ENSOLUM

March 22, 2024

New Mexico Oil Conservation Division
New Mexico Energy, Minerals, and Natural Resources Department
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Re: **Soil Vapor Extraction Pilot Test Summary**
Pipkin Gas Com A #1E
San Juan County, New Mexico
Hilcorp Energy Company
NMOCD Incident Number: NAPP2315954357

To Whom it May Concern:

Ensolum, LLC (Ensolum), on behalf of Hilcorp Energy Company (Hilcorp), presents this *Soil Vapor Extraction Pilot Test Summary* performed at the Pipkin Gas Com A #1E natural gas production well pad (Site). The Site is located on federal land managed by the United States Bureau of Land Management (BLM) in Unit C, Section 7, Township 27 North, Range 10 West in San Juan County, New Mexico (Figure 1).

SITE BACKGROUND

Historical petroleum hydrocarbon impacts related to a below-grade tank (BGT) were discovered during BGT closure and well pad reclamation activities on July 26, 2022. Analytical results collected on July 29, 2022, confirmed the presence of total petroleum hydrocarbon (TPH) concentrations exceeding the applicable New Mexico Oil Conservation Division (NMOCD) Closure Criteria. Once delineation activities were completed at the Site in April and May 2023, Hilcorp estimated the release volume to be approximately 23 barrels based on laboratory analytical results obtained from soil samples and the approximate extent of soil impacts. The release was reported to the NMOCD on June 8, 2023, on a Form C-141, *Release Notification* and was assigned NMOCD Incident Number NAPP2315954357.

SITE CLOSURE CRITERIA

Based on the information presented in the *Site Investigation Report and Remediation Work Plan,* dated August 11, 2023, and in accordance with the *Table I, Closure Criteria for Soils Impacted by a Release* (19.15.29.12 of the New Mexico Administrative Code [NMAC]), the following Closure Criteria will be applied to the Site constituents of concern (COCs):

- Benzene: 10 milligrams per kilogram (mg/kg)
- Benzene, toluene, ethylbenzene, and xylenes (BTEX): 50 mg/kg
- Total petroleum hydrocarbons (TPH) as a combination of gasoline range organics (GRO), diesel range organics (DRO), and motor oil range organics (MRO): 100 mg/kg
- Chloride: 600 mg/kg

SITE INVESTIGATION ACTIVITIES

In response to the discovery of soil impacts beneath the former BGT, Hilcorp performed initial delineation activities using a backhoe to pothole at the center of the former BGT location on October 28, 2022. Due to limitations of the equipment, samples were collected at a maximum depth of 14 feet below ground surface (bgs). During this event, samples were collected at depths of 8, 10, 12, and 14 feet bgs and were submitted to Hall Environmental Analysis Laboratory (Hall) for analysis of BTEX following United States Environmental Protection Agency (EPA) Method 8021B, TPH following EPA Method 8015M/D, and chloride following EPA Method 300.0. Laboratory analytical results indicated the presence of TPH at concentrations exceeding the NMOCD Table I Closure Criteria in all collected samples.

Based on the initial field screening and sampling results, additional vertical and horizontal delineation with a drill rig was required. Drilling activities took place on April 14, 2023, utilizing a Central Mining Equipment (CME) 75 hollow-stem auger drill rig operated by Enviro-Drill, Inc. with split-spoon sampling, to advance a total of three borings (BH01 to BH03) to depths up to 35 feet bgs (Figure 2). Based on the laboratory analytical results collected during the April 2023 drilling event, additional drilling was conducted on May 17 and 18, 2023, to further delineate lateral impacts west of boring BH01 and to advance a boring at the center of the former BGT location. Laboratory analytical results from the delineation efforts are included in Table 1 and depicted on Figure 2. Based on field screening during drilling, borings BH01 and BH04 were completed as soil vapor extraction (SVE) wells to be used for pilot testing and potential future remediation. SVE well locations are shown on Figure 3.

Additional details regarding the delineation and SVE well construction activities are described in the *Site Investigation Report and Remediation Work Plan,* dated August 11, 2023.

PILOT TEST ACTIVITIES AND FINDINGS

Based on the nature and depth of the release, Ensolum conducted a pilot test on February 6, 2024, to assess the potential use of SVE to remediate impacted soil at depth at the Site. As described by the EPA, SVE is an in-situ technique for the removal of volatile organic compounds (VOCs) and some semi-volatile organic compounds (SVOCs) from vadose zone soil through the application of vacuum to the subsurface. When air is removed from the soil, contaminants are volatilized and removed simultaneously. Depending on contaminant concentrations in the extracted air, the SVE system may emit exhaust directly to the atmosphere.

During pilot testing activities, SVE-1D (associated with boring BH04) was used as the extraction well and well SVE-2 (associated with boring BH01) was used as an observation well to determine the potential radius of influence (ROI) at the Site. The extraction well was sealed off to the atmosphere and vacuum was applied via vacuum truck for the duration of the test. Flow rates and applied vacuum were measured at the extraction well using an adjustable manifold and vacuum responses were measured in SVE-2. An adjustable manifold was used to incrementally increase the vacuum being applied to the extraction pilot test well in order to determine the minimum vacuum required to induce airflow through the subsurface and to assess the Site-specific relationship between flow and vacuum. Flow, vacuum, and field headspace readings at the pilot test extraction well were recorded at 10- to 15-minute intervals throughout the test.

During the pilot test, flow and vacuum were incrementally increased until the maximum capable vacuum was applied by the vacuum truck at approximately 150 inches of water column (IWC). The maximum recorded flow when applying 150 IWC was approximately 12.8 actual cubic feet per minute (acfm). Vacuum measurements were also recorded during the pilot test from well SVE-2 at the same interval measurements as the extraction well. Observation well SVE-2 is located approximately 27 feet away from the extraction well and screened across a similar and overlapping interval as SVE-1D. Vacuum responses were not observed in the observation well during the test. As discussed in the textbook *Remediation Engineering: Design Concepts, Second Edition* (Sutherson, Horst, Schnobrich, Welty, &

McDonough, 2017), a minimum vacuum response of 0.1 IWC in observation wells is required to provide sufficient airflow through the subsurface for SVE to be an effective remedial technology at the given distance.

The pilot test results indicate SVE is not a viable remediation technique at the Site using the current configuration of wells. SVE could potentially be proven viable if additional "infill" wells are installed at the Site at closer distances to the extraction well and an additional pilot test is performed to verify a technologically effective and economically feasible ROI can be achieved.

CONCLUSIONS AND RECOMMENDATIONS

Based on the February 2024 SVE pilot test results, Hilcorp will reassess remedial options to address impacted soil at the Site. An *Updated Remediation Work Plan* will be submitted to the NMOCD within 90 days of submittal of this report providing a recommended adjustment to the pilot testing of the SVE system or an alternative remediation strategy for the Site.

We appreciate the opportunity to provide this document to the NMOCD. If you should have any questions or comments regarding this document, please contact the undersigned.

Sincerely,
Ensolum, LLC

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Attachments:

Figure 1: Site Location Map
Figure 2: Soil Sample Analytical Results
Figure 3: SVE Well Locations

Table 1: Delineation Soil Sample Analytical Results

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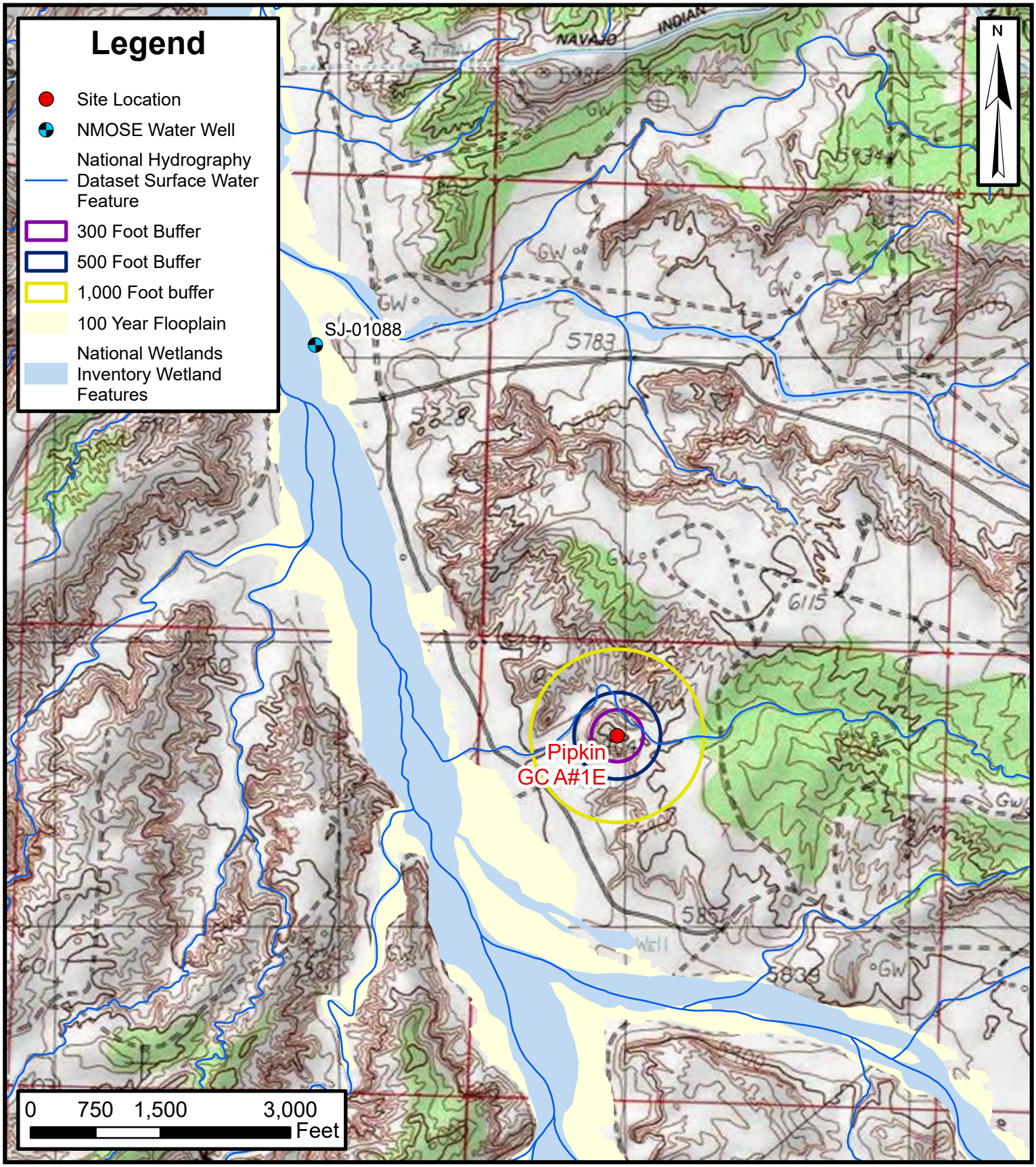
FIGURES



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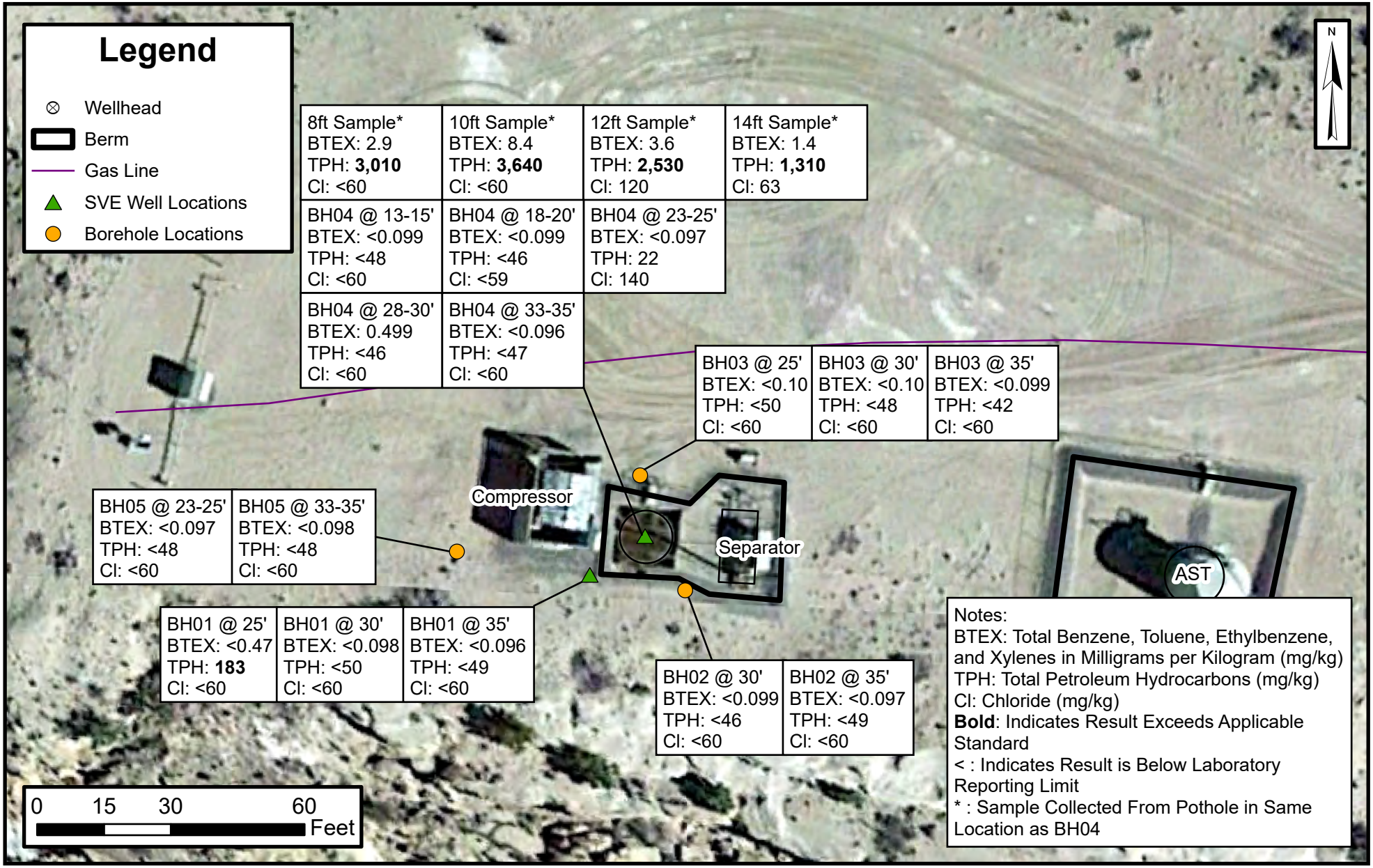
Site Location Map

Pipkin Gas Com A #1E
Hilcorp Energy Company
Unit C, Sec 7, T27N, R10W
36.59396, -107.94056
San Juan County, New Mexico

FIGURE
1

Sources: Environmental Systems Research Institute (ESRI), National Geographic Society, i-cubed, United States Geologic Survey (USGS), United States Fish and Wildlife Service (USFWS), New Mexico Office of the State Engineer (NMOSE)



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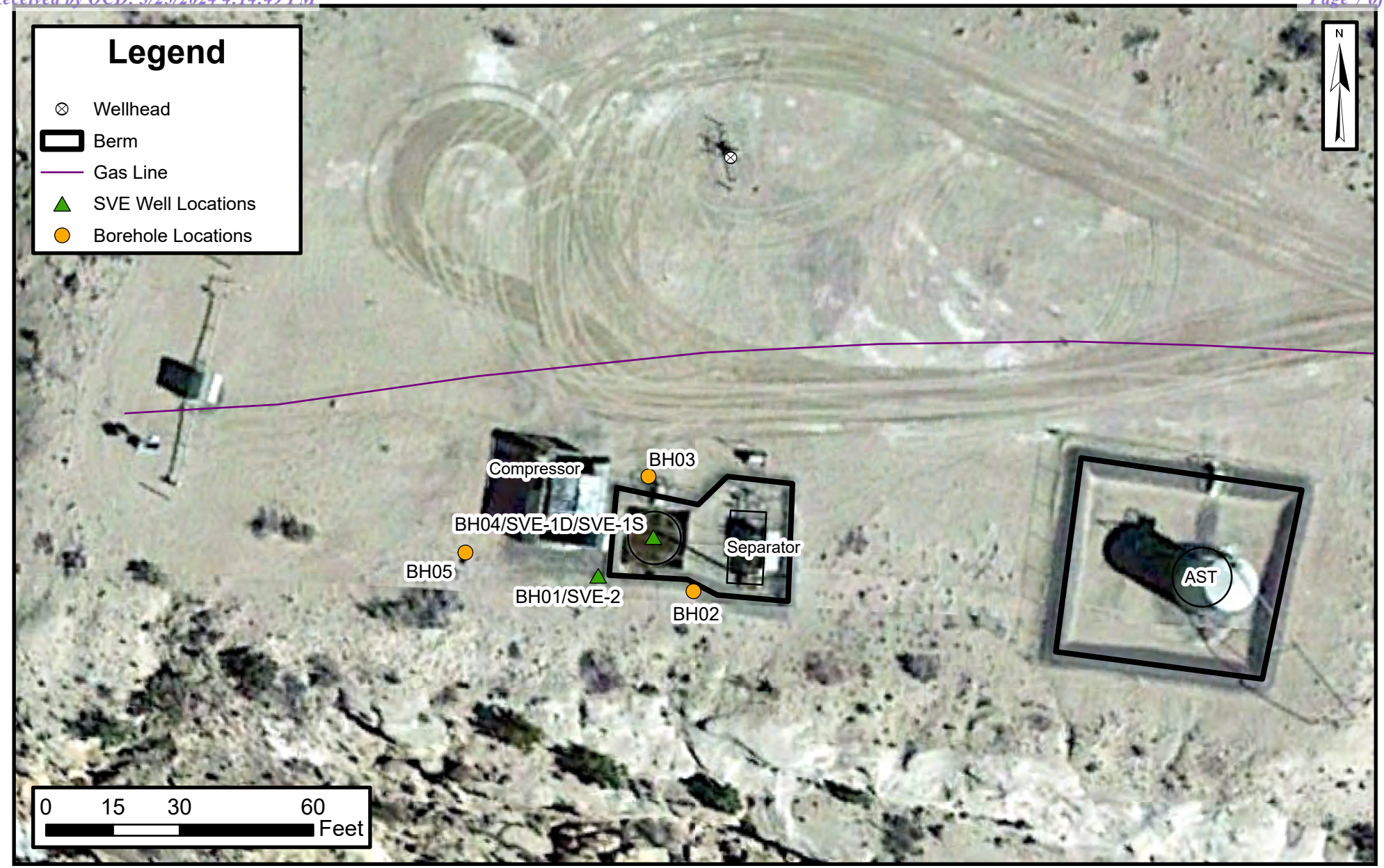
Soil Sample Analytical Results

Pipkin Gas Com A #1E
Hilcorp Energy Company
Unit C, Sec 7, T27N, R10W
36.59396, -107.94056
San Juan County, New Mexico

FIGURE
2

Sources: Google Earth



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SVE Well Locations

Pipkin Gas Com A #1E
Hilcorp Energy Company
Unit C, Sec 7, T27N, R10W
36.59396, -107.94056
San Juan County, New Mexico

FIGURE
3

Sources: Google Earth

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TABLES

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TABLE 1
DELINEATION SOIL SAMPLE ANALYTICAL RESULTS
Pipkin Gas Com A #1E
Hilcorp Energy Company
San Juan County, New Mexico

Sample ID	Date	Depth (feet bgs)	Benzene (mg/kg)	Total BTEX (mg/kg)	TPH GRO (mg/kg)	TPH DRO (mg/kg)	TPH MRO (mg/kg)	Total TPH (mg/kg)	Chloride (mg/kg)
NMOCD Closure Criteria for Soils Impacted by a Release			**10**	**50**	NE	NE	NE	**100**	**600**
8ft Sample (1)	10/28/2022	8	<0.021	2.9	110	1,900	1,000	**3,010**	<60
10ft Sample (1)	10/28/2022	10	<0.018	8.4	260	2,400	980	**3,640**	<60
12ft Sample (1)	10/28/2022	12	<0.020	3.6	200	1,700	630	**2,530**	120
14ft Sample (1)	10/28/2022	14	<0.017	1.4	110	1,200	<500	**1,310**	63
BH01 @ 25'	4/14/2023	25	<0.12	<0.47	<23	120	63	**183**	<60
BH01 @ 30'	4/14/2023	30	<0.024	<0.098	<4.9	<10	<50	<50	<60
BH01 @ 35'	4/14/2023	35	<0.024	<0.096	<4.8	<9.7	<49	<49	<60
BH02 @ 30'	4/14/2023	30	<0.025	<0.099	<4.9	<9.2	<46	<46	<60
BH02 @ 35'	4/14/2023	35	<0.024	<0.097	<4.8	<9.7	<49	<49	<60
BH03 @ 25'	4/14/2023	25	<0.025	<0.10	<5.0	<8.8	<50	<50	<60
BH03 @ 30'	4/14/2023	30	<0.025	<0.10	<5.0	<9.6	<48	<48	<60
BH03 @ 35'	4/14/2023	35	<0.025	<0.099	<5.0	<8.4	<42	<42	<60
BH-04 (13-15ft)	5/17/2023	13-15	<0.025	<0.099	<4.9	<9.6	<48	<48	<60
BH-04 (18-20ft)	5/17/2023	18-20	<0.025	<0.099	<4.9	<9.3	<46	<46	<59
BH-04 (23-25ft)	5/17/2023	23-25	<0.024	<0.097	<4.8	22	<47	22	140
BH-04 (28-30ft)	5/17/2023	28-30	<0.025	0.499	<4.9	<9.3	<46	<46	<60
BH-04 (33-35ft)	5/17/2023	33-35	<0.024	<0.096	<4.8	<9.4	<47	<47	<60
BH05 23-25'	5/18/2023	23-25	<0.024	<0.097	<4.9	<9.7	<48	<48	<60
BH05 33-35'	5/18/2023	33-35	<0.025	<0.098	<4.9	<9.7	<48	<48	<60

Notes:

(1): sample collected from pothole in same location as BH04

bgs: below ground surface

BTEX: Benzene, Toluene, Ethylbenzene, and Xylenes

mg/kg: milligrams per kilogram

NE: Not Established

NMOCD: New Mexico Oil Conservation Division

': feet

GRO: Gasoline Range Organics

DRO: Diesel Range Organics

MRO: Motor Oil/Lube Oil Range Organics

TPH: Total Petroleum Hydrocarbon

< : indicates result less than the stated laboratory reporting limit (RL)

*Concentrations in **bold** and shaded exceed the New Mexico Oil Conservation Division Table I Closure Criteria for Soils Impacted by a Release*

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

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

CONDITIONS

Operator:	OGRID:
HILCORP ENERGY COMPANY 1111 Travis Street Houston, TX 77002	372171
	Action Number: 326573
	Action Type: [REPORT] Alternative Remediation Report (C-141AR)

CONDITIONS

Created By	Condition	Condition Date
nvelez	Report accepted for the record. Hilcorp must submit to OCD its reassessment of its remedial options or final remediation closure report by July 31, 2024.	5/2/2024