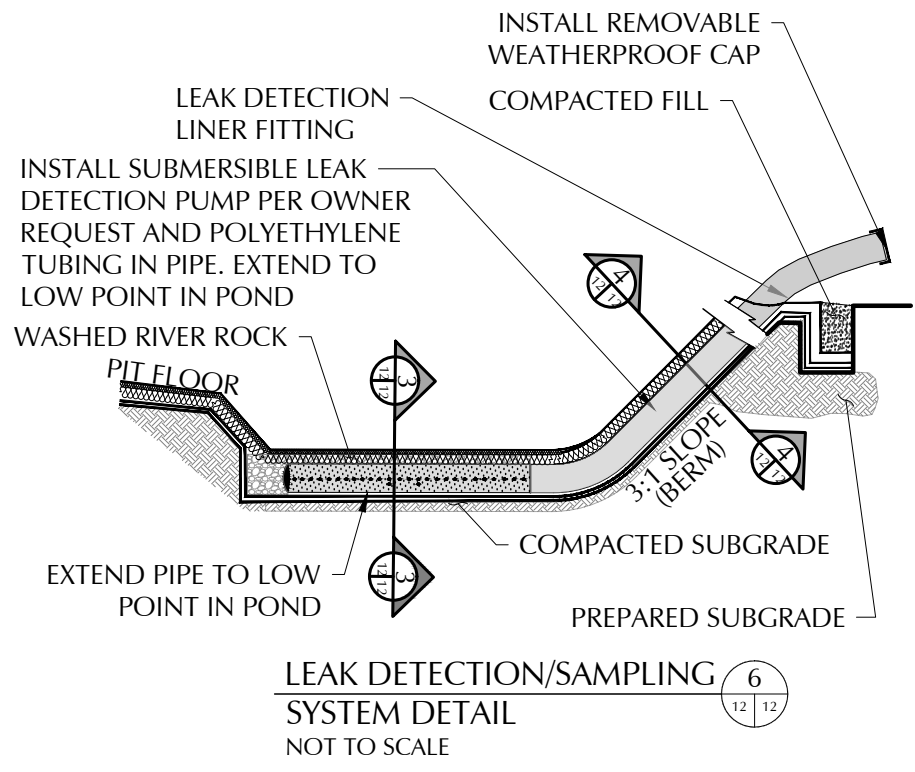
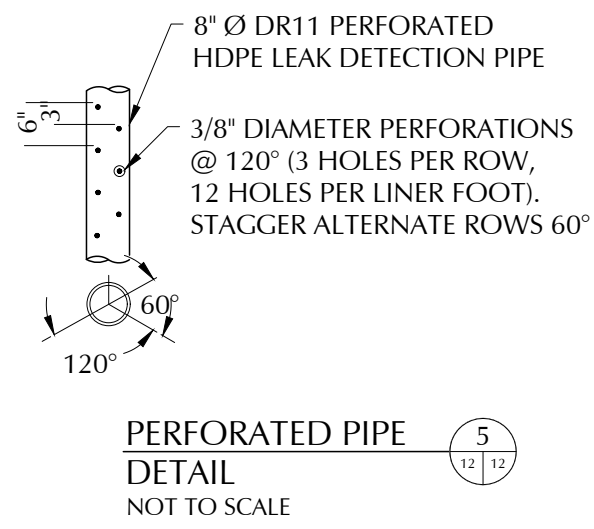
TYPICAL TRANSFER PIPE DETAIL
NOT TO SCALE

ISSUED FOR
CONSTRUCTION

TRANSFER PIPE DETAIL
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	VARIES
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	11 OF 23



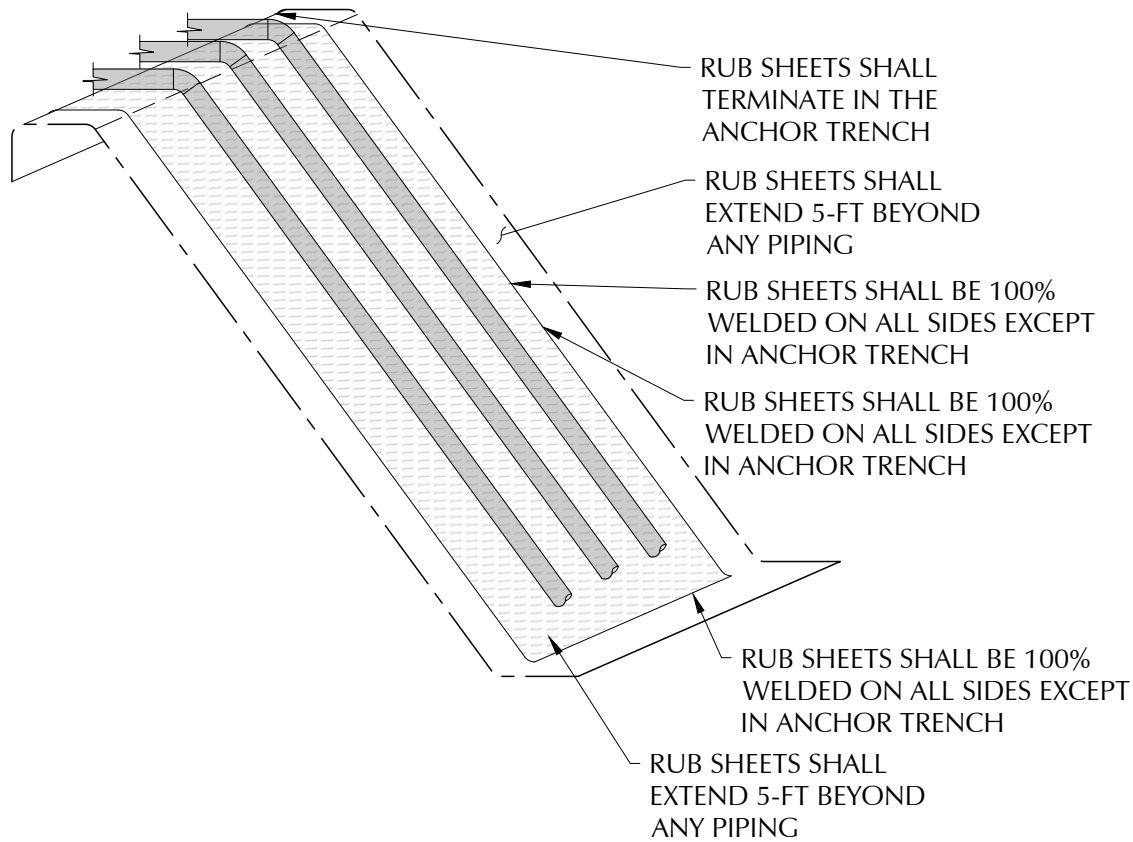


PROPOSED PIT REFERENCE TABLE	
<u>DETAIL</u>	<u>DESCRIPTION</u>
PRIMARY LINER	60- MIL HDPE SMOOTH LINER
LEAK DETECTION	200-MIL GEONET
SECONDARY LINER	40-MIL HDPE SMOOTH LINER
UNDERLAYMENT	10 OZ GEOTEXTILE
INFLOW CONTAINMENT SUMP	3645.30-FT ELEVATION
STORAGE CONTAINMENT SUMP	3636.00-FT ELEVATION
INFLOW CONTAINMENT BERM (ROAD CREST)	DESIGN ELEV. 3657.30 FT- RD CREST (VARIES)
STORAGE CONTAINMENT BERM (ROAD CREST)	DESIGN ELEV. 3656.00 FT- RD CREST (VARIES)
LEAK DETECTION PIPING	8-IN DR11.X PERFORATED HDPE LEAK DETECTION PIPE

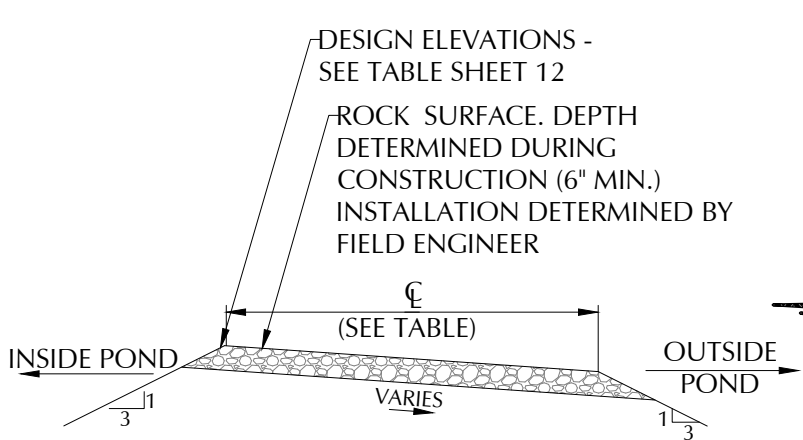
- NOTES:
1. LEAK DETECTION SYSTEM TO BE INSTALLED BY OWNER.
 2. PERFORATED PIPE TO BE ALONG THE BOTTOM OF THE POND. SOLID PIPE ON THE SIDE SLOPE.
 3. CONSTRUCT COMPACTED SUBGRADE TO 95% STANDARD PROCTOR AS PER ASTM D-698.
 4. EXTEND 60 MIL. RUB SHEET 1.0-FT PAST TOP OF SHOULDER OF SUMP.
 5. WASH RIVER ROCK SHALL BE 3/4" MIN. & 2" MAX.

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CONSTRUCTION

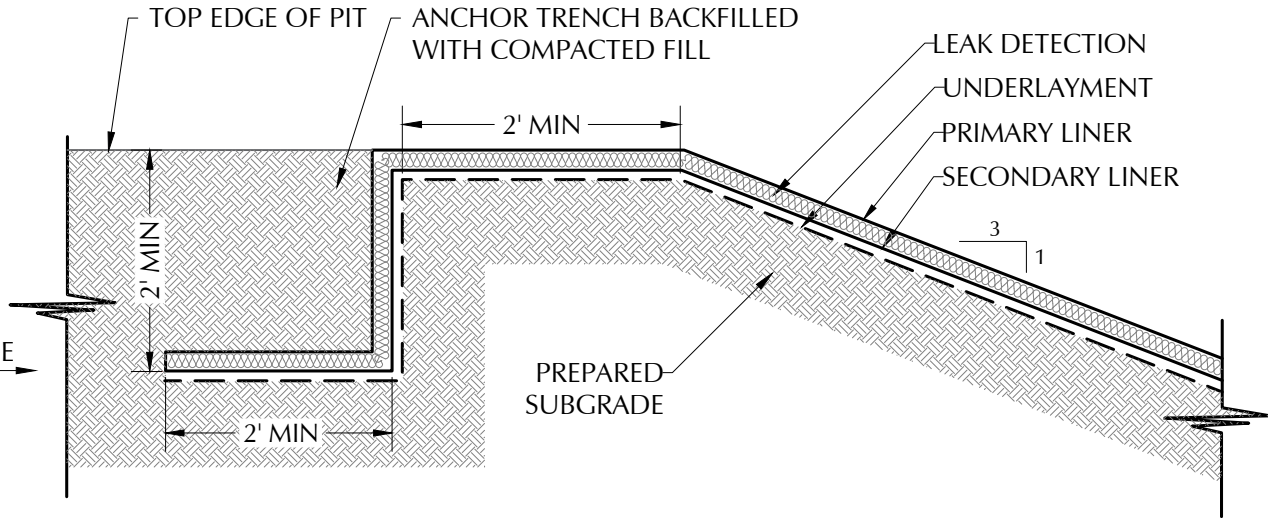
 ENVIROTECH ENGINEERING 2500 North Eleventh Street Enid, Oklahoma 580.234.8780 envirotechconsulting.com P.E. #29736 - Expiration Date: 12-31-2026		
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NO.	DATE	DESCRIPTION
 LEGION WATER SERVICES		
SUMP DETAILS PALOMA EAST RECYCLE FACILITY LEGION WATER SERVICES SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST LEA COUNTY, NEW MEXICO		
DATE:	SEPTEMBER 2025	
SCALE:	NOT TO SCALE	
DESIGNED BY:	R. MOHAN	
DRAWN BY:	S. JOSSELYN	
CHECKED BY:	M. RATKE	
PROJECT NO.	025281-00	
SHEET NO.	12 OF 23	



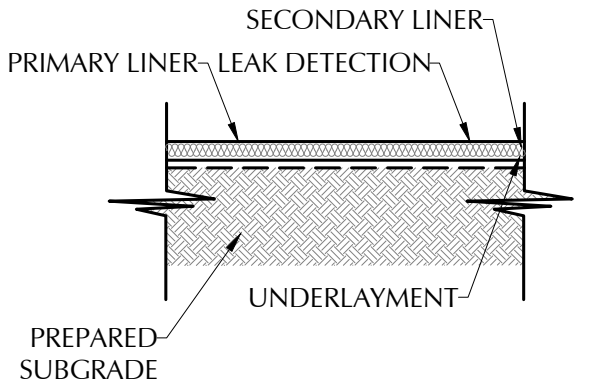
SUMP/CORNER RUB SHEET DETAIL 7
NOT TO SCALE



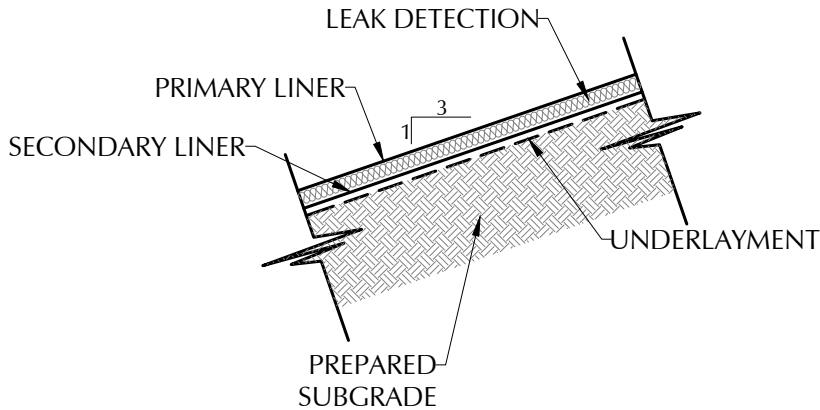
TYPICAL BERM CREST DETAIL 10
NOT TO SCALE



ANCHOR TRENCH DETAIL 11
NOT TO SCALE



LINER SYSTEM FLOOR DETAIL 8
NOT TO SCALE



LINER SYSTEM SIDE SLOPE DETAIL 9
NOT TO SCALE

GENERAL NOTES:

1. SEE REFERENCE TABLES SHEET 12 FOR LINER SPECIFICATIONS
2. PREPARED SUBGRADE MEANS COMPACTED SMOOTH SUBGRADE FREE OF ROCK, ROOTS, WOOD DEBRIS, CONCRETE RUBBLE AND ANY SHARP OBJECTS THAT MIGHT PUNCTURE THE HDPE LINER.
3. ALL INTERIOR SLOPES AND TOP OF BERMS TO BE SMOOTH DRUM ROLLED.
4. ALL EMBANKMENT SLOPES SHALL HAVE A RATIO OF 3:1, COMPACTED EARTH EMBANKMENTS TO BE CONSTRUCTED WITH 8 INCH (MAXIMUM LOOSE LIFTS), COMPACTED TO 95% STANDARD PROCTOR DENSITY (ASTM D698), AND MOISTURE CONDITIONS TO +/- 2% OPTIMUM MOISTURE (ASTM D698)
5. PERFORM GEOTECHNICAL ANALYSIS ON EXISTING SOIL TO CONFIRM SOIL IS SUITABLE FOR USE IN THE LEVEE.
6. ALL BOTTOM OF PITS SHALL SLOPE TO THE SUMP.



LINER DETAILS

PALOMA EAST RECYCLE FACILITY

LEGION WATER SERVICES

SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	NOT TO SCALE
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	13 OF 23

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Enid, Oklahoma

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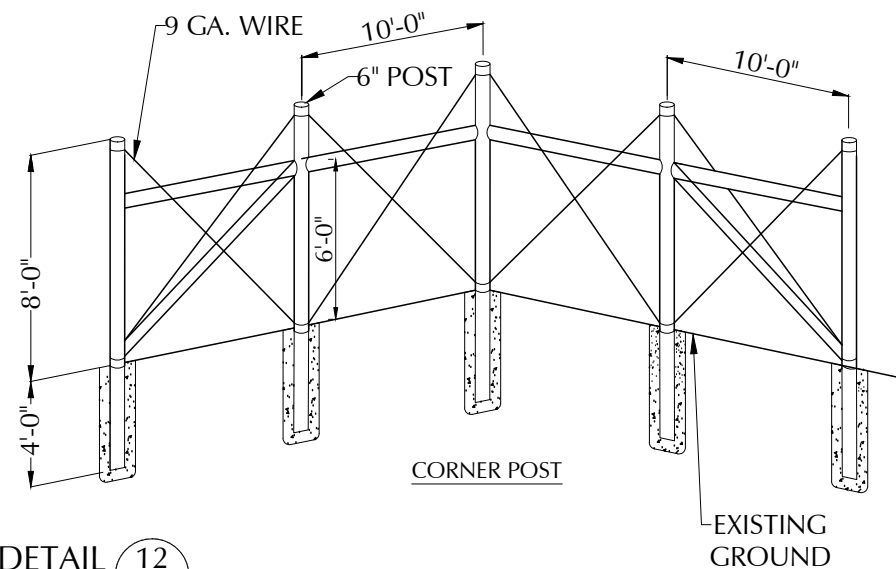
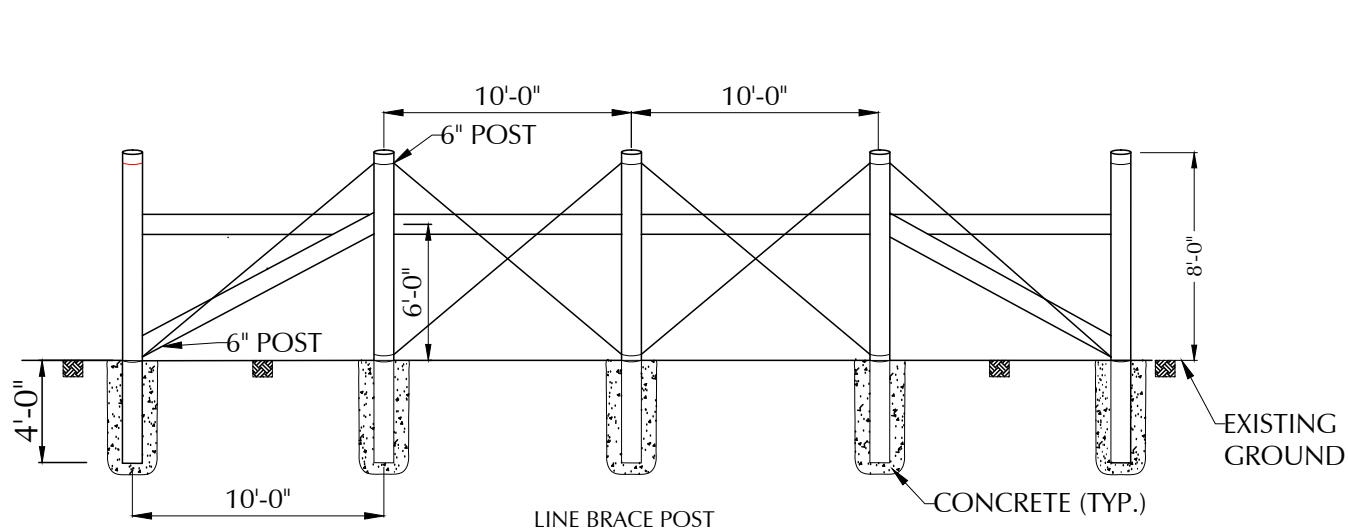
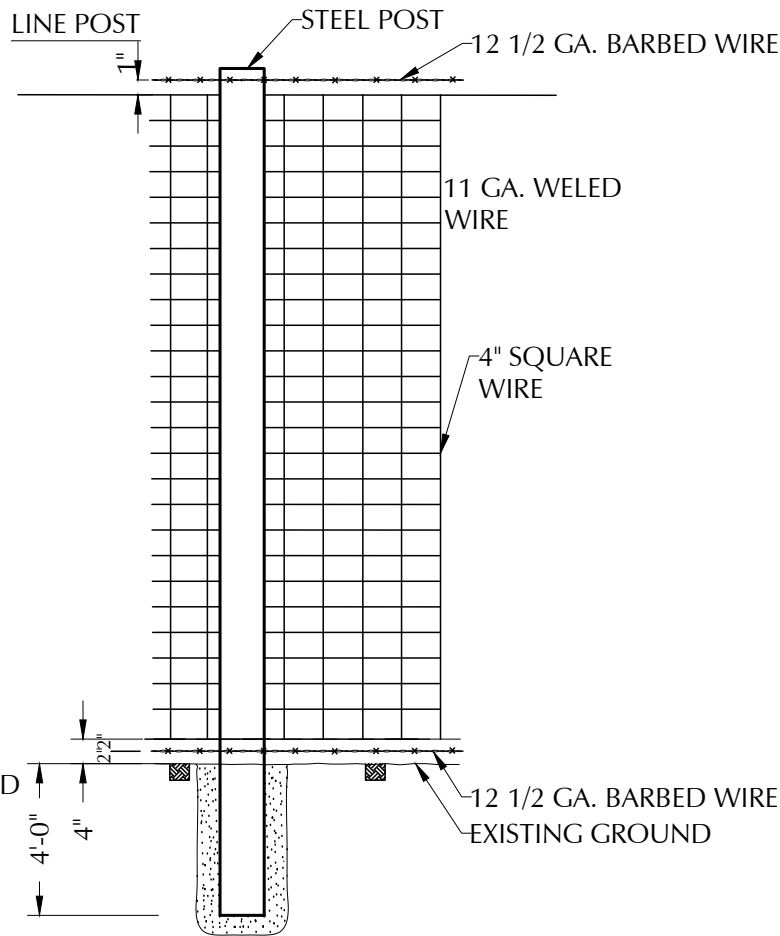
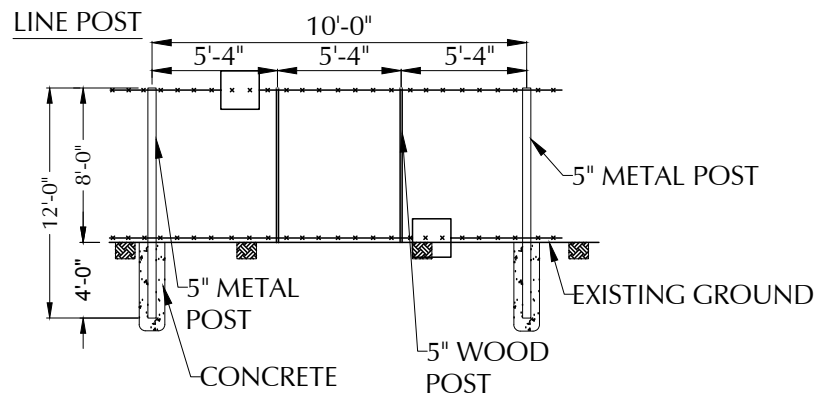
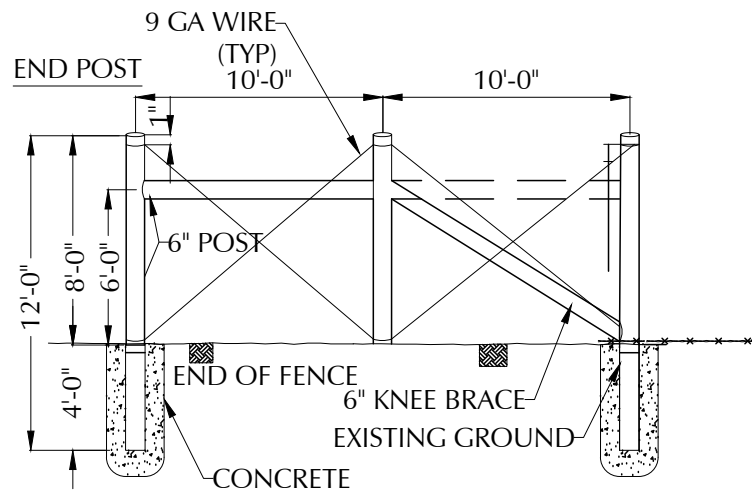
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NO.	DATE	DESCRIPTION



8-FT GAME FENCE DETAIL 12
Not to Scale

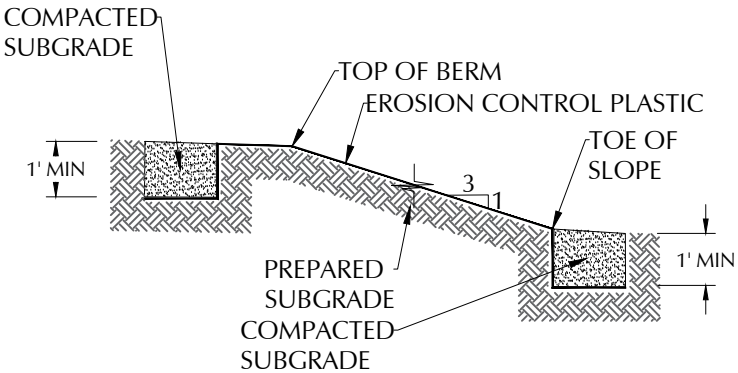
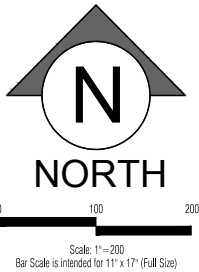
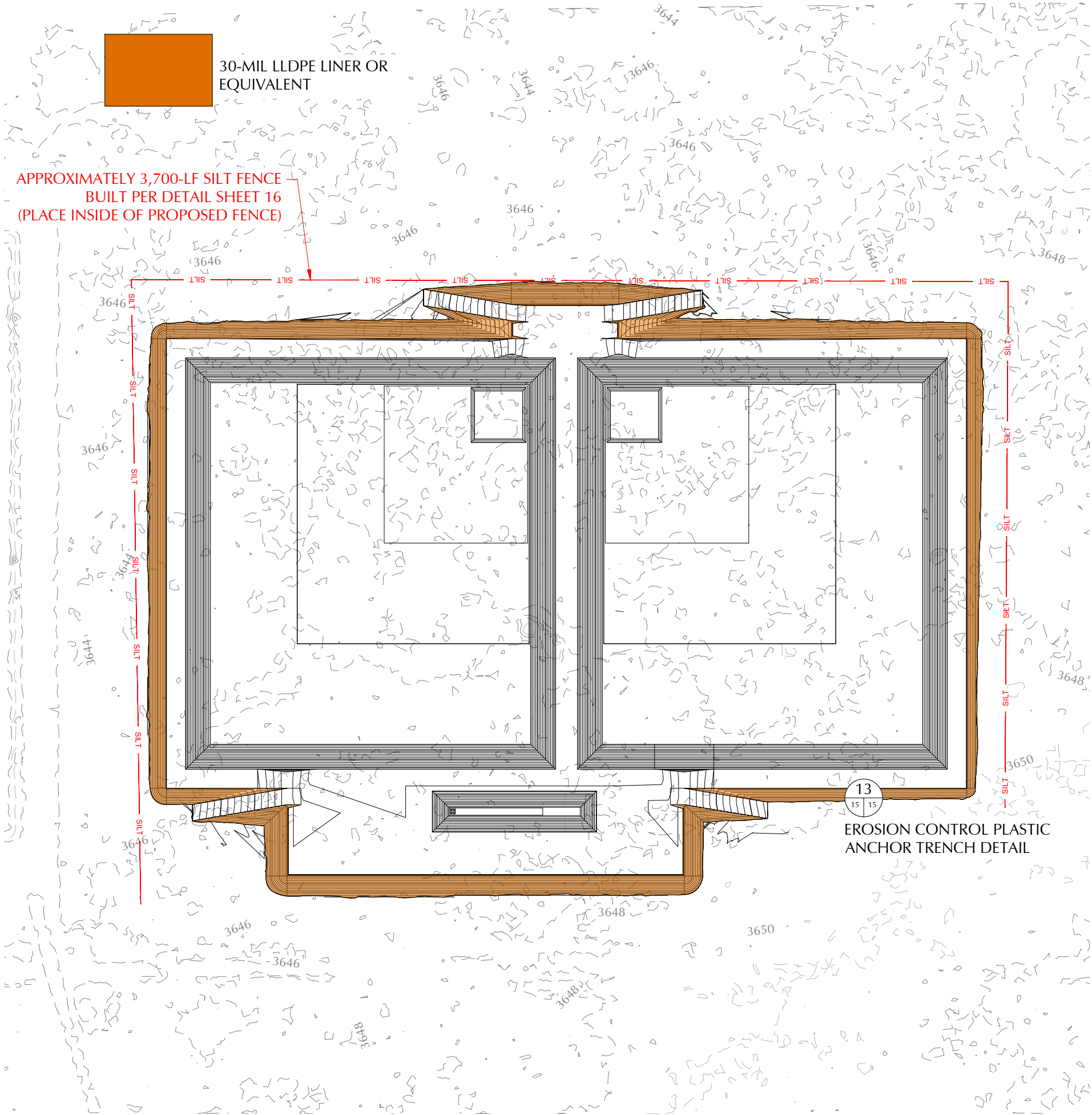
GENERAL NOTES:

1. AT EACH LOCATION WHERE AN ELECTRIC TRANSMISSION, DISTRIBUTION OR SECONDARY LINE CROSSES A BARRIER FENCE, THE CONTRACTOR SHALL FURNISH AND INSTALL A GROUND CONFORMING TO ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE- THE GROUND ROD SHALL BE A MINIMUM DIAMETER OF 1/2-IN. AND 8-FT. IN LENGTH, AND DRIVEN AT LEAST 7 1/2 FT. INTO THE GROUND. THE ROD SHALL BE CONNECTED TO EACH WIRE WITH A MINIMUM AWG NO. 8 STRANDED COPPER WIRE. GROUNDING WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
2. LINE BRACE POSTS SHALL BE SPACED AT 400 FT. INTERVALS, WHERE FENCING IS CONTINUOUS AND WHERE END, CORNER AND LINE BRACE POSTS ARE NOT SPECIFIED.
3. ALL LINE POSTS SHALL BE 5 IN. MIN. DIAMETER AND 12 FT. LONG. ALL END, CORNER AND LINE BRACE POSTS SHALL BE 6 IN. MIN. DIAMETER AND 12 FT. LONG.
4. BARBED WIRE SHALL BE DOUBLE WRAPPED AND TIED OFF AT END POSTS, CORNER POSTS AND LINE BRACE POSTS.
5. WOVEN WIRE SHALL BE SINGLE WRAPPED AND TIED OFF. FENCE TO BE CONTINUED, SHALL BE RESTARTED IN LIKE MANNER. WOVEN WIRE FENCE FABRIC SHALL CONFORM TO AASHTO M 279 (ASTM A 116) DESIGN NO. 1047-6-11 WITH CLASS I COATING.
6. STEEL BARBED WIRE SHALL CONFORM TO AASHTO M 200 (ASTM A 121) 12-1/2 GAGE WITH CLASS 1 COATING.
7. ALL FENCE WIRE TIES, BRACE WIRES, STAPLES AND OTHER WIRE APPURTENANCES SHALL BE GALVANIZED IN CONFORMANCE WITH AASHTO M 232.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RE-ESTABLISHING DISTURBED OR DESTROYED SURVEY MONUMENTS TO THE APPROPRIATE ACCURACY.
9. ALL MISCELLANEOUS HARDWARE SHALL BE FURNISHED GALVANIZED OR ALUMINUM COATED. ALL METAL PIPE POSTS SHALL BE CAPPED.
10. READY MIX CONCRETE MAY BE USED AS A SUBSTITUTE FOR CLASS "A" CONCRETE FOR THE CONCRETE FOOTING IF APPROVED BY THE ENGINEER.

NO.	DATE	DESCRIPTION

DATE:	SEPTEMBER 2025
SCALE:	NOT TO SCALE
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	14 OF 23

ISSUED FOR
CONSTRUCTION



EROSION CONTROL PLASTIC ANCHOR TRENCH DETAIL
NOT TO SCALE

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NO.	DATE	DESCRIPTION

LEGION
WATER SERVICES

SWPPP
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	1" = 200'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	15 OF 23

ISSUED FOR
CONSTRUCTION

DAILY	WEEKLY AND/OR WITHIN 24HRS OF 0.5 STORM EVENT OR GREATER	MONTHLY AND/OR UNTIL NOTICE OF TERMINATION
CONSTRUCTION EXIT STORAGE AREAS FOR POTENTIAL POLLUTANTS: PETROLEUM FERTILIZER PAINT CONCRETE DETERGENTS CLEANING SOLVENTS WOOD/MASONRY/ROOFING MATERIAL TAR METAL STUDS OTHER HAZARDOUS MATERIALS	ALL EROSION CONTROL MEASURES CONSTRUCTION EXIT SILT FENCE- SEDIMENT SHALL BE REMOVED FROM SILT FENCE WHEN IT REACHES ½ THE HEIGHT OF THE FENCE. INSPECT SILT FENCE FOR TEARS, SEE THAT FABRIC IS FIRMLY IN PLACE AND ALL POSTS SECURE. SEDIMENT BASIN- INSPECT FOR DEPTH OF SEDIMENT, REMOVE WHEN SEDIMENT REACHES 10% OF DESIGN CAPACITY DIVERSION DIKES- INSPECT AND REPAIR ANY BREACHES ACCESSIBLE DISCHARGE POINTS- ENSURE THAT EROSION CONTROL MEASURES ARE EFFECTIVE IN PREVENTING SIGNIFICANT IMPACTS TO RECEIVING WATERS TEMPORARY AND PERMANENT SEEDING- INSPECT FOR BARE SPOTS, WASHOUTS AND HEALTHY GROWTH.	ALL AREAS WHICH HAVE UNDERGONE FINAL STABILIZATION ALL EROSION CONTROL MEASURES INSPECT FOR EVIDENCE OF OR POTENTIAL FOR POLLUTANTS ENTERING THE DRAINAGE SYSTEM AND THE RECEIVING WATER ACCESSIBLE DISCHARGE POINTS- ENSURE THAT EROSION CONTROL MEASURES ARE EFFECTIVE IN PREVENTING SIGNIFICANT IMPACTS TO RECEIVING WATER.
A MAINTENANCE REPORT WILL BE MADE AFTER EACH INSPECTION. A COPY OF THE REPORT FORM TO BE COMPLETED IS ATTACHED TO PLANS.		
INSPECTIONS SHALL BE CONDUCTED UNDER THE SUPERVISION OF THE PRIMARY PERMITEE BY "QUALIFIED PERSONNEL". QUALIFIED PERSONNEL MEANS A PERSON WHO HAS SUCCESSFULLY COMPLETED AN EROSION AND SEDIMENT CONTROL SHORT COURSE ELIGIBLE FOR CONTINUING EDUCATION UNITS, OR AN EQUIVALENT COURSE APPROVED BY EPA.		
RECORD KEEPING- A REPORT SHALL BE MADE AFTER EACH INSPECTION SUMMARIZING THE RESULTS. THE INSPECTOR MUST RECORD ANY DAMAGE OR DEFICIENCIES IN THE CONTROL MEASURES ON THE PROVIDED REPORT FORM. THE OPERATOR SHALL REPAIR ANY DAMAGE AS SOON AS PRACTICAL AND NO LATER THAN (7) SEVEN DAYS AFTER THE INSPECTION. THE PLANS MUST BE KEPT CURRENT. IT IS THE RESPONSIBILITY OF THE PRIMARY PERMITEE TO REVISE THE METHODS USED TO CONTROL EROSION AND SEDIMENTS ONSITE.		

MAJOR SOIL DISTURBANCE ACTIVITY

CONSTRUCTION ACTIVITY	SOIL DISTURBANCE	BMP
CLEARING AND GRUBBING TOPSOIL REMOVAL TREE REMOVAL - AS NECESSARY	TOPSOIL REMOVAL STOCKPILING	FILTER FABRIC RIP-RAP CHECK DAM
SEDIMENTATION PONDS AS REQUIRED UTILITY LINES GRADING	EARTHWORK CUT AND FILL ACTIVITY	FILTER FABRIC RIP-RAP CHECK DAM
CONCRETE CHANNEL FOUNDATIONS	FINISH GRADING	MAINTAIN AND MONITOR EROSION CONTROL PERMANENT GRASSING
WALKWAYS PERMANENT GRASSING AND LANDSCAPING		REMOVAL OF TEMPORARY SEDIMENT CONTROL AND TREE PROTECTION

SEEDING REQUIREMENTS

AREA	SOWING SEASON	SPECIES	SEED
CHANNEL AND ENBANKMENTS PERMANENT	SPRING-SUMMER	BERMUDA SPRIGING	BUSHEL/ACRE

FERTILIZER LBS/ACRE
450 lbs. (10-20-10)

* APPROVED EQUALS INCLUDES FRIO COUNTY SANDY SOIL AND CLAY SOILS MIXES FROM TEXAS NATIVE SEED PROJECT

PETROLEUM PRODUCTS:
ALL ONSITE VEHICLES WILL BE MONITORED FOR LEAKS AND RECEIVE REGULAR PREVENTATIVE MAINTENANCE TO REDUCE THE CHANCE OF LEAKAGE. PETROLEUM PRODUCTS WILL BE STORED IN TIGHTLY SEALED CONTAINERS WHICH ARE CLEARLY LABELED. ANY PETROLEUM TO BE STORED IN TANKS WILL BE SURROUNDED BY AN EARTHEN BERM AS A SECONDARY PROTECTIVE MEASURE. ANY ASPHALT SUBSTANCES USED ONSITE WILL BE APPLIED ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS.

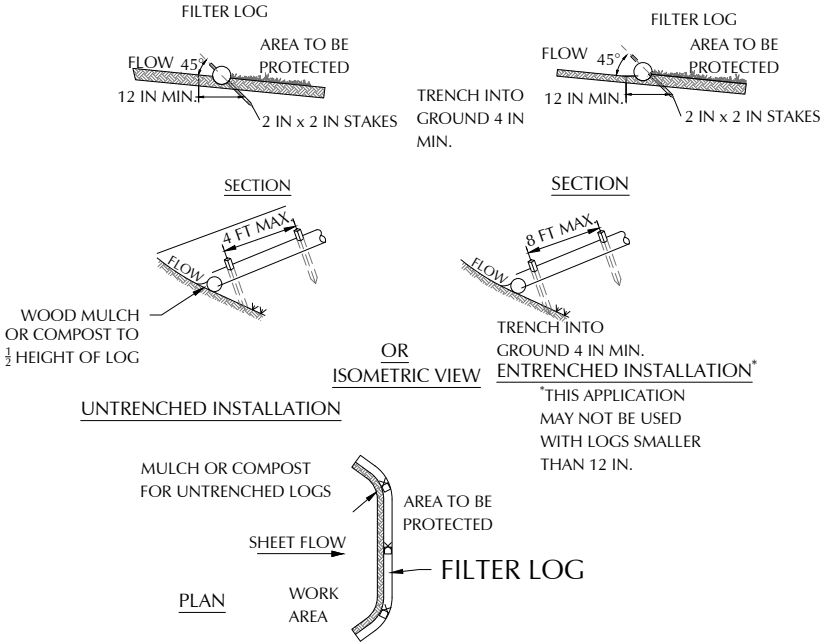
PAINTS:
ALL CONTAINERS WILL BE TIGHTLY SEALED AND STORED WHEN NOT REQUIRED FOR USE. EXCESS PAINT WILL NOT BE DISCHARGED TO THE STORM SEWER SYSTEM, BUT WILL BE DISPOSED OF PROPERLY ACCORDING TO MANUFACTURER'S INSTRUCTIONS OR STATE AND LOCAL REGULATIONS.

CONCRETE TRUCKS:
CONCRETE TRUCKS WILL NOT BE ALLOWED TO WASHOUT OR DISCHARGE SURPLUS CONCRETE OR DRUM WASH TRUCK ON SITE.

FERTILIZERS:
FERTILIZER USED WILL BE APPLIED ONLY IN THE MINIMUM AMOUNTS RECOMMENDED BY THE MANUFACTURER. ONCE APPLIED, FERTILIZER WILL BE WORKED INTO THE SOIL TO LIMIT EXPOSURE TO STORM WATER. STORAGE WILL BE IN A COVERED SHED. THE CONTENTS OF ANY PARTIALLY USED BAGS OF FERTILIZER WILL BE TRANSFERRED TO A SEALABLE PLASTIC BIN TO AVOID SPILLS.

WASTE DISPOSAL:
KEEP PORTA-JOHNS AWAY FROM STORM DRAIN INLETS AND RECEIVING BODIES OF WATER OR RINSING OF PORTA-JOHNS INTO STORM INLETS OR RECEIVING BODIES OF WATER. RUNOFF FROM PORTA-JOHNS INTO WATER SYSTEMS IS A VIOLATION OF FEDERAL, STATE AND LOCAL ORDINANCES.

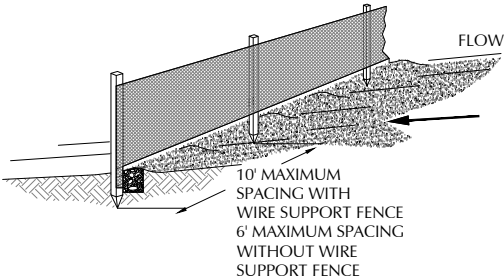
MULCH:
MULCH STORAGE MUST COMPLY WITH THE FOLLOWING SECTION OF THE STANDARD FIRE PREVENTION CODE. SECTION 502.3.1 - NO PERSON SHALL STORE IN ANY BUILDING OR UPON ANY PREMISES IN EXCESS OF 2,500 CU.FT. GROSS VOLUME OF COMBUSTIBLE EMPTY PACKING CASES, BOXES, BARRELS OR SIMILAR CONTAINERS OR RUBBER TIRES, OR RUBBER OR OTHER SIMILARLY COMBUSTIBLE MATERIALS WITHOUT A PERMIT.



CONSTRUCTION SPECIFICATIONS

- PRIOR TO INSTALLATION, CLEAR ALL OBSTRUCTIONS INCLUDING ROCKS, CLODS, AND DEBRIS GREATER THAN ONE INCH THAT MAY INTERFERE WITH PROPER FUNCTION OF FILTER LOG.
- FILL LOG NETTING UNIFORMLY WITH COMPOST (IN ACCORDANCE WITH SECTION H-1 MATERIALS), OR OTHER APPROVED BIODEGRADABLE MATERIAL TO DESIRED LENGTH SUCH THAT LOGS DO NOT DEFORM.
- INSTALL FILTER LOGS PERPENDICULAR TO THE FLOW DIRECTION AND PARALLEL TO THE SLOPE WITH THE BEGINNING AND END OF THE INSTALLATION POINTING SLIGHTLY UP THE SLOPE CREATING A "J" SHAPE AT EACH END TO PREVENT BYPASS.
- FOR UNTRENCHED INSTALLATION BLOW OR HAND PLACE MULCH OR COMPOST ON UPHILL SIDE OF THE SLOPE ALONG LOG.
- STAKE FILTER LOG EVERY 4 FEET OR CLOSER ALONG ENTIRE LENGTH OF LOG OR TRENCH LOG INTO GROUND A MINIMUM OF 4 INCHES AND STAKE LOG EVERY 8 FEET OR CLOSER.
- USE STAKES WITH A MINIMUM NOMINAL CROSS SECTION OF 2X2 INCH AND OF SUFFICIENT LENGTH TO ATTAIN A MINIMUM OF 12 INCHES INTO THE GROUND AND 3 INCHES PROTRUDING ABOVE LOG.
- WHEN MORE THAN ONE LOG IS NEEDED, OVERLAP ENDS 12 INCHES MINIMUM AND STAKE.
- REMOVE SEDIMENT WHEN IT HAS ACCUMULATED TO A DEPTH OF ½ THE EXPOSED HEIGHT OF LOG AND REPLACE MULCH. REPLACE FILTER LOG IF TORN. REINSTALL FILTER LOG IF UNDERMINING OR DISLODGING OCCURS. REPLACE CLOGGED FILTER LOGS. FOR PERMANENT APPLICATIONS, ESTABLISH AND CONTINUOUSLY MEET REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT IN ACCORDANCE WITH SECTION B-4 VEGETATIVE STABILIZATION.

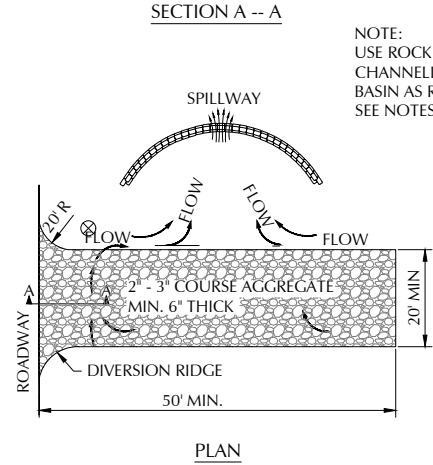
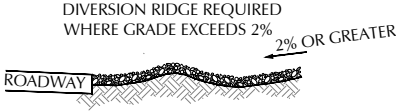
WADDLE FILTER LOG
(AS NEEDED FOR LOCALIZED WASHES)



SILT FENCE DETAILS

NOTES:

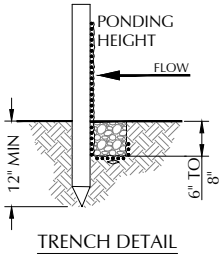
- MUST BE INSTALLED PROPERLY TO AVOID NOTICE OF VIOLATION.
- SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE POUNDING EFFICIENCY.
- INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY. 9" MAXIMUM RECOMMENDED STORAGE HEIGHT.
- REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE TO SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.



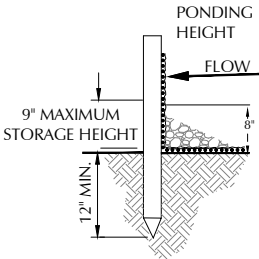
CONSTRUCTION ENTRANCE DETAILS

NOTES:

- THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.
- WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY.
- WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.
- ROCK BAGS OR SANDBAGS SHALL BE PLACED SUCH THAT NO GAPS ARE EVIDENT. SEE NOTES ERO-03.



TRENCH DETAIL



INSTALLATION WITHOUT TRENCHING

ISSUED FOR
CONSTRUCTION

ENVIROTECH
ENGINEERING
2500 North Eleventh Street
Enid, Oklahoma
580.234.8780
envirotechconsulting.com
P.E. #29736 - Expiration Date: 12-31-2026

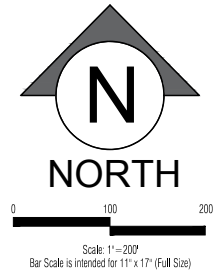
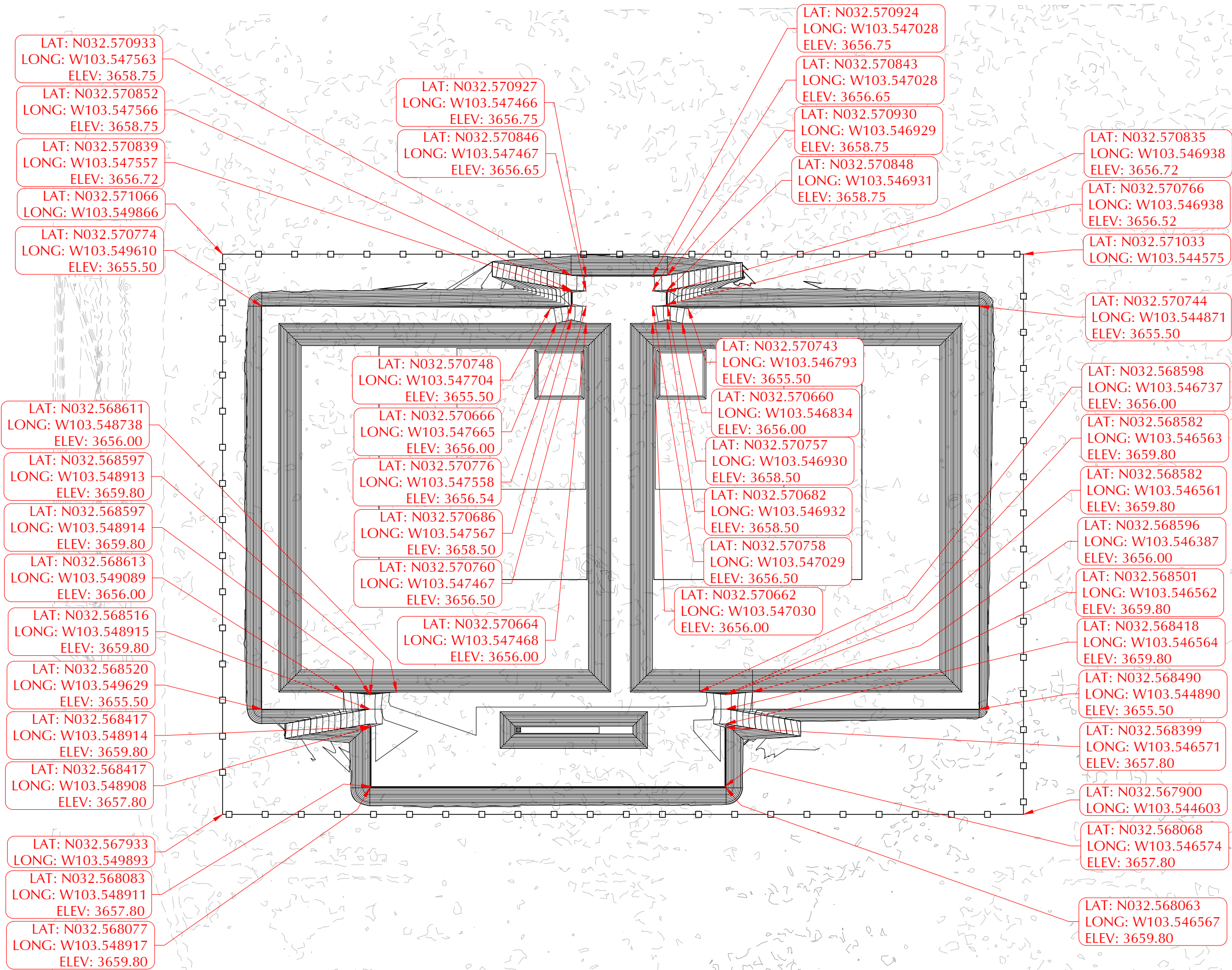
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NO.	DATE	DESCRIPTION

LEGION
WATER SERVICES

SWPPP DETAILS
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	NOT TO SCALE
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	16 OF 23



ENVIROTECH ENGINEERING
2500 North Eleventh Street
Enid, Oklahoma 73601
580.234.8780
envirotechconsulting.com
P.E. #29736 - Expiration Date: 12-31-2026

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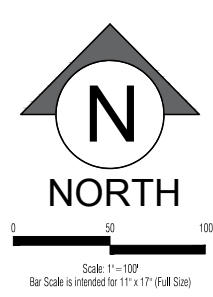
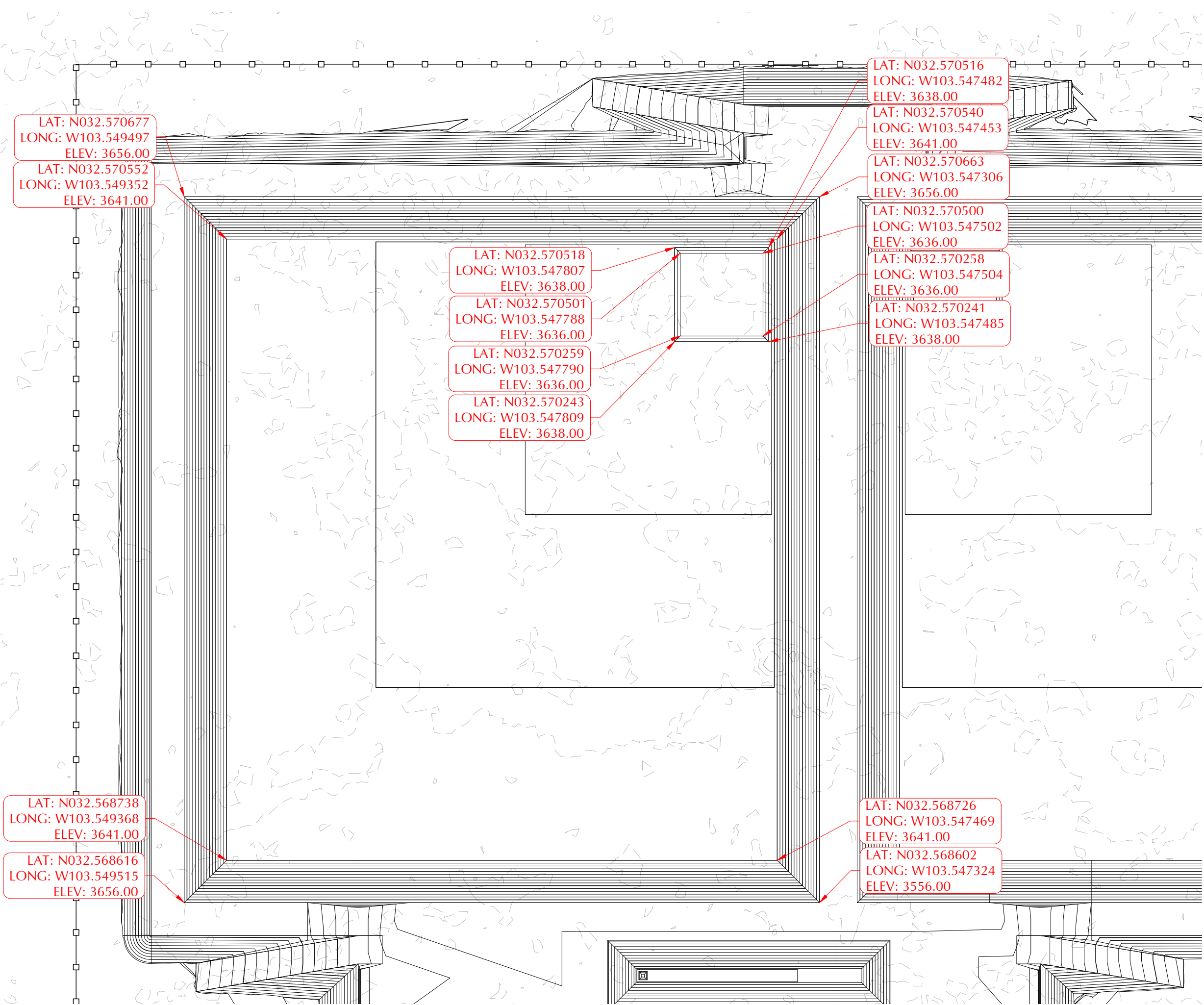
NO.	DATE	DESCRIPTION

LEGION WATER SERVICES

SITE STAKING PLAN
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	1" = 200'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	17 OF 23

ISSUED FOR
CONSTRUCTION



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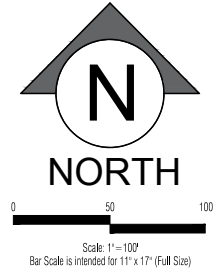
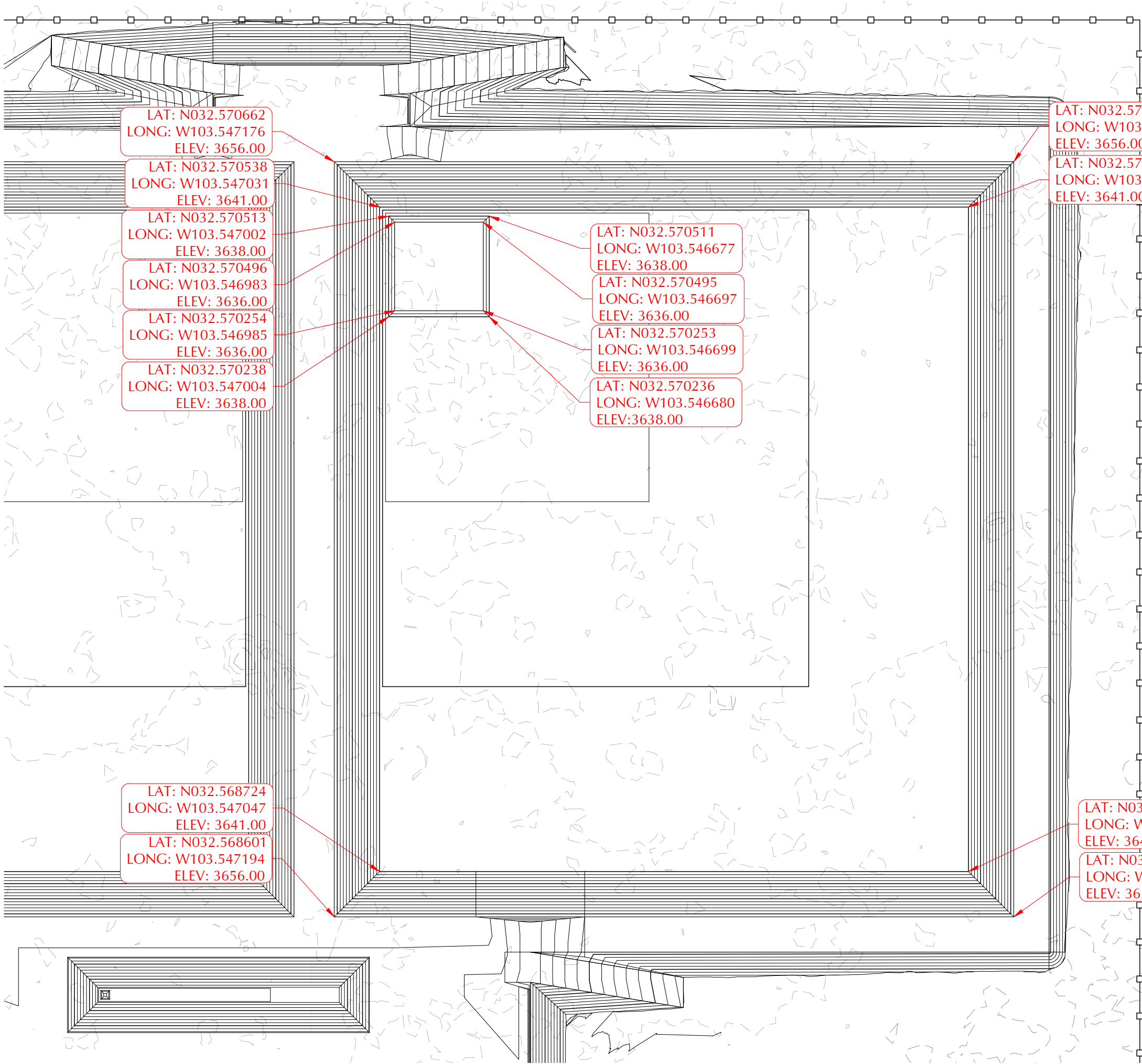
NO.	DATE	DESCRIPTION

LEGION
WATER SERVICES

WEST CONTAINMENT STAKING PLAN
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	1" = 100'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	19 OF 23

ISSUED FOR
CONSTRUCTION





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NO.	DATE	DESCRIPTION



LEGION
WATER SERVICES

EAST CONTAINMENT STAKING PLAN

PALOMA EAST RECYCLE FACILITY

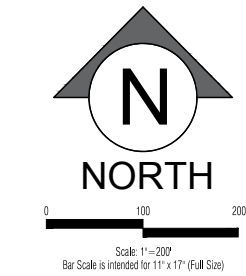
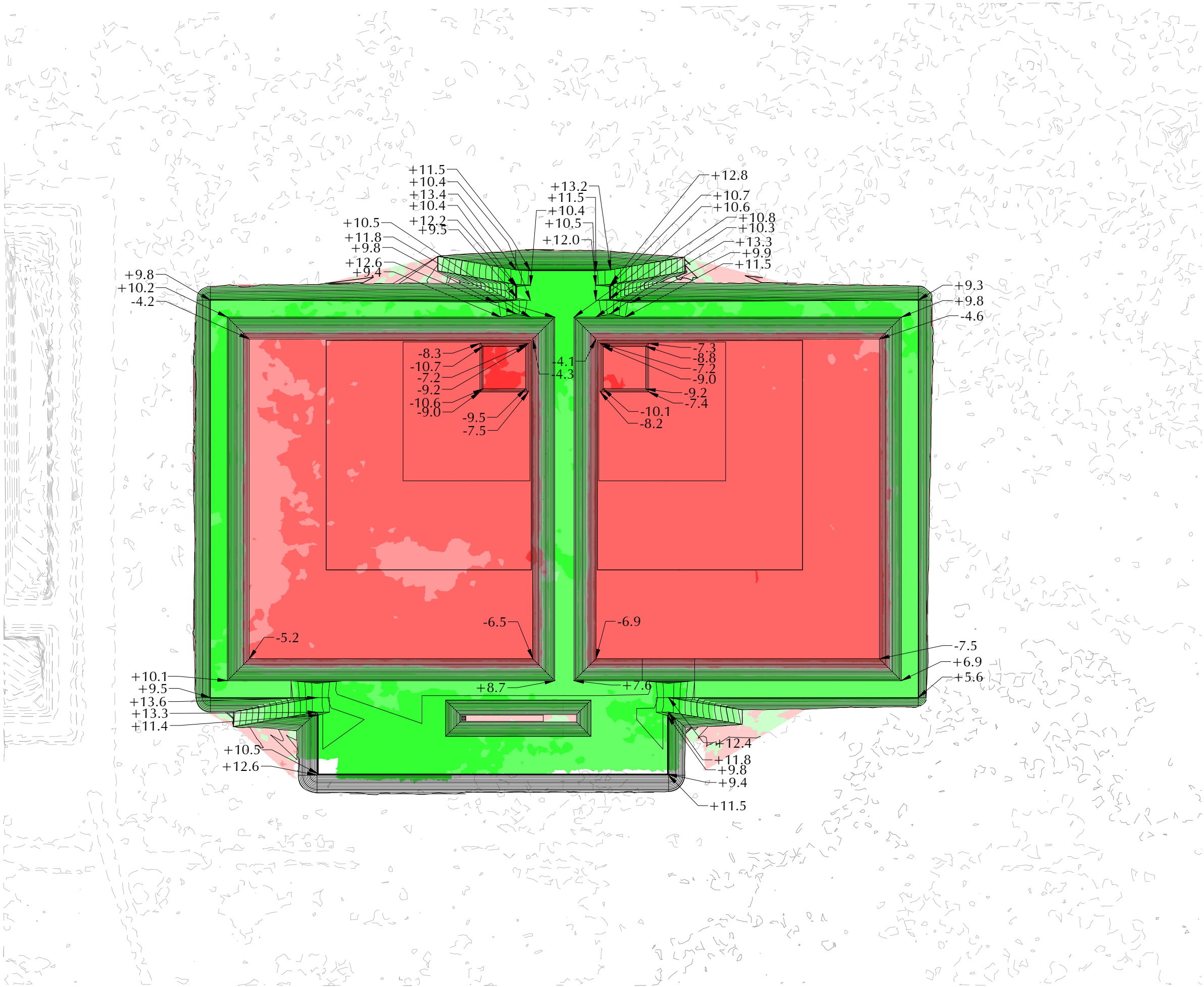
LEGION WATER SERVICES

SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST

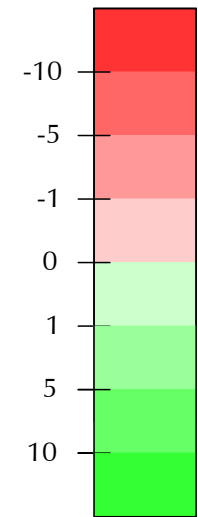
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	1" = 100'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025281-00
SHEET NO.	20 OF 23

ISSUED FOR
CONSTRUCTION



CUT/FILL LEGEND (FT)





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ENGINEERING**
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NO.	DATE	DESCRIPTION



**LEGION
WATER SERVICES**

STORAGE CONTAINMENTS CUT & FILL MAP
PALOMA EAST RECYCLE FACILITY
LEGION WATER SERVICES
SECTION 15, TOWNSHIP 20 SOUTH, RANGE 34 EAST
LEA COUNTY, NEW MEXICO

DATE:	SEPTEMBER 2025
SCALE:	1" = 200'
DESIGNED BY:	R. MOHAN
DRAWN BY:	S. JOSSELYN
CHECKED BY:	M. RATKE
PROJECT NO.	025261-00
SHEET NO.	22 OF 23

ISSUED FOR
CONSTRUCTION

CONSTRUCTION QUANTITY ESTIMATES						
ITEMS	DESCRIPTION	UNIT	INFLOW PIT QUANTITY	WEST PIT QUANTITY	EAST PIT QUANTITY	TOTAL QUANTITY
PRIMARY LINER	60- MIL HDPE SMOOTH LINER-BLACK	S.F.	28,213	530,474	530,474	1,089,161
LEAK DETECTION LAYER	200-MIL GEONET	S.F.	28,213	530,474	530,474	1,089,161
SECONDARY LINER	40-MIL HDPE SMOOTH LINER	S.F.	28,213	530,474	530,474	1,089,161
UNDERLAYMENT	10 OZ GEOTEXTILE	S.F.	28,213	530,474	530,474	1,089,161
RUB SHEETS	60-MIL HDPE SINGLE SIDED TEXTURE LINER - BLACK OR WHITE PER OWNER REQUEST	S.F.	7,130	36,467	36,467	80,064
ESOSION CONTROL LINER	30-MIL LLDPE OR OTHER PER CLIENT REQUEST PLACED ON EXTERIOR BERMS	S.F.	-	-	-	173,424
LEAK DETECTION PIPE (SOLID)	8-IN DR11.X SOLID PIPE	L.F.	39	65	65	169
LEAK DETECTION (PERFORATED)	8-IN DR11.X PERFORATED PIPE	L.F.	3	88	88	179
TRANSFER PIPE	12-IN DR11 HDPE SOLID POPE	L.F.	-	-	-	126
LEAK DETECTION ROCK	3/4" TO 2" WASHED RIVER ROCK	C.Y.	0.25	3.75	3.75	7.75
BERM CREST ROCK	PER OWNER REQUEST	C.Y.	-	-	-	5,679
FENCE	8 FT. GAME FENCE	L.F.	-	-	-	5,540
SILT FENCE	INSTALLED PER DETAIL ON SWPPP SHEET	L.F.	-	-	-	3,700
ACCESS GATE	ELECTRONICALLY OPERATED DOUBLE SLIDER GATE OR OWNER REQUEST	EA.	-	-	-	4
SUCTION LINES	TO BE INSTALLED PER OWNER REQUEST	EA.	PER REQUEST	PER REQUEST	PER REQUEST	PER REQUEST
SIGNAGE	MUST MEET NMAC 19.15.34.12 (C)	LSUM.	PER REQUEST	PER REQUEST	PER REQUEST	PER REQUEST
BIRD DETERRENT	AUDIBLE SYSTEM LIKE BIRD X MEGA BLASTER PRO, INSTALLED PER MANUAFACTURER SPEC.	EA.	PER REQUEST	PER REQUEST	PER REQUEST	PER REQUEST

NOTES

GENERAL NOTES

1. TOPOGRAPHIC AND UTILITY SURVEY PROVIDED BY DATAPOINT, WITH JEREMY HORTON AS PROJECT MANAGER. SURVEY BEARINGS, DISTANCES, AND COORDINATE VALUES ARE BASED ON NAD 1983 NEW MEXICO STATE PLANE EAST ZONE, US SURVEY FEET.
2. ALL CONTRACTORS SHALL LOCATE AND IDENTIFY ALL UTILITIES BEFORE ANY WORK COMMENCES.
3. QUANTITIES SHOWN ARE ESTIMATES. CONTRACTORS ARE RESPONSIBLE FOR VERIFYING THEIR OWN QUANTITIES.

Venegas, Victoria, EMNRD

From: Venegas, Victoria, EMNRD
Sent: Wednesday, October 8, 2025 2:41 PM
To: Sarah Ferreyros; Mike Feaga; Mitchell Ratke
Subject: 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207]
Attachments: C-147 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207] 10.08.2025.pdf

1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207]

Good afternoon, Mr. Feaga.

The NMOCD has reviewed the recycling containment permit application and related documents, submitted by [333437] Legion Water Services II, LLC on 09/30/2025, Application ID **510624**, for 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207] in N-15-20S-34E, Lea County, New Mexico. [333437] Legion Water Services II, LLC requested variances from 19.15.34 NMAC for 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207].

The following variances have been approved:

- The variance from 19.15.34.13.E NMAC for the installation of an audible “Bird-X Mega Blaster Pro” bird deterrence system is approved.
- The variance to NMAC 19.15.34.12.D to install a wire mesh, game fence, eight (8) feet in height is approved.
- The variance to 19.15.34.12.A.(4) NMAC for the installation of a 40-mil HDPE secondary liner is approved. The proposed liner system cross-section for the earthen containments is as follows: prepare subgrade, 10 oz. geotextile, 40-mil HDPE secondary liner, 200-mil geonet, 60-mil HDPE primary liner.

The form C-147 and related documents for the 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207] are approved with the following conditions of conditions of approval:

- The purpose of this permit is for oil and gas activities regulated under the NMAC 19.15.34.3 STATUTORY AUTHORITY: 19.15.34 NMAC is adopted pursuant to the Oil and Gas Act, Paragraph (15) of Section 70-2-12(B) NMSA 1978, which authorizes the division to regulate the disposition of water produced or used in connection with the drilling for or producing of oil and gas or both and Paragraph (21) of Section 70-2-12(B) NMSA 1978 which authorizes the regulation of the disposition of nondomestic wastes from the exploration, development, production or storage of crude oil or natural gas.
- 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207] is approved for five years of operation from the date of the permit application of 09/30/2025. 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207] permit expires on 09/30/2030.
- The 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207] consists of three (3) earthen Containments:
Paloma East Inflow Containment: 12,191 barrels
Paloma East, East Storage Containment: 1,009,412 barrels
Paloma East, West Storage Containment: 1,009,412 barrels
- The total operational volume of 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207] is approximately 2,031,015-bbls.

- Per NMAC 19.15.34.15.A.(1) operators without existing financial assurance pursuant to NMAC 19.15.8 shall furnish financial assurance acceptable to the division in the amount of the recycling containment's estimated closure cost.
- The total closure cost estimated of 1RF-540 - SYSTEM CONNECTOR POND RECYCLING FACILITY AND AST [FVV2512941876] in the amount of \$ 1,825,076.01, meets the requirements of NMAC 19.15.34.15.A. The financial assurance should be mailed to:
**EMNRD - Oil Conservation Division,
Administration & Compliance Bureau Attn:
Bond Administrator 1220 S. St. Francis Drive
| Santa Fe, NM 87505**
- [333437] Legion Water Services II, LLC shall construct, operate, maintain, close, and reclaim the 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207] in compliance with 19.15.34 NMAC.
- [333437] Legion Water Services II, LLC shall notify NMOCD when construction of the 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207] commences.
- [333437] Legion Water Services II, LLC shall notify NMOCD when recycling operations commence and cease at 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207].
- A minimum of 3-feet freeboard must be maintained 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207] recycling containment, at all times during operations.
- If less than 20% of the total fluid capacity is utilized every six months, beginning from the first withdrawal, operation of the facility is considered ceased and notification of cessation of operations should be sent electronically to OCD Permitting. An extension to extend the cessation of operation, not to exceed six months, may be submitted using a C-147 form through OCD Permitting.
- [333437] Legion Water Services II, LLC shall submit monthly reports of recycling and reuse of produced water, drilling fluids, and liquid oil field waste on NMOCD form C-148 even if there is zero activity.
- [333437] Legion Water Services II, LLC shall comply with 19.15.29 NMAC Releases in the event of any release of produced water or other oil field wastes at 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207].
- According to Table 1 of NMAC 19.15.34.14, the closure criteria for 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207] is for groundwater depth of 51 to 100 feet.

Please reference number 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207] in all future communications.

Best,

Victoria Venegas • Senior Environmental Scientist
EMNRD - Oil Conservation Division
506 W. Texas Ave. Artesia, NM 88210
575.909.0269 | Victoria.Venegas@emnrd.nm.gov

Sante Fe Main Office
Phone: (505) 476-3441

General Information
Phone: (505) 629-6116

Online Phone Directory
<https://www.emnrd.nm.gov/ocd/contact-us>

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

CONDITIONS

Action 510624

CONDITIONS

Operator: Legion Water Services II, LLC 1515 Wynkoop Street Denver, CO 80202	OGRID: 333437
	Action Number: 510624
	Action Type: [C-147] Water Recycle Long (C-147L)

CONDITIONS

Created By	Condition	Condition Date
vvenegas	1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207] permit expires on 09/30/2030. • [333437] Legion Water Services II, LLC shall construct, operate, maintain, close, and reclaim the 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207] in compliance with 19.15.34 NMAC. • [333437] Legion Water Services II, LLC shall submit monthly reports of recycling and reuse of produced water, drilling fluids, and liquid oil field waste on NMOCD form C-148 even if there is zero activity. • [333437] Legion Water Services II, LLC shall comply with 19.15.29 NMAC Releases in the event of any release of produced water or other oil field wastes at 1RF-542 - PALOMA EAST RECYCLE FACILITY [FVV2528142207].	10/8/2025