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

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

For State Use Only:

Form C-137
Revised August 1, 2011

Submit 1 Copy to Santa Fe Office

APPLICATION FOR SURFACE WASTE MANAGEMENT FACILITY

A meeting should be scheduled with the Division's Santa Fe office Environmental Bureau prior to pursuing an application for a surface waste management facility in order to determine if the proposed location is capable of satisfying the siting requirements of Subsections A and B of 19.15.36.13 NMAC for consideration of an application submittal.

1 Application: ☒ New ☐ Modification ☐ Renewal

2. Type: ☐ Evaporation ☐ Injection ☐ Treating Plant ☐ Landfill ☒ Landfarm ☐ Other

3. Facility Status: ☐ Commercial ☒ Centralized

4. Operator: Hilcorp Energy Company.

Address: 382 County Road 3100, Aztec, NM 87401

Contact Person: Lindsay Dumas Phone: 832-839-4585

5. Location: SE /4 SW /4 Section 5 Township 31 N Range 9W

6. Is this an existing facility? ☐ Yes ☒ No If yes, provide permit number ____________

7. Attach the names and addresses of the applicant and principal officers and owners of 25 percent or more of the applicant. Specify the office held by each officer and identify the individual(s) primary responsible for overseeing management of the facility.

8. Attach a plat and topographic map showing the surface waste management facility's location in relation to governmental surveys (quarter-quarter section, township and range); highways or roads giving access to the surface waste management facility site; watercourses; fresh water sources, including wells and springs; and inhabited buildings within one mile of the site's perimeter.

9. Attach the names and addresses of the surface owners of the real property on which the surface waste management facility is sited and surface owners of the real property within one mile of the site's perimeter.

10. Attach a description of the surface waste management facility with a diagram indicating the location of fences and cattle guards, and detailed construction/installation diagrams of pits, liners, dikes, piping, sprayers, tanks, roads, fences, gates, berms, pipelines crossing the surface waste management facility, buildings and chemical storage areas.

11. Attach engineering designs, certified by a registered professional engineer, including technical data on the design elements of each applicable treatment, remediation and disposal method and detailed designs of surface impoundments.

12. Attach a plan for management of approved oil field wastes that complies with the applicable requirements contained in 19.15.36.13, 19.15.36.14, 19.15.36.15 and 19.15.36.17 NMAC.

13. Attach an inspection and maintenance plan that complies with the requirements contained in Subsection L of 19.15.36.13 NMAC.

14. Attach a hydrogen sulfide prevention and contingency plan that complies with those provisions of 19.15.3.118 NMAC that apply to surface waste management facilities.

15. Attach a closure and post closure plan, including a responsible third party contractor's cost estimate, sufficient to close the surface waste management facility in a manner that will protect fresh water, public health, safety and the environment (the closure and post closure plan shall comply with the requirements contained in Subsection D of 19.15.36.18 NMAC).

16 Attach a contingency plan that complies with the requirements of Subsection N of 19.15.36.13 NMAC and with NMSA 1978, Sections 12-12-1 through 12-12-30, as amended (the Emergency Management Act).

17. Attach a plan to control run-on water onto the site and run-off water from the site that complies with the requirements of Subsection M of 19.15.36.13 NMAC.

18. In the case of an application to permit a new or expanded landfill, attach a leachate management plan that describes the anticipated amount of leachate that will be generated and the leachate's handling, storage, treatment and disposal, including final post closure options.

19. In the case of an application to permit a new or expanded landfill, attach a gas safety management plan that complies with the requirements of Subsection O of 19.15.36.13 NMAC

20. Attach a best management practice plan to ensure protection of fresh water, public health, safety and the environment.

21. Attach a demonstration of compliance with the siting requirements of Subsections A and B of 19.15.36.13 NMAC.

22. Attach geological/hydrological data including:

(a) a map showing names and location of streams, springs or other watercourses, and water wells within one mile of the site;

(b) laboratory analyses, performed by an independent commercial laboratory, for major cations and anions; benzene, toluene, ethyl benzene and xylenes (BTEX); RCRA metals; and total dissolved solids (TDS) of ground water samples of the shallowest fresh water aquifer beneath the proposed site;

(c) depth to, formation name, type and thickness of the shallowest fresh water aquifer;

(d) soil types beneath the proposed surface waste management facility, including a lithologic description of soil and rock members from ground surface down to the top of the shallowest fresh water aquifer;

(e) geologic cross-sections;

(f) potentiometric maps for the shallowest fresh water aquifer; and

(g) porosity, permeability, conductivity, compaction ratios and swelling characteristics for the sediments on which the contaminated soils will be placed.

23. In the case of an existing surface waste management facility applying for a minor modification, describe the proposed change and identify information that has changed from the last C-137 filing.

24. The division may require additional information to demonstrate that the surface waste management facility's operation will not adversely impact fresh water, public health, safety or the environment and that the surface waste management facility will comply with division rules and orders

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

Name: Matt Henderson Title: Environmental Manager

Signature: Matt Henderson Date: 10-17-20

E-mail Address: mhenderson@hilcorp.com

TANK MOUNTAIN LANDFARM FORM C-137 SUPPLEMENTAL INFORMATION

HILCORP TANK MOUNTAIN LANDFARM
SAN JUAN COUNTY, NEW MEXICO

OCTOBER 2020

Prepared for:

HILCORP ENERGY COMPANY
382 County Road 3100
Aztec, New Mexico 87401

Prepared by:

LT ENVIRONMENTAL, INC.
848 East Second Avenue
Durango, Colorado 81301
970.385.1096

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APPENDICES

1.0 STATEMENT OF APPLICATION

This Permit Application submitted for the Tank Mountain Landfarm located in San Juan County, New Mexico , was prepared by LT Environmental, Inc. technical staff under my direct supervision. It is my opinion as a licensed professional engineer, in good standing with the State of New Mexico, that to the best of my knowledge and belief, that the information contained in this Permit Application complies with the current New Mexico Oil and Gas Rules (19.15.36 NMAC).

Allison S. White, P.E.
New Mexico P.E. No. 25204
Senior Engineer

Environmental Consultant to and Representative of Applicant:

LT Environmental, Inc.
848 East Second Avenue
Durango, Colorado 81301
970.385.1096

Applicant:

Hilcorp Energy Company.
1111 Travis Street
Houston, TX 77002

I certify that the information provided in the application is true, accurate, and complete to the best of my knowledge, after reasonable inquiry.

Matt Henderson, Hilcorp Energy Company

2.0 APPLICANT INFORMATION: 19.15.36.8 (C)(1)

The names and addresses of the applicant and principal officers and owners of 25 percent (%) or more of the applicant.

Applicant:	Matt Henderson Hilcorp Energy, Inc. 1111 Travis Street Houston, TX 77002
Principal Officers/Owners:	Jeff Hildebrand Hilcorp Energy, Inc. 1111 Travis Street Houston, TX 77002

3.0 PLAT AND TOPOGRAPHIC MAP: 19.15.36.8 (C)(2)

A plat and topographic map showing the surface waste management facility's location in relation to governmental surveys (quarter-quarter section, township, range); highways or roads giving access to the surface waste management facility site; watercourses; fresh water sources, including wells and springs; and inhabited buildings within one-half mile of site's perimeter based upon the records of the applicable county clerk or clerk's office.

The Tank Mountain Landfarm (Landfarm) is located in San Juan County, New Mexico.

Latitude/Longitude: 36.922505, -107.800434

Legal Description: Southeast ¼ of the southwest ¼, Section 5, Township 31N, Range 9W

A Plat Map of the proposed Landfarm has been prepared by a licensed Surveyor and is included as Attachment 1 of Appendix A.

Figure 1A is a map that includes the location of the proposed Landfarm in relation to the surrounding geographical area. Figure 1B is a topographic map depicting the location of Landfarm in relation to roads/highways and inhabited buildings within a one-half mile of the site boundary. Specifically, County Road 2770 is located adjacent to the Landfarm within a one-half mile. All other roads are access roads for oil and gas leases. Additionally, no inhabited buildings are located within a one-half mile radius of the Landfarm.

Figure 2 is a topographic map depicting the location of Landfarm in relation to watercourses, fresh water sources, permitted water wells, and springs located within a 200-foot, one-half mile, and one-mile radius of the site boundary. Mapped watercourse locations were obtained from the United States Geological Survey (USGS) National Hydrography Dataset (NHD). Locations of permitted water wells and springs presented on Figure 2 were obtained from the USGS National Water Information System (NWIS) database.

4.0 NAMES AND ADDRESS OF ADJACENT LANDOWNERS: 19.15.36.8 (C)(3)

The names and addresses of the surface owners of the real property on which the surface waste management facility is sited and surface owners of the real property within one mile of the site's perimeter.

The surface owner of the real property on which the Landfarm is located is:

Hilcorp Energy Company
Parcel No. 2054185264132
Property Address: 650 Road 2770, Aztec, New Mexico 87410
Owner Address: 1111 Travis Street, Houston, Texas 77002

Surface owners within one mile of the site's perimeter are shown on Figure 3 and include the following:

Blancett Land and Cattle LLC
Parcel No. 2052185066462
Property Address: 648 Road 2770, Aztec, New Mexico 87410
Owner Address: 271 Road 3000, Aztec, New Mexico 87410

State of New Mexico
Parcel No. 2088188888888
Property Address: US 64, Kirtland, New Mexico 87417
Owner Address: Facility Management Division, P.O. Box 6850, Santa Fe, New Mexico 87502

United States Bureau of Land Management
Parcel No. 2099199900900
Property Address: 70 Road 3536, Farmington, New Mexico 87410
Owner Address: 301 Dinosaur Train, Santa Fe, New Mexico 85708

Information to the surface owners was provided by the San Juan County Assessor's Office and New Mexico State Land Office. "Property Record Cards" provided by the San Juan County Assessor's Office for the Landfarm and surrounding properties are included in Attachment 1 of Appendix B.

5.0 SURFACE WASTE MANAGEMENT FACILITY DIAGRAM: 19.15.36.8 (C)(4)

A description of the surface waste management facility with a diagram indicating the location of fences and cattle guards, and detailed construction/installation diagrams of pits, liners, dikes, piping, sprayers, tanks, roads, fences, gates, berms, pipelines crossing the surface waste management facility, buildings and chemical storage areas.

The layout of the proposed Landfarm is described in Section 5.0, with additional information, including a proposed facility layout, provided in Attachment 2 of Appendix A of this document.

6.0 ENGINEERING DESIGNS: 19.15.36.8 (C)(5)

Engineering designs, certified by a registered professional engineer (PE), including technical data on the design elements of each applicable treatment, remediation and disposal method and detailed design surface impoundments.

Engineering designs and specifications, certified by a registered PE, are provided in the *Tank Mountain Landfarm Design Specifications* (Appendix A). A Plat Map is included as Attachment 1 in Appendix A and the Design Drawings are included as Attachment 2 in Appendix A

No cattle guards, dikes, sprayers, tanks, liners, or chemical storage areas are planned at this time.

6.1 SITE SECURITY

The Landfarm will be surrounded by a minimum 4-foot tall fence of chain link material or of similar quality and durability just inside the Landfarm boundary. Gates will be installed at the two entrances to the Landfarm. The gates will remain closed and locked with a padlock. Hilcorp will maintain keys or combinations and restrict entry to the Landfarm. Hilcorp employees will provide access to other personnel as needed for regular maintenance and monitoring.

Entrance to the Landfarm will be equipped with a sign, readable from 50 feet, similar to the following:

HILCORP ENERGY COMPANY
Tank Mountain Landfarm
Surface Waste Management Facility Permit # (TBD)
SESW Unit O SEC 5 T31N R9W
505-599-3400

IN CASE OF EMERGENCY
Call 911
New Mexico State Police – District 10: 505-325-7547
Fire Department (San Juan County): 505-334-1180
New Mexico Oil Conservation Division (Aztec Office): 505-419-2687

A rendering of the proposed sign is included in Attachment 2 of Appendix A.

At the entrance to the Landfarm, Hilcorp will construct a receiving area with a Landfarm Office to house records, health and safety equipment, and release response equipment. Trucks transporting soil generated from Hilcorp sites to the Landfarm will enter the gate into the receiving area and check in with a Hilcorp employee assigned and trained to review and accept the transported soil. If the waste is acceptable, Hilcorp personnel will instruct trucks to deliver soil to the receiving area. Backhoes will transfer the material from the receiving area to the appropriate Landfarm cell. Waste-acceptance criteria and documents required for the transport of soil to the Landfarm are further described in the *Plan for Management of Approved Oil field Wastes* (Appendix B).

6.2 GRADING

Grading will be accomplished to meet the design criteria described on the drawings and in accordance with the design specifications which are both included in Appendix A. Grading will progress to maintain control of run-on and run-off in accordance with the *Run-on and Run-off Control Plan* described in Section 11.0 below.

6.3 STORMWATER CONTROL MEASURES

Ditches, stormwater culverts, and earthen berms were included in the design to prevent run-on to the Landfarm. Please see Section 11.0, *Run-On and Run-Off Control Plan*, for additional stormwater control measures.

6.4 CELLS

The Landfarm design includes 17 cells that range from 0.4 to 1.6 acres in area. Locations of the cells are included on the facility diagram in the *Landfarm Design Specifications* (Attachment 2 of Appendix A). Hilcorp anticipates constructing the landfarm cells in two stages: Stage 1 will include the construction of cells 1 through 7; Stage 2 will include the construction of cells 8 through 17 (construction schedules subject to change based on conditions at the time of construction).

Soils will be applied to one cell at a time for remediation. Once a cell reaches capacity, incoming soil will be applied to a new cell. Berms will separate each treatment cell and will vary in height due to the natural slope of the site. The uphill side of each cell will not be bermed during use in order to allow for soil receiving and allow for equipment to enter the cell for tilling/turning. Once the cell reaches capacity, berms will be constructed on the uphill sides of that particular cell. Drainage ditches and down-slope berms will be used to control potential surface water run-on and run-off during operation, as described in the *Run-On and Run-Off Control Plan* (Appendix F and further discussed in Section 11.0 of this document).

6.5 OPERATION

Landfill operations and procedures are described in the *Plan for Management of Approved Oil field Wastes* (Appendix B) and *Inspection and Maintenance Plan* (Appendix C).

6.6 REMEDIATION

Procedures for disking and potentially treating landfarmed materials with bio-applications are included in the *Plan for Management of Approved Oil field Wastes* (Appendix B).

7.0 PLAN FOR MANAGEMENT OF APPROVED OIL FIELD WASTES: 19.15.36.8(C)(6)

A plan for management of approved oil field wastes that complies with the applicable requirements contained in 19.15.36.13 New Mexico Administrative Code (NMAC), 19.15.36.14 NMAC, 19.15.36.15 NMAC, and 19.15.36.17 NMAC.

As this application is for a landfarm approximately 38 acres in size, Sections 19.15.36.13 NMAC (all surface waste management facilities), 19.15.36.14 NMAC (landfills) and 19.15.36.17 NMAC (evaporation, storage, treatment, and skimmer ponds) do not apply for this application. Information pertaining to siting and operational requirements of the Landfarm are included in the *Plan for Management of Approved Oil field Wastes* (Appendix B). A training plan also is included in Appendix B.

8.0 INSPECTION AND MAINTENANCE PLAN: 19.15.36.8 (C)(7)

An inspection and maintenance plan that complies with the requirements contained in Subsection L of 19.15.36.13 NMAC.

The *Inspection and Maintenance Plan* has been prepared for the Site and is included as Appendix C.

9.0 HYDROGEN SULFIDE PREVENTION AND CONTINGENCY PLAN: 19.15.36.8(C)(8)

A Hydrogen Sulfide Prevention and Contingency Plan that complies with those provisions of 19.15.11 NMAC that apply to surface waste management facilities.

Due to the nature of the expected operations at the Landfarm, hydrogen sulfide is not anticipated to be present in soils, when accepted, nor produced during remediation operations at the Landfarm. However, in order to be overly conservative, information regarding a potential release of hydrogen sulfide at the Landfarm is included in the *Contingency Plan* described in Section 10.0 below. In the case that hydrogen sulfide is detected at the Landfarm, a hydrogen sulfide prevention and contingency plan will be prepared in accordance with the 19.15.11 NMAC and the American Petroleum Institute (API) document RP-55. The plan will be submitted for NMOCD review and approval prior to implementation.

10.0 CLOSURE AND POST CLOSURE PLAN: 19.15.36.8 (C)(9)

A closure and post closure plan, including a responsible third party contractor's cost estimate, sufficient to close the surface waste management facility in a manner that will protect fresh water, public health and the environment, and to comply with the closure and post closure requirements contained in Subsections A through F of 19.15.36.18 NMAC.

The *Closure and Post Closure Plan* which complies with the requirements of Subsections A through F of 19.15.36.18 NMAC is included as Appendix D.

11.0 CONTINGENCY PLAN: 19.15.36.8 (C)(10)

A Contingency Plan that complies with the requirements of Subsection N of 19.15.36.13 NMAC and with New Mexico Statutes Annotated (NMSA) 1978, Sections 12-12-1 through 12-12-30, as amended.

The *Contingency Plan*, which complies with the requirements of Subsection N of 19.15.36.13 NMAC and with NMSA 1978, Sections 12-12-1 through 12-12-30, as amended (the Emergency Management Act), is included as Appendix E. The *Contingency Plan* also includes information regarding hydrogen sulfide prevention and contingencies that complies with those provisions of 19.15.11 NMAC.

12.0 RUN-ON AND RUN-OFF CONTROL PLAN: 19.15.36.8 (C)(11)

A plan to control run-on water onto the site and run-off water from the site that complies with the requirements of Subsection M of 19.15.36.13 NMAC.

The *Run-on and Run-off Control Plan* at the Landfarm which complies with the requirements of Subsection M of 19.15.36.13 NMAC is included as Appendix F.

13.0 LEACHATE MANAGEMENT PLAN: 19.15.36.8 (C)(12)

In the case of an application to permit a new or expanded landfill, a leachate management plan that describes the anticipated amount of leachate that will be generated and the leachate's handling, storage, treatment and disposal, including final post closure options.

A *Leachate Management Plan* is not required for landfarms and has not been prepared for this site.

14.0 GAS SAFETY MANAGEMENT PLAN: 19.15.36.8 (C)(13)

In the case of an application to permit a new or expanded landfill, a gas safety management plan that complies with the requirements of Subsection O of 19.15.36.13 NMAC.

A *Gas Safety Management Plan* is not required for landfarms and has not been prepared for this site.

15.0 BEST MANAGEMENT PRACTICE PLAN: 19.15.36.8 (C)(14)

A best management practice plan to ensure protection of fresh water, public health and the environment.

The Landfarm *Best Management Practices (BMP) Plan* to ensure protection of freshwater, public health, and the environment, which complies with the requirements of Subsection C of 19.15.36.8 NMAC, is included as Appendix G.

16.0 GEOLOGICAL AND HYDROLOGICAL DATA: 19.15.36.8 (C)(15)

The Landfarm lies to the northwest of Pump Canyon. It consists of shales and sandstones of the San Jose Formation (Dane and Bachman, 1965). The site is located at an elevation approximately 6,700 feet above mean sea level (amsl) (Figure 1). The geologic and hydrological data specified in 19.15.36.8 (C)(15) is provided in this section.

16.1 19.15.36.8 (C)(15)(a): WATER SOURCES

A map showing names and location of streams, springs or other watercourses, and water wells within one mile of the site;

Groundwater data available from the New Mexico State Engineer's iWaters Database for wells near the proposed site are attached in Appendix H. The nearest permitted water well with publicly available water-level information is SJ00014, located approximately 9,584 feet to the southeast of the Landfarm. The water-bearing unit described in this area is sandstone/gravel/conglomerate. Ground surface elevation at the well location is approximately 6,575 feet amsl, which is 125 feet lower in elevation than the site. The water well has a depth to groundwater of 312 feet below ground surface (bgs) and a total depth of 462 feet.

Based on available information, the Landfarm meets the siting criteria for a landfarm as specified in Subsections A, B, and C of 19.15.36.13 NMAC. Figure 2 depicts water wells, springs, and wellhead protection areas located within a one-mile radius of the Landfarm. Figure 4 depicts watercourses, lakebeds, sinkholes, and playa lakes within a 200-foot radius of the Landfarm. Figures 5A, 5B, and 5C depict the Landfarm and the flood-zone classification in the surrounding area. Figure 6 depicts wetlands within a 500-foot radius of the Landfarm. Figure 6 also depicts field-sampling locations used to determine whether mapped water features/erosional features constituted a wetland. Supporting documentation (Wetland Determination Data Forms) completed for the Landfarm are included in Attachment 1 of Appendix B. Field verification of site characterization information was performed by LT Environmental, Inc. (LTE) personnel in 2019.

16.2 19.15.36.8 (C)(15)(b): GROUNDWATER ANALYTICAL RESULTS

Laboratory analyses, performed by an independent commercial laboratory, for major cations and anions; benzene, toluene, ethylbenzene, and total xylenes (BTEX); Resource Conservation and Recovery Act (RCRA) metals; and total dissolved solids (TDS) of groundwater samples of the shallowest freshwater aquifer beneath the proposed site;

Three borings were advanced at the Landfarm to assess site lithology and depth to groundwater (locations shown on Figure 7). The borings were advanced on and adjacent to the Landfarm to depths ranging from 105 to 110 feet bgs. Shallow perched groundwater was present in wells MW01 and MW03 at depths of 43 and 71 feet bgs, respectively. Additionally, MW01 was advanced outside of the Landfarm boundary at an elevation of approximately 6,606 feet amsl (approximately 35 feet below the lowest point of the proposed Landfarm boundary). Due to the presence of water, borings MW01 and MW03 were completed as permanent groundwater-monitoring wells. Boring MW02 was drilled to a depth of 110 feet bgs and did not encounter groundwater. Boring MW02 was backfilled upon completion.

Once installed, well MW01 was developed by removing approximately 10 well casing volumes of groundwater using a disposable bailer. Groundwater was allowed to recharge for at least 24 hours prior to purging and sampling. Groundwater from well MW01 was analyzed for anions by United States Environmental Protection Agency (EPA) Method 300.0, conductivity by Method SM2510B, alkalinity by Method SM2320B, TDS by EPA Method SM2540C, metals by EPA Method 6010B/7470, and volatile organic compounds (VOCs) by EPA Method 8021B. Of the analyzed compounds, concentrations of sulfate and TDS were detected above the New Mexico Water Quality Control Commission (NMWQCC) standards (600 and 1,000 milligrams per liter [mg/L], respectively) for domestic water supply. All other constituents were either below available NMWQCC standards or were not detected above laboratory reporting limits. Based on the elevated concentrations of sulfate and TDS in groundwater at the Landfarm (2,000 and 3,170 mg/L, respectively), the shallow perched groundwater located near the Landfarm would not fall within the NMWQCC standards for domestic use. Table 1 summarizes the groundwater analytical results sampling conducted at the Landfarm. Laboratory analytical reports are included in Appendix H of this document.

In contrast to the San Jose Aquifer (described below), shallow groundwater present near the Landfarm is believed to constitute a perched groundwater table consisting of meteoric water sitting on a shallow shale unit and strongly influenced by surface-water infiltration. In addition, given the large differences in depths to and presence of groundwater across the Landfarm, this perched-water zone likely is discontinuous and not a reliable source of water. Additional information regarding the shallowest fresh-groundwater aquifer is presented in Section 16.3 below.

16.3 19.15.36.8 (C)(15)(c): SHALLOWEST FRESH GROUNDWATER AQUIFER

Depth to, formation name, type and thickness of the shallowest freshwater aquifer;

As defined in 19.15.2.7 NMAC, an aquifer a “geologic formation, group of formations or a part of a formation that can yield a significant amount of water to a well or spring” and groundwater is defined as “interstitial water that occurs in saturated earth material and can enter a well in sufficient amounts to be used as a water supply”. To assess whether the lithologic unit and shallow water encountered in wells MW01 and MW03 constituted an aquifer and/or groundwater, a short-term pumping test was performed at the Landfarm. Based on the data, the sustainable yield for well MW01 is 36.9 gallons per day (gpd), approximately one-quarter of the value of 150 gpd that EPA indicates is required for a typical small household. At the desired minimum rate of 150 gpd, the water in the well will drop below the saturated interval. Groundwater was not encountered at any other interval while drilling wells/borings MW01, MW02, and MW03. Therefore, the perched saturated interval encountered in wells MW01 and MW03 does not meet the definition of aquifer because it does not yield a significant amount of water to a well, nor does it meet the definition of groundwater because it does not enter a well in sufficient amounts to be used as a water supply. No freshwater aquifer or groundwater as defined in 19.15.2.7 NMAC is present within 105 feet of the ground surface at the Landfarm. A description of the pumping test, results, and conclusions is provided in Appendix I.

According to Stone et al (1983) and Kernodle (1996), the shallowest aquifer in the area of the Landfarm is located within the San Jose Formation, which is the “youngest Tertiary bedrock unit in the San Juan Basin proper” (Stone 1983). The San Jose Formation was deposited in various fluvial-type environments. In general, the formation consists of an interbedded sequence of sandstone, siltstone, and shale. The occurrence of groundwater is mainly controlled by distribution of sandstone in the formation and is associated with alluvial and fluvial sandstone aquifers. The reported discharge from numerous groundwater wells completed in the San Jose Formation range from 216 to 87,840 gpd and with a median of 7,200 gpd. Most of the wells screened in this aquifer provide groundwater for livestock and domestic purposes (Stone, 1983).

In addition, depth-to-groundwater information was obtained from the New Mexico State Engineer's (NMOSE) iWaters Database for wells located within 4 miles of the Landfarm (included in Appendix J). The closest water well is approximately 1.8 miles to the east-southeast. In total, 18 wells were identified within a 4-mile radius, of which only nine have water rights for livestock, domestic, and/or industrial purposes (the other nine wells are for monitoring or have no water rights). Four of these wells have depth-to-groundwater information included in the iWaters Database, with groundwater ranging from 178 to 550 feet below ground surface (bgs). One additional well with no water rights (SJ00022) had depth-to-groundwater information at 120 feet bgs. Lithologic information included in several of the well summaries indicate that these wells are likely placed within a sandstone unit of the San Jose Formation.

16.4 19.15.36.8 (C)(15)(d): SOIL TYPES AND LITHOLOGY

Soil types beneath the proposed surface waste management facility, including a lithologic description of soil and rock members from ground surface down to the top of the shallowest freshwater aquifer;

LTE used lithologic logs from on-site borings (locations shown on Figure 7) and published documentation/regional geologic mapping to determine soil types and lithology on the Landfarm. On-site borings encountered silty sand and clay up to 23 feet bgs. Unconsolidated soil in the region generally is sourced from Quaternary-age valley-fill deposits. Sandstone and interbedded thin shale units were present below the soil to the terminus depths of each boring. Lithologic logs for onsite borings are attached in Appendix K.

Based on geologic mapping of the San Juan Basin, these units are believed to be included in the San Jose Geologic Formation, which is the "youngest Tertiary bedrock unit in the San Juan Basin proper" (Stone et al, 1983). The San Jose Formation was deposited in various fluvial-type environments. In general, lithology of the San Jose Formation consists of thinly interbedded sandstones and shales and ranges in thickness from less than 200 feet to approximately 2,700 feet in the San Juan Basin (Stone, 1983). The occurrence of groundwater within this formation is mainly controlled by distribution of sandstone and is associated with alluvial and fluvial sandstone aquifers.

Figure 8, 9, 10A, and 10B present additional siting criteria as specified in Subsections A, B, and C of 19.15.36.13 NMAC. Figure 8 presents the proximity of subsurface mines in relation to the Landfarm boundary. No subsurface mines are located within a one mile radius of the Landfarm. Figure 9 presents the proximity of permanent residences, hospitals, institutions, and churches within a 500-foot radius of the Landfarm. Figures 10A and 10B indicates that there are no unstable areas are located within the Landfarm boundary. Subsurface mines and karst geologic features are not present near the Landfarm location and no known faults or seismic activity are associated with this area.

16.5 19.15.8.13 (C)(15)(e): GEOLOGIC CROSS-SECTIONS

Geologic cross-sections;

The location of geologic cross section A to A' is shown on Figure 11, with the interpreted cross section presented on Figure 12.

16.6 19.15.8.13 (C)(15)(f): POTENTIOMETRIC MAPS

Potentiometric maps for the shallowest freshwater aquifer;

Groundwater elevation contours for the shallowest freshwater aquifer located in the San Jose Formation have been interpreted using depth-to-groundwater information for wells included in the NMOSE iWaters Database. Wells located within 4 miles of the Landfarm with depth-to-water information were used to calculate groundwater elevations, with surface-elevation data obtained from ArcGIS at each well location. Groundwater elevations were calculated by subtracting the depth-to-groundwater data from the ground-surface elevation. Groundwater elevation contours were interpreted from these data and are presented in Appendix J. Based on this interpretation, groundwater generally flows to the east in the vicinity of the Landfarm towards the Los Pinos River and Navajo Lake.

Depth-to-groundwater and flow direction near the Landfarm correlates with the information provided in *Hydrogeology and Steady-State Simulation of Ground-Water Flow in the San Juan Basin, New Mexico, Colorado, Arizona, and Utah* (Kernodle, 1996). Kernodle's description of the San Jose Aquifer and his interpreted groundwater-flow direction to the east-southeast towards the Los Pinos River and Navajo Lake support the interpretation of the local hydrogeologic conditions near the Landfarm.

16.7 19.15.36.8 (C)(15)(g): SUBSURFACE CHARACTERISTICS

Porosity, permeability, conductivity, compaction ratios and swelling characteristics for the sediments on which the contaminated soils will be placed;

In October 2019, LTE retained Trautner Geotech, LLC (geotechnical engineering contractor) to assess several geotechnical parameters required for the Landfarm. During their work, three continuous flight auger borings were advanced at the same general location to depths of five feet bgs (location shown on Figure 7). Soil samples were collected to perform the following laboratory tests:

- Moisture content-dry density relationships (Proctor Compaction Test)
- Moisture content
- Porosity
- Hydraulic conductivity
- Sieve/grain-size analysis
- Atterberg Limits
- Swelling Characteristics

A Proctor Compaction Test was run on a composite sample with soil from all three borings. The test indicated a maximum dry density of 117.3 pounds per cubic foot and optimum moisture content of 13.7 percent (%). Tests indicated a soil-moisture content of 13.0%, dry bulk density of 1.85 grams per cubic meter (g/cm^3), porosity of 37.2%, and effective porosity of 22.2%. The hydraulic conductivity was tested for each boring, with values ranging from 4.7 X 10^{-6} centimeters per second (cm/sec) to 7.11 X 10^{-6} cm/sec.

The grain-size analysis indicates that the material is classified as a “sandy lean clay” with a Unified Soil Classification System (USCS) description of CL (lean clay). The Atterberg Limits results indicated a plastic limit of 16%, a liquid limit of 32%, and a plasticity index of 16 (medium plasticity). The degree of swelling in the three collected samples ranged from 3.0 to 3.8 percent. The geotechnical laboratory reports are attached as Appendix L. The results from the geotechnical borings and testing results indicate the conditions encountered are suitable for development of the location as a landfarm facility.

17.0 WAIVER REQUEST: 19.15.36.19 (A)

In accordance with Subsection A of 19.15.36.19 NMAC, Hilcorp is requesting a waiver from certain requirements specified in 19.15.36 NMAC. The following alternatives regarding operations, maintenance, and monitoring provide equivalent protection of fresh water, public health, and the environment.

17.1 APPENDIX B, SECTION 4.3

As stated in 19.15.36.15 (C)(5), soils at the Landfarm are required to be disked biweekly. This requirement will generally be satisfied. However, Hilcorp is requesting that disking be postponed during winter or adverse conditions that prevent disking (e.g., frozen ground) and/or prevent access to the Landfarm (e.g., muddy/impassable roads). Disking frozen ground is more dangerous and not effective for remediating contaminants bound in soil. Disking is generally a remediation function and delaying it by weeks does not introduce an increased risk to public health safety or the environment. In addition, because the ground is frozen, contaminants are less likely to migrate vertically to groundwater or laterally to surface water.

Biweekly disking will resume once conditions allow Landfarm access and the ability to disk the soil to the appropriate depths (at least 8 inches).

17.2 APPENDIX C, SECTION 2.2

As stated in 19.15.36.13 (L)(2), the *Inspection and Maintenance Plan* (Appendix C) should “include semi-annual inspection and sampling of monitoring wells as required”. As presented in Section 16.0 above, groundwater at the Landfarm is greater than 100 feet below ground surface. Due to the vertical distance between the treatment zone and groundwater, vertical migration would take years to achieve. With ongoing remediation, potential contaminant concentrations are constantly degraded/reduced, making migration even less likely. Additionally, ongoing monitoring of the treatment and vadose zone soils will document any vertical or lateral migration of contaminants. If abatement is necessary, additional risk to groundwater can be assessed/addressed at that time.

17.3 HYDROGEN SULFIDE PREVENTION AND CONTINGENCY PLAN, 19.15.36.8(C)(8)

As stated in Section 9.0 above, hydrogen sulfide is not anticipated to be present in soils accepted at the Landfarm nor produced during remediation operations. Because of this a hydrogen sulfide prevention and contingency plan has not been prepared for the Landfarm that meets the standards set forth in 19.15.11 NMAC nor API document RP-55. However, in order to be overly conservative, information regarding a potential release of hydrogen sulfide at the Landfarm has been included in the *Contingency Plan* attached as Appendix E. in Section 10.0 below. In the case that hydrogen sulfide is detected at the Landfarm, a hydrogen sulfide prevention and contingency plan will be prepared in accordance with the 19.15.11 NMAC and the American Petroleum Institute (API) document RP-55. The plan will be submitted for NMOCD review and approval prior to implementation.

18.0 REFERENCES

Kernodle, J. M. (1996). *Hydrogeology and Steady-State Simulation of Ground-Water Flow in the San Jan Basin, New Mexico, Colorado, Arizona, and Utah.* Albuquerque: United States Geological Survey.

Stone, W., Lyford, F., Frenzel, P., Mizell, N., & Padgett, E. (1983). *Hydrogeology and Water Resources of San Juan Basin, New Mexico.* New Mexico Bureau of Mines & Mineral Resources.

New Mexico Oil Conservation Division on-line well log database.

U.S. Geological Survey, various water well logs.

FIGURES

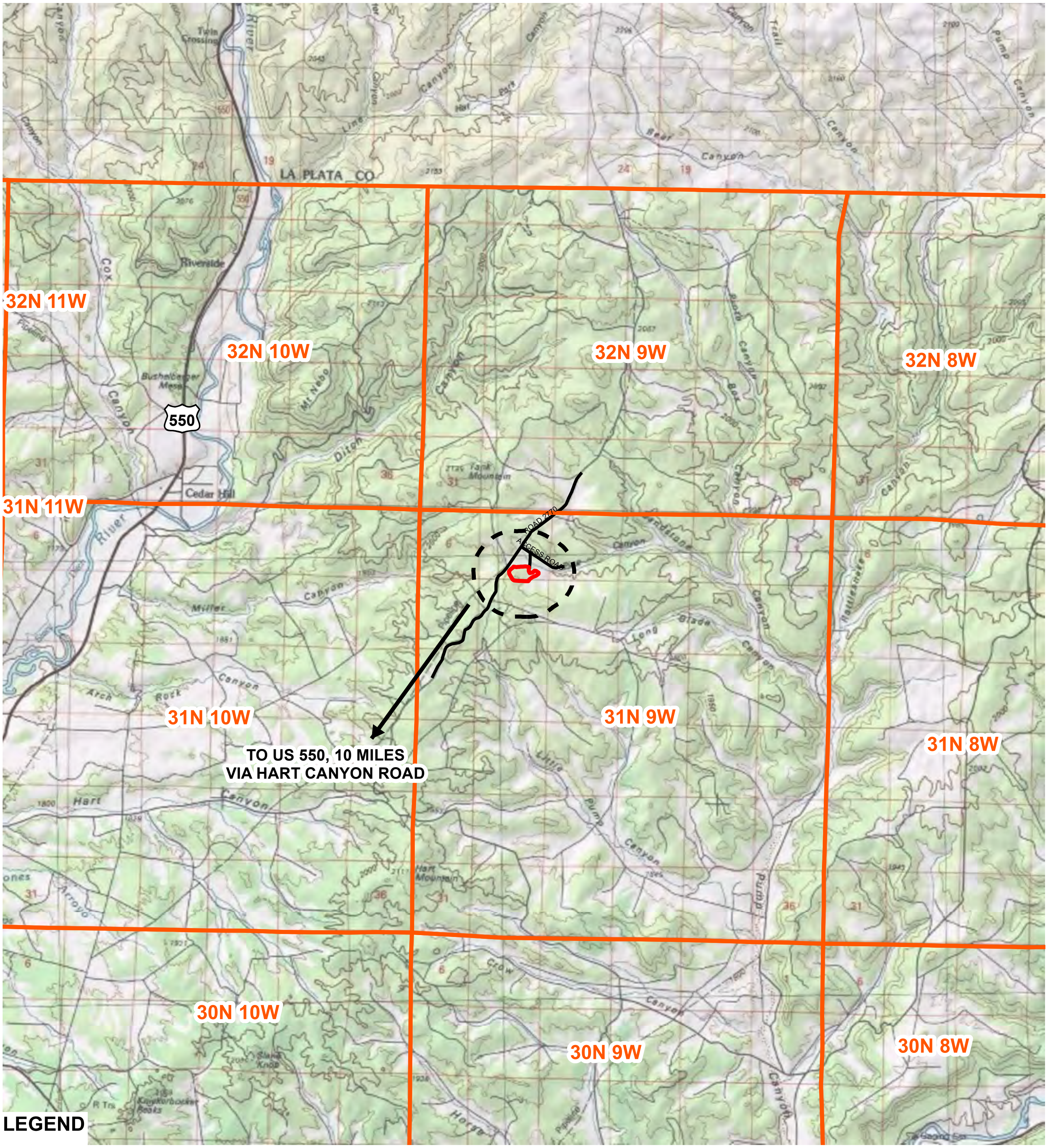


IMAGE COURTESY OF ESRI/USGS

LEGEND

ROAD

TANK MOUNTAIN LANDFARM BOUNDARY

TOWNSHIP AND RANGE

HALF-MILE RADIUS

NOTE:
SITE IS NOT WITHIN A HALF-MILE OF ANY SITES INTENDED FOR HUMAN OCCUPANCY (SIHO). AERIAL AND SATELLITE IMAGERY INTERPRETATION FOR SIHO LOCATIONS WERE CONDUCTED USING GOOGLE EARTH IMAGERY ACQUIRED IN 2019.

0 2 4
Miles

N

FIGURE 1A
SITE LOCATION MAP
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

P:\Hilcorp\GIS\MXD\017818018_LANDFARM PERMITTING\TANK MOUNTAIN\2020_UPDATES\017818018_FIG01A_TANK MOUNTAIN_PLAT_TOPO_2020.mxd

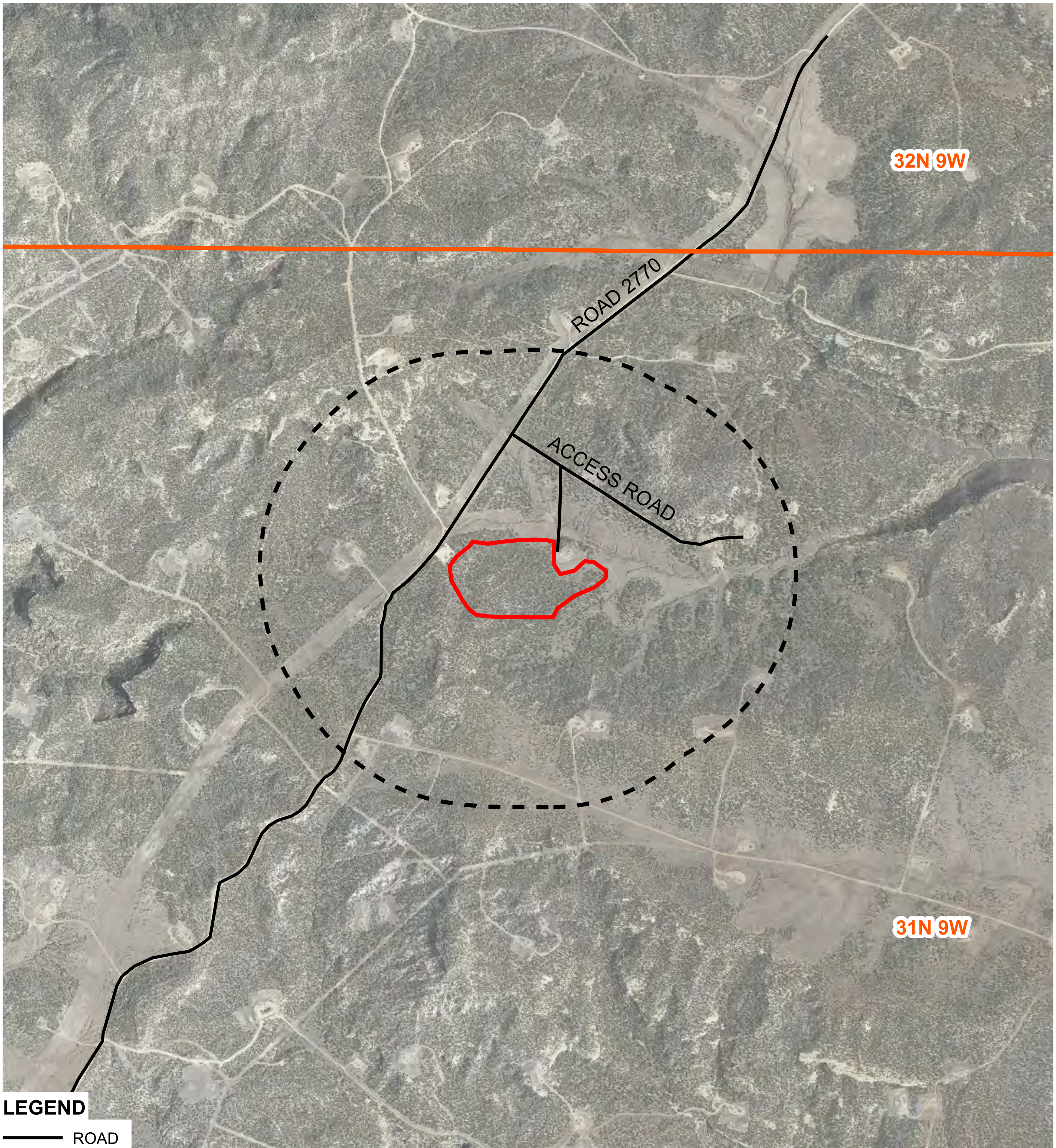


IMAGE COURTESY OF GOOGLE EARTH 2019

LEGEND

- ROAD
- TANK MOUNTAIN LANDFARM BOUNDARY
- TOWNSHIP AND RANGE
- HALF-MILE RADIUS

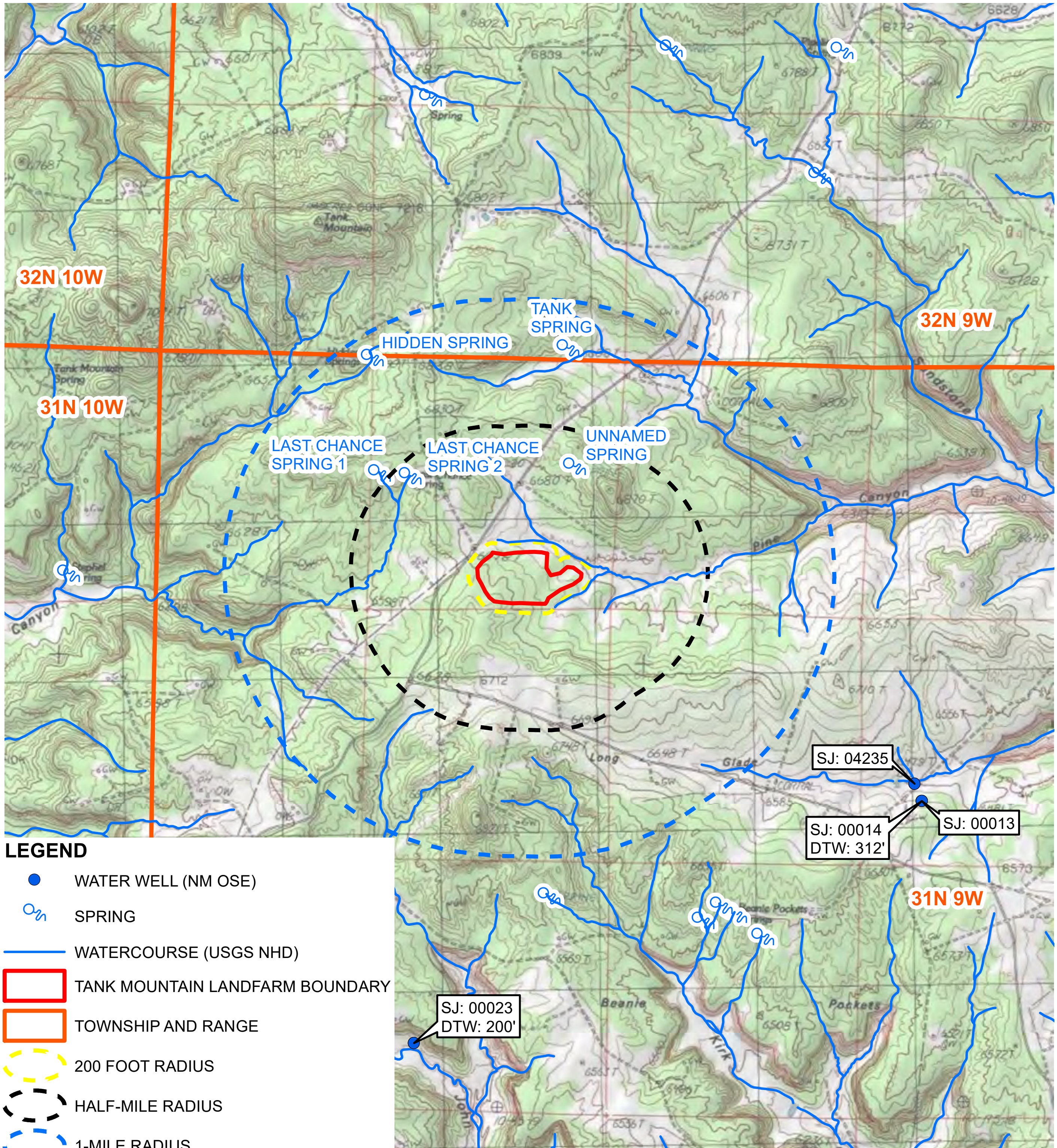
0 2,000 4,000
Feet

N

NOTE:
SITE IS NOT WITHIN A HALF-MILE OF ANY SITES INTENDED FOR HUMAN OCCUPANCY (SIHO). AERIAL AND SATELLITE IMAGERY INTERPRETATION FOR SIHO LOCATIONS WERE CONDUCTED USING GOOGLE EARTH IMAGERY ACQUIRED IN 2019.

FIGURE 1B
SITE MAP
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

P:\Hilcorp\GIS\MXD\017818018_LANDFARM PERMITTING\TANK MOUNTAIN\2020_UPDATES\017818018_FIG01B_TANK MOUNTAIN_PLAT_AERIAL_2020.mxd



NOTE:
ACCORDING TO 19.15.2 NMAC, A WELLHEAD PROTECTION AREA CONSISTS OF THE AREA WITHIN 200 HORIZONTAL FEET OF A PRIVATE, DOMESTIC FRESH WATER WELL OR SPRING USED BY <5 HOUSEHOLDS FOR DOMESTIC OR STOCK WATERING PURPOSE, OR WITHIN 1,000 HORIZONTAL FEET OF ANY OTHER FRESH WATER WELL OR SPRING. NO USGS WELLS IN AREA PER NWIS.

DTW: DEPTH TO WATER
ELEV: APPROXIMATE ELEVATION IN FEET ABOVE MEAN SEA LEVEL
NM OSE: NEW MEXICO OFFICE OF THE STATE ENGINEER
': FEET

FIGURE 2
SITE RECEPTOR MAP
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

P:\Hilcorp\GIS\MXD\017818018_LANDFARM PERMITTING\TANK MOUNTAIN\2020_UPDATES\017818018_FIG02_TANK MOUNTAIN_HYDRO_REC_2020.mxd

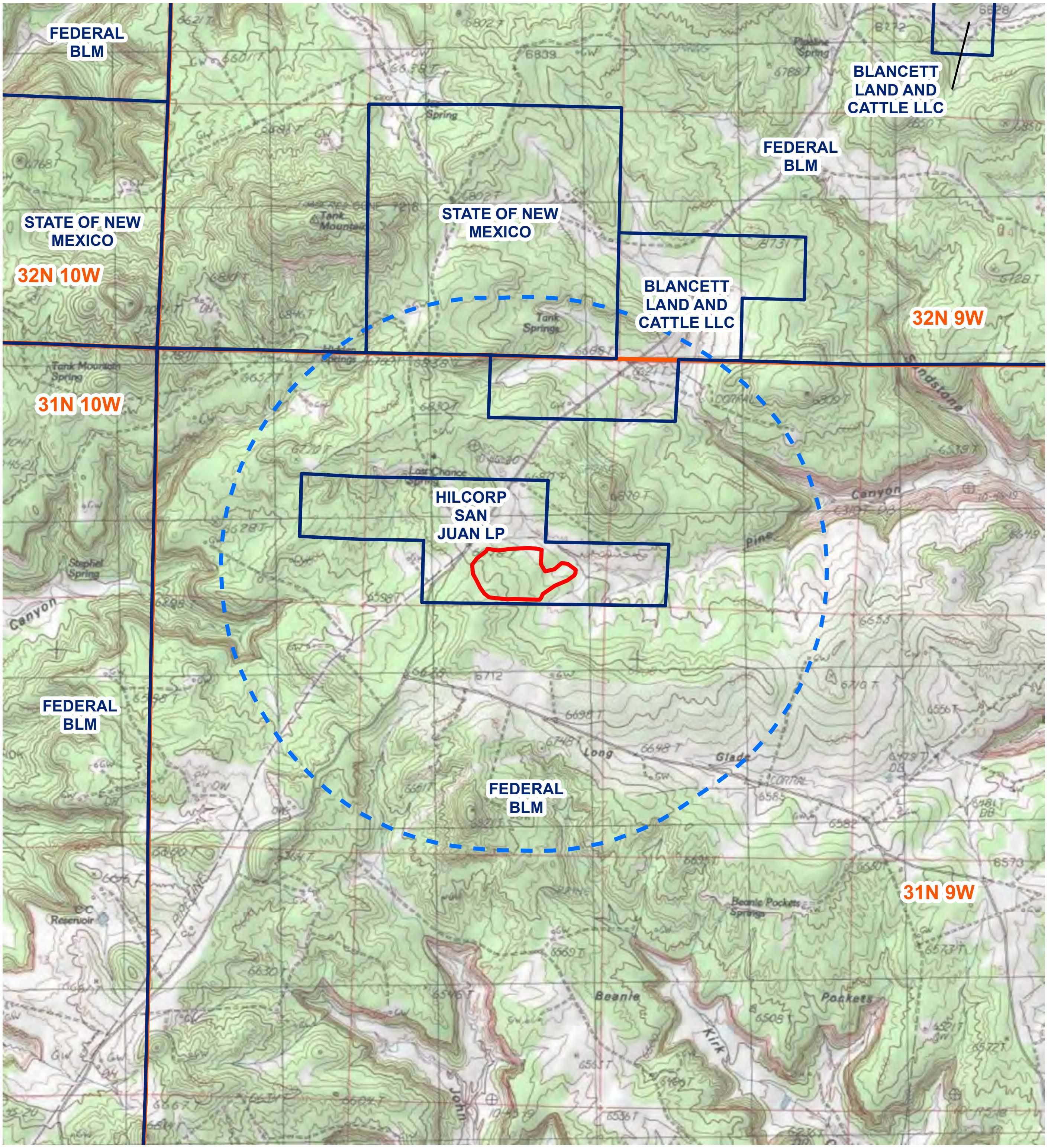


IMAGE COURTESY OF ESRI/USGS

LEGEND

- TANK MOUNTAIN LANDFARM BOUNDARY
- TOWNSHIP AND RANGE
- PARCEL BOUNDARY
- 1-MILE RADIUS

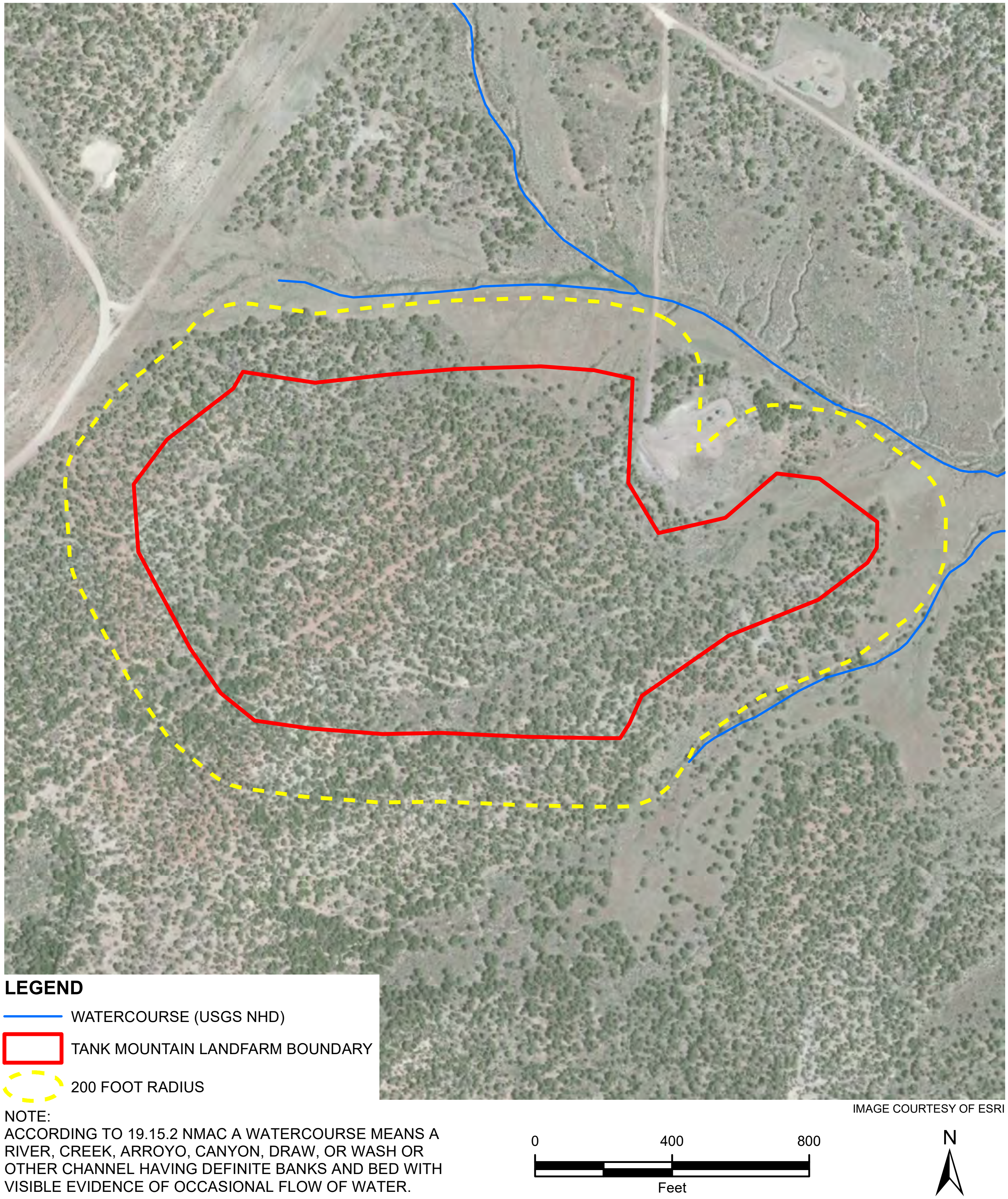
BLM: BUREAU OF LAND MANAGEMENT

0 3,000 6,000
Feet

N

FIGURE 3
LAND OWNERSHIP-PARCEL MAP
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

P:\Hilcorp\GIS\MXD\017818018_LANDFARM PERMITTING\TANK MOUNTAIN\2020_UPDATES\017818018_FIG03_TANK MOUNTAIN_LAND OWNERS_2020.mxd



NOTE:
ACCORDING TO 19.15.2 NMAC A WATERCOURSE MEANS A RIVER, CREEK, ARROYO, CANYON, DRAW, OR WASH OR OTHER CHANNEL HAVING DEFINITE BANKS AND BED WITH VISIBLE EVIDENCE OF OCCASIONAL FLOW OF WATER.

THERE ARE NO SINKHOLES, LAKEBEDS OR PLAYA LAKES WITHIN THE BOUNDARIES OF THIS MAP USING MAPPED DATA FROM THE USFS NWI.

NHD: NATIONAL HYDROGRAPHY DATASET
NMAC: NEW MEXICO ADMINISTRATIVE CODE
NM OSE: NEW MEXICO OFFICE OF THE STATE ENGINEER
USGS: UNITED STATES GEOLOGICAL SURVEY

FIGURE 4
PROXIMITY TO WATERCOURSE, LAKEBED, SINKHOLE, OR PLAYA LAKE
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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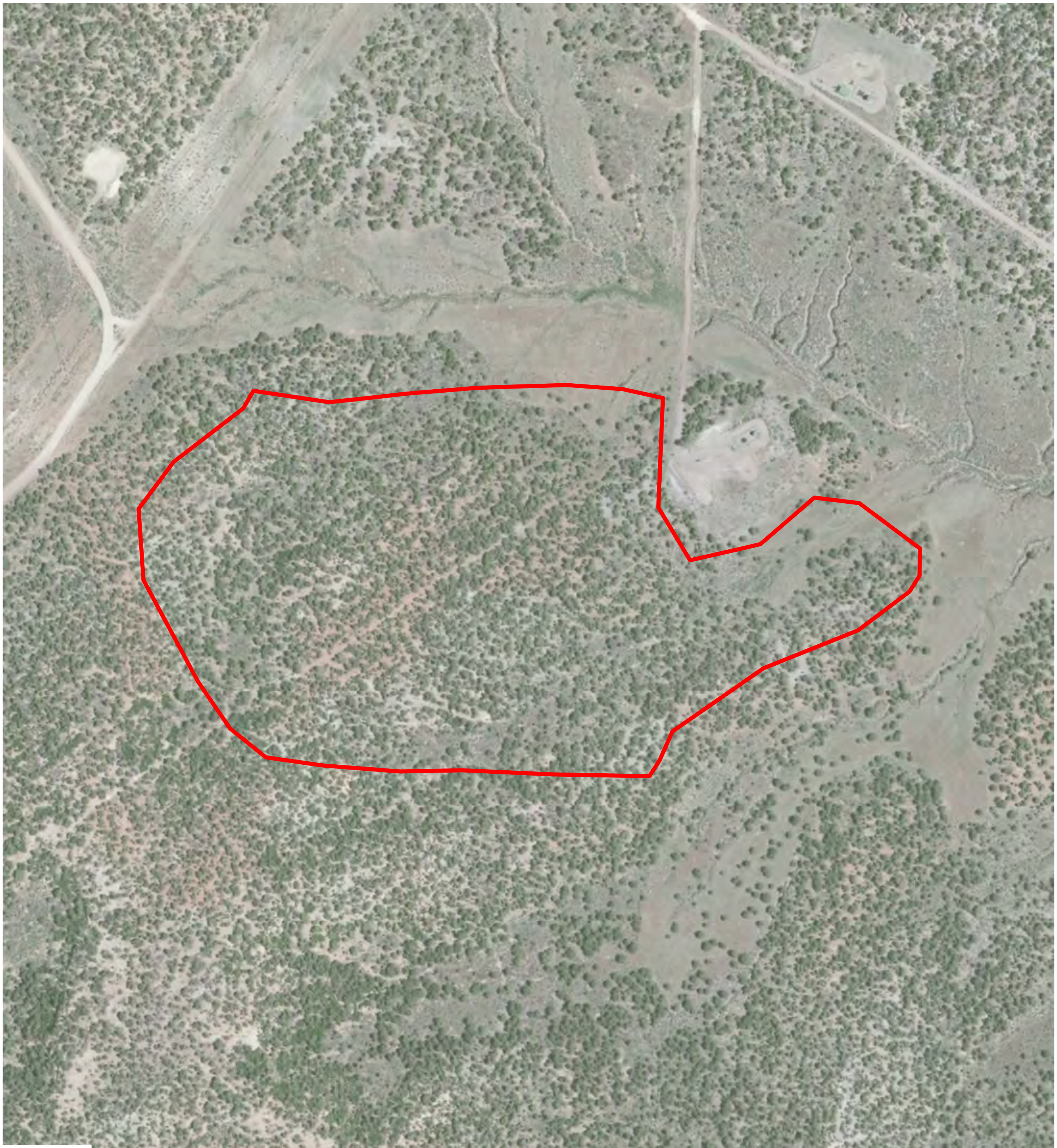

LEGEND

TANK MOUNTAIN LANDFARM BOUNDARY

FEMA FLOOD ZONE CLASSIFICATION

NO SCREEN INDICATES ZONE X - AREA OF MINIMAL FLOOD HAZARD

IMAGE COURTESY OF ESRI

0 400 800
Feet

N

NOTE:
SITE IS WITHIN AN AREA OF MINIMAL FLOOD HAZARD DEFINED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA).
SOURCE: FEMA FLOOD MAP NUMBER 35045CO425F/ZONE X

FIGURE 5A
PROXIMITY TO 100 YEAR FLOODPLAIN
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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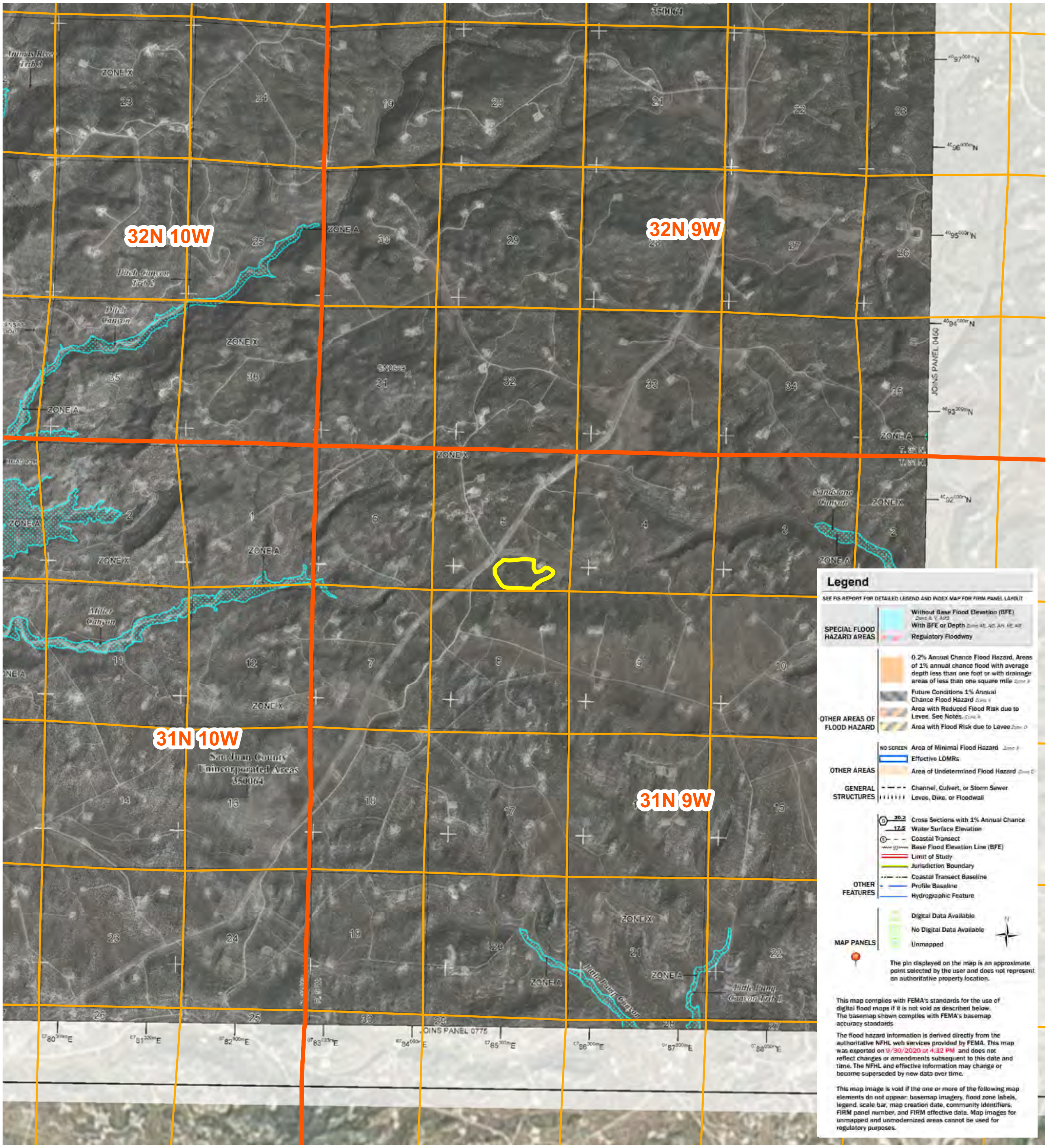

IMAGE COURTESY OF ESRI

LEGEND

- TANK MOUNTAIN LANDFARM BOUNDARY
- SECTION
- TOWNSHIP AND RANGE

0 1 2
Miles

N

NOTE:
SITE IS WITHIN AN AREA OF MINIMAL FLOOD HAZARD DEFINED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA).
SOURCE: FEMA FLOOD MAP NUMBER 35045CO425F/ZONE X

FIGURE 5B
FEMA FIRM MAP
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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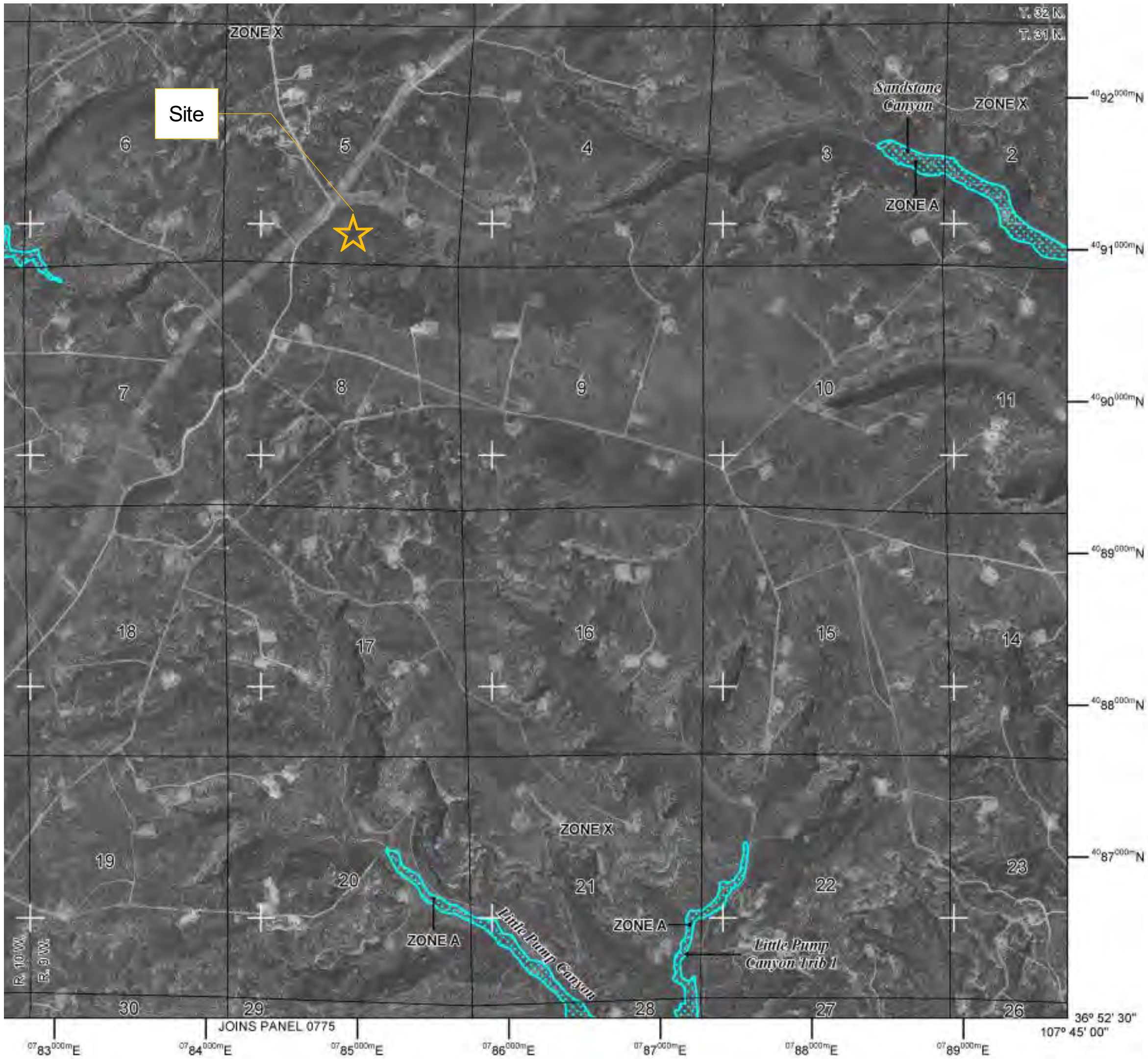
FIGURE 5C
FEMA FIRM PANEL
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY



EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 2000'

1000 0 2000 4000 FEET

600 0 600 1200 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0425F

FIRM

FLOOD INSURANCE RATE MAP

SAN JUAN COUNTY,
NEW MEXICO
AND INCORPORATED AREAS

PANEL 425 OF 2750

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

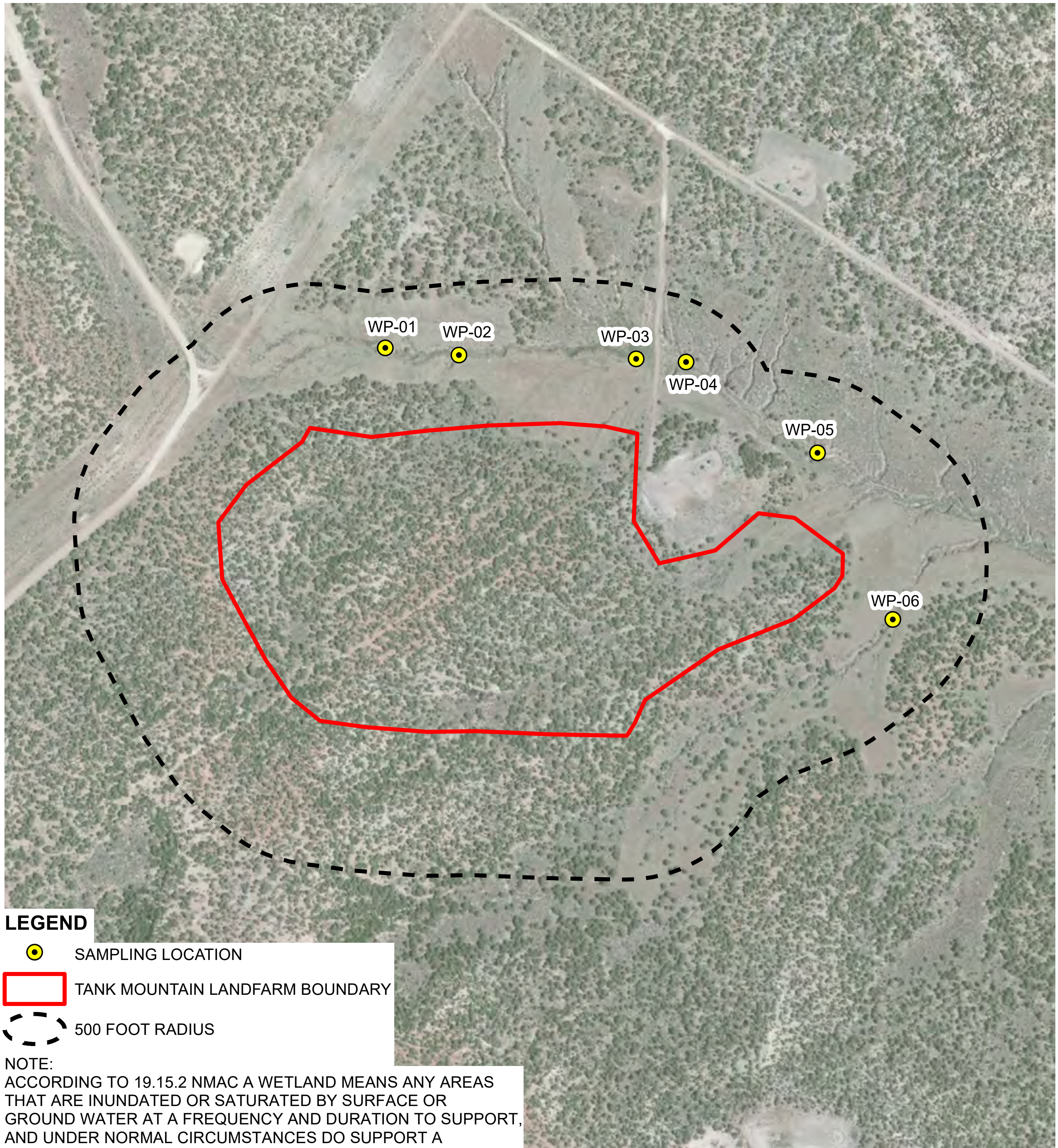
COMMUNITY	NUMBER	PANEL	SUFFIX
SAN JUAN COUNTY	350064	0425	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
35045C0425F

EFFECTIVE DATE
AUGUST 5, 2010

Federal Emergency Management Agency



NOTE:
ACCORDING TO 19.15.2 NMAC A WETLAND MEANS ANY AREAS THAT ARE INUNDATED OR SATURATED BY SURFACE OR GROUND WATER AT A FREQUENCY AND DURATION TO SUPPORT, AND UNDER NORMAL CIRCUMSTANCES DO SUPPORT A PREVALENCE OF VEGETATION TYPICALLY ADAPTED FOR LIFE IN SATURATED SOILS IN NEW MEXICO.
ACCORDING TO THE FGDC CLASSIFICATION OF WETLANDS AND DEEPWATER HABITATS (FGDC-STD-004-2013), A RIVERINE SUBSYSTEMS INCLUDES CHANNELS THAT CONTAIN FLOWING WATER ONLY PART OF THE YEAR. WHEN WATER IS NOT FLOWING, IT MAY REMAIN IN ISOLATED POOLS OR SURFACE WATER MAY BE ABSENT.
NO WETLANDS ARE PRESENT WITHIN 500 FEET OF THE LANDFARM BOUNDARY BASED ON A WETLAND DELINEATION SURVEY PERFORMED BY LTE
FGDC: FEDERAL GEOGRAPHIC DATA COMMITTEE
NMAC: NEW MEXICO ADMINISTRATIVE CODE
NWI: NATIONAL WETLAND INVENTORY
USFS: UNITED STATES FISH AND WILDLIFE SERVICE

FIGURE 6
PROXIMITY TO WETLANDS
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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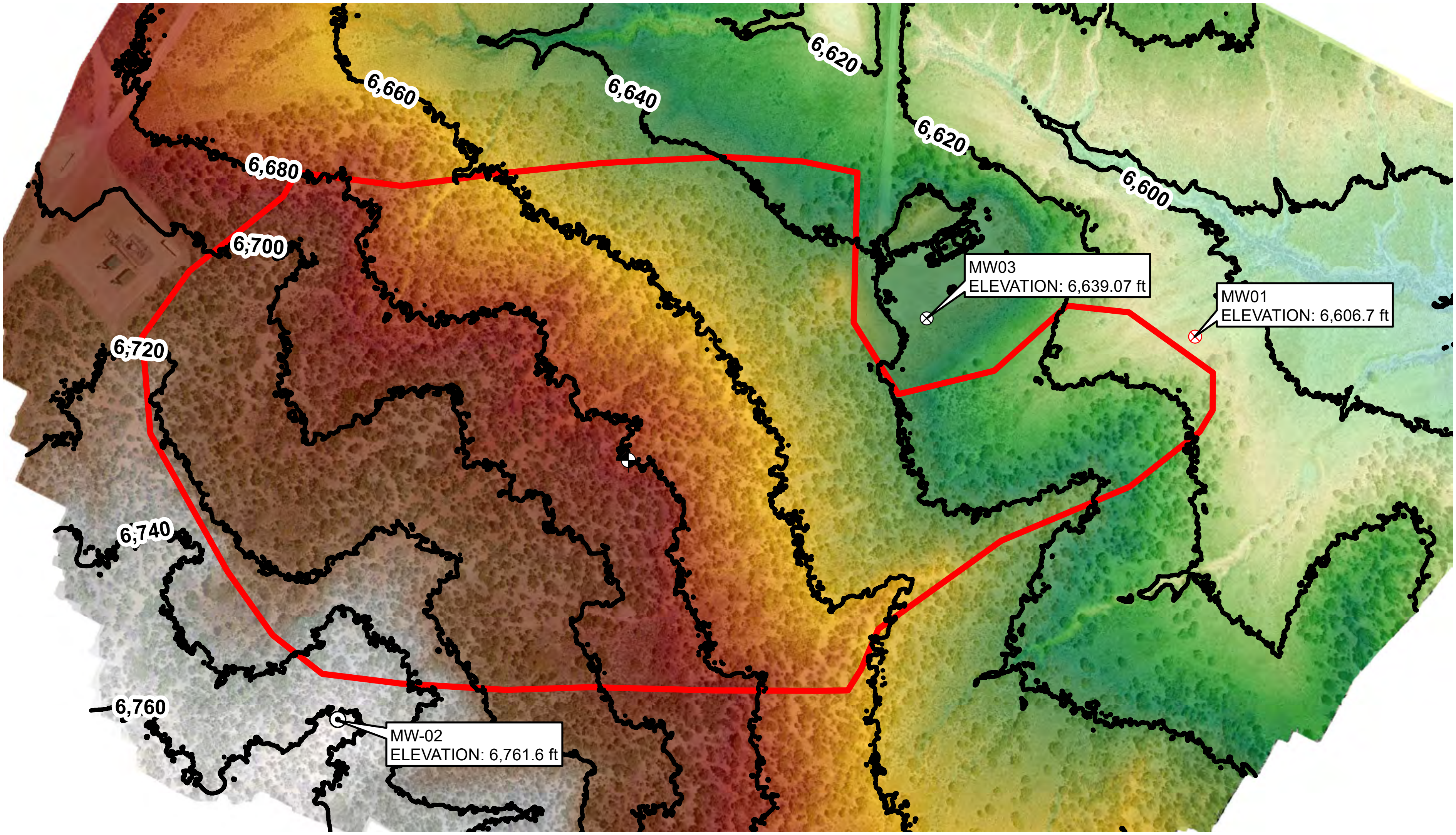

IMAGE: LTE DRONE SURVEY JUNE 19, 2019

LEGEND

- HIGHEST ELEVATION SOIL BORING / WELL LOCATION
- LOWEST ELEVATION SOIL BORING / WELL LOCATION
- SOIL BORING / WELL LOCATION
- GEOTECH SAMPLE LOCATION
- GROUND ELEVATION CONTOUR (20 FT)
- TANK MOUNTAIN LANDFARM BOUNDARY

ELEVATION

High : 6,780 FT

Low : 6,580 FT

0 300 600

Feet

N

FIGURE 7
BORING/WELL LOCATIONS
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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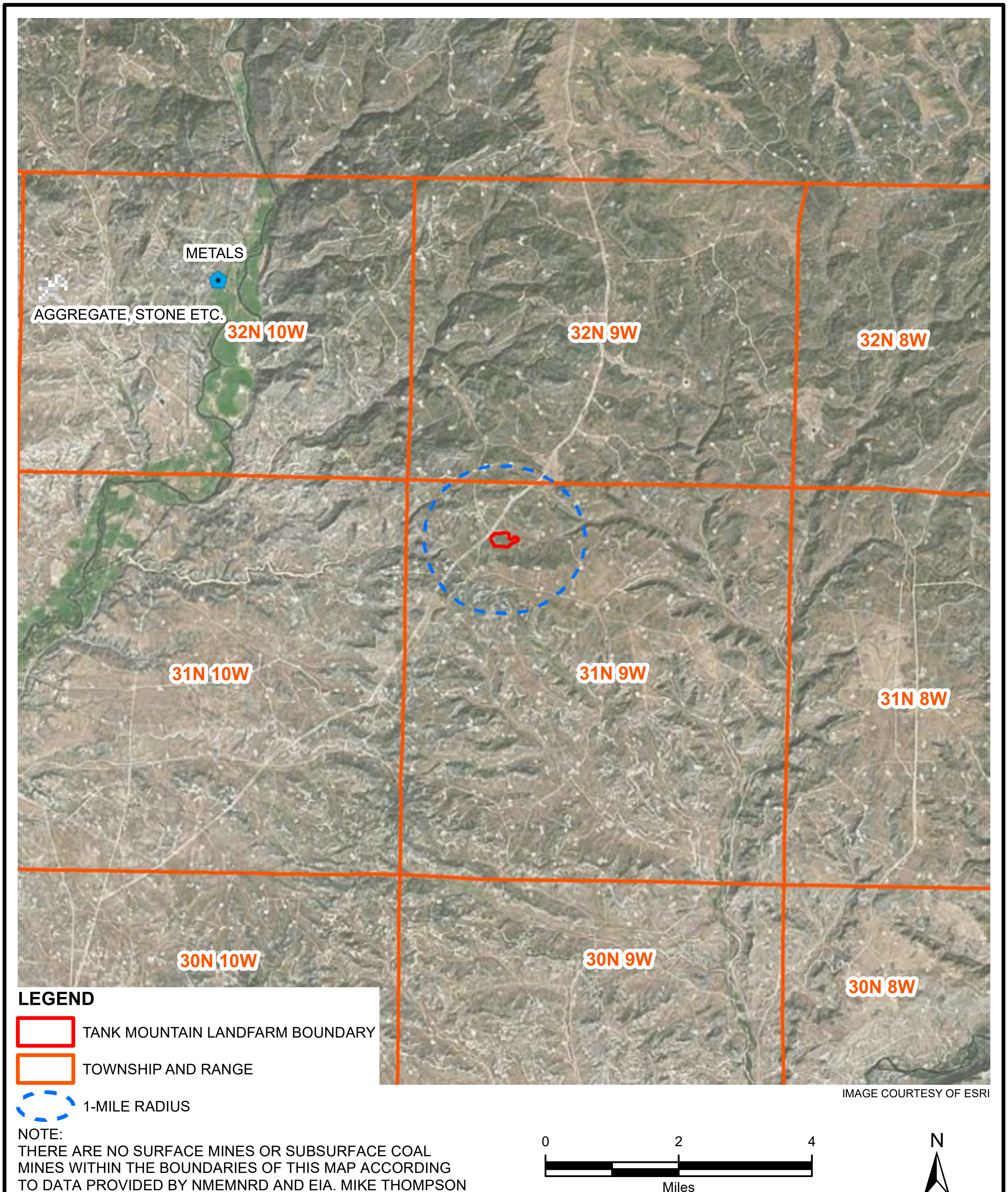

NOTE:
THERE ARE NO SURFACE MINES OR SUBSURFACE COAL MINES WITHIN THE BOUNDARIES OF THIS MAP ACCORDING TO DATA PROVIDED BY NMEMNRD AND EIA. MIKE THOMPSON (505-476-4327) WITH NMEMNRD WAS CONTACTED TO CONFIRM THAT THE NEW MEXICO ABANDONED MINE LAND PROGRAM HAS NO RECORD OF UNDERGROUND MINES IN THIS AREA.

EIA: ENERGY INFORMATION ADMINISTRATION
NMEMNRD: NEW MEXICO ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

FIGURE 8
PROXIMITY TO SUBSURFACE MINE
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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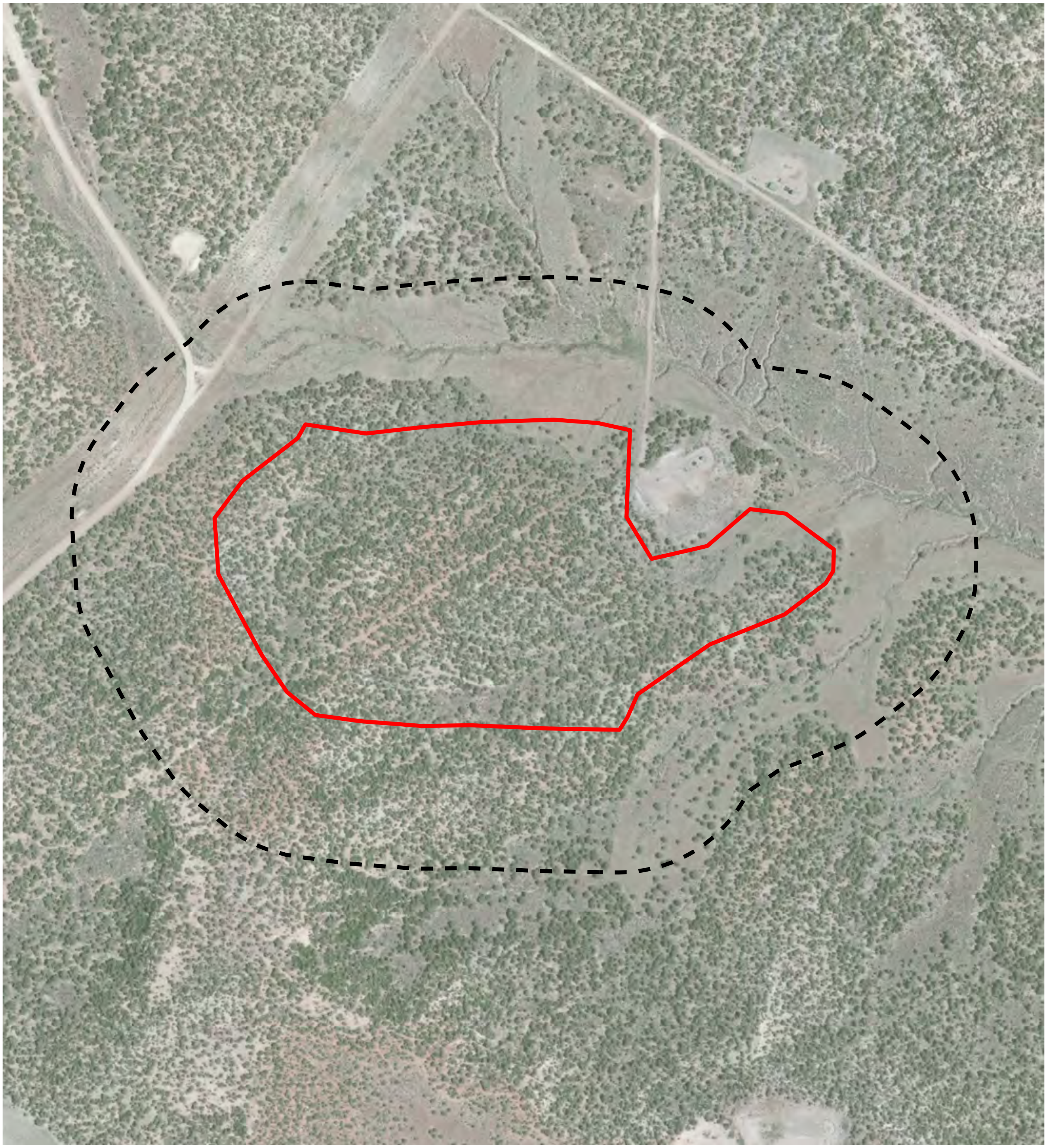

IMAGE COURTESY OF ESRI

LEGEND

TANK MOUNTAIN LANDFARM BOUNDARY

500 FOOT RADIUS

0 500 1,000

Feet

N

NOTE:
SITE IS NOT WITHIN 500 FEET OF ANY SITES INTENDED FOR HUMAN OCCUPANCY (SIHO). AERIAL AND SATELLITE IMAGERY INTERPRETATION FOR SIHO LOCATIONS WERE CONDUCTED USING GOOGLE EARTH IMAGERY ACQUIRED IN 2016. FIELD VERIFICATION CONDUCTED IN SUMMER 2019.

FIGURE 9
PROXIMITY TO PERMANENT RESIDENCE, SCHOOL, HOSPITAL, INSTITUTION, OR CHURCH
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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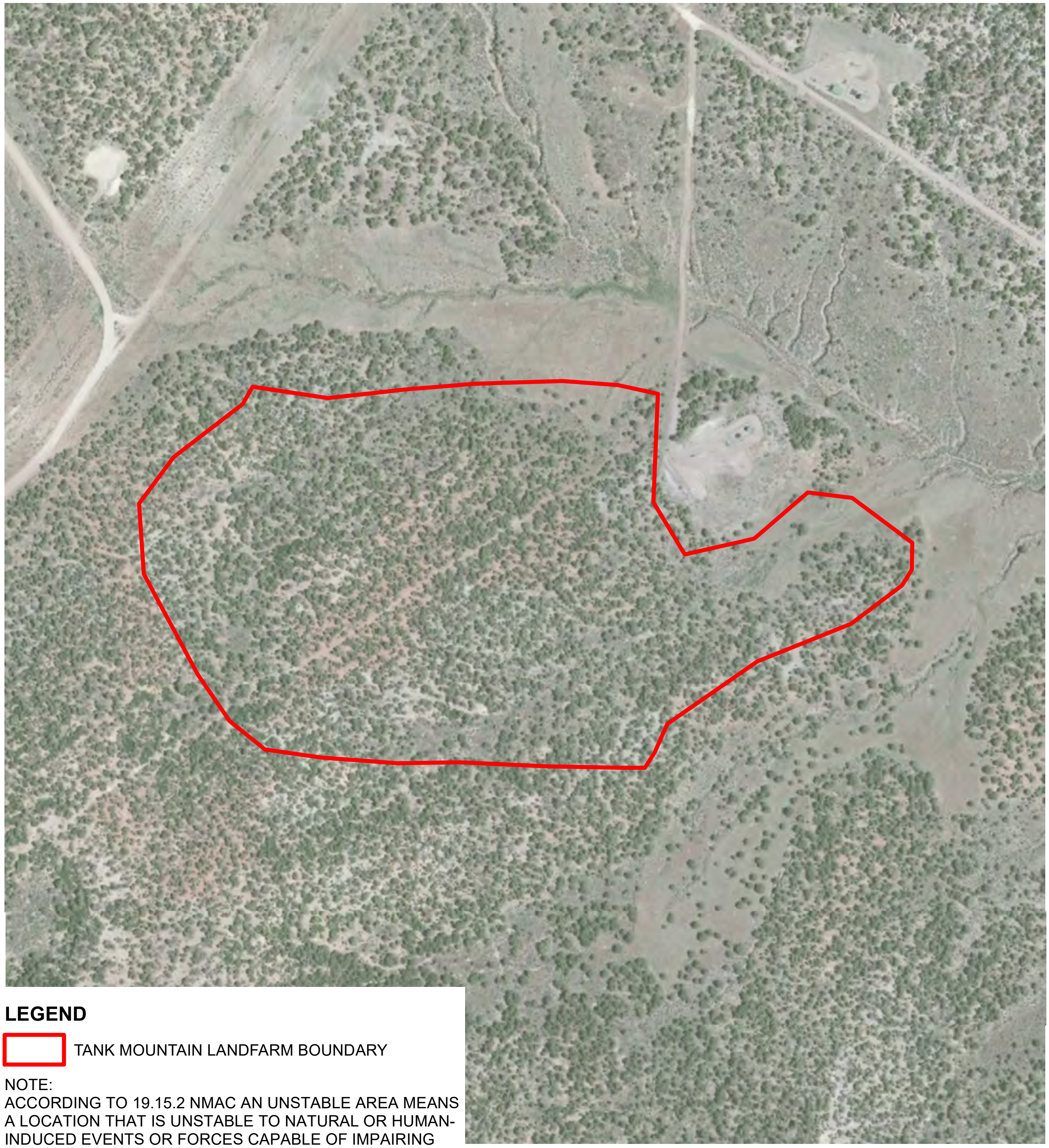

LEGEND

TANK MOUNTAIN LANDFARM BOUNDARY

NOTE:
ACCORDING TO 19.15.2 NMAC AN UNSTABLE AREA MEANS A LOCATION THAT IS UNSTABLE TO NATURAL OR HUMAN-INDUCED EVENTS OR FORCES CAPABLE OF IMPAIRING THE DIVISION-APPROVED FACILITY'S STRUCTURAL COMPONENTS.

SITE RESIDES WITHIN THE USGS SAN JOSE GEOLOGIC FORMATION WHICH EXHIBITS MEDIUM-GRAINED, MIXED CLASTIC MATERIAL AND IS NOT ASSOCIATED WITH KARST GEOLOGIC ENVIRONMENT. THERE ARE NO FAULTS WITHIN THE BOUNDARIES OF THIS MAP AND NO KNOWN SEISMIC ACTIVITY ACCORDING TO DATA PROVIDED BY THE USGS MOUNT NEBO QUADRANGLE ID 36107-H7

NMAC: NEW MEXICO ADMINISTRATIVE CODE
USGS: USGS: UNITED STATES GEOLOGICAL SURVEY

0 400 800
Feet

N

FIGURE 10A
PROXIMITY TO UNSTABLE AREA
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

P:\Hilcorp\GIS\MXD\017818018_LANDFARM PERMITTING\TANK MOUNTAIN\2020_UPDATES\017818018_FIG09_TANK MOUNTAIN_GEOLOGY_2020.mxd

IMAGE COURTESY OF USGS

LEGEND

★ TANK MOUNTAIN LANDFARM

Tsr: San Jose Formation

0 1.25 2.5
Miles

N

FIGURE 10B
USGS GEOLOGIC QUADRANGLE - MOUNT NEBO
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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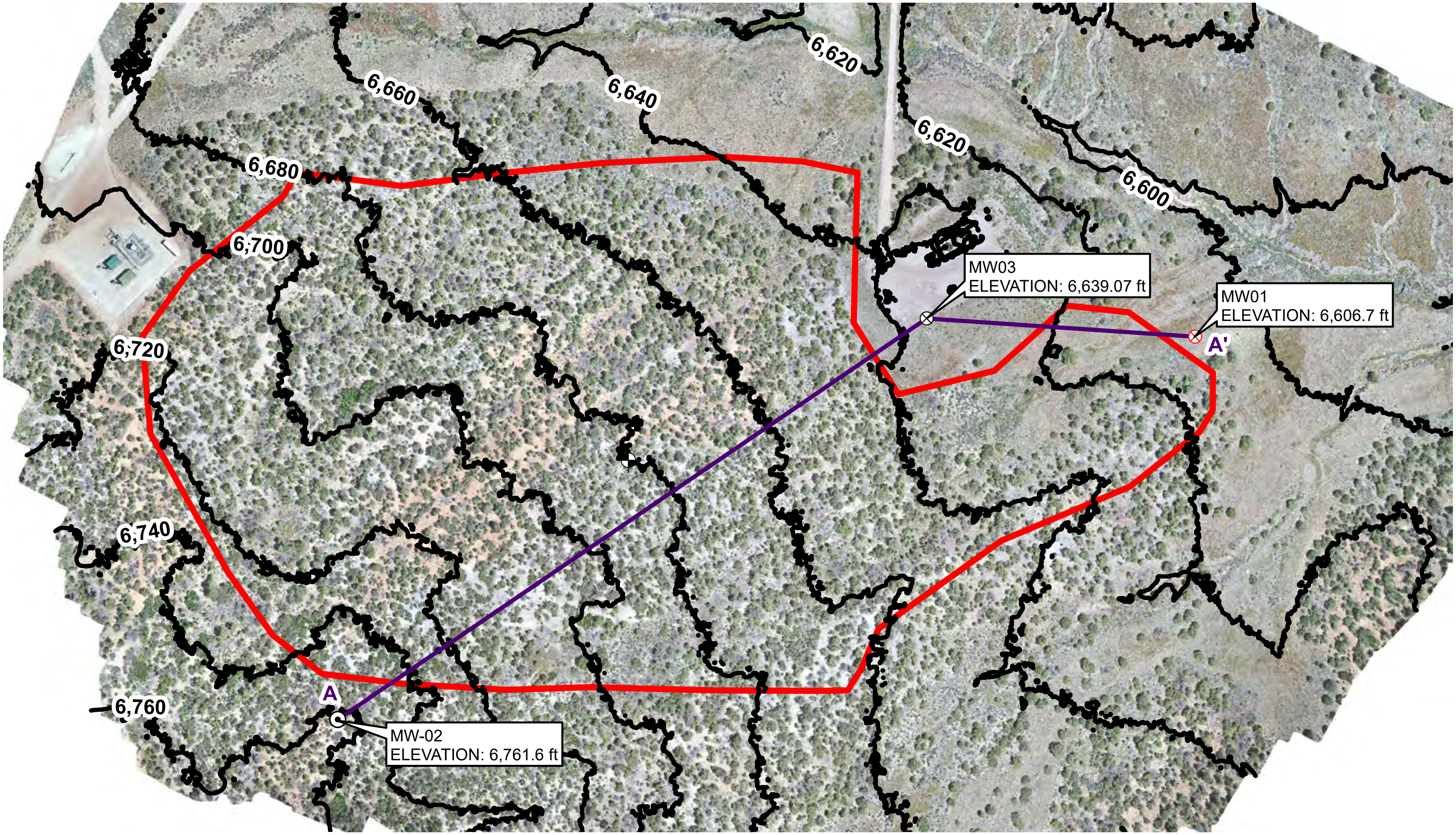

LEGEND

- HIGHEST ELEVATION SOIL BORING / WELL LOCATION
- LOWEST ELEVATION SOIL BORING / WELL LOCATION
- SOIL BORING / WELL LOCATION
- GEOTECH SAMPLE LOCATION
- GROUND ELEVATION CONTOUR (20 FT)
- CROSS SECTION A - A'
- TANK MOUNTAIN LANDFARM BOUNDARY

FIGURE 11
CROSS SECTION LOCATION
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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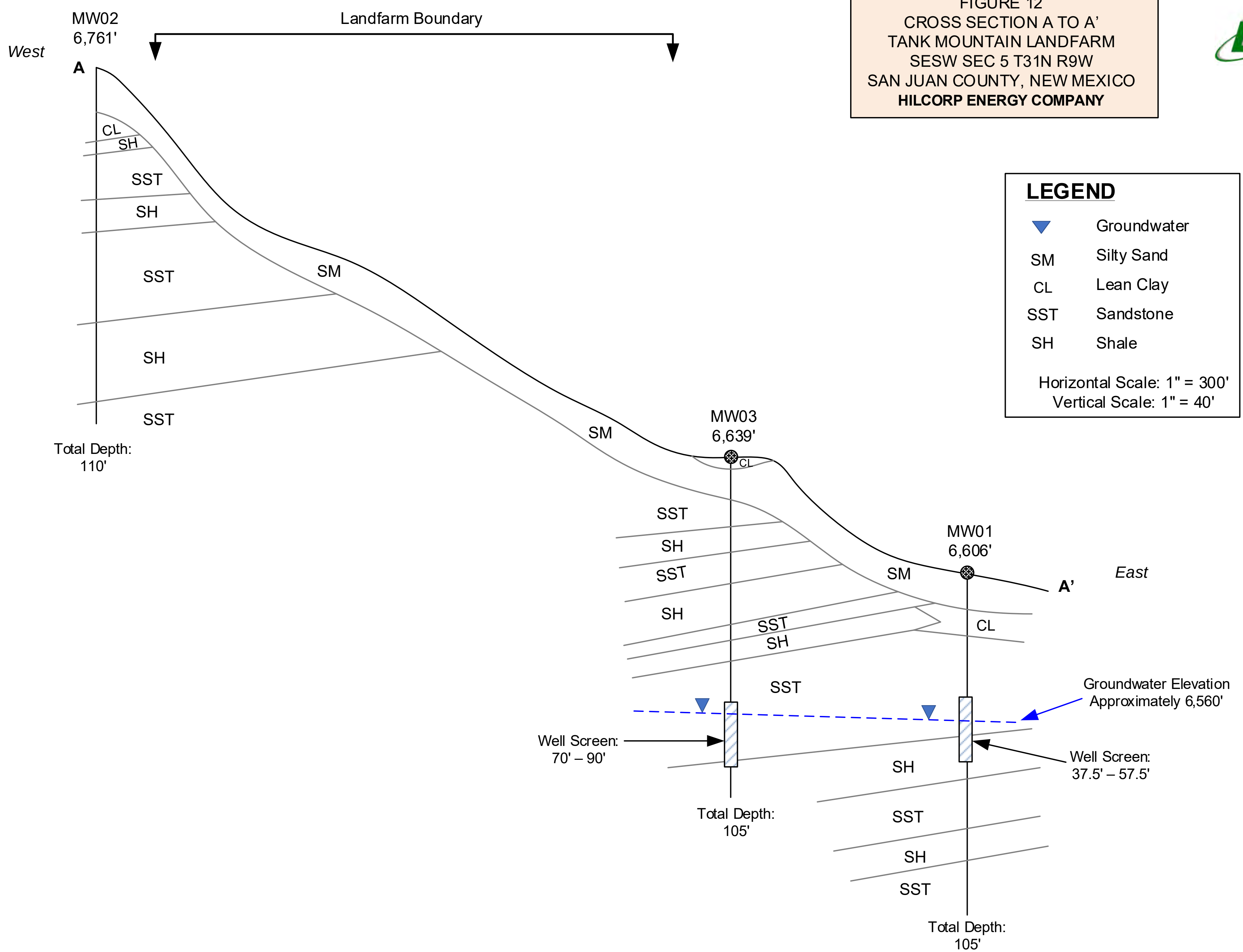
FIGURE 12
CROSS SECTION A TO A'
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY



TABLE

TABLE 1
GROUNDWATER ANALYTICAL RESULTS

TANK MOUNTAIN LANDFARM
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

Analyte	NMWQCC Standard	Unit	MW-01 09/23/2019
USEPA Method 8021B - Volatiles			
Benzene	**10**	µg/L	<1.0
Toluene	**750**	µg/L	<1.0
Ethylbenzene	**750**	µg/L	<1.0
Methyl Tert-Butyl Ether (MTBE)	**NE**	µg/L	<2.5
Xylenes, Total	**620**	µg/L	<2.0
USEPA Method 300.0: Anions			
Bromide	**NE**	mg/L	<0.50
Chloride	**250**	mg/L	22
Sulfate	**600**	mg/L	**2,000**
Fluoride	**1.6**	mg/L	<0.50
Nitrogen, Nitrite as N	**NE**	mg/L	<0.50
Nitrogen, Nitrate as N	**NE**	mg/L	<0.50
Phosphorus, Orthophosphate (As P)	**NE**	mg/L	<2.5
USEPA Method 6010B: Dissolved Metals			
Calcium	**NE**	mg/L	610
Magnesium	**NE**	mg/L	91
Potassium	**NE**	mg/L	7.2
Sodium	**NE**	mg/L	130
USEPA Method 6010B: Total Recoverable Metals			
Arsenic	**NE**	mg/L	<0.020
Barium	**NE**	mg/L	0.33
Cadmium	**NE**	mg/L	<0.0020
Calcium	**NE**	mg/L	540
Chromium	**NE**	mg/L	0.024
Lead	**NE**	mg/L	<0.0050
Magnesium	**NE**	mg/L	100
Potassium	**NE**	mg/L	13
Selenium	**NE**	mg/L	<0.050
Silver	**NE**	mg/L	0.0062
Sodium	**NE**	mg/L	140

TABLE 1
GROUNDWATER ANALYTICAL RESULTS

TANK MOUNTAIN LANDFARM
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

Analyte	NMWQCC Standard	Unit	MW-01 09/23/2019
Standard Method 2320B: Alkalinity			
Alkalinity, Hydroxide (As CaCO3)	**NE**	mg/L	<2.000
Bicarbonate (As CaCO3)	**NE**	mg/L	<20.00
Carbonate (As CACO3)	**NE**	mg/L	<2.000
Total Alkalinity	**NE**	mg/L	<20.00
Standard Method 2510B: Specefic Conductance			
Conductivity	**NE**	µmhos/c	3,100
USEPA Method 7470: Mercury			
Mercury	**NE**	mg/L	<0.00020
USEPA Method SM2540C Modified: Total Dissolved Solids			
Total Dissolved Solids	**1,000**	mg/L	**3,170**

Notes:

BOLD - indicates concentration exceeds the NMWQCC standard

µg/L - micrograms per liter

µmhos/c - micro ohms per centimeter

mg/L - milligrams per liter

NE - not established

NMWQCC - New Mexico Water Quality Control Commission

USEPA - United States Environmental Protection Agency

APPENDIX A: TANK MOUNTAIN LANDFARM DESIGN SPECIFICATIONS

APPENDIX A

TANK MOUNTAIN LANDFARM CONSTRUCTION

DESIGN SPECIFICATIONS AND DRAWINGS

SOUTHEAST QUARTER, SOUTHWEST QUARTER, SECTION 5, TOWNSHIP 31 NORTH RANGE 9 WEST

SAN JUAN COUNTY, NEW MEXICO

HILCORP ENERGY COMPANY

TANK MOUNTAIN LANDFARM
TABLE OF CONTENTS

DIVISION 1: GENERAL REQUIREMENTS

SECTION 01010
SUMMARY OF WORK

PART 1 GENERAL

1.01 DEFINITIONS

A. Additional definitions and clarification of terms:

1) CONTRACTOR: The general contractor to be selected by the OWNER.

2) ENGINEER: The engineer(s) selected by the OWNER (LT Environmental, Inc. [LTE]).

3) Equal or Equivalent: Equal in materials, weight, size, design, construction, capacity, performance, and efficiency of specified product, as determined by the ENGINEER.

4) OWNER: Hilcorp Energy Company (Hilcorp).

5) Work: Construction of the Tank Mountain Landfarm (Landfarm).

6) Project Area: Proposed limits of permit boundary per the Design Drawings in Attachment 1.

1.02 SUMMARY

A. The work described by these Specifications and Drawings is for implementing construction of the Landfarm located in San Juan County in New Mexico.

B. The overall scope of work (SOW) is more fully described in these Construction Plans and Specifications and includes, but is not limited to, providing all labor materials, tools, equipment, and services necessary to construct the Landfarm, including clearing and grubbing of all existing vegetation in the proposed Landfarm area, completing Landfarm grading, constructing Landfarm cell construction, access roads, run-on and runoff controls including culverts and swales, and a graded pad for the Landfarm Office enclosure.

C. Completion will include providing and installing all Landfarm fencing, gates, signs and an office enclosure.

1.03 SITE DESCRIPTION

A. The Landfarm is a vacant parcel located in the southeast quarter of the southwest quarter of Section 5, Township 31 North, Range 9 West in San Juan County, New Mexico. The property is approximately 37.8 acres in size and is currently unimproved forested land.

1.04 SCOPE OF WORK

The SOW includes the following items:

A. Conduct clearing and grubbing of all existing vegetation in the proposed Landfarm area.

B. Complete Landfarm grading per the Design Drawings in Attachment 2.

C. Construct Landfarm cells per the Design Drawings in Attachment 2.

D. Construct access roads per the Design Drawings in Attachment 2.

E. Construct run-on and run-off controls including culverts and swales per the Design Drawings in Attachment 2.

F. Construct an elevated pad for the Landfarm Office enclosure and provide a skid or trailer-mounted office enclosure.

G. Furnish transportation services to deliver the Landfarm Office enclosure to the Landfarm.

H. Provide and install the perimeter Landfarm fencing per SECTION 02020 SITE FACILITIES, 2.01 SITE FENCING.

I. Provide and install two access gates per SECTION 02020 SITE FACILITIES, 2.02 ACCESS GATES.

J. Provide and install all signage per SECTION 02020 SITE FACILITIES, 2.03 SIGNAGE.

1.05 HEALTH AND SAFETY

Comply with all applicable sections of the federal, state, and local regulations. Of special importance to this section are the worker health and safety requirements including, but not necessarily limited to, the following:

A. Federal Occupational Safety and Health Administration (OSHA) regulation under 29 Code of Federal Regulations (CFR) 1910 (OSHA Standards) and 29 CFR 1926 (Safety and Health Regulations for Construction); and

B. Oil and Gas worker safety requirements by Hilcorp.

1.06 SITE USE AND ACCESS

A. Respect the private property owner's rights and concerns related to on-site activity. Use of the project site is limited to construction activities.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01530
PROTECTION OF EXISTING FACILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Contact New Mexico 811 at 800-321-2537, and the appropriate utility companies including oil and gas production providers, on adjacent properties for utility locates prior to beginning any earthwork.

1.02 RIGHT-OF-WAY

A. Do not enter upon the rights-of-way (ROW) involved until notification of the proper party and obtain required licenses and permits. Remove, shore, support, or otherwise protect any pipeline, transmission line, fence, or structure, or replace the same if it interferes with the work.

1.03 EXISTING UTILITIES AND IMPROVEMENTS

A. Protect all underground utilities including service lines and other improvements which may be impaired during construction operations. Ascertain the actual location of all existing utilities, service lines, and other improvements that will be encountered during construction operations, and to see that such utilities, service/lines, or other improvements are adequately protected from damage due to such operations. Take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide special protection as may be necessary.

B. Prior to any excavation in the vicinity of any existing underground facility, notify the respective authorities representing the owners or agencies responsible for such facilities not less than three days, nor more than seven days, prior to excavation so that a representative of said owners or agencies can be present during such work if desired.

1.04 LANDSCAPING

A. Exercise all necessary precautions so as not to damage or destroy any trees, shrubs, or other landscaped areas outside of the work area.

1.05 FENCE AND GUARD RAIL REMOVAL/REPLACEMENT

A. Remove existing fences and/or guard rail, as necessary, to perform the work. All fence and/or guard rail removed shall be salvaged and replaced.

B. The removed fence and/or guard rail shall be replaced to a condition equal to or better than preconstruction conditions.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)END OF SECTION

DIVISION 2: SITE WORK

SECTION 02010
EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

A. This section includes the general cut and fill, placement, compaction and grading requirements necessary to complete the work indicated on the Design Drawings.

1.02 REFERENCES STANDARDS

A. Applicable Standards:

1. ASTM D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3)

3. ASTM D2216 – Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

4. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

B. OSHA:

1. 29 CFR Part 1910 - OSHA Standards
2. 29 CFR Part 1926 - Safety and Health Regulations for Construction

1.03 OPERATING CONDITIONS

A. Lay out and construct the work properly to meet the intent of preventing run-on and collecting run-off within individual cells. Overall lines and grades shall be as indicated within +/- 1-foot of those indicated in the design drawings. Berms shall be constructed within +/- 3-inches of the designed height relative to unbermed areas.

B. Carefully maintain all benchmarks, monuments, monitoring wells, and other reference points and replace as directed by OWNER if disturbed or destroyed.

C. Temporary Erosion and Sediment Controls: Furnish, install, construct, and maintain temporary measures to control erosion and minimize runoff offsite. Temporary erosion and sediment control measures shall be constructed in substantial compliance with local, state, federal, and jurisdictional agency's regulations and Drawings. Temporary erosion and sediment control measures shall be maintained until completion of the work.

D. Temporary stabilization measures shall be provided for disturbed surfaces where construction activities have temporarily or permanently ceased and will not resume for 14 days.

PART 2 - PRODUCTS

2.01 BORROW MATERIALS

A. Obtain suitable borrow materials from OWNER-approved on-site or off-site borrow sources. If used, borrow material shall be placed in a manner consistent with "general fill" material, as described in Part 2.02 below.

B. Obtain, excavate, haul, handle, place and compact borrow materials.

C. Borrow materials shall be free of waste, debris, organic material, and frozen material, suitable for embankment construction, and contain a maximum 4-inch stone size in any dimension as per ASTM D422.

2.02 GENERAL FILL

A. General fill shall be material obtained from on-site or off-site borrow sources and shall be free of waste, debris, organic material, and frozen material, suitable for embankment construction, and contain a maximum 4-inch stone size in any dimension as per ASTM D422. It shall be of such a nature and character that it can be compacted to the minimum specified dry density of 95 percent (%) of the standard Proctor (measured as a percentage of the maximum dry density as determined by ASTM D 698) with a reasonable compaction effort.

B. Moisture content shall be that required to obtain specified compaction of the soil or as indicated.

C. Perform moisture curing by wetting or drying of the material as required to attain required compaction criteria.

D. Provide soil amendments and gravel to facilitate road and berm construction if required to meet compaction and/or traction requirements.

PART 3 - EXECUTION

3.01 SITE PREPARATION

A. Install and remove all sediment control practices required as a result of earthwork activities.

B. Implement Best Management Practices (BMPs) as required by the Design Drawings. Additional BMPs shall be implemented as dictated by the site conditions.

C. Sufficient oil and grease absorbing materials shall be maintained on site or readily available to contain and clean-up fuel or chemical spills and leaks.

D. Dust on the Landfarm shall be controlled. The use of motor oils and other petroleum based or toxic liquids for dust suppression operations is prohibited.

E. Rubbish, trash, garbage, litter generated as a result of operations on site or other such materials shall be deposited into sealed containers. Such materials shall be prevented from leaving the premises through the action of wind or stormwater discharge into drainage ditches or waters of the state.

F. All stormwater pollution prevention measures presented in the Design Drawings shall be initiated as soon as practicable prior to the start of work.

G. Disturbed portions of the site outside the area where construction activity has been completed shall be permanently seeded. When completion occurs outside of optimal seeding times, BMPs shall be implemented to protect areas from erosion until the next optimal seeding timeframe.

H. If the action of vehicles traveling over the gravel construction entrances is not sufficient to remove the majority of dirt or mud, then the tires must be washed before the vehicles enter onto a public road. If washing is used to remove mud, provisions must be made to intercept the wash water and trap the sediment before it is carried off Landfarm.

I. All materials spilled, dropped, washed, or tracked from vehicles onto roadways must be removed immediately.

J. Soil stockpile areas shall be protected from erosion and sedimentation through implementation of BMPs.

K. Slopes shall be left in a roughened condition during the grading phase to reduce runoff velocities and erosion.

L. Due to the grade changes during the work, adjust the erosion control measures in order to prevent erosion.

3.02 CLEARING AND GRUBBING

A. Perform clearing and grubbing only in areas where earthwork or other construction operations are to be performed.

B. Clear designated areas and properly dispose of other trees, brush, and vegetation before starting construction.

3.03 GENERAL FILL

A. Construct embankments to contours and elevations indicated, using satisfactory material from excavations and borrow areas:

1. Place fill material in maximum 12-inch loose lifts.

2. Place embankment only on subgrades approved by the ENGINEER.

3. Do not place snow, ice, or frozen earth in fill; do not place fill on a frozen surface.

4. Obtain compaction by the controlled movement of compaction equipment approved by the ENGINEER during placing and grading of layers and to minimum 95% of standard Proctor dry density.

5. Except as indicated or specified otherwise, compact cohesionless soils as directed by the ENGINEER.

B. Backfill shall be as specified in this Section, with the following additional provisions:

1. Complete promptly upon completion of excavation and approval to proceed.

2. Mechanical methods shall be acceptable where hand backfill is not required.

3. Backfill in lifts of thickness within compacting ability of equipment used, but not greater than eight inches.

3.04 SITE GRADING

A. Excavate, fill, compact fill, and rough grade to bring project area to subgrades as follows:

1. For surfaced areas, to underside of respective surfacing or base course.

2. When rock is encountered in grading areas, over excavate to depth specified and backfill to grade with compacted fill, except that boulder or protruding rock outcrop, if so indicated, shall be left undisturbed if not readily cut using conventional excavation equipment.

B. Waste Materials (Native Site Materials Not to be Used for Landfarm Construction):

1. Remove unsuitable materials from work area as excavated.

2. Deposit such materials in locations and within areas indicated or designated by the ENGINEER or OWNER.

3. Finishing: Finish the surface of excavation, embankments, and subgrades to a smooth and compact surface in accordance with lines, grades and elevations shown and as follows:

a. Degree of finish for rough grading shall be that ordinarily obtained from blade grader or scraper operations except as otherwise specified.

b. Finish all ditches, swales, and gutters to drain readily.

c. Provide roundings at top and bottom of banks and at other breaks in grade.

C. Construct to approximate contours, elevations, and thicknesses indicated on the Drawings, using suitable approved material from OWNER-approved borrow source.

D. Do not place snow, ice, or frozen earth in fill; do not place fill on a frozen surface.

E. Spread and loosely compact soil by the controlled movement of track-mounted, low ground pressure equipment.

F. Establish a network of temporary haul roads to deliver the final cover material to the placement areas.

G. Soil placed on the access road of the Landfarm shall be compacted to a minimum 95% of its standard Proctor maximum dry density.

H. Break up clods larger than four inches.

I. CONTRACTOR may be required to spread out and dry material prior to placement to lower moisture content below optimum or to break up clods before placement.

J. Construct the final grading per the Design Drawings and meet the design intent with respect to storm water drainage. Deviations from the final grades must be approved by the ENGINEER.

3.05 EXCAVATION

A. Unless otherwise indicated or approved by the ENGINEER, perform excavation by open cut methods.

B. Stockpile material acceptable for backfilling during excavation in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 12 inches, or as governed by OSHA requirements.

C. Place excavated material not required or not acceptable for backfill in an area protected from runoff.

D. Perform grading as necessary to prevent surface water from flowing into the excavation and remove any water that accumulates therein to maintain stability of the bottom and sides of excavations.

E. Shore, or otherwise cut back, to achieve a stable slope all walls more than three feet high, or provide equivalent means of protection for employees who may be exposed to moving ground or cave-in.

F. Give special attention to slopes that may be adversely affected by weather or moisture content.

3.06 CELL CONSTRUCTION

A. Each cell will be contained by an earthen berm constructed out of stockpile material or approved borrow material compacted to 95% standard Proctor density.

B. Construct each cell area to the approximate dimensions detailed in Table 02225-1.

Table 02225-1
Cell Construction Details

Cell	Cell Area (acres)
1	0.4
2	0.9
3	1.3
4	1.3
5	1.5
6	1.4
7	1.0
8	0.7
9	1.0
10	0.6
11	1.2
12	0.9
13	1.0
14	0.9
15	1.6
16	1.2
17	0.8
TOTAL	**17.7**

3.07 STORMWATER CONTROL MEASURES

A. Construct run-on/runoff protection including ditches, berms and culverts to the dimensions and locations shown on the Design Drawings.

3.08 ACCESS ROADS

A. Existing or similar imported material compacted to 95% standard Proctor density.

B. Roads will be a minimum of 6 inches above the adjacent graded area to prevent standing water.

C. Roads will be a minimum of 30 feet wide.

3.09 MAINTENANCE

A. Protect newly graded and vegetated areas from actions of the elements while construction of the Landfarm is still in progress.

B. Fill and repair settling or erosion occurring prior final completion and re- establish grades to required elevations and slopes.

END OF SECTION

A proud member of WSP

SECTION 02020
SITE FACILITIES

PART 1 GENERAL

1.01 SUMMARY

A. This section includes Landfarm facility details regarding fencing, Landfarm access, and signage as indicated on the Design Drawings and Specifications.

PART 2 – PRODUCTS

2.01 SITE FENCING

A. All fence construction shall comply with federal, state, and local fencing codes.

B. All fence materials shall be of new construction free from rust.

C. Fence lines shall be cleared of brush and vegetation prior to installation. Gullies and steep banks may require grading.

D. Site fencing will be located immediately inside the Landfarm boundary to prevent unauthorized access to vehicles, personnel, and livestock.

E. Fencing shall be a minimum of 48 inches, suitable for preventing livestock from entering the facility.

F. Gates shall be a minimum of four feet tall.

2.02 ACCESS GATES

A. Gates shall be constructed of chain link material or similar quality and durable material that equals or exceeds the quality of the adjoining fence.

B. Gate hinges shall be attached directly to a braced end post.

C. Gates shall be a minimum of 30 feet wide to accommodate the width of the access road.

D. Gates shall be lockable with a key.

2.03 SIGNAGE

A. Both entrances to the Landfarm will be equipped with a sign, readable from 50 feet, as indicated in the Drawings with the following information:

HILCORP ENERGY COMPANY
Tank Mountain Landfarm
Surface Waste Management Facility Permit # (TBD)
SESW Unit O SEC 5 T31N R9W

IN CASE OF EMERGENCY
Call 911
New Mexico State Police – District 10: 505-325-7547
Fire Department (San Juan County): 505-334-1180
New Mexico Oil Conservation Division (Aztec Office): 505-419-2687

2.04 OFFICE FACILITY

A. An office structure shall be provided for storage of paperwork relating to soil documentation.

B. The office will be a minimum eight feet by six feet, skid-mounted, or trailer-mounted, suitable for placement on compacted earth.

C. The office will be weathertight and provide adequate ventilation for daily occupation by Landfarm personnel.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

ATTACHMENT 1

PLAT MAP

CLAIM OF EXEMPTION – SAN JUAN COUNTY
PROPOSED LAND DIVISION FOR HILCORP ENERGY COMPANY
TANK MOUNTAIN LAND FARM LOCATED IN
S/2 OF SECTION 5, TOWNSHIP 31 NORTH, RANGE 9 WEST, N.M.P.M.
SAN JUAN COUNTY, NEW MEXICO

LEGAL DESCRIPTION – TRACT "A"

A TRACT OF LAND LOCATED IN SOUTH-HALF (S/2) OF SECTION 5, TOWNSHIP 31 NORTH, RANGE 9 WEST, N.M.P.M., SAN JUAN COUNTY, NEW MEXICO, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT BEING THE WEST QUARTER SECTION CORNER OF SAID SECTION 5; THENCE S89°48'55"E A DISTANCE OF 3867.22 FEET TO A POINT ON THE CENTERLINE OF SECTION 5; THENCE S01°36'52"W A DISTANCE OF 1297.37 FEET TO A POINT; THENCE N89°53'55"E A DISTANCE OF 1285.67 FEET TO A POINT; THENCE S02°14'15"W A DISTANCE OF 1291.38 FEET TO A POINT; THENCE S89°36'23"W A DISTANCE OF 2543.66 FEET TO A POINT; THENCE S89°37'56"W A DISTANCE OF 1269.82 FEET TO A POINT; THENCE N0°40'14"E A DISTANCE OF 1309.47 FEET TO A POINT; THENCE S89°54'22"W A DISTANCE OF 1277.15 FEET TO A POINT; THENCE N0°24'22"E A DISTANCE OF 1315.83 FEET TO TRUE POINT-OF-BEGINNING.
SAID TRACT OF LAND CONTAINING 229.890 ACRES, MORE OR LESS.

LEGAL DESCRIPTION – TRACT "B"

A TRACT OF LAND LOCATED IN SOUTH-HALF OF SOUTH-HALF (S/2 S/2) OF SECTION 5, TOWNSHIP 31 NORTH, RANGE 9 WEST, N.M.P.M., SAN JUAN COUNTY, NEW MEXICO, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT IN SOUTHWEST-QUARTER OF SOUTHEAST-QUARTER (SW/4 SE/4) OF SAID SECTION 5 WHICH LIES S44°22'53"W A DISTANCE OF 2032.68 FEET FROM THE EAST QUARTER-SECTION CORNER OF SAID SECTION 5 TO POINT-OF-BEGINNING. THENCE S01°23'20"W A DISTANCE OF 304.12 FEET TO A POINT; THENCE S31°54'01"E A DISTANCE OF 171.04 FEET TO A POINT; THENCE N76°09'20"E A DISTANCE OF 200.33 FEET TO A POINT; THENCE N48°15'23"E A DISTANCE OF 197.85 FEET TO A POINT; THENCE S83°56'49"E A DISTANCE OF 125.78 FEET TO A POINT; THENCE S54°16'59"E A DISTANCE OF 210.20 FEET TO A POINT; THENCE S00°18'11"W A DISTANCE OF 75.77 FEET TO A POINT; THENCE S30°53'31"W A DISTANCE OF 51.66 FEET TO A POINT; THENCE S52°01'44"W A DISTANCE OF 179.76 FEET TO A POINT; THENCE S67°09'51"W A DISTANCE OF 282.37 FEET TO A POINT; THENCE S54°19'17"W A DISTANCE OF 307.48 FEET TO A POINT; THENCE S23°05'30"W A DISTANCE OF 88.40 FEET TO A POINT; THENCE S31°56'36"W A DISTANCE OF 50.92 FEET TO A POINT; THENCE S89°59'37"W A DISTANCE OF 273.18 FEET TO A POINT; THENCE N88°28'13"W A DISTANCE OF 248.40 FEET TO A POINT; THENCE S88°09'25"W A DISTANCE OF 171.66 FEET TO A POINT; THENCE N86°31'25"W A DISTANCE OF 215.47 FEET TO A POINT; THENCE N83°00'36"W A DISTANCE OF 159.46 FEET TO A POINT; THENCE N51°55'44"W A DISTANCE OF 127.50 FEET TO A POINT; THENCE N35°20'23"W A DISTANCE OF 158.09 FEET TO A POINT; THENCE N29°13'59"W A DISTANCE OF 178.08 FEET TO A POINT; THENCE N29°13'56"W A DISTANCE OF 142.18 FEET TO A POINT; THENCE N04°49'12"W A DISTANCE OF 197.60 FEET TO A POINT; THENCE N35°42'50"E A DISTANCE OF 163.44 FEET TO A POINT; THENCE N51°30'09"E A DISTANCE OF 243.65 FEET TO A POINT; THENCE N29°04'17"E A DISTANCE OF 55.98 FEET TO A POINT; THENCE S82°30'25"E A DISTANCE OF 215.07 FEET TO A POINT; THENCE N82°38'43"E A DISTANCE OF 206.55 FEET TO A POINT; THENCE N8412'22"E A DISTANCE OF 200.65 FEET TO A POINT; THENCE N87°12'44"E A DISTANCE OF 251.87 FEET TO A POINT; THENCE S86°46'00"E A DISTANCE OF 155.77 FEET TO A POINT; THENCE S78°20'23"E A DISTANCE OF 114.85 FEET TO TRUE POINT-OF-BEGINNING. SAID TRACT OF LAND CONTAINING 37.836 ACRES, MORE OR LESS.

SAID TRACT BEING DIVIDED WITH THE FREE CONSENT AND IN ACCORDANCE WITH THE DESIRES OF THE UNDERSIGNED OWNERS THEREOF SURVEYED AND SUBDIVIDED ACCORDING TO THE TRACTS AS THEY APPEAR HEREON.

IN WITNESS WHEREOF, THE UNDERSIGNED OWNERS OF SAID LAND, HAVE SET THEIR HAND THIS _____ DAY OF __________, 2020.

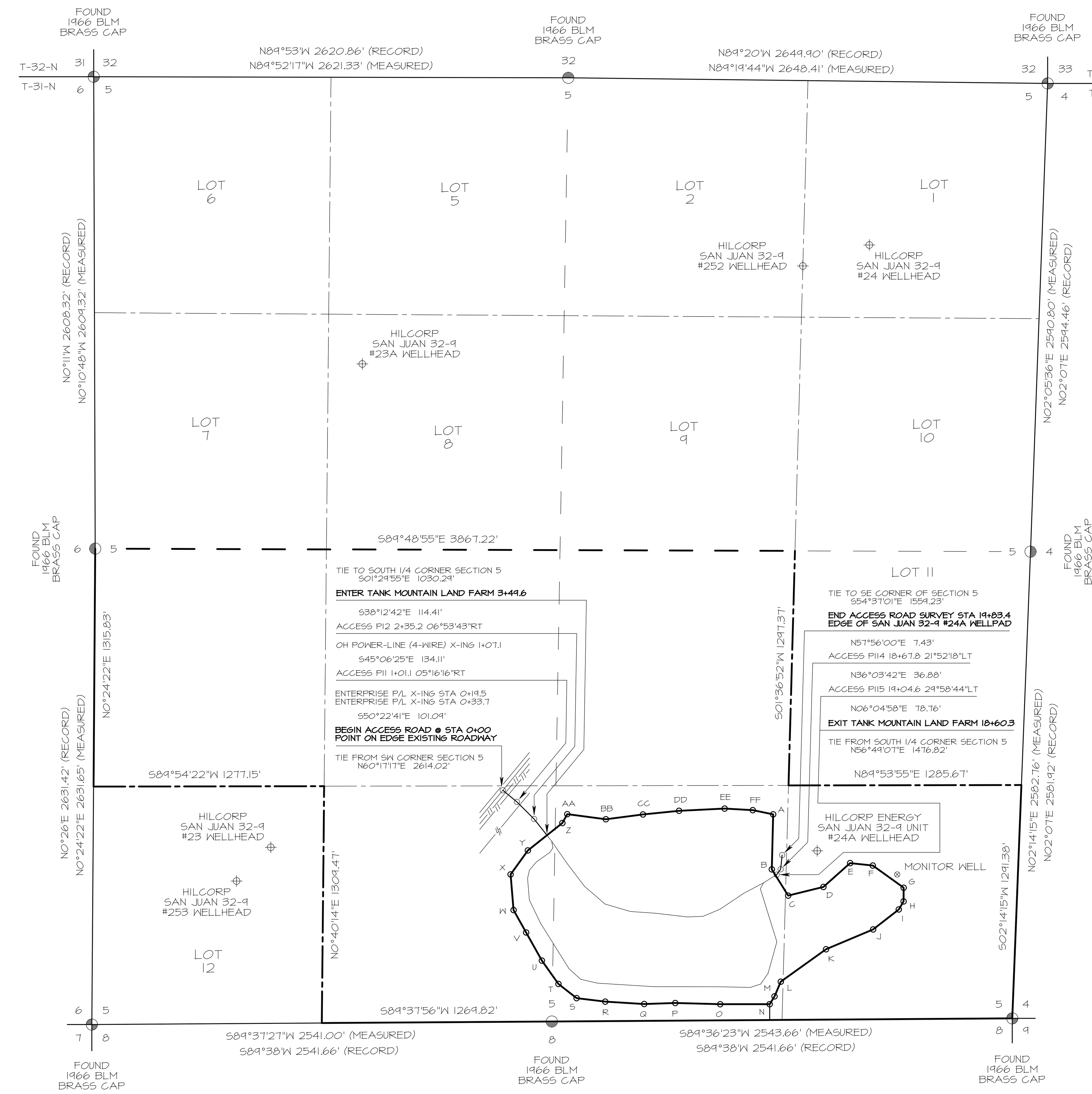
____
HILCORP ENERGY COMPANY

STATE OF NEW MEXICO
COUNTY OF SAN JUAN } SS

ON THIS _____ DAY OF __________, 2020, BEFORE ME PERSONALLY APPEARED ______________________________ KNOWN TO ME TO BE THE PERSON DESCRIBED IN AND WHO EXECUTED THE FOREGOING INSTRUMENT AND ACKNOWLEDGED THAT THEY THE SAME AS THEIR FREE ACT AND DEED.

WITNESS MY HAND AND OFFICIAL SEAL THE DAY AND YEAR LAST ABOVE WRITTEN.

MY COMMISSION EXPIRES ______________ ______________________________
NOTARY PUBLIC



PLAT LEGEND

EXISTING PIPELINE
OVERHEAD POWER-LINE
EXISTING WELLHEAD
EXISTING MONITOR WELL

BASIS OF BEARING

REAL-TIME KINEMATIC GPS SURVEY SOLUTION OBTAINED FROM SATELLITES TRACKED ON MARCH 2, 2020 FROM A REFERENCE STATION POSITIONED IN SE/4 SW/4 OF SECTION 5, T31N, R9W

PLAT NOTE

BEFORE ANY CONSTRUCTION BEGINS, CONTRACTOR IS ADVISED TO CALL ONE-CALL FOR LOCATION OF ANY MARKED OR UNMARKED PIPELINES OR CABLES IN THE AREA OF THE PROJECT

N

GRAPHIC SCALE 1"=500'
0 500 1000

CERTIFICATE OF APPROVAL OF EXEMPTION TO SUBDIVISION REGULATIONS BY SAN JUAN COUNTY

PURSUANT TO SAN JUAN COUNTY REGULATIONS, SECTION 7.5 (1997) THE PLAT AND CLAIM OF EXEMPTION MEET THE CRITERIA FOR THE DIVISION OF LAND RESULTING ONLY IN THE ALTERATION OF PARCEL BOUNDARIES WHERE PARCELS ARE ALTERED FOR THE PURPOSE OF INCREASING OR REDUCING THE SIZE OF CONTIGUOUS PARCELS AND WHERE THE NUMBER OF PARCELS IS NOT INCREASED. AND IS APPROVED FOR A CLAIM OF EXEMPTION ON THIS _____ DAY OF __________, 2020.

SAN JUAN COUNTY, NEW MEXICO

BY: ______________________________

SAN JUAN COUNTY DESIGNEE

STATE OF NEW MEXICO
COUNTY OF SAN JUAN } SS

THE FOREGOING INSTRUMENT AND ACKNOWLEDGED BEFOR ME THIS _____ DAY OF __________, 2020 BY SAN JUAN COUNTY DESIGNEE

MY COMMISSION EXPIRES ______________ ______________________________
NOTARY PUBLIC

LINE	BEARING	DISTANCE
A-B	S01°23'20"W	304.12'
B-C	S31°54'01"E	171.04'
C-D	N76°09'20"E	200.33'
D-E	N48°15'23"E	197.85'
E-F	S83°56'49"E	125.78'
F-G	S54°16'59"E	210.20'
G-H	S00°18'11"W	75.77'
H-I	S30°53'31"W	51.66'
I-J	S52°01'44"W	179.76'
J-K	S67°09'51"W	282.37'
K-L	S54°19'17"W	307.48'
L-M	S23°05'30"W	88.40'
M-N	S31°56'36"W	50.92'
N-O	S89°59'37"W	273.18'
O-P	N88°28'13"W	248.40'
P-Q	S88°09'25"W	171.66'

LINE	BEARING	DISTANCE
Q-R	N86°31'25"W	215.47'
R-S	N83°00'36"W	159.46'
S-T	N51°55'44"W	127.50'
T-U	N35°20'23"W	158.09'
U-V	N29°13'59"W	178.08'
V-W	N29°13'56"W	142.18'
W-X	N04°49'12"W	197.60'
X-Y	N35°42'50"E	163.44'
Y-Z	N51°30'09"E	243.65'
Z-AA	N29°04'17"E	55.98'
AA-BB	S82°30'25"E	215.07'
BB-CC	N82°38'43"E	206.55'
CC-DD	N84°12'22"E	200.65'
DD-EE	N87°12'44"E	251.87'
EE-FF	S86°46'00"E	155.77'
FF-A	S78°20'23"E	114.85'

PT	ELEVATION
A	6627.07'
B	6645.51'
C	6636.42'
D	6623.72'
E	6617.05'
F	6608.25'
G	6608.75'
H	6611.43'
I	6614.31'
J	6630.47'
K	6643.89'
L	6657.94'
M	6658.49'
N	6660.05'
O	6681.04'
P	6695.55'

PT	ELEVATION
Q	6707.56'
R	6735.76'
S	6742.07'
T	6728.92'
U	6722.22'
V	6725.67'
W	6722.33'
X	6714.54'
Y	6703.76'
Z	6682.40'
AA	6677.36'
BB	6669.33'
CC	6657.17'
DD	6646.47'
EE	6637.18'
FF	6630.49'

I, JASON C. EDWARDS, A REGISTERED PROFESSIONAL SURVEYOR UNDER THE LAWS OF THE STATE OF NEW MEXICO, HEREBY CERTIFY THAT THIS PLAT WAS PREPARED FROM FIELD NOTES OF AN ACTUAL SURVEY AND MEETS OR EXCEEDSALL REQUIREMENTS FOR LAND SURVEYS AS SPECIFIED BY THIS STATE. THIS SURVEY IS A SUBDIVISION OF LAND AND IS BEING PROCESSED USING COUNTY OF SAN JUAN'S "CLAIM OF EXEMPTION" PROCESS.

______________________ DATE: APRIL 13, 2020
JASON C. EDWARDS, P.L.S.
NEW MEXICO LS #15269

JASON C. EDWARDS
NEW MEXICO
15269
REGISTERED PROFESSIONAL SURVEYOR

Prepared for:
HILCORP ENERGY COMPANY
P.O. BOX #61529
HOUSTON, TX 77208-1529

NCE SURVEYS, INC.

Land Surveyor:
Jason C. Edwards
Mailing Address:
Post Office Box 6612
Farmington, NM 87499
Business Address:
111 East Pinon Street
Farmington, NM 87402
(505) 486-1695 (Office)
ncesurveys@comcast.net

CHECKED BY: JCE
DRAWN BY: RAP
SHEET 1 OF 1
FILENAME: 3195ZP1

STATE OF NEW MEXICO
COUNTY OF SAN JUAN
FILED

______________________________, 2020

AT __________ O'CLOCK _____ M

RECORDED IN BOOK ______ PAGE ______

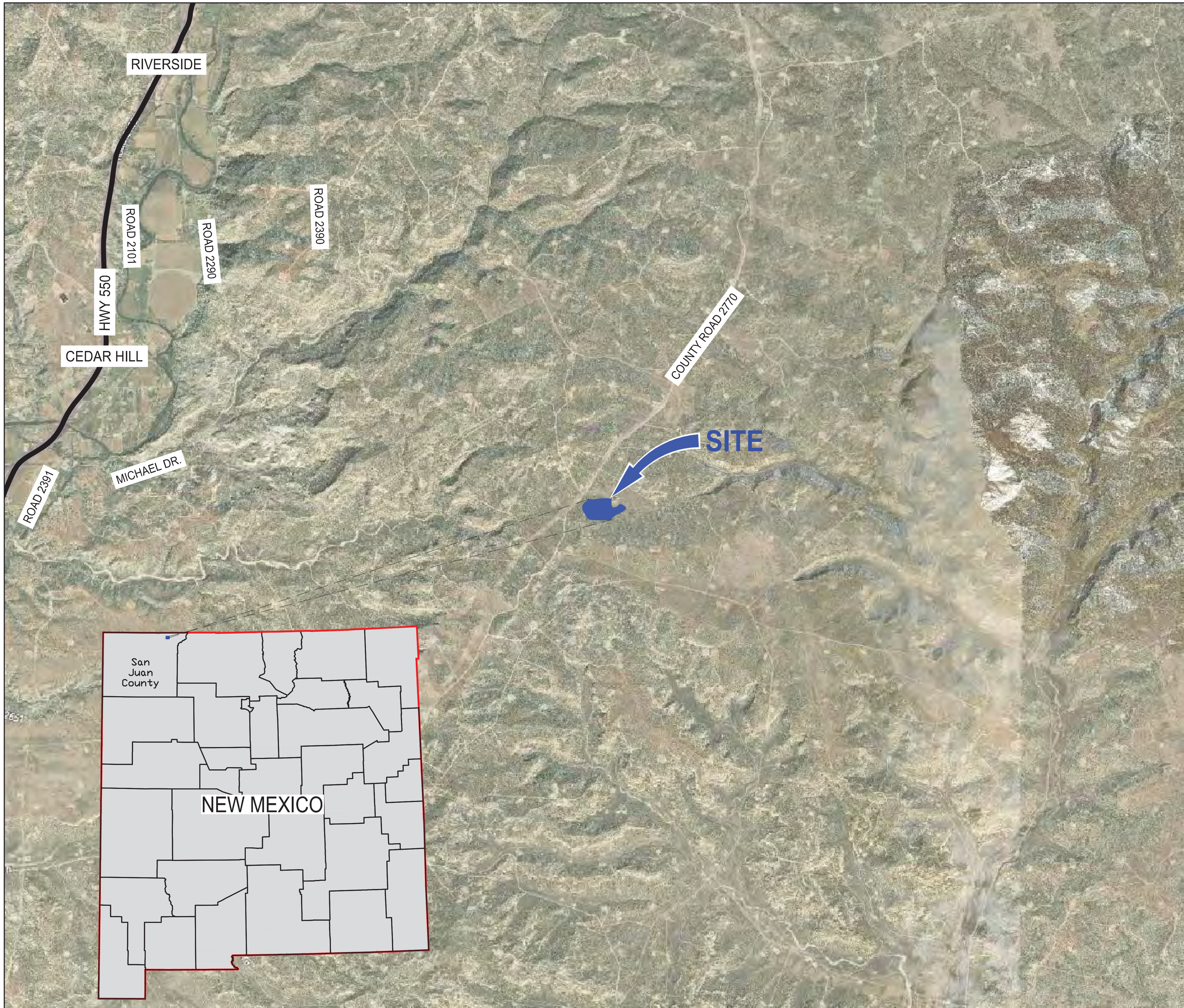
SAN JUAN COUNTY CLERK

BY ______________________________ DEPUTY

ATTACHMENT 2

DESIGN DRAWINGS

A proud member
of WSP



LIST OF DRAWINGS

ALLISON S. WHITE
NEW MEXICO
25204
LICENSED PROFESSIONAL ENGINEER
11·2·2020

0 1/2 1
MILES

COVER SHEET
TANK MOUNTAIN LANDFARM
SWSE SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO

PROJECT NO. 017818018-01
DWG NO. 01
REV NO. A

CLIENT: HILCORP ENERGY COMPANY

LT Environmental, Inc.
Arvada, Colorado

DRAWING INFORMATION	BY	DATE
DESIGNED	CS	11/25/19
DRAWN	JGM	11/25/19
CHECKED	CS	11/25/19
REVIEWED	ES	11/25/19
APPROVED	AW	11/25/19

SCALE: AS SHOWN
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REVISIONS

NO.	DESCRIPTION	BY	APPROVED	DATE
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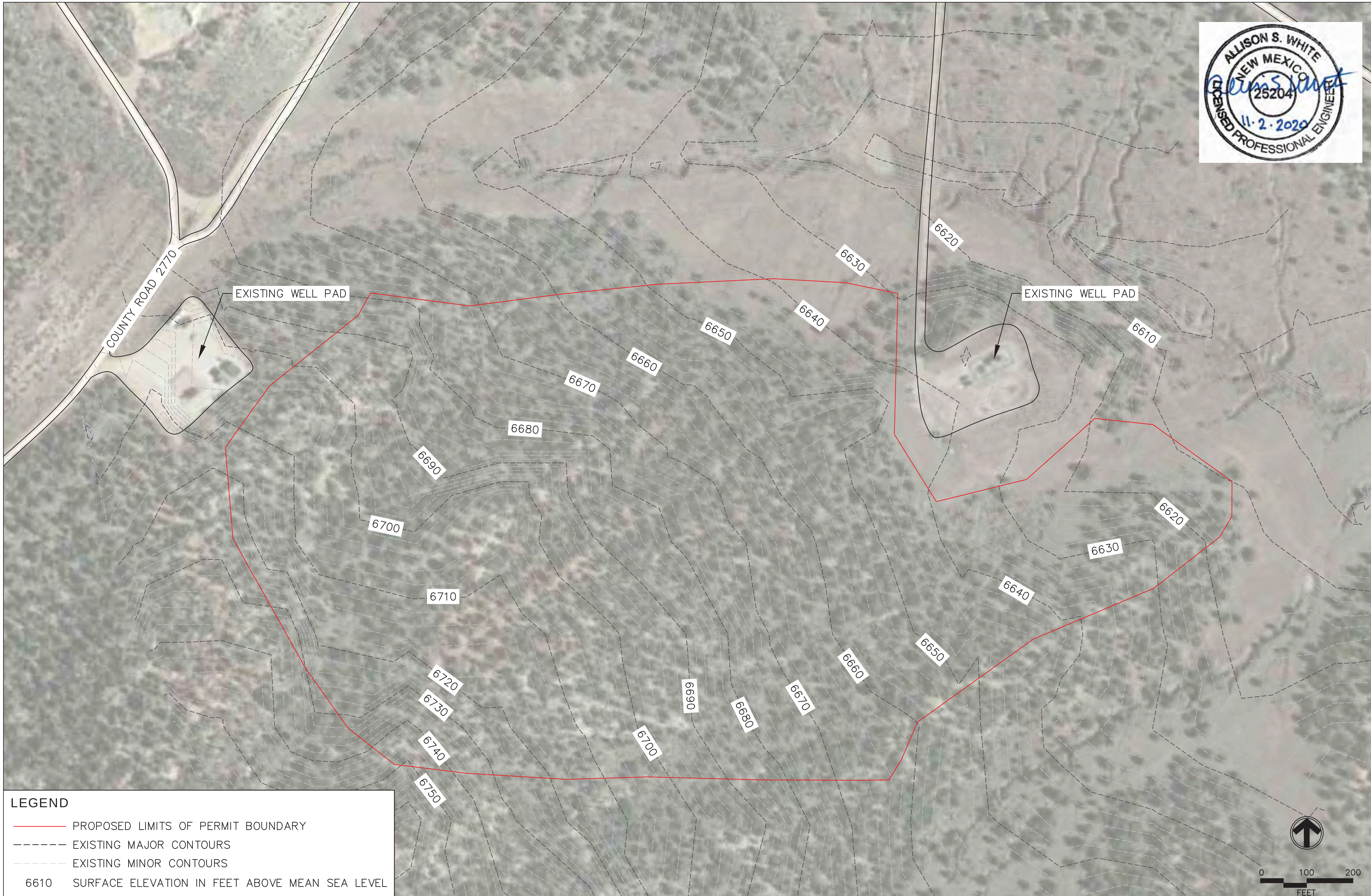

LEGEND

(red line)	PROPOSED LIMITS OF PERMIT BOUNDARY
- - - - - -	EXISTING MAJOR CONTOURS
- - - - - -	EXISTING MINOR CONTOURS
6610	SURFACE ELEVATION IN FEET ABOVE MEAN SEA LEVEL

ALLISON S. WHITE
NEW MEXICO
25204
LICENSED PROFESSIONAL ENGINEER
11.2.2020

EXISTING SITE CONDITIONS
TANK MOUNTAIN LANDFARM
SWSE SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO

CLIENT: HILCORP ENERGY COMPANY

PROJECT NO. 017818018-01
REV NO. A
DWG NO. 02

LT Environmental, Inc.
Arvada, Colorado

DRAWING INFORMATION	BY	DATE
DESIGNED	CS	11/25/19
DRAWN	AG	11/25/19
CHECKED	CS	11/25/19
REVIEWED	ES	11/25/19
APPROVED	AW	11/25/19

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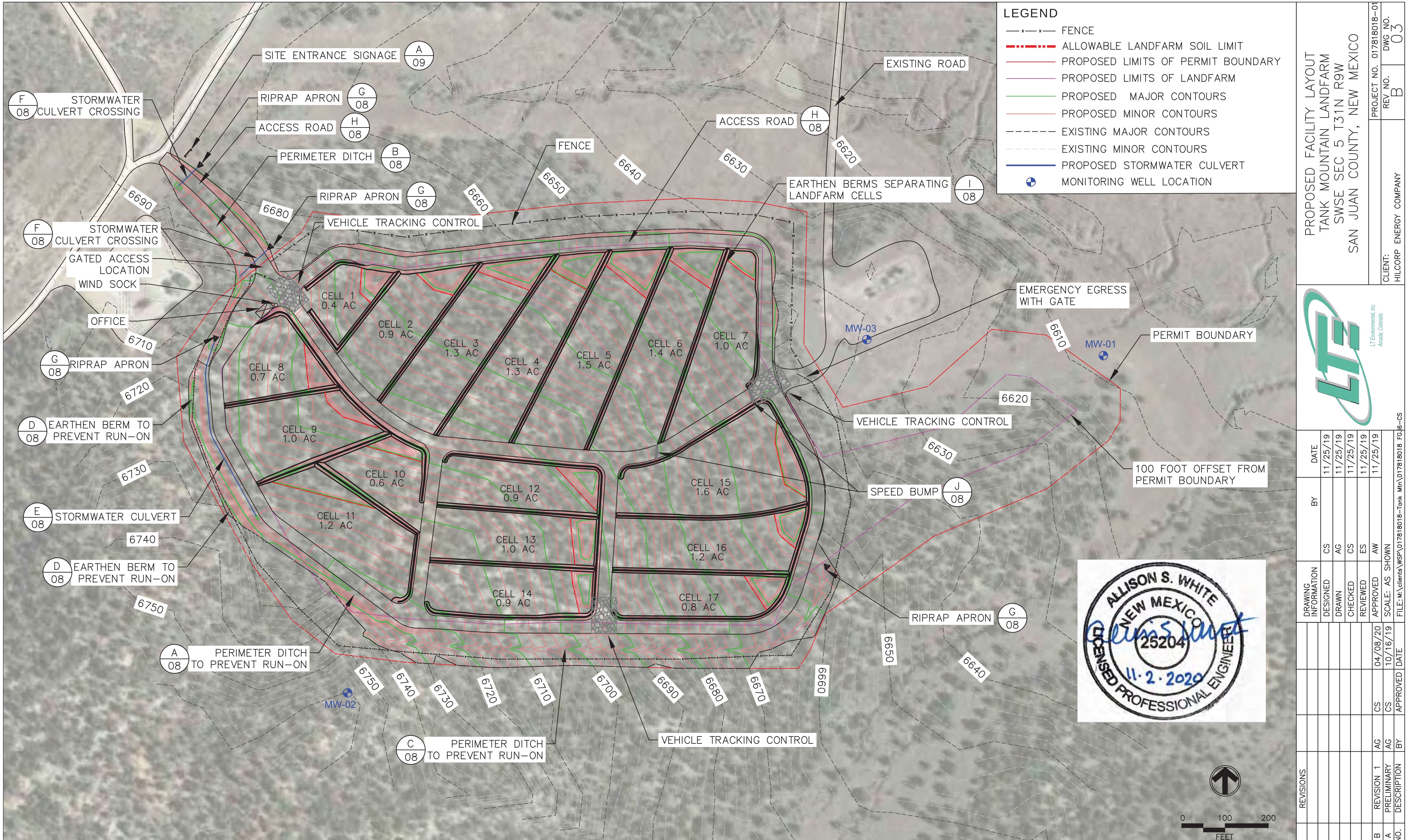
LEGEND
FENCE
ALLOWABLE LANDFARM SOIL LIMIT
PROPOSED LIMITS OF PERMIT BOUNDARY
PROPOSED LIMITS OF LANDFARM
PROPOSED MAJOR CONTOURS
PROPOSED MINOR CONTOURS
EXISTING MAJOR CONTOURS
EXISTING MINOR CONTOURS
PROPOSED STORMWATER CULVERT
MONITORING WELL LOCATION
SITE ENTRANCE SIGNAGE A 09
STORMWATER CULVERT CROSSING F 08
RIPRAP APRON G 08
ACCESS ROAD H 08
PERIMETER DITCH B 08
FENCE
EXISTING ROAD
EARTHEN BERMS SEPARATING LANDFARM CELLS I 08
VEHICLE TRACKING CONTROL
GATED ACCESS LOCATION
WIND SOCK
OFFICE
EARTHEN BERM TO PREVENT RUN-ON D 08
STORMWATER CULVERT E 08
PERIMETER DITCH TO PREVENT RUN-ON A 08
PERIMETER DITCH TO PREVENT RUN-ON C 08
EMERGENCY EGRESS WITH GATE
PERMIT BOUNDARY
100 FOOT OFFSET FROM PERMIT BOUNDARY
SPEED BUMP J 08
MW-01
MW-02
MW-03
CELL 1 0.4 AC
CELL 2 0.9 AC
CELL 3 1.3 AC
CELL 4 1.3 AC
CELL 5 1.5 AC
CELL 6 1.4 AC
CELL 7 1.0 AC
CELL 8 0.7 AC
CELL 9 1.0 AC
CELL 10 0.6 AC
CELL 11 1.2 AC
CELL 12 0.9 AC
CELL 13 1.0 AC
CELL 14 0.9 AC
CELL 15 1.6 AC
CELL 16 1.2 AC
CELL 17 0.8 AC
6610 6620 6630 6640 6650 6660 6670 6680 6690 6700 6710 6720 6730 6740 6750
ALLISON S. WHITE
NEW MEXICO
25204
LICENSED PROFESSIONAL ENGINEER
11-2-2020
0 100 200
FEET
PROPOSED FACILITY LAYOUT
TANK MOUNTAIN LANDFARM
SWSE SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
PROJECT NO. 017818018-01
DWG NO. 03
REV NO. B
CLIENT: HILCORP ENERGY COMPANY
LT Environmental, Inc. Arvada, Colorado
DRAWING INFORMATION | BY | DATE
DESIGNED | CS | 11/25/19
DRAWN | AG | 11/25/19
CHECKED | CS | 11/25/19
REVIEWED | ES | 11/25/19
APPROVED | AW | 11/25/19
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NO. | DESCRIPTION | BY | APPROVED | DATE
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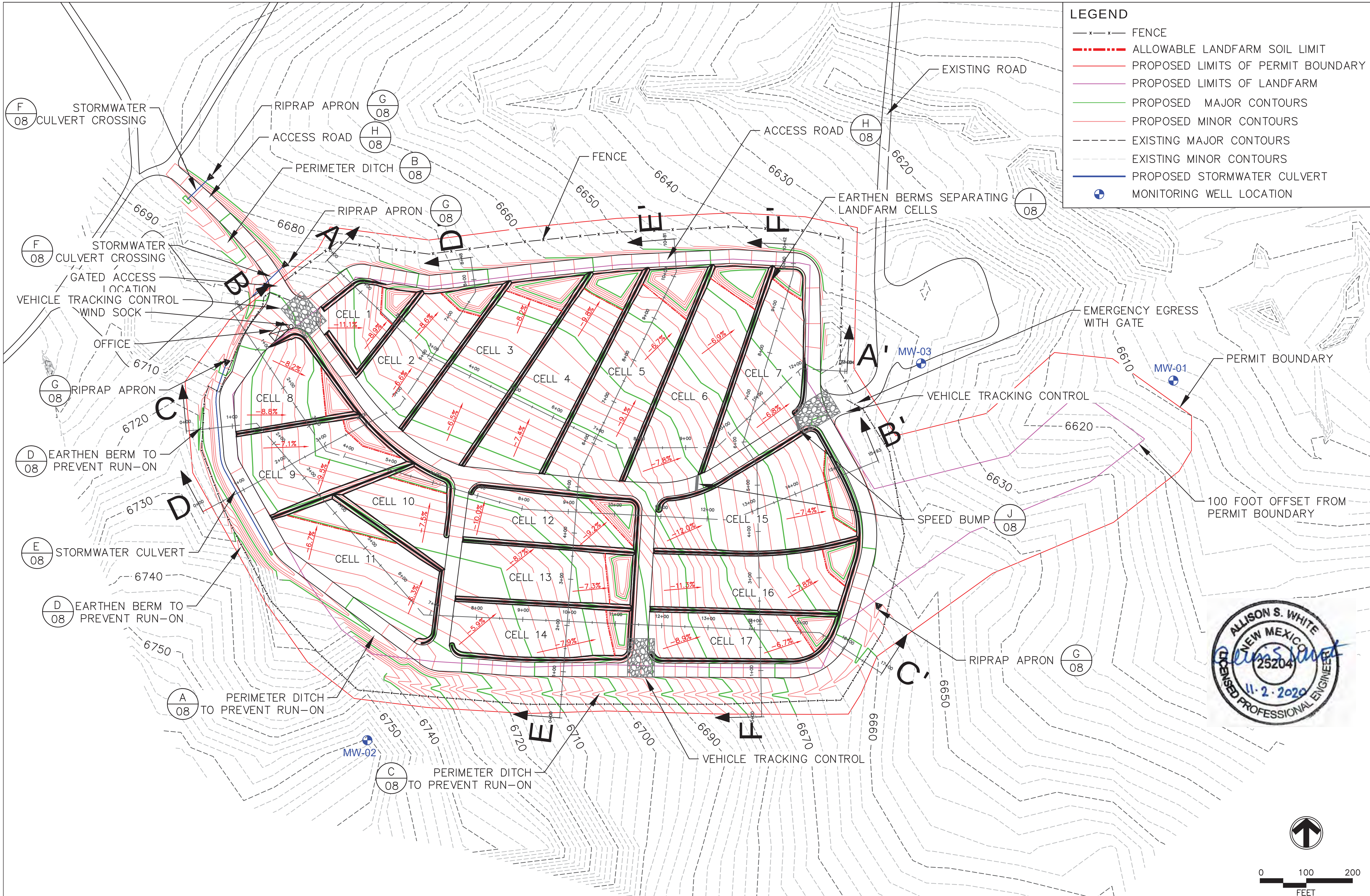
A | PRELIMINARY | AG | CS | 10/16/19



LEGEND

—x—x—	FENCE
	ALLOWABLE LANDFARM SOIL LIMIT
	PROPOSED LIMITS OF PERMIT BOUNDARY
	PROPOSED LIMITS OF LANDFARM
	PROPOSED MAJOR CONTOURS
	PROPOSED MINOR CONTOURS
	EXISTING MAJOR CONTOURS
	EXISTING MINOR CONTOURS
	PROPOSED STORMWATER CULVERT
	MONITORING WELL LOCATION

CROSS SECTIONS LAYOUT
TANK MOUNTAIN LANDFARM
SWSE SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO

PROJECT NO. 017818018-01
DWG NO. 04
REV NO. A
CLIENT: HILCORP ENERGY COMPANY

LT Environmental, Inc.
Arvada, Colorado

ALLISON S. WHITE
NEW MEXICO
25204
LICENSED PROFESSIONAL ENGINEER
11-2-2020

DRAWING INFORMATION	BY	DATE
DESIGNED	CS	11/25/19
DRAWN	AG	11/25/19
CHECKED	CS	11/25/19
REVIEWED	ES	11/25/19
APPROVED	AW	11/25/19

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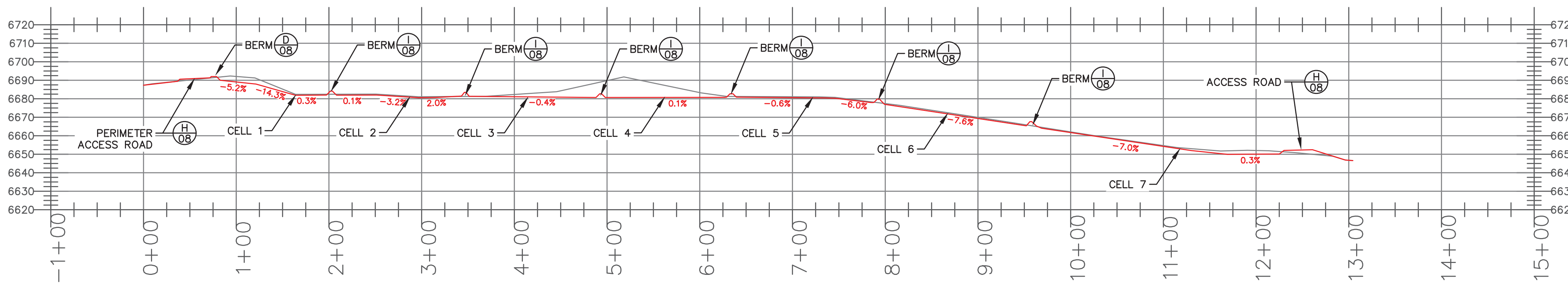
FILE: M:\clients\WSP\017818018-Tank Mtn\017818018

REVISIONS

NO.	DESCRIPTION	BY	APPROVED	DATE
A	PRELIMINARY	AG	CS	10/16/19

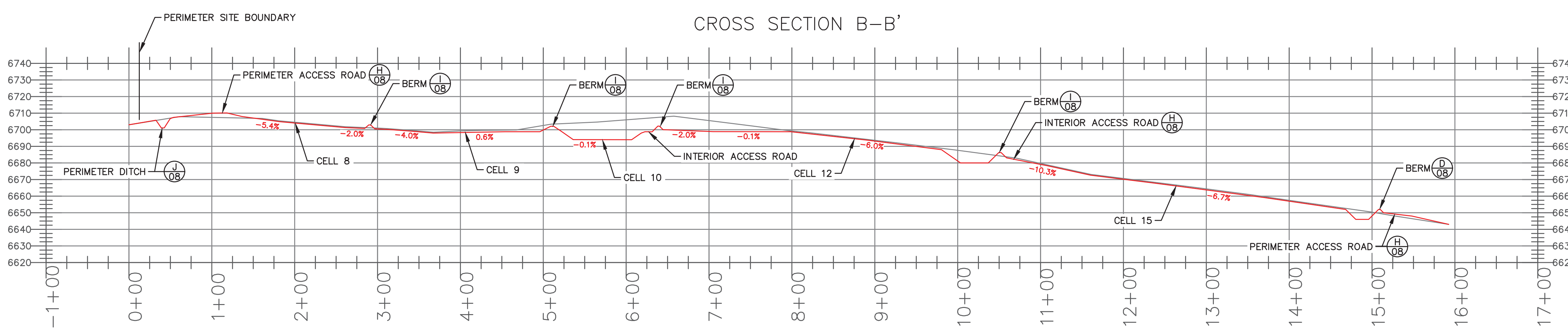
CROSS SECTION A–A'



Cell No.	Cell Area (ac)	Drainage Area Into Cell (ac)	Volume of Runoff Produced by Drainage Area (ft3)	Sump Volume (ft3)	Available Soil Storage (yd3)
Cell 1	0.4	0.44	3,934	4,916	927
Cell 2	0.9	0.93	8,279	10,600	2,119
Cell 3	1.3	1.35	11,962	12,944	3,236
Cell 4	1.3	1.33	11,870	13,514	3,194
Cell 5	1.5	1.51	13,442	18,024	3,505
Cell 6	1.4	1.43	12,738	17,734	3,204
Cell 7	1.0	1.03	9,139	9,224	2,543

ALLISON S. WHITE
NEW MEXICO
25204
LICENSED PROFESSIONAL ENGINEER
11·2·2020

CROSS SECTION B–B'



Cell No.	Cell Area (ac)	Drainage Area Into Cell (ac)	Volume of Runoff Produced by Drainage Area (ft3)	Sump Volume (ft3)	Available Soil Storage (yd3)
Cell 8	0.7	0.73	6,495	7,788	1,682
Cell 9	1.0	1.04	9,206	10,856	2,423
Cell 10	0.6	0.59	5,208	5,824	1,505
Cell 12	0.9	0.88	7,789	8,838	2,249
Cell 15	1.6	1.62	14,435	15,714	3,999

LEGEND

PROPOSED GROUND SURFACE
EXISTING GROUND SURFACE
ac =ACRE
ft3 =FEET CUBED
yd3 =YARD CUBED

NOTES:
CELL VOLUME REQUIRED IS BASED ON RAINFALL FROM A 24–HR, 25–YR RAIN EVENT ENTERING THE CELLS.

CROSS SECTIONS A–A' & B–B'
TANK MOUNTAIN LANDFARM
SWSE SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO

PROJECT NO. 017818018–01
DWG NO. 05
REV NO. A
CLIENT: HILCORP ENERGY COMPANY

LT Environmental, Inc. Arvada, Colorado

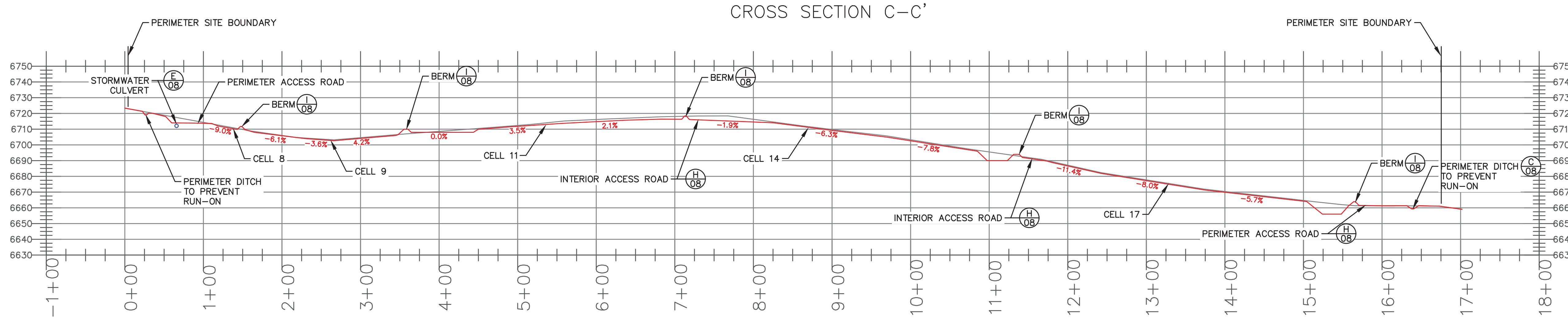
DRAWING INFORMATION	BY	DATE
DESIGNED	CS	11/25/19
DRAWN	AG	11/25/19
CHECKED	CS	11/25/19
REVIEWED	ES	11/25/19
APPROVED	AW	11/25/19

SCALE: AS SHOWN
FILE: M:\clients\WSP\017818018–Tank Mtn\017818018

REVISIONS

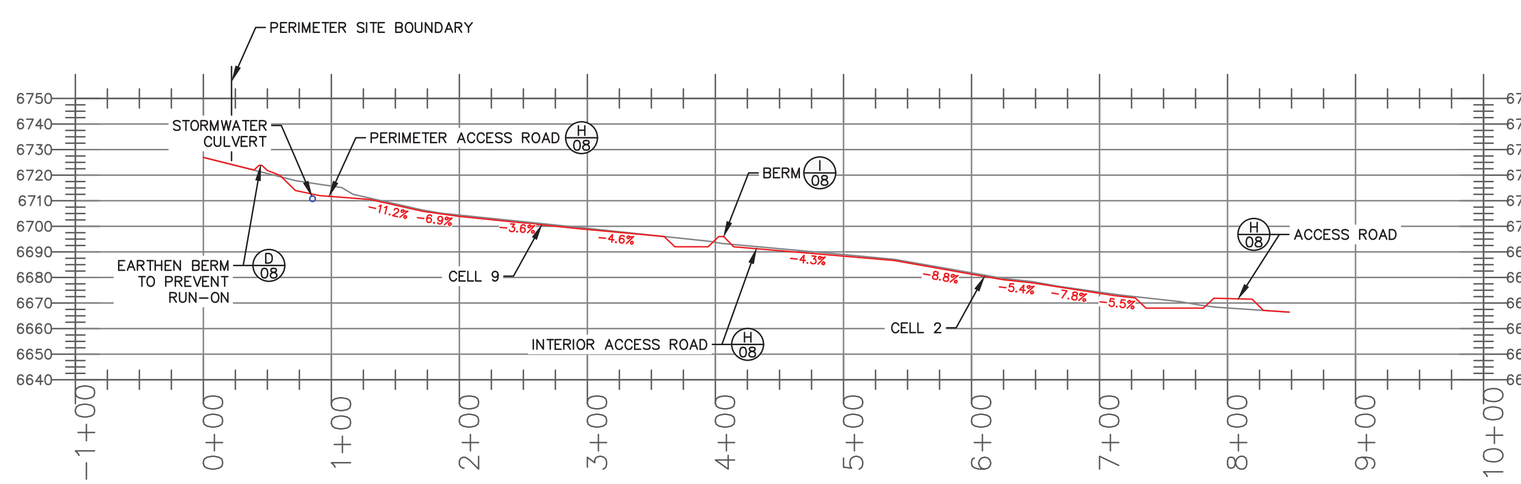
NO.	DESCRIPTION	BY	APPROVED	DATE
A	PRELIMINARY	AG	CS	10/16/19

CROSS SECTION C–C'



Cell No.	Cell Area (ac)	Drainage Area Into Cell (ac)	Volume of Runoff Produced by Drainage Area (ft3)	Sump Volume (ft3)	Available Soil Storage (yd3)
Cell 8	0.7	0.73	6,495	7,788	1,682
Cell 9	1.0	1.04	9,206	10,856	2,423
Cell 11	1.2	1.22	10,878	13,938	2,840
Cell 14	0.9	0.92	8,177	8,878	2,246
Cell 17	0.8	0.83	7,346	9,186	1,901

CROSS SECTION D–D'



Cell No.	Cell Area (ac)	Drainage Area Into Cell (ac)	Volume of Runoff Produced by Drainage Area (ft3)	Sump Volume (ft3)	Available Soil Storage (yd3)
Cell 9	1.0	1.04	9,206	10,856	2,423
Cell 2	0.9	0.93	8,279	10,600	2,119

LEGEND

PROPOSED GROUND SURFACE
EXISTING GROUND SURFACE
ac =ACRE
ft3 =FEET CUBED
yd3 =YARD CUBED

NOTES:
CELL VOLUME REQUIRED IS BASED ON RAINFALL FROM A 24–HR, 25–YR RAIN EVENT ENTERING THE CELLS.

CROSS SECTIONS C–C' & D–D'
TANK MOUNTAIN LANDFARM
SWSE SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO

PROJECT NO. 017818018-01
DWG NO. 06
REV NO. A
CLIENT: HILCORP ENERGY COMPANY

LT Environmental, Inc. Arvada, Colorado

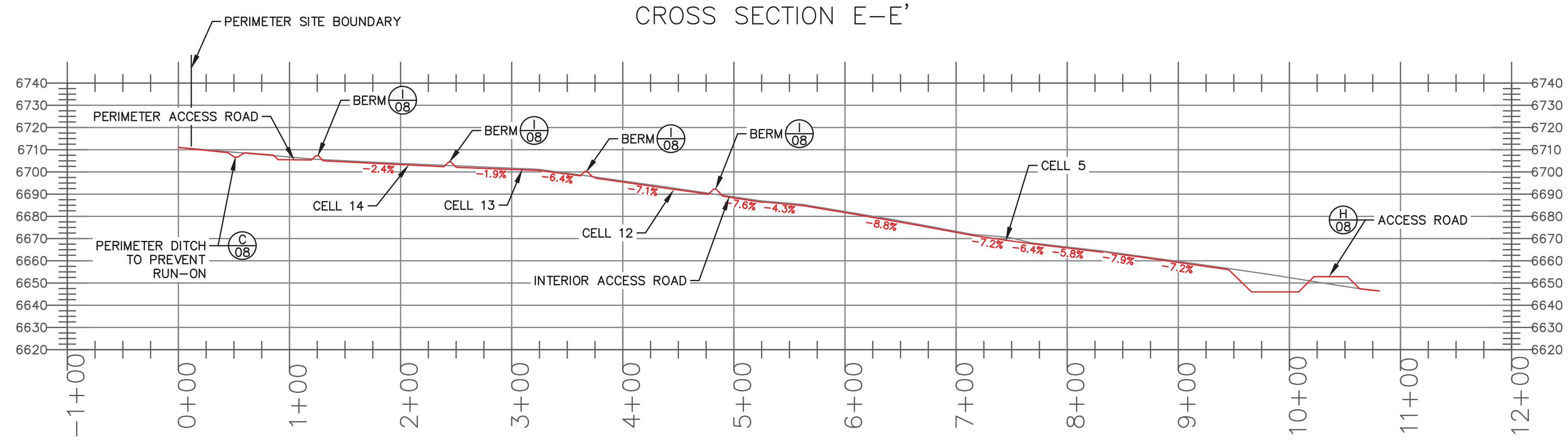
DRAWING INFORMATION	BY	DATE
DESIGNED	CS	11/25/19
DRAWN	AG	11/25/19
CHECKED	CS	11/25/19
REVIEWED	ES	11/25/19
APPROVED	AW	11/25/19

SCALE: AS SHOWN
FILE: M:\clients\WSP\017818018–Tank Mtn\017818018

REVISIONS

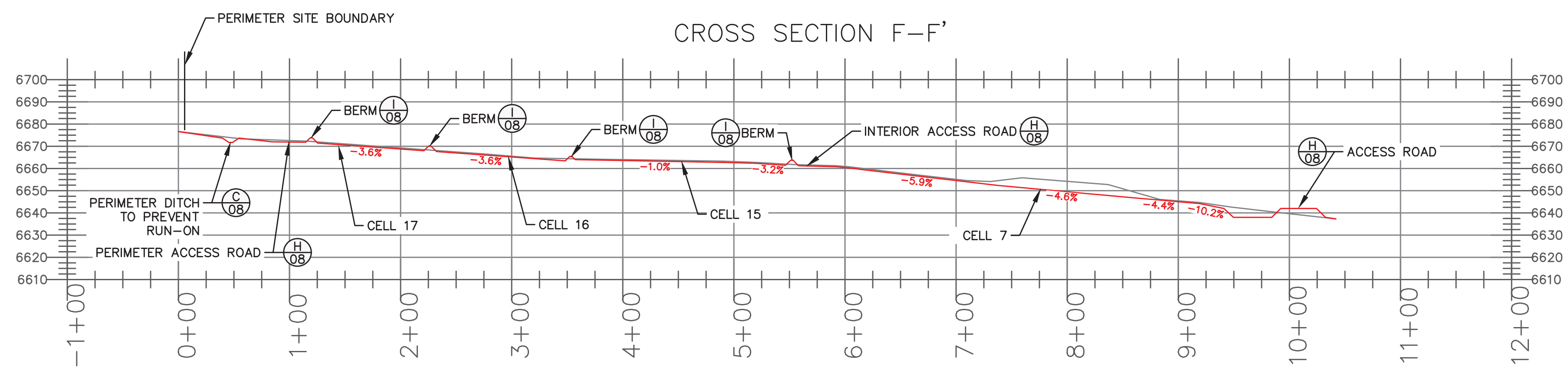
NO.	DESCRIPTION	BY	APPROVED	DATE
A	PRELIMINARY	AG	CS	10/16/19

CROSS SECTION E–E'



Cell No.	Cell Area (ac)	Drainage Area Into Cell (ac)	Volume of Runoff Produced by Drainage Area (ft3)	Sump Volume (ft3)	Available Soil Storage (yd3)
Cell 14	0.9	0.92	8,177	8,878	2,246
Cell 13	1.0	0.96	8,557	8,708	2,582
Cell 12	0.9	0.88	7,789	8,838	2,249
Cell 5	1.5	1.51	13,442	18,024	3,505

CROSS SECTION F–F'



Cell No.	Cell Area (ac)	Drainage Area Into Cell (ac)	Volume of Runoff Produced by Drainage Area (ft3)	Sump Volume (ft3)	Available Soil Storage (yd3)
Cell 17	0.8	0.83	7,346	9,186	1,901
Cell 16	1.2	1.17	10,374	11,088	3,051
Cell 15	1.6	1.62	14,435	15,714	3,999
Cell 7	1.0	1.03	9,139	9,224	2,543

LEGEND

PROPOSED GROUND SURFACE
EXISTING GROUND SURFACE
ac =ACRE
ft3 =FEET CUBED
yd3 =YARD CUBED

NOTES:
CELL VOLUME REQUIRED IS BASED ON RAINFALL FROM A 24–HR, 25–YR RAIN EVENT ENTERING THE CELLS.

CROSS SECTIONS E–E' & F–F'
TANK MOUNTAIN LANDFARM
SWSE SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO

PROJECT NO. 017818018–01
DWG NO. 07
REV NO. A

CLIENT: HILCORP ENERGY COMPANY

LT Environmental, Inc. Arvada, Colorado

DRAWING INFORMATION	BY	DATE
DESIGNED	CS	11/25/19
DRAWN	AG	11/25/19
CHECKED	CS	11/25/19
REVIEWED	ES	11/25/19
APPROVED	AW	11/25/19

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NO.	DESCRIPTION	BY	APPROVED	DATE
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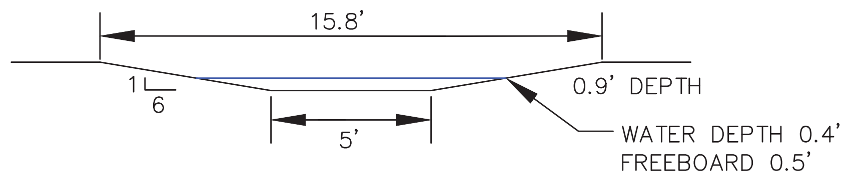
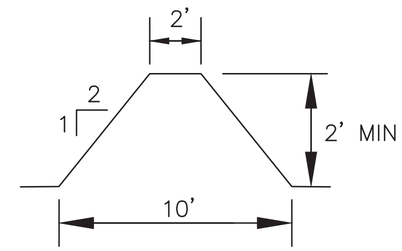
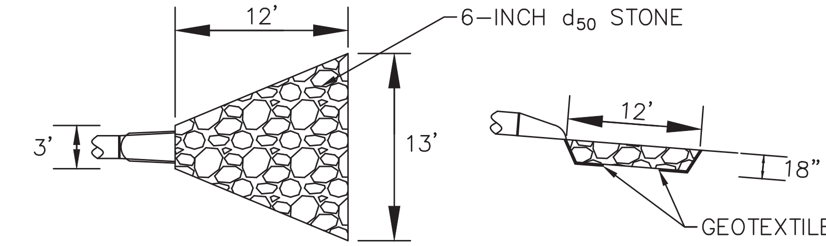


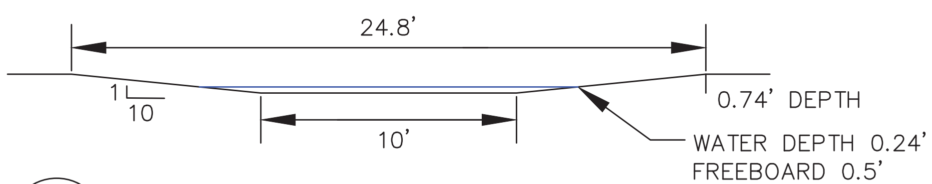
A / 08 PERIMETER DITCH 1 PREVENTING RUN-ON MINIMUM DIMENSIONS



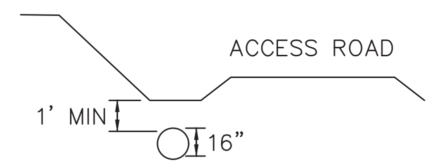
D / 08 TYPICAL EARTHEN BERM PREVENTING RUN-ON



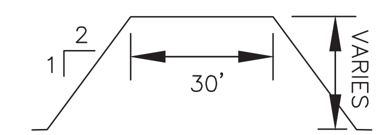
G / 08 TYPICAL RIPRAP APRON



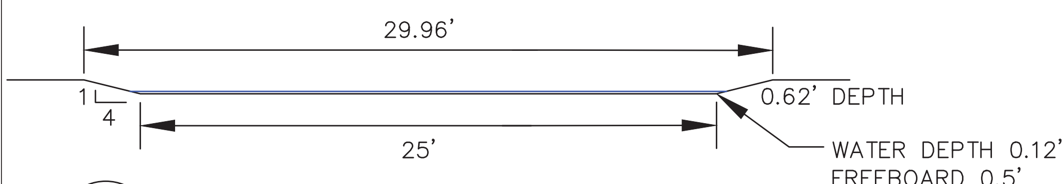
B / 08 PERIMETER DITCH 2 MINIMUM DIMENSIONS



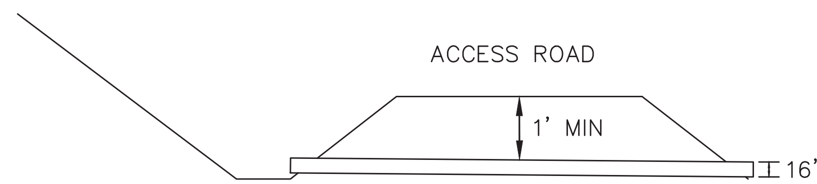
E / 08 STORMWATER CULVERT



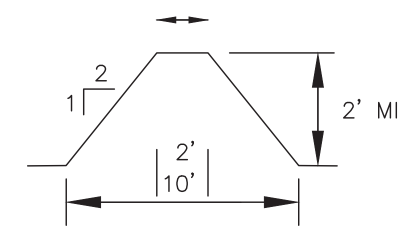
H / 08 TYPICAL ACCESS ROAD



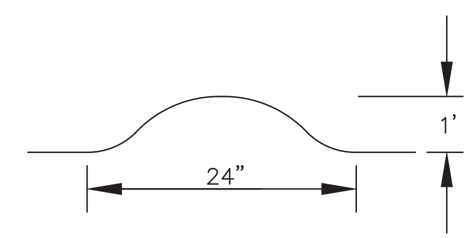
C / 08 PERIMETER DITCH 3 PREVENTING RUN-ON MINIMUM DIMENSIONS



F / 08 STORMWATER CULVERT CROSSING



I / 08 TYPICAL EARTHEN BERM SEPARATING CELLS



J / 08 SPEED BUMP

NOTE: ALL DITCHES LINED WITH EROSION CONTROL BLANKET AND ARMORED WITH 2" RIPRAP

DETAILS
TANK MOUNTAIN LANDFARM
SWSE SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO

PROJECT NO. 017818018-01
DWG NO. 08
REV NO. A
CLIENT: HILCORP ENERGY COMPANY

LT Environmental, Inc.
Arvada, Colorado

DRAWING INFORMATION	BY	DATE
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CHECKED	CS	11/25/19
REVIEWED	ES	11/25/19
APPROVED	AW	11/25/19

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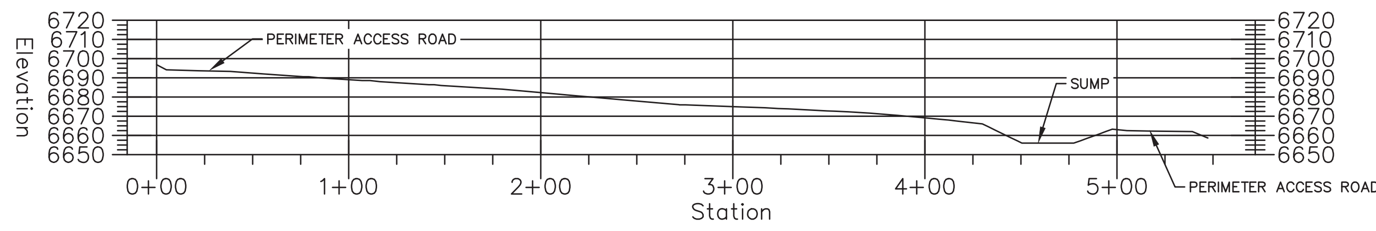
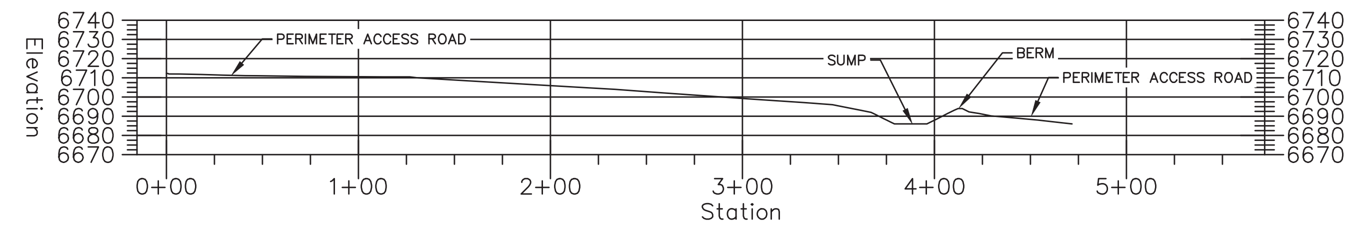
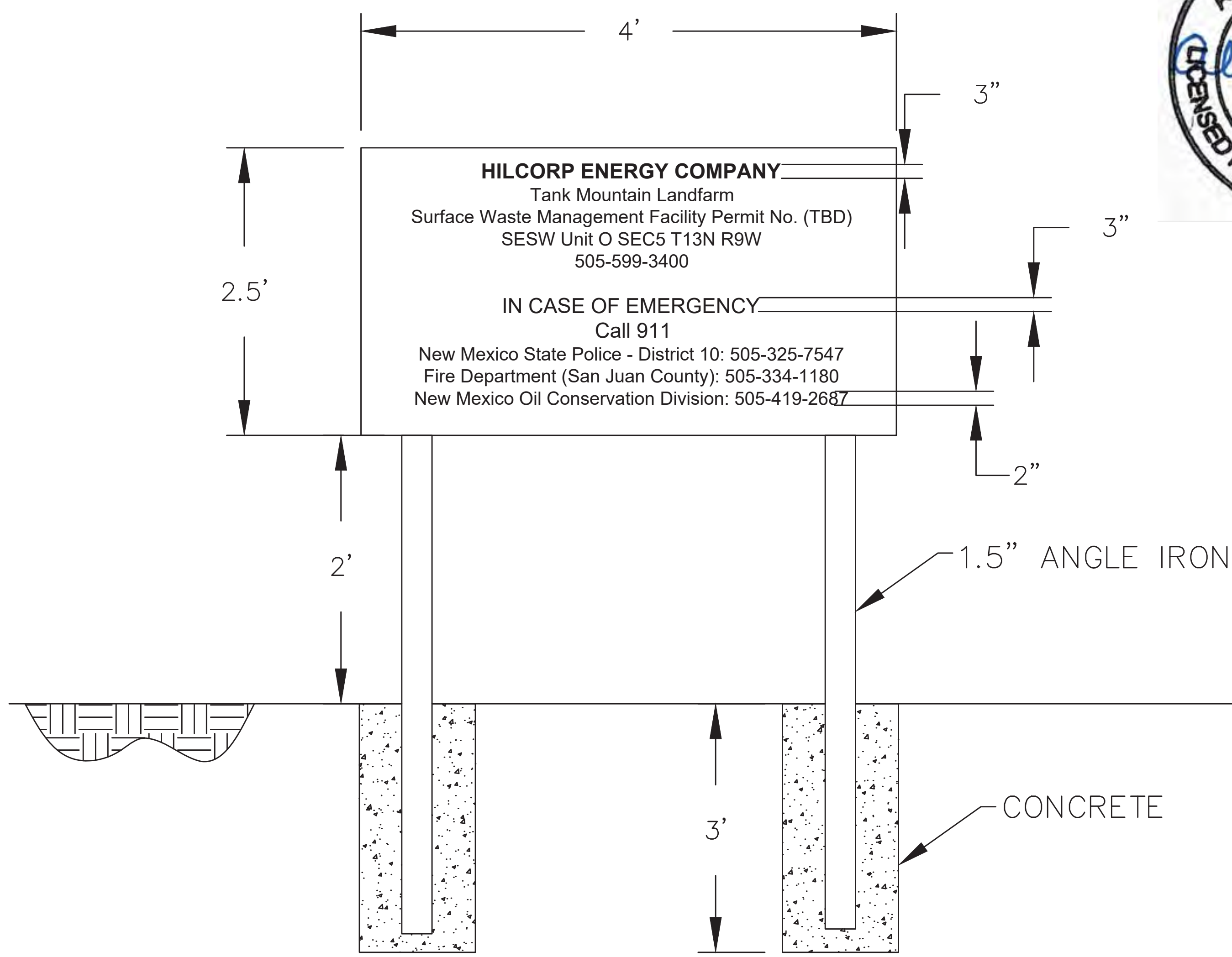


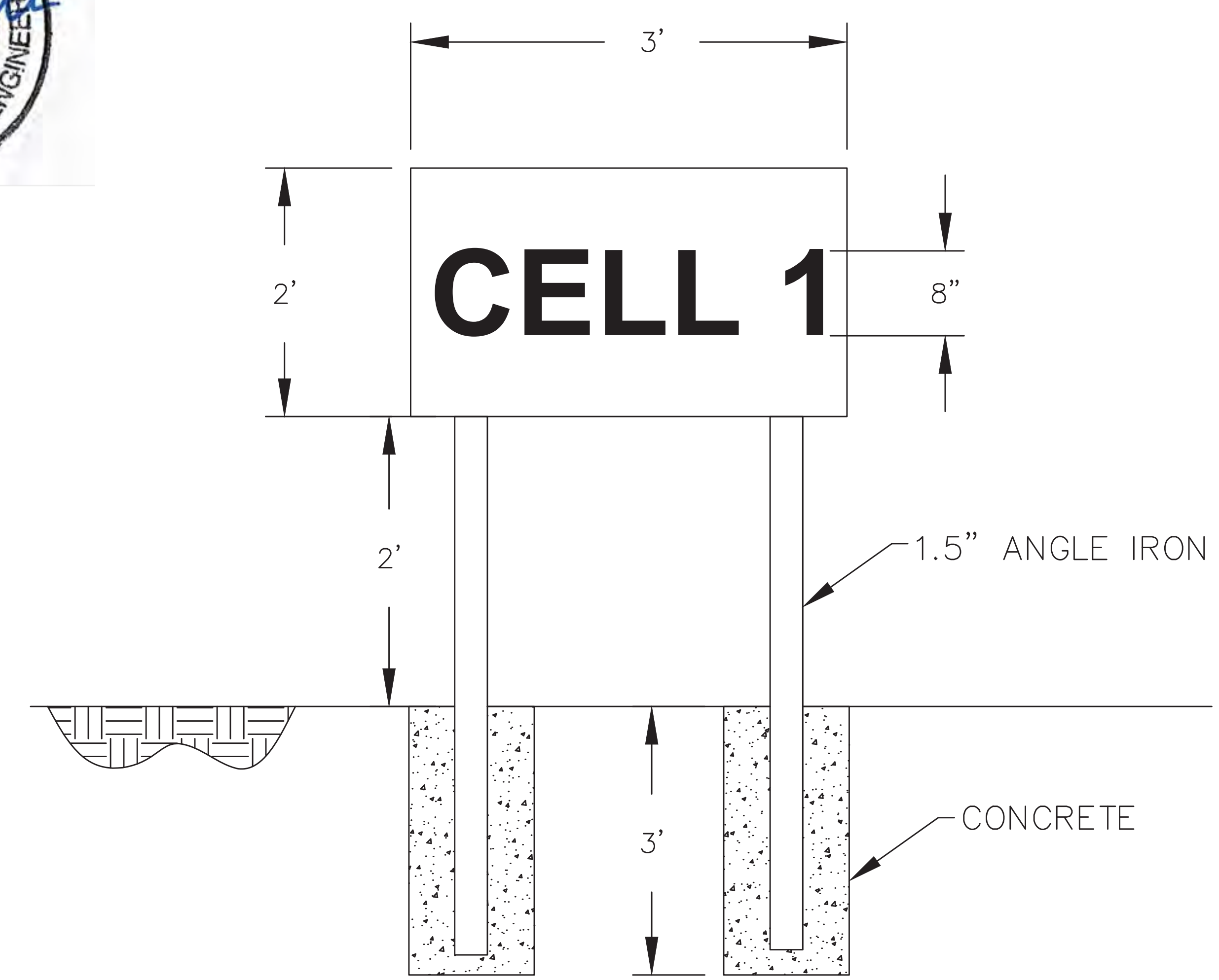
TYPICAL SECTION THROUGH CELL
(CELL 3 USED FOR EXAMPLE)



TYPICAL SECTION THROUGH CELL
(CELL 13 USED FOR EXAMPLE)



A
09
SITE ENTRANCE SIGNAGE



B
09
TYPICAL CELL IDENTIFICATION SIGNAGE

NOTE: ENTRANCE TO LANDFARM SHALL BE EQUIPPED WITH ABOVE LISTED INFORMATION, LEGIBLE FROM 50-FEET AWAY.

DETAILS
TANK MOUNTAIN LANDFARM
SWSE SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO

PROJECT NO. 017818018-01
DWG NO. 09
REV NO. B
CLIENT: HILCORP ENERGY COMPANY

LT Environmental, Inc.
Arvada, Colorado

DRAWING INFORMATION	BY	DATE
DESIGNED	CS	11/25/19
DRAWN	AG	11/25/19
CHECKED	CS	11/25/19
REVIEWED	ES	11/25/19
APPROVED	AW	11/25/19

SCALE: NTS
FILE: M:\clients\WSP\017818018-Tank Mtn\017818018

REVISIONS

NO.	DESCRIPTION	BY	APPROVED	DATE
B	REVISION 1	AG	CS	4/8/20
A	PRELIMINARY	AG	CS	10/16/19

Received by OCD: 11/25/2020 2:17:22 PM

APPENDIX B: PLAN FOR MANAGEMENT OF APPROVED OILFIELD WASTES

APPENDIX B - PLAN FOR MANAGEMENT OF APPROVED OIL FIELD WASTES

HILCORP TANK MOUNTAIN LANDFARM
SAN JUAN COUNTY, NEW MEXICO

OCTOBER 2020

Prepared for:

HILCORP ENERGY COMPANY
382 County Road 3100
Aztec, New Mexico 87401

Prepared by:

LT ENVIRONMENTAL, INC.
848 East Second Avenue
Durango, Colorado 81301
970.385.1096

A proud member of WSP

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

ATTACHMENTS

1.0 INTRODUCTION

This Plan for the Management of Approved Oil Field Wastes (Plan) for the Tank Mountain Landfarm (Landfarm) operated by Hilcorp Energy Company (Hilcorp) is required in New Mexico Administrative Code (NMAC) 19.15.36.8 (C)(6) and complies with the applicable specifications contained in 19.15.36.13 and 19.15.36.15 NMAC.

1.1 19.15.36.8 (C)(6): MANAGEMENT OF APPROVED OIL FIELD WASTES

This Plan was written to address and ensure compliance with Landfarm siting requirements, outline proper and approved procedures for managing waste acceptance, and provide detailed procedures for handling wastes on site. The Plan references the associated written plans for the Landfarm, including the *Run-on and Run-off Control Plan* (Appendix F), *Contingency Plan* (Appendix E), and the attached *Waiver Request*.

2.0 SITING CRITERIA FOR LANDFARMS

This section provides information regarding compliance with the siting requirements of Subsections A, B, and C of 19.15.36.13 NMAC.

2.1 19.15.36.13 (A): DEPTH TO GROUNDWATER

As described in the *Short Term Aquifer Test and Groundwater Information* document (Appendix I), Hilcorp has installed two monitoring wells onsite into a shallow water-bearing zone with total depths at approximately 105 feet below ground surface (bgs). The most recent depth-to-water measurement was approximately 43 feet below the top of casing. An aquifer test and modeling were completed on well MW01 with details included in Appendix I. The highest pumping rate that could be simulated without the well going dry was 0.0256 gallons per minute (gpm), which is equivalent to 36.9 gallons per day (gpd). The sustainable yield for well MW01 is 36.9 gpd, approximately one-quarter of the value of 150 gpd that EPA indicates is required for a typical small household. Therefore, the perched saturated interval encountered in wells MW01 and MW03 is not considered a sustainable water resource, and an aquifer nor groundwater, per the definitions in 19.15.2.7 NMAC, is not present within 105 feet of the ground surface at the Landfarm.

2.2 19.15.36.13 (B): ADDITIONAL SITING CRITERIA

The *NMAC Surface Waste Management Facilities Siting Criteria* (Siting Criteria) Summary Information and appropriate figures are included in Attachment 1. Siting Criteria was submitted to the New Mexico Environment Department (NMED) on May 20, 2019 and verbally approved. Attachment 1 includes tax-assessor documents for the parcels identified on Figure 3. Attachment 1 also includes wetland determination documents for sample locations identified on Figure 6.

2.3 19.15.36.13 (C): LANDFARM SIZE

The proposed Landfarm permit boundary is approximately 38 acres in size, meeting the criteria that the "no surface waste management facility shall exceed 500 acres". In total, 17.7 acres of the Landfarm will be used as active treatment-zone cells.

3.0 OPERATIONAL REQUIREMENTS

3.1 19.15.36.13 (D), (E), AND (F): WASTE ACCEPTANCE

The Landfarm, located in San Juan County, New Mexico, is intended for acceptance of oil field waste, including petroleum hydrocarbon-contaminated soil, drill cuttings, and tank bottoms.

(D) The operator shall not accept oil field wastes transported by motor vehicle at the surface waste management facility unless the transporter has a form C-133, authorization to move liquid waste, approved by the division.

Form C-133 is required to move produced water, drilling fluids or other liquid field waste, including drilling fluids and residual liquids in oil field equipment. As stated in Subsection E of 19.15.36.13, oil field waste containing free liquids is not allowed to be placed in landfill or Landfarm cells. As such, Form C-133 should not be required for waste being accepted at the Landfarm.

(E) The operator shall not place oil field waste containing free liquids in a landfill or landfarm cell. The operator shall use the paint filter test, as prescribed by the United States Environmental Protection Agency (EPA) (EPA SW-846, method 9095) to determine conformance of the oil field waste to this criterion.

Landfarm operators will inspect each load upon arrival at the Landfarm for free liquids. The person tendering oil field waste for treatment at the Landfarm is required to certify on Form C-138, *Request for Approval to Accept Solid Waste* (Attachment 2) that representative samples of the oil field waste have been subjected to and pass the paint filter test. If oil field waste has not been subject to the paint filter test, then a paint filter test (as prescribed by EPA SW-846 method 9095B, Attachment 3) will be administered on site prior to soil being placed in a Landfarm cell. Hilcorp Landfarm operators will be trained to conduct this test per the *Landfarm Training Plan* (included as Attachment 4).

(F) Surface waste management facilities shall accept only exempt or non-hazardous waste, except as provided in Paragraph (3) of Subsection F of 19.15.36.13 NMAC. The operator shall not accept hazardous waste at a surface waste management facility. The operator shall not accept wastes containing naturally occurring radioactive material(s) (NORM) at a surface waste management facility except as provided in 19.15.35 NMAC.

The Landfarm will accept only oil field waste generated by Hilcorp at oil and natural gas well production sites, pipelines, or compressor stations in the form of petroleum hydrocarbon-contaminated soils from remediation activities, petroleum hydrocarbon-contaminated drill cuttings, and tank bottoms not containing economically-recoverable petroleum hydrocarbons. The soil, drill cuttings, and tank bottoms shall be exempt non-hazardous waste, except under emergency conditions when the Department of Public Safety (DPS) has the authority to order acceptance of emergency non-oil field waste.

Hilcorp will not accept hazardous waste at the Landfarm. To ensure no hazardous waste is accepted, Hilcorp personnel will implement an acceptance procedure that eliminates this potential:

- Upon arrival at the Landfarm, each truck driver will produce Form C-138 for review.
- Hilcorp Landfarm operators will visually inspect the load, review the paint filter test results or conduct a paint filter test, review the origin location of the load, and review the origin source for the load.
- Since the Landfarm will only accept waste generated on a Hilcorp location, if the location or source is not a known Hilcorp location where process knowledge of the waste can be verified, the load will be held until the source is identified, or the load will be rejected.

A summary of potential sources to help define exempt and non-exempt waste is included as Attachment 5 and will be part of the training program for Landfarm operators. In addition, Hilcorp will not accept wastes containing regulated NORM. NORM is not present in oil field waste from drilling and production waste in the San Juan Basin (USGS documentation included in Attachment 5). No waste from outside the San Juan Basin will be accepted.

The operator shall require the following documentation for accepting oil field wastes, and both the operator and the generator shall maintain and make the documentation available for division inspection.

All oil field waste received at the Landfarm must be accompanied by a Bill of Lading containing the generator, origin of waste, volume, description of waste, date of transport, the name of the transporter, and appropriate signatures.

Hilcorp personnel will document if each oil field waste load is in compliance with the required paperwork and testing in the Waste Tracking Form provided in Attachment 2. Hilcorp will deny any oil field waste that does not have the proper paperwork. These waste tracking records will be maintained until five years after closure of the Landfarm.

(1) Exempt oil field wastes. The operator shall require a certification on Form C-138, signed by the generator or the generator's authorized agent, that represents and warrants that the oil field wastes are generated from oil and gas exploration and production operations, are exempt waste and are not mixed with non-exempt waste. The operator shall have the option to accept such certifications on a monthly, weekly, or per load basis. The operator shall maintain and shall make the certificates available for the division's inspection.

For exempt oil field waste received at the Landfarm, Hilcorp will require a complete and signed Form C-138, *Request for Approval to Accept Solid Waste* (Attachment 2). Hilcorp personnel, trained and knowledgeable in the differentiation of waste types, will review the form prior to acceptance of waste at the Landfarm. The completed form will be valid for 30 calendar days for a single event at a given site. The completed C-138 forms will be maintained on site in the Landfarm Office. Landfarm documentation will be periodically scanned and stored on a secure server at the Hilcorp field office in Aztec, New Mexico and will be made available to the New Mexico Oil Conservation Division (NMOCD) upon request. The records will be maintained until five years after closure of the Landfarm.

(2) Non-exempt, non-hazardous, oil field wastes. The operator shall require a form C-138, oil field waste document, signed by the generator or its authorized agent. This form shall be accompanied by acceptable documentation to determine that the oil field waste is non-hazardous.

In circumstances where Hilcorp considers disposal of petroleum hydrocarbon-contaminated soil that is classified as non-exempt oil field waste, such as soil impacted by compressor oil, Hilcorp will require a completed Form C-138, *Request for Approval to Accept Solid Waste* (Attachment 2), signed by an Hilcorp employee trained and knowledgeable in waste characterization.

In addition, the Form C-138 must be accompanied by analytical results to confirm the material is non-hazardous. In addition to the required paint filter test discussed above for general acceptance, testing will include source-applicable analysis, such as reactivity, corrosivity, ignitability (RCI), toxicity characteristic leaching procedure (TCLP) benzene, toluene, ethylbenzene and total xylenes (BTEX), chlorides, and Resource Conservation and Recovery Act (RCRA) 8 metals. Additional testing may be required and will be determined on a case-by-case basis, taking into consideration process knowledge and the nature and source of contamination. The completed C-138 Forms and analytical results will be maintained on site in the Landfarm Office. Landfarm documentation will be periodically scanned and stored on a secure server at the Hilcorp field office in Aztec, New Mexico and will be available to the NMOCD upon request. The records will be maintained until five years after closure of the Landfarm.

(3) Emergency non-oil field wastes. The operator may accept non-hazardous, non-oil field wastes in an emergency if ordered by the (DPS). The operator shall complete a Form C-138, oil field waste document, describing the waste, and maintain the same, accompanied by the department of public safety order, subject to division inspection.

In the event that Hilcorp is ordered by the Department of Public Safety to accept emergency non-hazardous, non-oil field wastes, Hilcorp will require a completed Form C-138, *Request for Approval to Accept Solid Waste* (Attachment 2), signed by the generator or the generator's authorized agent. The completed Form C-138 and the Department of Public Health order and associated laboratory analytical results (if available) will be maintained on site in the Landfarm Office and will be periodically scanned and stored on a secure server at the Hilcorp field office in Aztec, New Mexico and will be available to the NMOCD upon request. The records will be maintained until five years after closure of the Landfarm.

3.2 19.15.36.13 (G): RECORDKEEPING

The operator of a commercial facility shall maintain records reflecting the generator, the location of origin, the location of disposal within the commercial facility, the volume and type of oil field waste, the date of disposal and the hauling company for each load or category of oil field waste accepted at the commercial facility. The operator shall maintain such records for a period of not less than five years after the commercial facility's closure, subject to division inspection.

All records and associated waste documentation will be maintained on site in the Landfarm Office and periodically will be scanned and stored on a secure server and at the Hilcorp field office in Aztec, New Mexico and will be made available to the NMOCD upon request. Documentation includes, but is not limited to:

- Form C-138;
- Bills of Lading;
- Analytical laboratory reports; and
- Regulatory orders and/or approvals and communications.

In addition, all completed Landfarm Inspection Checklists (included in the *Inspection and Maintenance Plan*, Appendix C), will be maintained in the manner described above.

Hilcorp will complete Landfarm-specific Waste Tracking and Daily Remediation Forms to document arriving loads (Attachment 2). In addition, total soil volumes will be tracked for each treatment cell using the Treatment Cell Volume Tracking Form (Attachment 2). These records will serve to document the following for each load accepted at the Landfarm:

- The location of origin
- The location of disposal within the Landfarm
- Generator of the waste
- Volume and type of oil field waste
- Date of disposal
- Hauling company

All records will be maintained for at least five years after closure of the Landfarm. Attachment 2 includes a sample Annual Recordkeeping Checklist.

3.3 19.15.36.13 (H): FACILITY STAFFING

Disposal at a commercial facility shall occur only when an attendant is on duty unless loads can be monitored or otherwise isolated for inspection before disposal. The surface waste management facility shall be secured to prevent unauthorized disposal.

The proposed Landfarm is an on-call centralized facility (not a commercial facility) periodically staffed by Hilcorp personnel. Access to the Landfarm will be controlled via a locked gate. Acceptance of loads into the Landfarm will only be allowed when an authorized Hilcorp employee, trained and knowledgeable in Landfarm operations, is present to open the gate and to monitor and inspect incoming loads and associated forms and documents. This will normally occur during normal business hours. The access gate will remain closed and locked when the authorized Hilcorp representative is not on site. Hilcorp Landfarm operators will have the authority to reject a load.

The facility will have a minimum four-foot fence with a locked gate at the entrance so that only authorized Hilcorp employees will be able to enter the Landfarm.

3.4 19.15.36.13 (I): PROTECTION OF MIGRATORY BIRDS

To protect migratory birds, tanks exceeding eight feet in diameter, and exposed pits and ponds shall be screened, netted, or covered. Upon the operator's written application, the division may grant an exception to screening, netting, or covering upon the operator showing that an alternative method will protect migratory birds or that the surface waste management facility is not hazardous to migratory birds. Surface waste management facilities shall be fenced in a manner approved by the division.

Exposed pits/ponds are not planned at the Landfarm; therefore, this requirement is not applicable.

3.5 19.15.36.13 (J): SIGNAGE

Surface waste management facilities shall have a sign, readable from a distance of 50 feet and containing the operator's name; surface waste management facility permit or order number; surface waste management facility location by unit letter, section, township, and range; and emergency telephone numbers.

Entrance to the Landfarm will be equipped with a sign, readable from 50 feet, similar to the following:

HILCORP ENERGY COMPANY
Tank Mountain Landfarm
Surface Waste Management Facility Permit # (TBD)
SESW Unit O SEC 5 T31N R9W
505-599-3400

IN CASE OF EMERGENCY
Call 911
New Mexico State Police – District 10: 505-325-7547
Fire Department (San Juan County): 505-334-1180
New Mexico Oil Conservation Division (Aztec Office): 505-419-2687

3.6 19.15.36.13 (K): SPILL REPORTING AND CORRECTIVE ACTIONS

The operators shall comply with the spill reporting and corrective action provisions of 19.15.30 NMAC or 19.15.29 NMAC.

Hilcorp has no plans to store petroleum liquids in tanks at the Landfarm. However, Hilcorp has a field-wide Spill Prevention, Control, and Countermeasure (SPCC) Plan in place and Hilcorp personnel are trained and aware of the appropriate notification procedures. Additional notification information is provided in Section 3.8 of the associated *Contingency Plan* (attached in Appendix E).

3.7 19.15.36.13 (P): TRAINING PLAN

Each operator shall conduct an annual training program for key personnel that includes general operations, permit conditions, emergencies proper sampling methods and identification of exempt and non-exempt waste and hazardous waste. The operator shall maintain records of such training, subject to division inspection, for five years.

A Training Plan has been prepared for the Landfarm and is included as Attachment 4 of this Plan.

4.0 SPECIFIC REQUIREMENTS APPLICABLE TO LANDFARMS

4.1 19.15.36.15 (A): OIL FIELD WASTE ACCEPTANCE CRITERIA

Only soils and drill cuttings predominantly contaminated by petroleum hydrocarbons shall be placed in a landfarm. The division may approve placement of tank bottoms in a landfarm if the operator demonstrates that the tank bottoms do not contain economically recoverable petroleum hydrocarbons. Soils and drill cuttings placed in a landfarm shall be sufficiently free of liquid content to pass the paint filter test, and shall not have a chloride concentration exceeding 500 mg/kg if the landfarm is located where groundwater is less than 100 feet but at least 50 feet below the lowest elevation at which the operator will place oil field waste or exceeding 1,000 mg/kg if the landfarm is located where groundwater is 100 feet or more below the lowest elevation at which the operator will place oil field waste. The person tendering oil field waste for treatment at a landfarm shall certify, on form C-138, that representative samples of the oil field waste have been subjected to the paint filter test and tested for chloride content, and that the samples have been found to conform to these requirements. The landfarm's operator shall not accept oil field waste for landfarm treatment unless accompanied by this certification.

Hilcorp will accept only oil field wastes such as soil and/or drill cuttings predominantly contaminated by petroleum hydrocarbons. Tank bottoms will be accepted at the Landfarm only when Hilcorp determines that the waste does not contain economically recoverable phase-separated petroleum hydrocarbons.

Depth to groundwater at the Landfarm location is greater than 100 feet below the lowest elevation of the design depth at which Hilcorp will place oil field wastes. A demonstration of the geology and hydrogeology is presented in the *Tank Mountain Landfarm Form C-137 Supplemental Information* document. As such, oil field waste exceeding 1,000 milligrams per kilogram (mg/kg) of chloride will not be accepted at the Landfarm. Chloride testing will be conducted on one composite soil sample to represent all oil field waste collected from an individual site.

Additional waste acceptance criteria are outlined in Section 3.1 above.

4.2 19.15.36.15 (B): BACKGROUND TESTING

Prior to beginning operation of a new landfarm, or to opening a new cell at an existing landfarm, at which the operator has not already established background, the operator shall take, at a minimum, 12 composite background soil samples, with each consisting of 16 discrete samples from areas that previous operations have not impacted at least six inches below the original ground surface, to establish background soil concentrations for the entire surface waste management facility. The operator shall analyze the background soil samples for TPH, as determined by EPA method 418.1 or other EPA method approved by the division; BTEX, as determined by EPA SW-846 method 8021B or 8260B; chlorides; and other constituents listed in Subsections A and B of 20.6.2.3103 NMAC, using approved EPA methods.

Prior to beginning operation at the Landfarm, a *Background Sampling Plan* will be prepared and submitted to the NMOCD for approval. The *Background Sampling Plan* will outline the procedures for sampling and analysis to establish soil background concentrations at the Landfarm before soil begins to be accepted for treatment.

4.3 19.15.36.15 (C): OPERATION AND OIL FIELD WASTE TREATMENT

(1) The operator shall berm each landfarm cell to prevent rainwater run-on and runoff.

Each Landfarm cell will be bermed to prevent and control run-on from entering the cell and runoff from leaving the cell and to direct precipitation around the Landfarm. More details on the management of stormwater is included the *Run-on and Runoff Control Plan* (included in Appendix F).

(2) The operator shall not place contaminated soils received after the effective date of 19.15.36 NMAC within 100 feet of the surface waste management facility's boundary.

The Landfarm cells are surrounded by a 100-foot buffer from the Landfarm boundary. Berms will be constructed and flagging/signage will be used in a manner to ensure contaminated soils are not placed within 100 feet of the Landfarm boundary.

(3) The operator shall not place contaminated soils received at a landfarm after the effective date of 19.15.36 NMAC within 20 feet of a pipeline crossing the landfarm.

A pipeline is parallel to the western boundary of the Landfarm. The Landfarm is designed to be at least 100 feet from the pipeline.

(4) With 72 hours after receipt, the operator shall spread and disk contaminated soils in eight-inch or less lifts or approximately 1000 cubic yards per acre per eight-inch lift or biopile.

Hilcorp will maintain an operations schedule (Attachment 6) and institute training to ensure contaminated soil is spread and disked in in 8-inch or less lifts or approximately 1,000 cubic yards per acre, within 72 hours after receipt. A paper copy of the schedule will be available at the Landfarm Administrative Office at all times. Details regarding the training for these duties are discussed in the Training Plan.

(5) The operator shall ensure that soils are disked biweekly and biopiles are turned at least monthly.

Hilcorp will maintain an operations schedule and institute training to ensure contaminated soil is disked at least biweekly, when possible. Disking operations will be postponed during winter and/or other adverse conditions that prevent disking (e.g., frozen ground) and/or access to the Landfarm (e.g., muddy roads). Biweekly disking will resume once conditions allow Landfarm access and the ability to disk the soil to appropriate depths (at least 8 inches).

A paper copy of the schedule will be available at the Landfarm Administrative Office at all times. Details regarding the training for these duties are discussed in the Training Plan.

(6) The operator shall add moisture, as necessary, to enhance bioremediation and to control blowing dust.

To maintain moisture requirements and control dust, landfarmed materials will be sprayed with water when moisture drops below 40 percent (%) field capacity (estimated 15% by weight) or if dust is being generated as a result of daily operations. Hilcorp personnel will be trained in how to determine moisture content of soil. Hilcorp will conduct or contract the water spray services.

(7) The application of microbes for the purposes of enhancing bioremediation requires prior division approval.

Hilcorp may apply to the division for approval of microbe application. If the addition of microbes is determined to be necessary to enhance bioremediation, division approval will be obtained prior to application.

(8) Pooling of liquids in the landfarm is prohibited. The operator shall remove freestanding water within 24 hours.

Hilcorp employees will conduct inspections within 24 hours of a storm event to determine if any pooling of liquids has occurred at the Landfarm. Any pooling liquids or precipitation will be removed and hauled for disposal if not evaporated before 24 hours following a storm event. A suitable drive area will be maintained within the berm areas to allow truck access for precipitation removal, inspection, and maintenance of the berm and to monitor redirected drainage around the Landfarm. All water will be collected with a vacuum truck and transported to an NMOCD-approved/permitted liquids disposal location. The Landfarm Inspection Checklist (Attachment 2) will be completed for each storm event requiring inspection.

(9) The operator shall maintain records of the landfarm's remediation activities in a form readily accessible for division inspection.

Once remediation activities begin (after soil is first accepted at the Landfarm), Hilcorp will record and maintain all Landfarm remediation activities logs on site at the Landfarm Office and will be periodically scanned and stored on a secure server at the Hilcorp field office in Aztec, New Mexico. A sample Daily Remediation Activities Form is included in Attachment 2. Records will be available for division inspection and will be maintained for five years after Landfarm closure.

<u>The Daily Remediation Activities Form includes:</u>

Times and initials for each truck load arrival and disking activities, a load tracking number, the cell and lift number the load is assigned to, as well as the cell disking activities, biocell turning activities when stormwater is removed (if needed), when the Landfarm is sprayed for dust control, and any additional comments or information.

(10) The division's environmental bureau may approve other treatment procedures if the operator demonstrates that they provide equivalent protection for fresh water, public health, safety, and the environment.

Hilcorp may apply to the division for approval of other treatment procedures, should the need arise. No other treatment procedures are being pursued at this time.

4.4 19.15.36.15 (D): TREATMENT ZONE MONITORING

The operator shall spread contaminated soils on the surface in eight inch or less lifts or approximately 1000 cubic yards per acre per eight-inch lift. The operator shall conduct treatment zone monitoring to ensure that, prior to adding an additional lift, the TPH concentration of each lift, as determined by EPA SW-846 method 8015M or EPA method 418.1 or other EPA method approved by the division, does not exceed 2500 mg/kg and that the chloride concentration, as determined by EPA method 300.1, does not exceed 500 mg/kg if the landfarm is located where ground water is less than 100 feet but at least 50 feet below the lowest elevation at which the operator will place oil field waste or 1000 mg/kg if the landfarm is located where groundwater is 100 feet or more below the lowest elevation at which the operator will place oil field waste. The operator shall collect and analyze at least one composite soil sample, consisting of four discrete samples, from the treatment zone at least semi-annually using the methods specified below for TPH and chlorides.

Hilcorp will maintain an operations schedule (Attachment 6) to ensure contaminated soils are spread on the surface in 8-inch or less lifts or approximately up to 1,000 cubic yards per acre per 8-inch lift.

Hilcorp will maintain and implement a monitoring schedule (Attachment 6). Hilcorp will sample the treatment zone semi-annually to monitor concentrations of contaminants and prior to adding an additional lift to a Landfarm cell. Sampling will consist of collecting and analyzing at least one composite soil sample, consisting of four discrete samples, from the treatment zone. The soil samples will be analyzed for TPH according to EPA Method 8015M or EPA Method 418.1, and for chloride according to EPA Method 300.1. Hilcorp will provide the NMOCD with the analytical results, and request approval to add an additional lift based on depth to groundwater greater than 100 feet below ground surface (bgs). The following performance standards must be met prior to adding soil to an 8-inch lift:

- TPH concentration as determined by EPA SW-846 method 8015M or EPA method 418.1 does not exceed 2,500 mg/kg.
- The chloride concentration, as determined by EPA method 300.1, does not exceed 1,000 mg/kg.
- This semi-annual sampling event will occur during the second and fourth quarters of every year.

The maximum thickness of treated soils in a landfarm cell shall not exceed two feet or approximately 3000 cubic yards per acre. When that thickness is reached, the operator shall not place additional oil field waste in the landfarm cell until it has demonstrated by monitoring the treatment zone at least semi-annually that the contaminated soil has been treated to the standards specified in Subsection F of 19.15.36.15 NMAC or the contaminated soils have been removed to a division approved surface waste management facility.

The maximum thickness of treated soils in a cell at the Landfarm will not exceed two feet. In addition, the minimum berm height around each cell will be two feet above the treatment-zone soils. If a thickness of two feet or 3,000 cubic yards per acre is reached, Hilcorp will not place additional oil field waste in the Landfarm cell until it has demonstrated by sampling semi-annually that the contaminated soil has been treated to the standards specified below or the contaminated soils have been removed to a division-approved surface waste management facility:

- Benzene, as determined by EPA SW-846 method 8021B or 8260B, shall not exceed 0.2 mg/kg
- Total BTEX , as determined by EPA SW-846 method 8021B or 8260B, shall not exceed 50 mg/kg
- The TPH-Gasoline Range Organics (GRO) and TPH-Diesel Range Organics (DRO) combined fractions, as determined by EPA SW-846 method 8015M, shall not exceed 500 mg/kg
- TPH, as determined by EPA method 8015M or 418.1, shall not exceed 2,500 mg/kg
- Chlorides, as determined by EPA method 300.1, shall not exceed 1,000 mg/kg
- The concentration of constituents listed in Subsections A and B of 20.6.2.3103 NMAC shall be determined by EPA SW-846 methods 6010B or 6020. If the concentration of those constituents exceeds the practical quantitation limit (PQL) or background concentrations (to be established prior to Landfarm operation), Hilcorp will perform a site-specific risk assessment using EPA approved methods and will propose closure standards based upon individual site conditions that protect fresh water, public health, safety, and the environment. Any proposed closure standards requested will be subject to division approval or the division may require the landfarmed materials to be hauled offsite to an approved facility.
- This semi-annual sampling event will occur during the second and fourth quarters of every year.

4.5 19.15.36.15 (E): VADOSE ZONE MONITORING

(1) Sampling. The operator shall monitor the vadose zone beneath the treatment zone in each landfarm cell. The operator shall take the vadose zone samples from soils between three and four feet below the cell's original ground surface.

(2) Semi-annual monitoring program. The operator shall collect and analyze a minimum of four randomly selected, independent samples from the vadose zone at least semi-annually using the methods specified below for TPH, BTEX and chlorides and shall compare each result to the higher of the PQL or the background soil concentrations to determine whether a release has occurred.

Hilcorp will perform vadose zone monitoring semi-annually, collecting four samples from between three and four feet below each cell's original ground surface. Semi-annual vadose zone samples collected from each cell will be analyzed for:

- Total BTEX, as determined by EPA SW-846 method 8021B
- TPH, as determined by EPA method 8015M
- Chloride, as determined by EPA method 300.1

Hilcorp will compare each result to the higher of the PQL or the background soil concentrations (to be established prior to Landfarm operation) to determine whether a release has occurred. This semi-annual sampling event will occur during the second and fourth quarters of every year.

(3) Five year monitoring program. The operator shall collect and analyze a minimum of four randomly selected, independent samples from the vadose zone, using the methods specified below for the constituents listed in Subsections A and B of 20.6.2.3103 NMAC at least every five years and shall compare each result to the higher of the PQL or the background soil concentrations to determine whether a release has occurred.

Once every five years, Hilcorp will perform vadose zone monitoring collecting a minimum of four randomly selected, independent samples from between three and four feet below the original ground surface of the Landfarm cells. The 5-year vadose zone samples will be analyzed for the constituents listed in Subsection A and B of 20.6.2.3103 NMAC by EPA SW-846 methods 6010B or 6020 and compared to the higher of the PQL or the background soil concentration (to be established prior to Landfarm operation) to determine whether a release has occurred.

(4) Record keeping. The operator shall maintain a copy of the monitoring reports in a form readily accessible for division inspection.

All sampling and monitoring reports and associated analytical data for the semi-annual treatment zone sampling, semi-annual vadose zone sampling, and the 5-year vadose zone monitoring will be readily available for division inspection upon request. Monitoring reports will be maintained on site at the Landfarm Administrative Office and at the Hilcorp field office in Aztec, New Mexico for at least five years after Landfarm closure.

(5) Release response. If vadose zone sampling results show that the concentrations of TPH, BTEX or chlorides exceed the higher of the PQL or the background soil concentrations, then the operator shall notify the division's environmental bureau of the exceedance and shall immediately collect and analyze a minimum of four randomly selected, independent samples for TPH, BTEX, chlorides and the constituents listed in Subsections A and B of 20.6.2.3103 NMAC. The operator shall submit the results of the re-sampling event and a response action plan for the division's approval within 45 days of the initial notification. The response action plan shall address changes in the landfarm's operation to prevent further contamination and, if necessary, a plan for remediating existing contamination.

In the event that semi-annual or 5-year vadose zone sampling results show the concentrations of TPH, BTEX, chloride, and/or listed in Subsection A and B of 20.6.2.3103 NMAC by EPA SW-846 methods 6010B or 6020 exceed the higher of the PQL or background soil concentration (to be established prior to Landfarm operation), Hilcorp will notify the NMOCD and immediately collect a minimum of four randomly-selected independent samples for analysis of:

- Total BTEX, as determined by EPA SW-846 method 8021B
- TPH, as determined by EPA method 8015M
- Chloride, as determined by EPA method 300.1
- Other constituents as specified in Subsection E of 19.15.36.15 NMAC.

Hilcorp will submit the results of the re-sampling and a response action plan to the NMOCD for approval within 45 days of the initial notification. The response action plan will propose changes in the Landfarm operations and procedures to prevent further impact and, if necessary, a remediation plan for existing contamination beyond the Landfarm treatment amendments. The remediation plan may include recommendations for further delineation sampling for the above constituents.

4.6 19.15.36.15 (F): TREATMENT ZONE CLOSURE PERFORMANCE STANDARDS

After the operator has filled a landfarm cell to the maximum thickness of two feet or approximately 3000 cubic yards per acre, the operator shall continue treatment until the contaminated soil has been remediated to the higher of the background concentrations or the following closure performance standards. The operator shall demonstrate compliance with the closure performance standards by collecting and analyzing a minimum of one composite soil sample, consisting of four discrete samples.

Hilcorp will collect a single composite soil sample, consisting of four discrete samples, in the treatment zone of a Landfarm cell that has reached capacity and been treated. Sample results will be compared to the closure performance standards listed in the table below.

Treatment Zone Closure Performance Standards

Constituent	Lab Method	Limit
Benzene	EPA SW-846 Method 8021B or 8260B	0.2 mg/kg
BTEX	EPA SW-846 Method 8021B or 8260B	50 mg/kg
Gasoline range organics (GRO) plus diesel range organics (DRO)	EPA SW-846 Method 8015M	500 mg/kg
TPH	EPA Method 8015M or 418.1	2,500 mg/kg
Chloride concentration	EPA Method 300.1	1,000 mg/kg[a]
The constituents listed in subsections A and B of 20.6.2.3103 NMAC by EPA SW-846 methods 6010B and 6020.	EPA Methods 6010B and 6020	Limit will be based on the results of a *Background Sampling Plan* to be submitted to NMOCD prior to landfarm construction.

[a] 1,000 mg/kg is the limit due to groundwater being located greater than 100 feet below the lowest elevation where Hilcorp will place oil field waste at the Landfarm.

4.7 19.15.36.15 (G): DISPOSITION OF TREATED SOILS

(1) If the operator achieves the closure performance standards specified in Subsection F of 19.15.36.15 NMAC, then the operator may either leave the treated soils in place, or, with prior division approval, dispose or reuse of the treated soils in an alternative manner.

As described in Subsection G of 19.15.36.15 NMAC, once treatment-zone closure performance standards have been met, as described in Subsection F of 19.15.36.15 NMAC, soils can be reused. Hilcorp anticipates the reuse of treated soils at other Hilcorp-owned sites in order to backfill remedial excavations. Hilcorp will provide a written request to NMOCD prior to reusing soil from the Landfarm.

(2) If the operator cannot achieve the closure performance standards specified in Subsection F of 19.15.36.15 NMAC within five years or as extended by the division, then the operator shall remove contaminated soils from the landfarm cell and properly dispose of it at a division-permitted landfill, or reuse or recycle it in a manner approved by the division.

If Hilcorp cannot meet the closure performance standards within five years or as extended by the division, they will remove and dispose of the impacted soils at a NMOCD-permitted landfill, or reuse or recycle it in a manner approved by the division.

(3) If the operator cannot achieve the closure performance standards specified in Subsection F of 19.15.36.15 NMAC within five years or as extended by the division, then the division may review the adequacy of the operator's financial assurance, as provided in Subsection G of 19.15.36.11 NMAC. In that event, the division may require the operator to modify its financial assurance to provide for the appropriate disposition of contaminated soil in a manner acceptable to the division.

Hilcorp understands that if performance standards are not met that the division may require Hilcorp to modify its financial assurance up to $25,000.

(4) The operator may request approval of an alternative soil closure standard from the division, provided that the operator shall give division-approved public notice of an application for alternative soil closure standards in the manner provided in 19.15.36.9 NMAC. The division may grant the request administratively if no person files an objection thereto within 30 days after publication of notice; otherwise the division shall set the matter for hearing.

Hilcorp has submitted a Waiver Request (per 19.15.36.19 NMAC) as a substitute for background sampling to determine site-specific background closure standards based on NMED residential SSLs. Where no NMED SSLs have been developed, other sources of screening levels were consulted, such as the EPA RSLs, as suggested in the *Risk Assessment Guidance for Investigations and Remediation, Volume I* (NMED, 2019).

ATTACHMENT 1: NMAC SURFACE WASTE MANAGEMENT FACILITY SITING CRITERIA

NMAC SURFACE WASTE MANAGEMENT FACILITIES SITING CRITERIA
SUMMARY INFORMATION SHEET
19.15.13 NMAC & 19.15.2 NMAC

LT Environmental Inc.
848 East Second Avenue
Durango, Colorado 81301
T 970-385-1096

GENERAL INFORMATION

Operator:	Hilcorp Energy Company	Date:	5/20/2019
Site Name:	Tank Mountain Landfarm	Prepared By:	C. McGinn
Latitude:	36.922505	Longitude:	-107.800434
Section:	5	Section Unit:	O
Township:	31N	Range:	9W
Site Elevation:	6735 feet		

GENERAL SITING CRITERIA	Yes/No	Figure Reference
Within 200 feet of a watercourse, lakebed, sinkhole or playa lake? Nearest watercourse is an unnamed, first-order tributary of Pine Canyon approximately 209 feet northeast of the proposed facility location.	No	Figures 2 & 4
Is the location within a 100-year flood plain? Closest FEMA flood zone is Zone A, 1.2 miles to the SW.	No	Figures 5A, 5B, & 5C
Within, or within 500 feet of a wetland? Features identified as "riverine" by the United States Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) are within 500 feet of the proposed facility. These riverine features are classified by the USFWS using the Cowardin code "R4SBC," identifying them as intermittent, seasonally flooded streambeds. Seasonally Flooded riverine features have surface water present for extended periods especially early in the growing season, but surface water is typically absent by the end of the growing season in most years. The water table after flooding ceases is variable, extending from saturated to the surface to a water table well below the ground surface. This classification does not include palustrine systems (Cowardin code "P," i.e., nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens), or emergent wetlands (Cowardin code "E" which are characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens.) The New Mexico Administrative Code (NMAC) defines a wetland as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions in New Mexico. The riverine features that are mapped within 500 feet of the Site do not qualify as wetlands, according to the USFWS Cowardin code or the NMAC definition.	No	Figure 6
Within an area overlying a subsurface mine? Closest subsurface mine is 5.7 miles to the NW. Mike Thompson with the EMNRD Mining & Minerals Division was contacted to confirm that the New Mexico Abandoned Mine Land Program has no record of underground mines in the area.	No	Figure 7
Within 500 feet from the nearest permanent residence, school, hospital, institution or church? Closest residential area is 3.7 miles to the W.	No	Figures 3 & 8
Located within an unstable area susceptible to natural or human-induced events or forces capable of impairing the facilities structural components? Closest karst geologic environment is ~37 miles north.	No	Figures 9A & 9B
Within an existing wellhead protection area? The proposed waste management facility is not located within 200 horizontal feet of a private, domestic fresh water well or spring used by <5 households for domestic or stock watering purpose, or within 1000 horizontal feet of any fresh water well or spring.	No	Figure 2

Estimated Depth to Groundwater:		>100	
Justification:		Figure 2	
Distance to Closest water well with groundwater data:	9,584 feet	Direction to well:	Southeast
Well Name:	SJ 00014	Well Elevation:	6575 feet
Depth to groundwater:	312 feet	Total Depth:	462 feet

Additional Comments:

Hilcorp production facility visible in aerial 234 feet northeast of proposed landfarm boundary: San Juan 32-9 UN #024B, San Juan 32-9 UN #024 A.

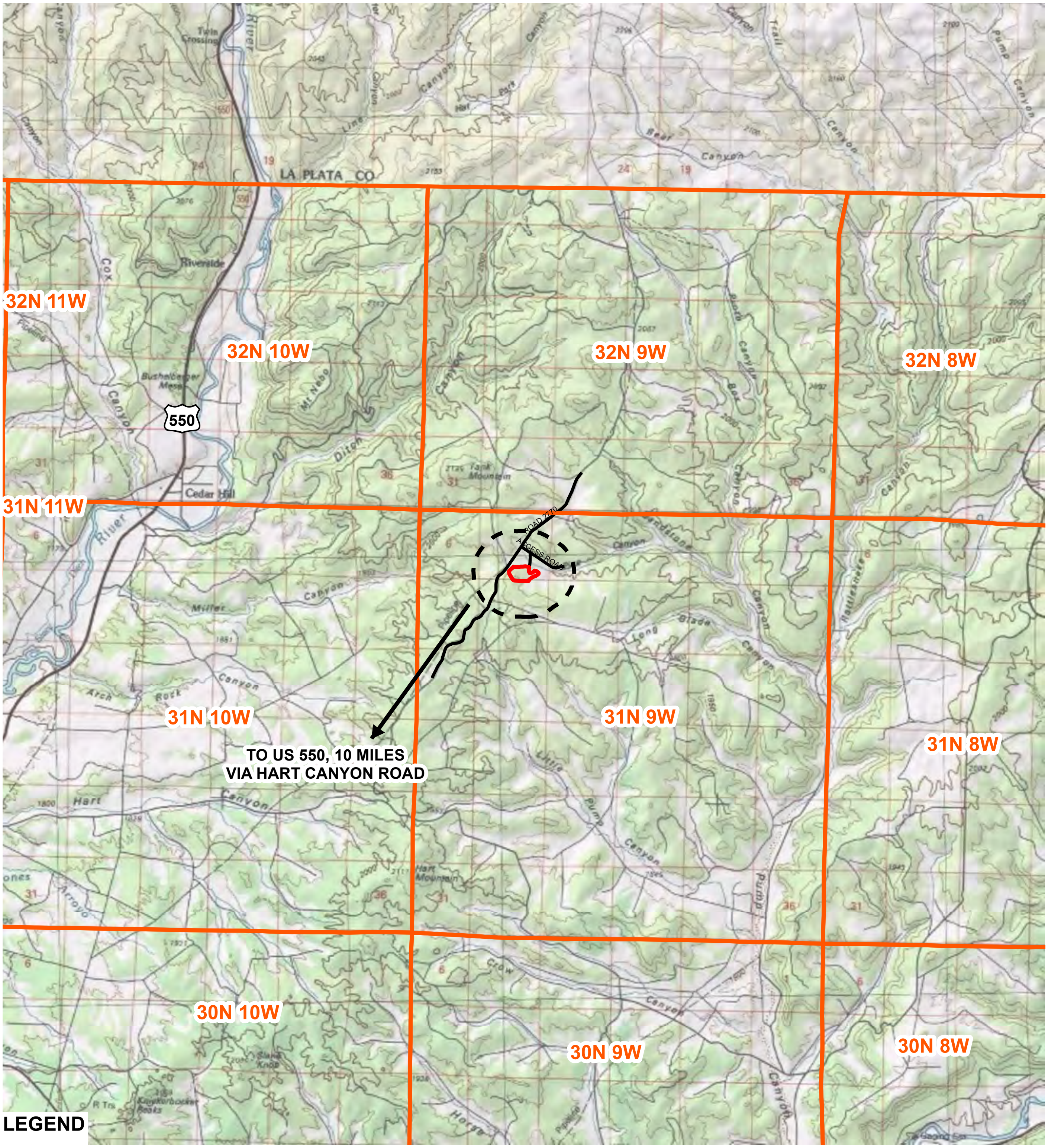


IMAGE COURTESY OF ESRI/USGS

LEGEND

ROAD

TANK MOUNTAIN LANDFARM BOUNDARY

TOWNSHIP AND RANGE

HALF-MILE RADIUS

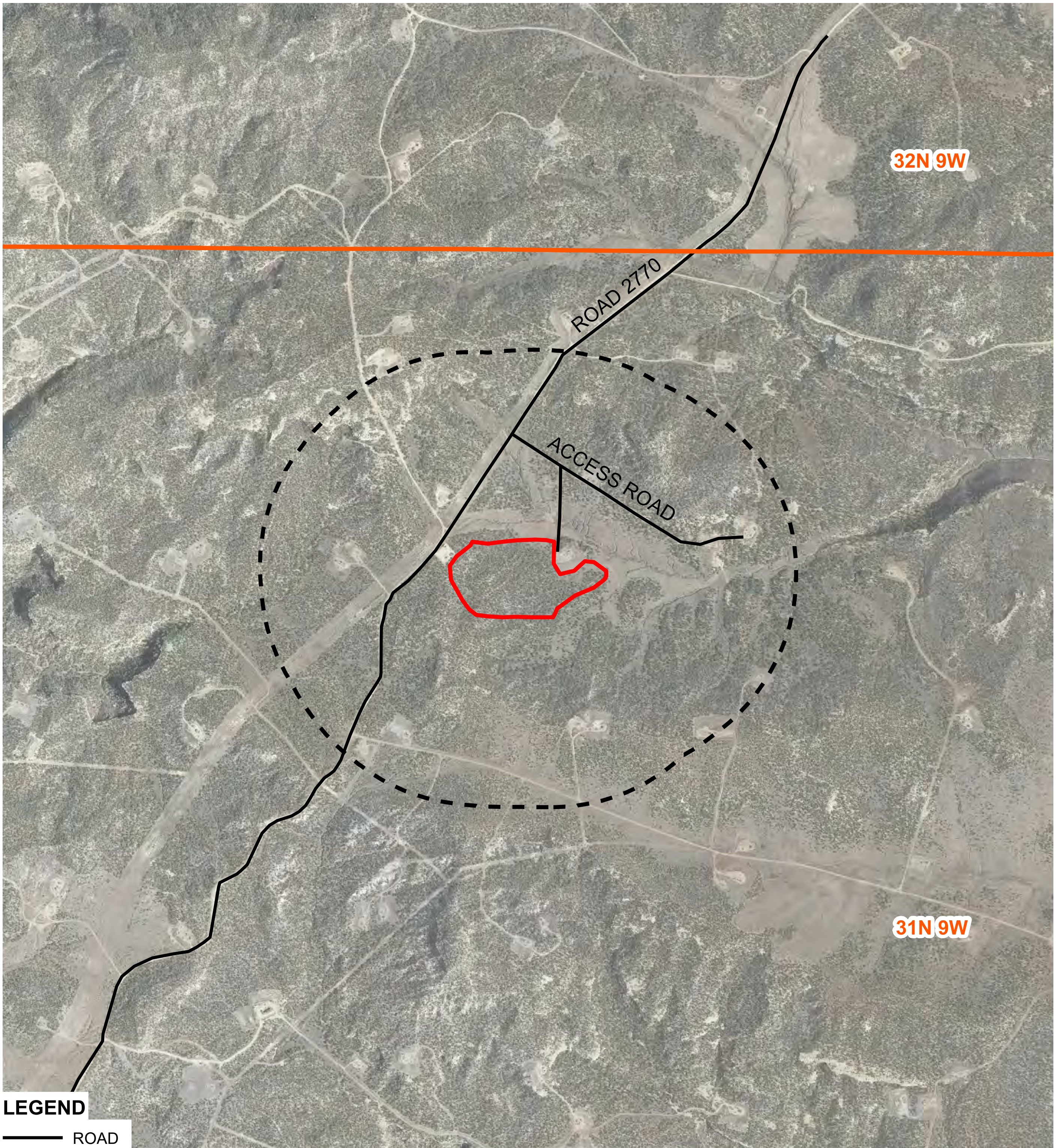
NOTE:
SITE IS NOT WITHIN A HALF-MILE OF ANY SITES INTENDED FOR HUMAN OCCUPANCY (SIHO). AERIAL AND SATELLITE IMAGERY INTERPRETATION FOR SIHO LOCATIONS WERE CONDUCTED USING GOOGLE EARTH IMAGERY ACQUIRED IN 2019.

0 2 4
Miles

N

FIGURE 1A
SITE LOCATION MAP
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

P:\Hilcorp\GIS\MXD\017818018_LANDFARM PERMITTING\TANK MOUNTAIN\2020_UPDATES\017818018_FIG01A_TANK MOUNTAIN_PLAT_TOPO_2020.mxd



LEGEND

ROAD

TANK MOUNTAIN LANDFARM BOUNDARY

TOWNSHIP AND RANGE

HALF-MILE RADIUS

IMAGE COURTESY OF GOOGLE EARTH 2019

0 2,000 4,000

Feet

N

NOTE:
SITE IS NOT WITHIN A HALF-MILE OF ANY SITES INTENDED FOR HUMAN OCCUPANCY (SIHO). AERIAL AND SATELLITE IMAGERY INTERPRETATION FOR SIHO LOCATIONS WERE CONDUCTED USING GOOGLE EARTH IMAGERY ACQUIRED IN 2019.

FIGURE 1B
SITE MAP
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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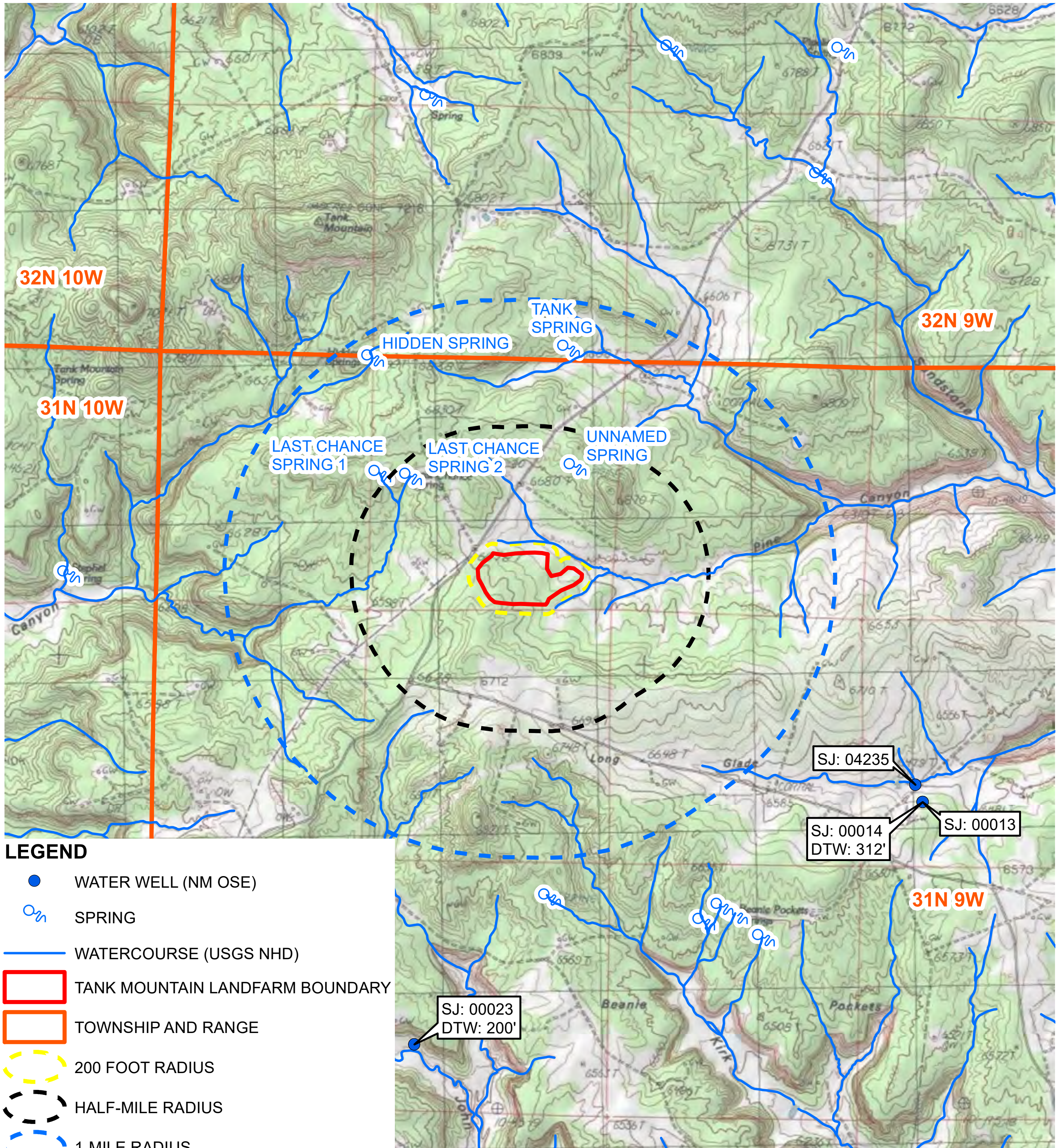

IMAGE COURTESY OF ESRI/USGS

NOTE:
ACCORDING TO 19.15.2 NMAC, A WELLHEAD PROTECTION AREA CONSISTS OF THE AREA WITHIN 200 HORIZONTAL FEET OF A PRIVATE, DOMESTIC FRESH WATER WELL OR SPRING USED BY <5 HOUSEHOLDS FOR DOMESTIC OR STOCK WATERING PURPOSE, OR WITHIN 1,000 HORIZONTAL FEET OF ANY OTHER FRESH WATER WELL OR SPRING. NO USGS WELLS IN AREA PER NWIS.

DTW: DEPTH TO WATER
ELEV: APPROXIMATE ELEVATION IN FEET ABOVE MEAN SEA LEVEL
NM OSE: NEW MEXICO OFFICE OF THE STATE ENGINEER
': FEET

0 3,000 6,000
Feet

N

FIGURE 2
SITE RECEPTOR MAP
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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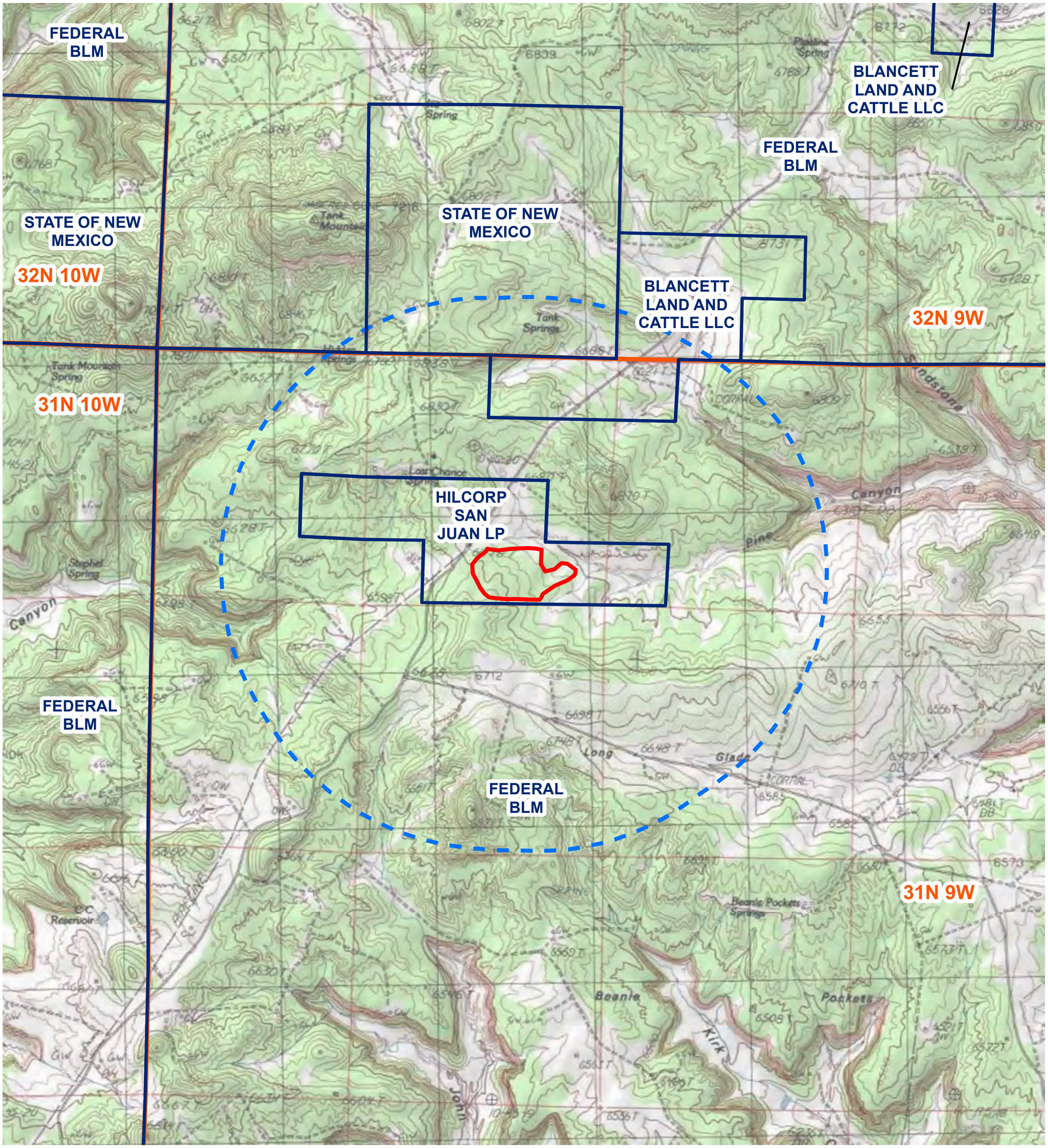

IMAGE COURTESY OF ESRI/USGS

LEGEND

- TANK MOUNTAIN LANDFARM BOUNDARY
- TOWNSHIP AND RANGE
- PARCEL BOUNDARY
- 1-MILE RADIUS

BLM: BUREAU OF LAND MANAGEMENT

0 3,000 6,000
Feet

N

FIGURE 3
LAND OWNERSHIP-PARCEL MAP
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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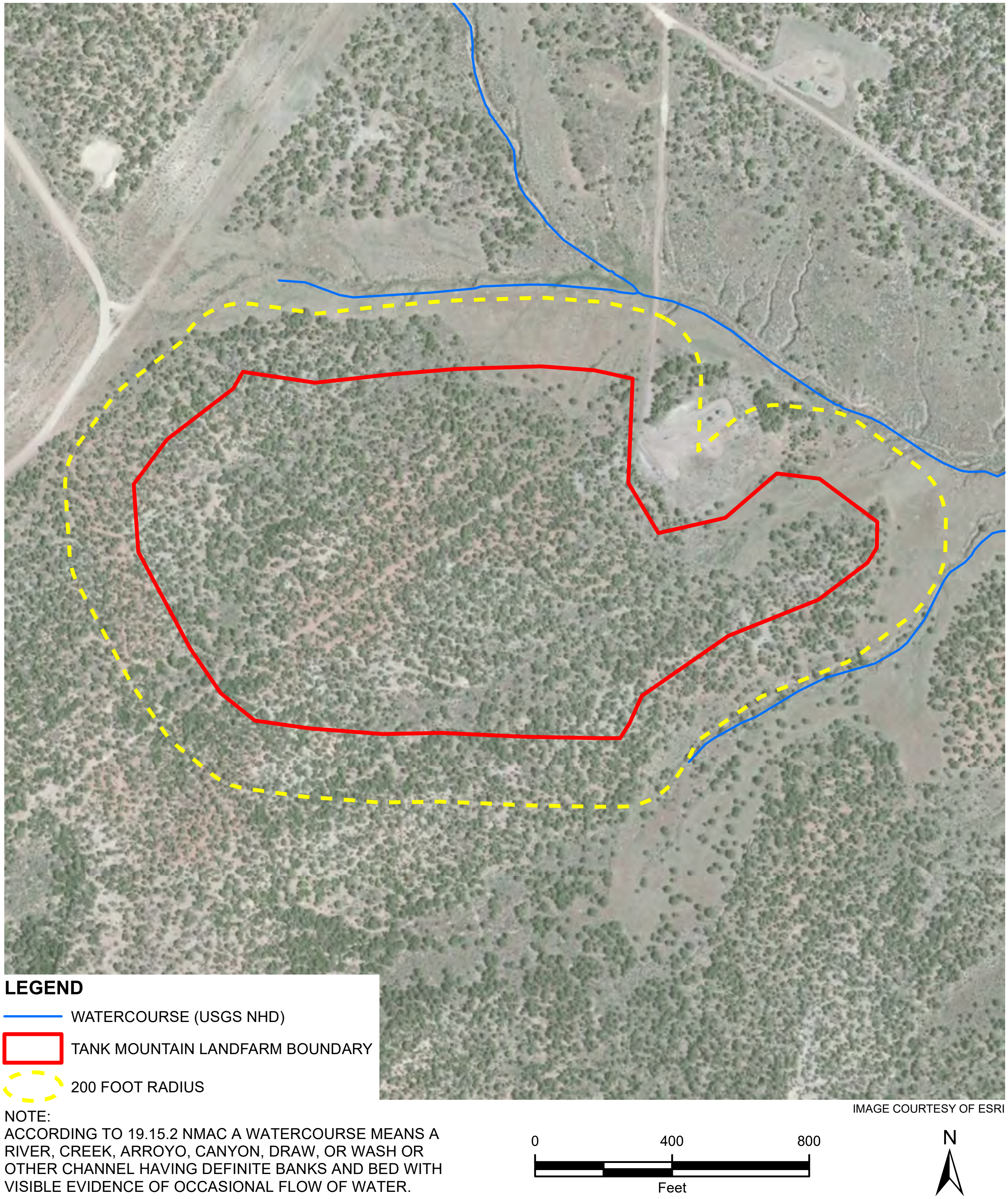

NOTE:
ACCORDING TO 19.15.2 NMAC A WATERCOURSE MEANS A RIVER, CREEK, ARROYO, CANYON, DRAW, OR WASH OR OTHER CHANNEL HAVING DEFINITE BANKS AND BED WITH VISIBLE EVIDENCE OF OCCASIONAL FLOW OF WATER.

THERE ARE NO SINKHOLES, LAKEBEDS OR PLAYA LAKES WITHIN THE BOUNDARIES OF THIS MAP USING MAPPED DATA FROM THE USFS NWI.

NHD: NATIONAL HYDROGRAPHY DATASET
NMAC: NEW MEXICO ADMINISTRATIVE CODE
NM OSE: NEW MEXICO OFFICE OF THE STATE ENGINEER
USGS: UNITED STATES GEOLOGICAL SURVEY

FIGURE 4
PROXIMITY TO WATERCOURSE, LAKEBED, SINKHOLE, OR PLAYA LAKE
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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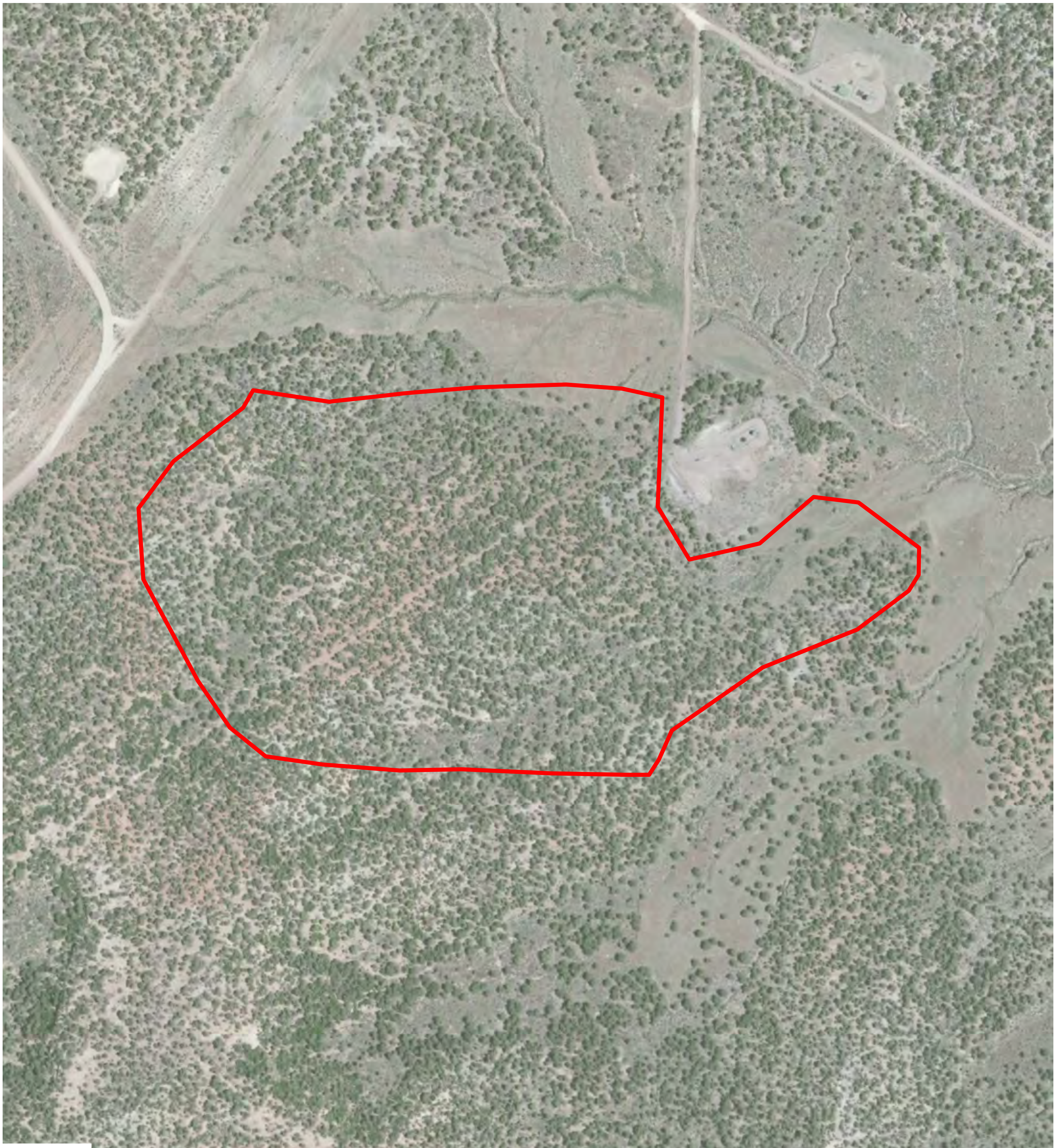

IMAGE COURTESY OF ESRI

LEGEND

TANK MOUNTAIN LANDFARM BOUNDARY

FEMA FLOOD ZONE CLASSIFICATION

NO SCREEN INDICATES ZONE X - AREA OF MINIMAL FLOOD HAZARD

0 400 800
Feet

N

NOTE:
SITE IS WITHIN AN AREA OF MINIMAL FLOOD HAZARD DEFINED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA).
SOURCE: FEMA FLOOD MAP NUMBER 35045CO425F/ZONE X

FIGURE 5A
PROXIMITY TO 100 YEAR FLOODPLAIN
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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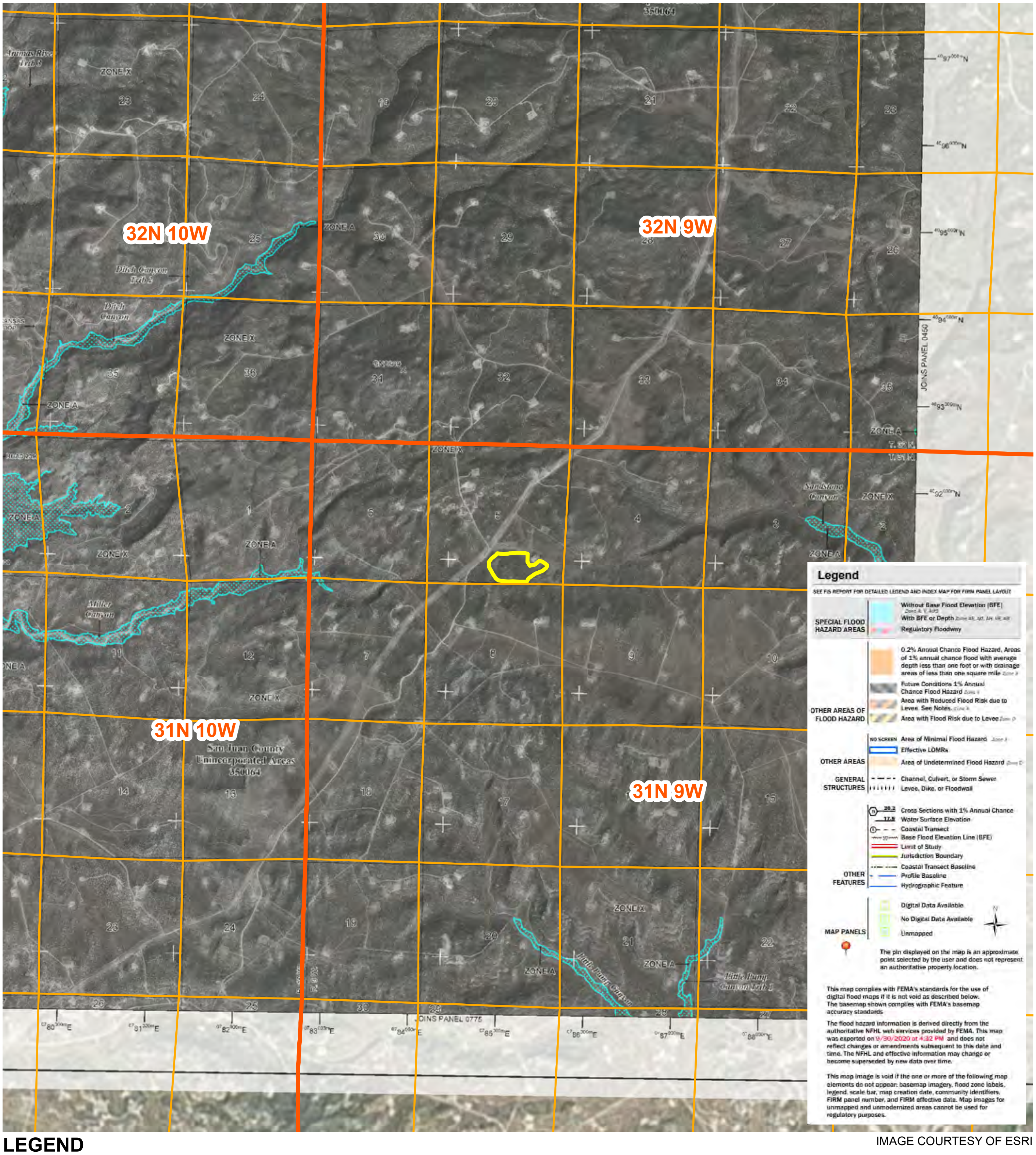

LEGEND

TANK MOUNTAIN LANDFARM BOUNDARY

SECTION

TOWNSHIP AND RANGE

NOTE:
SITE IS WITHIN AN AREA OF MINIMAL FLOOD HAZARD DEFINED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA).
SOURCE: FEMA FLOOD MAP NUMBER 35045CO425F/ZONE X

FIGURE 5B
FEMA FIRM MAP
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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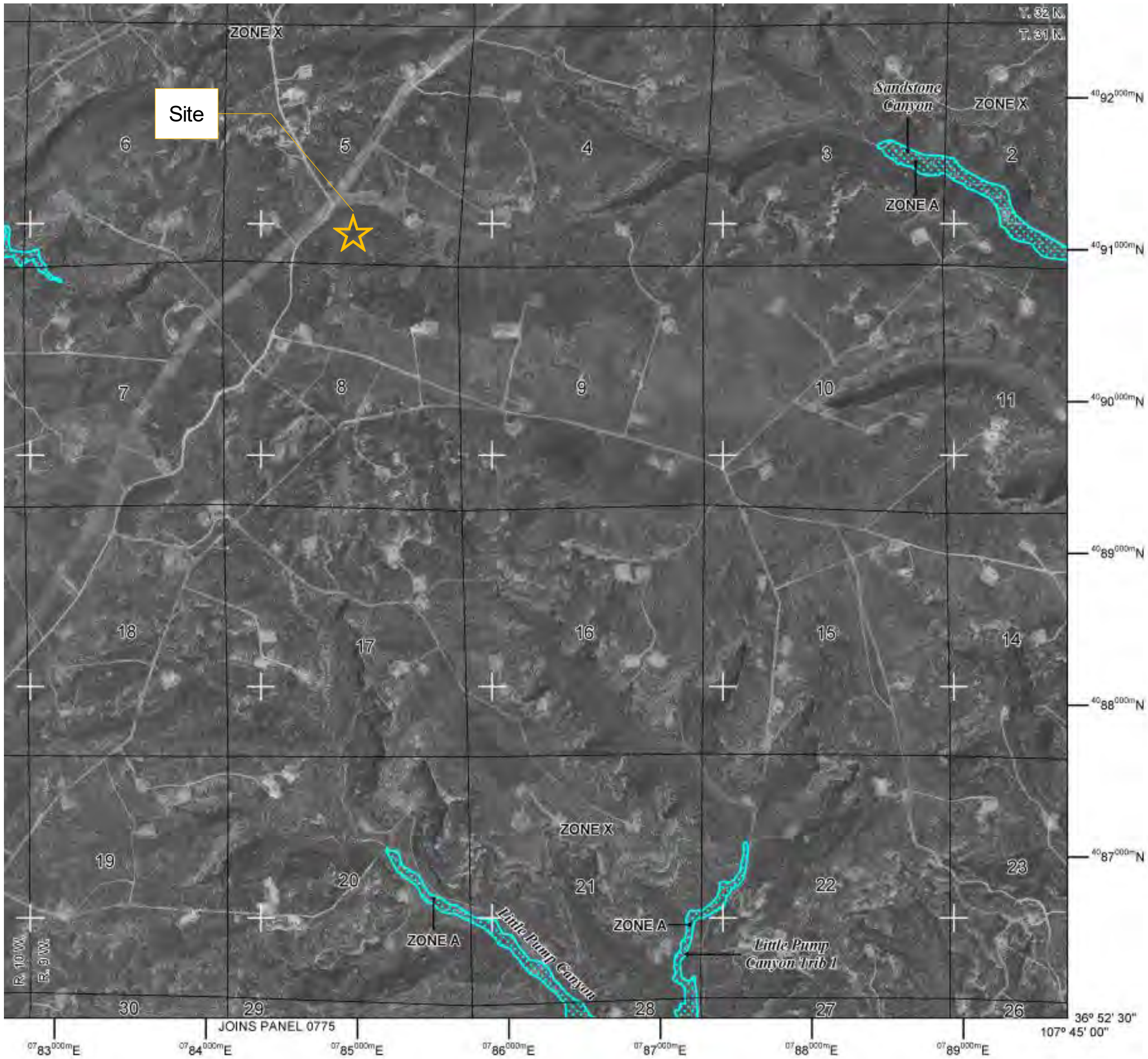
FIGURE 5C
FEMA FIRM PANEL
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY



EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 2000'

1000 0 2000 4000 FEET

600 0 600 1200 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0425F

FIRM

FLOOD INSURANCE RATE MAP

SAN JUAN COUNTY, NEW MEXICO AND INCORPORATED AREAS

PANEL 425 OF 2750

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

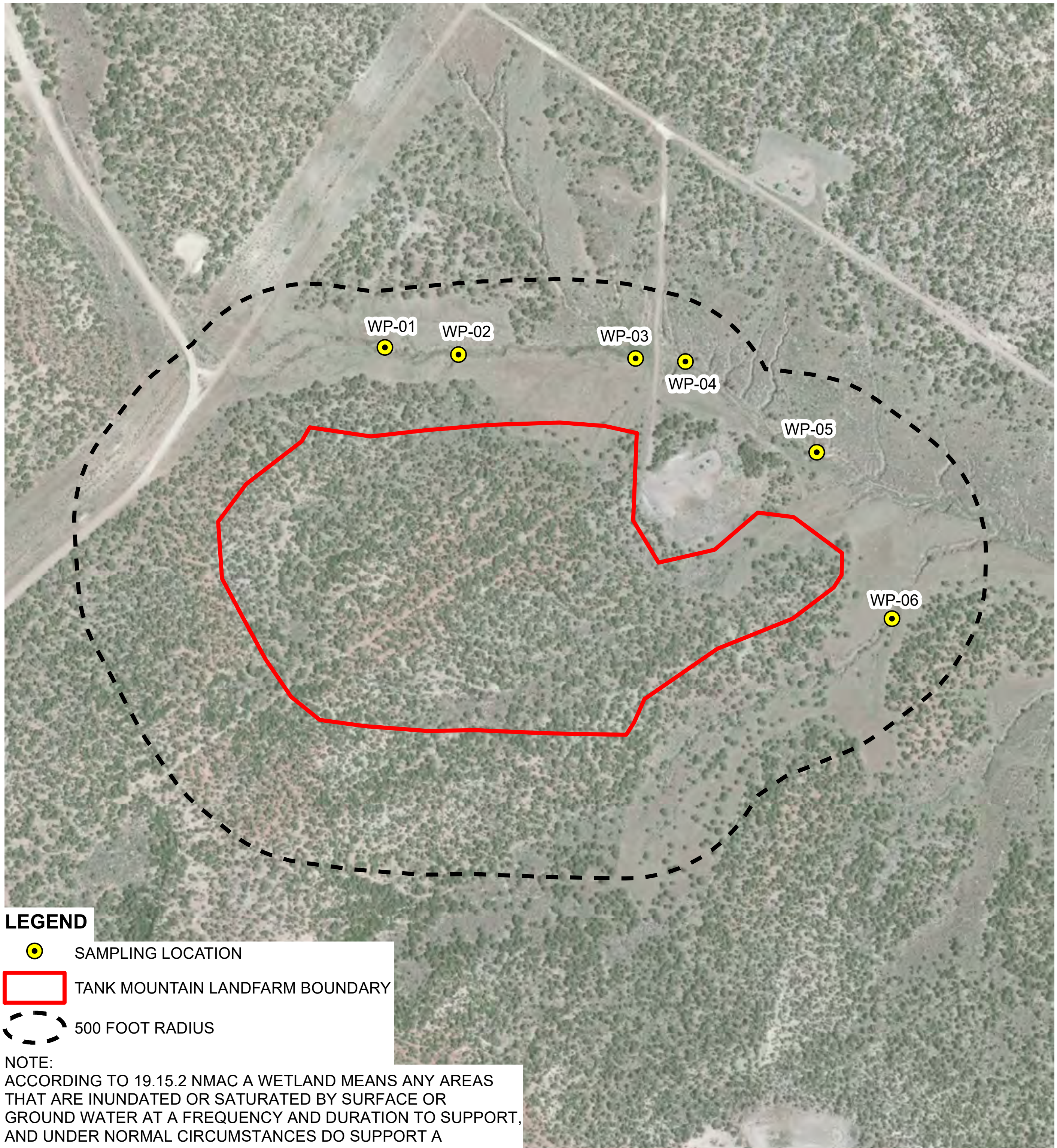
COMMUNITY	NUMBER	PANEL	SUFFIX
SAN JUAN COUNTY	350064	0425	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
35045C0425F

EFFECTIVE DATE
AUGUST 5, 2010

Federal Emergency Management Agency



LEGEND

SAMPLING LOCATION

TANK MOUNTAIN LANDFARM BOUNDARY

500 FOOT RADIUS

NOTE:
ACCORDING TO 19.15.2 NMAC A WETLAND MEANS ANY AREAS THAT ARE INUNDATED OR SATURATED BY SURFACE OR GROUND WATER AT A FREQUENCY AND DURATION TO SUPPORT, AND UNDER NORMAL CIRCUMSTANCES DO SUPPORT A PREVALENCE OF VEGETATION TYPICALLY ADAPTED FOR LIFE IN SATURATED SOILS IN NEW MEXICO.
ACCORDING TO THE FGDC CLASSIFICATION OF WETLANDS AND DEEPWATER HABITATS (FGDC-STD-004-2013), A RIVERINE SUBSYSTEMS INCLUDES CHANNELS THAT CONTAIN FLOWING WATER ONLY PART OF THE YEAR. WHEN WATER IS NOT FLOWING, IT MAY REMAIN IN ISOLATED POOLS OR SURFACE WATER MAY BE ABSENT.
NO WETLANDS ARE PRESENT WITHIN 500 FEET OF THE LANDFARM BOUNDARY BASED ON A WETLAND DELINEATION SURVEY PERFORMED BY LTE
FGDC: FEDERAL GEOGRAPHIC DATA COMMITTEE
NMAC: NEW MEXICO ADMINISTRATIVE CODE
NWI: NATIONAL WETLAND INVENTORY
USFS: UNITED STATES FISH AND WILDLIFE SERVICE

FIGURE 6
PROXIMITY TO WETLANDS
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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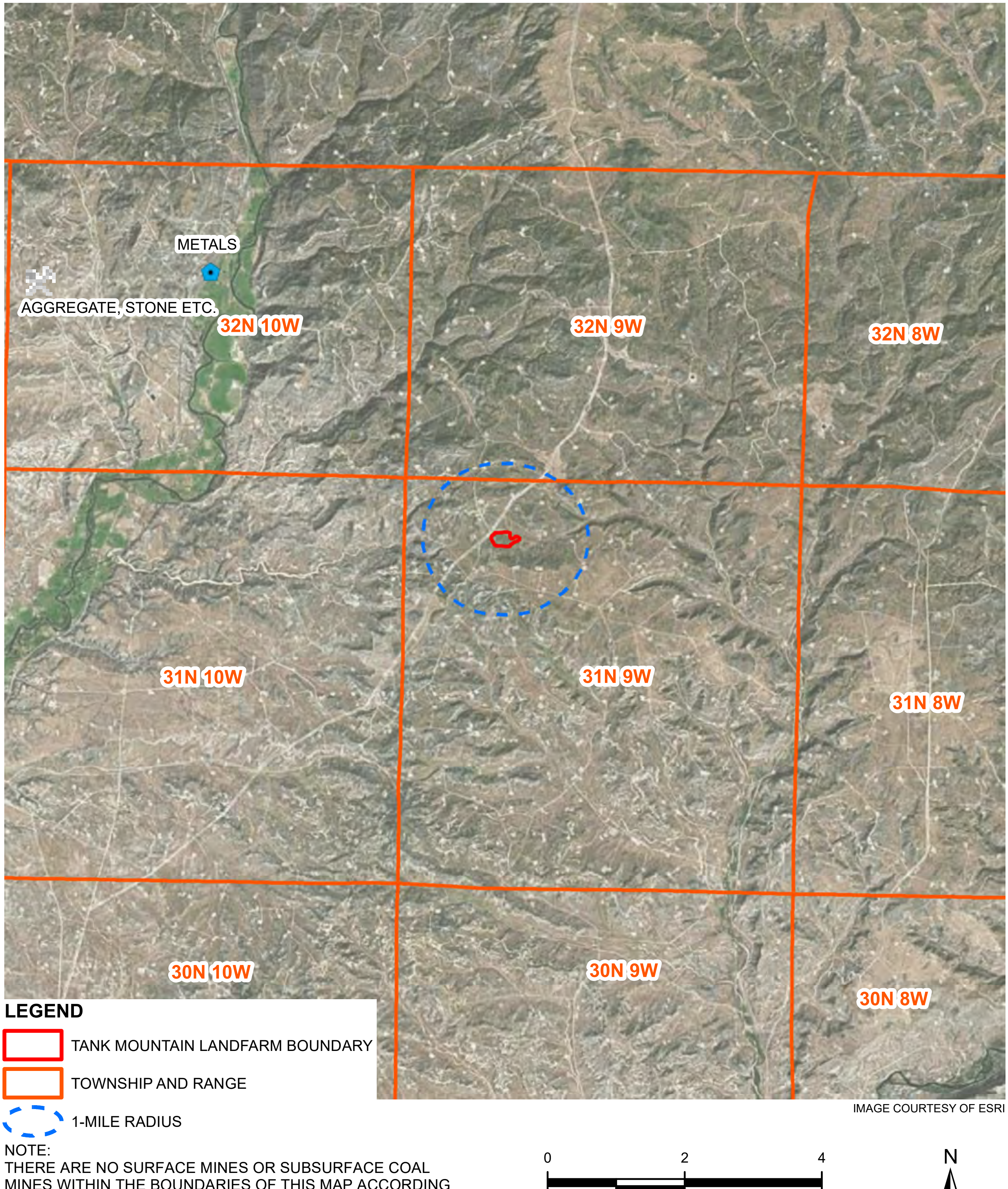

LEGEND

TANK MOUNTAIN LANDFARM BOUNDARY

TOWNSHIP AND RANGE

1-MILE RADIUS

NOTE:
THERE ARE NO SURFACE MINES OR SUBSURFACE COAL MINES WITHIN THE BOUNDARIES OF THIS MAP ACCORDING TO DATA PROVIDED BY NMEMNRD AND EIA. MIKE THOMPSON (505-476-4327) WITH NMEMNRD WAS CONTACTED TO CONFIRM THAT THE NEW MEXICO ABANDONED MINE LAND PROGRAM HAS NO RECORD OF UNDERGROUND MINES IN THIS AREA.

EIA: ENERGY INFORMATION ADMINISTRATION
NMEMNRD: NEW MEXICO ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

FIGURE 7
PROXIMITY TO SUBSURFACE MINE
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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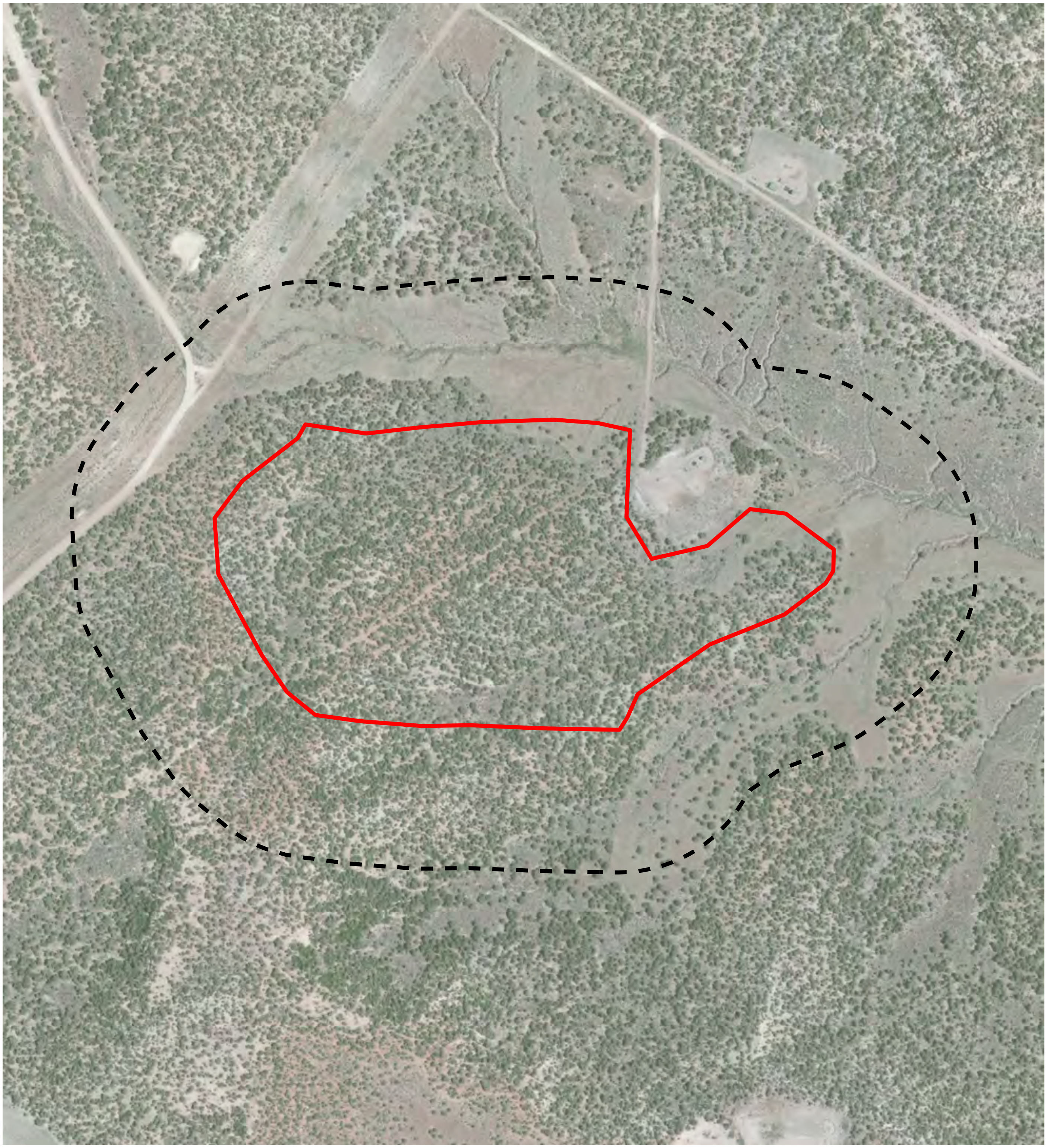

IMAGE COURTESY OF ESRI

LEGEND

TANK MOUNTAIN LANDFARM BOUNDARY

500 FOOT RADIUS

0 500 1,000

Feet

N

NOTE:
SITE IS NOT WITHIN 500 FEET OF ANY SITES INTENDED FOR HUMAN OCCUPANCY (SIHO). AERIAL AND SATELLITE IMAGERY INTERPRETATION FOR SIHO LOCATIONS WERE CONDUCTED USING GOOGLE EARTH IMAGERY ACQUIRED IN 2016. FIELD VERIFICATION CONDUCTED IN SUMMER 2019.

FIGURE 8
PROXIMITY TO PERMANENT RESIDENCE, SCHOOL, HOSPITAL, INSTITUTION, OR CHURCH
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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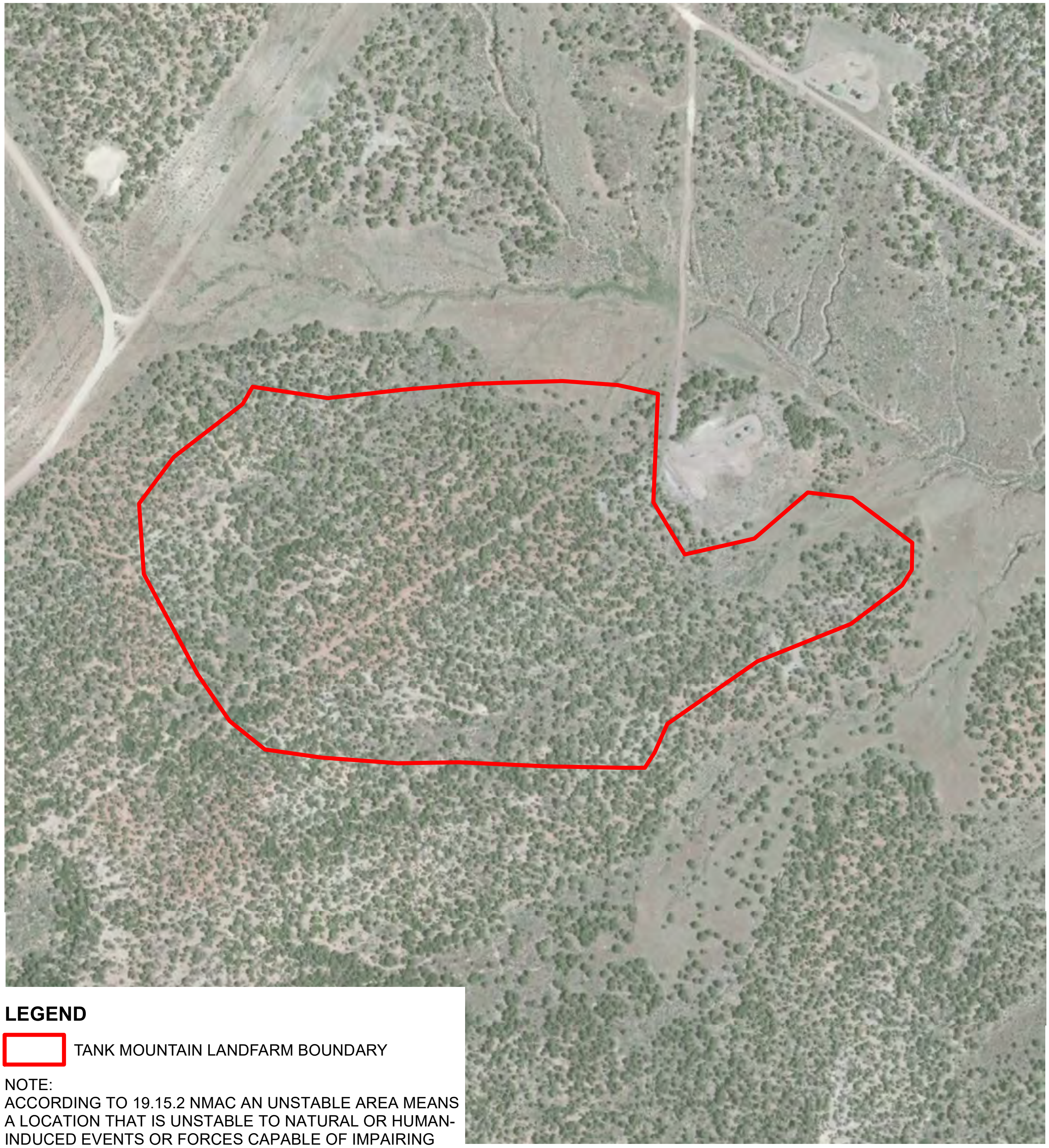

IMAGE COURTESY OF ESRI

LEGEND

TANK MOUNTAIN LANDFARM BOUNDARY

NOTE:
ACCORDING TO 19.15.2 NMAC AN UNSTABLE AREA MEANS A LOCATION THAT IS UNSTABLE TO NATURAL OR HUMAN-INDUCED EVENTS OR FORCES CAPABLE OF IMPAIRING THE DIVISION-APPROVED FACILITY'S STRUCTURAL COMPONENTS.

SITE RESIDES WITHIN THE USGS SAN JOSE GEOLOGIC FORMATION WHICH EXHIBITS MEDIUM-GRAINED, MIXED CLASTIC MATERIAL AND IS NOT ASSOCIATED WITH KARST GEOLOGIC ENVIRONMENT. THERE ARE NO FAULTS WITHIN THE BOUNDARIES OF THIS MAP AND NO KNOWN SEISMIC ACTIVITY ACCORDING TO DATA PROVIDED BY THE USGS MOUNT NEBO QUADRANGLE ID 36107-H7

NMAC: NEW MEXICO ADMINISTRATIVE CODE
USGS: USGS: UNITED STATES GEOLOGICAL SURVEY

0 400 800
Feet

N

FIGURE 9A
PROXIMITY TO UNSTABLE AREA
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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IMAGE COURTESY OF USGS

LEGEND

TANK MOUNTAIN LANDFARM

Tsr: San Jose Formation

0 1.25 2.5
Miles

N

FIGURE 9B
USGS GEOLOGIC QUADRANGLE - MOUNT NEBO
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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From: Tompson, Mike, EMNRD
To: Dustin Held
Subject: abandoned mine inventory
Date: Thursday, June 6, 2019 1:24:44 PM

Good afternoon.

The New Mexico Abandoned Mine Land Program knows of no abandoned mines in the section you provided (Section 5, Township 31N, Range 9W). To complete the search for sand & gravel and other operations not tracked by the Abandoned Mine Land Program, you can go to this link: http://www.emnrd.state.nm.us/MMD/mmdonline.html.

Please let me know if you have any other questions.

Mike Tompson
New Mexico Mining & Minerals Division
(505) 476-3427

Property Record Card

San Juan County Assessor

BLANCETT LAND AND CATTLE LLC

271 ROAD 3000
AZTEC, NM 87410

Account: R0010199

Tax Area: 2OUTNR - District 2OUT Non-Residential

Acres: 321.500

Parcel: 2052185066462

Situs Address:
648 ROAD 2770
AZTEC, 87410

Value Summary

Value By:	Market	Override
Land (1)	$1,013	N/A
Total	**$1,013**	**$1,013**

Legal Description

LOT 4, 043109 LOTS 1 AND 2 053109 SW1/4, NWSE 333209 B1417 P420

Land Occurrence 1

Property Code	0400 - AGRICULTURAL LAND	Land Code	4110_B_I - Grazing - Non Res_B_I
Agriculture Type	Grazing - Non Res	Description	GRAZING
Frontage	0	Measure	A - Acre
Street Code	2 - Dirt	Topography Code	3 - Rolling

SubArea		ACTUAL	AREA_UNITS	EFFECTIVE	FOOTPRINT	HEATED
Acres		321.5	321.5	321.5	321.5	321.5
Total		321.50	321.50	321.50	321.50	321.50
	Value	**Rate**	**Rate**	**Rate**	**Rate**	**Rate**
	$1,013	3.15	3.15	3.15	3.15	3.15

Abstract Summary

Code	Classification	Actual Value Value	Taxable Value	Actual Value Override	Taxable Override
0400	AGRICULTURAL LAND	$1,013	$338	NA	NA
Total		**$1,013**	**$338**	**NA**	**NA**

Property Record Card

San Juan County Assessor

FEDERAL

Account: R4004754 (INACTIVE)

Tax Area: 5OUTNR - District 5OUT Non-Residential

Acres: 0.000

Parcel: 2099199900900

Situs Address:
70 ROAD 3536
FARMINGTON, 87410

Value Summary

Value By:	Market	Override
Land (1)	$0	N/A
Total	**$0**	**N/A**

Legal Description

null

Land Occurrence 1

Property Code	9200 - EXEMPT NON-RESIDENTIAL LAND	Land Code	UNKNOWNA
Frontage	0	Measure	A - Acre

SubArea		ACTUAL	AREA_UNITS	EFFECTIVE	FOOTPRINT	HEATED
Acres						
Total						
	Value	**Rate**	**Rate**	**Rate**	**Rate**	**Rate**
	$0					

Abstract Summary

Code	Classification	Actual Value Value	Taxable Value	Actual Value Override	Taxable Override
9200	EXEMPT NON-RESIDENTIAL LAND	$0	$0	NA	NA
Total		**$0**	**$0**	**NA**	**NA**

Property Record Card

San Juan County Assessor

HILCORP SAN JUAN LP
1111 TRAVIS ST
HOUSTON, TX 77002

Account: R0010195
Tax Area: 2OUTNR - District 2OUT
Non-Residential
Acres: 320.000

Parcel: 2054185264132
Situs Address:
650 ROAD 2770
AZTEC, 87410

Value Summary

Value By:	Market	Override
Land (1)	$320,000	N/A
Total	**$320,000**	**$320,000**

Legal Description

SWSW OF SEC 4 31 09, N1/2 SW SESW W1/2 SE SESE OF 53109, NESE OF SEC 6 31 09 BK.1621 PG.803

Land Occurrence 1

Property Code	0200 - NON-RESIDENTIAL LAND	Land Code	31710A - 2OUT HART MOUNTAIN RANCHES - A
Frontage	0	Measure	A - Acre
Street Code	2 - Dirt	Topography Code	0 - None

SubArea		ACTUAL	AREA_UNITS	EFFECTIVE	FOOTPRINT	HEATED
Acres		320	320	320	320	320
Total		320.00	320.00	320.00	320.00	320.00
	Value	**Rate**	**Rate**	**Rate**	**Rate**	**Rate**
	$320,000	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00

Abstract Summary

Code	Classification	Actual Value Value	Taxable Value	Actual Value Override	Taxable Override
0200	NON-RESIDENTIAL LAND	$320,000	$106,667	NA	NA
Total		**$320,000**	**$106,667**	**NA**	**NA**

Property Record Card

San Juan County Assessor

STATE OF NEW MEXICO ATTN FACILTIY MANAGEMENT DIVISION

PO BOX 6850
SANTA FE, NM 87502

Account: R4004771 (INACTIVE)

Tax Area: 5OUTNR - District 5OUT Non-Residential

Acres: 0.000

Parcel: 2088188888888

Situs Address:
US 64
KIRTLAND, 87417

Value Summary

Value By:	Market	Override
Land (1)	$0	N/A
Total	**$0**	**N/A**

Legal Description

null

Land Occurrence 1

Property Code	0200 - NON-RESIDENTIAL LAND	Land Code	25300A - 2OUT DRY LAND MORE RURAL - A
Frontage	0	Measure	A - Acre

SubArea		ACTUAL	AREA_UNITS	EFFECTIVE	FOOTPRINT	HEATED
Acres						
Total						
	Value	**Rate**	**Rate**	**Rate**	**Rate**	**Rate**
	$0					

Abstract Summary

Code	Classification	Actual Value Value	Taxable Value	Actual Value Override	Taxable Override
0200	NON-RESIDENTIAL LAND	$0	$0	NA	NA
Total		**$0**	**$0**	**NA**	**NA**

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Cedar Hill Landfarm City/County: Cedar Hill / San Juan Sampling Date: 6/26/19

Applicant/Owner: Hilcorp Energy State: NM Sampling Point: WP-01

Investigator(s): C. Jones Section, Township, Range: Sec 5 Twn 31 N Rng 9W

Landform (hillslope, terrace, etc.): Hillslope / Draw Local relief (concave, convex, none): Concave Slope (%): 10-20

Subregion (LRR): Interior Desert LRR D Lat: 36.923644 Long: -107.802285 Datum: WGS 84

Soil Map Unit Name: Travessilla-Weska-Rock outcrop complex, moderately steep NWI classification: R4SBC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		✓
Hydric Soil Present?		✓
Wetland Hydrology Present?	✓	

Is the Sampled Area within a Wetland? Yes ____ No ✓

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. N/A	–	–	–
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. Big Sagebrush (Artemisia tridentata)	30	✓	UPL
2.			
3.			
4.			
5.			
	30 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Tansey Mustard (Descurainia pinnata)	40	✓	UPL
2. Cheatgrass (Bromus tectorum)	70	✓	UPL
3. Musk thistle (Carduus nutans)	15		FACU
4. Alyssum (Alyssum)	5		UPL
5. Scarlet globe mallow (Sphaeralcea coccinea)	1		UPL
6. Lambs quarter (Cenopodium album)	5		UPL
7.			
8.			
	136 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1. N/A	–	–	–
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum 5% % Cover of Biotic Crust Ø

Remarks:

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: Ø (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0/3 = Ø (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	Ø	x 1 = Ø
FACW species	Ø	x 2 = Ø
FAC species	Ø	x 3 = Ø
FACU species	15	x 4 = 60
UPL species	151	x 5 = 755
Column Totals:	166 (A)	815 (B)

Prevalence Index = B/A = 815/166 = 4.91

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

SOIL

Sampling Point: WP-01

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-4	7.5 YR 3/3	100					Sandy Loam	
4-5	7.5 YR 3/2	100					Sandy Loam	
5-6	7.5 YR 2.5/2	100					Sandy Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Heavy Clay Layer

Depth (inches): 6"

Could not continue to dig beyond 6".

Hydric Soil Present? Yes ______ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ✓ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ✓ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): __________

Water Table Present? Yes _____ No _____ Depth (inches): __________

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): __________

Secondary Indicators

Wetland Hydrology Present? Yes ✓ No ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Cedar Hill Landfarm City/County: Cedar Hill / San Juan Sampling Date: 6/26/19

Applicant/Owner: Hilcorp Energy State: NM Sampling Point: WP-02

Investigator(s): C. Jones Section, Township, Range: Sec 5 Twn 31N Rng 9W

Landform (hillslope, terrace, etc.): Drainage / Arroyo Local relief (concave, convex, none): Concave Slope (%): 1-5

Subregion (LRR): Interior Desert LRR D Lat: 36.923588 Long: -107.801407 Datum: WGS 84

Soil Map Unit Name: Travessilla-Weska-Rock outcrop complex, moderately steep NWI classification: R4SBC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	Is the Sampled Area within a Wetland?	Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓		
Wetland Hydrology Present?	Yes ✓	No ____		

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. N/A	-	-	-
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. Big Sagebrush (Artemisia tridentata)	5	✓	UPL
2. Rabbit brush (Ericameria nauseosa)	5	✓	UPL
3.			
4.			
5.			
	10 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Cheatgrass (Bromus tectorum)	80	✓	UPL
2. Musk thistle (Carduus nutans)	20		FACU
3. Tall tansymustard (Descurainia pinnata)	10		UPL
4. Alyssum (Alyssum)	5		UPL
5. Red-stem Filaree (Erodium cicutarium)	5		UPL
6. Crested wheatgrass (Agropyron cristatum)	5		UPL
7. Bluestem (Schizachyrium scoparium)	1		FACU
8. Western Wheatgrass (Pascopyrum smithii)	1		FAC
	127 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1.	-	-	-
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum 10% % Cover of Biotic Crust Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: Ø (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0/3 = Ø (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	Ø	x 1 = Ø
FACW species	Ø	x 2 = Ø
FAC species	1	x 3 = 3
FACU species	21	x 4 = 84
UPL species	116	x 5 = 580
Column Totals:	138 (A)	667 (B)

Prevalence Index = B/A = 667/138 = 4.83

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:

SOIL

Sampling Point: WP-02

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10 YR 3/3	100					Sandy Clay Loam	
3-4	10 YR 3/3	100					Loamy Sand	
4-6	10 YR 3/3	100					Sandy Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: Heavy Clay Layer
Depth (inches): 6"

Could not continue to dig beyond 6".

Hydric Soil Present? Yes ______ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ✓ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ✓ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): ___________
Water Table Present? Yes _____ No ✓ Depth (inches): ___________
Saturation Present? (includes capillary fringe) Yes _____ No ✓ Depth (inches): ___________

Secondary Indicators

Wetland Hydrology Present? Yes ✓ No ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Cedar Hill Landfarm City/County: Cedar Hill / San Juan Sampling Date: 6/26/19
Applicant/Owner: Hilcorp Energy State: NM Sampling Point: WP-03
Investigator(s): C. Jones Section, Township, Range: Sec5 Twn 31N Rng 9W
Landform (hillslope, terrace, etc.): Drainage / Arroyo Local relief (concave, convex, none): Concave Slope (%): 1-5
Subregion (LRR): Interior Desert LRR D Lat: 36.923577 Long: -107.797300 Datum: WGS 84
Soil Map Unit Name: Travessilla-Weska-Rock outcrop complex moderately steep NWI classification: R4SBC
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	Is the Sampled Area within a Wetland? Yes ____ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: Area appears to hold ponded water at times due to roadway & culverts. Natural drainage down the Arroyo pools below the roadway.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30')			
1. N/A	–	–	–
2.			
3.			
4.			
	Ø	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. Rabbitbrush (Ericameria nauseosa)	5	✓	UPL
2.			
3.			
4.			
5.			
	5	= Total Cover	
Herb Stratum (Plot size: 5')			
1. Squirrel Tail (Elymus elymoides)	50	✓	FACU
2. Russian Knapweed (Acroptilon repens)	50	✓	UPL
3. Field Bindweed (Convolvulus arvensis)	20		UPL
4. Musk thistle (Carduus nutans)	5		FACU
5. Pepperweed (Lepidum latifolium)	5		FAC
6. Tall tansey mustard (Descurainia pinnata)	1		UPL
7. Cheatgrass (Bromus tectorum)	5		UPL
8. Alyssum (Alyssum)	5		UPL
	141	= Total Cover	
Woody Vine Stratum (Plot size: 30')			
1. N/A	–	–	–
2.			
	Ø	= Total Cover	

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: Ø (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: Ø/3 = Ø (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	Ø	x 1 =	Ø
FACW species	Ø	x 2 =	Ø
FAC species	5	x 3 =	15
FACU species	55	x 4 =	220
UPL species	86	x 5 =	430
Column Totals:	155 (A)		665 (B)

Prevalence Index = B/A = 665/155 = 4.29

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:

SOIL

Sampling Point: WP-03

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	10 YR 3/2	100					Clay Loam	
5-8	10 YR 5/2	100					Clay Loam	
8-12	10 YR 4/2	98	7.5 YR 5/8	2%	C	PL	Silty Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ✓ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ______

Water Table Present? Yes ___ No ✓ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ______

Primary Indicators

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Cedar Hill Landfarm City/County: Cedar Hill/San Juan Sampling Date: 6/26/19
Applicant/Owner: Hilcorp Energy State: NM Sampling Point: WP-04
Investigator(s): C. Jones Section, Township, Range: Sec 5 Twn 31N Rng 9W
Landform (hillslope, terrace, etc.): Drainage/Arroyo Local relief (concave, convex, none): Concave Slope (%): 1-5
Subregion (LRR): Interior Desert LRR D Lat: 36.923555 Long: -107.798707 Datum: WGS 84
Soil Map Unit Name: Travessilla-Weska-Rock outcrop complex, moderately steep NWI classification: R4SBC
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ___
Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___ No ✓	Is the Sampled Area within a Wetland? Yes ___ No ✓
Hydric Soil Present?	Yes ___ No ✓	
Wetland Hydrology Present?	Yes ✓ No ___	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Rocky Mtn. Juniper (Juniperus scopulorum)	5	✓	UPL
2. Pinyon pine (Pinus edulis)	5	✓	UPL
3.			
4.			
	10 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. Big Sagebrush (Artemisia tridentata)	15	✓	UPL
2. Rabbitbrush (Ericameria nauseosa)	25	✓	UPL
3.			
4.			
5.			
	40 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Cheat grass (Bromus tectorum)	40	✓	UPL
2. Smooth Brome (Bromus inermis)	5		UPL
3. Alyssum (Alysium)	15	✓	UPL
4. Yellow Salsify (Tragopogon pratensis)	1		UPL
5. Indian Ricegrass (Achnatherum hymenoides)	1		UPL
6. Common mullein (Verbascum thapsus)	5		FACU
7. Musk thistle (Carduus nutans)	10		FACU
8. Scarlet globe mallow (Sphaeralcea coccinea)	10		UPL
	87 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1. N/A	–	–	–
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum 30 % Cover of Biotic Crust Ø

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: Ø (A)
Total Number of Dominant Species Across All Strata: 6 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: Ø/6 = Ø (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	Ø	x 1 = Ø
FACW species	Ø	x 2 = Ø
FAC species	Ø	x 3 = Ø
FACU species	15	x 4 = 60
UPL species	122	x 5 = 610
Column Totals:	137 (A)	670 (B)

Prevalence Index = B/A = 670/137 = 4.89

Hydrophytic Vegetation Indicators:
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No ✓

Remarks:

SOIL

Sampling Point: WP-04

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/3	100					Clay Loam	
2-7	10 YR 5/3	100					Sandy Loam	
7-9	10 YR 5/2	100					Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ___ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ✓ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ✓ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No ✓	Depth (inches): ___
Water Table Present?	Yes ___	No ✓	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No ✓	Depth (inches): ___

Secondary Indicators

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Cedar Hill Landfarm City/County: Cedar Hill / San Juan Sampling Date: 6/26/19

Applicant/Owner: Hilcorp Energy State: NM Sampling Point: WP-05

Investigator(s): C. Jones Section, Township, Range: Sec 5 Twn 31N Rng 9W

Landform (hillslope, terrace, etc.): Drainage/Arroyo Local relief (concave, convex, none): Concave Slope (%): 1-5

Subregion (LRR): Interior Desert LRR D Lat: 36.922709 Long: -107.797127 Datum: WGS 84

Soil Map Unit Name: Travessilla-Weska-Rock outcrop complex moderately steep NWI classification: R4SBC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		✓
Hydric Soil Present?		✓
Wetland Hydrology Present?	✓	

Is the Sampled Area within a Wetland? Yes ____ No ✓

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Pinyon pine (Pinus edulis)	20	✓	UPL
2. Rocky Mtn. Juniper (Juniperus scopulorum)	5	✓	UPL
3.			
4.			
= Total Cover	25		
Sapling/Shrub Stratum (Plot size: 15')			
1. Rabbitbrush (Ericameria nauseosa)	15	✓	UPL
2. Big Sagebrush (Artemisia tridentata)	10	✓	UPL
3.			
4.			
5.			
= Total Cover	25		
Herb Stratum (Plot size: 5')			
1. Lupinus wyethii	15		UPL
2. Beardstongue (Penstemon barbatus)	10	✓	UPL
3. Cheatgrass (Bromus tectorum)	25	✓	UPL
4. Indian Ricegrass (Achnatherum hymenoides)	20	✓	UPL
5. Alyssum (Alyssum)	15		UPL
6. Scarlet globe mallow (Sphaeralcea coccinea)	15		UPL
7. Musk thistle (Carduus nutans)	5		FACU
8. Tall tansymustard (Descurainia pinnata)	5		UPL
= Total Cover	110		
Woody Vine Stratum (Plot size: 30')			
1. N/A	–	–	–
2.			
= Total Cover	∅		

% Bare Ground in Herb Stratum 50 % Cover of Biotic Crust ∅

Remarks:

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ∅ (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ∅/7 = ∅ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	∅	x 1 = ∅
FACW species	∅	x 2 = ∅
FAC species	∅	x 3 = ∅
FACU species	5	x 4 = 20
UPL species	155	x 5 = 775
Column Totals:	160 (A)	795 (B)

Prevalence Index = B/A = 795/160 = 4.96

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

SOIL

Sampling Point: WP-05

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-11	10 YR 4/3	100					Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______________

Depth (inches): ______________

Hydric Soil Present? Yes ______ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ✓ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ✓ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No ✓	Depth (inches): ________
Water Table Present?	Yes _____	No ✓	Depth (inches): ________
Saturation Present? (includes capillary fringe)	Yes _____	No ✓	Depth (inches): ________

Secondary Indicators

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Cedar Hill Landfarm City/County: Cedar Hill / San Juan Sampling Date: 6/26/19

Applicant/Owner: Hilcorp Energy State: NM Sampling Point: WP-06

Investigator(s): C. Jones Section, Township, Range: Sec 5 Twn 31N Rng 9W

Landform (hillslope, terrace, etc.): Drainage / Arroyo Local relief (concave, convex, none): Concave Slope (%): 1-5

Subregion (LRR): Interior Desert LRR D Lat: 36.921130 Long: -107.796203 Datum: WGS 84

Soil Map Unit Name: Travessilla-Weska-Rock outcrop complex moderately steep NWI classification: R4SBC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ✓	Is the Sampled Area within a Wetland? Yes ____ No ✓
Hydric Soil Present?	Yes ____ No ✓	
Wetland Hydrology Present?	Yes ✓ No ____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Pinyon pine (Pinus edulis)	5	✓	UPL
2. Rocky Mtn. Juniper (Juniperus scopulorum)	5	✓	UPL
3.			
4.			
	10 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. Big Sagebrush (Artemesia tridentata)	15	✓	UPL
2. Rabbitbrush (Ericameria nauseosa)	5	✓	UPL
3. Broom snakeweed (Gutierezia sarothrae)	1		UPL
4.			
5.			
	21 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Russian knapweed (Acroptilion repens)	20	✓	UPL
2. Field Bindweed (Convolvulus arvensis)	20	✓	UPL
3. Squirrel tail (Elymus elymoides)	15	✓	FACU
4. Cheatgrass (Bromus tectorum)	15		UPL
5. Musk thistle (Carduus nutans)	15		FACU
6. Bluestem (Schizachyrum smithii)	5		FAC
7. Tall tansymustard (Descurainia pinnata)	5		UPL
8. Red-stem filaree (Erodium cicutarium)	5		UPL
	100 = Total Cover		
Woody Vine Stratum (Plot size: 30')			
1. N/A	–	–	–
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: Ø (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: Ø/7 = Ø (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	Ø	x 1 = Ø
FACW species	Ø	x 2 = Ø
FAC species 1	5	x 3 = 15
FACU species 2	30	x 4 = 120
UPL species 10	96	x 5 = 480
Column Totals:	131 (A)	615 (B)

Prevalence Index = B/A = 615/131 = 4.69

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:

SOIL

Sampling Point: WP-06

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10 YR 5/3	100					Silty Loam / Silty Clay Loam	
3-9	10 YR 3/3	100					Silty Loam / Silty Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- ✓ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Primary Indicators

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

ATTACHMENT 2: WASTE TRACKING FORMS

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

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-138
Revised August 1, 2011

*Surface Waste Management Facility Operator and Generator shall maintain and make this documentation available for Division inspection.

REQUEST FOR APPROVAL TO ACCEPT SOLID WASTE

1. Generator Name and Address:

2. Originating Site:

3. Location of Material (Street Address, City, State or ULSTR):

4. Source and Description of Waste:

Estimated Volume ___________ yd^3 / bbls   Known Volume (to be entered by the operator at the end of the haul) ___________ yd^3 / bbls

5. GENERATOR CERTIFICATION STATEMENT OF WASTE STATUS

I, ____________________________, representative or authorized agent for ____ do hereby certify that according to the Resource Conservation and Recovery Act (RCRA) and the US Environmental Protection Agency's July 1988 regulatory determination, the above described waste is: (Check the appropriate classification)

☐ RCRA Exempt: Oil field wastes generated from oil and gas exploration and production operations and are not mixed with non-exempt waste. *Operator Use Only: Waste Acceptance Frequency* ☐ *Monthly* ☐ *Weekly* ☐ *Per Load*

☐ RCRA Non-Exempt: Oil field waste which is non-hazardous that does not exceed the minimum standards for waste hazardous by characteristics established in RCRA regulations, 40 CFR 261.21-261.24, or listed hazardous waste as defined in 40 CFR, part 261, subpart D, as amended. The following documentation is attached to demonstrate the above-described waste is non-hazardous. (Check the appropriate items)

☐ MSDS Information ☐ RCRA Hazardous Waste Analysis ☐ Process Knowledge ☐ Other (Provide description in Box 4)

GENERATOR 19.15.36.15 WASTE TESTING CERTIFICATION STATEMENT FOR LANDFARMS

I, ____________________________, representative for ____ do hereby certify that representative samples of the oil field waste have been subjected to the paint filter test and tested for chloride content and that the samples have been found to conform to the specific requirements applicable to landfarms pursuant to Section 15 of 19.15.36 NMAC. The results of the representative samples are attached to demonstrate the above-described waste conform to the requirements of Section 15 of 19.15.36 NMAC.

5. Transporter:

OCD Permitted Surface Waste Management Facility

Name and Facility Permit #:

Address of Facility:

Method of Treatment and/or Disposal:

☐ Evaporation ☐ Injection ☐ Treating Plant ☐ Landfarm ☐ Landfill ☐ Other

Waste Acceptance Status:

☐ **APPROVED** ☐ **DENIED** (Must Be Maintained As Permanent Record)

PRINT NAME: ______________________________ TITLE: ________________________ DATE: __________

SIGNATURE: ___________________________________ TELEPHONE NO.: ______________________
Surface Waste Management Facility Authorized Agent

Hilcorp

LANDFARM NAME	
DATE	

Waste Type (Circle): Exempt Oilfield Waste Non-Hazardous Waste Emergency Non-Oilfield Waste

Waste Tracking Form

Document Per Load:

	SATISFACTORY	UNSATISFACTORY	COMMENTS / ACTION TAKEN
Form C-138 Complete			
Generator			
Source Location			
Volume			
Transporter			
Generator Signature			
Analytical Results Attached / On File			
Passed Paint Filter			
Acceptable Chlorides (<1,000 mg/kg)			
Orders from Dept of Public Safety			Emergency Non-Oilfield Waste Only
Truck Load Wet			Resample for Paint Filter
Assign Load Tracking #:			(assign unique load tracking #)
Load Assigned To Cell:			(fill in cell #/location)

LANDFARM NAME	
DATE	

Waste Type (Circle): Exempt Oilfield Waste Non-Hazardous Waste Emergency Non-Oilfield Waste

Waste Tracking Form

Document Per Load:

	SATISFACTORY	UNSATISFACTORY	COMMENTS / ACTION TAKEN
Form C-138 Complete			
Generator			
Source Location			
Volume			
Transporter			
Generator Signature			
Analytical Results Attached / On File			
Passed Paint Filter			
Acceptable Chlorides (<1,000 mg/kg)			
Orders from Dept of Public Safety			Emergency Non-Oilfield Waste Only
Truck Load Wet			Resample for Paint Filter
Assign Load Tracking #:			(assign unique load tracking #)
Load Assigned To Cell:			(fill in cell #/location)

LANDFARM NAME	
DATE	

Daily Remediation Activities Form

ACTIVITY	TIME	INITIALS		TRACKING NUMBERS
Waste Acceptance Instructions: Disk Within 72 Hours of Arrival; Maximum of 8-Inch Lifts; Maximum 1,000 cubic yards per 1 acre				
Truck Load Arrives			Load Tracking #:	
			Load Assigned To Cell:	
Truck Load Disked			Comments:	
Truck Load Arrives			Load Tracking #:	
			Load Assigned To Cell:	
Truck Load Disked			Comments:	
Truck Load Arrives			Load Tracking #:	
			Load Assigned To Cell:	
Truck Load Disked			Comments:	
Truck Load Arrives			Load Tracking #:	
			Load Assigned To Cell:	
Truck Load Disked			Comments:	
Truck Load Arrives			Load Tracking #:	
			Load Assigned To Cell:	
Truck Load Disked			Comments:	
Truck Load Arrives			Load Tracking #:	
			Load Assigned To Cell:	
Truck Load Disked			Comments:	
Truck Load Arrives			Load Tracking #:	
			Load Assigned To Cell:	
Truck Load Disked			Comments:	
Truck Load Arrives			Load Tracking #:	
			Load Assigned To Cell:	
Truck Load Disked			Comments:	
Truck Load Arrives			Load Tracking #:	
			Load Assigned To Cell:	
Truck Load Disked			Comments:	
Truck Load Arrives			Load Tracking #:	
			Load Assigned To Cell:	
Truck Load Disked			Comments:	
Truck Load Arrives			Load Tracking #:	
			Load Assigned To Cell:	
Truck Load Disked			Comments:	

ACTIVITY	TIME	INITIALS	COMPLETED	COMMENTS
Landfarm Management: Contaminated soil disked bi-weekly. Spray when moisture below 40%.				
Landfarm Soil Disked				Cell:
Biocell Turned				
Stormwater Removed (if pooled)				Disposal Facility:
Landfarm Sprayed with Water				

Hilcorp

LANDFARM NAME	
TREATMENT CELL #	

Treatment Cell Volume Tracking Form			
DATE	TOTAL # LOADS	TOTAL VOLUME ACCEPTED	INITIALS
Waste Acceptance Instructions: Disk Within 72 Hours of Arrival; Maximum of 8-Inch Lifts; Maximum 1,000 cubic yards per 1 acre			

Hilcorp

LANDFARM NAME	
DATE	

Inspection Type (circle): Quarterly Post-Rain Event Post Windstorm Event

Landfarm Inspection Checklist

ITEM / AREA	SATISFACTORY	UNSATISFACTORY	COMMENTS / ACTION TAKEN
Overall Facility Condition			
General Facility Housekeeping			
Exterior Berm Condition			
Width Maintained?			
Slopes Maintained?			
Internal Cell Berm Condition			
Width Maintained?			
Slopes Maintained?			
Liner Condition (if applicable)			
Stormwater Accumulation			
Exterior Drainage Ditch			
Erosion			
Sediment Accumulation			
Debris / Trash Accumulation			
Access Ramp Condition			
Truck Unloading Area			
Exterior Driveway / Road			
Leaks / Equipment Requiring Maintenance			
Disking / Tilling On Schedule?			
Recordkeeping			

NA – Not Applicable

Comment section should be used to provide details of unsatisfactory findings.

Additional Inspection Remarks:

Inspector Signature:______________________ Manager Signature:______________________________

Name (Print):____________________________ Name (Print):___________________________________

Hilcorp

LANDFARM NAME	
DATE	

Landfarm Annual Recordkeeping Checklist			
ITEM / AREA	SATISFACTORY	UNSATISFACTORY	COMMENTS / ACTION TAKEN
Landfarm Field Office Record Keeping *hard copies will be kept in the Landfarm office and periodically scanned to be saved on the secure server at the Hilcorp Field Office in Aztec, NM			
Form C-138 & Analytical Results			
Landfarm Inspection Checklist			
Waste Tracking Form			
Daily Remediation Activities Form			
Treatment Cell Volume Tracking Form			
Regulatory Order			
Bills of Lading			
Other:			
Hilcorp Field Office *electronic copies will be saved on the secure server at the Hilcorp Field Office in Aztec, NM			
Form C-138 & Analytical Results			
Landfarm Inspection Checklist			
Waste Tracking Form			
Daily Remediation Activities Form			
Treatment Cell Volume Tracking Form			
Regulatory Order			
Bills of Lading			
Other:			

NA – Not Applicable
Comment section should be used to provide details of unsatisfactory findings.

Additional Inspection Remarks:

Auditor Signature:____________________________ Manager Signature:______________________________

Name (Print):____________________________________ Name (Print):_________________________________

ATTACHMENT 3: METHOD 9095B PAINT FILTER LIQUIDS TEST

METHOD 9095B

PAINT FILTER LIQUIDS TEST

1.0 SCOPE AND APPLICATION

1.1 This method is used to determine the presence of free liquids in a representative sample of waste.

1.2 The method is used to determine compliance with 40 CFR 264.314 and 265.314.

2.0 SUMMARY OF METHOD

2.1 A predetermined amount of material is placed in a paint filter. If any portion of the material passes through and drops from the filter within the 5-min test period, the material is deemed to contain free liquids.

3.0 INTERFERENCES

3.1 Filter media were observed to separate from the filter cone on exposure to alkaline materials. This development causes no problem if the sample is not disturbed.

3.2 Temperature can affect the test results if the test is performed below the freezing point of any liquid in the sample. Tests must be performed above the freezing point and can, but are not required to, exceed room temperature of 25 °C.

4.0 APPARATUS AND MATERIALS

4.1 <u>Conical paint filter</u> -- Mesh number 60 +/- 5% (fine meshed size). Available at local paint stores such as Sherwin-Williams and Glidden.

4.2 <u>Glass funnel</u> -- If the paint filter, with the waste, cannot sustain its weight on the ring stand, then a fluted glass funnel or glass funnel with a mouth large enough to allow at least 1 in. of the filter mesh to protrude should be used to support the filter. The funnel should be fluted or have a large open mouth in order to support the paint filter yet not interfere with the movement, to the graduated cylinder, of the liquid that passes through the filter mesh.

4.3 <u>Ring stand and ring, or tripod</u>.

4.4 <u>Graduated cylinder or beaker</u> -- 100-mL.

5.0 REAGENTS

5.1 None.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

A 100-mL or 100-g representative sample is required for the test. If it is not possible to obtain a sample of 100 mL or 100 g that is sufficiently representative of the waste, the analyst may use larger size samples in multiples of 100 mL or 100 g, i.e., 200, 300, 400 mL or g. However, when larger samples are used, analysts shall divide the sample into 100-mL or 100-g portions and test each portion separately. If any portion contains free liquids, the entire sample is considered to have free liquids. If the sample is measured volumetrically, then it should lack major air spaces or voids.

7.0 PROCEDURE

7.1 Assemble test apparatus as shown in Figure 1.

7.2 Place sample in the filter. A funnel may be used to provide support for the paint filter. If the sample is of such light bulk density that it overflows the filter, then the sides of the filter can be extended upward by taping filter paper to the inside of the filter and above the mesh. Settling the sample into the paint filter may be facilitated by lightly tapping the side of the filter as it is being filled.

7.3 In order to assure uniformity and standardization of the test, material such as sorbent pads or pillows which do not conform to the shape of the paint filter should be cut into small pieces and poured into the filter. Sample size reduction may be accomplished by cutting the sorbent material with scissors, shears, a knife, or other such device so as to preserve as much of the original integrity of the sorbent fabric as possible. Sorbents enclosed in a fabric should be mixed with the resultant fabric pieces. The particles to be tested should be reduced smaller than 1 cm (i.e., should be capable of passing through a 9.5 mm (0.375 inch) standard sieve). Grinding sorbent materials should be avoided as this may destroy the integrity of the sorbent and produce many "fine particles" which would normally not be present.

7.4 For brittle materials larger than 1 cm that do not conform to the filter, light crushing to reduce oversize particles is acceptable if it is not practical to cut the material. Materials such as clay, silica gel, and some polymers may fall into this category.

7.5 Allow sample to drain for 5 min into the graduated cylinder.

7.6 If any portion of the test material collects in the graduated cylinder in the 5-min period, then the material is deemed to contain free liquids for purposes of 40 CFR 264.314 and 265.314.

8.0 QUALITY CONTROL

8.1 Duplicate samples should be analyzed on a routine basis.

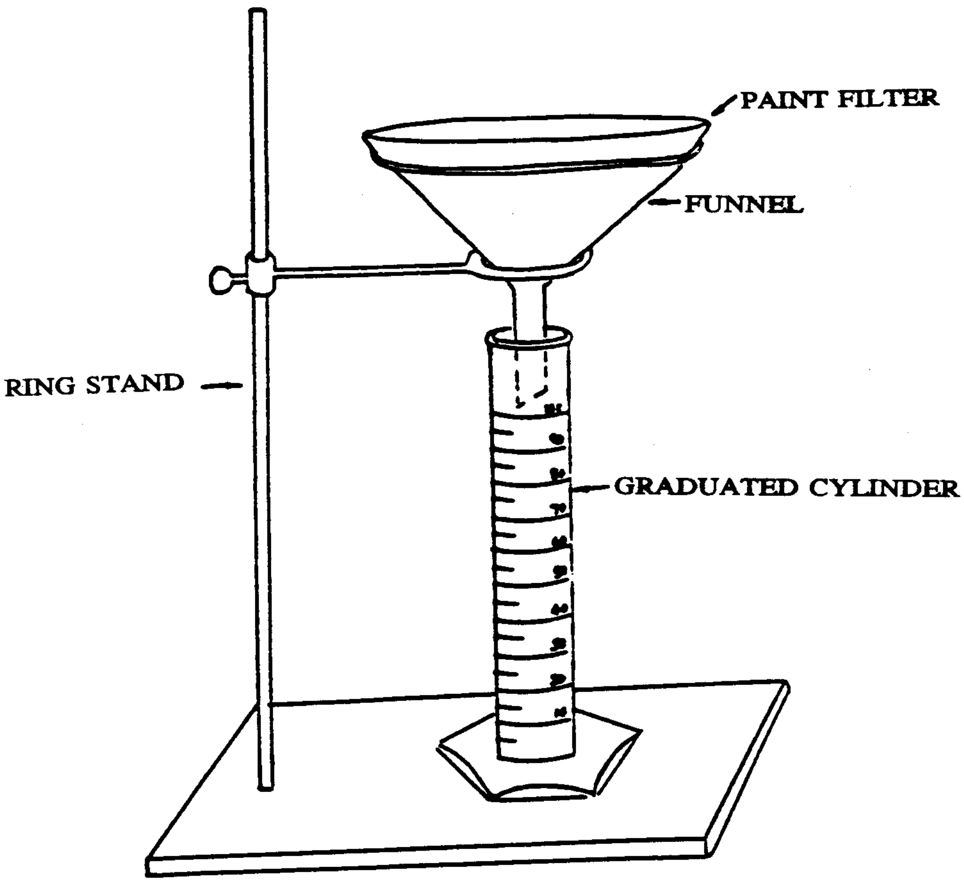
9.0 METHOD PERFORMANCE

9.1 No data provided.

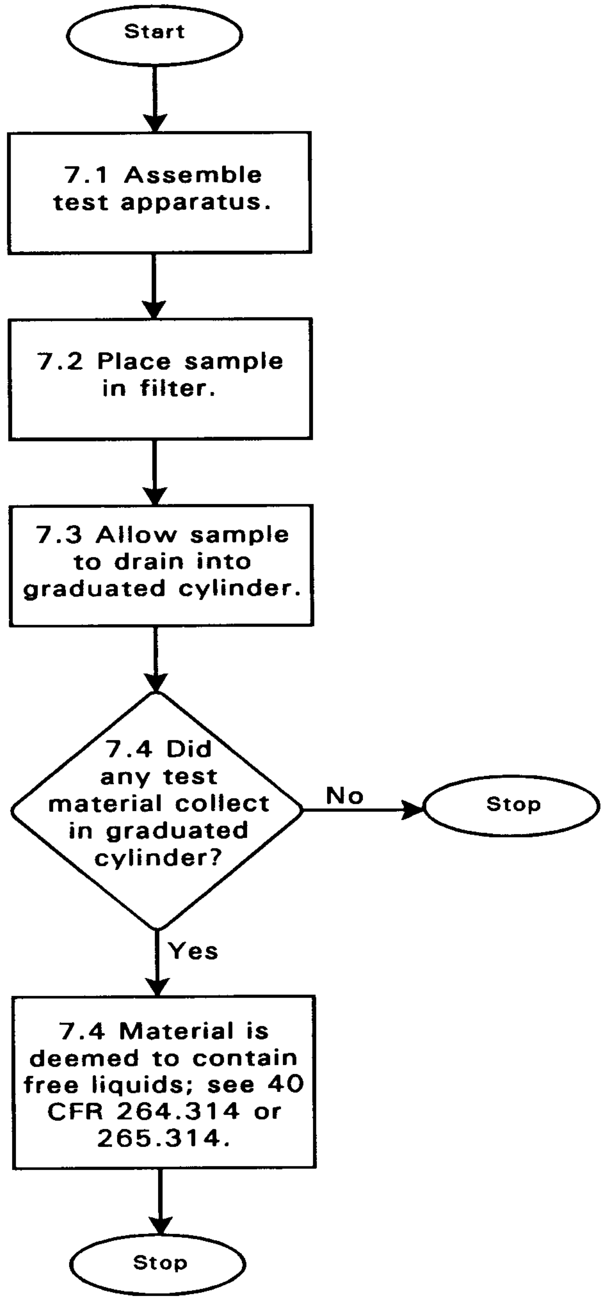
10.0 REFERENCES

10.1 None provided.

FIGURE 1
PAINT FILTER TEST APPARATUS



METHOD 9095B
PAINT FILTER LIQUIDS TEST



ATTACHMENT 4: TRAINING PLAN

LANDFARM TRAINING PLAN

HILCORP TANK MOUNTAIN LANDFARM
SAN JUAN COUNTY, NEW MEXICO

OCTOBER 2020

Prepared for:

HILCORP ENERGY COMPANY
382 County Road 3100
Aztec, New Mexico 87401

Prepared by:

A proud member of WSP

LT ENVIRONMENTAL, INC.
848 East Second Avenue
Durango, Colorado 81301
970.385.1096

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APPENDICES

1.0 INTRODUCTION

Hilcorp Energy Company (Hilcorp) has designed the following training plan (Plan) based on Subsection P of 19.15.36.13 of the New Mexico Administrative Code (NMAC). This training plan applies to the Hilcorp Tank Mountain Landfarm (Landfarm) and is written to serve as an outline for an annual training program for key personnel.

This Plan references associated written plans for the Landfarm, including the *Inspection and Maintenance Plan*, the *Plan for Management of Approved Oil field Wastes*, and the *Contingency Plan*.

2.0 19.15.36.13 (P): TRAINING PLAN

Each operator shall conduct an annual training program for key personnel that includes general operations, permit conditions, emergencies proper sampling methods, and identification of exempt and non-exempt waste and hazardous waste. The operator shall maintain records of such training, subject to division inspection, for five years.

Hilcorp will conduct initial employee onboarding training and annual training (training) for all Hilcorp personnel who work at the Landfarm. Training will cover general operations at the Landfarm, permit conditions, emergency procedures, proper sampling methods, and identification of exempt, non-exempt, and hazardous wastes. All employees are trained to respond to unexpected releases to the environment, including reporting, notification, and remediation.

2.1 GENERAL HILCORP HEALTH AND SAFETY TRAINING

All Hilcorp personnel that work at the Landfarm will comply with field-wide health and safety training and protocol.

2.2 SITE-SPECIFIC SAFETY ORIENTATION

The Landfarm site-specific orientation is required prior to working on site. All visitors, contractors, and new employees must complete the site-specific orientation before visiting or performing any job at the Landfarm. This orientation includes information on safety, operations, personal protective equipment (PPE) requirements, short service employee (SSE), and emergency procedures for the Landfarm. Orientations may be delivered by any Hilcorp representative working at the Landfarm. Signed site-specific orientation documents (Attachment 1) will be kept at the Landfarm Office and will be scanned and stored on a secure server at the Hilcorp field office in Aztec, New Mexico. Documents will available to the New Mexico Oil Conservation Division (NMOCD) upon request.

2.3 GENERAL OPERATIONS AT THE LANDFARM

Training will cover general operations at the Landfarm, including a review of the *Inspection and Maintenance Plan* (Appendix C) and *Plan for Management of Approved Oil field Wastes* (Appendix B). Any changes to the general operations at the Landfarm will be discussed and *the Inspection and Maintenance Plan* and *Plan for Management of Approved Oil field Wastes* will be updated as needed.

The following general operation activities will be reviewed during training:

- Review of Form C-138 and analytical results
- Review of Daily Remediation Activities Form and Waste Tracking Form
- Observation of free liquids
- Observation and determination of tank bottoms with economically-recoverable hydrocarbons
- Disking and landfarm operations
- Amendment application procedures

- Inspection procedure and frequency
- Recordkeeping and recordkeeping auditing

2.4 PERMIT CONDITIONS

Permit conditions will be reviewed with key personnel during the annual training. Any permit modifications will be implemented after NMOCD approval and reviewed during the training.

2.5 EMERGENCY PROCEDURES

Training will cover emergency procedures at the Landfarm, including a review of the *Contingency Plan* (Appendix E). If there were any incidents or near misses during the previous year, the annual training will address those incidents and include a discussion of changes in operations as a result.

Procedures for accepting emergency non-hazardous, non-oil field wastes if ordered by the New Mexico Department of Public Safety will be reviewed during training.

2.6 PROPER SAMPLING METHODS

Training will cover proper sampling methods at the Landfarm, as discussed in the *Plan for Management of Approved Oil field Wastes* (Appendix B). Sampling procedures for both treatment-zone monitoring (*Plan for Management of Approved Oil field Wastes*, Section 3.4), and vadose-zone monitoring *(Plan for Management of Approved Oil field Wastes*, Section 3.5) will be covered. Any changes to the sampling methods will be discussed and the *Plan for Management of Approved Oil field Wastes* will be updated as needed.

The following sampling activities will be reviewed during training:

- Determining moisture content
- Paint filter testing

2.7 IDENTIFICATION OF EXEMPT, NON-EXEMPT, AND HAZARDOUS WASTE

Training will cover identification of exempt, non-exempt, and hazardous waste at the Landfarm, including a review of the *Plan for Management of Approved Oil field Wastes* (Appendix B). Any changes to the identification of exempt, non-exempt, and hazardous waste will be discussed and the *Plan for Management of Approved Oil field Wastes* will be updated as needed.

2.8 SPILL RESPONSE

Training will cover spill prevention and response, including a review of notification procedures, location of spill control equipment, identify potential spill areas and drainage routes, and a review of proper cleanup procedures. The established procedures can be found in Section 3.8 of the *Contingency Plan* (Appendix E).

2.9 GENERATOR AND THIRD-PARTY CONTRACTOR TRAINING

Generators and their subcontractors will be required to be in compliance with field-wide Hilcorp training, as described above. Third-party contractors will be required to be in compliance with field-wide Hilcorp training and go through a one-time Landfarm-specific health and safety training. Third-party contractors may include but are not limited to the following:

- Environmental sampling consultants
- Construction companies
- Equipment maintenance contractors

2.10 TRAINING RECORDS

A sample of an annual training log is provided in Attachment 1. All training documentation will be maintained on site at the Landfarm Office and will be scanned and stored on a secure server at the Hilcorp field office in Aztec, New Mexico and will available to the NMOCD upon request. Training records will be maintained until five years after closure of the Landfarm.

ATTACHMENT 1: ANNUAL TRAINING LOG

ANNUAL TRAINING LOG
SIGN IN SHEET

TOPICS DISCUSSED:____

____

(Note: Required topics must include: general operations, permit conditions, emergencies, proper sampling methods, and identification of exempt and non-exempt waste and hazardous waste.)

NAME (PLEASE PRINT)	COMPANY/POSITION	TELEPHONE / EXT.
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		

Instructor: ____________________________________ Date:________________________

Subject/Issue Identified	Required Action
	Implementation Date:

SAFETY ORIENTATION
SIGN IN SHEET

TOPICS DISCUSSED:____

____

(Note: Required topics must include: safety, general landfarm operations, personal protective equipment requirements, and emergency procedures)

NAME (PLEASE PRINT)	COMPANY/POSITION	TELEPHONE / EXT.
1.		
2.		
3.		
4.		
5.		
6.		
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12.		
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16.		
17.		
18.		

Instructor: ____ Date:__________________________

ATTACHMENT 5: EXEMPT AND NON-EXEMPT WASTES AND NORM WASTE EXEMPTION

EPA WASTE CLASSIFICATION
O & G EXPLORATION AND PRODUCTION WASTES

WHAT IS EXEMPT

(Oil and natural gas exploration and production materials and wastes exempted by EPA from consideration as "Hazardous Wastes")

. Produced water;
. Drilling fluids & cuttings;
. Rigwash;
. Geothermal production fluids;
. Hydrogen sulfide abatement wastes;
. Well completion and workover wastes;
. BS&W and other tank bottoms facilities that hold exempt waste;
. Accumulated materials from production impoundments;
. Pit sludges and contaminated bottoms from treatment, storage or disposal of exempt wastes;
. Gas plant dehydration wastes;
. Gas plant sweetening wastes;
. Cooling tower blowdown;
. Spent filters, filter media, and backwash (assuming the filter itself is not hazardous and the residue in it is from an exempt waste steam);
. Packing fluids;
. Produced sand;
. Deposits removed from piping and equipment prior to transportation;
. Hydrocarbon-bearing soil contaminated from exempt streams;
. Pigging wastes from gathering lines;
. Wastes from subsurface gas storage and retrieval;
. Constituents removed from produced water;
. Liquid hydrocarbons & gases removed from the production stream but not from oil refining;
. Waste crude oil from primary field operations;
. Light organics volatilized from exempt wastes;
. Liquid and solid wastes generated by crude oil and crude tank bottom reclaimers,
. Stormwater runoff contaminated by exempt materials,
. Mixtures of exempt and non exempt wastes pursuant to OCD mixture policy (see reverse)

WHAT IS NOT EXEMPT

(Materials and wastes not exempted and may be a "hazardous waste" if tests or EPA listing define as "hazardous")

. Unused fracturing fluids or acids;
. Cooling tower cleaning wastes;
. Painting wastes;
. Oil and gas service company wastes;
. Vacuum truck and drum rinsate from trucks and drums transporting or containing non-exempt waste;
. Refinery wastes;
. Used lubrication oils;
. Waste compressor oil and filters;
. Used hydraulic fluids;
. Waste solvents;
. Transportation Waste;
. Caustic or acid cleaners;
. Boiler cleaning wastes;
. Incinerator ash;
. Laboratory wastes;
. Pesticide wastes;
. Radioactive tracer wastes;
. Drums, insulation, and miscellaneous solids;
. Industrial wastes from activities other than oil & gas exploration & production;
. Manufacturing wastes;
. Contamination from refined products.

NEW MEXICO OIL CONSERVATION DIVISION
1220 S. St. Francis Dr.
Santa Fe New Mexico 87505
(505) 476-3440
www.emnrd.state.nm.us/ocd/

(rev. 9/97)

NOTES:

1. As of September 1997 The OCD has adopted the following mixture policy:

   A mixtures of exempt and nonexempt waste will be considered exempt **ONLY** if it meets all of the following conditions:

   A. The nonexempt portion of the waste is nonhazardous through testing,
   2. The total nonexempt portion of the waste constitutes no more than five (5) percent by volume of the final mixture unless an exception is granted by the director,
   3. The mixture is the result of an incidental and unavoidable part of an OCD approved process ,
   4. Both the exempt and nonexempt portion of the waste are generated as a result of exploration and production of oil and gas, processing of gas or the transportation of natural gas prior to processing.

   If a waste which is classified as hazardous by testing or listing is mixed with any other waste, the entire resultant volume will be considered hazardous.

2. The following OCD regulated facilities may be subject to hazardous waste rules for disposal of wastes and contaminated soils containing benzene:

   -- Oil and gas service companies having wastes such as vacuum truck, tank, and drum rinsate from trucks, tanks and drums transporting or containing non-exempt waste.
   -- Transportation pipelines and mainline compressor stations generating waste, including waste deposited in transportation pipeline-related pits.

   Source: Federal Register, Thursday, March 29, 1990, p.11,798 - 11,877.

3. In April, 1991, EPA clarified the status of oil and tank bottom reclamation facilities:

   A Those wastes that are derived from the processing by reclaimers of only exempt wastes from primary oil and gas field operations are also exempt from the hazardous waste requirements. For example, wastes generated from the process of recovering crude oil from tank bottoms are exempt because the crude storage tanks are exempt.

   B. Those reclaimer wastes derived from non-exempt wastes (e.g. reclamation of used motor oil, refined product tank bottoms), or that otherwise contain material which are not uniquely associated with or intrinsic to primary exploration and production field operations would not be exempt. An example of such non-exempt wastes would be waste solvent generated from the solvent cleaning of tank trucks that are used to transport oil field tank bottoms. The use of solvent is neither unique nor intrinsic to the production of crude oil.

   Source: EPA Office of Solid Waste and Emergency Response letter opinion dated April 2, 1991, signed by Don R. Clay, Assistant Administrator.

USGS
science for a changing world

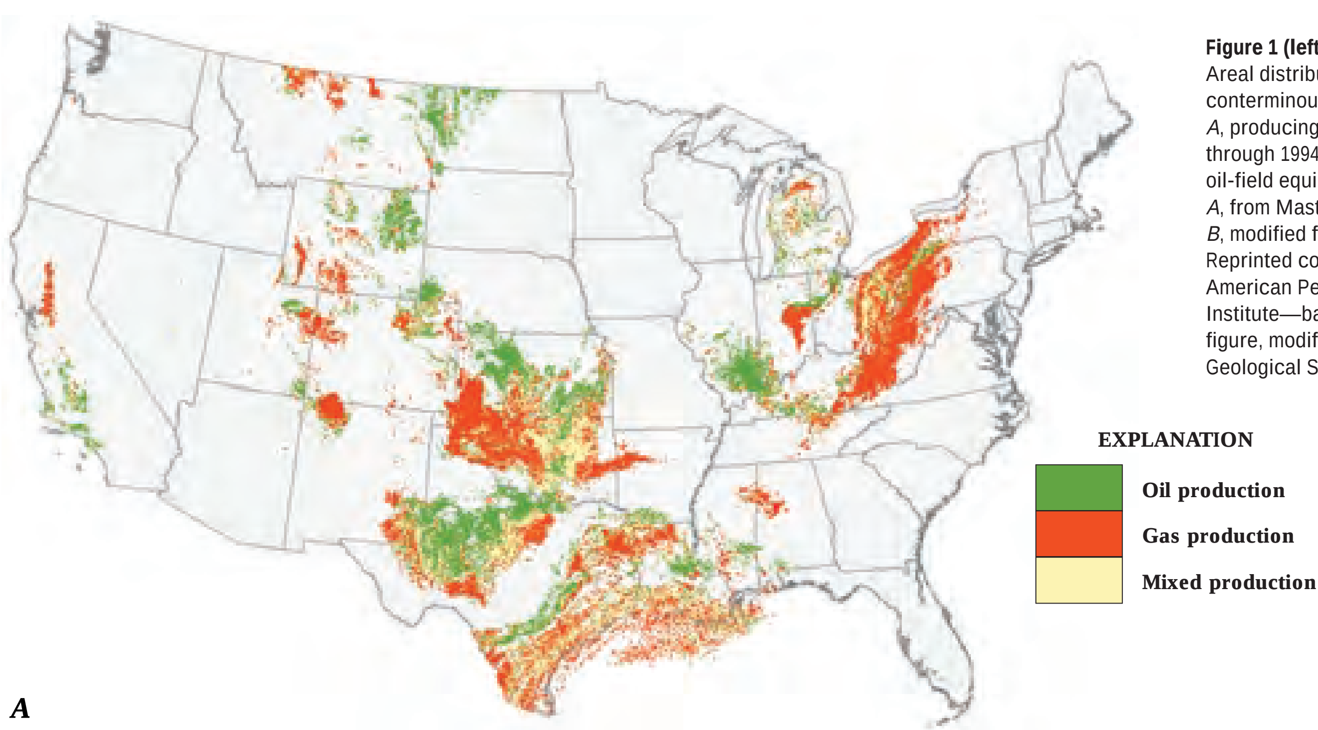
Naturally Occurring Radioactive Materials (NORM) in Produced Water and Oil-Field Equipment— An Issue for the Energy Industry

Introduction

Naturally occurring radioactive elements such as uranium, radium, and radon are dissolved in very low concentrations during normal reactions between water and rock or soil. Ground water that coexists with deposits of oil can have unusually high concentrations of dissolved constituents that build up during prolonged periods of water/rock contact. Many oil-field waters are particularly rich in chloride, and this enhances the solubility of other elements including the radioactive element radium. Some of this saline, radium-bearing water is unavoidably brought to the Earth's surface with the oil and must be separated and then disposed, usually by return to depth in an injection well. At some oil-field sites the pipes and tanks that handle large volumes of this "produced water" can become coated with scale deposits that contain radium. Radium-bearing scale is the type of "diffuse NORM waste" that occurs in the oil industry. Radium accumulation in oil-field equipment in the United States first became apparent in the 1980's when scrap metal dealers began to routinely detect unacceptable levels of radioactivity in shipments of oil-field pipe. Since that time the oil and gas industry has sought to better define the extent of the oil-field NORM problem, and to develop techniques for the prediction, prevention, remediation, and disposal of oil-field NORM. In parallel efforts, State and Federal regulatory agencies have worked to develop guidelines for the control of NORM that will adequately protect public health and the environment. This report summarizes current understanding of the composition and mode of occurrence of oil-field NORM in the United States, briefly reviews the status of NORM regulations, and identifies some health and environmental issues associated with oil-field NORM.

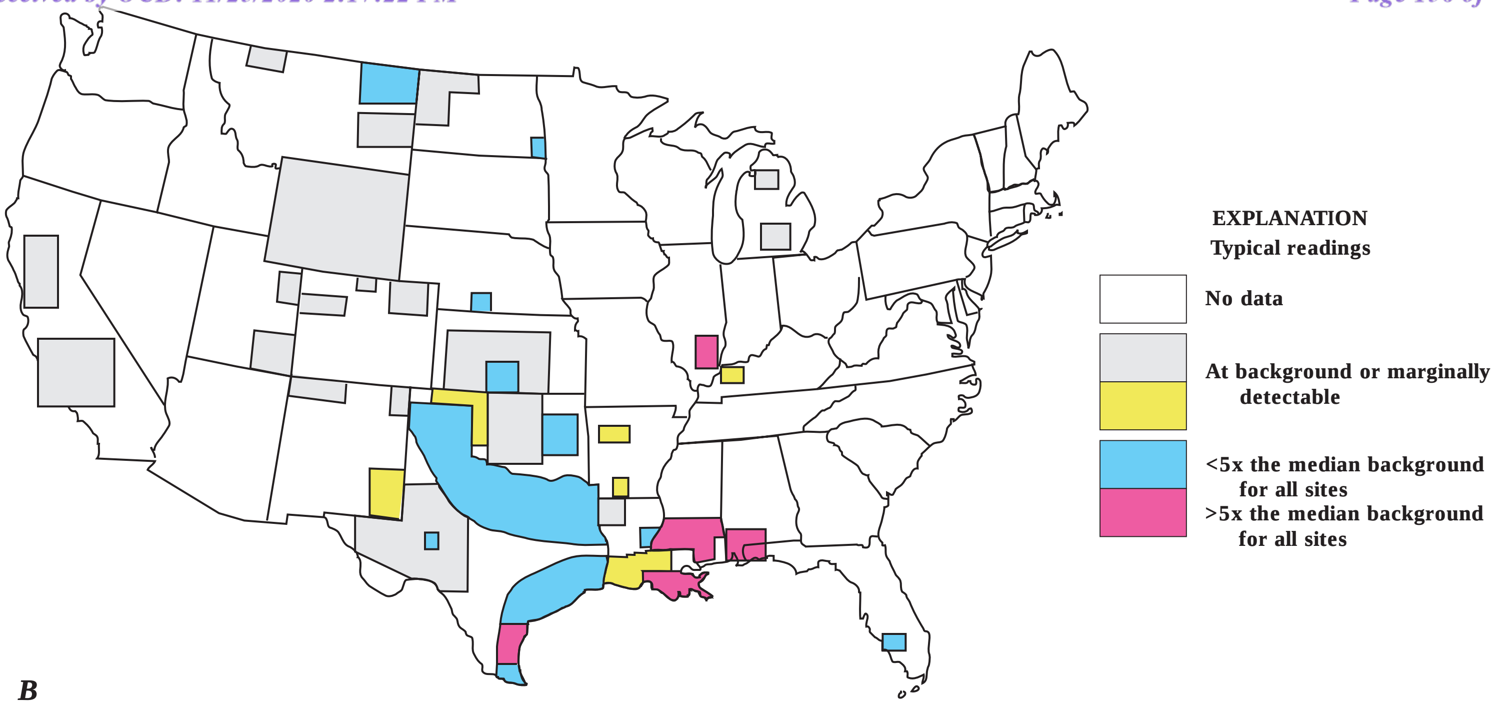
Location of Oil-Field NORM in the United States

Deposits of oil are found in 30 States, but the vast majority (86 percent) of onshore oil production is concentrated in Texas, Oklahoma, Louisiana, Wyoming, California, Kansas, and New Mexico (fig. 1*A*). In 1989 the American Petroleum Institute sponsored a preliminary nationwide reconnaissance of measurable radioactivity at the exterior surfaces of oil-field equipment (Otto, 1989). The results of this nonstatistical sampling indicated that gamma-ray radiation levels exceeded natural background radiation levels at 42 percent of the sites. Radiation levels greater than five times the median background of all sites were found at approximately 10 percent of the sites. Most of the sites with markedly higher radioactivity were concentrated in specific geographical areas, such as the Gulf Coast, northeast Texas, southeast Illinois, and south-central Kansas (fig. 1*B*). Additional surveys by some State agencies identified radioactive oil-field equipment in northern Michigan and eastern Kentucky. Pipe, casing, fittings, and tanks that have an extended history of contact with produced water are more likely to contain radioactive deposits than other parts of the plumbing system at oil-field production



A

Figure 1 (left and next page). Areal distribution in conterminous United States of *A*, producing oil and gas wells through 1994, and *B*, radioactive oil-field equipment (next page). *A*, from Mast and others, 1998. *B*, modified from Otto, 1989. Reprinted courtesy of the American Petroleum Institute—based on original API figure, modified by U.S. Geological Survey.



B

sites. Soil in the immediate vicinity of production sites may be unusually radioactive if affected by spills or leakage of produced water, or if contaminated by scale removed during pipe or tank cleaning operations. Handling of used pipe at pipe storage yards may also contaminate soil with radioactive scale. Although not discussed herein, some equipment used to process and transport natural gas may contain small amounts of radioactive decay products of radon gas.

Form of Oil-Field NORM

Oil-field equipment can contain radioactive scale and scale-bearing sludge, both of which form as coatings or sediments. The scale precipitates from produced water in response to changes in temperature, pressure, and salinity as the water is brought to the surface and is processed to separate coexisting crude oil. The scale is typically a mixture of carbonate and sulfate minerals. One of these sulfate minerals is barite (barium sulfate), which is known to readily incorporate radium (Ra) in its structure. Many studies of radioactive scale from oil-field equipment have documented that barite is the primary host of oil-field NORM and that the radioactivity is from isotopes of radium and their decay products. The two radium isotopes present in produced water and barite scale are ^{226}Ra (half-life =1,600 years) and ^{228}Ra (half-life =5.8 years). These two isotopes are produced by radioactive decay of uranium and thorium present in rocks of the oil-producing formations. The concentration of dissolved radium is therefore influenced by the abundance of uranium and thorium in reservoir rock and by the accessibility of water to the sites containing uranium and thorium. When radium is brought to the surface in produced water, the concentration of radium that is incorporated in barite scale is largely a function of (1) the concentration of dissolved radium and (2) the amount of produced water that moves past the site of barite precipitation.

Ongoing studies by USGS scientists are documenting variations in the mineralogy, chemistry, and radium concentration of in-place scale deposits. Better understanding of the specific location and texture of the most radioactive barite scale should contribute to more cost-effective strategies for its removal. Figure 2*A* illustrates some of the textural and mineralogical variability in a sample of scale from an old section of above-ground oil-field pipe. Lighter colored barite is present along with variable amounts of darker iron oxides. Barite occurs as intact layers as well as fragments of former layers that were transported and recemented with iron oxides. A corresponding image of radioactivity in this sample (fig. 2*B*) is recorded on a special film and illustrates the variable concentration of radium and its radioactive decay products in these layers.

Abundance of Radium in Oil-Field NORM

Measurement of total radioactivity with a hand-held radiation detection instrument permits rapid assessment of a site for NORM contamination, but site cleanup criteria and waste disposal options are based on actual concentrations of radium isotopes. Some specialized field instruments permit rapid estimates of the concentration of radium isotopes, but such estimates require confirmation by careful laboratory analysis of selected subsets of samples. Radium concentrations are generally reported as picocuries/gram (pCi/g) of solid material or picocuries/liter (pCi/L) of water or air. A picocurie equals 2.22 disintegrations-per-minute (dpm). Figure 3*A* illustrates the distribution of total radium concentration (^{226}Ra and ^{228}Ra) in barrels of oil-field NORM waste stored in Louisiana in 1992 (Wascom, 1994). The maximum radium concentration in this waste and in most reported oil-field scale from the U.S. is several thousand pCi/g, although very small quantities of scale have been reported with as much as 400,000 pCi/g of radium. For comparison, most natural soils and rocks contain approximately 0.5–5 pCi/g of total radium. A uranium ore sample containing 1 weight percent uranium has approximately 3,300 pCi/g of ^{226}Ra. Most of the radium in older oil-field scale is ^{226}Ra, because the shorter lived ^{228}Ra decays with a half-life of 5.8 years.

Figure 3*B* illustrates the distribution of dissolved ^{226}Ra concentration in 215 samples of produced water from seven major oil-producing areas (Fisher, 1998). Radium tends to be more abundant in the more saline and chloride-rich varieties of these produced waters. The maximum concentration of dissolved ^{226}Ra in this limited data set is several thousand pCi/L, but concentrations above 10,000 pCi/L have been reported in the U.S. Produced water also contains dissolved ^{228}Ra, which is typically one-half to twice the concentration of ^{226}Ra. For comparison, the U.S. EPA maximum contaminant level for drinking water is 5 pCi/L for total dissolved radium.

Regulations for the Control of Oil-Field NORM

There currently exist no Federal regulations that specifically address the handling and disposal of oil-field NORM wastes. States that have enacted specific NORM regulations include some important oil producers such as Texas, Louisiana, New Mexico, and Mississippi. New NORM regulations or modifications to general radiation protection statutes are under consideration in other major oil-producing States such as California, Kansas, and Oklahoma. Standards for cleanup of radium-contaminated soils that typically appear in enacted or proposed NORM regulations call for an average concentration of less than 5 pCi/g in the upper 15 cm (centimeters) of soil and an average of less than 15 pCi/g in deeper increments of 15 cm. Some States allow an average of as much as 30 pCi/g of radium in the upper 15 cm of soil. For oil-field equipment, typical standards for release for other uses or for recycling require that radioactivity at the surface should not exceed some low multiple of natural background radioactivity.

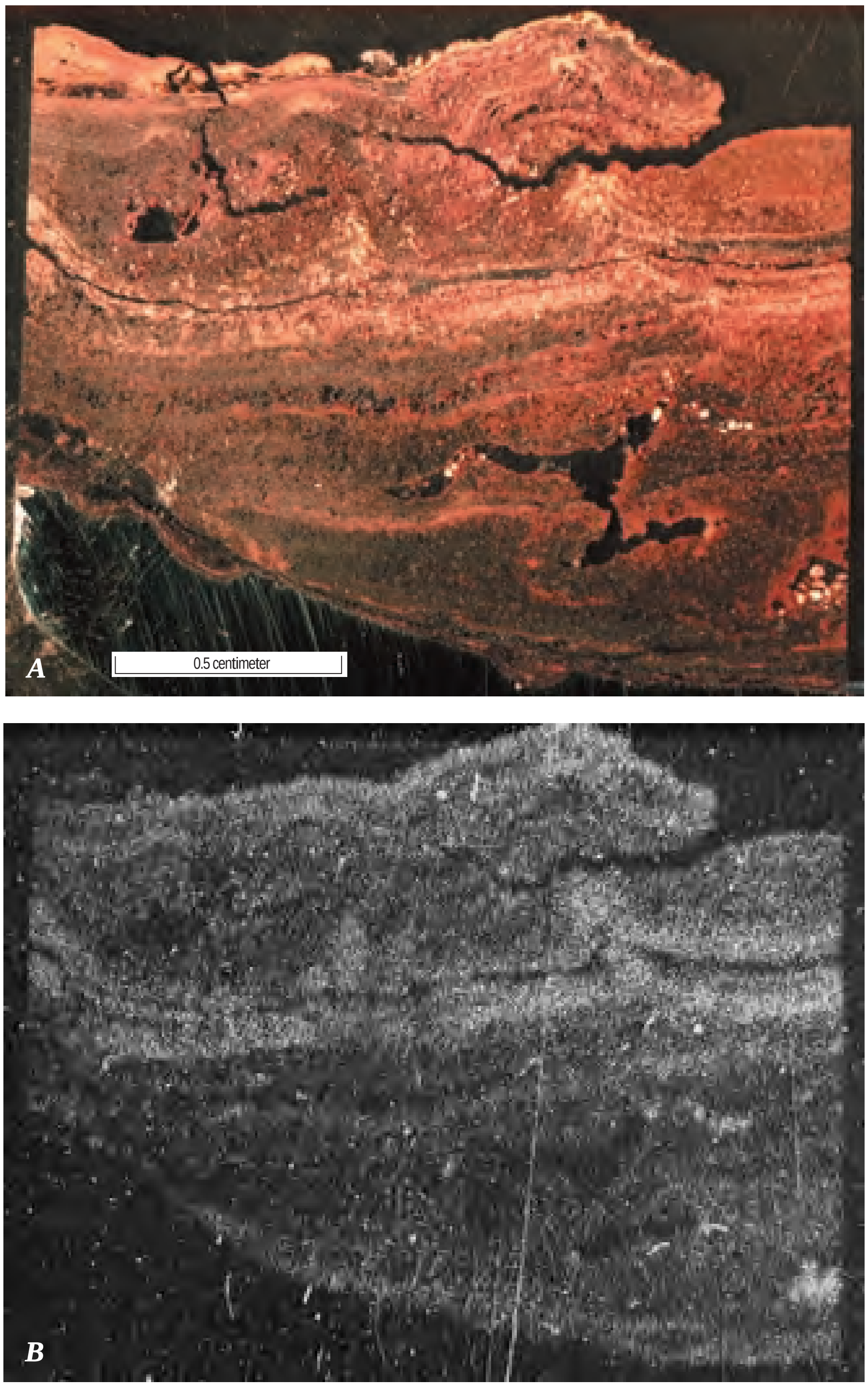


Figure 2. Radioactive scale deposits inside oil-field pipe (*A*) and the distribution of alpha-particle-emitting radium and radium decay products in the same sample (*B*). Brighter regions on the alpha emission image indicate areas of scale with higher concentrations of radioactive elements.

Health and Environmental Issues of Oil-Field NORM

Once formed, barite is a very insoluble mineral. One liter of water at the Earth's surface dissolves only 0.0025 grams of barite. Efficient removal of barite deposits from oil-field equipment requires special chemicals or vigorous mechanical methods. The process of barite removal and disposal is complicated by the need to minimize radiation dose to workers and the general public. Radiation exposure pathways include external gamma radiation (major), ingestion (minor), and inhalation of particulates and radon gas (major).

Figure 4 illustrates the relative isolation of NORM waste from the general public for a variety of possible disposal options. As degree of isolation increases so does the capability for disposing of higher radium concentrations. Currently most oil-field NORM waste is stored at production sites awaiting disposal in specially designated and permitted landfills, disposal wells, or injection wells (fig. 4). Surface spreading and dilution of low-level NORM waste (fig. 4) is a past practice that is now disallowed by most States with NORM regulations. A preliminary radiological dose assessment was reported for a scenario in which individuals live on a NORM-amended soil and consume local water, livestock, and food crops (Smith and others, 1996). For soils amended with radium to the highest concentration under regulatory consideration (30 pCi/g) the additional annual radiation dose by all pathways was equivalent to the average annual background dose to the U.S. population. Current limits set by the Nuclear Regulatory Commission require that the total of such additional doses to the general public be limited to about 30 percent of the average annual background dose.

Prior to 1970 the regulations governing disposal of produced water and scale were less restrictive, and thus older oil-field production sites are more likely to have above-background concentrations of NORM in nearby soils and stream sediments. Several studies, including some by USGS researchers, have documented the presence of barite in soils contaminated with oil-field NORM.

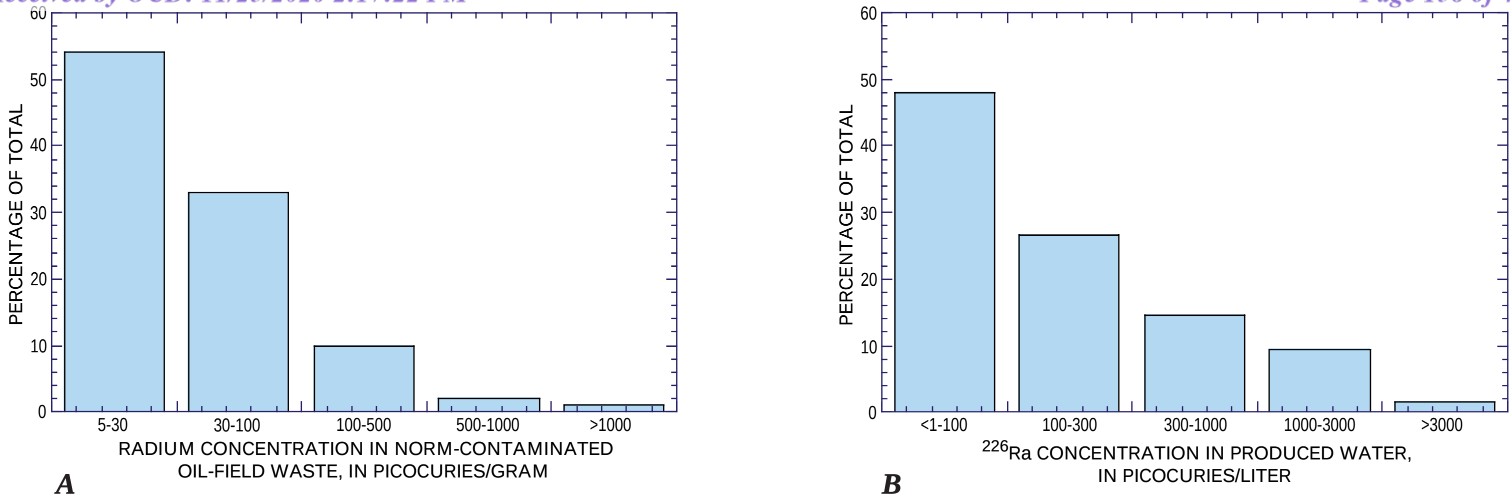
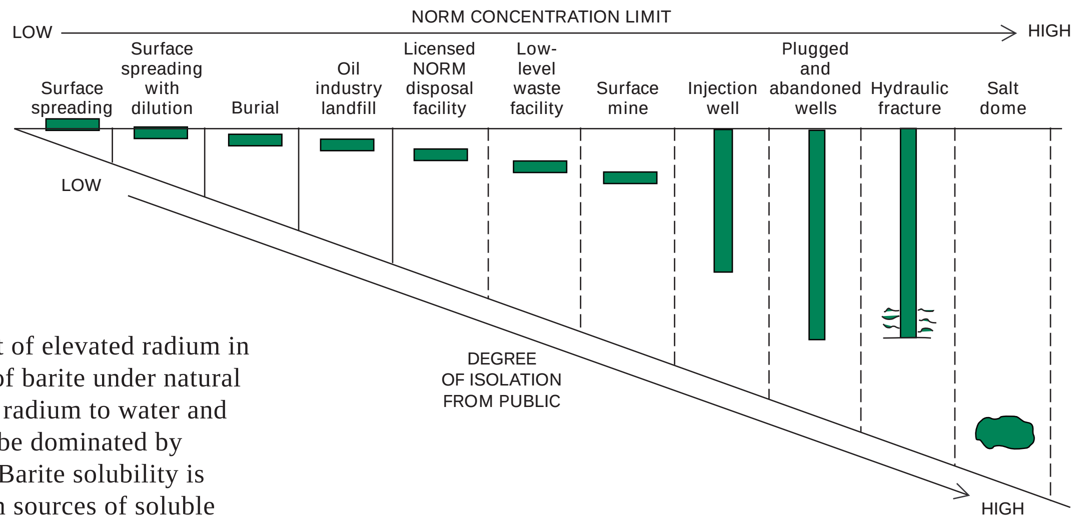


Figure 3. Estimated distribution of radium concentration in *A*, solid oil-field waste and *B*, produced water.

Figure 4. Disposal alternatives for NORM wastes. Disposal of more concentrated wastes requires greater isolation of waste from the general public. Modified from American Petroleum Institute (1992). Reprinted courtesy of the American Petroleum Institute—based on original API figure, modified by U.S. Geological Survey.



Barite scale is the most likely host of elevated radium in these soils. The extreme insolubility of barite under natural conditions limits the rate of release of radium to water and suggests that dispersal of radium will be dominated by physical transport of barite particles. Barite solubility is lowest in oxidized soils that are rich in sources of soluble sulfate such as gypsum. In organic-rich soils barite solubility is increased by the action of sulfate-consuming bacteria. The average age of formation of barite scale can be estimated based on the different rates of decay of ^{226}Ra and ^{228}Ra, or based on the buildup of radioactive decay products of these radium isotopes. Such information is useful for determining the sources and history of contamination at a site and for assigning possible liability.

Current Status and Future Direction of the Oil-Field NORM Issue

The magnitude of the oil-field NORM problem in the U.S. has been estimated, but it remains to be completely assessed. Increased industry awareness and understanding of the problem coupled with government regulatory efforts have provided much better control of oil-field NORM wastes and have reduced the radiation exposure to workers and the public. Management of the present inventory of stored oil-field NORM waste and options for its disposal are designed to reduce radiation hazard to the general public. The challenge to the oil and gas industry will be to develop safer and more cost-effective methods to minimize, process, and dispose of future oil-field NORM. An additional challenge to industry and government is to identify, remediate, and if necessary, remove NORM contamination that remains at old or abandoned petroleum production sites.

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ATTACHMENT 6: LANDFARM SCHEDULES

TANK MOUNTAIN LANDFARM
HILCORP ENERGY COMPANY

MONITORING SCHEDULE				
Sample Location	**Frequency**	**Sample Type**	**Analysis**	**Analytical Method**
Treatment Zone (landfarmed soil in cells)	Semi-Annually (Q1/Q3)	1 Composite Sample Consisting of 4 Discrete Samples	TPH Chloride	EPA Method 8015M or 418.1 EPA Method 300.1
Vadose Zone (3 to 4 ft below landfarm cell's original ground surface)	Semi-Annually (Q1/Q3)	4 Discrete Samples	TPH - GRO, DRO TPH BTEX Chloride	EPA Method 8015M EPA Method 8015M or 418.1 EPA Method 8021 EPA Method 300.1
Soil Vadose Zone (3 to 4 ft below landfarm cell's original ground surface)	Every 5 Years	4 Discrete Samples	Constituents Listed in Subsections A and B of 20.6.2.3103 NMAC by Method 6010B/6020	EPA Method 6010B and 6020

Notes:
DRO - Diesel Range Organics
GRO - Gasoline Range Organics
EPA - United States Environmental Protection Agency
NMAC - New Mexico Administrative Code

Hilcorp

Landfarm Operations Schedule			
FREQUENCY	**ACTIVITY**	**PERSONNEL**	**DOCUMENTATION**
Biweekly	Contaminated soil is disked (or after 72 hours of load receipt, whichever is sooner)	Hilcorp Onsite Personnel	Waste Tracking Form, Daily Remediation Activities Form
Quarterly	Inspection of bermed areas	Hilcorp Onsite Personnel	Landfarm Inspection Checklist
Semi-Annually	Treatment Zone Monitoring (prior to adding another lift to cell) - four point composite soil sampling for TPH and chloride prior to adding another lift to cell	Hilcorp Employee or Third Party Contractor	Third Party Contractor Analytical Result Reports
	Treatment Zone Monitoring (once two feet thickness is reached) - four point composite soil sampling for benzene, BTEX, GRO, DRO, TPH, chloride, and waiver request analytes	Hilcorp Employee or Third Party Contractor	Third Party Contractor Analytical Result Reports
	Vadose Zone Monitoring - at least four randomly selected independent samples for TPH, BTEX, and chloride	Hilcorp Employee or Third Party Contractor	Third Party Contractor Analytical Result Reports
Annually	Recordkeeping audit	Hilcorp Employee or Third Party Contractor	Annual Recordkeeping Audit Checklist
Every Five Years	Soil Vadose Zone Monitoring - at least four randomly selected independent samples for constituents listed in Subsection A and B of 20.6.2.3103 NMAC by EPA SW-846 methods 6010B or 6020	Hilcorp Employee or Third Party Contractor	Third Party Contractor Analytical Result Reports

APPENDIX C: INSPECTION AND MAINTENANCE PLAN

APPENDIX C - INSPECTION AND MAINTENANCE PLAN

HILCORP TANK MOUNTAIN LANDFARM
SAN JUAN COUNTY, NEW MEXICO

OCTOBER 2020

A proud member of WSP

Prepared for:

HILCORP ENERGY COMPANY
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Prepared by:

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ATTACHMENTS

1.0 INTRODUCTION

This *Inspection and Maintenance Plan* (IMP) for the Tank Mountain Landfarm (Landfarm) operated by Hilcorp Energy Company (Hilcorp) complies with the applicable requirements contained in Subsection L of 19.15.36.13 of the New Mexico Administrative Code (NMAC). The IMP is organized with section headings referencing each applicable requirement.

1.1 PURPOSE

This IMP was written to address and ensure that inspections and maintenance procedures are outlined for the protection of fresh water, public health, and the environment. The IMP references the NMAC Surface Waste Management Facilities Siting Criteria Summary Information Sheet and associated written plans for the Landfarm, including the Run-on and Runoff Control Plan (Appendix F) and the *Plan for the Management of Approved Oil field Wastes* (Appendix B).

2.0 INSPECTION AND MAINTENANCE PLAN

This IMP outlines written inspection and maintenance procedures for the Landfarm.

2.1 19.15.36.13 (L)(1): MONTHLY INSPECTION OF LEAK DETECTION SUMPS

Each operator shall have an inspection and maintenance plan that includes monthly inspection of leak detection sumps including sampling if fluids are present with analyses of fluid samples furnished to the division; and maintenance of records of inspection dates, the inspector and the leak detection system's status.

Hilcorp will not be accepting liquid waste and does not plan on installing leak detection sumps for the Landfarm.

2.2 19.15.36.13 (L)(2): INSPECTION AND SAMPLING OF MONITORING WELLS

Each operator shall have an inspection and maintenance plan that includes semi-annual inspection and sampling of monitoring wells as required, with analyses of ground water furnished to the division; and maintenance of records of inspection dates, the inspector and ground water monitoring wells' status.

Hilcorp has installed two monitoring wells onsite into a shallow water-bearing zone with total depths at approximately 105 feet below ground surface (bgs). The most recent depth-to-water measurement was approximately 43 feet below the top of casing. An aquifer test and modeling were completed on well MW01 (see *Short Term Aquifer Test and Groundwater Information,* Appendix I). The highest pumping rate that could be simulated without the well going dry was 0.0256 gallons per minute (gpm), which is equivalent to 36.9 gallons per day (gpd). The sustainable yield for well MW01 is 36.9 gpd, approximately one-quarter of the value of 150 gpd that EPA indicates is required for a typical small household. Therefore, the perched saturated interval encountered in wells MW01 and MW03 is not a sustainable water resource and does not meet the definition of an aquifer or groundwater as defined in 19.15.2.7 NMAC.

Groundwater is not present within 105 feet of the ground surface at the Landfarm. As such, Hilcorp does not plan to sample or monitor groundwater at the Landfarm.

2.3 19.15.36.13 (L)(3): QUARTERLY INSPECTIONS

Each operator shall have an inspection and maintenance plan that includes inspections of the berms and the outside walls of pond levees quarterly and after a major rainfall or windstorm, and maintenance of berms in such a manner as to prevent erosion.

Hilcorp will perform quarterly inspections of the berms, roads, access ramp, and receiving area. Additionally, Hilcorp will conduct inspections after a major rainfall or windstorm. A major rainfall will be considered one inch of rain in a 24-hour period (which is equivalent to the NOAA 24-hour/1-year storm event). A windstorm will be considered significant when sustained wind speed exceeds 55 miles per hour.

The inspections will confirm that internal cell berms will comply with the design requirements and maintained to direct runoff away from the Landfarm (see *Run-on and Run-off Control Plan*, Appendix F).

The inspections will include an evaluation of the perimeter ditch to ensure it is maintained according to the engineering designs.

The site access ramp and receiving area will also be inspected quarterly and after a major rainfall or windstorm to eliminate erosion gullies and preclude runoff.

Because a berm will surround each Landfarm cell, sediment is anticipated to accumulate in the lowest elevation area of each cell (location will be cell-dependent). As detailed in the *Run On Run Off Control Plan* (Appendix F), there will be an area in each cell where fill is not allowed to be placed to ensure that there is a portion of each cell that would allow water to collect in larger storm events without exceeding the berm height. Inspections will include the depth of accumulated sediment. Accumulations of one foot or more will be re-graded.

The Landfarm Inspection Checklist is included in Attachment 1. All completed inspection forms will be maintained on site at the Landfarm Office and will be periodically scanned and stored on a secure server at the Hilcorp Field Office in Aztec, New Mexico. Should an inspection indicate insufficiencies with berms, the drainage ditch, or other specific areas that require maintenance, repairs will be scheduled as necessary after any inspection.

2.4 19.15.36.13 (G): RECORDKEEPING

The operator of a commercial facility shall maintain records reflecting the generator, the location of origin, the location of disposal within the commercial facility, the volume and type of oil field waste, the date of disposal and the hauling company for each load or category of oil field waste accepted at the commercial facility. The operator shall maintain such records for a period of not less than five years after the commercial facility's closure, subject to division inspection.

All completed Landfarm Inspection Checklists will be maintained on site in the Landfarm Office and will be periodically scanned and stored on a secure server at the Hilcorp Field Office in Aztec, New Mexico and will be made available to the NMOCD upon request. All records will be maintained for at least five years after closure of the Landfarm.

3.0 19.15.36.15: SPECIFIC REQUIREMENTS APPLICABLE TO LANDFARMS

The *Plan for the Management of Approved Oil field Wastes* (Appendix B) for the Landfarm covers the details associated with implementing the specific requirements applicable to landfarms (19.15.36.15 NMAC). Specifics are provided in Appendix B regarding oil field acceptance criteria, background testing, waste treatment, treatment zone and vadose zone monitoring, treatment zone closure performance standards, and disposition of wastes. Additional monitoring and inspections specified by 19.15.36.15 NMAC are also outlined in the *Plan for the Management of Approved Oil field Wastes*, including inspection checklists and additional recordkeeping requirements.

ATTACHMENT 1: LANDFARM INSPECTION CHECKLIST

Hilcorp

LANDFARM NAME	
DATE	

Inspection Type (circle): Quarterly Post-Rain Event Post Windstorm Event

Landfarm Inspection Checklist

ITEM / AREA	SATISFACTORY	UNSATISFACTORY	COMMENTS / ACTION TAKEN
Overall Facility Condition			
General Facility Housekeeping			
Exterior Berm Condition			
Width Maintained?			
Slopes Maintained?			
Internal Cell Berm Condition			
Width Maintained?			
Slopes Maintained?			
Liner Condition (if applicable)			
Stormwater Accumulation			
Exterior Drainage Ditch			
Erosion			
Sediment Accumulation			
Debris / Trash Accumulation			
Access Ramp Condition			
Truck Unloading Area			
Exterior Driveway / Road			
Leaks / Equipment Requiring Maintenance			
Disking / Tilling On Schedule?			
Recordkeeping			

NA – Not Applicable
Comment section should be used to provide details of unsatisfactory findings.

Additional Inspection Remarks:

Inspector Signature:______________________ Manager Signature:______________________________

Name (Print):____________________________ Name (Print):___________________________________

APPENDIX D: CLOSURE AND POST CLOSURE PLAN

APPENDIX D - CLOSURE AND POST CLOSURE PLAN

HILCORP TANK MOUNTAIN LANDFARM
SAN JUAN COUNTY, NEW MEXICO

OCTOBER 2020

Prepared for:

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ATTACHMENTS

1.0 INTRODUCTION

LT Environmental, Inc. (LTE) has prepared the following *Closure and Post-Closure Plan* (Plan) at the Tank Mountain Landfarm (Landfarm) for Hilcorp Energy Company (Hilcorp), in accordance with the requirements contained in 19.15.36 of the New Mexico Administrative Code (NMAC). The Plan is organized with section headings referencing each applicable requirement.

1.1 SITE DESCRIPTION

The Landfarm occupies approximately 38 acres in the southeast quarter of the southwest quarter of Section 5, Township 31 North, Range 9 West in San Juan County, New Mexico. The Landfarm will contain 17 distinct treatment cells. Soil will be added to each cell until a maximum thickness of two feet of soil or maximum of 3,000 cubic yards per acre has been applied, at which time Hilcorp will continue treatment of each cell until treatment zone closure performance standards have been achieved (as specified in Subsection F of 19.15.36.15 NMAC).

1.2 LANDFARM CLOSURE SCHEDULE

Hilcorp anticipates constructing the landfarm cells in two stages: Stage 1 will include the construction of cells 1 through 7; Stage 2 will include the construction of cells 8 through 17 (construction schedules subject to change based on conditions at the time of construction). Because of this, landfarm closure and post-closure activities also is anticipated to take place in two stages. For scheduling and cost estimate purposes, Stage 1 cells 1 through 7 are anticipated to receive soils for approximately 2 to 5 years, at which time closure and post-closure procedures will be initiated. Stage 2 cells 8 through 17 are anticipated to be constructed at the time of Stage 1 cell closure. This proposed schedule is subject to change based on conditions at the time of construction.

2.0 19.15.36.18 (A): SURFACE WASTE MANAGEMENT FACILITY CLOSURE BY OPERATOR

(1) *The operator shall notify the division's environmental bureau at least 60 days prior to cessation of operations at the surface waste management facility and provide a proposed schedule for closure. Upon receipt of such notice and proposed schedule, the division shall review the current closure and post closure plan (post closure is not required for oil treating plants) for adequacy and inspect the surface waste management facility.*

Hilcorp will notify the New Mexico Oil Conservation Division (NMOCD) at least 60 days prior to cessation of operations at the Landfarm. At that time, Hilcorp will provide a proposed schedule for closure of the Landfarm.

(2) *The division shall notify the operator within 60 days after the date of cessation of operations specified in the operator's closure notice of modifications of the closure and post closure plan and proposed schedule or additional requirements that it determines are necessary for the protection of fresh water, public health, or the environment.*

Within 60 days after the date of cessation of operations at the Landfarm, NMOCD will notify Hilcorp of modifications of the Plan and proposed schedule or additional requirements that NMOCD determines necessary for the protection of fresh water, public health, safety, or the environment.

(3) *If the division does not notify the operator of additional closure or post closure requirements within 60 days as provided, the operator may proceed with closure in accordance with the approved closure and post closure plan; provided that the director may, for good cause, extend the time for the division's response for an additional period not to exceed 60 days by written notice to the operator.*

If Hilcorp does not receive notification from NMOCD within 60 days after the date of cessation of operations, Hilcorp will proceed with closure of the Landfarm in accordance with this Plan. Hilcorp acknowledges NMOCD may extend their review time of the Plan review by a period not to exceed 60 days; NMOCD will notify Hilcorp in writing of such extension of the review time.

(4) *The operator shall be entitled to a hearing concerning a modification or additional requirement the division seeks to impose if it files an application for a hearing within 10 days after receipt of written notice of the proposed modifications or additional requirements.*

Hilcorp acknowledges that they will be entitled to a hearing concerning a modification or additional requirements NMOCD seeks to impose on the Plan at the time of cessation of operations. In order to receive a hearing, Hilcorp must file an application for a hearing within 10 days after receipt of written notice of the proposed modifications or additional requirements.

(5) *Closure shall proceed in accordance with the approved closure and post closure plan and schedule and modifications or additional requirements the division imposes. During closure operations the operator shall maintain the surface waste management facility to protect fresh water, public health, and the environment.*

Closure of the Landfarm shall proceed in accordance with this Plan and the proposed schedule and modifications or additional requirements Hilcorp and NMOCD have agreed upon at the time of cessation of operations.

At the time of closure, Hilcorp will evaluate the current site and surrounding conditions to determine the appropriate actions required to maintain the Landfarm to protect fresh water, public health, safety, and the environment. Evaluation factors include, but are not limited to, volume of remaining soil, monitoring results, and current surrounding land use. The Closure Inspection Checklist (Attachment 1) will be used during closure activities.

For costing purposes, closure activities (including biweekly disking and ongoing monitoring) is assumed to take three years. A closure cost estimate prepared by a third-party consultant (LT Environmental, Inc.) in accordance with 19.15.36.18 and is included as Attachment 2.

(6) *Upon completion of closure, the operator shall re-vegetate the site unless the division has approved an alternative site use plan as provided in Subsection F of 19.15.36.18 NMAC. Re-vegetation, except for landfill cells, shall consist of establishment of a vegetative cover equal to seventy percent of the native perennial vegetative cover (un-impacted by overgrazing, fire or other intrusion damaging to native vegetation) or scientifically documented ecological description consisting of at least three native plant species, including at least one grass, but not including noxious weeds, and maintenance of that cover through two successive growing seasons.*

Upon completion of closure, Hilcorp will revegetate the Landfarm. A site-specific *Post-Closure Revegetation and Reclamation Plan* has been prepared for the Landfarm and is included in Attachment 3. A post-closure cost estimate is included in Attachment 2. Hilcorp, or another responsible entity, will regularly inspect and maintain the required revegetation in accordance with the site-specific plan.

3.0 19.15.36.18 (B): RELEASE OF FINANCIAL ASSURANCE

Upon notification by the NMOCD that is has approved the Landfarm permit, but prior to issuing the permit, Hilcorp will secure financial assurance in the form of a non-cancelable surety bond, payable to the “New Mexico Energy, Minerals, and Natural Resources Department, Oil Conservation Division.” Hilcorp will submit financial assurance in the amount of $25,000 for the Tank Mountain Landfarm. Alternatively, Hilcorp may elect to submit a statewide “blanket” financial assurance in the amount of $50,000 to cover all centralized facilities proposed by the applicant. Cost estimates for the closure and post-closure activities anticipated for the Landfarm are included in Attachment 2. These cost estimates are presented in current dollars (year 2020), with unit costs based on similar projects being conducted by Hilcorp and LTE. These costs assume that no contamination or remedial actions will be required after the closure of the Landfarm.

(1) *When the division determines that closure is complete it shall release the financial assurance, except for the amount needed to maintain monitoring wells for the applicable post closure care period, to perform semi-annual analyses of such monitoring wells and to re-vegetate the site. Prior to the partial release of the financial assurance covering the surface waste management facility, the division shall inspect the site to determine that closure is complete.*

> NMOCD shall release the financial assurance, except for the amount needed to maintain monitoring wells (if applicable) for the post-closure care period, to perform semi-annual analyses of such monitoring wells and to revegetate the Landfarm. Prior to the partial release of the financial assurance covering the Landfarm, NMOCD shall inspect the Landfarm to determine that closure is complete.

(2) *After the applicable post closure care period has expired, the division shall release the remainder of the financial assurance if the monitoring wells show no contamination and the re-vegetation in accordance with Paragraph (6) of Subsection A of 19.15.36.18 NMAC is successful. If monitoring wells or other monitoring or leak detection systems reveal contamination during the surface waste management facility’s operation or in the applicable post closure care period following the surface waste management facility’s closure the division shall not release the financial assurance until the contamination is remediated in accordance with 19.15.30 NMAC and 19.15.29 NMAC, as applicable.*

> After the applicable post-closure care period has expired, NMOCD shall release the remainder of the financial assurance if there is no evidence of residual contamination and revegetation of the site is successful according to the approved *Post-Closure Revegetation and Reclamation Plan*. If monitoring activities reveal contamination during the Landfarm’s operation or in the applicable post-closure care period following the closure of the Landfarm, NMOCD shall not release the financial assurance until the contamination is remediated in accordance with 19.15.29 and 19.15.30 NMAC, as applicable.

(3) *In any event, the division shall not finally release the financial assurance until it determines that the operator has successfully re-vegetated the site in accordance with Paragraph (6) of Subsection A of 19.15.36.18 NMAC, or, if the division has approved an alternative site use plan, until the landowner has obtained the necessary regulatory approvals and begun implementation of the use.*

NMOCD shall not finally release the financial assurance until it determines that Hilcorp has successfully revegetated the site in accordance with the approved *Post-Closure Revegetation and Reclamation Plan*; or, if NMOCD has approved an alternative site use plan, until Hilcorp has obtained the necessary regulatory approvals and begun implementation of the use.

4.0 19.15.36.18 (C): SURFACE WASTE MANAGEMENT CELL AND FACILITY CLOSURE STANDARDS

The following minimum standards shall apply to closure and post closure of the installations indicated, whether the entire surface waste management facility is being closed or only a part of the surface waste management facility.

(4) *Landfarm closure. The operator shall ensure that:*

(a) *disking and addition of bioremediation enhancing materials continues until soils within the cells are remediated to the standards provided in Subsection F of 19.15.36.15 NMAC, or as otherwise approved by the division;*

A single composite soil sample, consisting of four discrete samples, will be collected and compared to the Treatment Zone Closure Performance Standards below for each Landfarm cell. Hilcorp will ensure that disking and/or addition of bioremediation enhancing materials will continue within each Landfarm cell until soils within the cell are remediated to the higher of the background concentrations (where applicable) or the closure standards provided below.

Treatment Zone Closure Performance Standards [19.15.36.15(F)]

Constituent	Lab Method	Limit
Benzene	EPA SW-846 Method 8021B or 8260B	0.2 milligrams per kilogram (mg/kg)
Benzene, toluene, ethylbenzene, and total xylenes (BTEX)	EPA SW-846 Method 8021B or 8260B	50 mg/kg
Gasoline range organics (GRO) plus diesel range organics (DRO)	EPA SW-846 Method 8015M	500 mg/kg
Total petroleum hydrocarbons (TPH)	EPA Method 418.1 or 8015M	2,500 mg/kg
Chloride concentration	EPA Method 300.1	1,000 mg/kg[a]
The constituents listed in subsections A and B of 20.6.2.3103 NMAC by EPA SW-846 methods 6010B and 6020	EPA Methods 6010B and 6020	Limit will be based on the results of a *Background Sampling Plan* to be submitted to NMOCD prior to landfarm construction.

[a] 1,000 mg/kg is the limit due to groundwater being located greater than 100 feet below the lowest elevation where Hilcorp will place oil field waste at the Landfarm.

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(b) *soils remediated to the foregoing standards and left in place are re-vegetated in accordance with Paragraph (6) of Subsection A of 19.15.36.18 NMAC;*

Soils remediated to the standards provided in the Treatment Zone Closure Performance Standards, as summarized above, will be left in place will be revegetated in accordance with the *Post-Closure Revegetation and Reclamation Plan* included as Attachment 3 of this Plan.

(c) *landfarmed soils that have not been or cannot be remediated to the standards in Subsection F of 19.15.36.15 NMAC are removed to a division-approved surface waste management facility and the landfarm remediation area is filled in with native soil and re-vegetated in accordance with Paragraph (6) of Subsection A of 19.15.36.18 NMAC;*

Landfarmed soils that have not been, or cannot be, remediated to the treatment zone closure performance standards, summarized above, will be removed to a NMOCD-approved surface waste management facility and the Landfarm remediation area will be filled in with native soil revegetated in accordance with the approved *Post-Closure Revegetation and Reclamation Plan* included as Attachment 3 of this Plan.

(d) *if treated soils are removed, the cell is filled in with native soils and re-vegetated in accordance with Paragraph (6) of Subsection A of 19.15.36.18 NMAC;*

Treatment-zone soils may be reused by Hilcorp in accordance with Subsection G of 19.15.36.15 NMAC and Subsection G of 19.15.36.18 NMAC (see Section 7.0 below). If soils are reused, cells then will be revegetated in accordance with the *Post-Closure Revegetation and Reclamation Plan* included as Attachment 3 of this Plan.

(e) *berms are removed; and*

(f) *buildings, fences, roads and equipment are removed, the site cleaned-up and tests conducted on the soils for contamination;*

At the time of closure, Hilcorp will remove all berms, buildings, fences, roads, and equipment from the site. The site will be cleaned up prior to revegetation and any areas of soil staining outside of the Landfarm cells will be sampled for benzene, BTEX, GRO, DRO, TPH, and chloride. If samples come back above the Treatment Zone Closure Standards above, the soil will be remediated prior to revegetation.

(g) *annual reports of vadose zone and treatment zone sampling are submitted to the division's environmental bureau until the division has approved the surface waste management facility's final closure; and*

Hilcorp will submit annual reports of vadose zone and treatment zone sampling to NMOCDs Environmental Bureau until NMOCD has approved the Landfarm's final closure. Vadose zone monitoring requirements are outlined in Sections 4.4 and 4.5 of the *Plan for Management of Approved Oil field Wastes* (Appendix B).

(h) *for an operator who chooses to use the landfarm methods specified in Subsection H of 19.15.36.15 NMAC, that the soil has an ECs of less than or equal to 4.0 mmhos/cm (dS/m) and a SAR of less than or equal to 13.0.*

Hilcorp is not pursuing the environmentally acceptable bioremediation endpoint approach for management or closure of the Landfarm at this time.

5.0 19.15.36.18 (E): LANDFARM AND POND AND PIT POST-CLOSURE

The post-closure care period for a landfarm or pond or pit shall be three years if the operator has achieved clean closure. During that period the operator or other responsible entity shall regularly inspect and maintain required re-vegetation. If there has been a release to the vadose zone or to ground water, then the operator shall comply with the applicable requirements of 19.15.30 NMAC and 19.15.29 NMAC.

The post-closure care period for the Landfarm will be three years if Hilcorp has achieved clean closure as outlined in this Plan. During that period, Hilcorp, or another responsible entity, will regularly inspect and maintain required revegetation, in accordance with the site-specific *Post-Closure Revegetation and Reclamation Plan* included as Attachment 3. Post-closure care will include semi-annual monitoring of the site to assess weed management/treatment, percent vegetative cover, and erosion control measures. Corrective measures will be conducted, if necessary, per the *Revegetation and Reclamation Plan.* A Post-Closure Inspection Checklist will be used during post-closure monitoring events (Attachment 4)

If there has been a release to the vadose zone or to groundwater, then Hilcorp will comply with all the applicable requirements of 19.15.29 NMAC (Release Notification) and 19.15.30 NMAC (Remediation) and work with the local NMOCD office located in Aztec, New Mexico.

6.0 19.15.36.18 (F): ALTERNATIVES TO REVEGETATION

If the landowner contemplates use of the land where a cell or surface waste management facility is located for purposes inconsistent with re-vegetation, the landowner may, with division approval, implement an alternative surface treatment appropriate for the contemplated use, provided that the alternative treatment will effectively prevent erosion. If the division approves an alternative to re-vegetation, it shall not release the portion of the operator's financial assurance reserved for post-closure until the landowner has obtained necessary regulatory approvals and begun implementation of such alternative use.

If Hilcorp contemplates use of the land where the Landfarm is located for purposes inconsistent with revegetation, Hilcorp may, with NMOCD approval, implement an alternative surface treatment appropriate for the contemplated use, provided that the alternative treatment will effectively prevent erosion. Hilcorp will assess the reuse of treatment-zone soils once treatment zone closure performance standards have been met at the site. Hilcorp will prepare an alternative site-use plan for the Landfarm prior to deviating from this Plan and provided revegetation plan.

Hilcorp acknowledges that, if NMOCD approves an alternative to revegetation, the NMOCD shall not release the portion of Hilcorp's financial assurance reserved for post-closure until Hilcorp has obtained necessary regulatory approvals and begun implementation of such alternative use.

7.0 19.15.36.18 (G): CLOSURE INITIATED BY NMOCD AND FINANCIAL ASSURANCE FORFEITURE

***(1)** For good cause, the division may, after notice to the operator and an opportunity for a hearing, order immediate cessation of a surface waste management facility's operation when it appears that cessation is necessary to protect fresh water, public health or the environment, or to assure compliance with statutes or division rules and orders. The division may order closure without first having a hearing in the event of an emergency, subject to Section 70-2-23 NMSA 1978, as amended.*

NMOCD may, for good cause, after notice to Hilcorp and an opportunity for a hearing, order immediate cessation of operation at the Landfarm when it appears that cessation is necessary to protect fresh water, public health, safety, or the environment, or to assure compliance with statutes or NMOCD rules and orders. NMOCD may order closure without notice and an opportunity for hearing in the event of an emergency, subject to NMSA 1978, Section 70-2-23, as amended.

***(2)** If the operator refuses or is unable to conduct operations at a surface waste management facility in a manner that protects fresh water, public health and the environment; refuses or is unable to conduct or complete an approved closure and post closure plan; is in material breach of the terms and conditions of its surface waste management facility permit; or the operator defaults on the conditions under which the division accepted the surface waste management facility's financial assurance; or if disposal operations have ceased and there has been no significant activity at the surface waste management facility for six months the division may take the following actions to forfeit all or part of the financial assurance:*

***(a)** send written notice by certified mail, return receipt requested, to the operator and the surety, if any, informing them of the decision to close the surface waste management facility and to forfeit the financial assurance, including the reasons for the forfeiture and the amount to be forfeited, and notifying the operator and surety that a hearing request or other response shall be made within 20 days of receipt of the notice; and*

***(b)** advise the operator and surety of the conditions under which they may avoid the forfeiture; such conditions may include but are not limited to an agreement by the operator or another party to perform closure and post closure operations in accordance with the surface waste management facility permit conditions, the closure and post closure plan (including modifications or additional requirements imposed by the division) and division rules, and satisfactory demonstration that the operator or other party has the ability to perform such agreement.*

If Hilcorp refuses or is unable to conduct operations at the Landfarm in a manner that protects fresh water, public health, safety, and the environment; or refuses or is unable to conduct or complete an approved closure plan, is in material breach of the terms and conditions of its surface water management facility permit; or Hilcorp defaults on the conditions under which NMOCD accepted the Landfarm's financial assurance; or if disposal operations have ceased and there has been no significant activity at the Landfarm for six months, NMOCD may take the following actions to forfeit all or part of the financial assurance:

1) Send written notice by certified mail, return receipt requested, to Hilcorp and the surety, if any, informing them of the decision to close the Landfarm and to forfeit the financial assurance, including the reason for the forfeiture and the amount to be forfeited, and notifying Hilcorp and surety that a hearing request or other response shall be made within ten days of receipt of the notice.

2) Advise Hilcorp and the surety of the conditions under which they may avoid the forfeiture. Such conditions may include, but are not limited to, an agreement by Hilcorp or another party to perform closure and post-closure operations in accordance with the Landfarm permit conditions, the Plan (including modifications or additional requirements imposed by NMOCD), and NMOCD rules, and satisfactory demonstration that Hilcorp or other party has the ability to perform such agreement.

(3) *The division may allow a surety to perform closure and post closure if the surety can demonstrate an ability to timely complete the closure and post closure in accordance with the approved plan*

NMOCD may allow a surety to perform closure if the surety can demonstrate an ability to timely complete the closure and post-closure in accordance with the approved plan.

(4) *If the operator and the surety do not respond to a notice of proposed forfeiture within the time provided, or fail to satisfy the specified conditions for non-forfeiture, the division shall proceed, after hearing if the operator or surety has timely requested a hearing, to declare the financial assurance's forfeiture. The division may then proceed to collect the forfeited amount and use the funds to complete the closure and post closure, or, at the division's election, to close the surface waste management facility and collect the forfeited amount as reimbursement.*

(a) *The division shall deposit amounts collected as a result of forfeiture of financial assurance in the oil and gas reclamation fund.*

(b) *In the event the amount forfeited and collected is insufficient for closure and post closure, the operator shall be liable for the deficiency. The division may complete or authorize completion of closure and post closure and may recover from the operator reasonably incurred costs of closure and post closure and forfeiture in excess of the amount collected pursuant to the forfeiture.*

(c) *In the event the amount collected pursuant to the forfeiture was more than the amount necessary to complete closure and post closure, including remediation costs, and forfeiture costs, the division shall return the excess to the operator or surety, as applicable, reserving such amount as may be reasonably necessary for post closure operations and re-vegetation in accordance with Paragraph (6) of Subsection A of 19.15.36.18 NMAC. The division shall return excess of the amount retained over the actual cost of post closure operations and re-vegetation to the operator or surety at the later of the conclusion of the applicable post closure period or when the site re-vegetation in accordance with Paragraph (6) of Subsection A of 19.15.36.18 NMAC is successful.*

If Hilcorp and the surety do not respond to a notice of proposed forfeiture within the time provided or fail to satisfy the specified conditions for non-forfeiture, NMOCD shall proceed, after hearing if Hilcorp or surety has timely requested a hearing, to declare the financial assurance's forfeiture. NMOCD may then proceed to collect the forfeited amount and use the funds to complete the closure, or, at NMOCD's election, to close the Landfarm and collect the forfeited amount as reimbursement.

NMOCD shall deposit amounts collected as a result of forfeiture of financial assurance in the oil and gas reclamation fund.

In the event the amount forfeited and collected is insufficient for closure, Hilcorp will be liable for the deficiency. NMOCD may complete or authorize completion of closure and post-closure and may recover from Hilcorp reasonably incurred costs of closure and forfeiture in excess of the amount collected pursuant to the forfeiture.

In the event the amount collected pursuant to the forfeiture was more than the amount necessary to complete closure, including remediation costs, and forfeiture costs, NMOCD shall return the excess to Hilcorp or the surety, as applicable, reserving such amount as may be reasonably necessary for post-closure monitoring and revegetation in accordance with the approved revegetation plan. NMOCD shall return excess of the amount retained over the actual cost of post-closure monitoring and revegetation to Hilcorp or surety at the later of the conclusion of the applicable post-closure period or when the has been successfully revegetated in accordance with the approved revegetation plan.

(5) *If the operator abandons the surface waste management facility or cannot fulfill the conditions and obligations of the surface waste management facility permit or division rules, after notice and an opportunity for hearing, the state of New Mexico, its agencies, officers, employees, agents, contractors and other entities designated by the state shall have all rights of entry into, over and upon the surface waste management facility property, including all necessary and convenient rights of ingress and egress with all materials and equipment to conduct operation, termination and closure of the surface waste management facility, including but not limited to the temporary storage of equipment and materials, the right to borrow or dispose of materials and all other rights necessary for the surface waste management facility's operation, termination and closure in accordance with the surface waste management facility permit and to conduct post closure operations.*

If Hilcorp abandons the Landfarm or cannot fulfill the conditions and obligations of the Landfarm permit or NMOCD rules; the State of New Mexico, its agencies, officers, employees, agents, contractors and other entities designated by the State shall have all rights of entry into, over and upon the Landfarm property, including all necessary and convenient rights of ingress and egress with all materials and equipment to conduct operation, termination and closure of Landfarm, including, but not limited to, the temporary storage of equipment and materials, the right to borrow or dispose of materials and all other rights necessary for the Landfarm's operation, termination, and closure in accordance with the Landfarm permit and to conduct post-closure monitoring.

ATTACHMENT 1: CLOSURE INSPECTION CHECKLIST

Hilcorp

LANDFARM NAME	
DATE	

Landfarm Closure Inspection Checklist			
ITEM / AREA	Yes, No, NA	Cell Number	COMMENTS / ACTION TAKEN
Biweekly Disking Conducted?			
Treatment Zone Closure Samples Collected?			
Treatment Zone Soil Reused Offsite?			
Berms Removed?			
Buildings, Fences, Roads, and Equipment Removed?			
Residual Contamination/Staining Removed and Sampled?			
Sampling Reports Submitted to NMOCD?			

NA – Not Applicable

Comment section should be used to provide details of unsatisfactory findings.

Additional Inspection Remarks:

Inspector Signature:_____________________________ Manager Signature:________________________________

Name (Print):___________________________________ Name (Print):_____________________________________

ATTACHMENT 2: CLOSURE AND POST CLOSURE ESTIMATES

TABLE 1 - ESTIMATED CLOSURE COSTS
TANK MOUNTAIN LANDFARM
HILCORP ENERGY COMPANY

PHASE I CLOSURE COSTS: CELLS 1 - 7				
THIRD-PARTY CONSULTANT: LABOR COSTS	**Senior Sci/Eng I**	**Project Sci/Eng I**	**Staff Sci/Eng II**	**Admin/ Clerical**
Task 1 - Field - Final Treatment Zone Closure Sampling		5	22	1
Task 2 - Office - Reporting	5	20	30	1
TOTAL HOURS	5	25	52	2
RATE ($)	$150.00	$130.00	$90.00	$60.00
	$750.00	$3,250.00	$4,680.00	$120.00
			SUBTOTAL	**$8,800.00**
THIRD-PARTY CONSULTANT: OTHER DIRECT COSTS	**QTY.**	**UNIT**	**RATE**	**UNIT TOTAL**
Field Vehicle	1	day	$120.00	$120.00
Trimble GPS	1	day	$60.00	$60.00
PID	1	day	$65.00	$65.00
Misc. Field Equipment	1	ea.	$23.00	$23.00
			SUBTOTAL	**$268.00**
CLOSURE SAMPLING LABORATORY COSTS	**QTY.**	**UNIT**	**RATE**	**UNIT TOTAL**
Laboratory Analyses - (Constituents Listed in 19.15.36.15[F])	7	ea.	$427.00	$2,989.00
			SUBTOTAL	**$2,989.00**
SUBCONTRACTOR COSTS	**QTY.**	**UNIT**	**RATE**	**UNIT TOTAL**
Task 1 - Mobilization	1	ea.	$2,000.00	$2,000.00
Task 2 - Removal of Non-Complaint Soils and Berms (if necessary)	125	cubic yard	$150.00	$18,750.00
Task 3 - Earthwork	550	cubic yard	$15.00	$8,250.00
Task 4 - Seeding / Planting	15	acre	$800.00	$12,000.00
Task 5 - Mulching (1.5 tons/acre, straw/hay), Rilling/Erosion Control, Dust Suppress	15	acre	$2,000.00	$30,000.00
			SUBTOTAL	**$71,000.00**
			PHASE I ESTIMATED TOTAL	**$83,057.00**
			CONTINGENCY (10%)	**$8,305.70**
			TOTAL PHASE I ESTIMATED COST	**$91,362.70**

PHASE II CLOSURE COSTS: CELLS 8 - 17				
THIRD-PARTY CONSULTANT: LABOR COSTS	**Senior Sci/Eng I**	**Project Sci/Eng I**	**Staff Sci/Eng II**	**Admin/ Clerical**
Task 1 - Field - Final Treatment Zone Closure Sampling		5	24	1
Task 2 - Office - Reporting	5	20	30	1
TOTAL HOURS	5	25	54	2
RATE ($)	$150.00	$130.00	$90.00	$60.00
	$750.00	$3,250.00	$4,860.00	$120.00
			SUBTOTAL	**$8,980.00**
THIRD-PARTY CONSULTANT: OTHER DIRECT COSTS	**QTY.**	**UNIT**	**RATE**	**UNIT TOTAL**
Field Vehicle	1	day	$120.00	$120.00
Trimble GPS	1	day	$60.00	$60.00
PID	1	day	$65.00	$65.00
Misc. Field Equipment	1	ea.	$23.00	$23.00
			SUBTOTAL	**$268.00**
CLOSURE SAMPLING LABORATORY COSTS	**QTY.**	**UNIT**	**RATE**	**UNIT TOTAL**
Laboratory Analyses - (Constituents Listed in 19.15.36.15[F])	10	ea.	$427.00	$4,270.00
			SUBTOTAL	**$4,270.00**
SUBCONTRACTOR COSTS	**QTY.**	**UNIT**	**RATE**	**UNIT TOTAL**
Task 1 - Mobilization	1	ea.	$2,000.00	$2,000.00
Task 2 - Fence / Building Removal	1	ea.	$10,000.00	$10,000.00
Task 3 - Removal of Non-Complaint Soils and Berms (if necessary)	150	cubic yard	$150.00	$22,500.00
Task 4 - Earthwork	800	cubic yard	$15.00	$12,000.00
Task 5 - Seeding / Planting	20	acre	$800.00	$16,000.00
Task 6 - Mulching (1.5 tons/acre straw/hay), Rilling/Erosion Control, Dust Suppress	20	acre	$2,000.00	$40,000.00
			SUBTOTAL	**$117,465.00**
			PHASE II ESTIMATED TOTAL	**$130,983.00**
			CONTINGENCY (10%)	**$13,098.30**
			TOTAL PHASE II ESTIMATED COST	**$144,081.30**

TABLE 2 - ESTIMATED POST-CLOSURE COSTS
TANK MOUNTAIN LANDFARM
HILCORP ENERGY COMPANY

PHASE I POST-CLOSURE COSTS: CELLS 1 - 7				
THIRD-PARTY CONSULTANT: LABOR COSTS	**Senior Sci/Eng I**	**Project Sci/Eng I**	**Staff Sci/Eng II**	**Admin/ Clerical**
Task 1 - Field - BMP and Weed Control Monitoring (2 Per Year, 3 Years)		3	30	0.5
Task 2 - Field - Storm Event Monitoring (2 Per Year, 3 Years)		3	30	0.5
Task 2 - Office - Closure Reporting	5	20	30	1
TOTAL HOURS	5	26	90	2
RATE ($)	$150.00	$130.00	$90.00	$60.00
	$750.00	$3,380.00	$8,100.00	$120.00
			SUBTOTAL	**$12,350.00**
SUBCONTRACTOR POST-CLOSURE COSTS	**QTY.**	**UNIT**	**RATE**	**UNIT TOTAL**
Task 1 - Soil Loss Replacement (2.0 tons/acre/year from erosion)	15	acre	$180.00	$2,700.00
Task 2 - Weed Control and Revegetation Maintenance	15	acre	$350.00	$5,250.00
Task 3 - BMP / Damage Repair (1 Per Year, 3 Years)	3	event	$3,000.00	$9,000.00
			SUBTOTAL	**$16,950.00**
			PHASE I ESTIMATED TOTAL	**$29,300.00**
			CONTINGENCY (10%)	**$2,930.00**
			TOTAL PHASE I ESTIMATED COST	**$32,230.00**

PHASE II POST-CLOSURE COSTS: CELLS 8 - 17				
THIRD-PARTY CONSULTANT: LABOR COSTS	**Senior Sci/Eng. I**	**Project Sci/Eng I**	**Staff Sci/Eng II**	**Admin/ Clerical**
Task 1 - Field - BMP and Weed Control Monitoring (2 Per Year, 3 Years)		3	30	0.5
Task 2 - Field - Storm Event Monitoring (2 Per Year, 3 Years)		3	30	0.5
Task 2 - Office - Closure Reporting	5	20	30	1
TOTAL HOURS	5	26	90	2
RATE ($)	$150.00	$130.00	$90.00	$60.00
	$750.00	$3,380.00	$8,100.00	$120.00
			SUBTOTAL	**$12,350.00**
SUBCONTRACTOR POST-CLOSURE COSTS	**QTY.**	**UNIT**	**RATE**	**UNIT TOTAL**
Task 1 - Soil Loss Replacement (2.0 tons/acre/year from erosion)	20	acre	$180.00	$3,600.00
Task 2 - Weed Control and Revegetation Maintenance	20	acre	$350.00	$7,000.00
Task 3 - BMP / Damage Repair (1 Per Year, 3 Years)	3	event	$3,000.00	$9,000.00
			SUBTOTAL	**$19,600.00**
			PHASE I ESTIMATED TOTAL	**$31,950.00**
			CONTINGENCY (10%)	**$3,195.00**
			TOTAL PHASE I ESTIMATED COST	**$35,145.00**

ATTACHMENT 3: POST-CLOSURE REVEGETATION AND RECLAMATION PLAN

POST-CLOSURE REVEGETATION AND RECLAMATION PLAN

TANK MOUNTAIN LANDFARM
SAN JUAN COUNTY, NEW MEXICO

OCTOBER 2020

Prepared for:

HILCORP ENERGY COMPANY
382 County Road 3100
Aztec, New Mexico 87410

Prepared by:

A proud member of WSP

LT ENVIRONMENTAL, INC.
848 East Second Avenue
Durango, Colorado 81301
970.385.1096

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FIGURES

ATTACHMENTS

1.0 INTRODUCTION

Hilcorp Energy Company (Hilcorp) proposes to construct the Tank Mountain Landfarm (Landfarm) in Unit O, Section 05, Township 31 North, Range 09 West in San Juan County, New Mexico. The Landfarm boundary will occupy approximately 38 acres.

The following *Post-Closure Revegetation and Reclamation Plan* (Plan) has been prepared in accordance with 19.15.36.18 of the New Mexico Administrative Code (NMAC). The purpose of this Plan is to ensure that the project does not:

- Generate erosion and dust
- Propagate noxious weeds
- Cause excessive loss of wildlife habitat and food sources
- Create long-term visual eyesores

1.1 EXISTING CONDITIONS

The Landfarm is located within the western portion of the Natural Resources Conservation Service (NRCS) Land Resource Region (LRR) d – Southwestern Plateaus, Mesas, and Foothills, Major Land Resource Area (MLRA) 36. Approximately 58 percent (%) of the MLRA is in New Mexico, 32% is in Colorado, and 10% is in Utah. The project area is located in the canyon lands zone that extends from northwestern New Mexico into southwestern Colorado. The average annual precipitation in this area ranges from 8 to 31 inches (205 to 785 millimeters). Approximately 20 to 35% of the total precipitation falls in July and August.

Most of the area is characterized by generally horizontal beds of sedimentary rocks. Representative formations are the Morrison Formation, Dakota Sandstone, Mancos Shale, and Cliff House Sandstone. The sedimentary rocks have been eroded into plateaus, mesas, hills, and canyons.

Nearly all of this area supports natural vegetation and is used as grazing land, forestland, or cropland. Primary vegetation is grass and sagebrush at lower elevations. Pinyon-juniper woodland and ponderosa pine forests are found at middle elevations. Forests of Rocky Mountain Douglas fir and white fir are found at the higher elevations.

Table 1. Common Plants within the MLRA

Scientific name	Common Name	USDA* Plant Code
Artemisia tridentata	Wyoming big sagebrush	ARTR2
Bouteloua gracilis	Blue grama	BOGR2
Cercocarpus	Mountain mahogany	CERCO
Festuca arizonica	Arizona fescue	FEAR2
Hesperostipa comata	Needle and thread	HECO26
Hilaria rigida	Galleta grass	PLRI3

Table 1. Common Plants within the MLRA

Scientific name	Common Name	USDA* Plant Code
Juniperus osteosperma	Utah juniper	JUOS
Oryzopsis hymenoides	Indian ricegrass	ACHY
Pascopyrum	Western wheatgrass	PASM
Pinus edulis	Two-needle pinyon	PIED
Pinus ponderosa	Ponderosa pine	PIPO
Poa fendleriana	Muttongrass	POFE
Quercus gambelii	Gambel oak	QUGA

*USDA – United States Department of Agriculture

2.0 SOIL HANDLING

Ground-disturbing activities associated with the Landfarm will include construction areas as well as areas used for staging of personnel, equipment, and material necessary for the project.

2.1 EROSION AND SEDIMENT CONTROLS

Sediment controls will be placed at the base of soil stockpiles, as necessary. Sediment controls may include, but are not limited to, berms, straw wattles, or ditches. Combinations of these methods may be employed as necessary for sediment control of runoff.

Seeding will be employed as a stabilization method to guard against erosion if soils are not replaced within 90 days from the initial excavation date. A certified weed-free seed mix with a fast-growing cover crop may be used to establish a temporary vegetative cover of the soil.

2.2 DUST SUPPRESSION MEASURES

Roads will be surfaced or dust inhibitors will be used, if appropriate (e.g., surfacing materials, non-saline dust suppressants, water, etc.). Dust suppression will be used on roads and construction areas where soil is susceptible to wind erosion to reduce the amount of fugitive dust generated by traffic or other activities. Speed limits will be enforced to the extent practicable on roads in and adjacent to the project area to further reduce fugitive dust.

2.3 SOIL REPLACEMENT

Following the closure of the Landfarm, soils remaining on site will be evenly distributed and tilled to make an adequate seed bed. Soil lost to erosion will be replaced and regraded as necessary. Reclamation will be conducted per Section 3.4 below.

3.0 SURFACE RECLAMATION PLAN

Interim reclamation activities, including reestablishment of vegetation cover will facilitate stabilization of the disturbed areas and, once accomplished, will eliminate the potential for sediment transport from areas disturbed by project activities. Changes and additions to this Plan may be necessary over the lifetime of the Landfarm to achieve the reclamation objectives and standards. Disturbed areas will be reclaimed after Landfarm has achieved closure of all treatment zone cells.

Hilcorp anticipates constructing the landfarm cells in two stages: Stage 1 will include the construction of cells 1 through 7; Stage 2 will include the construction of cells 8 through 17 (construction schedules subject to change based on conditions at the time of construction). Because of this, landfarm closure and post-closure activities also is anticipated to take place in two stages. For scheduling and cost estimate purposes, Stage 1 cells 1 through 7 are anticipated to receive soils for approximately 2 to 5 years, at which time closure and post-closure procedures will be initiated. Stage 2 cells 8 through 17 are anticipated to be constructed at the time of Stage 1 cell closure. This proposed schedule is subject to change based on conditions at the time of construction.

3.1 DISTURBANCE AREA

The Landfarm boundary will occupy approximately 38 acres, of which approximately 35 acres of ground surface will be disturbed. The project area boundaries and areas of disturbance are identified on attached Figure 1.

3.2 RECLAMATION OBJECTIVES

The objective of final surface reclamation is to return the land, following use for waste management, to a condition approximating that which existed prior to disturbance. This includes restoration of the Landform and natural vegetative community, hydrologic systems, ecological function, and other natural resource values to maintain healthy, biologically active topsoil; to control erosion and sediment transport; and to minimize loss of habitat, forage, and visual resources. Surface reclamation will be judged successful when disturbed areas have been re-contoured, stabilized, and re-vegetated with a self-sustaining, vigorous, diverse, native (or otherwise approved) plant community sufficient to minimize visual impacts, provide forage, stabilize soil, and impede the invasion of noxious weeds.

3.3 REVEGETATION AND RESTORATION

Disturbed areas will be seeded using seed mixes appropriate to the location (Table 2), including at least three grass species and excluding noxious weeds or deep-rooted shrubs or trees. Prior to seeding, local soil conservation authorities associated with the NRCS, surface owners, and/or reclamation contractors familiar with the area may be consulted regarding other seed mixes to be used. The seed mix is subject to change.

Re-vegetation shall consist of establishment of vegetative cover equal to 70% of the native perennial vegetative cover through two consecutive growing seasons. Juniper dominated woodlands tend to include open savannas of scattered trees without a significant shrub component, except in areas where big sagebrush (Artemisia tridentata) has become dominant. As is typical in the region, this location will be seeded with grass- and forb-dominant seed mixes following ground disturbance in an effort to stabilize the soil against erosion and encourage the establishment of desirable ground cover to compete with invasive species that tend to dominate disturbed areas. As such, the quantitative assessments for relative overall percent vegetative cover will compare the grass-dominated reclaimed areas with the tree-dominated surrounding areas. The resulting overall relative cover estimates will be highly skewed due to the variable habitat types. For this reason, overall relative cover will not be heavily weighted in evaluating the reclamation status of each location but will be considered in conjunction with the other qualitative and quantitative criteria.

Table 2. Recommended Seed Mix to Be Used for Revegetation

Common Name	Scientific Name	Drilled Application Rate* (PLS lbs./acre)
Crested Wheatgrass	*Agropyron cristatum*	2
Indian Ricegrass	*Oryzopsis hymenoides*	2
Blue Grama Grass	*Bouteloua gracilis*	2
Galleta Grass	*Hilaria rigida*	2
Sand Drop Seed	*Sporobolus cryptandrus*	1
Fourwing Saltbush	*Atriplex canescens*	1
Western Wheatgrass	*Pascopyrum smithii*	4
Pubescent Wheatgrass	*Thinopyrum intermedium*	12
	TOTAL	**26**

*These are drilled rates. These rates shall be doubled for broadcast seeding; PLS = pure live seed; lbs = pounds

Weed-free seeds will be planted in the amount specified in pounds of pure live seed (PLS) per acre. Seeding rate should be doubled for broadcast application. Re-vegetation will be initiated as soon as practical following the reclamation of the disturbance area.

The preferred seeding method is rangeland drill. In areas with slopes greater than 3%, imprinting of the seed bed is recommended. Imprinting can be in the form of dozer tracks or furrows perpendicular to the direction of slope. When hydro-seeding or mulching, imprinting should be done prior to seeding unless the mulch is to be crimped into the soil surface. If mulch is used, seeded areas would be covered with stray or hay at a rate of 1.5 tons per acre. If broadcast seeding and harrowing are necessary, imprinting should be done as part of the harrowing. Furrowing can be done by several methods, the simplest of which is to drill seed perpendicular to the direction of slope in a prepared bed. Other simple imprinting methods include deep hand raking and harrowing, always perpendicular to the direction of slope.

Alternative seeding methods include, but are not limited to:

- Harrowing with just enough soil moisture to create a rough surface, broadcasting seed and re- harrowing, preferably at a right angle to the first harrow.
- Hydro-seeding (most economical in terms of seed cost).

- Hand raking and broadcasting followed by re-raking at a right angle to the first raking.
- If fertilizing is necessary, the rates of application will be based on site-specific requirements of the soil.

3.4 SOIL LOSS ESTIMATES DURING RECLAMATION/REVEGETATION

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) developed a version of RUSLE2 software (acronym for "Revised Universal Soil Loss Equation") to estimate soil loss during agricultural and construction operations. Site-specific and region-specific parameters contained in the NRCS RUSLE2 database were used to estimate soil loss at the Landfarm during post-closure activities. The software uses the following factors when evaluating soil-loss estimates: rainfall erosivity, soil erodibility, topography, crop management, and conservation practice.

For the Landfarm, the following parameters were used to calculate soil loss at the Landfarm:

- **Location**: San Juan County, New Mexico, Range 9.
- **Soil Type**: Travessilla-Weska-Rock outcrop complex, moderately steep, Sandy loam.
- **Slope Length**: 1,000 feet (maximum allowable input).
- **Average Slope Steepness**: 8.3% (calculated based on site specific contours).
- **Site Management**: Bare ground, assuming first year has minimal vegetation growth.
- **Contouring**: Absolute row grade 8 percent.
- **Strips/Barriers**: None.

Based on these parameters, the RUSLE2 software estimated annual soil loss of 2.0 tons/acre/year. A report produced by RUSLE2 is included as Attachment 1.

4.0 WEED MANAGEMENT PLAN

4.1 NOXIOUS WEEDS

The New Mexico Noxious Weeds Management Act requires the New Mexico Department of Agriculture (NMDA) to develop a noxious weed list for the state, identify methods of control, and educate the public about noxious weeds. The NMDA maintains a list of plants that are considered noxious weeds. The NMDA noxious weed list includes four categories: Class A, Class B, Class C, and Watch List species.

- Class A species are currently not present in New Mexico or have limited distribution. Preventing new infestations of these species and eradicating existing infestations is the highest priority.
- Class B species are limited to portions of the state. In areas with severe infestations, management should be designed to contain the infestation and stop any further spread.
- Class C species are widespread in the state. Management decisions for these species should be determined at the local level, based on feasibility of control and level of infestation.
- Watch List species are species of concern in the state. These species have the potential to become problematic. More data is needed to determine if these species should be listed.

When NMDA noxious weeds are encountered, their location, density, and estimated size of the infestation will be documented. Photographs will be taken to aid in identification and geographical location. Noxious weeds will be treated using integrated weed management.

4.2 INTEGRATED WEED MANAGEMENT

Care must be taken to prevent damage to desirable plant species during weed treatments performed to avoid further infestations by other pioneer invaders. Weed management is best achieved through a variety of methods over a long period of time including inventory (surveys), direct treatments, prevention through best management practices, monitoring of treatment efficacy, and subsequent detection efforts. Weed management strategies are used primarily to control existing species and to prevent further infestations (existing and new species) rather than eradication. After successful and effective management, decreases in infestation size and density can be expected, and after several years of successful management practices, eradication is sometimes possible. Construction equipment traveling from weed-infested areas into weed-free areas could disperse noxious or invasive weed seeds and propagates, resulting in the establishment of these weeds in previously weed-free areas.

4.2.1 Prevention and Assessment of Noxious Weed Infestations

Assessment of the existence and extent of noxious weeds for an area is essential for developing an integrated weed management plan. To effectively manage of noxious weeds, inventory and analysis is necessary to 1) determine the effectiveness of past treatment strategies; 2) modify the treatment plan if necessary; and 3) detect new infestations early, resulting in more economical treatments.

A field inventory of noxious weeds should take place prior to ground-breaking disturbances to document existing noxious weeds in order to understand baseline conditions on site. Field personnel should document List A and B noxious weed species using photographs and a GPS unit with sub-meter accuracy.

After the facility is in operation, regular weed inventories are recommended to document noxious weed infestations and develop effective treatment strategies.

4.3 TREATMENT AND CONTROL OF NOXIOUS WEED INFESTATIONS

If noxious weeds become established in the project area, herbicides, mechanical treatment, grazing, and alternative methods are commonly used to treat noxious weed infestations. The appropriate treatment strategy will be assessed on a case-by-case basis depending on the species, size of infestation, accessibility, and time of year of the treatment.

4.3.1 Herbicides

Annual and biennial weeds are best controlled at the pre-bud stage after germination or in the spring of the second year. Several of the species identified in the survey are susceptible to commercially-available herbicides. Selective herbicides are recommended to minimize damage to desirable grass species.

Professionals or landowners using herbicides must use the concentration specified on the label of the container in hand. Herbicides generally do not work better at higher concentrations. Most herbicide failures observed are related to incomplete control caused by high concentrations killing top growth before the active ingredient can be transported to the roots through the nutrient translocation process. Most herbicide applications should use a surfactant, if directed on the herbicide label, or other adjuvant as called for on the herbicide label. A certified commercial applicator is a good choice for herbicide control efforts. Restricted herbicides require a state licensed applicator. A licensed applicator has the full range of knowledge, skills, equipment, and experience desired when dealing with noxious weeds.

4.3.2 Mechanical Treatment

Small isolated infestations of weed species can often be controlled with cutting and digging by hand. For dense or more extensive infestations, mechanical treatments can be useful in combination with chemical control. Effectiveness of mechanical control can often be increased by severing the root just below the crown of noxious weeds. Weeds that easily re-sprout from rootstocks, such as Canada thistle (*Cirsium arvense*) and Russian knapweed (*Acroptilon repens*), may increase rather than decrease if mechanical control is the only method used.

4.3.3 Grazing

In the event grazing is allowed in the project area it will be deferred in reclaimed areas until the desired plant species that have been seeded are established through two growing seasons.

4.3.4 Alternative Methods

Biological control of noxious weeds may be feasible for some weed species if they are found at the Landfarm in the future. The musk thistle seed head weevil (*Rhinocyllus conicus*), for example, is a biological control agent for musk thistle (Roduner et al. 2003). This weevil may be useful for reducing musk thistle, but significant results may take several years.

Vesicular-Arbuscular Mycorrhizal Fungi

An alternative method to assist revegetation, particularly where there is poor or destroyed topsoil, is the application of vesicular-arbuscular mycorrhizal fungi, typically referred to as AMF. These fungi, mostly of the genus *Glomus*, are symbiotic with about 80% of all vegetation. Endo-mycorrhizal fungi are associated mostly with grasses and forbs and could be helpful when reclaiming the project area. In symbiosis, the fungi increase water and nutrient transfer capacity of the host root system by as much as several orders of magnitude (Barrow and McCaslin 1995).

Over-the-counter, commercial AMF products, which are better adapted to coating seeds when reseeding and treating roots of live seedling trees and shrubs at time of planting, come in powder form and are available from many different sources. Some come in granular form to be spread with seed from a broadcast spreader. The best AMF products should contain more than one species.

Humates

Compacted soil responds well to fossilized humic substances and byproducts called humates. These humates, including humic and fulvic acids and humin, were formed from prehistoric plant and animal deposits and work especially well on compacted soil when applied as directed.

4.4 RECOMMENDED TREATMENT STRATEGIES

Treatment strategies are different depending on plant type and are summarized below. It is important to know whether the target species is an annual, biennial, or perennial to select strategies for effective control and eradication. Both biennial and perennial weeds are common in the vicinity of the project area.

In general, recommended treatment strategies for annual and biennial noxious weeds to prevent seed production include (Sirota 2004) the following:

- Hand grub (pull), hoe, till, or cultivate in rosette stage and before flowering or seed maturity. If seeds develop, cut and bag seed heads.
- Cut roots with a spade just below soil level.
- Treat with herbicide in rosette or bolting stage, before flowering.
- Mow biennials after bolting stage but before seed set. Mowing annuals will not prevent flowering but can reduce total seed production.

Treatment strategies for perennials to deplete nutrient reserves in the root system and prevent seed production include (Sirota 2004) the following:

- Allow plants to expend as much energy from the root system as possible. Do not treat when first emerging in spring but allow growth to bud/bloom stage. If seeds develop, cut and bag if possible.
- Herbicide treatment at bud to bloom stage or in the fall (recommended after August 15 when natural precipitation is present). In the fall, plants draw nutrients into the roots for winter storage. Herbicides will be drawn down to the roots more efficiently at this time due to

translocation of nutrients to roots rather than leaves. If the weed patch has been present for a long period of time, another season of seed production is not as important as getting the herbicide into the root system. Spraying in the fall (after middle August) will kill the following year's shoots, which are being formed on the roots at this time.

- Mowing usually is not recommended because the plants will flower regardless, rather, seed production should be reduced. Many studies have shown that mowing perennials and spraying the regrowth is not as effective as spraying without mowing. The effect of mowing is species dependent, therefore, it is imperative to know the species and its basic biology. Timing of application must be done when biologically appropriate, which is not necessarily convenient.
- Tillage may or may not be effective. Most perennial roots can sprout from pieces only 0.5 to 1.0-inch long. Clean machinery thoroughly before leaving the infested area.
- Hand pulling is generally not recommended for perennial species unless you know the plants are seedlings and not established plants. Hand pulling can be effective on small patches but is very labor intensive because it must be done repeatedly.

Note that herbicides should not always be the first treatment of choice when other methods can be effectively employed.

A combination of two or more methods is recommended to prevent the development of resistance and reduce the likelihood of mismanaging an infestation. Implementing an Integrated Pest Management (IPM) Plan will assist in managing and preventing undesirable species. IPM is an ecosystem-based strategy that focuses on long-term prevention of pests or the damage they cause. A well-defined IPM is based on prevention, monitoring, and control.

4.5 MONITORING

Areas where noxious weed infestations are identified and treated will be inspected over time to ensure that control methods are working to reduce and suppress the identified infestation. The sites will be monitored until the infestations are eliminated or reduced to acceptable levels. These inspections can then be used to prioritize future weed control efforts.

5.0 REFERENCES

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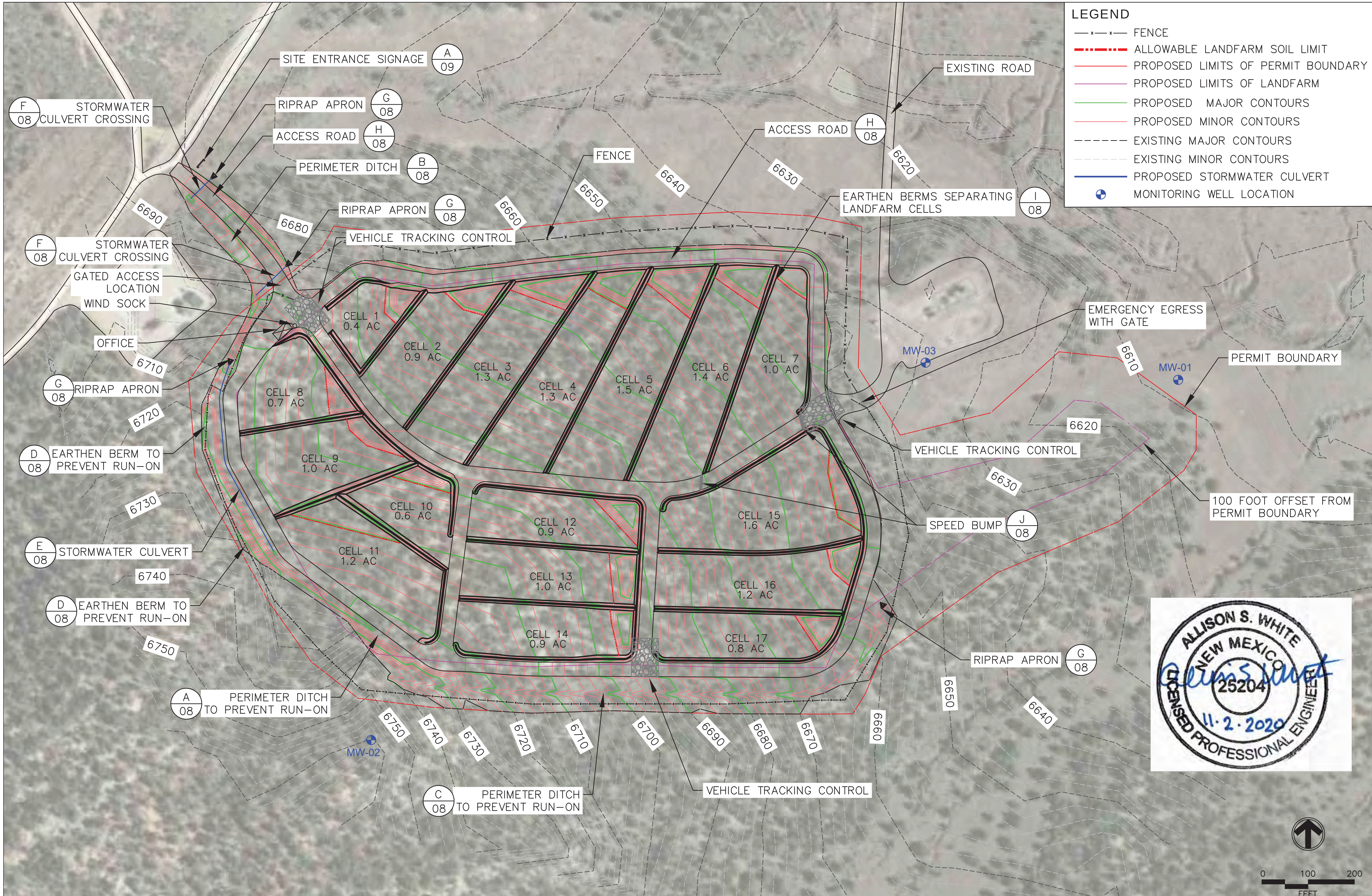
Roduner, M., G. Cuperus, P. Mulder, J. Stritzke, M. Payton; *Successful Biological Control of the Musk Thistle in Oklahoma Using the Musk Thistle Head Weevil and the Rosette Weevil*. Am Entomol 2003; 49 (2): 112-120.

Sirota, J. 2004. *Best management practices for noxious weeds of Mesa County*. Colorado State University, Cooperative Extension Tri River Area, Grand Junction, Colorado. URL: http://www.coopext.colostate.edu/TRA/Weeds/weedmgmt.html

FIGURE



PROPOSED FACILITY LAYOUT
TANK MOUNTAIN LANDFARM
SWSE SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO

PROJECT NO. 017818018-01
DWG NO. 03
REV NO. B

CLIENT: HILCORP ENERGY COMPANY

LT Environmental, Inc. Arvada, Colorado

DRAWING INFORMATION	BY	DATE
DESIGNED	CS	11/25/19
DRAWN	AG	11/25/19
CHECKED	CS	11/25/19
REVIEWED	ES	11/25/19
APPROVED	AW	11/25/19

SCALE: AS SHOWN
FILE: M:\clients\WSP\017818018-Tank Mtn\017818018 FG\6-CS

REVISIONS

NO.	DESCRIPTION	BY	APPROVED	DATE
B	REVISION 1	AG	CS	04/08/20
A	PRELIMINARY	AG	CS	10/16/19

ATTACHMENT 1: RUSLE2 SOIL LOSS CALCULATIONS

USDA NRCS Natural Resources Conservation Service

RUSLE2 Profile Erosion Calculation Record

Info:

File: profiles\Tank Mountain Landfarm

Inputs:
Location: USA\New Mexico\SanJuan County\NM_San Juan R 9
Soil: nm618\TA Travessilla-Weska-Rock outcrop complex, moderately steep\Travessilla Sandy loam 40%
Slope length (horiz): 1000 ft
Avg. slope steepness: 8.3 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*

Contouring: b. absolute row grade 8 percent
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 1.0 t/ac/yr
Soil loss erod. portion: 2.0 t/ac/yr
Detachment on slope: 2.0 t/ac/yr
Soil loss for cons. plan: 2.0 t/ac/yr
Sediment delivery: 2.04 t/ac/yr

Crit. slope length: 306 ft
Surf. cover after planting: -- %
Avg. ann. total biomass removal: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
4/15/0	No operation		0

ATTACHMENT 4: POST-CLOSURE INSPECTION CHECKLIST

Hilcorp

LANDFARM NAME	
DATE	
WEATHER	
PRECIPITATION (LAST 24 HOURS)	

Landfarm Post-Closure Inspection Checklist

Inspection Item	Met	Not Met	NA	COMMENTS / ACTION TAKEN
All Facilities Removed for Final Reclamation				
Free of Contaminated Soil				
Compacted Areas (i.e., roadways) Ripped/Disked				
Seeded: □ Drill Seeded □ Broadcast □ Other:				
Erosion and Runoff Controlled: Methods:				
Mulch: Type:				
Reclamation Fence Present and in Good Condition (if applicable)				
Free of Noxious or Invasive Weeds: Species Present: Treatment Needed Yes □ No □ Treatment Performed Yes □ No □ Type:				
Revegetation Success: Density/Cover Measurement and %: Species Types and %:				
Overal Site Stability (wind/water erosion, subsidence, vegetation)				
Other: (describe)				

NA – Not Applicable

Comment section should be used to provide details of unsatisfactory findings.

Additional Inspection Remarks:

Inspector Signature:_____________________________

Name (Print):___________________________________

Final Reclamation Approvable (year 3): Yes □ No □

Manager Signature:_______________________________

Name (Print):____________________________________

NMOCD Signature (if final reclamation approved):_______________________________

APPENDIX E: CONTINGENCY PLAN

APPENDIX E - CONTINGENCY PLAN

HILCORP TANK MOUNTAIN LANDFARM
SAN JUAN COUNTY, NEW MEXICO

OCTOBER 2020

Prepared for:

HILCORP ENERGY COMPANY
382 County Road 3100
Aztec, New Mexico 87401

Prepared by:

LT ENVIRONMENTAL, INC.
848 East Second Avenue
Durango, Colorado 81301
970.385.1096

A proud member of WSP

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1.0 INTRODUCTION

Hilcorp Energy Company (Hilcorp) has prepared the following *Contingency Plan* based on Subsection N of 19.15.36.13 of the New Mexico Administrative Code (NMAC) and with the New Mexico Statute Authority (NMSA) 1978, Sections 12-12-1 through 12-12-30, as amended (the Emergency Management Act).

This *Contingency Plan* applies to the Hilcorp Tank Mountain Landfarm (Landfarm) and is written to minimize hazards to fresh water, public health, safety, or the environment from fires, explosions, or an unplanned sudden or non-sudden release of contaminants or oil field waste to air, soil, surface water, or groundwater. In addition, as described in Subsection K of 19.15.36.13 NMAC, Hilcorp will comply with the spill reporting and corrective action provisions and 19.15.30 NMAC and/or 19.15.29 NMAC.

2.0 19.15.36.13 (N): CONTINGENCY PLAN

Each operator shall have a contingency plan. The operator shall provide the division's environmental bureau with a copy of an amendment to the contingency plan, including amendments required by Paragraph (8) of Subsection N of 19.15.36.13 NMAC; and promptly notify the division's environmental bureau of changes in the emergency coordinator or in the emergency coordinator's contact information. The contingency plan shall be designed to minimize hazards to fresh water, public health or the environment from fires, explosions or an unplanned sudden or non-sudden release of contaminants or oil field waste to air, soil, surface water or ground water. The operator shall carry out the plan's provisions immediately whenever there is a fire, explosion or release of contaminants or oil field waste constituents that could threaten fresh water, public health or the environment; provided that the emergency coordinator may deviate from the plan as necessary in an emergency situation.

Hilcorp will provide the New Mexico Oil Conservation Division (NMOCD) with a copy of any amendments to the *Contingency Plan*, including amendments made if the Landfarm permit is revised or modified and if the *Contingency Plan* fails in an emergency. Hilcorp will notify the NMOCD of any changes to the Emergency Coordinator or Emergency Coordinator's contact information.

The *Contingency Plan* was designed to minimize hazards to fresh water, public health, safety, or the environment from fires, explosions, or an unplanned sudden or non-sudden release of contaminants or oil field waste to air, soil, surface water, or groundwater. Hilcorp will carry out the provisions identified in this *Contingency Plan* immediately whenever there is a fire, explosion, or release of contaminants or oil field waste constituents that could threaten fresh water, public health, safety, or the environment; however, the Emergency Coordinator may deviate from the plan as necessary in an emergency situation.

The Landfarm is located in the Southeast ¼ of the southwest ¼ of Section 5, Township 31 North, Range 9 West. Figure 1 is a map that includes the location of the proposed Landfarm in relation to the surrounding geographical area.

3.0 19.15.36.13 (N)(1): PERSONNEL ACTIONS

Describe the actions surface waste management facility personnel shall take in response to fires, explosions or releases to air, soil, surface water or ground water of contaminants or oil field waste containing constituents that could threaten fresh water, public health or the environment.

Specific actions to take in response to fires, explosions, and releases of contaminants to air, soil, surface water, or groundwater are described below.

3.1 GENERAL SCENE RESPONSE

The first person at the scene of an emergency may be faced with a complex situation. These "First Responders" should try to use common sense, remain calm, exercise decisiveness, and provide assurance. Responders should take the following steps and improvise as needed:

1. Scan the surroundings to ensure your own safety and the safety of those who might enter the area. A general assessment of the situation will help clarify the actions required. If person(s) with injuries are present, contact the appropriate emergency services (if necessary) first, and treat the injured person(s) to the best of your training and abilities next.
2. Evacuate people in immediate danger or with injuries if movement will not cause them further harm. Administer first aid, if necessary, per your training.
3. Arrange for traffic control when required. Be firm, explicit, and courteous with the public. Exert positive leadership and give instructions calmly.
4. Isolate and eliminate any sources of ignition, such as running engines, sources of sparks, etc. Check road crossings, public utilities, and overhead power lines for danger from possible fire. Shut down operations as needed.
5. Notify the Emergency Coordinator and give a brief overview of the incident and your actions.
6. Maintain control of the scene until relieved. Use whatever actions are necessary to safeguard all persons, property, and the environment that can be done in a safe manner. Avoid commenting on any information to the public or news media; re-direct inquiries to the designated spokesperson.
7. The Emergency Coordinator will assume or appoint the appropriate person to the role of Incident Commander and will conduct regulatory notifications, if required, in accordance with this *Contingency Plan*.

3.2 FIRES AND EXPLOSIONS

3.2.1 Detection and Notification

Fires, explosions, or other emergency situations should be verbally reported to the Emergency Coordinator. Where appropriate, 911 should also be called to initiate public emergency response resources.

3.2.2 Response

If a fire is still in the incipient stage, Hilcorp personnel and contractors who are trained in the use of a handheld fire extinguisher may attempt to extinguish the fire. Once the fire has grown past the incipient stage, or in the event of an explosion or potential explosion, all personnel will retreat to the assembly area to ensure their own safety and wait for the San Juan County Fire Department responders to arrive on scene. If directed, personnel may assist responders in tasks that do not jeopardize their or someone else's safety and health.

3.2.3 Return to Normal Operations

Once the fire is extinguished and the site deemed safe to enter, the site will be secured pending an incident investigation. Lessons learned from the incident will be incorporated in existing process and will be shared with other Hilcorp operations. If it is determined the site will return to service, the normal repair and maintenance processes will be utilized to repair and/or replace equipment on site.

3.3 GAS RELEASES

Due to the type of operations at the Landfarm, a gas release is not anticipated to occur. However, the following information has been provided to be overly cautious and conservative.

3.3.1 General Information

Hydrogen Sulfide (H_2S) is an extremely toxic, flammable gas that can be encountered during the production of gas wells, high sulfur content crude oil, natural gas liquids, and associated gas and waters. Additionally, H_2S gas is produced from bacterial breakdown of organic matter, as well as human and animal waste, and can also be found in hot springs and septic systems. H_2S is a colorless gas that can be characterized by a "rotten egg" smell. H_2S is heavier than air and may travel across the ground and collect in low-lying, poorly-ventilated areas such as depressions, manholes, basements, sewer lines, and various other low-lying areas. H_2S is highly soluble in water and liquid hydrocarbons at elevated pressures and temperatures. H_2S may evolve as a gas at ambient conditions. H_2S is a highly-flammable gas and has a lower explosive limit percent (LEL %) of 4.3%.

Sulfur dioxide (SO_2) has a pungent odor associated with burning sulfur. It produces a suffocating effect and produces sulfurous acid on membranes of the nose and throat. Sulfur dioxide is a colorless gas that normally is two times heavier than air and is non-flammable (produced from burning H_2S).

3.3.2 Toxicity

H_2S gas has a characteristic "rotten egg" odor, but smell cannot be relied upon to foreworn of dangerous concentrations because exposure to concentrations of H_2S over 100 parts per million (ppm) rapidly paralyzes the sense of smell by paralyzing the olfactory nerve. A longer exposure to lower concentrations has a similar desensitizing effect on the sense of smell.

3.3.3 H_2S Release

Due to the nature of the expected operations at the Landfarm, Hydrogen Sulfide (H_2S) is not anticipated. However, employees are trained on H_2S risks and will wear personal H_2S monitors (i.e., 4-gas meter and/or H_2S badge) while on site. All employees and contractors working in the Landfarm area must be aware of the potential for a release of H_2S through normal work procedures. An appropriate Job Safety Analysis must be performed prior to starting work.

CAUTION: It should be well understood that the sense of smell will be rendered ineffective by H_2S, which can result in an individual failing to recognize the presence of dangerously high concentrations. Excess exposure to H2S causes death by poisoning the respiratory system.

Exposure to SO_2 at concentrations below 20 ppm can cause eye irritation, throat irritation, respiratory tract irritation, chest constriction, and some nausea. Exposure to concentrations above 20 ppm can result in marked coughing, sneezing, eye irritation, and chest constriction. Exposure to 50 ppm causes irritation to the nose and throat, running nose, coughing, reflex broncho-constriction (with possible increase in bronchial mucous secretion) and increased pulmonary resistance to air flow (breathing congestion), which can occur rapidly. This atmosphere (50 ppm or more) will not be tolerated by most persons for more than 15 minutes.

3.3.4 Detection and Notification

A release should be verbally reported to the Emergency Coordinator. Depending on the situation, the Emergency/Evacuation procedure may be initiated. The Emergency Coordinator will follow their internal incident reporting procedures to notify Envirotech, Inc. (Primary Emergency Spill Response Contractor) and obtain Emergency Management assistance, if necessary.

3.3.5 Employee and Contractor Protection

Hilcorp employees and contractors are required to wear 4-gas monitors (i.e. MSA Altair 4XR meter that measures combustibles/LEL, oxygen, H_2S, and carbon monoxide) at all times while working on site. These monitors are designed to monitor for H_2S in the breathing zone of personnel and emit a low alarm at 10 ppm. It is Hilcorp's policy that every 4-gas monitor be calibrated at least once a month and bump tested every day prior to use. Employees are not permitted to work in concentrations of H_2S at 10 ppm or greater, or in concentrations of SO_2 exceeding 2 ppm. Workers will immediately leave the area, pursuant to the evacuation plan (Section 7.2), when measured concentrations of H_2S meet 10 ppm or greater or SO_2 concentrations exceed 2 ppm.

In the unlikely event that H_2S is detected on site at 10 ppm or greater, the Emergency Coordinator will be notified. The Emergency Coordinator will be responsible for notifying the NMOCD of H_2S at the Landfarm and developing a Hydrogen Sulfide Plan in accordance with 19.15.11 NMAC.

3.3.6 Response

Hilcorp personnel and contractors will only respond to gaseous releases if they are trained to do so and will not jeopardize their health and safety in the process. Response actions include calling 911 and evacuating the site and surrounding area. The extent of the evacuated area will be determined by the Emergency Coordinator based on the type and volume of gas released, wind speed and direction, and other factors as needed.

3.3.7 Return to Normal Operations

Once the release is isolated or secured and the site deemed safe to enter, the site will be secured pending an incident investigation. If it is determined the site will return to service, the normal repair and maintenance processes will be utilized to repair and/or replace equipment on site.

3.4 SITE SECURITY AND ACCESS

The Landfarm is surrounded by a fence and a locked gate. All contractors and visitors must be accompanied by a Hilcorp employee to access the process area. All personnel entering the process area must wear the proper Personal Protective Equipment (PPE). The minimum PPE for the process area is:

- Hard hat
- Fire retardant clothing (FRC)
- Safety glasses
- Steel-toe safety footwear
- 4-gas meter and/or H_2S badge

3.5 SEVERE WEATHER

Types of severe weather events that can occur at or near the Landfarm include, but are not limited to, high winds, low visibility due to blowing snow/fog, hail storm, extreme cold weather/winter storm, and extreme warm weather/heat wave.

3.5.1 Response

Personnel response actions during severe weather can include suspending operations and finding a secure, safe place to shelter in place, such as in a vehicle or on-site Landfarm office, until the weather passes or ends.

3.5.2 Return to Normal Operations

Once the severe weather ceases and the site deemed safe to enter, the site will be secured pending an incident investigation and damage assessment. If it is determined the site will return to service, normal repair and maintenance processes will be utilized to repair and/or replace equipment on site.

3.6 MEDICAL EMERGENCY/MAN DOWN PROCEDURES

Types of medical emergencies that can occur at the Landfarm include, but are not limited to, illness, entrapment, and injured personnel.

3.6.1 Response

Any response will be handled according to the responder's level of training. If appropriate, call 911. Driving directions to the nearest hospital are included in Figure 2. Employees who have completed current training in First Aid/Cardiac Pulmonary Resuscitation (CPR) and have received Blood Borne Pathogen training may render assistance to injured employees (these trainings are not included in the Landfarm-specific annual training program). The Landfarm Office building will be equipped with First Aid materials. As per internal procedures, Hilcorp's Injury Case Management vendor shall be contacted.

3.6.2 Return to Normal Operations

Once the medical emergency has been mitigated and the site is deemed safe to enter, the site will be secured pending an incident investigation. If needed, employee assistance will be requested to help with any emotional issues that may arise after a medical emergency on site.

3.7 SECURITY BREACH

There are various types of security breaches that can occur within the Landfarm. These include, but are not limited to, vandalism, bomb threat, sabotage, disgruntled employee, and theft. For most cases, the local law enforcement authorities will handle response efforts. Personnel may assist in this effort if it does not place one in harm's way. Personnel will fully cooperate with requests for information from law enforcement personnel during a security breach response.

3.7.1 Detection and Notification

Any unauthorized site entry will be verbally reported to the Emergency Coordinator. When appropriate, 911 will be called to initiate emergency response procedures.

3.7.2 Response

Depending on the security breach situation, personnel safety is paramount. Any response to the security breach will be handled by appropriate law enforcement authorities.

3.7.3 Return to Normal Operations

Until law enforcement authorities have determined the location safe for re-entry, personnel will not return to operations. Personnel may return to work only after an "all clear" is issued.

3.8 SPILLS

3.8.1 Detection and Notification

Spills will be verbally reported by on-site personnel to the Emergency Coordinator listed in Section 5.0. If the spill creates an imminent health threat, local emergency authorities (fire department, police department, etc., as appropriate) will also be notified by on-site personnel. The Emergency Coordinator will notify spill response contractors, if necessary, and provide notice to the appropriate regulatory agencies listed in Section 4.0 above. Follow-up written reports also will be provided as instructed by the regulatory authority.

In accordance with Subsection K of 19.15.36.13 NMAC, in the case of an unauthorized release at the Landfarm, the NMOCD will be notified pursuant to 19.15.29 NMAC. As defined by NMOCD, a "release" is "breaks, leaks, spills, releases, fires or blowouts involving crude oil, produced water, condensate, drilling fluids, completion fluids or other chemical or contaminant or mixture thereof, including oil field wastes and natural gases to the environment."

A major release includes an unauthorized release of a volume in excess of 25 barrels; or of any volume which results in a fire, will reach a water course, may with reasonable probability endanger public health or results in substantial damage to property or to the environment, cause detriment to water or exceed the standards in 19.15.30 NMAC. A major release requires both immediate verbal or e-mail notification (within 24 hours) as well as timely written notification to NMOCD (within 15 days) using NMOCD Form C-141 relating to Release Notification and Corrective Action. A minor release is an unauthorized release of greater than 5 barrels but less than 25 barrels and requires timely written notice within 15 days of discovery.

General spill-response procedures are outlined below. No permanent equipment and/or other sources of spills (i.e., tanks, pipelines, etc.) will be located on the Landfarm. The following procedures are most likely to be used in case of a spill from equipment brought onto the Landfarm for maintenance operations (i.e., tilling).

3.8.2 Response

The following procedures are applicable to all discharge scenarios and will be implemented following spill discovery in the event that the release is not hazardous or life threatening. If it is not safe to implement these procedures, the Emergency Coordinator should be immediately notified, and personnel should evacuate the facility to a safe location, per the evacuation plan (see Section 7.0 below).

1. Stop valve leaks on equipment, if equipped, by closing all valves and checking the valve connection for a proper seal.
2. Stop pipe leaks on equipment, if possible, by minimizing flow to the leaking pipe or connection.
3. Shut off ignition sources of equipment, if possible.
4. On-site personnel will contact the Primary or Secondary Emergency Coordinator listed in Section 5.0.
5. Warn personnel who are working on site.
6. Identify and account for all personnel on site.
7. Contain the spill and/or dike ahead of the spill. PPE and spill-containment supplies (i.e., adsorbent pads) will be maintained in the on-site Landfarm Office.
8. Protect nearby people, property, surface waters, and equipment from the spill.
9. The Emergency Coordinator will evaluate the situation to obtain and direct the personnel, materials, and equipment required to clean up the spill area.
10. If necessary, response contractors (listed in Section 4.0) will be contacted to assist in spill control and cleanup.
11. The Emergency Coordinator will notify appropriate external parties, including federal, state, and local regulatory agencies, and public safety personnel and direct them to the appropriate arrival routes.
12. If necessary, local emergency agencies (e.g., fire department, sheriff, paramedics) will be contacted to assist in minimizing public exposure by evacuating the public, controlling traffic, assisting in fire control, and providing emergency medical care.
13. The Emergency Coordinator will perform a site inspection to verify any spill at the facility of a reportable quantity or if any quantity has reached a waterway and will report such spills to the appropriate government agency.

3.8.3 Return to Normal Operations

Once the spill is properly cleaned up and the site deemed safe to enter by the senior Hilcorp person on site, the site will be secured pending an incident investigation. Any damage at the location will be repaired and the site will return to service, if deemed appropriate.

4.0 19.15.36.13 (N)(2): ARRANGEMENTS TO COORDINATE EMERGENCY SERVICES

Describe arrangements with local police departments, fire departments, hospitals, contractors and state and local emergency response teams to coordinate emergency services;

Contact information for local police departments, fire departments, hospitals, contractors, and state and local emergency response teams to coordinate emergency services is listed below. Hilcorp will notify appropriate parties, such as the local emergency management coordinator, police, and fire departments, of the location of the Landfarm and the nature of business taking place after the Landfarm is constructed. In addition, Hilcorp will provide this *Contingency Plan* to these agencies in case of an emergency. Notification will take place via certified mail and will include a map to the location of the Landfarm.

The Emergency Contact List will be posted at the Landfarm Office.

PUBLIC SAFETY NOTIFICATION

Hilcorp maintains contracts with the following emergency response contractors. Depending on the nature of the emergency, any of the following contractors can be called in for assistance.

Emergency Notification - Fire/Ambulance/Police 911
New Mexico State Police – District 10 (Farmington) .... (505) 325-7547

Fire Department
San Juan County Fire Department .... (505) 334-1180
Bloomfield Fire Department .... (505) 632-6363
Farmington Fire Department .... (505) 599-1430

Ambulance
San Juan County Fire Department, Emergency Medical Services............ (505) 334-1180

Hospital
San Juan Regional Medical Center, Farmington .... (505) 609-2000

Police
San Juan County Sheriff .... (505) 334-6107
Bloomfield Police Department............ (505) 632-6311
Farmington Police Department .... (505) 599-1070
Aztec Police Department .... (505) 334-7601

Emergency Management Agencies
New Mexico State Emergency Response Commission (SERC)............ ....(505) 476-0617
United States Environmental Protection Agency/New Mexico Department of Homeland Security and Emergency Management............ (505) 476-9600
New Mexico Environment Department Emergency Number............ (505) 827-9329
San Juan County – Emergency Management .... (505) 333-3130
New Mexico Oil Conservation Division District 3 – Aztec, NM............ (505) 334-6178

EMERGENCY RESPONSE CONTRACTORS

Envirotech, Inc.
Primary Emergency Spill Response Contractor
5796 US 64, Farmington, NM 87401
24 Hour Emergency Response **800-362-1879**
Office 505-632-0615

Backhoe Service
Kelley Oilfield Services (Bloomfield, NM)
Office..505-632-2423

Water Hauling
M&R Trucking (Aztec, NM)
Office..505-334-5541

Vacuum Truck Services
Kelley Oilfield Services (Bloomfield, NM)
Office..505-632-2423

Absorbent Material Supplier
Envirotech, Inc. (Farmington, NM)
Office 505-632-0615

Bio-Remediation Supplier
NRE Field Services, LLC (Farmington, NM)
Office 505-258-4259

5.0 19.15.36.13 (N)(3): EMERGENCY COORDINATOR

List the emergency coordinator's name; address; and office, home and mobile phone numbers (where more than one person is listed, one shall be named as the primary emergency coordinator);

The primary Emergency Coordinator for the Landfarm is:

Paul Kelloff
SJN Emergency Coordinator and Safety Specialist
382 County Road 3100 Aztec, New Mexico
Office Number: 505-324-5180
Cell Number: 505-486-5640

In the event that the primary Emergency Coordinator cannot be reached, secondary emergency coordinators are:

Matt Henderson
Environmental Manager, Secondary Emergency Coordinator
1111 Travis Street, Houston, TX
Office Number: 713-289-2970
Cell Number: 512-983-2098

Jimmy Watson
Safety Manager
382 County Road 3100 Aztec, New Mexico
Cell Number: 970-795-6517

6.0 19.15.36.13 (N)(4): EMERGENCY EQUIPMENT

Include a list, which shall be kept current, of emergency equipment at the surface waste management facility, such as fire extinguishing systems, spill control equipment, communications and alarm systems and decontamination equipment, containing a physical description of each item on the list and a brief outline of its capabilities;

Hilcorp has the following emergency equipment on site:

- 20-pound ABC fire extinguishers (2 minutes), which can be used for incipient fires, will be located in the Landfarm Office, in each vehicle, and on each piece of heavy equipment used at the Landfarm (e.g., bulldozer, excavator, backhoe, etc.).
- Shovels for use in controlling minor spills and fires will be located in the Landfarm Office. Heavy equipment such as excavators and water trucks can also be used to smother minor fires, if on site at the time.
- A 55-gallon Emergency Spill Kit containing oil absorbent booms, and oil absorbent spreading material will be stored in the Landfarm Office. The kit will be used to minimize the impact of localized spills.
- First Aid Kits will be maintained in the Landfarm Office, each vehicle, and on each piece of equipment dedicated to the Landfarm. First Aid Kits will include bandages, gauze pads, hot and cold therapy, instruments (scissors, tweezers, etc.), ointments, preparation pads, over the counter medications, and accessories (eyewash, gloves, finger splints, etc.).
- Cellular phones will be in possession of all employees and used as the primary means of communication among Landfarm personnel.
- Hilcorp's *Contingency Plan* will be available in the Landfarm Office.

7.0 19.15.36.13 (N)(5): EVACUATION PLAN

Include an evacuation plan for surface waste management facility personnel that describes signals to be used to begin evacuation, evacuation routes and alternate evacuation routes in cases where fire or releases of wastes could block the primary routes.

7.1 MUSTER POINTS

Emergency evacuation routes and muster points are shown on Figure 3. The primary muster point for the Landfarm is located at the entrance to the facility. If this muster point is inaccessible, all employees and visitors will be directed to the secondary muster point.

7.2 EVACUATION PROCEDURES

Personnel present on location are noted by crew leaders and supervisors. Muster points are discussed during pre-job meetings and alternate muster points are established and noted in the Job Safety Analysis (JSA) if necessary. In the event of an emergency, personnel will evacuate to the designated muster point where a headcount will be conducted. An Emergency Evacuation Route Map is provided as Figure 3.

There are no critical operations at the Landfarm that would require personnel to remain behind and operate. However, to minimize the dangers associated with an emergency, any trained employee may shut off the Landfarm Office energy sources as they are evacuating.

Employees and visitors are required to sign a logbook upon entering the facility. They must note the time of their arrival and time of their departure from the facility. In the event of an emergency, Hilcorp personnel will use the logbook and verbal communication at the primary muster point (or secondary muster point if the primary muster point is inaccessible) to account for all personnel. If necessary, available personnel may initiate a search for any missing person as long as it is safe to do so.

Employees who have been certified in First Aid/CPR and have received Bloodborne Pathogen training may render assistance to injured employees.

7.3 H_2S RELEASE

If the personal H_2S monitor alarm sounds, check the wind direction and move upwind to a safe area. Report the alarm to the Landfarm Office and report what happened. A windsock will be located above or adjacent to the Landfarm Office.

7.4 FIRE

If a fire occurs in the area where you are working:

- Leave the process area.
- Notify Emergency Coordinator immediately.
- Follow the Operator’s instructions.

7.4.1 Exception

If a fire is still in the incipient stage, personnel who are trained in the use of a handheld fire extinguisher may attempt to extinguish the fire. Once the fire has grown past the incipient stage, all personnel will retreat to the assembly area to ensure their own safety and wait for the Local Fire Department responders to arrive on scene. If directed, personnel may assist responders in tasks that do not jeopardize their or someone else's safety and health.

7.5 ALL-CLEAR SIGNAL

When employees have been evacuated from the site, it may only be re-entered after it has been determined to be safe to do so by the senior Hilcorp person on site. This may be done in consultation with local emergency responders or Senior Hilcorp Management as appropriate. The senior Hilcorp person on site shall communicate the all-clear signal verbally to all affected employees.

7.6 TRAINING

Duties of individuals trained to carry out the safe and orderly emergency evacuation of the Landfarm will be reviewed with employees covered by the plan at intervals noted below.

- Upon employee's initial assignment to the Landfarm, employees receive training on this plan.
- On an annual basis.

Documentation of each review will be contained in the Emergency Coordinator's office at the Hilcorp Field Office in Aztec, New Mexico.

8.0 19.15.36.13 (N)(6): EXPECTED CONTAMINANTS

Include an evaluation of expected contaminants, expected media contaminated and procedures for investigation, containment and correction or remediation.

Expected contaminants include petroleum-hydrocarbon contaminated soil from off-site locations. No on-site releases are expected to occur, given that no permanent equipment will be left at the Landfarm, no fuel or waste oil tanks will be located on the Landfarm, and no energy source (heat or electricity) is required for the Landfarm office. All equipment maintenance will be performed off-site. If a release from vehicles, equipment, and/or other sources occurs on the Landfarm, laboratory analysis will be required for disposal purposes (either on or off of the Landfarm).

Waste Acceptance Criteria at the Landfarm include:

- Hilcorp will accept only oil field wastes such as soil and/or drill cuttings predominantly contaminated by petroleum hydrocarbons. Hydrocarbon contamination will be determined either by laboratory analysis of samples or by generator statement of waste generation.
- Tank bottom solids will be accepted at the Landfarm only when the generator demonstrates that the waste does not contain economically recoverable hydrocarbons (oil-phase liquids that separate from tank bottoms solids).
- Waste exceeding 1,000 milligrams per kilogram (mg/kg) chloride will not be accepted at the Landfarm.

Soil is the expected contaminated media. Should an unplanned release occur, the surrounding ground surface and subsurface soils are the only media expected to be contaminated since no surface water is nearby (nearest wash is 300 feet away) and groundwater is greater than 100 feet below ground surface.

9.0 19.15.36.13 (N)(7): LOCATION OF CONTINGENCY PLAN

List where copies of the contingency plan will be kept, which shall include the surface waste management facility; local police departments, fire departments and hospitals; and state and local emergency response teams;

Once approved, Hilcorp will maintain copies of this *Contingency Plan* at:

- Landfarm Office
- Hilcorp Field Office
  382 County Road 3100
  Aztec, New Mexico
- Hilcorp Primary Emergency Coordinator (on hand)
  Paul Kelloff
- Farmington Police Department
- Farmington Fire Department and Hazmat Team
- San Juan Regional Medical Center
- NMOCD Local Office
  1000 Rio Brazos Road
  Aztec, New Mexico
- NMOCD State Office
  1220 South Saint Francis Drive
  Santa Fe, New Mexico

10.0 19.15.36.13 (N)(8): CONTINGENCY PLAN AMENDMENTS

Indicate when the contingency plan will be amended, which shall be within five working days whenever:

(a) the surface waste management facility permit is revised or modified;

(b) the plan fails in an emergency;

(c) the surface waste management facility changes design, construction, operation, maintenance or other circumstances in a way that increases the potential for fires, explosions or releases of oil field waste constituents that could threaten fresh water, public health, safety or the environment or change the response necessary in an emergency;

(d) the list of emergency coordinators or their contact information changes; or

(e) the list of emergency equipment changes;

Hilcorp will amend the *Contingency Plan* within five working days whenever:

- The surface waste management facility permit is revised or modified.
- The plan fails in an emergency.
- The surface waste management facility changes design, construction, operation, maintenance or other circumstances in a way that increases the potential for fires, explosions or releases of oil field waste constituents that could threaten fresh water, public health, safety or the environment or change the response necessary in an emergency.
- The list of emergency coordinators or their contact information changes.
- The list of emergency equipment changes.

The Emergency Coordinator will be in charge of amending the *Contingency Plan* and new copies are distributed to all of the locations as specified in Section 9.0.

11.0 19.15.36.13 (N)(9): COMMUNICATION AND NOTIFICATIONS

Describe how the emergency coordinator or the coordinator's designee, whenever there is an imminent or actual emergency situation, will immediately;

(a) activate internal surface waste management facility alarms or communication systems, where applicable, to notify surface waste management facility personnel; and

(b) notify appropriate state and local agencies with designated response roles if their assistance is needed;

No permanent facility alarms will be located at the Landfarm. Hilcorp's Emergency Coordinator or designated Secondary Emergency Coordinator will immediately notify personnel via verbal communication or cellular phone that an emergency has occurred and will direct them how to respond (such as evacuating or assisting in spill response per this *Contingency Plan*).

11.1 EXTERNAL NOTIFICATIONS

Hilcorp's Emergency Coordinator will notify appropriate state and local agencies with designated response roles if their assistance is needed. External contacts can be found in Section 4.0 of this *Contingency Plan.*

11.2 INFORMATION REQUIRED FOR NOTIFICATIONS

A list of local, state, and federal emergency spill response and/or notification agencies is included in Section 4.0 above. The following information should be available and provided when making initial and follow-up notifications to emergency responders and/or the NMOCD.

- Name of facility/tank/pipeline
- Time of discharge
- Location of discharge
- Name of product involved
- Reason for release (e.g., material failure, excavation damage, corrosion)
- Estimated volume of product discharged
- Weather conditions on the scene
- Actions taken or planned by persons on the scene

12.0 19.15.36.13 (N)(10): CHARACTERIZATION OF EMERGENCY

Describe how the emergency coordinator, whenever there is a release, fire or explosion, will immediately identify the character, exact source, amount and extent of released materials (the emergency coordinator may do this by observation or review of surface waste management facility records or manifests, and, if necessary, by chemical analysis) and describe how the emergency coordinator will concurrently assess possible hazards to fresh water, public health or the environment that may result from the release, fire or explosion (this assessment shall consider both the direct and indirect hazard of the release, fire or explosion);

As defined in Subsection R of 19.15.2.7 NMAC, a "release" is defined as "breaks, leaks, spills, releases, fires or blowouts involving oil, produced water, condensate, drilling fluids, completion fluids or other chemical or contaminant or mixture thereof, including oil field wastes and gases to the environment".

Because the Landfarm is only receiving soils impacted by oil field waste (as described in Appendix B, *Plan for Management of Approved Oil field Wastes*), there will be no releases of oil, produced water, condensate, drilling fluids, or completion fluids associated with the production and transport of oil and gas. However, heavy equipment brought onto the Landfarm (i.e., backhoe, excavator, dump truck, etc.) will contain small volumes of "other chemical or contaminants" that may be released to the environment.

As such, on-site personnel and Hilcorp's Emergency Coordinator will be able to immediately identify the character, exact source, amount, and extent of released materials from on-site equipment by visual inspection and knowledge of the equipment (e.g., volume of onboard fuel tanks or chemicals used for equipment). If necessary, Hilcorp will submit soil samples for chemical analysis, delineation, and/or disposal purposes to further identify potential hazards to fresh water, public health, or the environment that may result from the release, fire, or explosion. Based on this information, the Emergency Coordinator will evaluate the need for immediate emergency response and/or evacuation.

13.0 19.15.36.13 (N)(11): EMERGENCY MONITORING

Describe how, if the surface waste management facility stops operations in response to fire, explosion or release, the emergency coordinator will monitor for leaks, pressure buildup, gas generation or rupture in valves, pipes or the equipment, wherever this is appropriate;

The Landfarm will not have permanent equipment and/or piping located at the site and there are no expected circumstances for pressure buildup or gas generation at the Landfarm. In the case that equipment brought onto the Landfarm (i.e., backhoe, excavator, dump truck, etc.) is the cause of a fire, explosion, or release, the Emergency Coordinator and/or on-site personnel will monitor the situation to their level of training. Piping/valve leaks will be isolated and the equipment immediately removed for offsite repairs. All equipment will be inspected by a professional mechanic prior to continued use at the Landfarm.

In addition, out of an abundance of caution, all personnel at the Landfarm will be required to use 4-gas monitors and/or H_2S badges to monitor the breathing space and atmosphere at the Landfarm. The 4-gas monitors measure combustibles/LEL, oxygen, H_2S, and carbon monoxide. It is Hilcorp's policy that every 4-gas monitor be calibrated at least once a month and bump tested every day prior to use.

14.0 19.15.36.13 (N)(12): RECOVERED OIL FIELD WASTE AND OTHER MATERIAL

Describe how the emergency coordinator, immediately after an emergency, will provide for treating, storing or disposing of recovered oil field waste, or other material that results from a release, fire or explosion at a surface waste management facility;

Hilcorp's Emergency Coordinator will immediately employ appropriate measures such as covering, barricading, berming, and/or placarding as needed to mark areas that have been contaminated by a release, fire, or explosion at the Landfarm to alert employees that the material cannot be accepted at the Landfarm. The Emergency Coordinator will ensure that only employees and contractors authorized by the Emergency Coordinator have access to the contaminated area. The Emergency Coordinator or designee will collect a sample for rush analysis to determine if the oil field waste or other material that results from an incident is deemed hazardous. If the material is deemed hazardous it will immediately be taken to and disposed of at a hazardous waste permitted facility. Non-hazardous petroleum hydrocarbon contaminated soils will remain at the Landfarm to be remediated.

15.0 19.15.36.13 (N)(13): OIL FIELD WASTE ACCEPTANCE DURING AN EMERGENCY

Describe how the emergency coordinator will ensure that no oil field waste, which may be incompatible with the released material, is treated, stored or disposed of until cleanup procedures are complete.

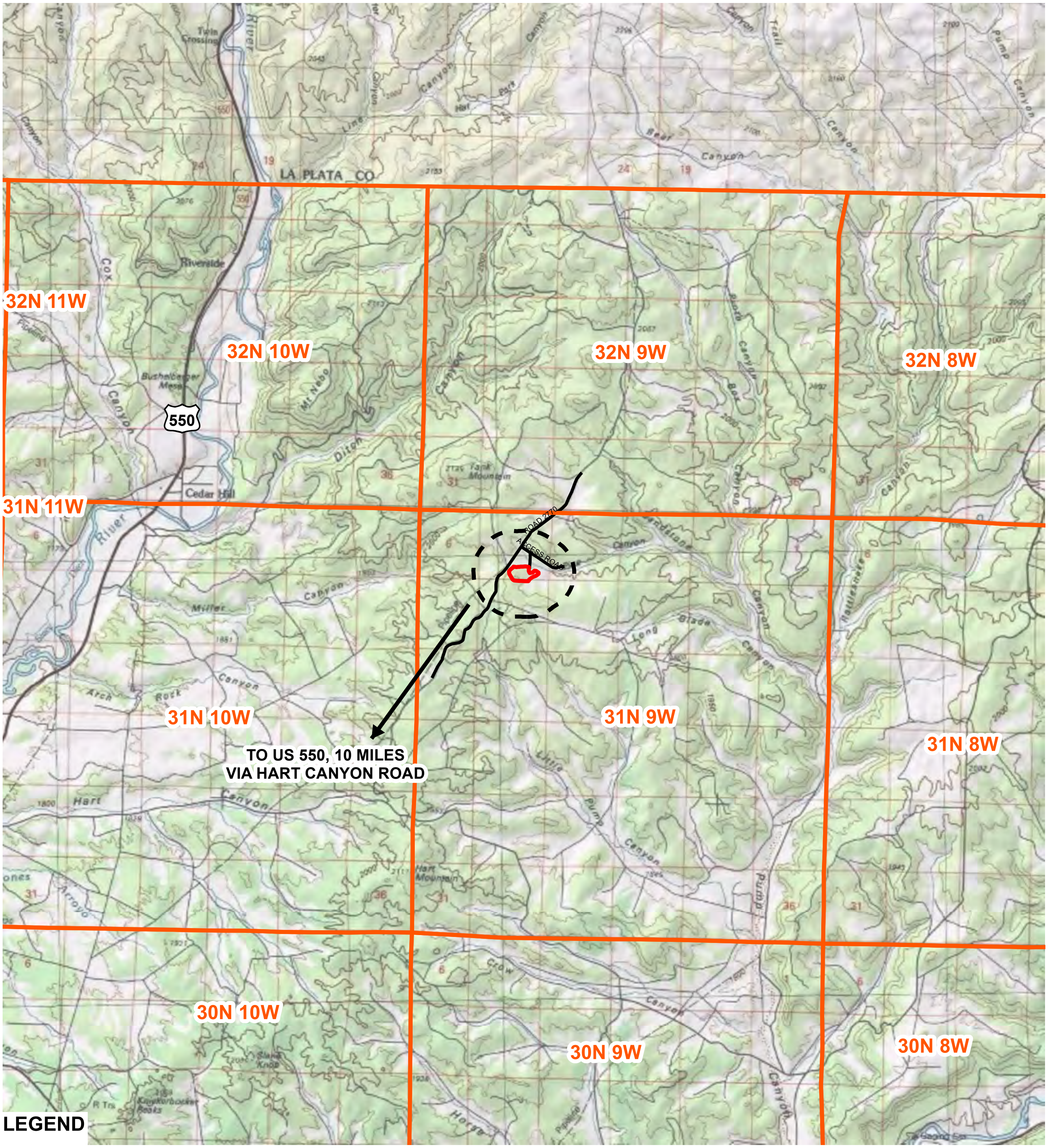
If an incidental release occurs at the Landfarm, Hilcorp's Emergency Coordinator will ensure that no landfarm waste that may be incompatible with the released material is treated, stored, or disposed of at the facility until cleanup procedures are completed. No incoming material will be accepted until the cleanup procedures are complete. In addition, the area of the release will be fenced and/or flagged to prevent personnel from accessing the incompatible waste. No incoming material will be accepted at the Landfarm until documentation of remediation is accepted by the NMOCD.

16.0 19.15.36.13 (N)(14): EMERGENCY AMENDMENTS

Provide that the emergency coordinator may amend the plan during an emergency as necessary to protect fresh water, public health or the environment.

Hilcorp's Emergency Coordinator may amend this *Contingency Plan* during an emergency as necessary to protect fresh water, public health, or the environment. Each emergency is unique and requires knowledge of all potential hazards to respond safely and quickly.

FIGURES



LEGEND

ROAD

TANK MOUNTAIN LANDFARM BOUNDARY

TOWNSHIP AND RANGE

HALF-MILE RADIUS

IMAGE COURTESY OF ESRI/USGS

0 2 4

Miles

N

NOTE:
SITE IS NOT WITHIN A HALF-MILE OF ANY SITES INTENDED FOR HUMAN OCCUPANCY (SIHO). AERIAL AND SATELLITE IMAGERY INTERPRETATION FOR SIHO LOCATIONS WERE CONDUCTED USING GOOGLE EARTH IMAGERY ACQUIRED IN 2019.

FIGURE 1
SITE LOCATION MAP
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

P:\Hilcorp\GIS\MXD\017818018_LANDFARM PERMITTING\TANK MOUNTAIN\2020_UPDATES\017818018_FIG01A_TANK MOUNTAIN_PLAT_TOPO_2020.mxd

FIGURE 2
DIRECTION TO NEAREST HOSPITAL
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

DIRECTIONS

1. Follow Rd 2770 southwest

2. Turn **RIGHT** onto Hart Canyon

3. Turn **LEFT** onto US-550 S/NE Aztec Blvd

4. Continue onto NM-516

5. Continue **STRAIGHT** onto E Main St

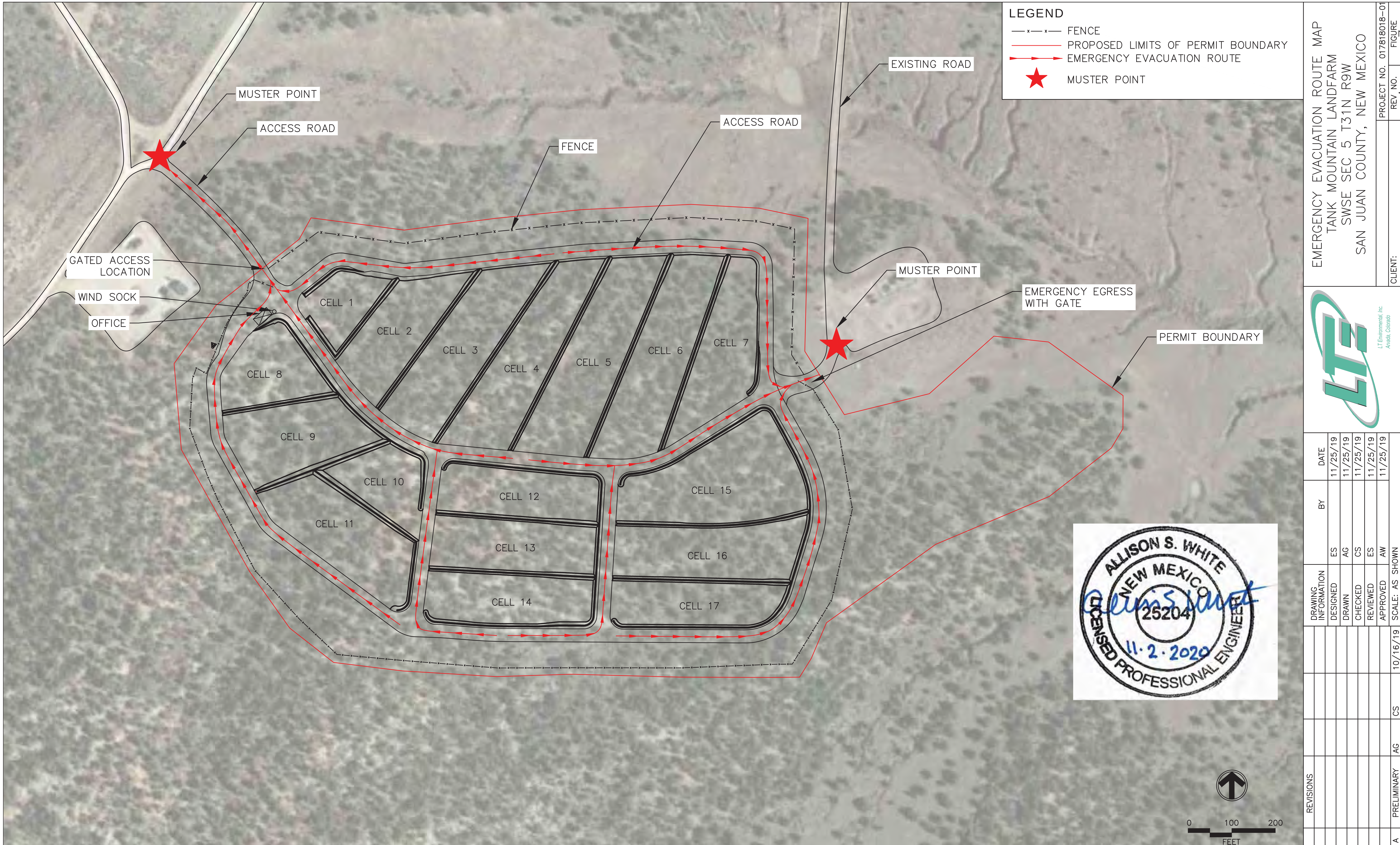
6. Turn **LEFT** onto Hill St

7. Continue onto S Miller Ave

8. Turn **RIGHT** onto E Maple St

9. San Juan Regional Medical Center: 801 W Maple St, Farmington, New Mexico 87401

Reference: Google Maps


LEGEND
FENCE
PROPOSED LIMITS OF PERMIT BOUNDARY
EMERGENCY EVACUATION ROUTE
MUSTER POINT
MUSTER POINT
ACCESS ROAD
FENCE
ACCESS ROAD
EXISTING ROAD
GATED ACCESS LOCATION
WIND SOCK
OFFICE
MUSTER POINT
EMERGENCY EGRESS WITH GATE
PERMIT BOUNDARY
CELL 1
CELL 2
CELL 3
CELL 4
CELL 5
CELL 6
CELL 7
CELL 8
CELL 9
CELL 10
CELL 11
CELL 12
CELL 13
CELL 14
CELL 15
CELL 16
CELL 17
ALLISON S. WHITE
NEW MEXICO
25204
LICENSED PROFESSIONAL ENGINEER
11.2.2020
0
100
200
FEET
EMERGENCY EVACUATION ROUTE MAP
TANK MOUNTAIN LANDFARM
SWSE SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
PROJECT NO. 017818018-01
FIGURE 3
REV NO. A
CLIENT: HILCORP ENERGY COMPANY
LT Environmental, Inc.
Arvada, Colorado
DRAWING INFORMATION
DESIGNED ES 11/25/19
DRAWN AG 11/25/19
CHECKED CS 11/25/19
REVIEWED ES 11/25/19
APPROVED AW 11/25/19
SCALE: AS SHOWN
FILE: M:\clients\WSP\017818018-Tank Mtn\017818018
BY
DATE
REVISIONS
A PRELIMINARY AG CS 10/16/19
NO. DESCRIPTION BY APPROVED DATE

APPENDIX F: RUN-ON AND RUN-OFF CONTROL PLAN

APPENDIX F – RUN-ON AND RUN-OFF CONTROL PLAN

HILCORP TANK MOUNTAIN LANDFARM
SAN JUAN COUNTY, NEW MEXICO

OCTOBER 2020

Prepared for:

HILCORP ENERGY COMPANY
382 County Road 3100
Aztec, New Mexico 87401

Prepared by:

LT ENVIRONMENTAL, INC.
848 East Second Avenue
Durango, Colorado 81301
970.385.1096

LT Environmental, Inc.
Advancing Opportunity

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

1.0 INTRODUCTION

This Run-On and Run-Off Control Plan (Plan) for the Tank Mountain Landfarm (Landfarm) operated by Hilcorp Energy Company (Hilcorp) is specified in New Mexico Administrative Code (NMAC) 19.15.36.8 (C)(11) and complies with the applicable requirements contained in 19.15.36.13 (M) NMAC.

2.0 PROJECT DESCRIPTION

2.1 PROJECT INTRODUCTION

The Landfarm is being developed on an empty parcel located in the southwest quarter of the southeast quarter of Section 5, Township 31 North, Range 9 West in San Juan County, New Mexico.

Proposed changes to the parcel consist of adding three drainage ditches on the southern Landfarm boundary, berms around each of the Landfarm cells, and three culverts. The purpose of this drainage study is to ensure that (1) the control system shall prevent flow onto the Landfarm's active portion during the peak discharge from a 25-year storm and (2) run-off from the Landfarm's active portion shall not be allowed to discharge a pollutant to the waters of the state or United States that violates state water quality parameters.

2.2 PRE-DEVELOPED SITE CONDITIONS

The property is comprised of a total of approximately 38 acres in size and is currently an unimproved forested site.

The existing soil types for the site were obtained from the National Resource Conservation Service (NRCS) Web Soil Survey and two soil types are present. The predominant soil type at the site is the Travessilla-Weska-Rock outcrop complex of 0 to 30 percent (%) slopes, which occupies approximately 91.9% of the site and is defined by a medium run-off ability. The Travessilla-Weska Rock outcrop complex is in the D hydrologic soil group. The second soil type, occupying approximately 8.1% of the site, is the Penistaja-Buckle association, gently sloping with 0 to 5% slopes. The Penistaja-Buckle association has low run-off ability with a moderately low to moderately high capacity to transmit groundwater and is in the C hydrologic soil group. The NRCS Web Soil Survey report is included in Attachment 1.

2.3 SURROUNDING LAND USE

The site is located southeast of Cedar Hill, New Mexico surrounded by well pads. Rawhide Canyon is located 200 feet northeast and a tributary of the Animas River is located 4 miles northwest of the site.

2.4 CURRENT SITE DRAINAGE

The current site drainage generally runs from southwest to northeast, with a low point located in the northeast corner. All drainage currently flows north towards Rawhide Canyon.

Based on visual observations current site drainage will transport from the southwest corner of the site to the northeast corner of the site and subsequently drain offsite to the north. Some drainage of offsite precipitation from the south and west will drain onto the site is anticipated based on site observations and United States Geological Survey (USGS) contour maps on Google Earth.

2.5 PROPOSED SITE CHANGES

Hilcorp is building a Landfarm on the site consisting of 17 cells with roads going around the perimeter and each cell grouping to allow truck traffic. There will be onsite machinery used to move the contaminated soil into the cell so that the trucks dropping off do not have to drive into any contaminated soil. In addition, there will be a rock vehicle tracking control (VTC) at the exit of the landfarm and at the intersection of interior roads at the east end of the facility as well as the south east to ensure that contaminated soil is removed from vehicles prior to leaving the landfarm. Also, the southern perimeter road will be one-way from west to east to ensure that the west intersection remains clean. Run-off from the Landfarm's active portion shall not be allowed to discharge a pollutant to the waters of the state or United States that violates state water quality parameters.

Each individual cell has a different amount of soil that can be stored as well as amount of stormwater that can be retained in the individual cell sumps.

- Cell Area - the total area of the cell including the sump
- Drainage Area into the Cell - includes the cell area plus run-on from the surrounding interior roads that drain into the cell (see Figure 3)
- Volume of Runoff Produced by Drainage Area - drainage area into cell multiplied by 80 percent (%) the 25-year, 24-hour storm event for the Site to account for percolation into the soil
- Sump Volume – Available sump volume within each cell
- Maximum Allowable Soil Volume – based on soil placed in 8-inch lifts

Cell	Cell Area (acre)	Drainage Area into Cell (acre)	Volume of Runoff Produced by Drainage Area* (ft^3)	Sump Volume (ft^3)	Maximum Allowable Soil Volume (yd^3)**
Cell 1	0.4	0.69	4,909	4,916	927
Cell 2	0.9	1.14	8,111	10,600	2,119
Cell 3	1.3	1.75	12,451	12,944	3,236
Cell 4	1.3	1.78	12,664	13,514	3,194
Cell 5	1.5	1.68	11,953	18,024	3,505
Cell 6	1.4	1.71	12,166	17,734	3,204
Cell 7	1.0	1.28	9,107	9,224	2,543
Cell 8	0.7	0.99	7,044	7,788	1,682
Cell 9	1.0	1.50	10,672	10,856	2,423
Cell 10	0.6	0.69	4,909	5,824	1,505
Cell 11	1.2	1.60	11,384	13,938	2,840
Cell 12	0.9	0.97	6,901	8,838	2,249

Cell 13	1.0	1.00	7,115	8,708	2,582
Cell 14	0.9	1.00	7,115	8,878	2,246
Cell 15	1.6	1.82	12,949	15,714	3,999
Cell 16	1.2	1.41	10,032	11,088	3,051
Cell 17	0.8	1.10	7,826	9,186	1,901

*Runoff based on a 25-year, 24-hour storm event
**Maximum allowable soil volume placed in 8-inch lifts

Surrounding each of the individual Landfarm cells on the downstream end, there will be a berm to ensure that the active portion will not allow water to be released during the peak discharge from a 24-hour, 25-year storm. The height of the berm varies depending on the size of the cell and the slope throughout the cell. See the Figure packet to see each cell's unique berm height. There will be an area in each cell where fill is not allowed to be placed to ensure that there is a portion of each cell that would allow water to collect in larger storm events without exceeding the berm height.

3.0 DRAINAGE ANALYSIS

Based on observations made during the site visit and as discussed above, the drainage basin for the Landfarm was estimated to fully encompass the site as well as the additional off-site run-on due to natural, existing topography. This results in a drainage basin of 60.90 acres broken into smaller subbasins. Based on the determined drainage basin size, the Rational Method was selected as the methodology to calculate the peak flow for the 25-year, 24-hour storm run-off rate at the site to be used in designing the stormwater controls, including ditches and culverts.

3.1 METHODOLOGY

The Urban Drainage and Flood Control District (UDFCD) states that the Rational Method is an accepted method to analyze the design storm run-off for basins that are generally simple in topography and ground cover, less than 90 acres in size, and when only the peak flow is needed (such as for on-site detention pond design). The Landfarm site meets these criteria.

3.1.1 Rational Method

The Rational Method is based on the Rational Formula, which is:

$$Q = CIA$$

Where:

Q = the peak rate of run-off (cubic feet per second [cfs])

C = run-off coefficient, a dimensionless coefficient equal to the ratio of run-off volume to rainfall volume

I = average intensity of rainfall for a duration equal to the time of concentration, t_c (inches per hour [in/hr])

A = drainage area (acres)

To calculate the peak rate of run-off, a catchment area and flow path must be delineated. The flow path will travel from the highest point within the area to the design point (such as a detention pond). Based on the length of the flow path, additional reaches may be designated based on flow type. Once the time of concentration, rainfall intensity based on time of concentration, and run-off coefficient are calculated/determined, the peak flow rate can be calculated using the Rational Formula. The UDFCD Peak Run-off Prediction by the Rational Method 2.00 Excel workbook was used for the calculations.

3.1.2 Site Parameters

The total site catchment basin, includes the property limits as well as an off-site run-on due to natural, existing topography, was divided into four historical portions, see Figure 1. H1 in the western portion of the property, H2 on the central portion of the property, H3 on the eastern portion of the property, and H4 between the west side of the property and the county road. Historical Subcatchment H1, located in the western section of the property, includes some minor run-on from south of the site and flows from south to north/northeast section of the site towards Rawhide Canyon. Historical Subcatchment H2, located in the central portion of the property and includes minor run-on from the south. Historical Subcatchment H3 includes all flows from the eastern side of the property, including minor run-on from the south. Historical Subcatchment H4 includes all flows from the western side of the property, including minor run-on from the existing roadside ditch on County Road 2770. The following parameters have been determined or calculated for the Landfarm.

3.1.2.1 Drainage Area, A

The site was divided into four subcatchments based on the historical elevation contour map. Historical Subcatchment H1, on the western portion of the property, has a total area of 18 acres. Historical Subcatchment H2, in the central portion of the property, has a total area of 13.4 acres. Historical Subcatchment H3, in the eastern portion, has a total area of 18.5 acres. Historical Subcatchment H4, in the western portion, has a total area of 11 acres. There is offsite run-off that will enter the site from the south due to existing topography.

3.1.2.2 Run-off Coefficient, C

As discussed in Section 1.2 above, an NRCS Web Soil Survey was completed for the site. The survey indicated that various soil types were present throughout the site. For all historical subcatchments, general site imperviousness value of 2% was chosen based on the UDFCD-recommended percentage imperviousness values for undeveloped areas. The C values for the historical subcatchments for various storm return periods were calculated through the run-off coefficient equations provided by UDFCD.

3.1.2.3 Average Rainfall Intensity, I

The average rainfall intensity is the average rainfall rate (in inches per hour) for the period of time that is equal to the time of concentration. The time of concentration is the time required for surface water to flow from the furthest part of the basin to the design point. The time of concentration is equal to the overland flow time (in minutes) plus the channelized flow time (in minutes). However, a correlation study completed by UDFCD determined that the regional time of concentration should also be calculated, and the smaller time of concentration calculated by the two methods should be used for the average rainfall intensity calculations.

For Subcatchment H1, an initial overland flow length of 170 feet and a slope of 0.006 feet per foot was determined based on historical imaging on Google Earth. This subcatchment will channel flow for a length of 1,450 feet with a slope of 0.084 feet per foot, and an NRCS conveyance factor of 8.

For Subcatchment H2, an initial overland flow length of 500 feet and a slope of 0.018 feet per foot was determined. This subcatchment will channel flow for a length of 1,484 feet with a slope of 0.084 feet per foot, and an NRCS conveyance factor of 8.

For Subcatchment H3, an initial overland flow length of 223 feet was chosen with a slope of 0.002 feet per foot was determined. This subcatchment will channel flow for a length of 2,076 feet with a slope of 0.076 feet per foot, and an NRCS conveyance factor of 8.

For Subcatchment H4, an initial overland flow length of 500 feet was chosen with a slope of 0.088 feet per foot was determined. This subcatchment will channel flow for a length of 1,182 feet with a slope of 0.039 feet per foot, and an NRCS conveyance factor of 8.

The rainfall intensity for a 25-year storm is then calculated using the selected time of concentration, the standard rainfall intensity equation coefficients, and the 1-hour rainfall depth in inches. The 1-hour rainfall depths for the site were obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, the most recent atlas in place for New Mexico, and are included in Attachment 2.

3.2 PEAK FLOW RESULTS

Based on the above design parameters, the peak flow run-off rates for the 25-year, 24-hour storm event for historical Subcatchments H1, H2, H3, and H4 were calculated. The four subcatchments combined for a total peak flow run-off rate for the 25-year, 24-hour storm event of 69.3 cubic feet per second (cfs).

The calculations discussed above were completed in the Peak Run-off Prediction by the Rational Method – UD Rational 2.00 Excel workbook, which is included in Attachment 3.

4.0 DRAINAGE CONTROL DESIGN

Based on the proposed grading plans, the site catchment basin was divided into six sections and the interior cells were treated separately, see Figure 2. NMAC regulations require that the run-on and run-off control system shall prevent flow onto the Landfarm's active portion during the peak discharge from a 25-year storm and that run-off from the Landfarm's active portion shall not be allowed to discharge a pollutant to the waters of the state or United States that violates state water quality standards. The run-on that would historically occur on this section of land will be conveyed through three minor drainage ditches on the southern portion of the property boundary as well as three culverts. There will also be a 2-foot berm on the southwestern corner of the site to reduce run-on potential at the property boundary of the site.

The drainage will be routed through ditches on the southern property boundary. At the high point, a portion of the drainage will be routed to the east and around the pad to Rawhide Canyon. The remaining run-off will be routed to the west and around the site and to a culvert under the western access road.

The first area, denoted as Subcatchment A, encompasses the area southwest of the property. The existing topography will direct the run-off to flow from the south to the north/northwest and toward the southwest drainage ditch, Ditch 2. This ditch will also be fed by the drainage coming out of culvert 1, Subcatchment B. This ditch will direct the flow around the pad to the west and through a culvert at the access road and ultimately to Rawhide Canyon. The peak flow for a 25-year, 24-hour storm for Subcatchment A is 10.66 cfs.

The second area, denoted as Subcatchment B, encompasses the area south of the property. The existing topography will direct the run-off to flow from the south to the highpoint and toward the southwest. This portion of flow will be directed towards a ditch, Ditch 1, and then to Culvert 1 that will bend around the southwestern side of the property. The peak flow for a 25-year, 24-hour storm for Subcatchment B is 7.75 cfs.

The third portion, denoted as Subcatchment C, encompasses the area southeast of the property. The existing topography will direct the run-off to flow from the south to the north/northeast and toward the southwest drainage ditch. This ditch will direct the flow around the pad to the west and through a culvert at the access road and ultimately to Rawhide Canyon. The peak flow for a 25-year, 24-hour storm for Subcatchment C is 9.25 cfs.

The fourth portion of the site, Subcatchment D, includes the area to the north of the site. This area will continue to follow historic drainage patterns and will drain north towards Rawhide Canyon. The peak flow for a 25-year, 24-hour storm for Subcatchment D is 5.90 cfs.

The fifth area, Subcatchment E, is comprised of the area to the east of the site. The low point of the site is in this Subcatchment and therefore, there is one of the steepest sections of the site. The peak flow for a 25-year, 24-hour storm for Subcatchment E is 9.71 cfs.

The final area, Subcatchment F, is comprised of the area that will drain along the county road up north. When adding this new access road in, a culvert will be installed to keep the historic flow path. The peak flow for a 25-year, 24-hour storm for Subcatchment F is 13.85 cfs.

The calculations discussed above were completed in the Peak Run-off Prediction by the Rational Method – UD Rational 2.00 Excel workbook, which is included in Attachment 4. The remaining 23.64 acres of total drainage area are the Landfarm cells and were treated separately but are shown in Attachment 4. Based on the design of the cells none of the runoff from the pad will leave the site; instead it will be contained within the cells and pumped out for proper disposal when necessary.

4.1 HYDRAULIC DESIGN

There are three proposed ditches that will convey run-off around the southern site boundary to ensure that there is no run-on to the Landfarm as well as two culverts under the access road on the west and a culvert 10 feet off of the southwestern property boundary. Each cell on the Landfarm will have berms built up around the entire cell to ensure that run-off cannot leave the cell. Contributing subcatchment areas were delineated and peak flows were calculated for 25-year storm events.

The soil type for this site is stiff, clayey sand and, therefore, can allow velocities of 3 cfs to 5.7 cfs without having erosion issues. Due to site restraints, the design channel side slopes cannot be implemented as calculated. To reduce the erosion potential, all ditches will be armored with a layer of turf reinforcement mat (TRM) or equivalent erosion blanket protection and riprap on top. This will help reduce the erosion potential throughout the channels due to the high Froud number and therefore supercritical flow. The proposed drainage flows were used to estimate the required ditch/roadside ditch dimensions listed in Table 2 below and are included in Attachment 5.

Ditch 1 will be 365 feet long at 0.014 ft/ft. This ditch will convey flow from the south and then will route it around the southern pad boundary and to Culvert 1. Ditch 2 will be 200 feet long at 0.050 ft/ft and will convey flow from Ditch 1/Culvert 1 and areas to the southwest. Ditch 3 will be 1,170 ft at 0.074 ft/ft and will convey water around the pad to the east. This ditch has the highest slopes and therefore has the lowest depth. This ensures that water doesn't reach supercritical flow causing higher erosion potential. All three ditches will be lined with erosion control blanket and will be armored with 2" riprap. For the Open Channel Flow Calculations in Attachment 5, an n value of 0.03 was used for 2" riprap.

Ditch 3 will end, and the flow will follow the existing contours to enter Rawhide Canyon. To help reduce the energy built up from the channelized flow existing in Ditch 3, a riprap apron will be at the end of the ditch. The apron will be 12-feet long by 3-feet wide at the outlet and extend to a width of 13 feet at the downstream end. The riprap will be laid 18-inches thick which requires a total quantity of approximately 15 tons.

TABLE 2: PROPOSED DITCH DIMENSIONS

	Design Flow *(cfs)	Design Depth including freeboard (ft)	Top Width (ft)	Channel Side Slopes (H:V)
Ditch 1	7.75	0.90	15.8	1:6
Ditch 2	11.66	0.74	24.8	1:10
Ditch 3	9.25	0.62	29.96	1:4

**25-year, 24-hour storm*

***The included freeboard is 0.5 feet*

A 440-foot culvert, Culvert 1, will be installed on the southwestern property boundary. Due to the low point on the southwestern corner of the pad, a culvert will have to be installed to reduce run-on to the pad. Culvert 1 will be a 16-inch and will be high-density polyethylene (HDPE) so that it can bend around the pad.

A 50-foot culvert, Culvert 2, will be installed at the intersection of the pad and the access road. This will also be a 16-inch HDPE pipe.

Culvert 3 will be installed at the intersection of the county road and the access road to keep any flow along the access road draining towards Rawhide Canyon.

All three culverts will have riprap aprons to dissipate the flow constructed with 6-inch d_{50} rock. Each riprap apron will be 12-feet long by 3-feet wide at the outlet and extend to a width of 13 feet at the downstream end. The riprap will be laid 18-inches thick which requires a total quantity of approximately 15 tons per apron. The culvert calculations are included in Attachment 6.

See the Drawings 3 and 8 (included in Appendix A of the Tank Mountain Landfarm Form C-137 Supplemental Information document) for the proposed facility layout and design details.

5.0 CONCLUSIONS

The historical flow of the proposed Landfarm is from southwest to northeast. As observed during the site visit, the historical site drainage includes minor pooling in a low area in the northeastern corner of the site. The proposed grading for the facility will not allow any flow to drain offsite and will reroute any run-on flows around the site.

The proposed site drainage was divided into six sections. The run-off from Subcatchment A will flow around the site to the west through the Ditch1 and includes flows from Culvert 1, Subcatchment B flow; the flow from Subcatchment B will flow from south of the site into Ditch 1 and then Culvert 1. Subcatchment C flow comes from the southeast and is directed to Ditch 3. The flow from Subcatchment D will continue to follow historic flow patterns and flow to the north towards Rawhide Canyon. Flow from Subcatchment E combines with the flow from Subcatchment C at the outfall of Ditch 3 at the riprap apron. Flow from both Subcatchment C and E flow towards Rawhide Canyon. Subcatchment F includes all flow from the county road that follows the roadside ditch. The flow goes towards Culvert 3 and will go under the access road and ultimately to Rawhide Canyon.

To reduce the potential that the historic run-on flows get into the Landfarm property boundaries, three ditches will be constructed as well as a berm on the southern property boundary. This will cause all run-off from south of the property to be routed to the east and the west around the site and will still flow towards Rawhide Canyon. The ditches will be graded according to the calculations shown in Attachment 5 and Ditch 3 on the southeast of the site will be lined with TRM to reduce erosion potential. Three 16-inch HDPE culverts will be installed with riprap aprons at the outlets installed according to calculation shown in Attachment 6.

For the Landfarm site, any run-on that hits the site will be contained on the site and not run-off. To ensure that run-off does not occur, berms will be constructed around each Landfarm cell with higher berms on the northern boundary. These berms vary in size but will be 2 feet at a minimum.

FIGURE 1: HISTORIC SUBCATCHMENTS

LEGEND

HISTORIC SUBCATCHMENT

TANK MOUNTAIN LANDFARM BOUNDARY

0 400 800
Feet

N

FIGURE 1
HISTORIC SUBCATCHMENTS
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

P:\Hilcorp\GIS\MXD\017818018_LANDFARM PERMITTING\TANK MOUNTAIN\2020_UPDATES\017818018_FIG01_TANK MOUNTAIN_HISTORIC_SUBCATCHMENTS_2020.mxd

FIGURE 2: PROPOSED SUBCATCHMENTS

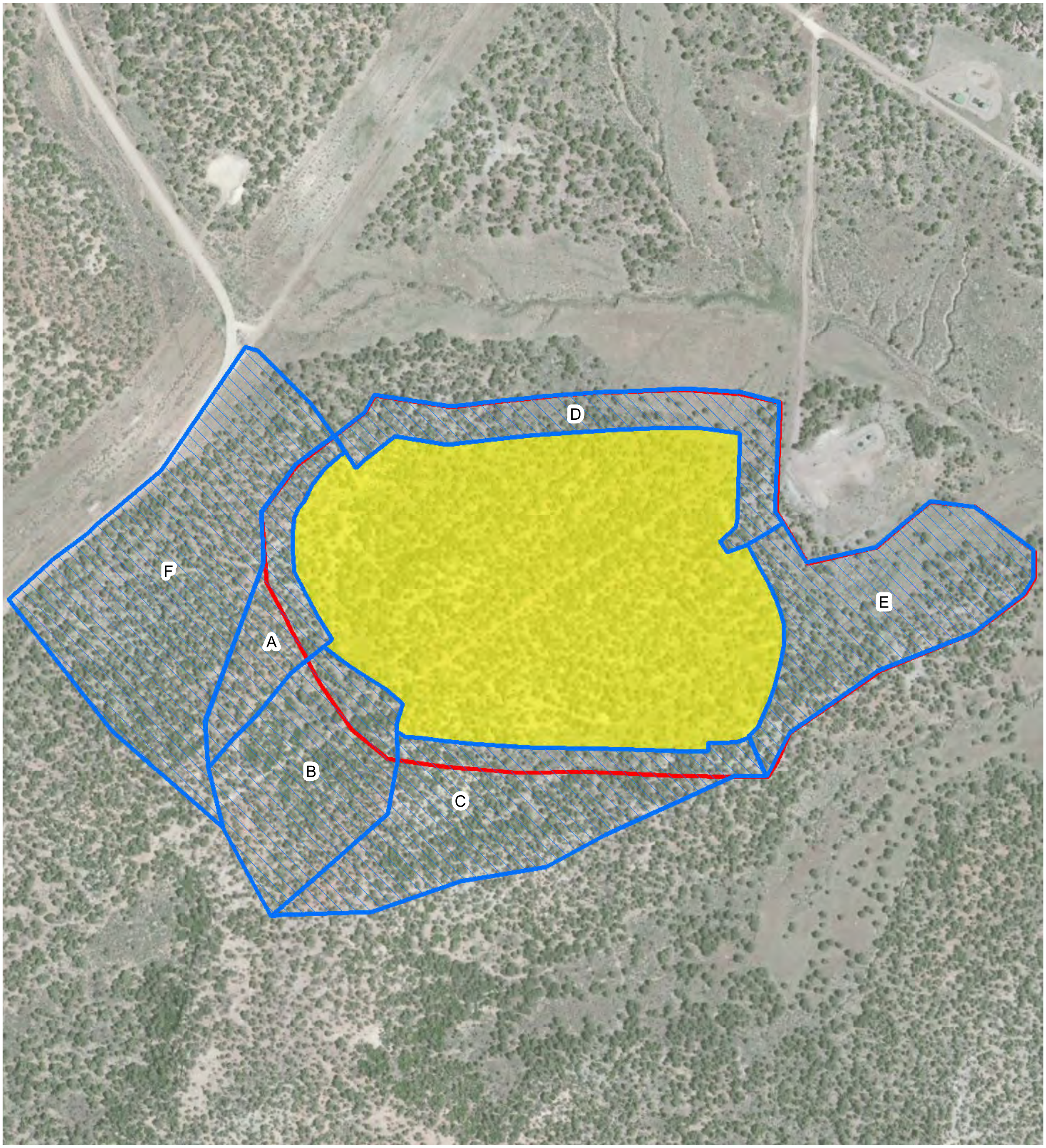


IMAGE COURTESY OF ESRI

LEGEND

PROPOSED SUBCATCHMENT

TREATMENT CELL AREA

TANK MOUNTAIN LANDFARM BOUNDARY

0 400 800

Feet

N

FIGURE 2
PROPOSED SUBCATCHMENTS
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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FIGURE 3: CELL DRAINAGE BASINS

LEGEND

DRAINAGE AREA INTO INDIVIDUAL CELLS

TANK MOUNTAIN LANDFARM BOUNDARY

0 400 800

Feet

N

FIGURE 3
CELL DRAINAGE BASINS
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

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ATTACHMENT 1: NRCS WEB SOIL REPORT

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for San Juan County, New Mexico, Eastern Part

June 10, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

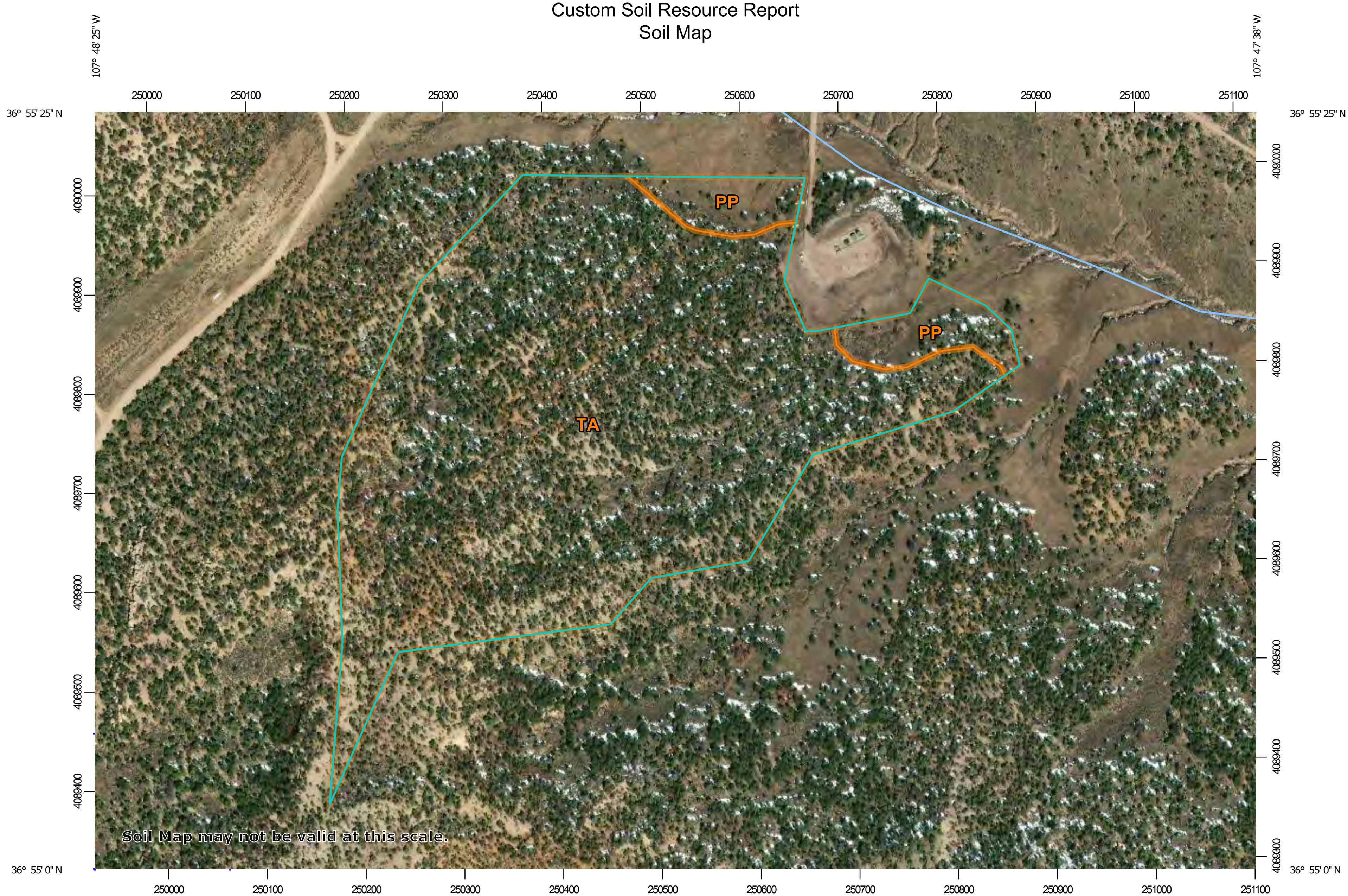
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:5,380 if printed on A landscape (11" x 8.5") sheet.

N

0 50 100 200 300 Meters

0 250 500 1000 1500 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:63,400.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Juan County, New Mexico, Eastern Part
Survey Area Data: Version 14, Sep 13, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 26, 2015—Oct 13, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
PP	Penistaja-Buckle association, gently sloping	4.2	8.1%
TA	Travessilla-Weska-Rock outcrop complex, moderately steep	47.7	91.9%
Totals for Area of Interest		**51.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Juan County, New Mexico, Eastern Part

PP—Penistaja-Buckle association, gently sloping

Map Unit Setting

National map unit symbol: 1wx7
Elevation: 6,400 to 7,200 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Penistaja and similar soils: 50 percent
Buckle and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Penistaja

Setting

Landform: Fan remnants, mesas
Landform position (three-dimensional): Talf
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Eolian deposits over fan alluvium derived from sandstone and shale

Typical profile

A - 0 to 3 inches: loam
Btk - 3 to 60 inches: clay loam
Ck - 60 to 64 inches: sandy loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6c
Hydrologic Soil Group: C
Ecological site: Loamy (R036XB006NM)
Hydric soil rating: No

Description of Buckle

Setting

Landform: Fan remnants, mesas
Landform position (three-dimensional): Talf
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Eolian deposits over fan alluvium derived from sandstone and shale

Typical profile

A - 0 to 13 inches: silt loam
CB - 13 to 47 inches: clay loam
Ck - 47 to 66 inches: silty clay loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6c
Hydrologic Soil Group: C
Ecological site: Loamy (R036XB006NM)
Hydric soil rating: No

Minor Components

Travessilla

Percent of map unit: 5 percent
Ecological site: Shallow Upland (R070AY003NM)
Hydric soil rating: No

Twick

Percent of map unit: 5 percent
Ecological site: Sandstone Upland 10-14" p.z. (R035XC314AZ)
Hydric soil rating: No

Weska

Percent of map unit: 5 percent
Ecological site: Sandstone Upland 10-14" p.z. (R035XC314AZ)
Hydric soil rating: No

TA—Travessilla-Weska-Rock outcrop complex, moderately steep

Map Unit Setting

National map unit symbol: 1wxx
Elevation: 6,400 to 7,200 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Travessilla and similar soils: 40 percent
Weska and similar soils: 30 percent
Rock outcrop: 25 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Travessilla

Setting

Landform: Breaks, hills
Landform position (two-dimensional): Backslope, footslope, shoulder, toeslope
Landform position (three-dimensional): Side slope, crest, nose slope, head slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone

Typical profile

A - 0 to 2 inches: sandy loam
C - 2 to 12 inches: sandy loam
R - 12 to 20 inches: bedrock

Properties and qualities

Slope: 0 to 30 percent
Depth to restrictive feature: 5 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Shallow Upland (R070AY003NM)
Hydric soil rating: No

Description of Weska

Setting

Landform: Hills, breaks
Landform position (two-dimensional): Backslope, footslope, shoulder, toeslope
Landform position (three-dimensional): Crest, nose slope, side slope, head slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from shale

Typical profile

A - 0 to 1 inches: clay loam
C - 1 to 9 inches: clay loam
Cr - 9 to 20 inches: bedrock

Properties and qualities

Slope: 0 to 30 percent
Depth to restrictive feature: 5 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Sandstone Upland 10-14" p.z. (R035XC314AZ)
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Rockfalls
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Typical profile

R - 0 to 60 inches: bedrock

Properties and qualities

Slope: 0 to 30 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Minor Components

Buckle

Percent of map unit: 2 percent
Ecological site: Loamy (R036XB006NM)
Hydric soil rating: No

Penistaja

Percent of map unit: 1 percent
Ecological site: Loamy (R036XB006NM)
Hydric soil rating: No

Twick

Percent of map unit: 1 percent
Ecological site: Sandstone Upland 10-14" p.z. (R035XC314AZ)
Hydric soil rating: No

Cobbles & gravels

Percent of map unit: 1 percent
Hydric soil rating: No

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ATTACHMENT 2: NOAA PRECIPITATION

NOAA Atlas 14, Volume 1, Version 5
Location name: Aztec, New Mexico, USA*
Latitude: 36.9212°, Longitude: -107.8047°
Elevation: 6729.75 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.159 (0.137-0.185)	0.205 (0.177-0.238)	0.274 (0.236-0.319)	0.331 (0.284-0.385)	0.412 (0.350-0.479)	0.479 (0.403-0.556)	0.550 (0.459-0.639)	0.626 (0.516-0.731)	0.736 (0.593-0.862)	0.827 (0.657-0.976)
10-min	0.242 (0.209-0.282)	0.311 (0.269-0.362)	0.417 (0.359-0.485)	0.504 (0.433-0.587)	0.627 (0.534-0.729)	0.729 (0.614-0.846)	0.837 (0.698-0.972)	0.953 (0.785-1.11)	1.12 (0.903-1.31)	1.26 (0.999-1.49)
15-min	0.300 (0.258-0.349)	0.385 (0.333-0.448)	0.517 (0.445-0.602)	0.625 (0.537-0.727)	0.777 (0.661-0.903)	0.903 (0.761-1.05)	1.04 (0.866-1.21)	1.18 (0.974-1.38)	1.39 (1.12-1.63)	1.56 (1.24-1.84)
30-min	0.403 (0.348-0.470)	0.519 (0.448-0.603)	0.697 (0.600-0.810)	0.842 (0.722-0.979)	1.05 (0.891-1.22)	1.22 (1.02-1.41)	1.40 (1.17-1.62)	1.59 (1.31-1.86)	1.87 (1.51-2.19)	2.10 (1.67-2.48)
60-min	0.499 (0.431-0.582)	0.642 (0.555-0.746)	0.862 (0.742-1.00)	1.04 (0.894-1.21)	1.30 (1.10-1.51)	1.51 (1.27-1.75)	1.73 (1.44-2.01)	1.97 (1.62-2.30)	2.31 (1.87-2.71)	2.60 (2.06-3.07)
2-hr	0.577 (0.503-0.674)	0.734 (0.639-0.856)	0.967 (0.841-1.13)	1.16 (1.01-1.35)	1.44 (1.24-1.68)	1.68 (1.42-1.95)	1.93 (1.62-2.25)	2.20 (1.82-2.57)	2.60 (2.10-3.05)	2.93 (2.32-3.46)
3-hr	0.637 (0.562-0.733)	0.802 (0.705-0.924)	1.03 (0.909-1.19)	1.23 (1.07-1.41)	1.51 (1.31-1.73)	1.74 (1.49-1.99)	1.99 (1.68-2.29)	2.26 (1.88-2.61)	2.65 (2.16-3.08)	2.98 (2.38-3.49)
6-hr	0.773 (0.694-0.876)	0.961 (0.863-1.09)	1.20 (1.08-1.36)	1.41 (1.26-1.59)	1.71 (1.50-1.93)	1.95 (1.70-2.21)	2.21 (1.90-2.50)	2.49 (2.11-2.83)	2.89 (2.40-3.30)	3.22 (2.62-3.70)
12-hr	0.944 (0.852-1.05)	1.17 (1.06-1.31)	1.44 (1.30-1.61)	1.67 (1.50-1.85)	1.97 (1.76-2.19)	2.21 (1.96-2.47)	2.46 (2.16-2.75)	2.73 (2.36-3.06)	3.09 (2.63-3.49)	3.39 (2.85-3.85)
24-hr	1.13 (1.04-1.24)	1.41 (1.30-1.55)	1.76 (1.62-1.93)	2.05 (1.88-2.24)	2.45 (2.22-2.67)	2.76 (2.49-3.01)	3.08 (2.77-3.37)	3.42 (3.05-3.74)	3.88 (3.43-4.27)	4.24 (3.71-4.69)
2-day	1.35 (1.24-1.48)	1.68 (1.55-1.84)	2.10 (1.92-2.30)	2.44 (2.23-2.66)	2.90 (2.64-3.18)	3.27 (2.96-3.58)	3.66 (3.28-4.01)	4.06 (3.62-4.46)	4.60 (4.06-5.10)	5.04 (4.40-5.61)
3-day	1.48 (1.36-1.61)	1.84 (1.70-2.01)	2.29 (2.10-2.50)	2.65 (2.43-2.89)	3.14 (2.87-3.43)	3.53 (3.21-3.86)	3.94 (3.55-4.31)	4.35 (3.90-4.78)	4.92 (4.36-5.43)	5.37 (4.71-5.95)
4-day	1.61 (1.48-1.74)	2.00 (1.85-2.18)	2.47 (2.28-2.69)	2.86 (2.63-3.11)	3.39 (3.10-3.69)	3.80 (3.46-4.14)	4.22 (3.82-4.61)	4.65 (4.18-5.10)	5.23 (4.66-5.77)	5.69 (5.03-6.30)
7-day	1.88 (1.73-2.04)	2.34 (2.15-2.54)	2.89 (2.65-3.15)	3.33 (3.05-3.63)	3.93 (3.58-4.28)	4.39 (3.98-4.79)	4.86 (4.38-5.31)	5.35 (4.79-5.86)	6.00 (5.31-6.60)	6.51 (5.71-7.19)
10-day	2.13 (1.97-2.31)	2.66 (2.45-2.89)	3.27 (3.01-3.55)	3.75 (3.45-4.09)	4.41 (4.03-4.80)	4.91 (4.47-5.35)	5.42 (4.92-5.93)	5.94 (5.36-6.51)	6.64 (5.93-7.31)	7.17 (6.35-7.94)
20-day	2.81 (2.60-3.05)	3.49 (3.22-3.80)	4.26 (3.92-4.63)	4.87 (4.47-5.30)	5.70 (5.21-6.20)	6.33 (5.75-6.90)	6.97 (6.30-7.62)	7.61 (6.85-8.35)	8.47 (7.56-9.33)	9.14 (8.08-10.1)
30-day	3.42 (3.17-3.71)	4.25 (3.93-4.61)	5.16 (4.76-5.62)	5.88 (5.40-6.40)	6.82 (6.24-7.42)	7.53 (6.87-8.21)	8.24 (7.47-9.00)	8.95 (8.07-9.80)	9.87 (8.83-10.9)	10.6 (9.39-11.7)
45-day	4.18 (3.87-4.53)	5.20 (4.81-5.64)	6.31 (5.83-6.86)	7.19 (6.62-7.81)	8.33 (7.64-9.06)	9.19 (8.39-10.0)	10.1 (9.13-11.0)	10.9 (9.85-12.0)	12.1 (10.8-13.3)	13.0 (11.5-14.4)
60-day	4.89 (4.50-5.30)	6.07 (5.60-6.60)	7.35 (6.75-8.00)	8.32 (7.63-9.07)	9.60 (8.76-10.5)	10.5 (9.58-11.5)	11.5 (10.4-12.5)	12.4 (11.2-13.6)	13.6 (12.2-15.0)	14.5 (12.9-16.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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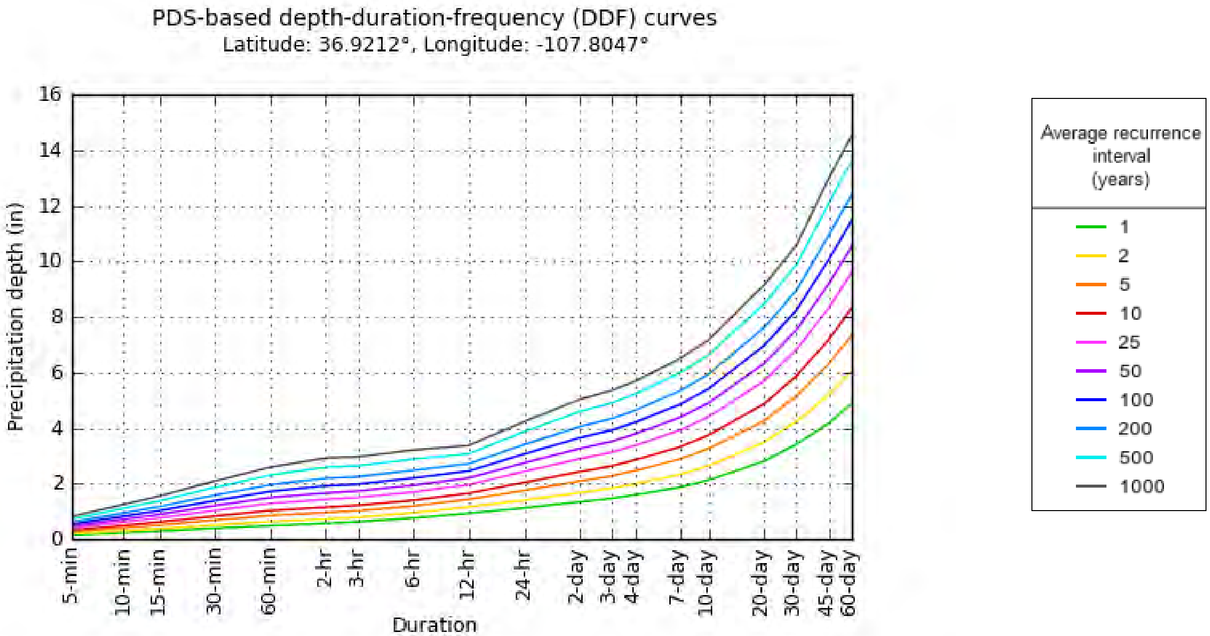
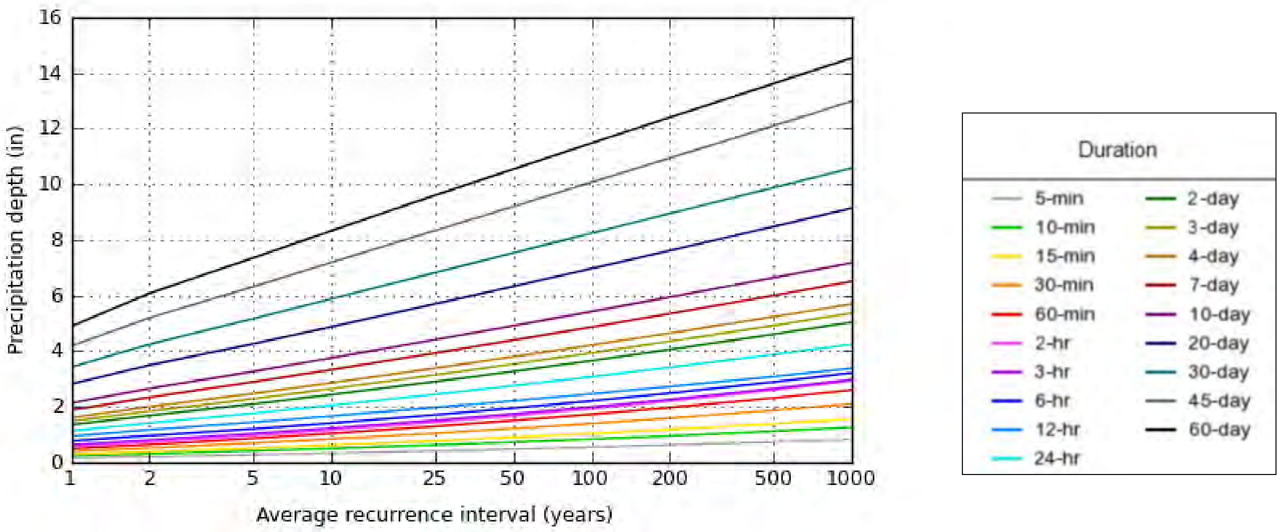
PF graphical





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Created (GMT): Wed Jun 5 13:44:39 2019

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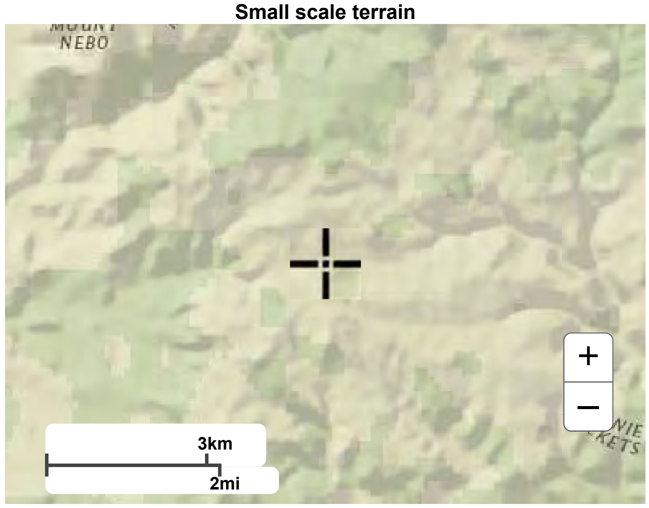
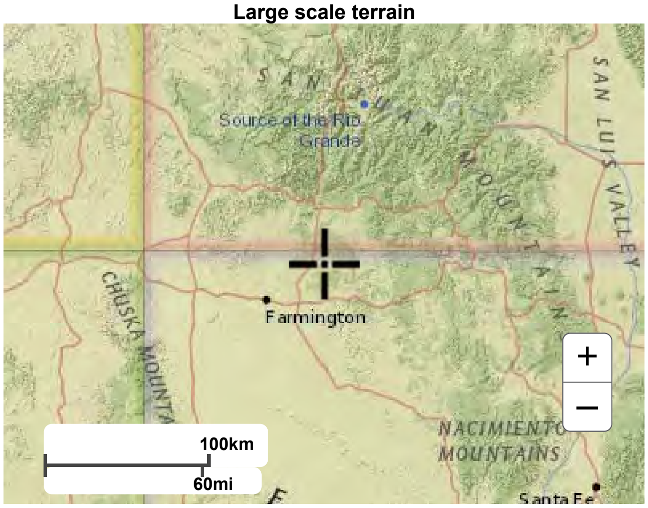
Maps & aerials

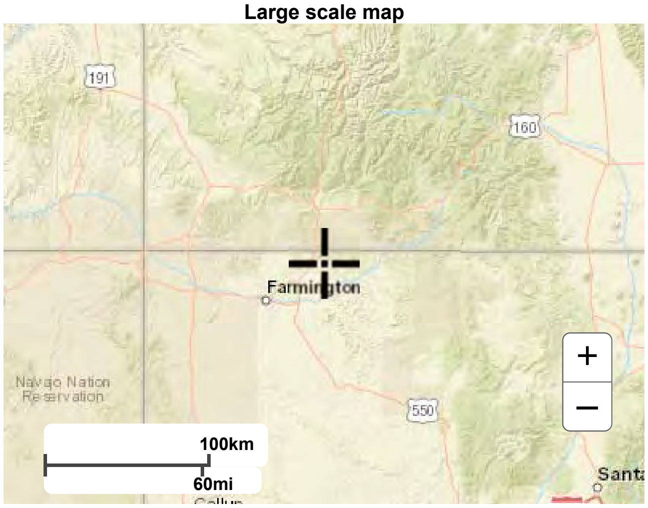
Small scale terrain



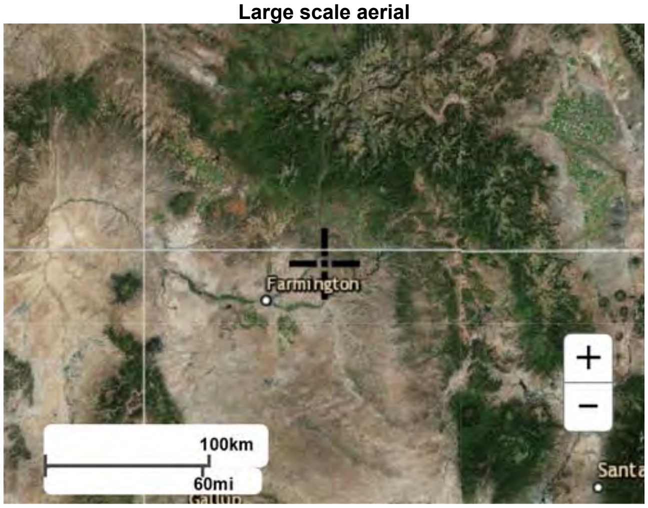
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

ATTACHMENT 3: RATIONAL METHOD PEAK RUN-OFF PREDICTION: HISTORIC DRAINAGE

PEAK RUNOFF PREDICTION BY THE RATIONAL METHOD

Version 2.00 released May 2017
Urban Drainage and Flood Control District
Denver, Colorado

Purpose: This workbook applies the Rational Method to estimate stormwater runoff and peak flows from small urban catchments (typically less than 90 acres)

Function:

1. To calculate the runoff coefficient, C for a catchment
2. To calculate the time of concentration, and then compare with the regional time of concentration limit used for the Denver region. The smaller one is recommended as the rainfall duration for use with the Rational Method.
3. To calculate the design rainfall intensity and resulting peak flow rate.

Content: The workbook consists of the following five sheets:

Intro	Describes the purpose of each sheet in the workbook.
Rational Calcs	Performs Rational Method calculations, Q = CIA
Weighted C	Supporting tool to calculate area-weighted runoff coefficients from sub-areas.
Weighted Slope	Supporting tool to calculate length-weighted slope from multiple flow reaches.
Weighted Tc	Supporting tool to calculate reach-weighted time of concentration from multiple flow reaches.
Design Info	Provides background information from the USDCM

Acknowledgements: *Spreadsheet Development Team:*
Derek N. Rapp, P.E.
Peak Stormwater Engineering, LLC
Holly Piza, P.E. and Ken MacKenzie, P.E.
Urban Drainage and Flood Control District

Comments? Direct all comments regarding this spreadsheet workbook to: UDFCD email
Revisions? Check for revised versions of this or any other workbook at: Downloads

Calculation of Peak Runoff using Rational Method

Designer: G. Davis
Company: LT Environmental, Inc.
Date: 12/30/2019
Project: Hilcorp Landfarm
Location: San Juan Basin: Tank Mountain

Version 2.00 released May 2017

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Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

$$\text{Computed } t_c = t_i + t_t$$

$$\text{Regional } t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

$t_{minimum}$ = 5 (urban)
$t_{minimum}$ = 10 (non-urban)

$$\text{Selected } t_c = \max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$$

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	1.41	1.76	2.05	2.45	2.76	3.08	3.88

	a	b	c
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C: 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
H1	18.00	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59
				0.01	0.05	0.15	0.33	0.40	0.49	0.59
H2	13.40	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59
				0.01	0.05	0.15	0.33	0.40	0.49	0.59
H3	18.50	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59
				0.01	0.05	0.15	0.33	0.40	0.49	0.59
H4	11.00	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59
	60.90									

Subcatchment Name	Overland (Initial) Flow Time: Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized (Travel) Flow Time: Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)
H1	170.00			0.006	29.42	1450.00			0.070	8	2.11	11.45
					29.42							
H2	500.00			0.018	34.87	1484.00			0.084	8	2.32	10.65
					34.87							
H3	223.00			0.002	46.99	2076.00			0.076	8	2.20	15.73
					46.99							
H4	500.00			0.088	20.66	1182.00			0.039	8	1.58	12.48

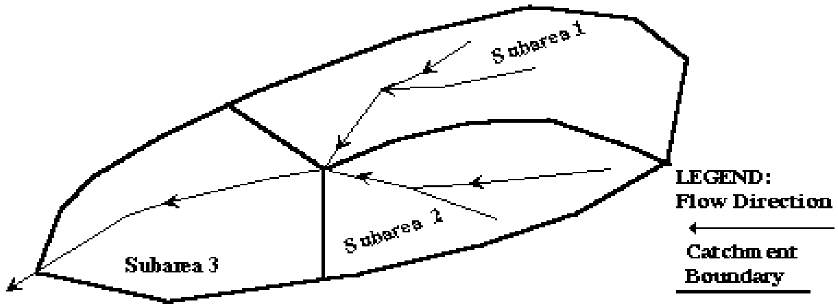
Subcatchment Name	Time of Concentration: Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	Rainfall Intensity, I (in/hr): 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
H1	40.86	35.53	35.53	2.00	2.49	2.91	3.47	3.91	4.37	5.50
	40.86									
H2	45.53	34.84	34.84	2.02	2.52	2.94	3.51	3.96	4.42	5.56
	45.53									
H3	62.72	39.22	39.22	1.88	2.35	2.73	3.27	3.68	4.11	5.17
	62.72									
H4	33.14	36.42	33.14	2.08	2.60	3.03	3.62	4.08	4.55	5.74

Subcatchment Name	Peak Flow, Q (cfs): 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
H1	0.37	2.30	7.67	20.64	28.37	38.67	58.82
	0.37	2.30	7.67	20.64	28.37	38.67	58.82
H2	0.28	1.74	5.78	15.55	21.37	29.13	44.32
	0.28	1.74	5.78	15.55	21.37	29.13	44.32
H3	0.36	2.23	7.42	19.95	27.42	37.38	56.86
	0.36	2.23	7.42	19.95	27.42	37.38	56.86
H4	0.24	1.47	4.89	13.16	18.08	24.65	37.50

Area-Weighted Runoff Coefficient Calculations

Version 2.00 released May 2017

Designer: G. Davis
Company: LT Environmental, Inc.
Date: 12/30/2019
Project: Hilcorp Landfarm
Location: San Juan Basin: Tank Mountain



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Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

Subcatchment Name
H1

See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
H1-A	17.89	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59
H1-B	0.11	C	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59
Total Area (ac)	18.00		Area-Weighted C	0.01	0.05	0.15	0.33	0.40	0.49	0.59
			Area-Weighted Override C	0.01	0.05	0.15	0.33	0.40	0.49	0.59

Area-Weighted Runoff Coefficient Calculations

Version 2.00 released May 2017

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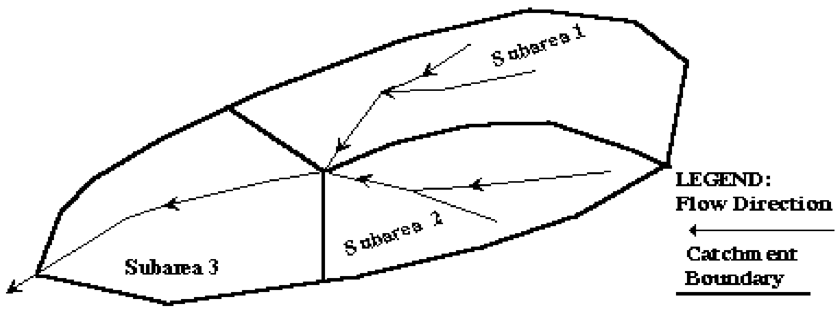

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Subcatchment Name
H2

See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
H1-A	12.17	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59
H1-B	1.23	C	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59
Total Area (ac)	**13.40**		**Area-Weighted C**	**0.01**	**0.05**	**0.15**	**0.33**	**0.40**	**0.49**	**0.59**
			Area-Weighted Override C	**0.01**	**0.05**	**0.15**	**0.33**	**0.40**	**0.49**	**0.59**

Area-Weighted Runoff Coefficient Calculations

Version 2.00 released May 2017

Designer: G. Davis
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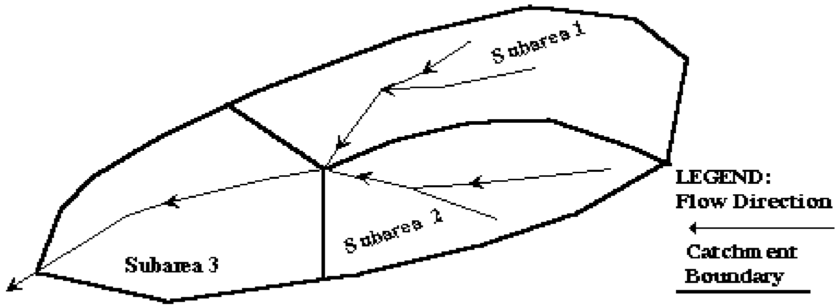

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Subcatchment Name
H3

See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
H1-A	16.58	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59
H1-B	2.22	C	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59
Total Area (ac)	18.80		Area-Weighted C	0.01	0.05	0.15	0.33	0.40	0.49	0.59
			Area-Weighted Override C	0.01	0.05	0.15	0.33	0.40	0.49	0.59

Supplementary Design Information for UD-Rational Workbook

Urban Storm Drainage Criteria Manual (USDCM) Volume 1, Chapter 6 - Runoff (March 2017)
Version 2.00 released May 2017

Table 6-1. Applicability of hydrologic methods

Watershed Size (acres)	Is the Rational Method Applicable?	Is CUHP Applicable?
0 to 90	Yes	Yes
90 to 160	No	Yes
160 to 3,000	No	Yes[1]
Greater than 3,000	No	Yes (subdividing into smaller catchments required)[1]

1. Subdividing into smaller subcatchments and routing the resultant hydrographs using SWMM may be needed to accurately model a catchment with areas of different soil types or percentages of imperviousness.

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

The general procedure for Rational Method calculations for a single catchment is as follows:

1. Delineate the catchment boundary and determine its area.
2. Define the flow path from the upper-most portion of the catchment to the design point. Divide the flow path into reaches of similar flow type (e.g., overland flow, shallow swale flow, gutter flow, etc.). Determine the length and slope of each reach.
3. Determine the time of concentration, t_c, for the selected waterway.
4. Find the rainfall intensity, I, for the design storm using the calculated t_c and the rainfall intensity-duration-frequency curve (see *Rainfall* chapter).
5. Determine the runoff coefficient, C.
6. Calculate the peak flow rate, Q, from the catchment using Equation 6-1.

The basic assumptions for the application of the Rational Method include:

1. The computed maximum rate of runoff to the design point is a function of the average rainfall rate during the time of concentration to that point.
2. The hydrologic losses in the catchment are homogeneous and uniform. The runoff coefficients vary with respect to type of soils, imperviousness percentage, and rainfall frequencies. These coefficients represent the average antecedent soil moisture condition.
3. The depth of rainfall used is one that occurs from the start of the storm to the time of concentration. The design rainfall depth during that period is converted to the average rainfall intensity for that period.
4. The maximum runoff rate occurs when the entire area is contributing flow. This assumption is not valid where a more intensely developed portion of the catchment with a shorter time of concentration produces a higher rate of runoff than the entire catchment with a longer time of concentration.

Table 6-3. Recommended percentage imperviousness values

Land Use or Surface Characteristics	Percentage Imperviousness (%)
Business:	
Downtown Areas	95
Suburban Areas	75
Residential lots (lot area only):	
Single-family	
2.5 acres or larger	12
0.75 – 2.5 acres	20
0.25 – 0.75 acres	30
0.25 acres or less	45
Apartments	75
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	10
Playgrounds	25
Schools	55
Railroad yard areas	50
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A = 0.84i^{1.302}$	$C_A = 0.86i^{1.276}$	$C_A = 0.87i^{1.232}$	$C_A = 0.84i^{1.124}$	$C_A = 0.85i+0.025$	$C_A = 0.78i+0.110$	$C_A = 0.65i+0.254$
B	$C_B = 0.84i^{1.169}$	$C_B = 0.86i^{1.088}$	$C_B = 0.81i+0.057$	$C_B = 0.63i+0.249$	$C_B = 0.56i+0.328$	$C_B = 0.47i+0.426$	$C_B = 0.37i+0.536$
C/D	$C_{C/D} = 0.83i^{1.122}$	$C_{C/D} = 0.82i+0.035$	$C_{C/D} = 0.74i+0.132$	$C_{C/D} = 0.56i+0.319$	$C_{C/D} = 0.49i+0.393$	$C_{C/D} = 0.41i+0.484$	$C_{C/D} = 0.32i+0.588$

Where:

i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

Supplementary Design Information for UD-Rational Workbook

Urban Storm Drainage Criteria Manual (USDCM) Volume 1, Chapter 6 - Runoff (March 2017)
Version 2.00 released May 2017

Table 6-5. Runoff coefficients, *c*

Total or Effective % Impervious	NRCS Hydrologic Soil Group A						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.01	0.01	0.01	0.04	0.13	0.27
5%	0.02	0.02	0.02	0.03	0.07	0.15	0.29
10%	0.04	0.05	0.05	0.07	0.11	0.19	0.32
15%	0.07	0.08	0.08	0.1	0.15	0.23	0.35
20%	0.1	0.11	0.12	0.14	0.2	0.27	0.38
25%	0.14	0.15	0.16	0.19	0.24	0.3	0.42
30%	0.18	0.19	0.2	0.23	0.28	0.34	0.45
35%	0.21	0.23	0.24	0.27	0.32	0.38	0.48
40%	0.25	0.27	0.28	0.32	0.37	0.42	0.51
45%	0.3	0.31	0.33	0.36	0.41	0.46	0.54
50%	0.34	0.36	0.37	0.41	0.45	0.5	0.58
55%	0.39	0.4	0.42	0.45	0.49	0.54	0.61
60%	0.43	0.45	0.47	0.5	0.54	0.58	0.64
65%	0.48	0.5	0.51	0.54	0.58	0.62	0.67
70%	0.53	0.55	0.56	0.59	0.62	0.65	0.71
75%	0.58	0.6	0.61	0.64	0.66	0.69	0.74
80%	0.63	0.65	0.66	0.69	0.71	0.73	0.77
85%	0.68	0.7	0.71	0.74	0.75	0.77	0.8
90%	0.73	0.75	0.77	0.79	0.79	0.81	0.84
95%	0.79	0.81	0.82	0.83	0.84	0.85	0.87
100%	0.84	0.86	0.87	0.88	0.88	0.89	0.9
Total or Effective % Impervious	NRCS Hydrologic Soil Group B						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.01	0.07	0.26	0.34	0.44	0.54
5%	0.03	0.03	0.1	0.28	0.36	0.45	0.55
10%	0.06	0.07	0.14	0.31	0.38	0.47	0.57
15%	0.09	0.11	0.18	0.34	0.41	0.5	0.59
20%	0.13	0.15	0.22	0.38	0.44	0.52	0.61
25%	0.17	0.19	0.26	0.41	0.47	0.54	0.63
30%	0.2	0.23	0.3	0.44	0.49	0.57	0.65
35%	0.24	0.27	0.34	0.47	0.52	0.59	0.66
40%	0.29	0.32	0.38	0.5	0.55	0.61	0.68
45%	0.33	0.36	0.42	0.53	0.58	0.64	0.7
50%	0.37	0.4	0.46	0.56	0.61	0.66	0.72
55%	0.42	0.45	0.5	0.6	0.63	0.68	0.74
60%	0.46	0.49	0.54	0.63	0.66	0.71	0.76
65%	0.5	0.54	0.58	0.66	0.69	0.73	0.77
70%	0.55	0.58	0.62	0.69	0.72	0.75	0.79
75%	0.6	0.63	0.66	0.72	0.75	0.78	0.81
80%	0.64	0.67	0.7	0.75	0.77	0.8	0.83
85%	0.69	0.72	0.74	0.78	0.8	0.82	0.85
90%	0.74	0.76	0.78	0.81	0.83	0.84	0.87
95%	0.79	0.81	0.82	0.85	0.86	0.87	0.88
100%	0.84	0.86	0.86	0.88	0.89	0.89	0.9
Total or Effective % Impervious	NRCS Hydrologic Soil Group C						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.05	0.15	0.33	0.40	0.49	0.59
5%	0.03	0.08	0.17	0.35	0.42	0.5	0.6
10%	0.06	0.12	0.21	0.37	0.44	0.52	0.62
15%	0.1	0.16	0.24	0.4	0.47	0.55	0.64
20%	0.14	0.2	0.28	0.43	0.49	0.57	0.65
25%	0.18	0.24	0.32	0.46	0.52	0.59	0.67
30%	0.22	0.28	0.35	0.49	0.54	0.61	0.68
35%	0.26	0.32	0.39	0.51	0.57	0.63	0.7
40%	0.3	0.36	0.43	0.54	0.59	0.65	0.71
45%	0.34	0.4	0.46	0.57	0.62	0.67	0.73
50%	0.38	0.44	0.5	0.6	0.64	0.69	0.75
55%	0.43	0.48	0.54	0.63	0.66	0.71	0.76
60%	0.47	0.52	0.57	0.65	0.69	0.73	0.78
65%	0.51	0.56	0.61	0.68	0.71	0.75	0.79
70%	0.56	0.61	0.65	0.71	0.74	0.77	0.81
75%	0.6	0.65	0.68	0.74	0.76	0.79	0.82
80%	0.65	0.69	0.72	0.77	0.79	0.81	0.84
85%	0.7	0.73	0.76	0.79	0.81	0.83	0.86
90%	0.74	0.77	0.79	0.82	0.84	0.85	0.87
95%	0.79	0.81	0.83	0.85	0.86	0.87	0.89
100%	0.83	0.85	0.87	0.88	0.89	0.89	0.9

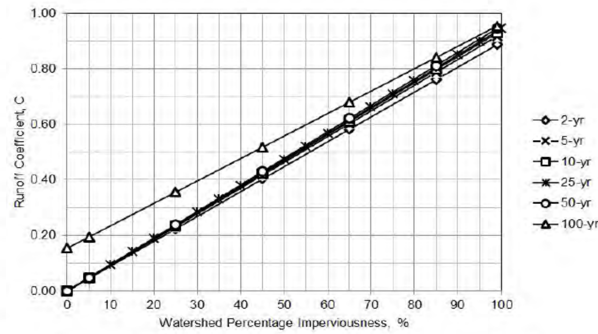


Figure 6-1. Runoff coefficient vs. watershed imperviousness NRCS HSG A

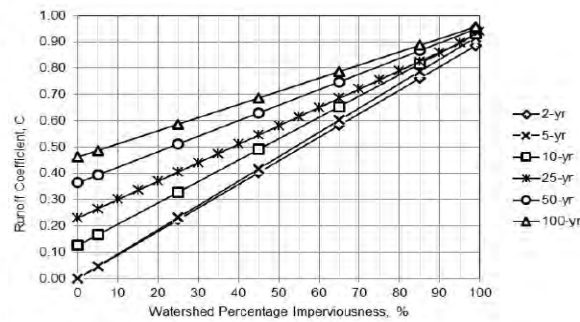


Figure 6-2. Runoff coefficient vs. watershed imperviousness NRCS HSG B

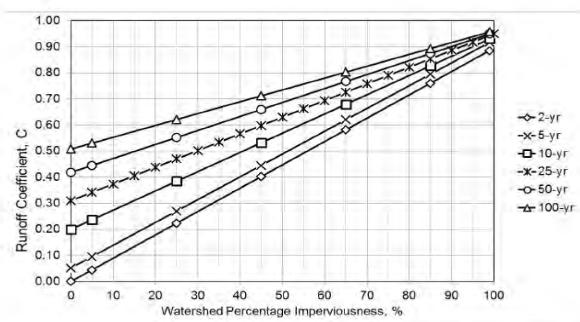


Figure 6-3. Runoff coefficient vs. watershed imperviousness NRCS HSG C and D

ATTACHMENT 4: RATIONAL METHOD PEAK RUN-OFF PREDICTION: PROPOSED DRAINAGE

PEAK RUNOFF PREDICTION BY THE RATIONAL METHOD

Version 2.00 released May 2017
Urban Drainage and Flood Control District
Denver, Colorado

Purpose: This workbook applies the Rational Method to estimate stormwater runoff and peak flows from small urban catchments (typically less than 90 acres)

Function:

1. To calculate the runoff coefficient, C for a catchment
2. To calculate the time of concentration, and then compare with the regional time of concentration limit used for the Denver region. The smaller one is recommended as the rainfall duration for use with the Rational Method.
3. To calculate the design rainfall intensity and resulting peak flow rate.

Content: The workbook consists of the following five sheets:

Intro	Describes the purpose of each sheet in the workbook.
Rational Calcs	Performs Rational Method calculations, Q = CIA
Weighted C	Supporting tool to calculate area-weighted runoff coefficients from sub-areas.
Weighted Slope	Supporting tool to calculate length-weighted slope from multiple flow reaches.
Weighted Tc	Supporting tool to calculate reach-weighted time of concentration from multiple flow reaches.
Design Info	Provides background information from the USDCM

Acknowledgements: ***Spreadsheet Development Team:***
Derek N. Rapp, P.E.
Peak Stormwater Engineering, LLC
Holly Piza, P.E. and Ken MacKenzie, P.E.
Urban Drainage and Flood Control District

Comments? Direct all comments regarding this spreadsheet workbook to: UDFCD email
Revisions? Check for revised versions of this or any other workbook at: Downloads

Calculation of Peak Runoff using Rational Method

Designer: G. Davis
Company: LT Environmental, Inc.
Date: 5/5/2020
Project: Hilcorp Landfarm
Location: San Juan Basin: Tank Mountain

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

$$\text{Computed } t_c = t_i + t_t$$

$$\text{Regional } t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

$t_{minimum}$ = 5 (urban)
$t_{minimum}$ = 10 (non-urban)

$$\text{Selected } t_c = \max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$$

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	1.41	1.76	2.05	2.45	2.76	3.08	3.88

	a	b	c
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

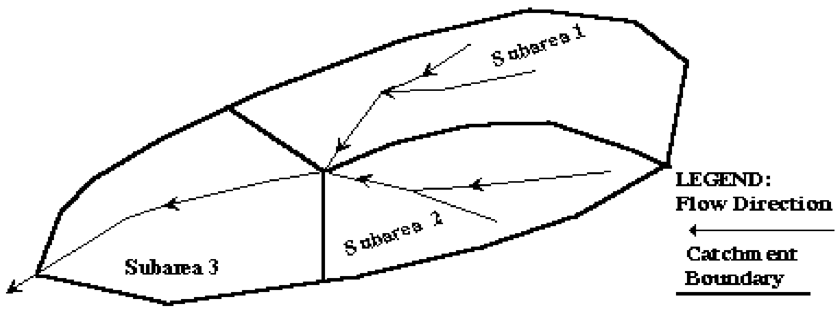
Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C: 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland (Initial) Flow Time: Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized (Travel) Flow Time: Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)
Subcatchment A - SW of Pad	2.61	D	9.5	0.06	0.11	0.20	0.37	0.44	0.52	0.62	500.00			0.058	22.32	576.00			0.065	7	1.78	5.39
Subcatchment B - S of Pad	5.68	D	3.1	0.02	0.06	0.15	0.34	0.41	0.50	0.60	500.00			0.054	24.06	326.00			0.055	7	1.64	3.30
Subcatchment C - SE of Pad	7.52	D	3.5	0.02	0.06	0.16	0.34	0.41	0.50	0.60	239.00			0.004	38.58	1211.00			0.079	7	1.97	10.24
Subcatchment D - North of Pad	3.88	D	6.2	0.04	0.09	0.18	0.35	0.42	0.51	0.61	401.00			0.052	21.24	666.00			0.053	7	1.60	6.92
				0.07	0.13	0.21	0.38	0.45	0.53	0.62					20.41							
Subcatchment E - East of Pad	6.47	D	7.0	0.04	0.09	0.18	0.36	0.43	0.51	0.61	285.00			0.056	17.39	714.00			0.063	7	1.76	6.77
				0.03	0.07	0.17	0.34	0.42	0.50	0.60					17.73							
Subcatchment F - North Access Road	11.10	D	6.5	0.04	0.09	0.18	0.36	0.43	0.51	0.61	500.00			0.096	19.37	1213.00			0.035	7	1.30	15.53
Pad	23.64	D	27.9	0.20	0.26	0.34	0.48	0.53	0.60	0.68	67.00			0.060	6.87	241.00			0.048	10	2.18	1.84

Subcatchment Name	Time of Concentration: Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	Rainfall Intensity, I (in/hr): 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Peak Flow, Q (cfs): 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Subcatchment A - SW of Pad	27.71	28.04	27.71	2.32	2.89	3.37	4.03	4.54	5.06	6.38	0.36	0.85	1.77	3.91	5.21	6.91	10.28
Subcatchment B - S of Pad	27.36	27.92	27.36	2.33	2.91	3.39	4.06	4.57	5.10	6.42	0.22	1.00	2.98	7.75	10.60	14.38	21.81
Subcatchment C - SE of Pad	48.82	32.96	32.96	2.09	2.61	3.04	3.63	4.09	4.57	5.76	0.31	1.25	3.61	9.25	12.63	17.12	25.93
Subcatchment D - North of Pad	28.16	29.85	28.16	2.30	2.87	3.34	3.99	4.49	5.01	6.32	0.33	0.95	2.30	5.48	7.39	9.91	14.89
	27.33										0.65	1.40	2.77	5.90	7.81	10.30	15.27
Subcatchment E - East of Pad	24.16	29.56	24.16	2.50	3.13	3.64	4.35	4.90	5.47	6.89	0.68	1.86	4.32	10.08	13.56	18.14	27.20
	24.50										0.43	1.47	3.91	9.71	13.19	17.80	26.86
Subcatchment F - North Access Road	34.90	35.86	34.90	2.02	2.52	2.94	3.51	3.95	4.41	5.56	0.87	2.46	5.86	13.85	18.66	25.01	37.55
Pad	8.70	22.69	8.70	4.02	5.02	5.85	6.99	7.87	8.78	11.06	18.91	31.11	46.56	78.47	98.75	124.17	176.77

Area-Weighted Runoff Coefficient Calculations

Version 2.00 released May 2017

Designer: G. Davis
Company: LT Environmental, Inc.
Date: 5/5/2020
Project: Hilcorp Landfarm
Location: San Juan Basin: Tank Mountain



Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

Subcatchment Name
Subcatchment E - East of Pad

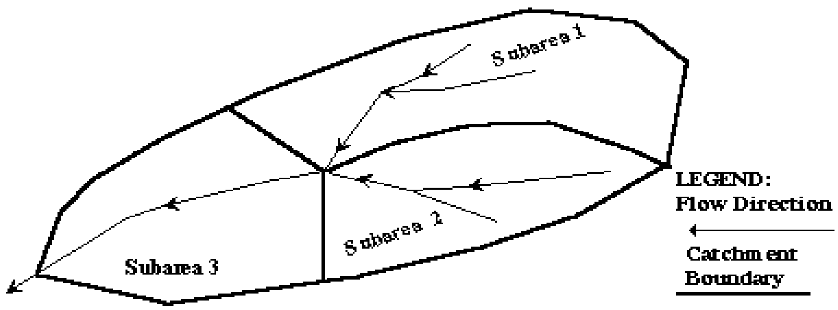
See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
E1	2.12	C	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59
E2	4.35	D	5.9	0.03	0.08	0.18	0.35	0.42	0.51	0.61
Total Area (ac)	6.47		Area-Weighted C	0.03	0.07	0.17	0.34	0.42	0.50	0.60
			Area-Weighted Override C	0.03	0.07	0.17	0.34	0.42	0.50	0.60

Area-Weighted Runoff Coefficient Calculations

Version 2.00 released May 2017

Designer: G. Davis
Company: LT Environmental, Inc.
Date: 5/5/2020
Project: Hilcorp Landfarm
Location: San Juan Basin: Tank Mountain



Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

Subcatchment Name
Subcatchment D - North of Pad

See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
N1	1.16	C	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59
N2	2.72	D	15.0	0.10	0.16	0.24	0.40	0.47	0.55	0.64
Total Area (ac)	**3.88**		**Area-Weighted C**	**0.07**	**0.13**	**0.21**	**0.38**	**0.45**	**0.53**	**0.62**
			Area-Weighted Override C	**0.07**	**0.13**	**0.21**	**0.38**	**0.45**	**0.53**	**0.62**

Supplementary Design Information for UD-Rational Workbook

Urban Storm Drainage Criteria Manual (USDCM) Volume 1, Chapter 6 - Runoff (March 2017)
Version 2.00 released May 2017

Table 6-1. Applicability of hydrologic methods

Watershed Size (acres)	Is the Rational Method Applicable?	Is CUHP Applicable?
0 to 90	Yes	Yes
90 to 160	No	Yes
160 to 3,000	No	Yes[1]
Greater than 3,000	No	Yes (subdividing into smaller catchments required)[1]

1. Subdividing into smaller subcatchments and routing the resultant hydrographs using SWMM may be needed to accurately model a catchment with areas of different soil types or percentages of imperviousness.

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

The general procedure for Rational Method calculations for a single catchment is as follows:

1. Delineate the catchment boundary and determine its area.
2. Define the flow path from the upper-most portion of the catchment to the design point. Divide the flow path into reaches of similar flow type (e.g., overland flow, shallow swale flow, gutter flow, etc.). Determine the length and slope of each reach.
3. Determine the time of concentration, t_c, for the selected waterway.
4. Find the rainfall intensity, I, for the design storm using the calculated t_c and the rainfall intensity-duration-frequency curve (see *Rainfall* chapter).
5. Determine the runoff coefficient, C.
6. Calculate the peak flow rate, Q, from the catchment using Equation 6-1.

The basic assumptions for the application of the Rational Method include:

1. The computed maximum rate of runoff to the design point is a function of the average rainfall rate during the time of concentration to that point.
2. The hydrologic losses in the catchment are homogeneous and uniform. The runoff coefficients vary with respect to type of soils, imperviousness percentage, and rainfall frequencies. These coefficients represent the average antecedent soil moisture condition.
3. The depth of rainfall used is one that occurs from the start of the storm to the time of concentration. The design rainfall depth during that period is converted to the average rainfall intensity for that period.
4. The maximum runoff rate occurs when the entire area is contributing flow. This assumption is not valid where a more intensely developed portion of the catchment with a shorter time of concentration produces a higher rate of runoff than the entire catchment with a longer time of concentration.

Table 6-3. Recommended percentage imperviousness values

Land Use or Surface Characteristics	Percentage Imperviousness (%)
Business:	
Downtown Areas	95
Suburban Areas	75
Residential lots (lot area only):	
Single-family	
2.5 acres or larger	12
0.75 – 2.5 acres	20
0.25 – 0.75 acres	30
0.25 acres or less	45
Apartments	75
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	10
Playgrounds	25
Schools	55
Railroad yard areas	50
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A = 0.84i^{1.302}$	$C_A = 0.86i^{1.276}$	$C_A = 0.87i^{1.232}$	$C_A = 0.84i^{1.124}$	$C_A = 0.85i+0.025$	$C_A = 0.78i+0.110$	$C_A = 0.65i+0.254$
B	$C_B = 0.84i^{1.169}$	$C_B = 0.86i^{1.088}$	$C_B = 0.81i+0.057$	$C_B = 0.63i+0.249$	$C_B = 0.56i+0.328$	$C_B = 0.47i+0.426$	$C_B = 0.37i+0.536$
C/D	$C_{C/D} = 0.83i^{1.122}$	$C_{C/D} = 0.82i+0.035$	$C_{C/D} = 0.74i+0.132$	$C_{C/D} = 0.56i+0.319$	$C_{C/D} = 0.49i+0.393$	$C_{C/D} = 0.41i+0.484$	$C_{C/D} = 0.32i+0.588$

Where:

i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

Supplementary Design Information for UD-Rational Workbook

Urban Storm Drainage Criteria Manual (USDCM) Volume 1, Chapter 6 - Runoff (March 2017)
Version 2.00 released May 2017

Table 6-5. Runoff coefficients, *c*

Total or Effective	NRCS Hydrologic Soil Group A						
% Impervious	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.01	0.01	0.01	0.04	0.13	0.27
5%	0.02	0.02	0.02	0.03	0.07	0.15	0.29
10%	0.04	0.05	0.05	0.07	0.11	0.19	0.32
15%	0.07	0.08	0.08	0.1	0.15	0.23	0.35
20%	0.1	0.11	0.12	0.14	0.2	0.27	0.38
25%	0.14	0.15	0.16	0.19	0.24	0.3	0.42
30%	0.18	0.19	0.2	0.23	0.28	0.34	0.45
35%	0.21	0.23	0.24	0.27	0.32	0.38	0.48
40%	0.25	0.27	0.28	0.32	0.37	0.42	0.51
45%	0.3	0.31	0.33	0.36	0.41	0.46	0.54
50%	0.34	0.36	0.37	0.41	0.45	0.5	0.58
55%	0.39	0.4	0.42	0.45	0.49	0.54	0.61
60%	0.43	0.45	0.47	0.5	0.54	0.58	0.64
65%	0.48	0.5	0.51	0.54	0.58	0.62	0.67
70%	0.53	0.55	0.56	0.59	0.62	0.65	0.71
75%	0.58	0.6	0.61	0.64	0.66	0.69	0.74
80%	0.63	0.65	0.66	0.69	0.71	0.73	0.77
85%	0.68	0.7	0.71	0.74	0.75	0.77	0.8
90%	0.73	0.75	0.77	0.79	0.79	0.81	0.84
95%	0.79	0.81	0.82	0.83	0.84	0.85	0.87
100%	0.84	0.86	0.87	0.88	0.88	0.89	0.9
Total or Effective	NRCS Hydrologic Soil Group B						
% Impervious	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.01	0.07	0.26	0.34	0.44	0.54
5%	0.03	0.03	0.1	0.28	0.36	0.45	0.55
10%	0.06	0.07	0.14	0.31	0.38	0.47	0.57
15%	0.09	0.11	0.18	0.34	0.41	0.5	0.59
20%	0.13	0.15	0.22	0.38	0.44	0.52	0.61
25%	0.17	0.19	0.26	0.41	0.47	0.54	0.63
30%	0.2	0.23	0.3	0.44	0.49	0.57	0.65
35%	0.24	0.27	0.34	0.47	0.52	0.59	0.66
40%	0.29	0.32	0.38	0.5	0.55	0.61	0.68
45%	0.33	0.36	0.42	0.53	0.58	0.64	0.7
50%	0.37	0.4	0.46	0.56	0.61	0.66	0.72
55%	0.42	0.45	0.5	0.6	0.63	0.68	0.74
60%	0.46	0.49	0.54	0.63	0.66	0.71	0.76
65%	0.5	0.54	0.58	0.66	0.69	0.73	0.77
70%	0.55	0.58	0.62	0.69	0.72	0.75	0.79
75%	0.6	0.63	0.66	0.72	0.75	0.78	0.81
80%	0.64	0.67	0.7	0.75	0.77	0.8	0.83
85%	0.69	0.72	0.74	0.78	0.8	0.82	0.85
90%	0.74	0.76	0.78	0.81	0.83	0.84	0.87
95%	0.79	0.81	0.82	0.85	0.86	0.87	0.88
100%	0.84	0.86	0.86	0.88	0.89	0.89	0.9
Total or Effective	NRCS Hydrologic Soil Group C						
% Impervious	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.05	0.15	0.33	0.40	0.49	0.59
5%	0.03	0.08	0.17	0.35	0.42	0.5	0.6
10%	0.06	0.12	0.21	0.37	0.44	0.52	0.62
15%	0.1	0.16	0.24	0.4	0.47	0.55	0.64
20%	0.14	0.2	0.28	0.43	0.49	0.57	0.65
25%	0.18	0.24	0.32	0.46	0.52	0.59	0.67
30%	0.22	0.28	0.35	0.49	0.54	0.61	0.68
35%	0.26	0.32	0.39	0.51	0.57	0.63	0.7
40%	0.3	0.36	0.43	0.54	0.59	0.65	0.71
45%	0.34	0.4	0.46	0.57	0.62	0.67	0.73
50%	0.38	0.44	0.5	0.6	0.64	0.69	0.75
55%	0.43	0.48	0.54	0.63	0.66	0.71	0.76
60%	0.47	0.52	0.57	0.65	0.69	0.73	0.78
65%	0.51	0.56	0.61	0.68	0.71	0.75	0.79
70%	0.56	0.61	0.65	0.71	0.74	0.77	0.81
75%	0.6	0.65	0.68	0.74	0.76	0.79	0.82
80%	0.65	0.69	0.72	0.77	0.79	0.81	0.84
85%	0.7	0.73	0.76	0.79	0.81	0.83	0.86
90%	0.74	0.77	0.79	0.82	0.84	0.85	0.87
95%	0.79	0.81	0.83	0.85	0.86	0.87	0.89
100%	0.83	0.85	0.87	0.88	0.89	0.89	0.9

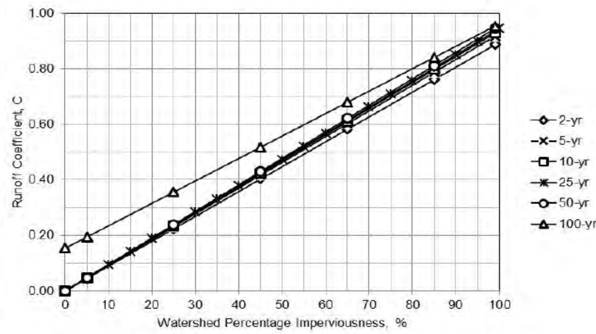


Figure 6-1. Runoff coefficient vs. watershed imperviousness NRCS HSG A

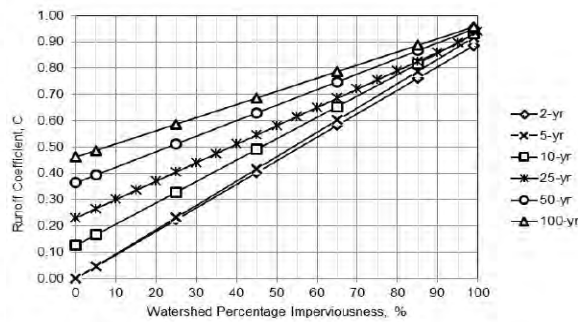


Figure 6-2. Runoff coefficient vs. watershed imperviousness NRCS HSG B

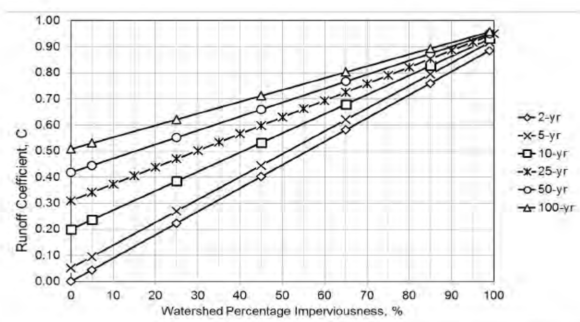


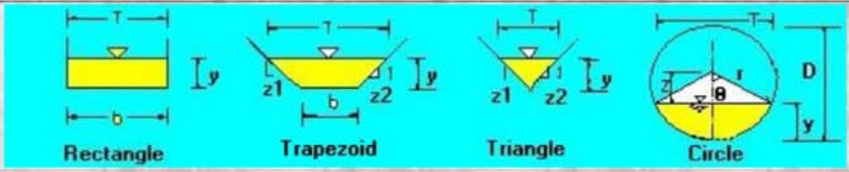
Figure 6-3. Runoff coefficient vs. watershed imperviousness NRCS HSG C and D

ATTACHMENT 5: HYDRAULIC CALCULATIONS: DITCHES

Ditch 1: Open Channel Flow Calculator used to account for TRM/armored channel with 2" Riprap (n=0.03)

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q

Select unit system: Feet(ft)

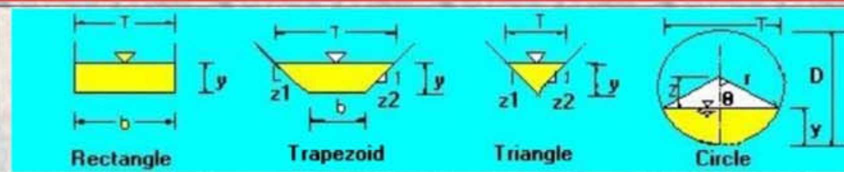
Channel slope: 0.014 ft/ft	Water depth(y): 0.4 ft	Bottom width(b) 5 ft
Flow velocity 2.602715 ft/s	LeftSlope (Z1): 6 to 1 (H:	RightSlope (Z2): 6 to 1 (H:\
Flow discharge 7.75 ft^3/s	Input n value 0.03 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 9.89 ft	Flow area 2.98 ft^2	Top width(T) 9.82 ft
Specific energy 0.51 ft	Froude number 0.83	Flow status Subcritical flow
Critical depth 0.36 ft	Critical slope 0.0201 ft/ft	Velocity head 0.11 ft

Received by OCD: 11/25/2020 2:17:22 PM

Ditch 2: Open Channel Flow Calculator used to account for TRM/armored channel with 2" Riprap (n=0.03)

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q

Select unit system: Feet(ft)

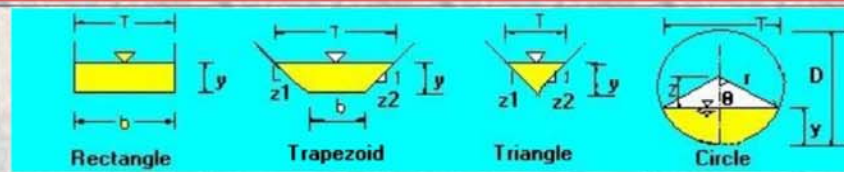
Channel slope:	0.05	ft/ft	Water depth(y):	0.24	ft	Bottom width(b)	10	ft
Flow velocity	3.822637	ft/s	LeftSlope (Z1):	10	to 1 (H:	RightSlope (Z2):	10	to 1 (H:\
Flow discharge	11.66	ft^3/s	Input n value	0.03	or select r			
Calculate!			Status:	Calculation finished		Reset		
Wetted perimeter	14.92	ft	Flow area	3.05	ft^2	Top width(T)	14.9	ft
Specific energy	0.47	ft	Froude number	1.49		Flow status	Supercritical flow	
Critical depth	0.31	ft	Critical slope	0.0204	ft/ft	Velocity head	0.23	ft

Received by OCD: 11/25/2020 2:17:22 PM

Ditch 3: Open Channel Flow Calculator used to account for TRM/armored channel with 2" Riprap (n=0.03)

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q

Select unit system: Feet(ft)

Channel slope: 0.074 ft/ft	Water depth(y): 0.12 ft	Bottom width(b) 25 ft
Flow velocity 3.088152 ft/s	LeftSlope (Z1): 4 to 1 (H:	RightSlope (Z2): 4 to 1 (H:\
Flow discharge 9.25 ft^3/s	Input n value 0.03 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 25.97 ft	Flow area 3 ft^2	Top width(T) 25.94 ft
Specific energy 0.27 ft	Froude number 1.6	Flow status Supercritical flow
Critical depth 0.16 ft	Critical slope 0.0238 ft/ft	Velocity head 0.15 ft

ATTACHMENT 6: HYDRAULIC CALCULATION: CULVERT

Version 3.05, Released November 2017 (click here to check for newer version)

Urban Drainage and Flood Control District
Denver, Colorado

Purpose:	**This workbook aids in analyzing the flow conditions in circular and box culverts, and calculates the vertical profile along the culvert.**
Function:	**1. To calculate normal and critical flow conditions in a circular pipe.**
	2. To calculate normal and critical flow conditions in a box culvert.
	3. To determine headwater depth for a culvert by comparing inlet vs. outlet control.
	5. To Determine the vertical profile along the culvert.
Content:	**The workbook consists of the following five sheets (excluding this sheet):**
Pipe	Calculates normal and critical flow conditions in a circular pipe.
Box	Calculates normal and critical flow condtions in a box culvert.
Culvert Rating	Determines the headwater for a circular or rectangular culvert.
HW & Outlet Protection	Determines the headwater and required outlet protection sizes.
Profile	Determines the vertical profile of the culvert and soil cover.
Design Info	Provides backup data, including values of Manning's n for culvert design.

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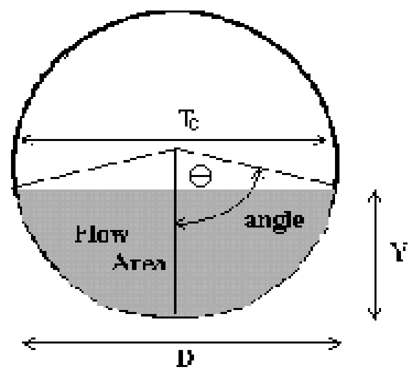
University of Colorado at Denver
Ken A. MacKenzie, P.E.
Urban Drainage and Flood Control District
Jason S. Stawski, E.I.
Urban Drainage and Flood Control District

Comments? Direct all comments regarding this spreadsheet workbook to: UDFCD E-Mail
Revisions? Check for revised versions of this or any other workbook at: Downloads

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

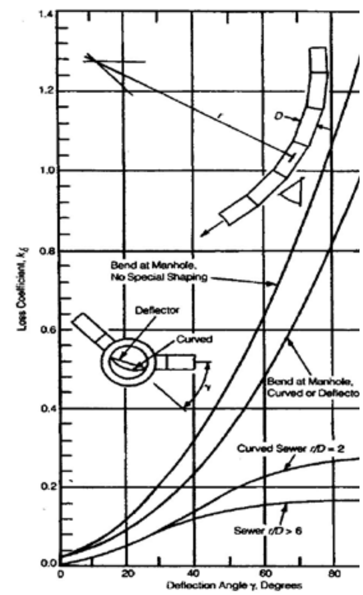
Project: **Hilcorp Landfarm: San Juan Basin**
Pipe ID: **Tank Mountain: Culvert 1**



Design Information (Input)			
Pipe Invert Slope	So =	0.0159	ft/ft
Pipe Manning's n-value	n =	0.0120	
Pipe Diameter	D =	16.00	inches
Design discharge	**Q =**	**7.75**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.40	sq ft
Full-flow wetted perimeter	Pf =	4.19	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	10.51	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.85	radians
Flow area	An =	0.94	sq ft
Top width	Tn =	1.28	ft
Wetted perimeter	Pn =	2.47	ft
Flow depth	Yn =	0.85	ft
Flow velocity	Vn =	8.23	fps
Discharge	Qn =	7.75	cfs
Percent Full Flow	Flow =	73.7%	of full flow
Normal Depth Froude Number	Fr_n =	1.69	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.28	radians
Critical flow area	Ac =	1.23	sq ft
Critical top width	Tc =	1.01	ft
Critical flow depth	Yc =	1.10	ft
Critical flow velocity	Vc =	6.28	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR (SHAPE = 1) SUMMARY OF SHAPES, MATERIALS, SIZES, & "n"

Matl CODE	SPANS (in.)	NO. OF CULVERTS	DEFAULT CORRUG.	DEF. "n"	ENTRANCE (ITYPE)	INLET EDGE (CI)	EQUATION NUMBER-IC	HDS 5 CHT#-SCALE
1-RCP	8-144	29,p96ac		.012	1-Conv	1-sq. proj.	8 (not used)	
						3-headwall	9	1-1
						4-groove	4	1-3
						5-groove,hd	5	1-2
						6-1:1 bevel	6	3-A
						7-1.5 bev.	7	3-B
2-CSP	12-96	17,p49ai	2.7x.5	.024	1-Conv	1-thin	1	2-3
	54-144	16,p50ai	3x1	.028		2-mitered	2	2-2
	54-144	16,p50ai	5x1	.026		3-headwall	3	2-1
	60-312	43,p58ai	6x2	.035		6-1.1 bevel	6	3-A
						7-1.5 bevel	7	3-B
3-CAP	12-84	16,p39ka	2.7x.5	.024	1-Conv	(Same as CSP)		
	30-120	16,p39ka	3x1	.028				
	48-120	13,p39ka	6x1	.025				
	60-252	33,p39ka	9x2.5	.035				
ALL	See Inlet Control Procedures For Equations				2-Side (Cir)	1-thin	face, side	56-3
						2-square		56-2
						3-bevel		56-1
					3-Side	see box	face, side	58-1/2
					4-slope	see box	face, slope	59-1/2



Values of Kb

ai = AISI, Handbook of Steel Drainage & Highway Construction Products, 1983
ka = Kaiser Aluminum, Hydraulic Design Detail, DP-131, Edition 2, 1984

EQ	EDGE	KE	SR	A	BS	C	DIP	EE	F
1	thin	0.9	0.5	0.187321	0.56771	-0.156544	0.0447052	-0.00343602	8.97E-05
2	mitered	0.7	0	0.107137	0.757789	-0.361462	0.1233932	-0.01606422	7.67E-04
3	headwall	0.5	0.5	0.167433	0.538595	-0.149374	0.0391543	-0.00343974	1.16E-04
4	groove	0.2	0.5	0.108786	0.662381	-0.233801	0.0579585	-0.0055789	2.05E-04
5	grv.hdw.	0.2	0.5	0.114099	0.653562	-0.233615	0.0597723	-0.00616338	2.43E-04
6	1.1-bev.	0.2	0.5	0.063343	0.766512	-0.316097	0.0876701	-0.009836951	4.17E-04
7	1.5-bev.	0.2	0.5	0.08173	0.698353	-0.253683	0.065125	-0.0071975	3.12E-04
8	sq.-proj.	0.2	0.5	0.167287	0.558766	-0.159813	0.0420069	-0.00369252	1.25E-04
9	headwall	0.5	0.5	0.087483	0.706578	-0.253295	0.0667001	-0.00661651	2.51E-04
10	end-sect.	0.4	0.5	0.120659	0.630768	-0.218423	0.0591815	-0.00599169	2.29E-04

EQ #'s: REFERENCE
1-9 : Calculator Design Series (CDS) 3 for TI-59, FHWA, 1980, page 60
1-10: Hydraulic Computer Program (HY) 1, FHWA, 1969, page 18

BOX (SHAPE = 2) SUMMARY OF SHAPES, MATERIALS, SIZES, & "n"

Matl CODE	SPAN RANGE	RISE RANGE	DEF. "n"	ENTRANCE (ITYPE)	INLET EDGE (CI)	EQUATION NUMBER-IC	HDS 5 CHT#-SCALE
1-RCB	4'-15'	4'-20'	.012	1-Conv	1-square	1	10-1
					2-1.5 bev	2	10-3
					3-1.1 bev	3	10-2
					4-30-75sq	4	8-1
					5-90-15sq	1	8-2
					6-0 sq	5	8-3
					7-1.5 bev	6	9-2
					8-bevel	6	9-1
All	See Inlet Control Procedures For Equations			2-Side	1&2-square	face, side	58-1
					3&4-bevel		58-2
				4-Slope	1&2-square	face, slope	59-1
					3&4-bevel		59-2

ac = ACPA, Concrete Pipe Design Manual, February 1985

EQ	EDGE	KE	SR	A	BS	C	DIP	EE	F
1	square	0.5	0.5	0.122117	0.505435	-0.10856	0.0207809	-1.37E-03	3.46E-05
2	1.5-bev.	0.2	0.5	0.0967588	0.4551575	-0.08128951	0.01215577	-6.78E-04	0.0000148
3	1.1-bev.	0.2	0.5	0.1566086	0.3989353	-0.06403921	0.01120135	-0.0006449	1.46E-05
4	sq-30/75	0.4	0.5	0.0724927	0.507087	-0.117474	0.0221702	-1.49E-03	0.000038
5	square	0.7	0.5	0.144133	0.461363	-0.0921507	0.0200028	-1.36E-03	0.0000358
6	bevel	0.2	0.5	0.0895633	0.4412465	-0.07434981	0.01273183	-0.0007588	1.77E-05

EQ #'s: REFERENCE
1-6: Hydraulic Computer Program (HY) 6, FHWA, 1969, subroutine BEQUA
1,4,5: Hydraulic Computer Program (HY) 3, FHWA, 1969, page 16
1,3,4,6: Calculator Design Series (CDS) 3 for TI-59, FHWA, 1980, page 16

Version 3.05, Released November 2017 (click here to check for newer version)

Urban Drainage and Flood Control District
Denver, Colorado

Purpose: This workbook aids in analyzing the flow conditions in circular and box culverts, and calculates the vertical profile along the culvert.

Function:

1. To calculate normal and critical flow conditions in a circular pipe.
2. To calculate normal and critical flow conditions in a box culvert.
3. To determine headwater depth for a culvert by comparing inlet vs. outlet control.
5. To Determine the vertical profile along the culvert.

Content: The workbook consists of the following five sheets (excluding this sheet):

Pipe	Calculates normal and critical flow conditions in a circular pipe.
Box	Calculates normal and critical flow condtions in a box culvert.
Culvert Rating	Determines the headwater for a circular or rectangular culvert.
HW & Outlet Protection	Determines the headwater and required outlet protection sizes.
Profile	Determines the vertical profile of the culvert and soil cover.
Design Info	Provides backup data, including values of Manning's n for culvert design.

Acknowledgements: ***Spreadsheet Development Team:***

Dr. James C.Y. Guo, P.E.
Professor, Department of Civil Engineering
University of Colorado at Denver
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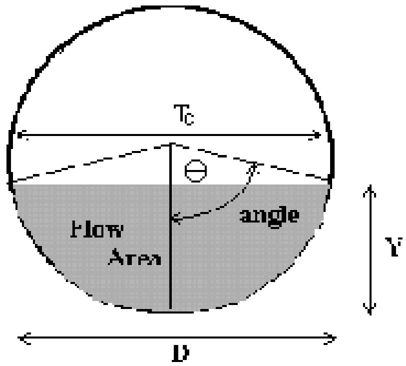
CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

Project: Hilcorp Landfarm: San Juan Basin
Pipe ID: Tank Mountain: Culvert 2



Design Information (Input)			
Pipe Invert Slope	So =	0.0800	ft/ft
Pipe Manning's n-value	n =	0.0120	
Pipe Diameter	D =	14.00	inches
Design discharge	**Q =**	**11.66**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.07	sq ft
Full-flow wetted perimeter	Pf =	3.67	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	16.51	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.81	radians
Flow area	An =	0.70	sq ft
Top width	Tn =	1.13	ft
Wetted perimeter	Pn =	2.12	ft
Flow depth	Yn =	0.72	ft
Flow velocity	Vn =	16.74	fps
Discharge	Qn =	11.66	cfs
Percent Full Flow	Flow =	70.6%	of full flow
Normal Depth Froude Number	Fr_n =	3.76	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.89	radians
Critical flow area	Ac =	1.07	sq ft
Critical top width	Tc =	0.29	ft
Critical flow depth	Yc =	1.15	ft
Critical flow velocity	Vc =	10.94	fps
Critical Depth Froude Number	Fr_c =	1.00	

Version 3.05, Released November 2017 (click here to check for newer version)

Urban Drainage and Flood Control District
Denver, Colorado

Purpose: This workbook aids in analyzing the flow conditions in circular and box culverts, and calculates the vertical profile along the culvert.

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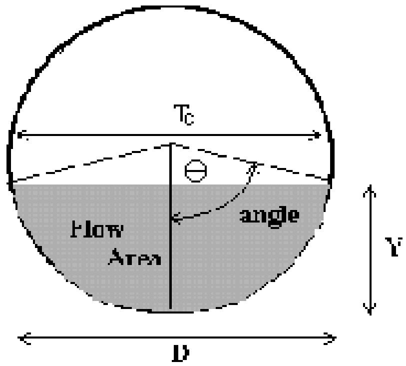
CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

Project: **Hilcorp Landfarm: San Juan Basin**
Pipe ID: **Tank Mountain: Culvert 3**



Design Information (Input)			
Pipe Invert Slope	So =	0.0400	ft/ft
Pipe Manning's n-value	n =	0.0120	
Pipe Diameter	D =	16.00	inches
Design discharge	**Q =**	**13.85**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.40	sq ft
Full-flow wetted perimeter	Pf =	4.19	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	16.67	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.97	radians
Flow area	An =	1.04	sq ft
Top width	Tn =	1.23	ft
Wetted perimeter	Pn =	2.63	ft
Flow depth	Yn =	0.93	ft
Flow velocity	Vn =	13.35	fps
Discharge	Qn =	13.85	cfs
Percent Full Flow	Flow =	83.1%	of full flow
Normal Depth Froude Number	Fr_n =	2.56	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.80	radians
Critical flow area	Ac =	1.38	sq ft
Critical top width	Tc =	0.45	ft
Critical flow depth	Yc =	1.29	ft
Critical flow velocity	Vc =	10.00	fps
Critical Depth Froude Number	Fr_c =	1.00	

APPENDIX G: BEST MANAGEMENT PRACTICES PLAN

APPENDIX G – BEST MANAGEMENT PRACTICES PLAN

HILCORP TANK MOUNTAIN LANDFARM
SAN JUAN COUNTY, NEW MEXICO

OCTOBER 2020

Prepared for:

HILCORP ENERGY COMPANY
382 County Road 3100
Aztec, New Mexico 87401

Prepared by:

LT ENVIRONMENTAL, INC.
848 East Second Avenue
Durango, Colorado 81301
970.385.1096

A proud member of WSP

TABLE OF CONTENTS

1.0 INTRODUCTION

This *Best Management Practices* (BMP) Plan for the Tank Mountain Landfarm (Landfarm) operated by Hilcorp Energy Company (Hilcorp) is required by New Mexico Administrative Code (NMAC) 19.15.36.8 (C)(14) and complies with the applicable requirements contained in 19.15.36.13 and 19.15.36.15 NMAC.

This BMP Plan was written to address and ensure protection of fresh water, public health, and the environment. The plan references the NMAC Surface Waste Management Facilities Siting Criteria Summary Information Sheet (Siting Summary) and associated written plans for the Landfarm, including the *Contingency Plan* (Appendix E). In addition, BMPs are inherently included into the Landfarm design as specified in Appendix A, *Tank Mountain Landfarm Design Specifications*.

2.0 PROTECTION OF FRESH WATER

Protection of fresh water includes groundwater, surface water features, and wellhead protection.

2.1 19.15.36.13 (A): DEPTH TO GROUNDWATER

(2): No landfarm that accepts soil or drill cuttings with a chloride concentration that exceeds 500 mg/kg shall be located where groundwater is less than 100 feet below the lowest elevation at which the operator will place oil field waste.

(3): No landfarm that accepts soil or drill cuttings with a chloride concentration that is 500 mg/kg or less shall be located where groundwater is less than 50 feet below the lowest elevation at which the operator will place oil field waste.

As described in the *Short Term Aquifer Test and Groundwater Information* document (Appendix I), Hilcorp has installed two monitoring wells onsite into a shallow water-bearing zone with total depths at approximately 105 feet below ground surface (bgs). The most recent depth-to-water measurement was approximately 43 feet below the top of casing. An aquifer test and modeling were completed on well MW01 with details included in Appendix I. The highest pumping rate that could be simulated without the well going dry was 0.0256 gallons per minute (gpm), which is equivalent to 36.9 gallons per day (gpd). The sustainable yield for well MW01 is 36.9 gpd, approximately one-quarter of the value of 150 gpd that EPA indicates is required for a typical small household. Therefore, the perched saturated interval encountered in wells MW01 and MW03 is not a sustainable water resource and does not meet the definition of an aquifer or groundwater as defined in 19.15.2.7 NMAC. Groundwater is not present within 105 feet of the ground surface at the Landfarm.

2.2 19.15.36.13 (B): ADDITIONAL SITING CRITERIA

(1) No surface waste management facility shall be located within 200 feet of a watercourse, lakebed, sinkhole or playa lake;

The Landfarm is not located within 200 feet of a watercourse, lakebed, sinkhole, or playa lake. The nearest watercourse is an unnamed, first-order tributary of Pine Canyon approximately 209 feet northeast of the Landfarm.

LTE conducted a detailed site visit to investigate two intermittent drainages inferred by contours on the topographic map. Both are unnamed tributaries to Pine Canyon approximately 209 feet northeast and 220 feet southeast, respectively, of the proposed facility location. The investigation included analyses of geomorphology (i.e. channel walls), a soil survey, a vegetation survey, and a wetland determination. The two areas contained notable erosion banks, but no consistent, uninterrupted watercourse was observed.

(2) No surface waste management facility shall be located within an existing wellhead protection area or 100-year floodplain;

The Landfarm is not located within an existing wellhead protection area or a 100-year floodplain. The facility is not located within 200 horizontal feet of a private, domestic fresh water well or spring used by less than five households for domestic or stock watering purpose, or within 1,000 horizontal feet of any fresh water well or spring. The closest Federal Emergency Management Agency (FEMA) flood zone is listed as Zone A, 1.2 miles to the southwest of the Landfarm.

(3) No surface waste management facility shall be located within, or within 500 feet of, a wetland;

The Landfarm is not located within, or within 500 feet of, a wetland. Features identified as "riverine" by the United States Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) are within 500 feet of the proposed facility. These riverine features are classified by the USFWS using the Cowardin code “R4SBC,” identifying them as intermittent, seasonally flooded streambeds. Seasonally flooded riverine features have surface water present for extended periods especially early in the growing season, but surface water is typically absent by the end of the growing season in most years. The groundwater table after flooding ceases is variable, extending from saturated to the surface to a groundwater table well below the ground surface. This classification does not include palustrine systems (Cowardin code “P,” i.e., nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens), or emergent wetlands (Cowardin code “E” which are characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens.)

NMAC defines a wetland as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions in New Mexico. The riverine features that are mapped within 500 feet of the facility do not qualify as wetlands, according to the USFWS Cowardin code or the NMAC definition.

3.0 SAFETY

3.1 19.15.36.13 (B): ADDITIONAL SITING CRITERIA

(4) No surface waste management facility shall be located within the area overlying a subsurface mine;

The Landfarm is not located within the area overlying a subsurface mine. The closest subsurface mine is 5.7 miles to the northwest. Mike Thompson of the New Mexico Energy, Minerals and Natural Resource Department Mining and Minerals Division was contacted to confirm that the New Mexico Abandoned Mine Land Program has no record of underground mines in the area.

(6) No surface waste management facility shall be located within an unstable area, unless the operator demonstrates that engineering measures have been incorporated into the surface waste management facility design to ensure that the surface waste management facility's integrity will not be compromised.

Based on the Siting Packet completed for the Landfarm, the Landfarm is not located within an unstable area (information in Appendix B of the Tank Mountain Landfarm C-137 Supplemental Information document).

3.2 19.15.36.13 (O): GAS SAFETY MANAGEMENT PLAN

Each operator of a surface waste management facility that includes a landfill shall have a gas safety management plan that describes in detail procedures and methods that will be used to prevent landfill-generated gases from interfering or conflicting with the landfill's operation and protect fresh water, public health,and the environment. The plan shall address anticipated amounts and types of gases that may be generated, an air monitoring plan that includes the vadose zone and measuring, sampling, analyzing, handling, control and processing methods. The plan shall also include final post closure monitoring and control options.

Not applicable for a landfarm.

4.0 PROTECTION OF PUBLIC HEALTH

Protection of public health includes associated public gathering locations such as permanent residences, schools, hospitals, institutions, or churches.

Hilcorp will implement a *Contingency Plan* (Appendix E) to address notifications to the public and regulatory agencies should an emergency arise.

4.1 19.15.36.13 (B): ADDITIONAL SITING CRITERIA

(5) No surface waste management facility shall be located within 500 feet from the nearest permanent residence, school, hospital, institution or church in existence at the time of initial application;

The Landfarm is not located within 500 feet from the nearest permanent residence, school, hospital, institution, or church. The closest residential area is 3.7 miles to the west.

5.0 PROTECTION OF THE ENVIRONMENT

Protection of the environment includes a site-specific Health and Safety Plan (HASP) along with protection of migratory birds and the site area ecosystem.

5.1 LANDFARM HEALTH AND SAFETY PLAN

Prior to commencement of operations at the Landfarm, Hilcorp will prepare and implement a site-specific HASP and train facility personnel on all aspects of the plan. Topics in the plan will include evacuation routes and muster locations, internal and external notification contacts and phone numbers, and appropriate chemicals of concern that may be appropriate for the Landfarm operations.

5.2 19.15.36.13 (I): PROTECTION OF MIGRATORY BIRDS - NETTING

To protect migratory birds, tanks exceeding eight feet in diameter, and exposed pits and ponds shall be screened, netted or covered. Upon the operator's written application, the division may grant an exception to screening, netting or covering upon the operator's showing that an alternative method will protect migratory birds or that the surface waste management facility is not hazardous to migratory birds. Surface waste management facilities shall be fenced in a manner approved by the division.

Exposed pits/ponds are not planned at the Landfarm; therefore, this requirement is not applicable.

APPENDIX H: GROUNDWATER SAMPLE ANALYTICAL LABORATORY REPORTS

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

October 11, 2019

Devin Hencmann
Hilcorp Energy
PO Box 61529
Houston, TX 77208-1529
TEL: (337) 276-7676
FAX

RE: Tank Mountain OrderNo.: 1909D08

Dear Devin Hencmann:

Hall Environmental Analysis Laboratory received 1 sample(s) on 9/24/2019 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0901

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1909D08**
Date Reported: **10/11/2019**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Hilcorp Energy
Project: Tank Mountain
Lab ID: 1909D08-001 **Matrix:** AQUEOUS

Client Sample ID: MW01
Collection Date: 9/23/2019 3:01:00 PM
Received Date: 9/24/2019 8:10:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst:	**CAS**
Fluoride	ND	0.50		mg/L	5	9/24/2019 3:23:24 PM	R63179
Chloride	22	2.5		mg/L	5	9/24/2019 3:23:24 PM	R63179
Nitrogen, Nitrite (As N)	ND	0.50		mg/L	5	9/24/2019 3:23:24 PM	R63179
Bromide	ND	0.50		mg/L	5	9/24/2019 3:23:24 PM	R63179
Nitrogen, Nitrate (As N)	ND	0.50		mg/L	5	9/24/2019 3:23:24 PM	R63179
Phosphorus, Orthophosphate (As P)	ND	2.5		mg/L	5	9/24/2019 3:23:24 PM	R63179
Sulfate	2000	50		mg/L	100	9/30/2019 10:07:46 PM	A63327
SM2510B: SPECIFIC CONDUCTANCE						Analyst:	**JRR**
Conductivity	3100	5.0		µmhos/c	1	9/26/2019 1:03:08 PM	R63224
SM2320B: ALKALINITY						Analyst:	**JRR**
Alkalinity, Hydroxide (As CaCO3)	ND	2.000		mg/L Ca	1	9/25/2019 2:11:11 PM	R63191
Bicarbonate (As CaCO3)	ND	20.00		mg/L Ca	1	9/25/2019 2:11:11 PM	R63191
Carbonate (As CaCO3)	ND	2.000		mg/L Ca	1	9/25/2019 2:11:11 PM	R63191
Total Alkalinity (as CaCO3)	ND	20.00		mg/L Ca	1	9/25/2019 2:11:11 PM	R63191
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst:	**KS**
Total Dissolved Solids	3170	200	*D	mg/L	1	9/25/2019 7:51:00 PM	47682
EPA METHOD 7470: MERCURY						Analyst:	**rde**
Mercury	ND	0.00020		mg/L	1	9/30/2019 4:43:31 PM	47814
EPA METHOD 6010B: DISSOLVED METALS						Analyst:	**ELS**
Calcium	610	10		mg/L	10	10/1/2019 12:20:46 PM	D63324
Magnesium	91	1.0		mg/L	1	10/1/2019 8:51:53 AM	A63324
Potassium	7.2	1.0		mg/L	1	10/1/2019 8:51:53 AM	A63324
Sodium	130	5.0		mg/L	5	10/1/2019 8:53:48 AM	A63324
EPA 6010B: TOTAL RECOVERABLE METALS						Analyst:	**ELS**
Arsenic	ND	0.020		mg/L	1	9/25/2019 11:02:13 AM	47679
Barium	0.33	0.020		mg/L	1	9/25/2019 11:02:13 AM	47679
Cadmium	ND	0.0020		mg/L	1	9/25/2019 11:02:13 AM	47679
Calcium	540	10		mg/L	10	9/25/2019 11:16:37 AM	47679
Chromium	0.024	0.0060		mg/L	1	9/25/2019 11:02:13 AM	47679
Lead	ND	0.0050		mg/L	1	9/25/2019 11:02:13 AM	47679
Magnesium	100	5.0		mg/L	5	9/25/2019 11:04:18 AM	47679
Potassium	13	1.0		mg/L	1	9/25/2019 11:02:13 AM	47679
Selenium	ND	0.050		mg/L	1	9/25/2019 11:02:13 AM	47679
Silver	0.0062	0.0050		mg/L	1	9/25/2019 11:02:13 AM	47679
Sodium	140	5.0		mg/L	5	9/25/2019 11:04:18 AM	47679
EPA METHOD 8021B: VOLATILES						Analyst:	**NSB**

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

Analytical Report
Lab Order **1909D08**
Date Reported: **10/11/2019**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Hilcorp Energy
Project: Tank Mountain
Lab ID: 1909D08-001
Matrix: AQUEOUS
Client Sample ID: MW01
Collection Date: 9/23/2019 3:01:00 PM
Received Date: 9/24/2019 8:10:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8021B: VOLATILES						Analyst:	**NSB**
Methyl tert-butyl ether (MTBE)	ND	2.5		µg/L	1	9/26/2019 11:32:34 AM	B63237
Benzene	ND	1.0		µg/L	1	9/26/2019 11:32:34 AM	B63237
Toluene	ND	1.0		µg/L	1	9/26/2019 11:32:34 AM	B63237
Ethylbenzene	ND	1.0		µg/L	1	9/26/2019 11:32:34 AM	B63237
Xylenes, Total	ND	2.0		µg/L	1	9/26/2019 11:32:34 AM	B63237
1,2,4-Trimethylbenzene	ND	1.0		µg/L	1	9/26/2019 11:32:34 AM	B63237
1,3,5-Trimethylbenzene	ND	1.0		µg/L	1	9/26/2019 11:32:34 AM	B63237
Surr: 4-Bromofluorobenzene	102	80-120		%Rec	1	9/26/2019 11:32:34 AM	B63237

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1909D08**

11-Oct-19

Client: Hilcorp Energy

Project: Tank Mountain

Sample ID: **MB** SampType: **MBLK** TestCode: **EPA Method 300.0: Anions**

Client ID: **PBW** Batch ID: **R63179** RunNo: **63179**

Prep Date: Analysis Date: **9/24/2019** SeqNo: **2155411** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	ND	0.10								
Chloride	ND	0.50								
Nitrogen, Nitrite (As N)	ND	0.10								
Bromide	ND	0.10								
Nitrogen, Nitrate (As N)	ND	0.10								
Phosphorus, Orthophosphate (As P	ND	0.50								

Sample ID: **LCS-b** SampType: **LCS** TestCode: **EPA Method 300.0: Anions**

Client ID: **LCSW** Batch ID: **R63179** RunNo: **63179**

Prep Date: Analysis Date: **9/24/2019** SeqNo: **2155442** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.50	0.10	0.5000	0	100	90	110			
Chloride	4.8	0.50	5.000	0	97.0	90	110			
Nitrogen, Nitrite (As N)	0.99	0.10	1.000	0	98.9	90	110			
Bromide	2.5	0.10	2.500	0	99.2	90	110			
Nitrogen, Nitrate (As N)	2.5	0.10	2.500	0	100	90	110			
Phosphorus, Orthophosphate (As P	4.9	0.50	5.000	0	97.4	90	110			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1909D08**

11-Oct-19

Client: Hilcorp Energy
Project: Tank Mountain

Sample ID: **RB** SampType: **MBLK** TestCode: **EPA Method 8021B: Volatiles**
Client ID: **PBW** Batch ID: **B63237** RunNo: **63237**
Prep Date: Analysis Date: **9/26/2019** SeqNo: **2158109** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Methyl tert-butyl ether (MTBE)	ND	2.5								
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Xylenes, Total	ND	2.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
Surr: 4-Bromofluorobenzene	19		20.00		97.1	80	120			

Sample ID: **100NG BTEX LCSB** SampType: **LCS** TestCode: **EPA Method 8021B: Volatiles**
Client ID: **LCSW** Batch ID: **B63237** RunNo: **63237**
Prep Date: Analysis Date: **9/26/2019** SeqNo: **2158110** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Methyl tert-butyl ether (MTBE)	16	2.5	20.00	0	81.8	80	120			
Benzene	19	1.0	20.00	0	96.6	80	120			
Toluene	20	1.0	20.00	0	98.4	80	120			
Ethylbenzene	20	1.0	20.00	0	98.9	80	120			
Xylenes, Total	59	2.0	60.00	0	98.3	80	120			
1,2,4-Trimethylbenzene	20	1.0	20.00	0	100	80	120			
1,3,5-Trimethylbenzene	20	1.0	20.00	0	99.6	80	120			
Surr: 4-Bromofluorobenzene	21		20.00		103	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1909D08**

11-Oct-19

Client: Hilcorp Energy
Project: Tank Mountain

Sample ID: **lcs-1 99.8uS eC** SampType: **lcs** TestCode: **SM2510B: Specific Conductance**
Client ID: **LCSW** Batch ID: **R63224** RunNo: **63224**
Prep Date: Analysis Date: **9/26/2019** SeqNo: **2157424** Units: **µmhos/cm**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Conductivity	100	5.0	99.80	0	100	85	115			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1909D08**

11-Oct-19

Client: Hilcorp Energy
Project: Tank Mountain

Sample ID: **MB-47814** SampType: **MBLK** TestCode: **EPA Method 7470: Mercury**
Client ID: **PBW** Batch ID: **47814** RunNo: **63308**
Prep Date: **9/30/2019** Analysis Date: **9/30/2019** SeqNo: **2160459** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	ND	0.00020								

Sample ID: **LCS-47814** SampType: **LCS** TestCode: **EPA Method 7470: Mercury**
Client ID: **LCSW** Batch ID: **47814** RunNo: **63308**
Prep Date: **9/30/2019** Analysis Date: **9/30/2019** SeqNo: **2160460** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0052	0.00020	0.005000	0	104	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1909D08**

11-Oct-19

Client: Hilcorp Energy

Project: Tank Mountain

Sample ID: **MB-A** SampType: **MBLK** TestCode: **EPA Method 6010B: Dissolved Metals**

Client ID: **PBW** Batch ID: **A63324** RunNo: **63324**

Prep Date: Analysis Date: **10/1/2019** SeqNo: **2161491** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Magnesium	ND	1.0								
Potassium	ND	1.0								
Sodium	ND	1.0								

Sample ID: **LCS-A** SampType: **LCS** TestCode: **EPA Method 6010B: Dissolved Metals**

Client ID: **LCSW** Batch ID: **A63324** RunNo: **63324**

Prep Date: Analysis Date: **10/1/2019** SeqNo: **2161493** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Magnesium	50	1.0	50.00	0	99.8	80	120			
Potassium	50	1.0	50.00	0	99.1	80	120			
Sodium	49	1.0	50.00	0	98.7	80	120			

Sample ID: **MB-D** SampType: **MBLK** TestCode: **EPA Method 6010B: Dissolved Metals**

Client ID: **PBW** Batch ID: **D63324** RunNo: **63324**

Prep Date: Analysis Date: **10/1/2019** SeqNo: **2162324** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	ND	1.0								

Sample ID: **LCS-D** SampType: **LCS** TestCode: **EPA Method 6010B: Dissolved Metals**

Client ID: **LCSW** Batch ID: **D63324** RunNo: **63324**

Prep Date: Analysis Date: **10/1/2019** SeqNo: **2162326** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	50	1.0	50.00	0	100	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1909D08**

11-Oct-19

Client: Hilcorp Energy

Project: Tank Mountain

Sample ID: **MB-47679** SampType: **MBLK** TestCode: **EPA 6010B: Total Recoverable Metals**

Client ID: **PBW** Batch ID: **47679** RunNo: **63183**

Prep Date: **9/24/2019** Analysis Date: **9/25/2019** SeqNo: **2155697** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	ND	0.020								
Barium	ND	0.020								
Cadmium	ND	0.0020								
Calcium	ND	1.0								
Chromium	ND	0.0060								
Lead	ND	0.0050								
Magnesium	ND	1.0								
Potassium	ND	1.0								
Selenium	ND	0.050								
Silver	ND	0.0050								
Sodium	ND	1.0								

Sample ID: **LCS-47679** SampType: **LCS** TestCode: **EPA 6010B: Total Recoverable Metals**

Client ID: **LCSW** Batch ID: **47679** RunNo: **63183**

Prep Date: **9/24/2019** Analysis Date: **9/25/2019** SeqNo: **2155698** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	0.47	0.020	0.5000	0	93.8	80	120			
Barium	0.45	0.020	0.5000	0	90.1	80	120			
Cadmium	0.46	0.0020	0.5000	0	91.8	80	120			
Calcium	48	1.0	50.00	0	95.5	80	120			
Chromium	0.46	0.0060	0.5000	0	91.3	80	120			
Lead	0.45	0.0050	0.5000	0	91.0	80	120			
Magnesium	49	1.0	50.00	0	98.7	80	120			
Potassium	49	1.0	50.00	0	98.7	80	120			
Selenium	0.45	0.050	0.5000	0	90.5	80	120			
Silver	0.099	0.0050	0.1000	0	98.8	80	120			
Sodium	51	1.0	50.00	0	101	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **1909D08**
11-Oct-19

Client: Hilcorp Energy
Project: Tank Mountain

Sample ID: **mb-1 alk** SampType: **mblk** TestCode: **SM2320B: Alkalinity**
Client ID: **PBW** Batch ID: **R63191** RunNo: **63191**
Prep Date: Analysis Date: **9/25/2019** SeqNo: **2156163** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00								

Sample ID: **lcs-1 alk** SampType: **lcs** TestCode: **SM2320B: Alkalinity**
Client ID: **LCSW** Batch ID: **R63191** RunNo: **63191**
Prep Date: Analysis Date: **9/25/2019** SeqNo: **2156164** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	78.92	20.00	80.00	0	98.6	90	110			

Sample ID: **mb-2 alk** SampType: **mblk** TestCode: **SM2320B: Alkalinity**
Client ID: **PBW** Batch ID: **R63191** RunNo: **63191**
Prep Date: Analysis Date: **9/25/2019** SeqNo: **2156188** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00								

Sample ID: **lcs-2 alk** SampType: **lcs** TestCode: **SM2320B: Alkalinity**
Client ID: **LCSW** Batch ID: **R63191** RunNo: **63191**
Prep Date: Analysis Date: **9/25/2019** SeqNo: **2156189** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	78.80	20.00	80.00	0	98.5	90	110			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1909D08**

11-Oct-19

Client: Hilcorp Energy
Project: Tank Mountain

Sample ID: **MB-47682**	SampType: **MBLK**			TestCode: **SM2540C MOD: Total Dissolved Solids**						
Client ID: **PBW**	Batch ID: **47682**			RunNo: **63196**						
Prep Date: **9/24/2019**	Analysis Date: **9/25/2019**			SeqNo: **2155942**		Units: **mg/L**				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID: **LCS-47682**	SampType: **LCS**			TestCode: **SM2540C MOD: Total Dissolved Solids**						
Client ID: **LCSW**	Batch ID: **47682**			RunNo: **63196**						
Prep Date: **9/24/2019**	Analysis Date: **9/25/2019**			SeqNo: **2155943**		Units: **mg/L**				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1010	20.0	1000	0	101	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: HILCORP ENERGY   Work Order Number: 1909D08   RcptNo: 1

Received By: Erin Melendrez   9/24/2019 8:10:00 AM

Completed By: Erin Melendrez   9/24/2019 9:27:01 AM

Reviewed By: DAD 9/24/19

Chain of Custody

1. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
2. How was the sample delivered? Courier

Log In

3. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
4. Were all samples received at a temperature of >0° C to 6.0°C Yes ☑ No ☐ NA ☐
5. Sample(s) in proper container(s)? Yes ☑ No ☐
6. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
7. Are samples (except VOA and ONG) properly preserved? Yes ☑ No ☐
8. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
9. VOA vials have zero headspace? Yes ☑ No ☐ No VOA Vials ☐
10. Were any sample containers received broken? Yes ☐ No ☑
11. Does paperwork match bottle labels? Yes ☑ No ☐
(Note discrepancies on chain of custody)
12. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
13. Is it clear what analyses were requested? Yes ☑ No ☐
14. Were all holding times able to be met? Yes ☑ No ☐
(If no, notify customer for authorization.)

# of preserved bottles checked for pH: 3
(<2 or >12 unless noted)
Adjusted? NO
Checked by: ENM 9/24/19

Special Handling (if applicable)

15. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: Date:
By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:
Client Instructions:

16. Additional remarks:

17. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	0.9	Good	Yes			
2	3.6	Good	Yes			

- At least 24 hours after well development, LTE will collect a groundwater sample using low-flow sampling techniques.
- Any groundwater sample will be sent to Hall Environmental laboratory for analysis of:
  - Major cations which include calcium, magnesium, iron, potassium, and sodium following United States Environmental Protection Agency (USEPA) Method 200.7 for total metals and USEPA Method 6010B for dissolved metals;
  - Major anions which include carbonate as CO_3, bicarbonate as HCO_3, bromine, chloride, fluoride, hydroxide (OH), nitrates, nitrites, phosphate, and sulfate following USEPA Method 300.0;
  - Alkalinity following Standard Method SM2320;
  - Electrical conductivity following Standard Method SM2510;
  - Benzene, toluene, ethylbenzene, and xylenes (BTEX) following USPEA Method 8021B;
  - Resource Conservation and Recovery Act (RCRA) metals which include arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver following USEPA Method 6010B and USEPA Method 7470A for Mercury; and
  - Total dissolved solids (TDS) following Standard Method SM2540C MOD.

If no freshwater aquifer is identified in the top 100 feet bgs, LTE will reference published data to address 19.15.36.8.C.(15)(b) and (c) NMAC.

Deliverables

Data collected during each subsurface investigation which will include boring logs, well completion diagrams, geotechnical and laboratory analytical results. Information regarding depth, formation, type and thickness of the shallowest freshwater aquifer, soil types, geologic cross sections, and potentiometric maps will be included as part of the geological and hydrological data in the proposed landfarm permits to comply with 19.15.36.8.C.(15) NMAC.

Chain-of-Custody Record

Client: Hilcorp

Lindsay Dumas

Mailing Address:

Phone #:

email or Fax#: ldumas@hilcorp.com

QA/QC Package:
☒ Standard ☐ Level 4 (Full Validation)

Accreditation: ☐ Az Compliance
☐ NELAC ☐ Other

☒ EDD (Type) PDF

Turn-Around Time: See remarks
☒ Standard ☐ Rush TDS only ASAP

Project Name: Tank mountain

Project #: 01718018

Project Manager: Devin Hencman

Sampler:
On Ice: ☒ Yes ☐ No
# of Coolers: 2
Cooler Temp(including CF): 1.1-0.2(CF)=0.9°C
3.8-0.2(CF)=3.6°C EWH 9/24/19

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com
4901 Hawkins NE - Albuquerque, NM 87109
Tel. 505-345-3975 Fax 505-345-4107

Date	Time	Matrix	Sample Name	Container Type and #	Preservative Type	HEAL No. 1909D08	BTEX / ~~MTBE / TMB's (8021)~~	TPH:8015D(GRO / DRO / MRO)	8081 Pesticides/8082 PCB's	EDB (Method 504.1)	PAHs by 8310 or 8270SIMS	RCRA 8 Metals	Cl, F, Br, NO_3, NO_2, PO_4, SO_4	8260 (VOA)	8270 (Semi-VOA)	Total Coliform (Present/Absent)	Major Cations / Anions	Alkalinity	Electrical Conductivity	TDS	Dissolved Metals
9.23.19	1501	Aqueous	MW01	various	various	-001	X					X					X	X	X	X	X

Date	Time	Relinquished by	Received by	Via	Date	Time
9.23.19	1626	Caitlin McE[illegible]	Christine Waite		9/23/19	1626
9/23/19	1811	Christine Waite	[signature]	Courier	9/24/19	0810

Remarks: ASAP
★ Rush TDS only★
cc: dhencman@ltenv.com
cmcginn@ltenv.com
See attached list for Analysis

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

APPENDIX I: SHORT TERM AQUIFER TEST AND GROUNDWATER INFORMATION

SHORT TERM AQUIFER TEST AND GROUNDWATER INFORMATION

HILCORP TANK MOUNTAIN LANDFARM
SAN JUAN COUNTY, NEW MEXICO

APRIL 2020

Prepared for:

HILCORP ENERGY COMPANY
382 County Road 3100
Aztec, New Mexico 87401

Prepared by:

LT ENVIRONMENTAL, INC.
848 East Second Avenue
Durango, Colorado 81301
970.385.1096

A proud member of WSP

TABLE OF CONTENTS

ATTACHMENTS

1.0 INTRODUCTION

Three borings were advanced at the Tank Mountain Landfarm (Landfarm) to assess site lithology and depth to groundwater (locations shown on Figure 10). The borings were advanced on and adjacent to the Landfarm to depths ranging from 105 to 110 feet bgs. Shallow groundwater was present in wells MW01 and MW03 at depths of 43 and 71 feet bgs, respectively, and was thought to be discontinuous perched water. Due to the presence of water, borings MW01 and MW03 were completed as permanent groundwater-monitoring wells. Boring MW02 was drilled to a depth of 110 feet bgs and did not encounter groundwater. Boring MW02 was backfilled upon completion.

Because of the presence of shallow water in at the Landfarm, a short-term aquifer test was performed on well MW01 to characterize the hydrogeologic conditions of this lithologic interval and assess if this interval contained usable quantities of groundwater to be classified as an aquifer. This document summarizes results of a short-term aquifer test performed at the Landfarm. This document also provides information regarding local and regional groundwater near the Landfarm that is required in Subsections (c) and (f) of 19.15.36.8(C)(15) New Mexico Administrative Code (NMAC)

2.0 SHORT TERM AQUIFER TEST

On September 6, 2019, LT Environmental (LTE) conducted a single well, short-term pumping test within the shallow water-bearing zone (within a sandstone rock unit) at the Tank Mountain Landfarm (Landfarm) to characterize the hydrogeologic conditions of this interval. The test results were used to further develop the site-characterization model and evaluate if the saturated interval has potential for use as a groundwater resource.

2.1 Aquifer Test Details

Prior to the test, depth-to-water (DTW) was measured in well MW01 at 43.28 feet. Testing was initiated by removing water with a 0.25-gallon bailer at a measured rate of approximately 0.5 gallons per minutes (gpm). After approximately 20 minutes, the well went dry (10 gallons of water were removed) and was allowed to recover while collecting DTW measurements at time intervals specified below.

Elapsed Recovery Time	Depth to Water (feet)	Drawdown (feet)
10 seconds	60.19	16.91
20 seconds	60.17	16.89
30 seconds	59.98	16.70
1 minute	59.91	16.63
2 minutes	59.65	16.37
3 minutes	59.33	16.05
4 minutes	59.26	15.98
5 minutes	59.07	15.79
15 minutes	57.90	14.62
25 minutes	57.23	13.95
35 minutes	56.52	13.24
60 minutes	54.62	11.34

2.2 Aquifer Test Analysis and Results

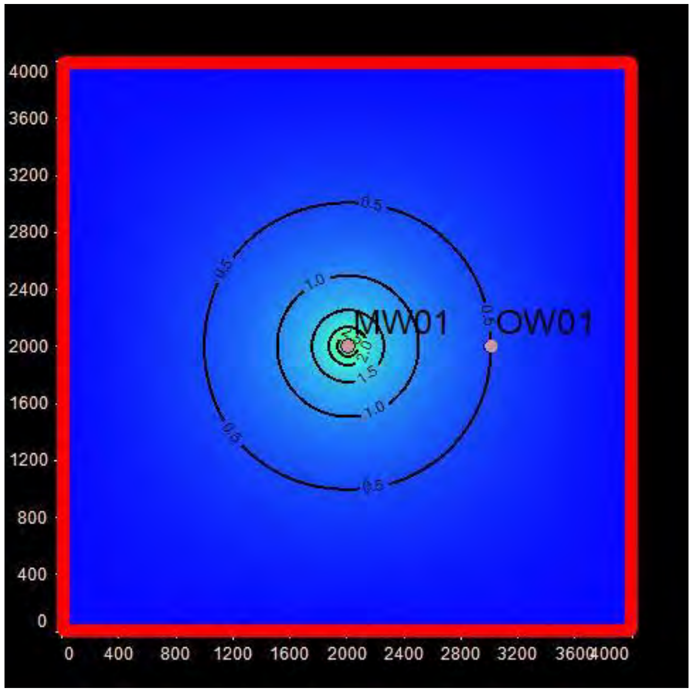
The aquifer test data was entered into the AQTESOLV software program to estimate aquifer properties via curve matching from mathematical solutions. Equations whose curves visually best fit the data were used to calculate transmissivity. Graphs of the AQTESOLV solution is provided in Attachment 1. The confined Theis solution was the best fit for the data with a calculated transmissivity of 1.12x10-5 square feet per second (ft2/sec). Using this transmissivity value and based on an aquifer saturated thickness of 8 feet, the calculated hydraulic conductivity is 1.4x10-6 feet per second (ft/sec). The 8-foot thickness corresponded with the observed saturated more permeable sandstone interval observed during drilling.

2.3 Data Evaluation

Visual MODFLOW was utilized to simulate steady state pumping from well MW01. The model size was 4,000 feet by 4,000 feet by 10 feet. A flat water table of 10 feet was simulated. Well MW01 was situated in the middle of the model and a fictional observation well OW01 was placed 1,000 feet east of MW01 in the model. The transmissivity and storativity estimated from the aquifer test were used to calculate the following model inputs: hydraulic conductivity, specific yield and effective porosity. A constant head boundary of 10 feet was simulated along the edges of the model. Model inputs are presented below.

Visual MODFLOW Inputs		
Transmissivity	1.12×10^{-5}	ft^2/sec
Saturated Thickness	8	ft
Hydraulic Conductivity	1.4×10^{-6}	ft/sec
Hydraulic Conductivity	4.27×10^{-5}	cm/sec
Specific Yield	0.2239	unitless
Effective Porosity	0.2239	unitless

The highest pumping rate that could be simulated without the well going dry was 0.0256 gallons per minute (gpm), which is equivalent to 36.9 gallons per day (gpd). The figure below illustrates the simulated drawdown from pumping MW01 at 0.0256 gpm.



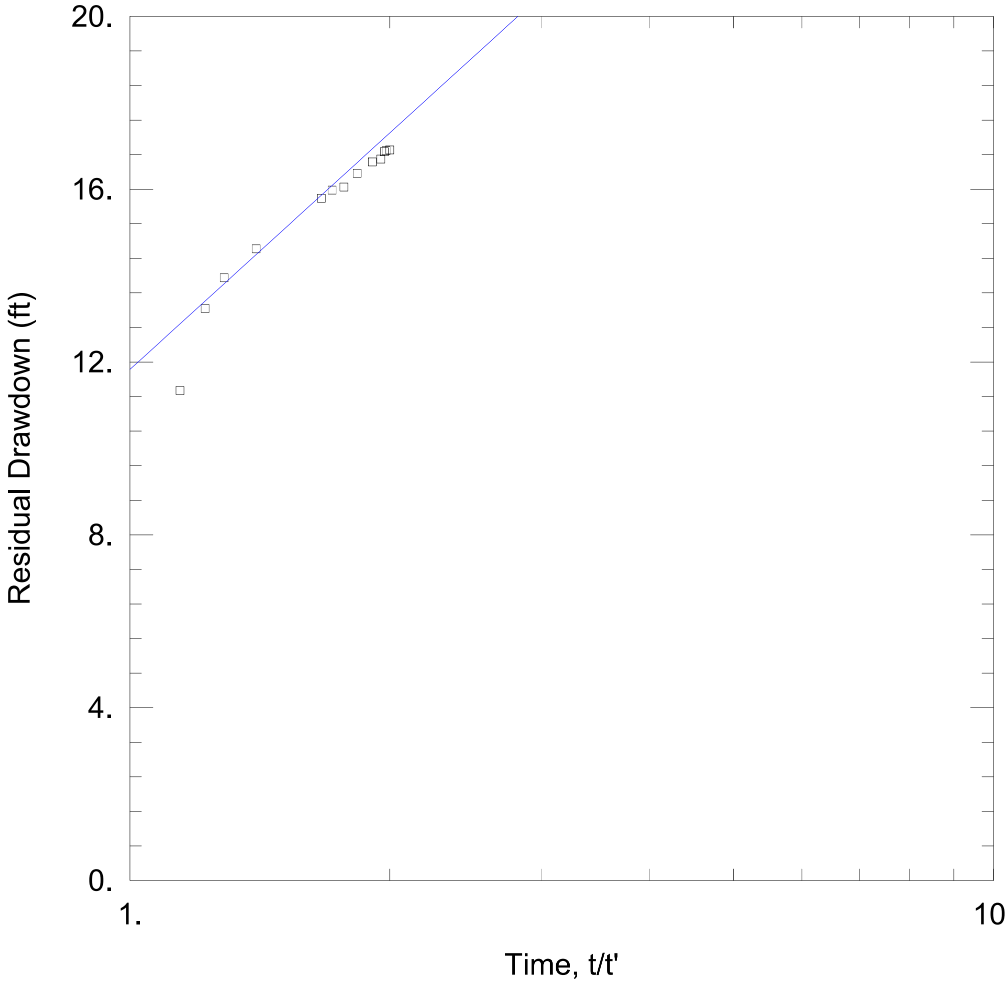
The sustainable yield for well MW01 is 36.9 gpd, approximately one-quarter of the value of 150 gpd that United Stated Environmental Protection Agency (EPA) indicates is required for a typical small household. At the desired minimum rate of 150 gpd, the water in the well will drop below the saturated interval and therefore, this perched saturated interval is not considered a sustainable water resource.

3.0 CONCLUSIONS

As defined in 19.15.2.7 NMAC, an aquifer a "geologic formation, group of formations or a part of a formation that can yield a significant amount of water to a well or spring" and groundwater is defined as "interstitial water that occurs in saturated earth material and can enter a well in sufficient amounts to be used as a water supply". To assess whether the lithologic unit and shallow water encountered in wells MW01 and MW03 constituted an aquifer and/or groundwater, a short-term pumping test was performed at the Landfarm. Based on the data, the sustainable yield for well MW01 is 36.9 gallons per day (gpd), approximately one-quarter of the value of 150 gpd that EPA indicates is required for a typical small household. At the desired minimum rate of 150 gpd, the water in the well will drop below the saturated interval.

Groundwater was not encountered at any other interval while drilling wells/borings MW01, MW02, and MW03. Therefore, the perched saturated interval encountered in wells MW01 and MW03 does not meet the definition of aquifer because it does not yield a significant amount of water to a well, nor does it meet the definition of groundwater because it does not enter a well in sufficient amounts to be used as a water supply. No freshwater aquifer or groundwater as defined in 19.15.2.7 NMAC is present within 105 feet of the ground surface at the Landfarm.

ATTACHMENT 1: AQTESOLV AQUIFER TEST ANALYSIS



WELL TEST ANALYSIS

Data Set: P:\...\Pump test - 20 min output ft sec.aqt
Date: 04/20/20 Time: 11:45:25

PROJECT INFORMATION

Company: LT Environmental, Inc.
Client: Hilcorp
Location: Tank Mtn/Cedar Hill MW01
Test Well: 9.6.2019 Test
Test Date: 9/6/2019

AQUIFER DATA

Saturated Thickness: 20ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
9.6.2019 test	0	0

Observation Wells

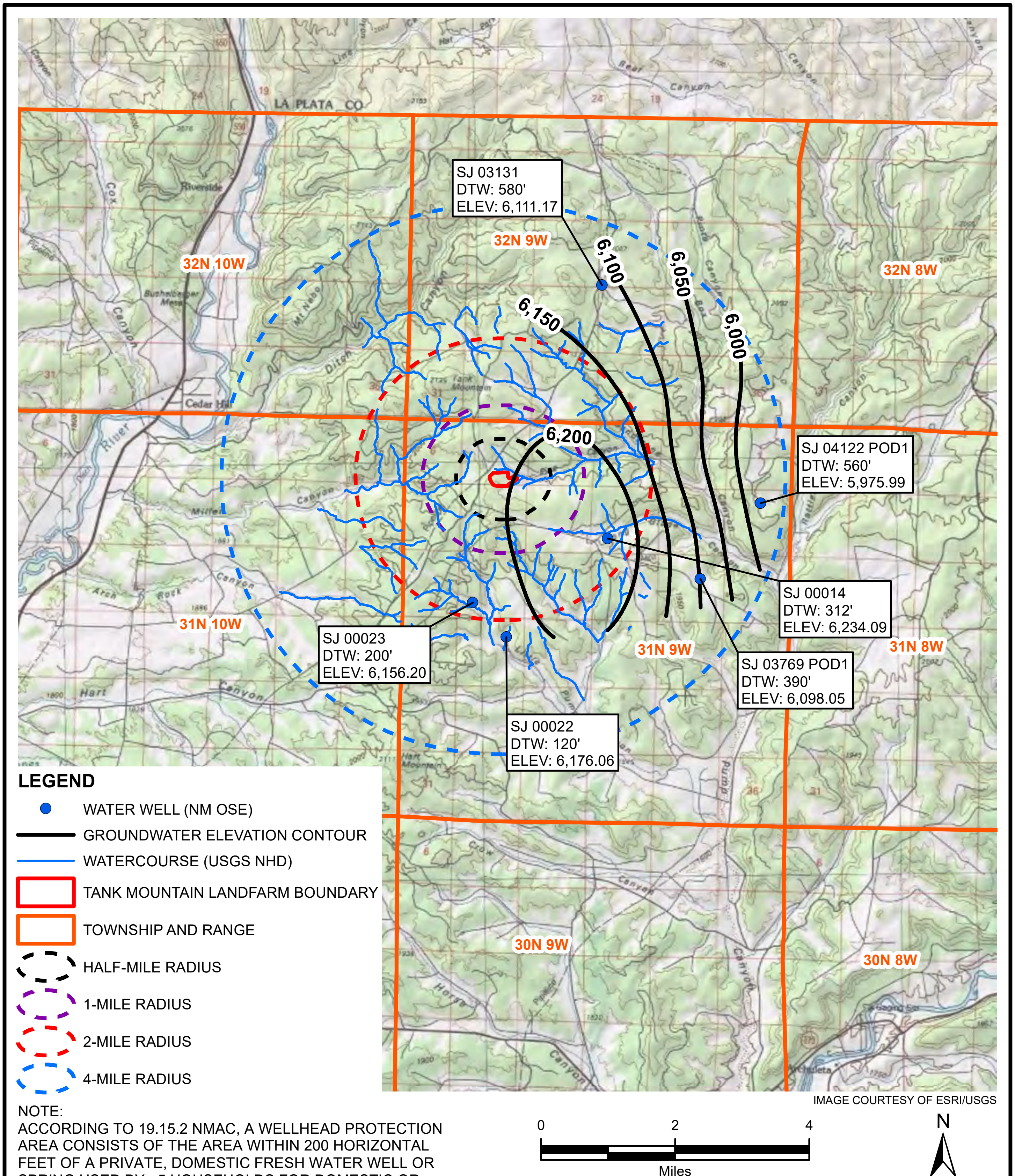
Well Name	X (ft)	Y (ft)
□ 9.6.2019 test	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 1.122E-5 ft^2/sec S/S' = 0.2239

APPENDIX J: SAN JOSE AQUIFER INFORMATION



NOTE:
ACCORDING TO 19.15.2 NMAC, A WELLHEAD PROTECTION AREA CONSISTS OF THE AREA WITHIN 200 HORIZONTAL FEET OF A PRIVATE, DOMESTIC FRESH WATER WELL OR SPRING USED BY <5 HOUSEHOLDS FOR DOMESTIC OR STOCK WATERING PURPOSE, OR WITHIN 1,000 HORIZONTAL FEET OF ANY OTHER FRESH WATER WELL OR SPRING. NO USGS WELLS IN AREA PER NWIS.

DTW: DEPTH TO WATER
ELEV: APPROXIMATE ELEVATION IN FEET ABOVE MEAN SEA LEVEL
NM OSE: NEW MEXICO OFFICE OF THE STATE ENGINEER
': FEET

APPENDIX J
GROUNDWATER ELEVATION CONTOURS FOR SURROUNDING WELLS
TANK MOUNTAIN LANDFARM
SESW SEC 5 T31N R9W
SAN JUAN COUNTY, NEW MEXICO
HILCORP ENERGY COMPANY

P:\Hilcorp\GIS\MXD\017818018_LANDFARM PERMITTING\TANK MOUNTAIN\2020_UPDATES\017818018_FIG02_TANK MOUNTAIN_APPENDIX I_2020.mxd

New Mexico Office of the State Engineer
Active & Inactive Points of Diversion
(with Well Drill Dates & Depths)

(R=POD has been replaced and no longer serves this file, C=the file is closed)

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

WR File Nbr	Sub basin	Use	Diversion	Cnty	POD Number	Well Tag	Code Grant	Source	q 64	q 16	q 4	Sec	Tws	Rng	X	Y	Distance	Start Date	Finish Date	Depth Well	Depth Water
SJ 04235	SJAR	STK	3	SJ	SJ 04235 POD1				4	1	3	10	31N	09W	252972	4088479	2927			700	
SJ 00013	SJ	NOT	0	SJ	SJ 00013			Shallow			3	10	31N	09W	253017	4088369*	3021	10/09/1952	10/19/1952	458	
SJ 00014	SJ	NOT	0	SJ	SJ 00014			Shallow			3	10	31N	09W	253017	4088369*	3021	10/09/1952	10/19/1952	462	312
SJ 00023	SJ	IND	10	SJ	SJ 00023			Shallow			3	17	31N	09W	249764	4086871*	3072	09/25/1953	10/26/1953	550	200
SJ 00022	SJ	IND	61	SJ	SJ 00022			Shallow			2	20	31N	09W	250557	4086032*	3848	09/22/1953	09/22/1953	202	120
SJ 04260	SJ	MON	0	SJ	SJ 04260 POD4					3	2	05	30N	09W	250378	4085805	4071				
SJ 00015	SJ	IND	32	SJ	SJ 00015			Shallow				19	31N	09W	248812	4085735*	4435	05/20/1953	05/20/1952	610	
SJ 00052	SJ	IND	24	SJ	SJ 00052			Shallow			3	20	31N	09W	249738	4085267*	4657	10/20/1952	10/20/1952	510	
SJ 00029	SJ	NOT	0	SJ	SJ 00029			Shallow			4	21	31N	09W	252139	4085175*	5013	02/07/1953	02/27/1953	178	
SJ 00545	SJ	DOM	0	SJ	SJ 00545					1	4	24	31N	10W	247525	4085548*	5196				
SJ 03131	SJ	STK	3	SJ	SJ 03131			Shallow	3	3	3	22	32N	09W	252963	4094453*	5245	10/07/2001	11/16/2001	843	580
SJ 03769	SJ	STK	3	SJ	SJ 03769 POD1			Shallow	2	3	2	14	31N	09W	255236	4087366	5449	11/25/2006	11/28/2006	485	390
SJ 00054	SJAR	IND	29	SJ	SJ 00054			Shallow			2	10	31N	10W	244754	4089470*	5659	01/21/1955	01/21/1955	455	
SJ 04097	SJ	MON	0	SJ	SJ 04097 POD7			Shallow		4	2	28	31N	09W	252181	4084256	5895	08/20/2014	08/20/2014	60	50
				SJ	SJ 04097 POD4			Shallow		4	2	28	31N	09W	252193	4084256	5899	08/20/2014	08/20/2014	60	50
				SJ	SJ 04097 POD2			Shallow		4	2	28	31N	09W	252192	4084255	5900			55	
				SJ	SJ 04097 POD6			Shallow		4	2	28	31N	09W	252189	4084244	5910	08/20/2014	08/20/2014	60	50
				SJ	SJ 04097 POD1			Shallow		4	2	28	31N	09W	252212	4084248	5912			65	

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

(R=POD has been replaced and no longer serves this file, C=the file is closed)

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

WR File Nbr	Sub basin	Use	Diversion	Cnty	POD Number	Well Tag	Code Grant	Source	q 64	q 16	q 4	Sec	Tws	Rng	X	Y	Distance	Start Date	Finish Date	Depth Well	Depth Water
				SJ	SJ 04097 POD5			Shallow		4	2	28	31N	09W	252206	4084245	5913	08/20/2014	08/20/2014	60	50
SP 04523	SJM2	OIL	0	SJ	SP 04523 1				1	4	1	26	32N	09W	254892	4093760*	5938				
SJ 04122	SJ	STK	3	SJ	SJ 04122 POD1			Shallow		3	2	12	31N	09W	256703	4089166	6343	03/23/2015	03/30/2015	650	560

Record Count: 21

UTMNAD83 Radius Search (in meters):

Easting (X): 250398.92 **Northing (Y):** 4089876.88 **Radius:** 6440

Sorted by: Distance

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

APPENDIX K: BORING/WELL COMPLETION LOGS

Advancing Opportunity
848 E. 2nd Ave
Durango, Colorado 81301

BORING LOG/MONITORING WELL COMPLETION DIAGRAM

Boring/Well Number: MW01		Project: Tank Mountain Surface Waste	
Date: 9/5/2019		Project Number: 017818018	
Logged By: E. Carroll		Drilled By: MO-TE Drilling Inc.	
Elevation: 6,606.7	Detector: PID	Drilling Method: Rotary	Sampling Method: Continuous
Gravel Pack: 10-20 Silica Sand 33' - 57'		Seal: 31' - 33'	Grout: 1' - 31'
Casing Type: Schedule 40 PVC	Diameter: 2" Length: 40'	Hole Diameter: 8"	Depth to Liquid: NA
Screen Type: Schedule 40 PVC Slot: 0.010"	Diameter: 2" Length: 20'	Total Depth: 105'	Depth to Water: 45'

Penetration Resistance	Moisture Content	Vapor (ppm)	HC Staining?	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion Gray= grout Brown=sand Blue=Bentonite
	Dry		No		0–10			SM	Dry, medium dense, red, silty sand	
	Dry		No		10–15			CL	Dry, stiff, grayish green, lean clay	

Boring/Well #	MW01
Project:	Tank Mountain Surface Waste
Project #	017818018
Date	9/5/2019

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion
	Dry		No		15–20			CL	Dry, stiff, grayish green, lean clay	
	Dry		No		20–30			Sst	Dry, light gray, coarse grained subangular weathered sandstone	
	Dry		No		30–35			Sst	Dry, light brown, coarse subangular micaceous sandstone	
					35–37					

Boring/Well #	MW01
Project:	Tank Mountain Surface Waste
Project #	017818018
Date	9/5/2019

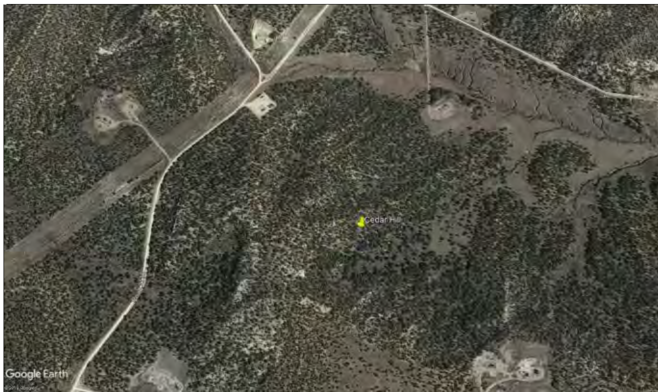
Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion
					37					
	Dry		No		38–40			Sst	Same as above	
	Moist		No		41–45			Sst	Moist, dark reddish brown, coarse, subangular, sandstone	
	Wet		No		46–50			Sst	Wet, white, coarse, rounded, sandstone	
	Moist		No		51–59			Sh	Moist, very firm, very dark greenish gray, shale, with purple mottling.	Total depth of well 57.5' bgs

Boring/Well #	MW01
Project:	Tank Mountain Surface Waste
Project #	017818018
Date	9/5/2019

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion
					60					
	Dry		No		61–62			Sh	Dry, very firm, very dark greenish gray, shale, with purple mottling.	Native
	Dry		No		62–78			Sst	Dry, light gray, coarse, subangular, sandstone	Native
	Dry		No		78–82			Sh	Dry, light gray, shale	Native

Boring/Well #	MW01
Project:	Tank Mountain Surface Waste
Project #	017818018
Date	9/5/2019

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion
	Dry		No		83–86			Sh	Same as above	Native
	Dry		No		87–90			Sst	Dry, light gray, fine, rounded, sandstone	
	Dry		No		91–105			Sst	Dry, light gray, coarse, subangular, sandstone	



Advancing Opportunity

848 E. 2nd Ave
Durango, Colorado 81301

BORING LOG/MONITORING WELL COMPLETION DIAGRAM

Boring/Well Number: MW02	Project: Tank Mountain Surface Waste
Date: 9/10/2019	Project Number: 017818018
Logged By: E. Carroll	Drilled By: MO-TE Drilling Inc.
Drilling Method: Rotary	Sampling Method: Continuous

Elevation: 6,761.6	Detector: PID
Gravel Pack: 10-20 Silica Sand	Seal:
Grout: 105' - Surface	
Casing Type: Schedule 40 PVC	Diameter: 2" Length:
Hole Diameter: 8"	Depth to Liquid: NA
Screen Type: Schedule 40 PVC	Slot: 0.010"
Diameter: 2" Length:	
Total Depth: 105'	Depth to Water:

Penetration Resistance	Moisture Content	Vapor (ppm)	HC Staining?	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	No well completed
	Dry		No		0–10			SM	Dry, medium dense, light reddish brown, silty sand	
	Moist		No		10–15			SM	Moist, light reddish brown, silty sand, some gravel	

Boring/Well #	MW02
Project:	Tank Mountain Surface Waste
Project #	017818018
Date	9/10/2019

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion
	Moist		No		15–20			CL	Moist, dark brown, lean clay, few sand/silt	
	Moist		No		20–23			SM	Moist, light reddish brown, coarse sand, weahtered sandstone	
	Dry		No		23–37			Sst	Dry, light reddish brown, coarse subangular poorly cemented, sandstone.	

Boring/Well #	MW02
Project:	Tank Mountain Surface Waste
Project #	017818018
Date	9/10/2019

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion
					37					
	Dry		No		38 39 40			Sh	Dry, dark green gray shale, very dusky red mottles	
	Dry		No		41 42 43 44 45			Sh	Dry, dense, green gray shale	
	Dry		No		46 47 48 49 50 51 52 53 54 55 56 57			Sst	Dry, rounded fine grained gray sandstone, micaceous, with interbedded shale lenses	
	Dry		No		58 59			Sst	Dry, rounded, medium fine grained, dark green gray sandstone	

Boring/Well #	MW02
Project:	Tank Mountain Surface Waste
Project #	017818018
Date	9/10/2019

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion
	Moist		No		60–67			Sst	Moist, light gray, subangular, medium coarse grained, sandstone	
	Dry		No		68–72			Sst	Dry, white, very coarse, sub angular, sandstone	
	Moist		No		73–75			Sst	Moist, light reddish brown, subangular, coarse, poorly cemented, sandstone	
	Dry		No		76–82			Sh	Dry, black, shale, with oxidized mottles	

Boring/Well #	MW02
Project:	Tank Mountain Surface Waste
Project #	017818018
Date	9/10/2019

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion
	Dry		No		83–86			Sh	Same as above	
	Dry		No		86–95			Sh	Dry, green gray shale, oxidized mottles	
	Dry		No		95–103			Sh	Dry, black, micaceous shale	
					103–105					

Boring/Well #	MW02
Project:	Tank Mountain Surface Waste
Project #	017818018
Date	9/10/2019

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion
	Dry		No		106–110			Sst	Dry, dark reddish brown, very fine grain, micaceous, sandstone	
					111					
					112					
					113					
					114					
					115					
					116					
					117					
					118					
					119					
					120					
					121					
					122					
					123					
					124					
					125					
					126					
					127					
					128					

LTE Advancing Opportunity
848 E. 2nd Ave
Durango, Colorado 81301

BORING LOG/MONITORING WELL COMPLETION DIAGRAM

Boring/Well Number: MW03		Project: Tank Mountain Surface Waste	
Date: 12/9/2019		Project Number: 017818018	
Logged By: E. Carroll		Drilled By: MO-TE Drilling Inc.	
Elevation: 6,606.7	Detector: PID	Drilling Method: Rotary	Sampling Method: Continuous
Gravel Pack: 10-20 Silica Sand	68' - 90'	Seal: 63' - 68'	Grout: 1' - 63'
Casing Type: Schedule 40 PVC	Diameter: 2" Length: 70'	Hole Diameter: 8"	Depth to Liquid: NA
Screen Type: Schedule 40 PVC	Slot: 0.010" Diameter: 2" Length: 20'	Total Depth: 105'	Depth to Water: 78'

Penetration Resistance	Moisture Content	Vapor (ppm)	HC Staining?	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion Gray= grout Brown=sand Blue=Bentonite
	Wet		No		0–1			CL	Wet, soft, cohesive, weak red, sandy clay	
	Moist		No		2–3			SM	Moist, medium dense, light reddish brown, silty sand.	
	Moist		No		4–12			SP-SM	Moist, dense, medium grain sand, little silt.	
	Dry		No		13–15			Sst	Dry, fine grain, white, sandstone, with thin <3cm shale lenses.	

Boring/Well #	MW03
Project:	Tank Mountain Surface Waste
Project #	017818018
Date	12/9/2019

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion
	Dry		No		15–23			Sst	Same as above	
	Dry		No		24–27			Sh	Dry, Firm dark gray, shale.	
	Dry		No		28–32			Sst	Dry, light brown, rounded, fine grain sandstone.	
	Dry		No		33–37			Sst	Dry, white, sub-angular, coarse sandstone.	

Boring/Well #	MW03
Project:	Tank Mountain Surface Waste
Project #	017818018
Date	12/9/2019

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion
					37					
	Moist		No		38 39 40			Sst	Moist, white, sub-angular, coarse, sandstone.	
	Dry		No		41 42 43 44 45 46 47 48 49 50 51 52			Sh	Weathered, black, shale, some oxidation mottling.	
	Dry		No		53 54 55 56			Sst	Dry, light reddish brown, fine, sandstone.	
	Dry		No		57 58 59			Sh/Sst	Dry, firm, black shale interbedded with light reddish brown, fine, sandstone.	

Boring/Well #	MW03
Project:	Tank Mountain Surface Waste
Project #	017818018
Date	12/9/2019

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion
					60					
	Dry		No		61–62			Sh/Sst	SAA	
	Dry		No		63–74			Sst	Dry, light brown, coarse, subangular, sandstone	
	Moist/ Sat		No		75–82			Sst	Moist, gray, sub-angular, sandstone. Saturation at 86 feet.	

Boring/Well #	MW03
Project:	Tank Mountain Surface Waste
Project #	017818018
Date	12/9/2019

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Recovery	Soil/Rock Type	Lithology/Remarks	Well Completion
	Sat		No		83–92			Sst	Same as above.	
	Moist/ Sat		No		93–98			Sh	Moist, weathered, dark gray shale with dusky brown and pale green mottling	Native
	Dry		No		99–105			Sh	Dry, dense, well cementd, dark gray shale.	

APPENDIX L: SOIL GEOTECHNICAL LABORATORY REPORT

TRAUTNER GEOTECH LLC
GEOTECHNICAL ENGINEERING, MATERIAL TESTING
AND ENGINEERING GEOLOGY

October 28, 2019

Joshua G. Adams
Staff Geologist
LT Environmental Inc.
970.456.5750 cell
970.385.1096 office
848 East Second Avenue Durango, CO 81301
www.ltenv.com

PN: 55814GE

Subject: Contract Exploration Services and Laboratory Testing for
The Proposed Cedar Hill Land Farm
Aztec, New Mexico

Mr. Adams,

This letter presents the logs of the test borings and laboratory test results from the geotechnical engineering contract drilling services and laboratory testing outlined in our September 6, 2019 proposal, P.N. 19208P. We performed the field work on October 7, 2019 and advanced three (3) shallow test borings. The logs of the test borings and the laboratory test results are presented in Appendix A and Appendix B below.

We advanced three (3) continuous flight auger test boring to a depth of 5 feet. The soil samples were collected and returned to our laboratory to perform the requested laboratory testing as described below. The borings were backfilled with the soil cuttings from the borings.

The laboratory tests we performed include;

- Moisture Content
- Three (3) Standard Test Method for Measurement of Hydraulic Conductivity of Porous Material Using a Rigid-Wall, Compaction-Mold Permeameter (ASTM D5856 – 95(2007)).
- Three (3) Standard Test Method for Measurements of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (ASTM D5084 – 10).
- One (1) Atterberg Limits test which is used for general classification purposes of the samples tested,
- One (1) Sieve analysis test to assess the grain distribution of the sample tested,
- One (1) Moisture content-dry density relationships (Proctor) test.

We understand the total porosity of the site soils using ASTM Test Method D 6836 was performed by others.

Please contact us if you have any questions or if we may provide additional information.

Respectfully Submitted,
TRAUTNER GEOTECH

Tom R. Harrison, P.E.

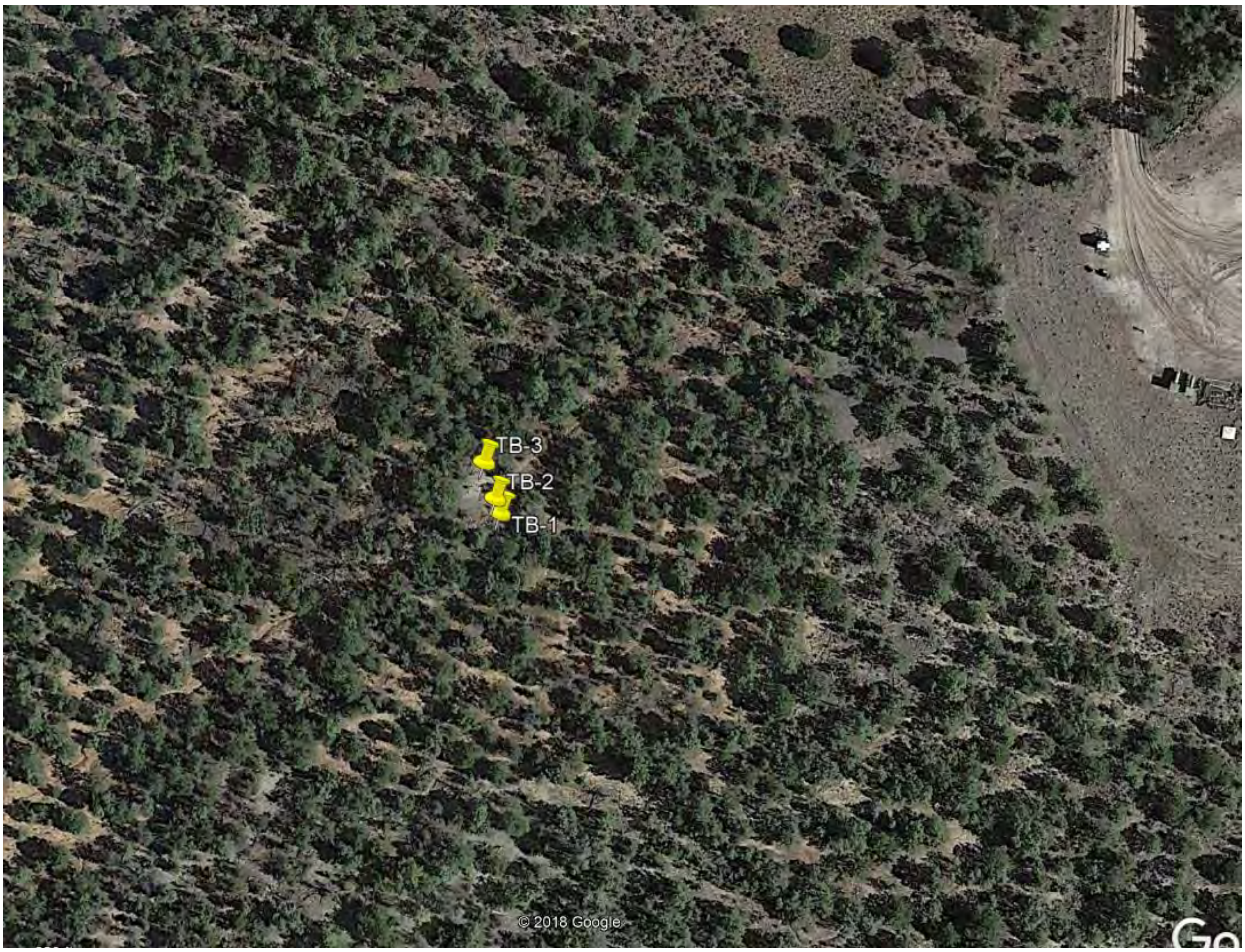


Figure 1; Test Boring Location Map

APPENDIX A

Field Study Results

TRAUTNER GEOTECH LLC

Field Engineer : T. Harrison
Hole Diameter : 4" Solid
Drilling Method : Continuous Flight Auger
Sampling Method : Mod. California Sampler
Date Drilled : 10/07/2019
Total Depth (approx.) : 5 feet
Location : See Figure 1 in Letter

LOG OF TEST BORING TB-1

Cedar Hill Land Farm
Josh Adams
LT Environmental

Project Number: 55814GE

Sample Type
- Mod. California Sampler
- Standard Split Spoon
- Bag Sample

Water Level
- Water Level During Drilling
- Water Level After Drilling

Depth in feet	DESCRIPTION	USCS	GRAPHIC	Samples	Blow Count	Water Level	REMARKS
0	SANDY CLAY, organics, medium stiff, moist, brown	CL					
1	Weathered Formational material, San Jose Formation, shale, hard, slightly moist, gray to purple	SH					
2					12/6		
					20/6		
3	Formational material, San Jose Formation, shale, hard to very hard, dry, gray to purple	SH					
4					50/6		
5	Bottom of test boring at 5 feet						
6							

10-28-2019 T:\Current GE\55800GE thru 55899GE\55804GE, Lot 8 River Valley Estates\Logs of Test Borings\Lot 8 RVE TB-2.bor

TRAUTNER GEOTECH LLC

Field Engineer	: T. Harrison
Hole Diameter	: 4" Solid
Drilling Method	: Continuous Flight Auger
Sampling Method	: Mod. California Sampler
Date Drilled	: 10/07/2019
Total Depth (approx.)	: 5 feet
Location	: See Figure 1 in Letter

LOG OF TEST BORING TB-2

Cedar Hill Land Farm
Josh Adams
LT Environmental

Project Number: 55814GE

Sample Type: Mod. California Sampler; Standard Split Spoon; Bag Sample

Water Level: ▼ Water Level During Drilling; ▽ Water Level After Drilling

Depth in feet	DESCRIPTION	USCS	GRAPHIC	Samples	Blow Count	Water Level	REMARKS
0	SANDY CLAY, organics, medium stiff, moist, brown	CL		Bag Sample			
	Weathered Formational material, San Jose Formation, shale, hard, slightly moist, gray to purple	SH					
1				Mod. California Sampler	6/6		
					10/6		
2				Bag Sample			
3	Formational material, San Jose Formation, shale, hard to very hard, dry, gray to purple	SH		Mod. California Sampler	15/6		
					36/6		
4							
5	Bottom of test boring at 5 feet						
6							

10-28-2019 T:\Current GE\55800GE thru 55899GE\55814GE, Cedar Hill Land Farm, Aztec\Logs of Test Borings\CHLF TB-1.bor

TRAUTNER GEOTECH LLC

Field Engineer	: T. Harrison
Hole Diameter	: 4" Solid
Drilling Method	: Continuous Flight Auger
Sampling Method	: Mod. California Sampler
Date Drilled	: 10/07/2019
Total Depth (approx.)	: 5 feet
Location	: See Figure 1 in Letter

LOG OF TEST BORING TB-3

Cedar Hill Land Farm
Josh Adams
LT Environmental

Project Number: 55814GE

Sample Type: Mod. California Sampler; Standard Split Spoon; Bag Sample

Water Level: Water Level During Drilling; Water Level After Drilling

Depth in feet	DESCRIPTION	USCS	GRAPHIC	Samples	Blow Count	Water Level	REMARKS
0	SANDY CLAY, organics, medium stiff, moist, brown	CL		Bag Sample			
	Weathered Formational material, San Jose Formation, shale, hard, slightly moist, gray to purple	SH		Bag Sample			
1				Mod. California Sampler	10/6		
					14/6		
2				Bag Sample			
3	Formational material, San Jose Formation, shale, hard to very hard, dry, gray to purple	SH		Mod. California Sampler	11/6		
					30/6		
4							
5	Bottom of test boring at 5 feet						
6							

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APPENDIX B

Laboratory Test Results

TRAUTNER GEOTECH LLC

Measurement of Hydraulic Conductivity of Porous Material Using a Rigid-Wall, Compaction-Mold, Permeameter

ASTM D-5856 Method B

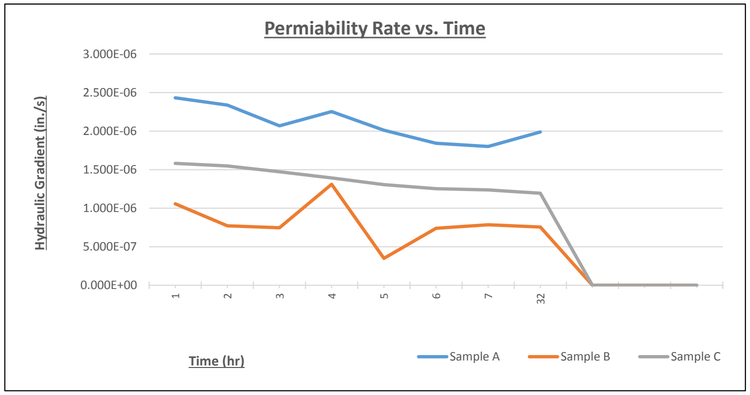
Project: Cedar Hill Land Farm, Aztec
Project Number: 55814 GE
Test Date: 10/22/2019
Technician: C. Deleon

Sample Date: 10/7/2019

Sample Type: Test Bore
Sampled By: T. Geotech

Compacion Method (if remolded): Insitu
Permeant Fluid Type: Tap Water

Tailwater Level (in.)	Influent Tube Diameter (in.)
4.125	0.5



			Sample A		Sample B		Sample C		Sample D	
Date / Time	Δ Time (s)	Total Time (hr)	Water Level (in.)	Hydraulic Gradient (in./s)	Water Level (in.)	Hydraulic Gradient (in./s)	Water Level (in.)	Hydraulic Gradient (in./s)	Water Level (in.)	Hydraulic Gradient (in./s)
10/22/19 8:45	0	0	122.375		122.313		122.125			
10/22/19 9:45	3600	1	117.000	2.431E-06	120.313	1.056E-06	119.313	1.581E-06		
10/22/19 10:45	3600	2	112.063	2.338E-06	118.875	7.702E-07	116.625	1.547E-06		
10/22/19 11:45	3600	3	107.875	2.068E-06	117.500	7.458E-07	114.125	1.473E-06		
10/22/19 12:45	3600	4	103.500	2.252E-06	115.125	1.310E-06	111.813	1.392E-06		
10/22/19 13:45	3600	5	99.750	2.010E-06	114.500	3.493E-07	109.688	1.306E-06		
10/22/19 14:45	3600	6	96.438	1.843E-06	113.188	7.401E-07	107.688	1.253E-06		
10/22/19 15:45	3600	7	93.313	1.800E-06	111.813	7.850E-07	105.750	1.238E-06		
10/23/19 16:30	89100	32	38.938	1.987E-06	83.750	7.547E-07	68.875	1.193E-06		

Sample Information

	Sample A:	Sample B:	Sample C:	Sample D:
Sample ID:	12316-E	12316-J	12316-L	
Sample Source	TB-1 @4'	TB-2 @ 3'	TB-3 @ 1'	
Soil Column Diameter (in.)	1.907	1.917	1.919	
Initial Soil Column Length (in.)	2.737	3.274	3.475	
Initial Moisture Content (%)	7.8	5.9	4.5	
Initial Dry Density (lbs./ft^3)	122.9	117.8	125.2	
Initial Pore Volume (in.^{3})	2.115	2.843	2.582	
Final Soil Column Length (in.)	2.824	3.400	3.580	
Swell (%)	3.2	3.8	3.0	
Final Moisture Content (%)	17.4	20.0	14.1	
Final Dry Density (lbs./ft^3)	113.7	111.3	121.5	
Final Saturation (%)	97.5	105.1	98.5	

Test Results Summary

	Sample A:	Sample B:	Sample C:	Sample D:
Average Hydraulic Gradient (in./s)	2.091E-06	7.808E-07	1.309E-06	
# of Pore Volumes of Inflow	11.361	8.449	9.288	

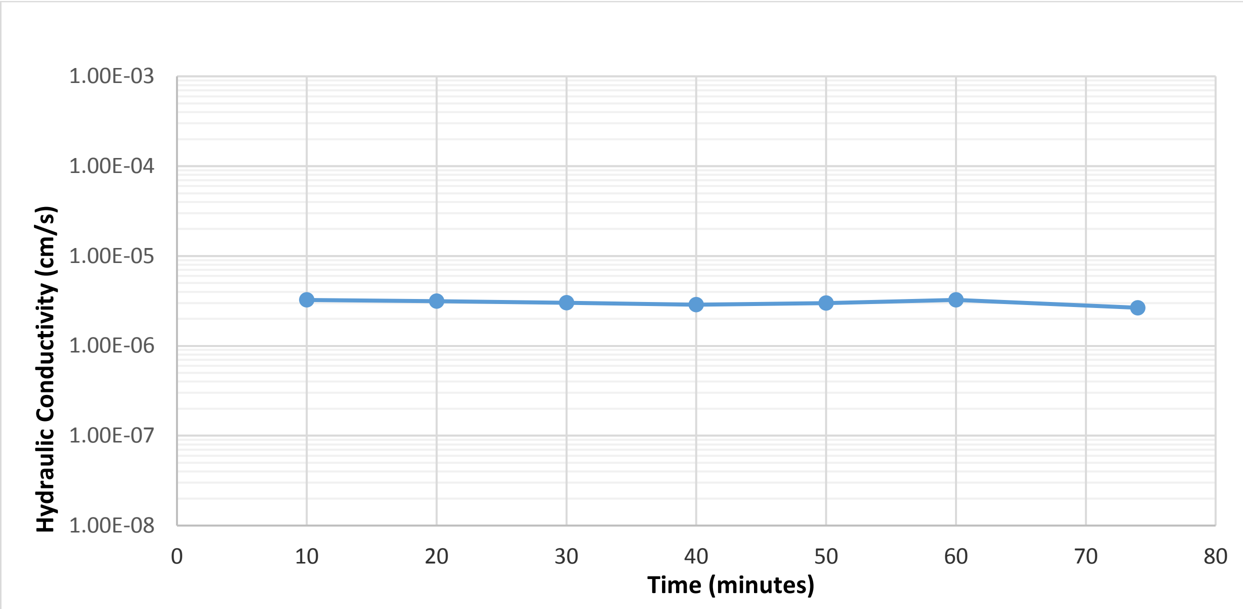
Notes: Assumed Specific Gravity of Solids to be 2.7 for Calculation of Pore Volume and Saturation.

TRAUTNER GEOTECH LLC
GEOTECHNICAL ENGINEERING, MATERIAL TESTING AND ENGINEERING GEOLOGY

Hydraulic Conductivity
ASTM D5084-Method C (Falling Head Rising Tail)

Project: Cedar Hill Land Farm
Project #: 55814GE
Sample Number: 12316-B (Sample A)
Sample Type: TB-1 @ 2 feet, Modified California Liner, N=32, Formational Claystone

Initial Specimen Parameters	
Sample Type	Modified California Liner
Sample Height	3.836 inch
Sample Diameter	1.947 inch
Sample Area	2.977 in^2
Sample Moisture Content	6.1%
Sample Wet Density	133.9 pcf
Sample Dry Density	126.2 pcf
Backpressure and Effective Confining Pressures Prior to Permeation	
Cell Backpressure	38.0 psi
Pore Water	35.0 psi
B-Value at Permeation	0.95
Effective Confining Pressure After Saturation and prior to Permeation	0.70 psi
Hydraulic Gradient at Initiation of Permeation	5.1
Fluid Temperature	20 degrees Celsius
Average Hydraulic Conductivity @ 20 Degrees Celsius (K_{20}) (cm/sec)	
$K_{20} = 3.02 \times 10^{-6}$ cm/sec	
Final Specimen Parameters	
Sample Wet Density	137.1 pcf
Sample Moisture Content	16.4%
Sample Dry Density	117.8 pcf (sample swelled during test)

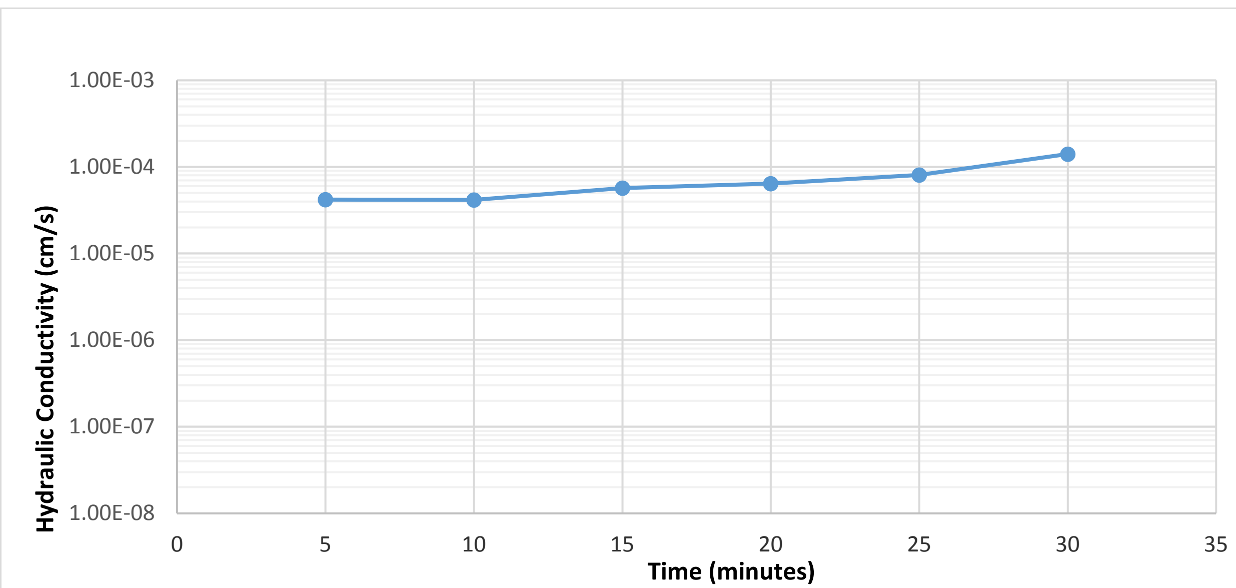


TRAUTNER GEOTECH LLC
GEOTECHNICAL ENGINEERING, MATERIAL TESTING AND ENGINEERING GEOLOGY

Hydraulic Conductivity
ASTM D5084-Method C (Falling Head Rising Tail)

Project: Cedar Hill Land Farm
Project #: 55814GE
Sample Number: 12316-G (Sample B)
Sample Type: TB-2 @ 1 feet, Modified California Liner, N=16, Formational Claystone
(it was noted that root was oriented perpendicular through sample after test was completed)

Initial Specimen Parameters	
Sample Type	Modified California Liner
Sample Height	3.176 inch
Sample Diameter	1.942 inch
Sample Area	2.962 in^2
Sample Moisture Content	8.1%
Sample Wet Density	123.5 pcf
Sample Dry Density	114.2 pcf
Backpressure and Effective Confining Pressures Prior to Permeation	
Cell Backpressure	38.0 psi
Pore Water	35.0 psi
B-Value at Permeation	0.95
Effective Confining Pressure After Saturation and prior to Permeation	0.60 psi
Hydraulic Gradient at Initiation of Permeation	5.2
Fluid Temperature	20 degrees Celsius
Average Hydraulic Conductivity @ 20 Degrees Celsius (K_{20}) (cm/sec)	
$K_{20} = 7.11 \times 10^{-5}$ cm/sec	
Final Specimen Parameters	
Sample Wet Density	132.6 pcf
Sample Moisture Content	21.1%
Sample Dry Density	109.5 pcf (sample swelled during test)

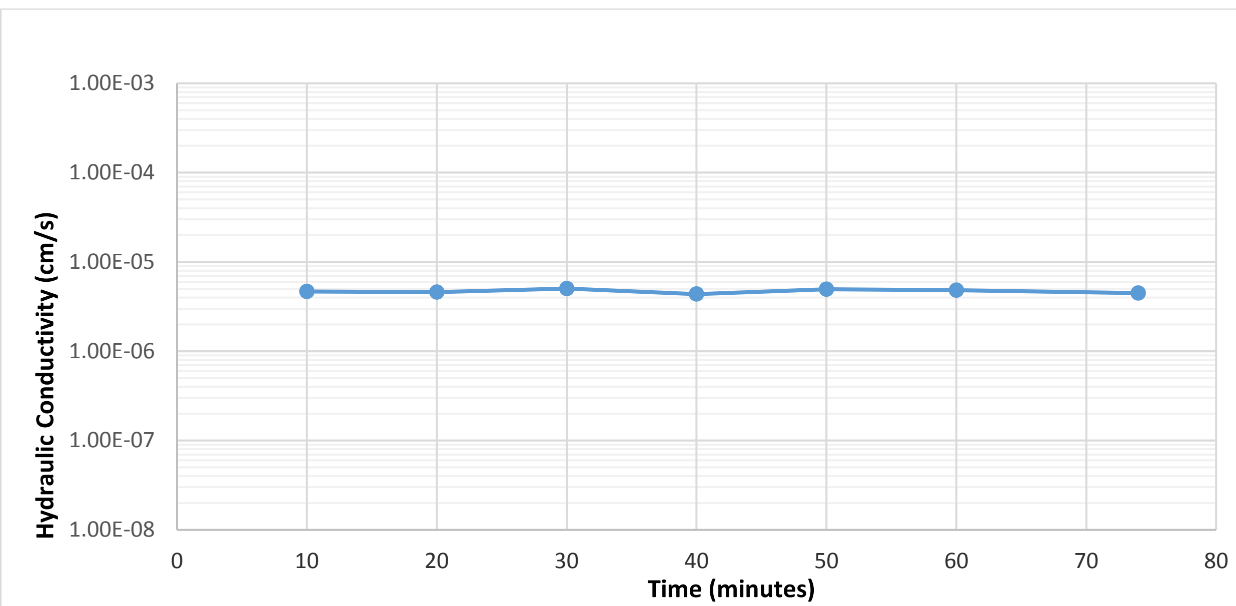


TRAUTNER GEOTECH LLC
GEOTECHNICAL ENGINEERING, MATERIAL TESTING
AND ENGINEERING GEOLOGY

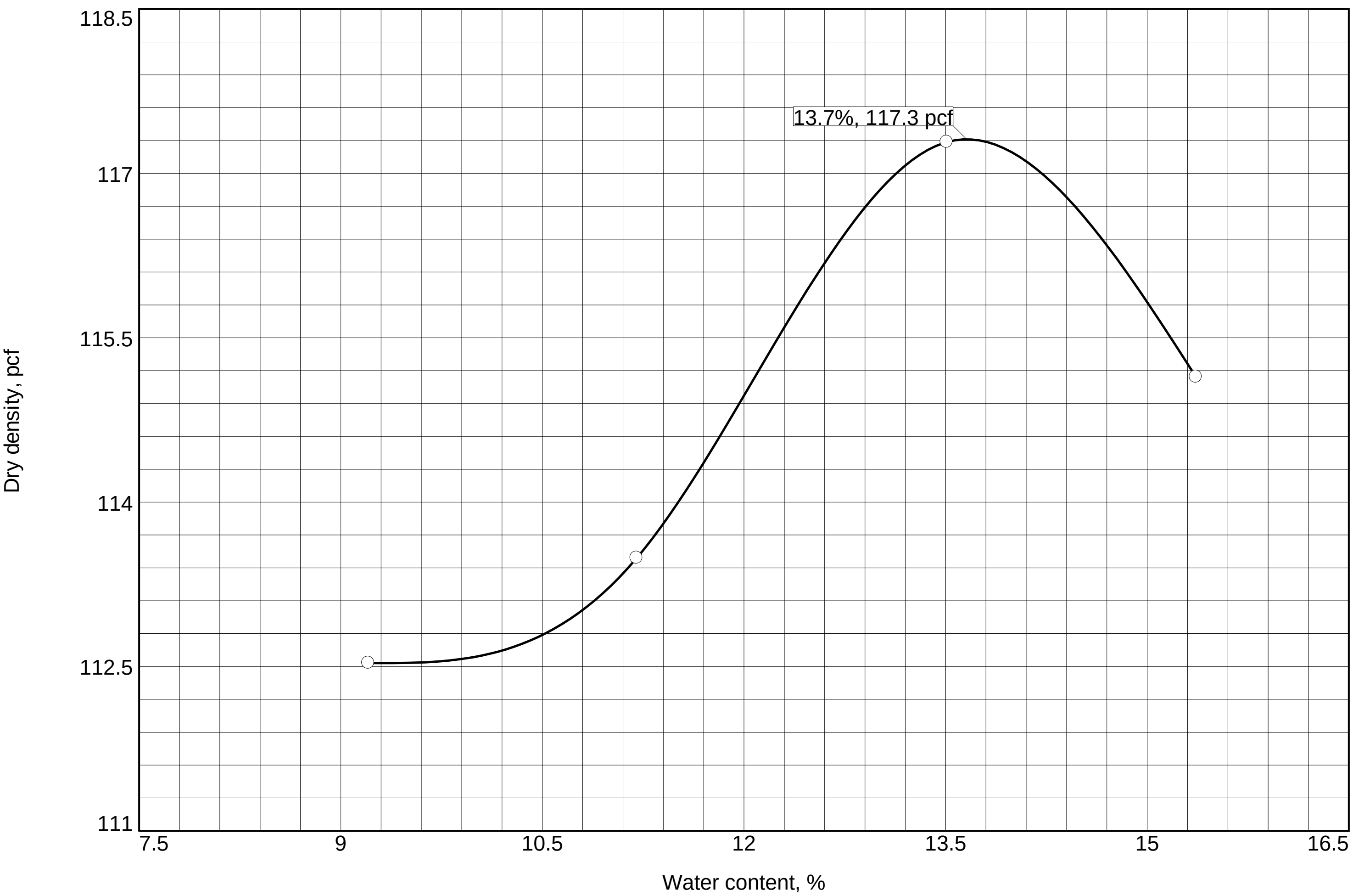
Hydraulic Conductivity
ASTM D5084-Method C (Falling Head Rising Tail)

Project: Cedar Hill Land Farm
Project #: 55814GE
Sample Number: 12316-I (Sample C)
Sample Type: TB-2 @ 3 feet, Modified California Liner, N=51, Formational Claystone

Initial Specimen Parameters	
Sample Type	Modified California Liner
Sample Height	3.324 inch
Sample Diameter	1.945 inch
Sample Area	2.971 in^2
Sample Moisture Content	6.0%
Sample Wet Density	119.9 pcf
Sample Dry Density	113.1 pcf
Backpressure and Effective Confining Pressures Prior to Permeation	
Cell Backpressure	38.0 psi
Pore Water	35.0 psi
B-Value at Permeation	0.96
Effective Confining Pressure After Saturation and prior to Permeation	0.60 psi
Hydraulic Gradient at Initiation of Permeation	5.0
Fluid Temperature	20 degrees Celsius
Average Hydraulic Conductivity @ 20 Degrees Celsius (K_{20}) (cm/sec)	
$K_{20} = 4.7 \times 10^{-6}$ cm/sec	
Final Specimen Parameters	
Sample Wet Density	122.1 pcf
Sample Moisture Content	19.7%
Sample Dry Density	102.0 pcf (sample swelled during test)



MOISTURE/DENSITY RELATIONSHIP



Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 117.3 pcf Optimum moisture = 13.7 %	CL-Sandy Lean Clay

Project No. 55814GE **Client:** Lt Environmental Inc.

Project: Cedar Hill Land Farm, Aztec

Date: 10-14-19

○ **Location:** Bulk - TB 1,2,3 **Sample Number:** 12316-P

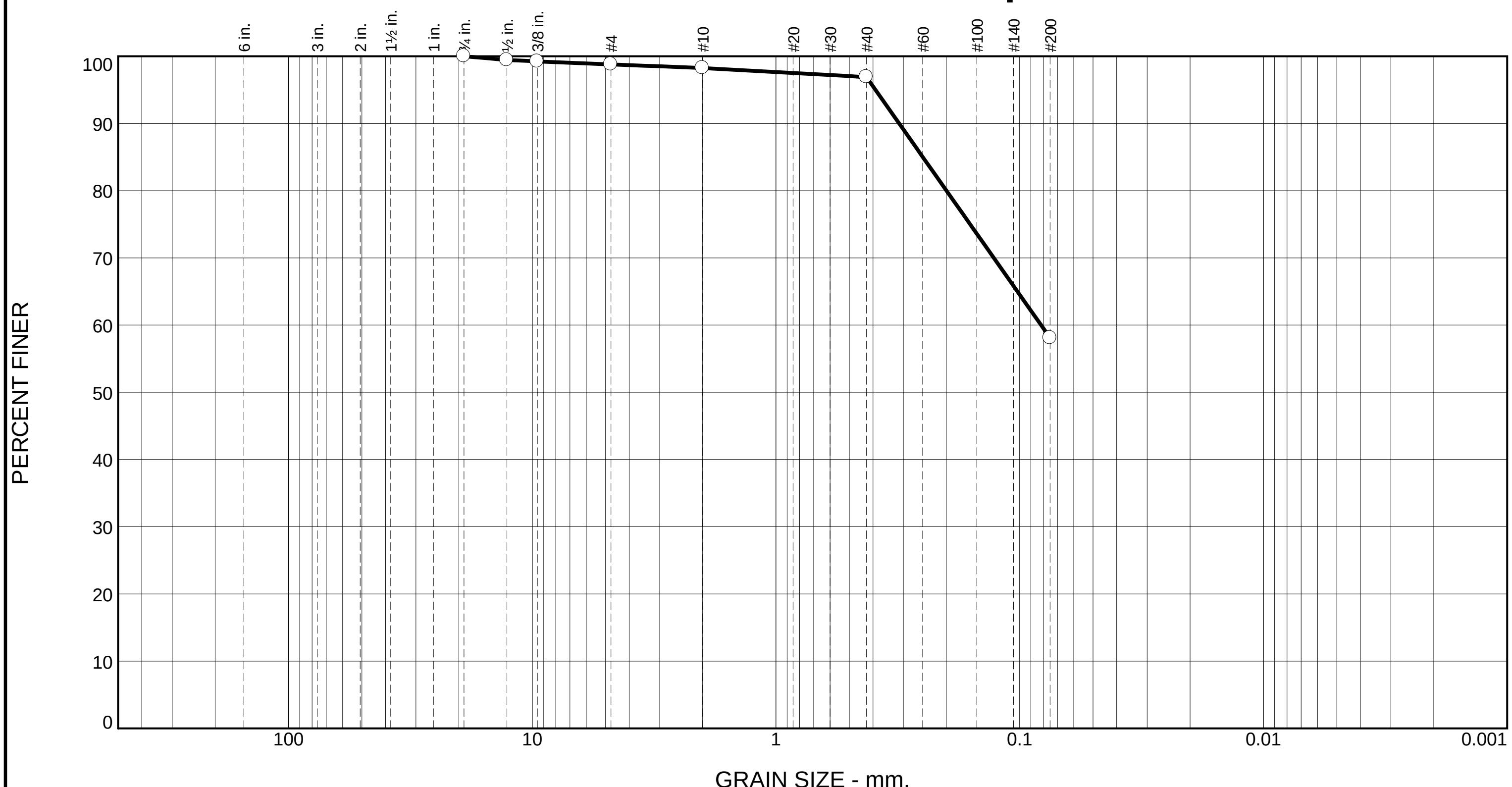
TRAUTNER GEOTECH LLC

Remarks:

Figure

Tested By: E. Howes **Checked By:** C. DeLeon

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	1	1	1	39	58	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100		
.50	99		
.375	99		
#4	99		
#10	98		
#40	97		
#200	58		

* (no specification provided)

Material Description

CL-Sandy Lean Clay

Atterberg Limits

PL= 16 LL= 32 PI= 16

Coefficients

D_{90}= 0.3122 D_{85}= 0.2497 D_{60}= 0.0817
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(6)

Remarks

Location: Test Boring 3
Sample Number: 12316-K **Depth:** 0'-3' **Date:** 10-7-19

TRAUTNER GEOTECH LLC

Client: Lt Environmental Inc.
Project: Cedar Hill Land Farm, Aztec
Project No: 55814GE **Figure** 4.1

Tested By: G. Jadrych **Checked By:** S. Chiarito

Laboratory Report for

LT Environmental, Inc.

Cedar Hill Land Farm, Aztec 558146E

October 29, 2019

Daniel B. Stephens & Associates, Inc.

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113

October 29, 2019

Joshua Adams
LT Environmental, Inc.
848 East Second Avenue
Durango, CO 81301
(970) 385-1096

Re: DBS&A Laboratory Report for the LT Environmental, Inc. Cedar Hill Land Farm, Aztec 558146E Project

Dear Mr. Adams:

Enclosed is the report for the LT Environmental, Inc. Cedar Hill Land Farm, Aztec 558146E project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to LT Environmental, Inc. and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Adam Bland
Laboratory Operations Manager

Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory
4400 Alameda Blvd. NE, Suite C
Albuquerque, NM 87113
505-889-7752
FAX 505-889-0258

Summaries

Daniel B. Stephens & Associates, Inc.

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
TB-3 @ 3'	X	X										X						X				

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method
[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall
[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity
[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer
[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Notes

Sample Receipt:
One sample, in two 2" x 4" brass sleeves sealed with end caps and tape, were received on October 10, 2019. The sample was delivered in a cardboard box surrounded by packing material and was received in good order.

Sample Preparation and Testing Notes:
The sample was subjected to initial properties analysis, specific gravity testing and effective porosity.

An intact sub-sample for the initial properties analysis was obtained using the most intact sleeve. The oven-dried material was then used for the specific gravity portion of the testing.

A representative sub-sample from the remaining sleeve was obtained for the dewpoint potentiometer portion of the testing, which was used to determine the effective porosity.

Daniel B. Stephens & Associates, Inc.

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

	Moisture Content						
	As Received		Remolded				
Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
TB-3 @ 3'	7.6	13.0	---	---	1.72	1.85	37.2

NA = Not analyzed
--- = This sample was not remolded

Daniel B. Stephens & Associates, Inc.

Summary of Specific Gravity Tests

Sample Number	<4.75 mm Fraction Specific Gravity	<4.75 mm Fraction Particle Size	<4.75 mm Fraction % of Bulk Sample	>4.75 mm Fraction Specific Gravity	>4.75 mm Fraction Particle Size	>4.75 mm Fraction % of Bulk Sample	Bulk Sample Specific Gravity[1]
TB-3 @ 3'	2.75	<4.75 mm	100%	NA	>4.75 mm	0%	2.75

[1] Based on the <4.75mm material

NA = Not Applicable since specificed fraction is less than 5% of composite sample mass

NR = Test not Requested

Daniel B. Stephens & Associates, Inc.

Summary of Moisture Retention (Effective Porosity)

Sample Number	Test Sample: Calculated Total Porosity (%, cm^3/cm^3)	Test Sample: -15 Bar Point Volumetric Water Content[1] (%, cm^3/cm^3)	Test Sample: Effective Porosity (%, cm^3/cm^3)	Oversize Corrected: Calculated Total Porosity (%, cm^3/cm^3)	Oversize Corrected: -15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Oversize Corrected: Effective Porosity (%, cm^3/cm^3)
TB-3 @ 3'	37.2	15.0	22.2	NA	NA	NA

*Effective Porosity (EP) is defined here as the difference in the moisture content of the sample at saturation (set equal to the sample total porosity) and the moisture content of the sample at -15 bars of water potential (commonly referred to as 'Wilting Point').

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable

NR = Not requested

Initial Properties

Daniel B. Stephens & Associates, Inc.

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

	Moisture Content						
	As Received		Remolded				
Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
TB-3 @ 3'	7.6	13.0	---	---	1.72	1.85	37.2

NA = Not analyzed
--- = This sample was not remolded

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: LT Environmental, Inc.
Job Number: DB19.1374.00
Sample Number: TB-3 @ 3'
Project Name: Cedar Hill Land Farm, Aztec
Date Sampled: 10/7/19

	As Received	Remolded
Test Date:	16-Oct-19	---
Field weight of sample* (g):	562.84	
Tare weight, ring (g):	0.00	
Tare weight, pan/plate (g):	208.59	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	329.37	
Sample volume (cm^3):	191.37	
Measured particle density (g/cm^3):	2.74	

Gravimetric Moisture Content (% g/g):	7.6	
Volumetric Moisture Content (% vol):	13.0	
Dry bulk density (g/cm^3):	1.72	
Wet bulk density (g/cm^3):	1.85	
Calculated Porosity (% vol):	37.2	
Percent Saturation:	35.0	

Laboratory analysis by: A. Bland
Data entered by: A. Bland
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Specific Gravity

Daniel B. Stephens & Associates, Inc.

Summary of Specific Gravity Tests

	<4.75 mm Fraction			>4.75 mm Fraction			Bulk Sample
Sample Number	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity[1]
TB-3 @ 3'	2.75	<4.75 mm	100%	NA	>4.75 mm	0%	2.75

[1]Based on the <4.75mm material

NA = Not Applicable since specificed fraction is less than 5% of composite sample mass

NR = Test not Requested

Daniel B. Stephens & Associates, Inc.

Data for Specific Gravity of Sample: TB-3 @ 3'

Job Name: LT Environmental, Inc.
Job Number: DB19.1374.00
Sample Number: TB-3 @ 3'
Project Name: Cedar Hill Land Farm, Aztec
Date Sampled: 10/7/19

ASTM D854 (<4.75mm Fraction)

Test Date:	23-Oct-19	
Percent of Test Sample (% g/g):	100.0	
Percent of Bulk Sample (% g/g):	100.0	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	88.32	89.93
Weight of pycnometer filled w/soil (g):	136.81	140.42
Weight of pycnometer filled w/soil & water (g):	368.62	371.45
Weight of pycnometer filled w/water (g):	337.78	339.36
Specific Gravity (g/g):	2.75	2.74
Observed temperature (°C):	20.10	20.00
Density of water at observed temperature (g/cm^3):	0.9982	0.9982
Correction factor, K:	1.0000	1.0000
Specific Gravity at 20°C (g/g):	2.75	2.74
Average Specific Gravity (g/g):	2.75	
Average Particle Density (g/cm^3):	2.74	

ASTM C127 (>4.75mm) Fraction

Test Date:	NA
Percent of Test Sample (% g/g):	0.0
Percent of Bulk Sample (% g/g):	0.0
Tare Weight (g):	---
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---
Saturated Apparent mass in Water & Tare (g):	---
Oven Dry (OD) mass in Air & Tare (g):	---
SSD Specific Gravity (g/g):	---
Apparent Specific Gravity (g/g):	---
OD Specific Gravity (g/g):	---
Percent Absorption (%):	---
Observed Temperature (°C):	---
Density of water at observed temperature (g/m^3):	---
Correction Factor, K:	---
Specific Gravity (Apparent), Corrected to 20° C:	---
Particle Density (Apparent), Corrected to 20° C (g/cm^3):	---

Test unnecessary since fraction is less than 5% of bulk sample mass

Specific Gravity (Apparent) of Sample*: **2.75**

Particle Density (Apparent) of Sample (g/cm^3)*: 2.74

** Based on <4.75mm Fraction*

Laboratory analysis by: A. Baldridge
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Effective Porosity

Daniel B. Stephens & Associates, Inc.

Summary of Moisture Retention (Effective Porosity)

Sample Number	Test Sample			Oversize Corrected		
	Calculated Total Porosity (%, cm^3/cm^3)	-15 Bar Point Volumetric Water Content[1] (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)	Calculated Total Porosity (%, cm^3/cm^3)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)
TB-3 @ 3'	37.2	15.0	22.2	NA	NA	NA

*Effective Porosity (EP) is defined here as the difference in the moisture content of the sample at saturation (set equal to the sample total porosity) and the moisture content of the sample at -15 bars of water potential (commonly referred to as 'Wilting Point').

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable

NR = Not requested

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: LT Environmental, Inc.
Job Number: DB19.1374.00
Sample Number: TB-3 @ 3'
Project Name: Cedar Hill Land Farm, Aztec
Date Sampled: 10/7/19

Initial sample calculated total porosity (cm^3): 37.20
Measured particle density (g/cm^3): 2.74
Initial sample bulk density (g/cm^3): 1.72
Fraction of sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 165.41
Tare weight, jar (g): 116.63

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	22-Oct-19	12:45	169.72	14787	15.21
	21-Oct-19	14:40	169.44	17847	14.22

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14787	---	---	---	---
	17847	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 15.0

***Effective Porosity* (% cm^3/cm^3): 22.2**

***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

NA Not Applicable — --- Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR Not Requested

Laboratory analysis by: D. O'Dowd
Data entered by: A. Albay-Yenney
Checked by: J. Hines

Laboratory Tests and Methods

Daniel B. Stephens & Associates, Inc.

Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263, ASTM D2216
Calculated Porosity:	ASTM D7263
Specific Gravity Fine:	ASTM D854
Effective Porosity:	ASTM D6836; Stephens, D.B.,1997, Hydrology Journal (1998) 6:6156-165, A Comparison of Estimated and Calculated Effective Porosity