AECOM

OCD's review of the Summary of Project Activities 2018-2022: Content satisfactory.

1. El Paso Natural Gas Company's (EPNG) can proceed with the Project Path Forward Section in this report.

2. Please present abatement plan to OCD no later than 12/29/2023.

Summary of Project Activities 2018 - 2022

Former El Paso Natural Gas Company, LLC Jal No. 4 Plant
Lea County, New Mexico

NMOCD Abatement Plan Case #AP – 101
Incident ID #nAPP2110635360

AECOM Project No. 60689389

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Delivering a better world

Quality information

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1. Introduction

AECOM, at the request of Kinder Morgan, Inc., has prepared this *Summary of Project Activities 2018 through 2022* for the Former El Paso Natural Gas Company, LLC (EPNG) Jal No. 4 Pant (Plant) located off Highway 18, approximately 10 miles north of the town of Jal, Lea County, New Mexico (Site). A Site Location Map is provided as **Figure 1-1**. The project activities have included installation of groundwater delineation monitor wells, hydrogeological assessment, aquifer testing, groundwater transport and fate modeling, and development of a preliminary groundwater recovery system design for future groundwater remediation at the Site, which includes the Plant and impacted areas east and north of the Plant.

1.1 Background

The Plant was constructed by EPNG in 1952 to treat, compress, store, and transport natural gas to EPNG's main transmission lines. From 1952 to 1981, brine and wastewater were managed in eight unlined retention ponds associated with creation and operation of natural gas cavern storage wells at the Plant. Beginning in 1981, brine has instead been managed in ponds with synthetic liners.

Site investigations have revealed the presence of chloride-impacted groundwater beneath the Site and adjacent offsite properties. Benzene concentrations in groundwater also exceed regulatory standards in a limited area beneath the eastern portion of the Site. The Site is regulated by the New Mexico Oil Conservation Division (NMOCD) under Abatement Plan AP-101.

The impacted groundwater beneath the Site occurs within reworked sediments of the Tertiary-age Ogallala formation, which unconformably overlies red-bed sediments of the Triassic-age Dockum Group. The water quality of the Ogallala and overlying Quaternary alluvium groundwater is better than the water quality of the underlying Triassic formations. The Ogallala and alluvial aquifers also have higher yields and are the primary sources of potable groundwater for domestic and industrial users in the Site area.

Groundwater occurs under unconfined conditions within the Ogallala sediments beneath the Site. The depth to groundwater in the Site area is approximately 100 feet (ft) below land surface (ft-bls). The saturated thickness of the groundwater bearing unit is approximately 60 to 80 ft and does not include known aquitards or significant barriers to vertical flow. The groundwater flow direction is generally to the southeast.

EPNG has installed 31 monitor wells (ACW-01, ACW-02, ACW-04 through ACW-07, ACW-09 through ACW-29, ACW-30S/D, and ACW-32S/D) on the Site and surrounding properties that are currently being sampled annually as Program Wells (**Figure 1-2**). The existing monitor wells are generally screened in two vertical zones within the groundwater bearing unit and have been grouped as upper and lower wells. The upper wells have been screened across the groundwater interface and the lower wells have been screened across a 20-foot interval at the base of the groundwater bearing unit which is defined by the contact with Triassic "red beds" underlying the Ogallala sediments. At several locations, paired wells have been installed, which include both an upper well and a lower well. The quarterly 2021 Groundwater Surface Elevation Maps for the Upper Groundwater and Lower Groundwater are provided as **Figure 1-3** and **Figure 1-4**, respectively. December 2021 Isopleths of Chloride Concentrations in Upper Groundwater and Lower Groundwater are provided as **Figure 1-5** and **Figure 1-6**, respectively.

EPNG has also installed six recovery wells at the site. Two of the recovery wells, RW-01 and RW-02, are 10-inch diameter PVC wells that fully penetrate the aquifer with approximately 70 feet of 0.035-inch slotted screen. Recovery wells RW-03 and RW-04 are screened in the lowermost part of the aquifer. Recovery well RW-03 is constructed of 4-inch diameter PVC with

40 feet of 0.020-inch slotted screen. Recovery well RW-04 is constructed of 5-inch diameter PVC with 20 feet of 0.010-inch slotted screen.

EPNG initiated continuous groundwater recovery from recovery well RW-01 in October 1999 and the groundwater recovery system was eventually operated out of wells RW-01, RW-03, ACW-03 and ACW-08 on the Plant property, and RW-02 east of the Plant across State Highway 18. Locations of the groundwater recovery wells RW-01 through RW-04 are depicted on **Figure 1-2**.

The groundwater recovery system is reported to have recovered 84,850,733 gallons of groundwater and has not been operated since May 2012. The recovered groundwater was injected into a Class II water disposal well located immediately north of the Plant.

Recovery wells EW-1 and EW-2 were installed in November 2021 and tested in June 2022, but are currently inactive and are not included in the groundwater sampling program.

1.2 Objective

The objective of this report is to describe the 2018 - 2022 project activities that have been conducted at the Site and summarize the findings associated with those activities. The 2018-2022 project activities include, but are not limited to, the following:

- Upper/lower monitor wells ACW-30S/30D and ACW-32S/32D were installed in June – July 2018.
- Recovery well inspection/rehabilitation and aquifer testing activities were performed in March – April 2019 (recovery wells RW-1 and RW-2).
- Phase I and Phase II groundwater modeling were performed from June to November 2019.
- Three soil borings were drilled and soil samples were collected for grain size analysis in October – November 2020.
- AECOM contracted with Sourcewater, Inc. (Sourcewater) to conduct a Class I Underground Injection Control (UIC) Site Characterization in January 2001.
- A groundwater model update was completed from November 2021 to February 2022, to incorporate viscosity into the groundwater flow simulation. The remedial alternative simulations included evaluation of the feasibility of horizontal groundwater extraction wells.
- Groundwater recovery wells EW-1 and EW-2 were installed in November 2021.
- Annual groundwater sampling was performed in December 2021.
- Aquifer testing was performed on recovery wells EW-1 and EW-2 in June 2022.
- Aquifer test data evaluation and groundwater modeling were conducted from July to September 2022.

Summaries of the 2018 – 2022 project activities referenced above are provided in Sections 2 through 12 of this report.

2. 2018 Installation of Monitor Wells ACW-30S/30D and ACW-32S/32D

In June – July 2018, nested monitoring well pairs ACW-30S/D and ACW-32S/D were installed using rotosonic drilling methods. The monitor well locations are shown on **Figure 1-2**. At each of the ACW-30 and ACW-32 locations, two nested monitoring wells were installed in a single borehole. The shallow and deep monitoring wells in each boring were constructed using 3-inch nominal diameter schedule 80 PVC (ID=2.9 inches, OD=3.5 inches) with 25 ft of slotted screen for the upper wells and 20 ft of slotted screen for the lower wells. Screened intervals for wells ACW-30S and ACW-30D were set at 95 to 120 ft bgs and 165 to 185 ft bgs, respectively. Screened intervals for wells ACW-32S and ACW-32D were set at 95 to 120 ft bgs and 150 to 170 ft bgs, respectively.

Previous monitor wells at the Site were drilled using mud rotary drilling methods, which make it challenging to prepare detailed lithologic logs due to the presence of the drilling mud and borehole slough mixed with the soil cuttings. Since the rotosonic drilling methods produce continuous soil cores across most of the depth of the boreholes, the drilling activities for these monitor wells provided an opportunity for preparation of more detailed lithologic logs. Of particular note in the lithologic logs in sonic cores was the significant presence of fine-grained soil at the base of the Ogallala sediments overlying the Triassic “redbeds” of the Dockum Group. Soil samples were collected from select intervals and submitted to a geotechnical testing laboratory for grain size analysis.

3. 2019 Aquifer Testing

In March and April 2019, aquifer testing was performed at the Site to further characterize the aquifer and develop site-specific estimates for aquifer parameters, including transmissivity, hydraulic conductivity, and storativity for the purpose of developing a predictive groundwater flow model to evaluate remediation strategies for the Site.

The aquifer testing activities included pumping tests for inactive recovery wells RW-1 and RW-2, which both fully penetrate the aquifer and have nearby observation wells that were required for obtaining the data necessary to develop storativity estimates. Slug tests were conducted at selected monitor wells using a sand-filled pipe to inject or remove a volume of water into each well, producing instantaneous changes in water level.

The 2019 aquifer testing included the activities described below.

3.1 Recovery Wells RW-1 and RW-2 Inspection and Rehabilitation

Prior to testing, recovery well inspection and rehabilitation operations were performed at recovery wells RW-1 and RW-2 to reduce the effects of potential well inefficiencies on pumping rates during the well testing. Rehabilitation activities at RW-1 and RW-2 included: 1) brushing the well screens with a nylon brush, 2) performing chemical treatment of the wells, and 3) swab, bail, and pump development of the wells after completion of chemical treatment.

3.2 Groundwater and Sediment Sample Collection and Analysis

Groundwater and sediment samples were collected from RW-1 and RW-2 to evaluate biological and geochemical activity in the wells. The laboratory reports for biological analysis indicated large and diverse populations of bacteria that could impact operations by biofouling, including slime forming bacteria and iron reducing bacteria that can cause fouling and microbiologically induced corrosion. The sample results also indicated elevated levels of mineral forming ions and the samples were supersaturated with calcium carbonate, iron, and manganese. Calcium carbonate, calcium sulfate, iron oxide, and manganese oxide scales are likely to form on wells and equipment. Mechanical fouling and corrosion due to fine sediment mobilization may also occur. Use of corrosion resistant materials is recommended, when possible. The laboratory report describes a program of physical and chemical rehabilitation procedures for these wells and other planned wells that will potentially be exposed to similar conditions.

3.3 Aquifer Testing at RW-1 and RW-2

Subsequent to well rehabilitation, a step-rate test was conducted at RW-1 for two hours at rates of approximately 16 and 25 gallons per minute (gpm). The step-rate test at RW-2 was conducted for three hours at rates of approximately 10 and 15 gpm.

Two constant rate pumping tests were also conducted during this study, with pumping periods of approximately 24 hours each. The first was completed with RW-01 as the pumping well and three observation wells (ACW-04, ACW-02A, and RW-03). The second was completed with RW-02 as the pumping well and two observation wells (ACW-09 and ACW-22). For analysis in AQTESOLV, the pumping rates were assumed to be constant at the average of each test: 17.2 gallons per minute (gpm) for the RW-1 test and 12.0 gpm for the RW-2 test.

3.4 Slug Tests

Slug testing was performed at 10 wells, which each included slug-in and slug-out tests. For all tests, a 10-foot slug was used, with an expected water level change of 3.94 feet in a 4-inch diameter well. The slug-in tests were completed by introducing the slug into the well to induce the expected change in water level. The water level in the well was monitored with a pressure transducer until it returned to the original water level or equilibrium. The slug-out test was then completed by removing the slug and continuing to monitor the water level until it returned to the original water level or equilibrium.

3.5 Summary of Aquifer Test Results

Pumping test and slug test data were analyzed using AQTESOLV software. A summary of the average estimated parameters for each well for both constant rate and slug tests are shown below.

Summary of 2019 Aquifer Testing Results

Well	Aquifer Location	Saturated Thickness (ft)	Average Hydraulic Conductivity (ft/d)		Average Transmissivity (ft^2/d)		Average Specific Storage (1/ft)		Average Specific Yield (-)
			Pumping	Slug	Pumping	Slug	Pumping	Slug	Pumping
ACW-01	Upper	85.3	-	3.99	-	340.28	-	1.8E-07	-
ACW-05	Upper	76.2	-	0.42	-	32.36	-	7.1E-05	-
ACW-06	Upper	94.0	-	0.63	-	59.64	-	6.9E-05	-
ACW-21	Upper	75.9	-	1.12	-	84.85	-	2.7E-04	-
ACW-22	Upper	65.6	26.89	3.14	1763.42	205.79	2.3E-04	-	0.06
ACW-02A	Upper	74.9	8.83	-	661.91	-	5.0E-05	-	0.04
Average	**Upper**	**78.6**	**17.86**	**1.86**	**1212.66**	**144.58**	**1.4E-04**	**1.0E-04**	**0.05**
ACW-04	Lower	73.1	3.22	-	235.27	-	8.2E-06	-	0.15
ACW-09	Lower	65.8	15.94	0.60	1048.06	39.41	1.1E-04	3.5E-06	0.05
ACW-11	Lower	78.1	-	0.83	-	64.54	-	9.6E-07	-
ACW-18	Lower	80.6	-	0.89	-	71.95	-	1.8E-06	-
ACW-24	Lower	82.7	-	0.59	-	48.63	-	4.1E-05	-
ACW-25	Lower	77.5	-	1.13	-	87.60	-	2.6E-06	-
RW-1	Lower	77.6	8.12	-	629.70	-	-	-	-
RW-2	Lower	65.7	8.32	-	546.49	-	-	-	-
RW-3	Lower	74.8	15.56	-	1163.20	-	2.5E-04	-	0.10
Average	**Lower**	**75.1**	**10.23**	**0.81**	**724.54**	**62.43**	**1.2E-04**	**9.9E-06**	**0.10**
Average	**Combined**	**76.5**	**12.41**	**1.33**	**864.01**	**103.50**	**1.3E-04**	**5.2E-05**	**0.08**

Notes:
ft/d – feet per day
ft^2/d – square feet per day
1/ft – unit per foot

4. 2019 Phase I and Phase II Groundwater Modeling

In June – November 2019, Phase I and Phase II groundwater modeling work was performed for the Site for the purpose of designing a groundwater recovery system. Phase I consisted of a 2-dimensional (2-D) steady state groundwater flow model and Phase II consisted of a 3-dimensional (3-D) density dependent groundwater flow and solute transport model.

4.1 Phase 1 Groundwater Modeling

The objective of the work was to develop and calibrate a numerical groundwater flow and solute transport model to support evaluation of alternative measures for remediation of groundwater impacted by historical operations at the Site. The primary goal of remediation is to reduce the extent of groundwater impacted with chloride concentrations exceeding the applicable regulatory standards and to limit the potential for impact to downgradient receptors.

Remediation of benzene was not considered, as chloride is by far the constituent of greatest concern at the Site. It is anticipated that the relatively minor benzene exceedances at the Site will be naturally attenuated during the time that will be required for active chloride remediation.

Phase I of the groundwater model development included construction and calibration of a simplified 2-D steady-state groundwater flow model using the model code MODFLOW-NWT (Niswonger, Panday and Ibaraki 2011) and the graphical user interface (GUI) Groundwater Vistas Version 7 (Rumbaugh and Rumbaugh 2017) to evaluate the number and location of extraction wells, pumping rates, and capture zones to provide initial information for preliminary design of an extraction well system, including water storage and handling infrastructure at the Site. The Phase I modeling work was documented in the *Technical Memorandum for Results of Phase I Groundwater Model Former El Paso Natural Gas Company, LLC (EPNG) Jal No. 4 Plant dated July 2019* (AECOM 2019).

The numerical groundwater flow model was calibrated to a groundwater level data set from November 2018 and verified with a groundwater level data set from May 2009. Predictive simulations of four recovery well system design configurations were performed to assess the number of wells, pumping rates, and estimated plume travel time. The preferred recovery system design included seven new pumping wells operating at a rate of 6.5 gpm, totaling 45.5 gpm. The design was simulated to fully capture the 2018 interpolated chloride plume with concentrations above 1,000 mg/l at pumping rates thought to be sustainable based on previous recovery well records and aquifer testing performed in 2019.

4.2 Phase II Groundwater Modeling

Phase II of the groundwater model development consisted of converting the Phase I steady-state groundwater model to a 3-D transient groundwater flow and solute transport model which accounts for the effects of density changes associated with elevated chloride concentrations in groundwater using the model code SEAWAT version 4 (Langevin, et al. 2012) and the GUI Groundwater Vistas version 7. The Phase II groundwater model was calibrated to historical water levels and chloride concentrations from the estimated initial release to the aquifer. Several configurations of pumping systems were analyzed to evaluate the most effective design for the number and location of extraction wells, pumping rates, and capture zones to achieve remediation goals for the Site. Phase II of this work was documented in the Report *Phase II Numerical Groundwater Model Former El Paso Natural Gas Company, LLC (EPNG) Jal No. 4 Plant dated November 2019* (AECOM 2019).

The model was iteratively calibrated to match the observed groundwater levels and chloride concentration data from 1997 through 2018. Iterative calibration was necessary because the flow field is dependent on the density of groundwater, which changes as a function of chloride concentration. Adequate matching of the groundwater heads and chloride concentrations therefore required adjustments to both the flow and transport models in order to meet quantitative and qualitative calibration goals. A history matching approach was used to fit the observed chloride concentrations including comparisons to the interpreted chloride plume from the 2018 Annual Report (AECOM 2019) and time series plots of chloride concentration data. The simulated plume and chloride concentrations over time fit reasonably well with observed concentration values. The model was considered to be sufficiently calibrated, allowing for the use of the model for predictive purposes.

The coupled numerical groundwater flow and chloride transport models were run as predictive simulations for the purpose of assessing natural attenuation and various groundwater recovery well system designs. Removing all groundwater with concentrations above 1,000 mg/l was used as the criteria for the assessment of effectiveness of recovery well pumping. The natural attenuation simulation indicated that the plume would continue to migrate off Site and did not dissipate to below 1,000 before exiting the downgradient model boundary located approximately 2.5 miles to the southeast of the Site. A total of five recovery well design options were simulated. Several designs indicated that full capture of the plume would be feasible and accelerated remediation could be achieved by placement of recovery wells close to the highest concentration area of the plume. The preferred remedial option based on these simulations is option #3b which includes 5 wells around the 2018 50,000 mg/l contour pumping for 75 years at 6.5 gpm each and 7 wells around the 2018 1,000 mg/l contour pumping for 107 years at 6.5 gpm each. Additional sensitivity analysis was performed demonstrating that capture was still achieved if the well rates were lowered to 5 gpm; however, cleanup times would increase.

5. 2020 Soil Borings and Collection of Samples for Grain Size Analysis

In October – November 2020, rotosonic drilling methods were used to drill three soil borings (BH-1 through BH-3) that fully penetrated the aquifer in the vicinity of the proposed groundwater recovery wellfield. The locations of soil borings BH-1 through BH-3 are shown on **Figure 5-1**. Soil samples from the saturated zone were submitted for grain size (sieve) analyses to characterize the aquifer matrix and provide information for future recovery well screen and filter pack designs.

Sieve analysis results were documented in the memorandum with the subject *Results for Sieve Analyses - Former Jal No. 4 Plant Site* (AECOM 2021). The sieve analysis results indicate that, for samples collected in the saturated part of the aquifer below a depth of approximately 100 feet, more than 80 percent of the material is very fine sand less than 0.3 millimeters, or 0.0118 inches, in diameter. Samples from the 20 feet of soil at the base of the unit (but above the clay beds) also contained silt and clay particles smaller than 0.075 mm, or 0.003 inches (#200 sieve) at percentages ranging from about 10% to over 40% in borings BH-1 through BH-3. Sieve analysis results for borings BH-1 through BH-3 are shown on **Figure 5-2**. Sieve analysis results for samples previously collected from monitor well borings ACW-30D and ACW-32D are provided as **Figure 5-3**.

6. 2021 Groundwater Model Update

From November 2021 to February 2022 the numerical groundwater model for the Site documented in the Phase II Numerical Groundwater Model Report (AECOM 2019) was updated to account for new data, improve accuracy, and evaluate additional remedial alternatives. Revisions to the Phase II model also included use of Groundwater Vistas Version 8.16 and incorporation of viscosity into the groundwater flow simulation.

Incorporation of viscosity and availability of data collected after the original model calibration necessitated a limited recalibration of the numerical model. The calibration model was extended through the year 2021 and new data including water levels and chloride concentrations collected through the year 2020 were appended to the existing calibration dataset. Recalibration of the model was performed comparing water levels, chloride trend plots at monitoring wells, and chloride concentration contours from both 2018 and 2020. Based on these comparisons, the numerical groundwater flow and solute transport model is considered to reasonably reproduce observed water levels and the development and migration of the chloride plume from the start of evaporation pond operation in 1952 through 2021.

A total of thirteen remedial alternative simulations were performed, including various combinations of horizontal extraction wells, vertical extraction wells, and both injection and extraction wells. One horizontal well design, three vertical injection and extraction well designs, and eight additional vertical well designs were iteratively designed and tested to optimize the design within the Site constraints and 175 gpm limit on pumping. For reference, design based on the results of the Phase II study indicated a minimum pumping rate of 78 gpm is required to capture the plume; however, this rate did not prioritize minimizing simulated cleanup times. The original vertical well simulation required 107 years to clean up to 1,000 mg/l and 140 years to clean up to 250 mg/l plume, compared to the horizontal well design which required 36 and 43 years respectively. Three variations of upgradient extraction wells and downgradient injection wells were simulated, none of which cleaned up the plume or diluted it to below 1,000 mg/l. All the vertical well combinations resulted in full capture of the plume with cleanup times to 250 mg/l ranging from 35 to 85 years. The alternative with the fastest cleanup time included 24 extraction wells pumping at 7.3 gpm each, totaling 175 gpm. As shown on **Figure 7-1**, the configuration includes a line of 13 wells oriented parallel to the plume and a line of 11 wells oriented along Highway 18 and resulted in a cleanup time of 30 years to 1,000 mg/l and 35 years to 250 mg/l.

7. Additional Considerations and Design Selection

The main concerns related to the pump and treat system include remedy effectiveness, estimated cleanup time, sustainable yield, constructability, operation and maintenance requirements, well rehabilitation requirements associated with fine grained aquifer material, and total cost. Effectiveness and cleanup time were addressed with the numerical model simulations discussed in Section 6.

AECOM conducted an evaluation and comparison of horizontal wells and conventional vertical extraction wells. The main considerations in the final selection were constructability, sand production, and cost. AECOM discussed constructability options and cost estimates with two horizontal drilling contractors to evaluate the feasibility of horizontal wells. AECOM also consulted with contractors and vendors to develop a design for screen slot and filter pack for vertical wells.

Most horizontal wells are constructed without filter pack due to the difficulties and costs required for filter pack installation. In typical cases, a grain size distribution exists in the formation that will develop a natural filter pack. Slotted casing for horizontal well construction has a minimum size of 0.03 inches. Wire-wrap screen has smaller slots 0.006 (+/- 0.005) inches, but has higher installation costs and risks. Four options for installing horizontal wells were evaluated including one with pre-pak filter sand.

Formation materials for vertical wells were evaluated by AECOM and a well design was prepared using 0.020 slot size and 16-40 mesh sand. The advantages of vertical wells are that they are easier to construct, maintain, and rehabilitate and an effective filter pack can be installed.

Construction of horizontal wells is inherently more complicated and has additional risks compared to vertical well construction methods. Horizontal well designs were eliminated from further consideration due to cost and risk factors associated with construction. Based on this evaluation and the numerical model results, the recovery well system with 24 vertical wells was selected as the preferred alternative (see **Figure 7-1**).

8. Installation of Recovery Wells EW-1 and EW-2

In November 2021, rotosonic drilling methods were used to install two potential groundwater recovery wells (EW-1 and EW-2) to the base of the uppermost groundwater bearing unit near monitoring well ACW-10. The recovery well locations are shown on **Figure 9-1**. Based on field observations and the previous sieve analysis and pumping test data, two six-inch diameter, schedule 80 PVC wells were constructed with 0.020-inch slotted screen from approximately 145 to 165 feet bgs and a 16-40 mesh filter pack. The wells were completed in above-ground protective casings with locks and bollards.

9. 2022 Aquifer Testing

Aquifer testing on both recovery wells EW-1 and EW-2 was performed in June 2022 to assess hydraulic properties of the aquifer in the area downgradient of the Site and to develop estimates of sustainable yields which could be scaled up to the full recovery well system. Step rate tests were performed at each of the two wells individually and a constant rate pumping test was performed with both wells operating simultaneously. During each test, pressure transducers were placed in both pumping wells and ACW-10 to monitor the aquifer response. A step rate pumping test was performed at EW-1 on June 3, 2022, which included three steps at 6.1, 7.2, and 10.8 gpm. Each step was conducted until water levels had stabilized based on field observations, then the rate was increased. After a total test time of approximately 11 hours, the pump was turned off and recovery was monitored overnight. A step pumping test was performed at EW-2 on June 4, 2022, which included six steps at 6.0, 8.3, 10.3, 12.2, 15.1, and 16.1 gpm. Each step was conducted until water levels had stabilized based on field observations, then the rate was increased. After a total test time of approximately 11 hours, the pump was turned off. A constant rate test was performed at both EW-1 and EW-2 between June 5 and June 7, 2022. EW-1 pumped at an average rate of 10.16 gpm and EW-2 pumped at an average rate of 14.43 gpm. After a total test time of roughly 60 hours, the pumps were turned off, and recovery was monitored until June 12 at EW-1 and EW-2, and until June 8 at ACW-10.

10. 2022 Aquifer Test Data Evaluation and Groundwater Modeling

The three pumping tests, including the individual step tests on EW-1 and EW-2, and the constant rate test with both EW-1 and EW-2 pumping simultaneously, were analyzed using the software AQTESOLV. Drawdown data from each test was analyzed using the Moench solution for unconfined aquifers (1997) to derive various properties of the aquifer and wells. Recovery data was also analyzed using the Moench solution by application of the Agarwal method transformation (Agarwal 1980). The Agarwal method is a data transformation that allows recovery data to be analyzed as drawdown using traditional curve-matching techniques, such as the Moench solution, as well as diagnostic and derivative methods.

During data analysis, application of a skin factor was utilized to account for exaggerated drawdown in the pumping wells compared to the surrounding aquifer. Estimation of a skin factor for the pumping wells is necessary to predict the in-well drawdown for the full recovery well system because pumping test data indicate less than 100% efficient wells.

The analyses of the three aquifer tests performed at the Site produced defensible results, particularly for the two most important parameters, hydraulic conductivity, and wellbore skin factor. Hydraulic conductivity values ranged from 8.1 to 7.1 ft/d, except for the constant rate recovery analysis which yielded an estimate of 5.7 ft/d; however, because it was derived from few data points, it is viewed as less reliable. The hydraulic conductivity utilized in the SEAWAT groundwater model for the layer representing the lowest 20 feet of the aquifer is 8 ft/d, consistent with the estimates from this study.

Wellbore skin factor is an important element for predicting sustainable yield of the recovery system, particularly because previously constructed recovery wells at the Site have exhibited significantly more drawdown than anticipated and compared to nearby observation wells. In this study, a skin factor for EW-1 was estimated from four analyses, which ranged from 10.6 to 13.8, with an average of 12.0. A skin factor for EW-2 was estimated from two tests which resulted in skin factors ranging from 1.9 to 2.7 with an average of 2.3. The indication from these results is that EW-2 is a more efficient well than EW-1. The skin factors derived from EW-1 are more conservative for application to estimates for the full system.

The SEAWAT numerical groundwater model, described in Section 6 was used to evaluate sustainable recovery rates of the full system through conversion of the SEAWAT model to the model code MODFLOW-USG Transport. MODFLOW-USG is a public domain code for simulating three-dimensional groundwater flow (GWF) and connected linear networks (CLN) (Panday, et al. 2013). USG-Transport is the enhancement of the MODFLOW-USG code which allows for the application of skin factors to wells (S. Panday 2022). The numerical model was converted to a steady-state groundwater flow model.

The selected design with 24 vertical pumping wells at 7.3 gpm each (see **Figure 7-1**) was implemented using the CLN package. If the water level in a CLN pumping well draws down too far, the flow rate will be corrected to a rate which does not pump the well dry. Results from model runs with appropriate skin factors assigned to the recovery well represent the steady state yield of the system accounting for the skin factor and in-well drawdown. The most conservative skin factor from the aquifer testing 13.8 was assigned to all wells for the initial simulation, which did not result in a reduction in total yield from the recovery system compared to the initial assigned pumping rates of 7.3 gpm per well. Increasing the skin factor to 25, nearly doubling inefficiency, resulted in only a 1.2% reduction in total system flow rate. An additional increase in skin factor to 50 resulted in a reduction of total system flow rate to 122.8 gpm, or 5.12 gpm per well. The skin factors of 25 and 50 significantly exceed the most conservative values estimated from testing of the two newly installed recovery wells and demonstrate that there is room for additional inefficiencies in the well system while still maintaining the proposed total flow of 175 gpm, or 7.3 gpm per well.

11. Additional 2021 and 2022 Groundwater Analyses

The quarterly groundwater monitoring and sampling program for the Site allows for only sampling Program wells ACW-13, ACW-14, and ACW-15 during the first three quarterly events and sampling of all Program wells during the fourth quarter event. The fourth quarter 2021 sampling event, which was conducted in December 2021, included collection of groundwater samples from 31 Program wells and four Non-Program wells. Per the groundwater sampling program approved by NMOCD, groundwater samples are analyzed for the following constituents:

- Benzene, toluene, ethylbenzene, and total xylenes (collectively referred to as BTEX) by EPA Method 8260B;
- Total dissolved solids (TDS) by Standard Method (SM) 2540C;
- Specific conductance by EPA Method 120.1;

- Chloride by EPA Method 9056; and
- Sodium by EPA Method 6010B.

Additional laboratory analyses were conducted during the fourth quarter 2021 sampling event to evaluate the Site groundwater for potential re-use. The supplemental analyses included:

- Bromide by EPA Method 9056; and
- Calcium and magnesium by EPA Method 6010B.

11.1 Dissolved Gasses

Dissolved gasses including propane, methane, ethane, and butane have been detected in groundwater at the Site and are believed to have originated from the gas storage wells. Fourth quarter 2021 groundwater samples were also analyzed for dissolved gases, including propane, methane, ethane, and butane using EPA Method RSK-175.

Propane was detected at maximum concentrations of 87 mg/L and 190 mg/L in the upper and lower groundwater, respectively. The highest propane concentrations in upper groundwater were observed in wells ENSR-01 and PTP-01 and the highest propane concentrations in lower groundwater were observed in the corresponding lower wells ACW-16 and ACW-17. These wells are located in the area of the gas cavern storage wells operated by Western Refining Inc. **Figure 10.1** and **Figure 10.2** show logarithmic isopleths for December 2021 dissolved propane concentrations for the upper and lower groundwater, respectively.

Elevated dissolved methane, ethane, and butane concentrations were also reported for upper and lower groundwater wells generally located in the area of the gas cavern storage wells. Regulatory standards for dissolved hydrocarbon gasses have not been established by the state of New Mexico or the EPA.

During the third quarter 2022 sampling event, groundwater samples were additionally collected from monitor wells ACW-24 and ACW-25 for laboratory analysis of flashpoint by EPA Method 1010A. The results for both samples indicted flashpoint values >200 degrees F.

12. 2021 Sourcewater Class I UIC Site Characterization

In late 2020, on behalf of Kinder Morgan, AECOM contracted with Sourcewater to perform research of possible locations near the Site for permitting an Underground Injection Control (UIC) Class I disposal well for potential management of recovered groundwater associated with a future groundwater remediation capture system for the Site.

The Environmental Protection Agency (EPA) defines a Class I Well as a well that injects industrial or municipal wastewater beneath the lowermost [Underground Source of Drinking Water] USDW (Sourcewater 2021). Class I wells are classified as hazardous or nonhazardous, depending on the characteristics of the wastewaters injected (EPA 2001). Operators of Class I wells must demonstrate the “Area of Review” (AoR) is geologically stable and suitable for wastewater disposal. Suitable geologic conditions require a disposal formation that is:

- Below the lowest underground source of drinking water.
- Overlain by confining layers of impermeable rocks such as shales, nonporous carbonates, salt or anhydrite to prevent upward movement of the injected waste. The overlying impermeable rocks are known as the confining zone (EPA 2001, 2020).

- The geological formation that wastewater is disposed into is the “injection zone”, which must be proven to be laterally extensive, thick enough, and sufficiently porous and permeable to hold injected fluids in place (EPA 2001).
- The operator must also demonstrate that transmissive faults do not pose a threat within or above the injection zone within a 2.5 mi (4 km) radius (N.M. Code R. § 20.6.2.5202, EPA 2001).

The Sourcewater research was focused on identification of geographic and geologic targets in a circular area of interest (AOI) within a 2.75-mile radius of the Plant. The Sourcewater research included collection of information regarding the following:

- Local land ownership;
- Wellbore configuration;
- Well permits; and
- Geologic formations and faults.

The NMOCD is responsible for permitting UIC wells. Concerns were identified in the Sourcewater report relative to permitting a Class I well within the AOI, which are described below.

- The most commonly permitted formations for UIC wells within the AOI include the Artesia Group (Tansill, Yates, Seven Rivers, Queen, and Grayburg formations), and San Andres formation of Guadalupian age, and the Clear Fork formation of Leonardian age. The NMOCD UIC Division currently has a stated and proven practice of exclusively permitting new UIC wells into deep Silurian and Devonian formations, with wells costing $10MM to $12MM to drill. The NMOCD now typically rejects permit applications for injection wells in the less deep Guadalupian-aged formations, which only cost about $2MM to $4MM to drill (Sourcewater 2021).
- Within the AOI, the Silurian and Devonian strata are in direct communication with a potentially transmissive fault, which could result in significant risk of induced seismicity.

Based on the above information, the NMOCD is unlikely to permit a UIC well within the AOI that was included in the Sourcewater study. Any permitted injection well would likely have to be installed greater than 2.75 miles from the Site and would include drilling costs of $10MM to $12MM for installation into Silurian and Devonian strata in an area where transmissive faults are not present.

13. Summary of Findings

A summary of the relevant findings for the work described above includes the following:

- Soil samples were collected from the saturated portion of rotosonic borings ACW-30 S/D, ACW-32-S/D, and BH-1 through BH-3 were submitted to a geotechnical laboratory for grain size (sieve) analysis. The sieve analysis results indicate that, for samples collected in the saturated part of the aquifer below a depth of approximately 100 feet, more than 80 percent of the material is very fine sand less than 0.3 millimeters, or 0.0118 inches, in diameter. Samples from the 20 feet of soil at the base of the unit (but above the clay beds) also contained silt and clay particles smaller than 0.075 mm, or 0.003 inches (#200 sieve) at percentages ranging from about 10% to over 40% in borings BH-1 through BH-3.

  - The presence of the fine grain soil in the lower portion of the water bearing unit was a significant factor in the decision to choose vertical wells over horizontal wells for future groundwater recovery efforts.
  - Based on analysis of the sieve test data, a well completion design was developed for vertical recovery wells which includes six-inch diameter, schedule 80 PVC with 0.020-inch slotted screen and a 16-40 mesh filter pack.
- Based on evaluation of the results for aquifer testing and groundwater modeling, various remedial alternative simulations were performed to develop a recovery wellfield design. All the vertical well combinations resulted in full capture of the plume with cleanup times to 250 mg/l ranging from 35 to 85 years. The alternative with the fastest cleanup time included 24 extraction wells pumping at 7.3 gpm each, totaling 175 gpm. The configuration includes a line of 13 wells oriented parallel to the plume and a line of 11 wells oriented along Highway 18 and resulted in a cleanup time of 30 years to 1,000 mg/l and 35 years to 250 mg/l.
  - Aquifer testing and groundwater modeling indicated that the proposed pumping rate of 7.3 gpm per well is still achievable when potential well inefficiencies are considered.
  - Simulated cleanup time is based on the advective flow field, density effects, and dispersion of chloride. Several additional factors which cannot be reasonably simulated by numerical groundwater models may increase actual cleanup time including local heterogeneities and effects of residual porosity not available for groundwater flow. Model results should be viewed as theoretical minimum cleanup times. Prediction of actual cleanup times are best made based on site observations after implementation of the recovery well system.

Sourcewater performed research of possible locations near the Site for permitting an UIC Class I disposal well for potential management of recovered groundwater. The Sourcewater research was focused on a circular AOI within a 2.75-mile radius of the Plant. Based on the research findings, the NMOCD is unlikely to permit a UIC well within the AOI that was included in the Sourcewater study. Any permitted injection well would likely have to be installed greater than 2.75 miles from the Site and would include drilling costs of $10MM to $12MM for installation into Silurian and Devonian strata in an area where transmissive faults are not present.

14. Project Path Forward

EPNG will evaluate the feasibility of remedial options for the Site in the first half of 2023.

Considerations related to the overall remedial effort will include:

- Comparative value versus the detrimental effects of removing approximately 9,880 acre-feet of water from the Ogallala aquifer over the expected 35 year life of the project; and
- Greenhouse gas / carbon footprint of remediation alternatives.

Considerations related to management of recovered groundwater will include:

- Transportation of extracted groundwater via the Palisade Pipeline to Class II deep injection wells in Texas – construction of the pipeline is planned for 2023;

- Separation of salt from recovered groundwater in regard to potential reuse or reinjection of the recovered water, including the feasibility of re-condensing water from a vapor state and the associated energy requirements and carbon footprint; and
- Potential reuse of recovered salt, or disposal alternatives if no economically viable reuse is available.

In early 2023 EPNG will be conferring with several of its preferred environmental consulting firms, providing background information and site-specific data, and soliciting remediation strategies. Potentially viable strategies will be evaluated for practicality, implementability, and cost. It is anticipated that an Abatement Plan for the site will be submitted to the NMOCD by September 30, 2023.

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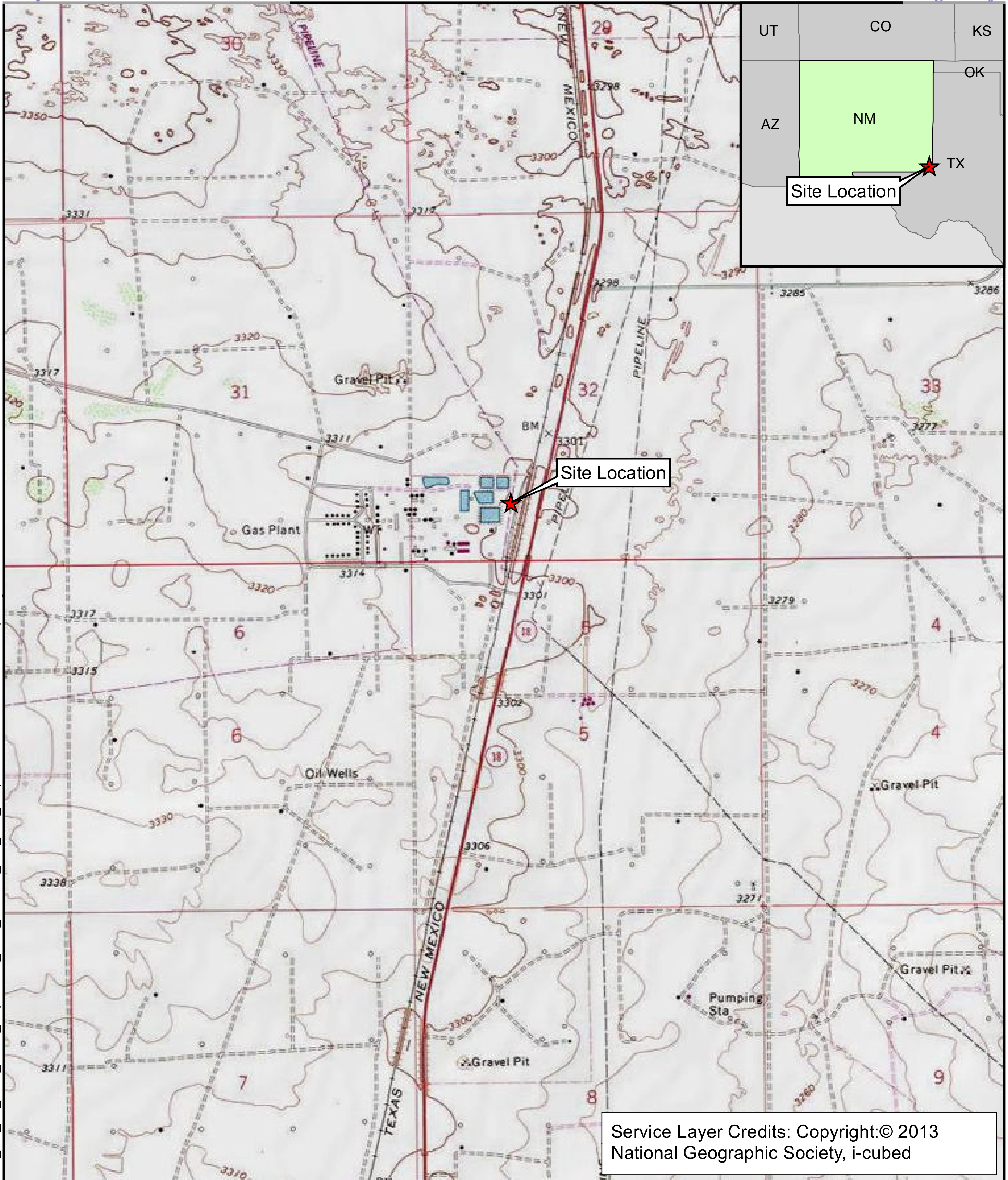
Figures



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★ Site_Location

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Feet

AECOM

19219 KATY FREEWAY, SUITE 100
HOUSTON, TX 77094
PH: (281) 646-2400
FAX: (281) 646-2401

Title: **Site Location Map**				
Project: 2021 Groundwater Remediation Report El Paso Natural Gas Company JAL #4 Gas Plant - Lea County, New Mexico				
Scale: As Shown	Drawn by: KPL	Date: 3/29/2022	Client: **Kinder Morgan**	
	Chk'd by: BMcC	Date: 3/29/2022	Project No.: 60678485	File Name: Site Location Map.mxd	Figure: 1-1

Legend

- DISPOSAL WELL
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- GROUNDWATER MONITOR WELL, SCREENED IN THE LOWER PORTION OF THE AQUIFER
- GROUNDWATER RECOVERY WELL
- GROUNDWATER MONITOR WELL CONVERTED TO GROUNDWATER RECOVERY WELL
- WATER SUPPLY WELL
- PLUGGED/ABANDONDED WATER SUPPLY WELL
- WATER SUPPLY WELL
- INJECTION WELL (WATER FLOOD)
- OIL WELL
- GAS WELL
- LPG STORAGE WELL
- PLUGGED/ABANDONED MAY 2012
- Approximate Property Boundary
- FORMER POND LOCATION WITH POND NUMBER

NOTES:

1) JAL #4 PLANT PROPERTY IS LOCATED WITHIN SECTIONS 31 AND 32 OF TOWNSHIP 23 SOUTH, RANGE 37 EAST, AND SECTIONS 5 AND 6 OF TOWNSHIP 24 SOUTH, RANGE 37 EAST, LEA COUNTY, NEW MEXICO.

2) SITE BASE AREA DIGITIZED FROM 11/04/76 AERIAL PHOTOGRAPH WITH PLANT PROPERTY BOUNDARY, WELLS INSERTED FROM VARIOUS OTHER SOURCES, AND DRAWING FILES PROVIDED BY SAIC ENERGY, ENVIRONMENT & INFRASTRUCTURE, LLC OF TULSA, OKLAHOMA.

3) RECOVERY SYSTEM HAS NOT BEEN OPERATED SINCE 2012.

4) AERIAL PHOTO SOURCED FROM MAXOR, DATED 4/08/2021.

5) SOURCE OF LAND OWNERSHIP IS THE LEA COUNTY APPRAISAL DISTRICT.

6) SOURCE OF INDUSTRY-RELATED WELLS IS NMOCD OIL & GAS MAP.

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Feet

AECOM

19219 KATY FREEWAY, SUITE 100
HOUSTON, TX 77094
PH: (281) 646-2400

Title:	Site Layout
Project:	2021 Groundwater Remediation Report El Paso Natural Gas Company JAL #4 Gas Plant - Lea County, New Mexico
Client:	Kinder Morgan
Scale:	As Shown
Drawn by:	KPL
Date:	3/29/2022
Chk'd by:	WG
Date:	3/29/2022
Project No.:	60678485
File Name:	Site Layout.mxd
Figure:	1-2

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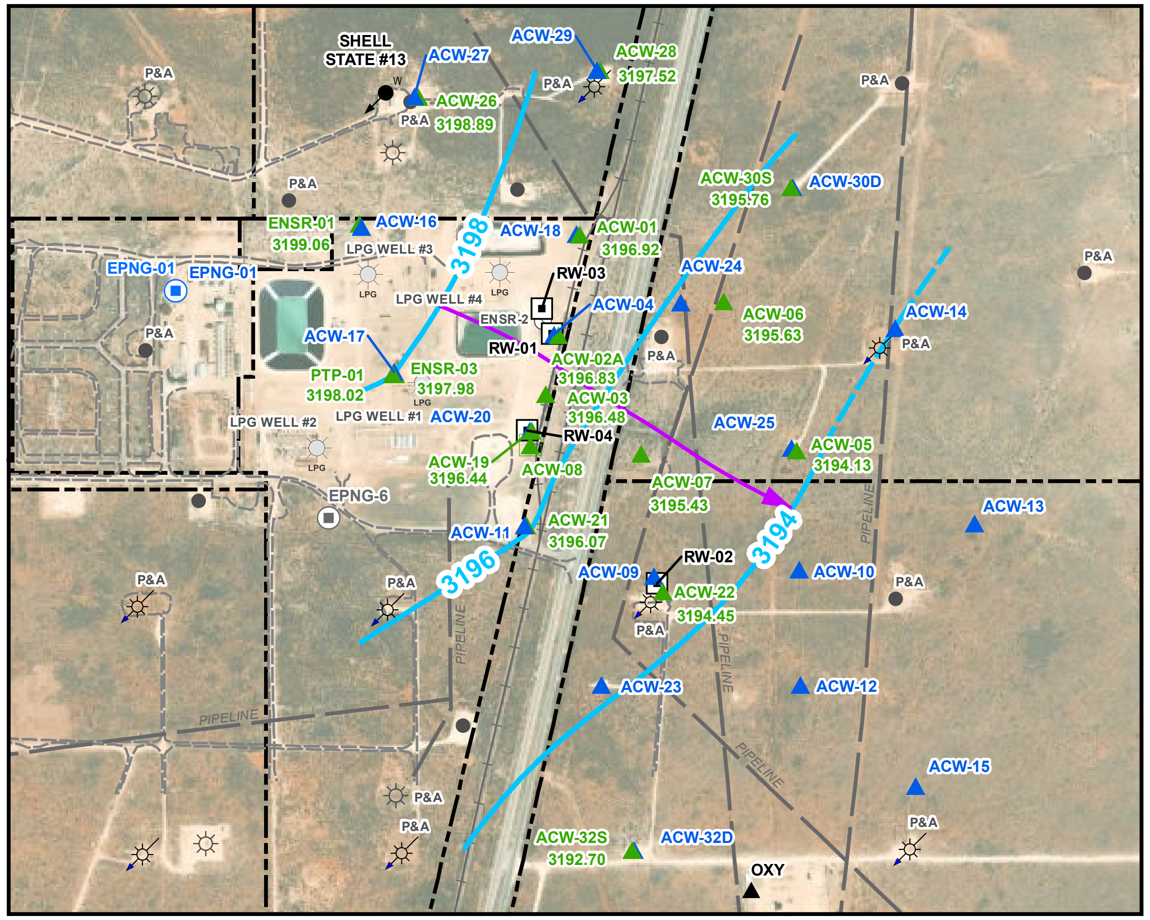

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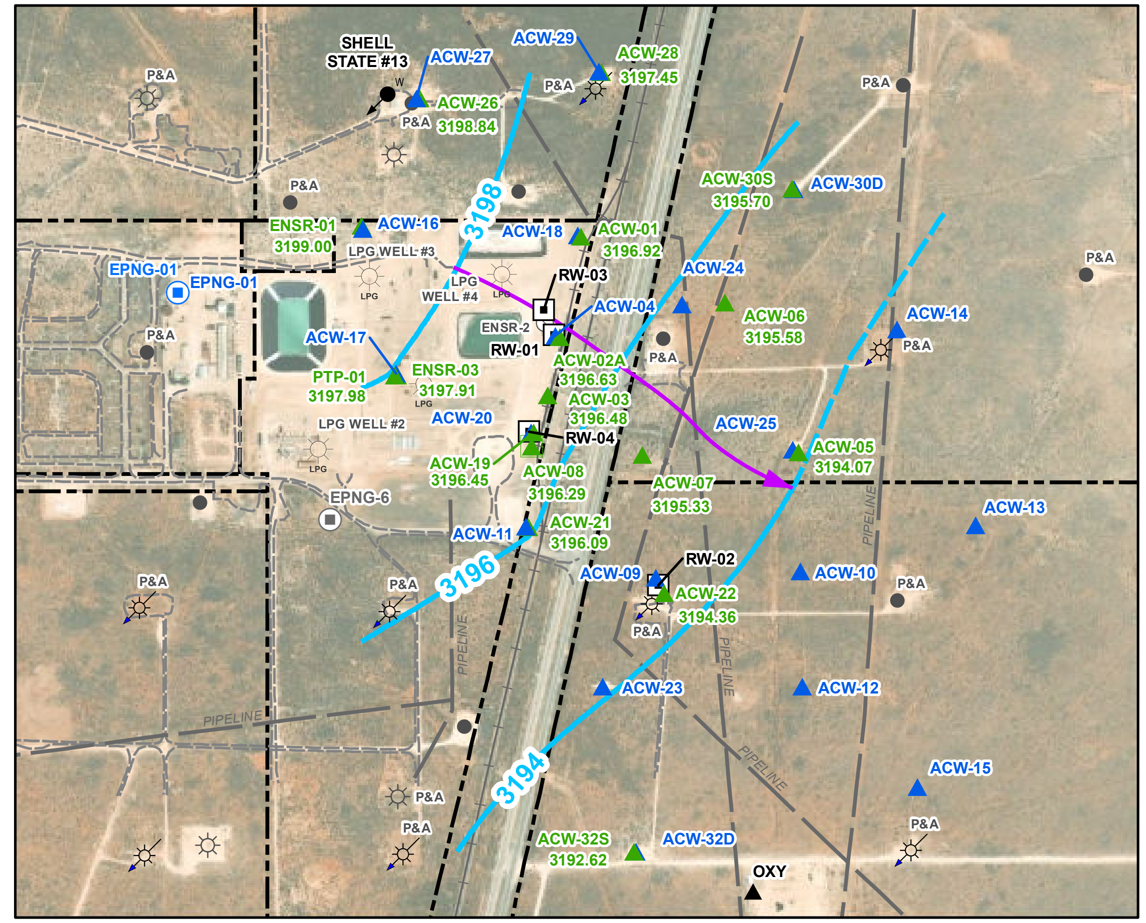

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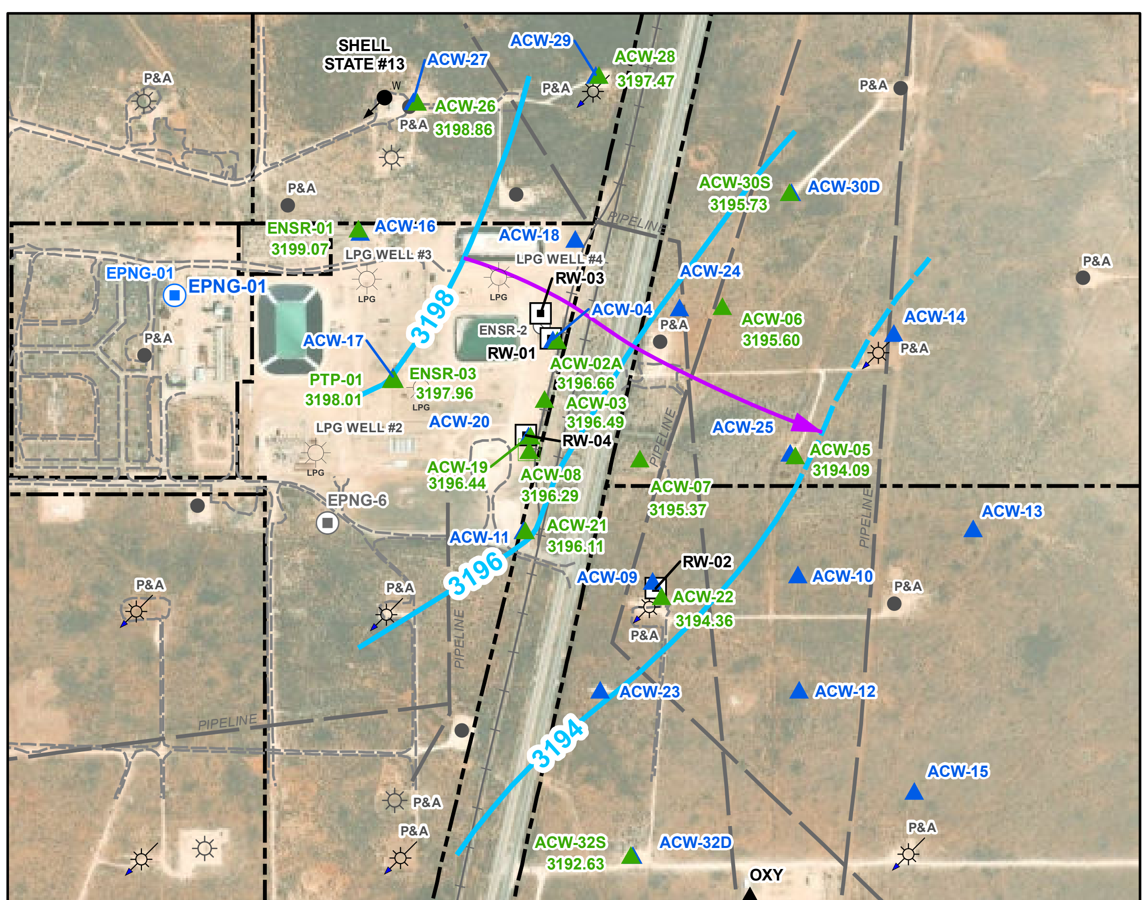

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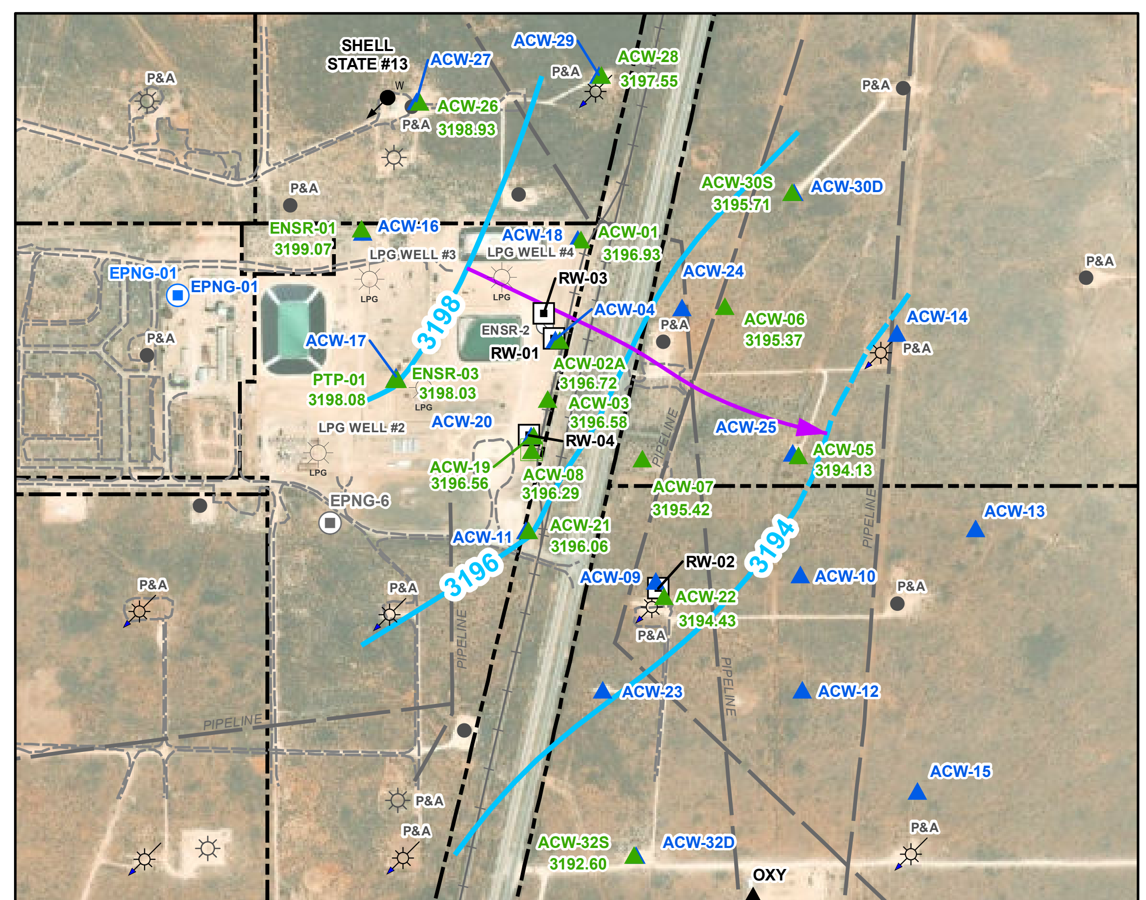

4th QUARTER 2021 (DECEMBER 1, 2021)

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- GROUNDWATER MONITOR WELL, SCREENED IN THE LOWER PORTION OF THE AQUIFER
- GROUNDWATER MONITOR WELL CONVERTED TO GROUNDWATER RECOVERY WELL
- GROUNDWATER RECOVERY WELL
- WATER SUPPLY WELL
- PLUGGED/ABANDONDED WATER SUPPLY WELL
- WATER SUPPLY WELL
- CONTOUR OF GROUNDWATER ELEVATION - FEET AMSL, WELLS SCREENED IN THE UPPER PORTION OF THE AQUIFER)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- SECONDARY ROAD
- RAILROAD TRACK
- APPROXIMATE PROPERTY BOUNDARY

NOTES:

1) JAL #4 PLANT PROPERTY IS LOCATED WITHIN SECTIONS 31 AND 32 OF TOWNSHIP 23 SOUTH, RANGE 37 EAST, AND SECTIONS 5 AND 6 OF TOWNSHIP 24 SOUTH, RANGE 37 EAST, LEA COUNTY, NEW MEXICO.

2) SITE BASE AREA DIGITIZED FROM 11/04/76 AERIAL PHOTOGRAPH WITH PLANT PROPERTY BOUNDARY, WELLS INSERTED FROM VARIOUS OTHER SOURCES, AND DRAWING FILES PROVIDED BY SAIC ENERGY, ENVIRONMENT & INFRASTRUCTURE, LLC OF TULSA, OKLAHOMA.

3) AERIAL PHOTO SOURCED FROM MAXOR, DATED 4/08/2021.

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Feet

AECOM
19219 KATY FREEWAY, SUITE 100
HOUSTON, TX 77094
PH: (281) 646-2400

Title: 2021 Groundwater Surface Elevation Map – Upper Groundwater					
Project: 2021 Groundwater Remediation Report, El Paso Natural Gas Company, JAL #4 Gas Plant - Lea County, New Mexico					
Scale: As Shown	Drawn by: KPL	Date: 3/29/2022	Client: Kinder Morgan		
	Chk'd by: WG	Date: 3/29/2022	Project No.: 60678485	File Name: Upper GWE Map 2021.mxd	Figure: 1-3

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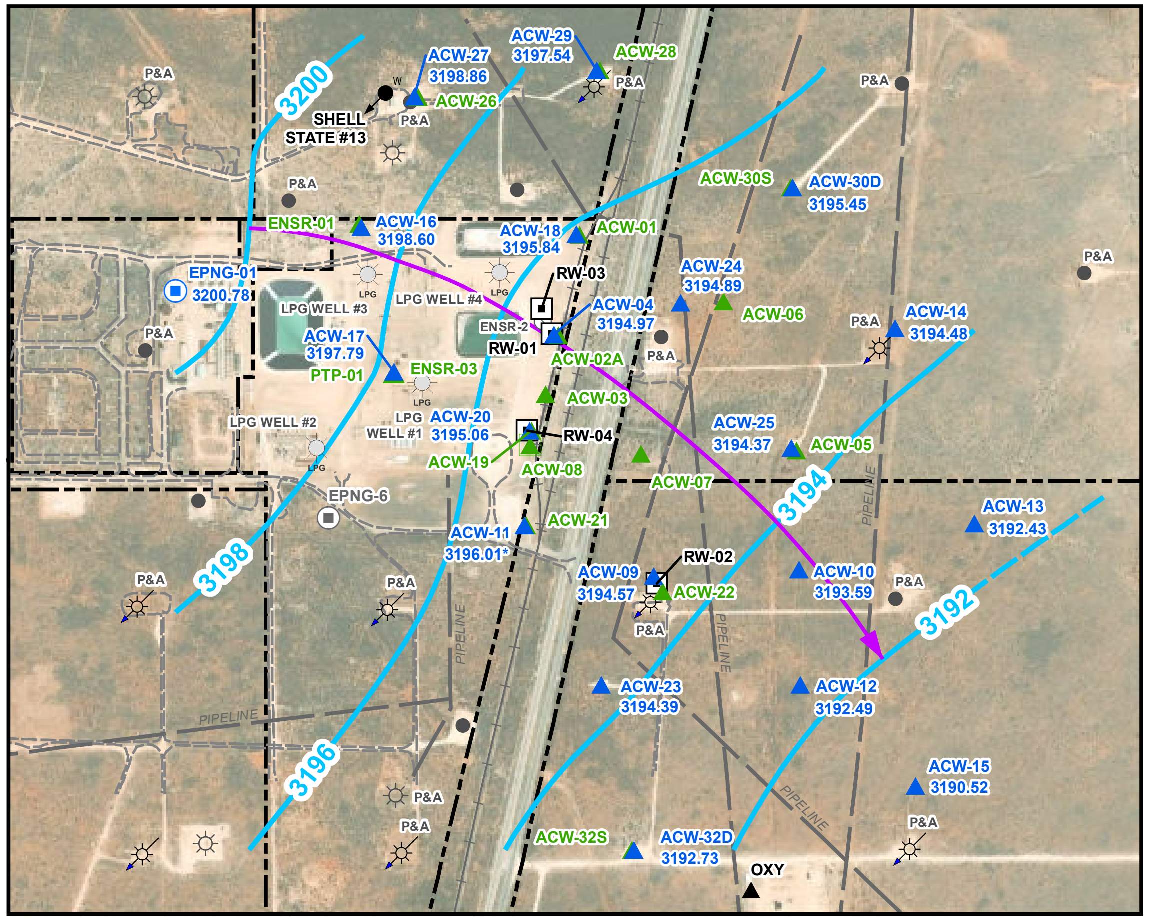

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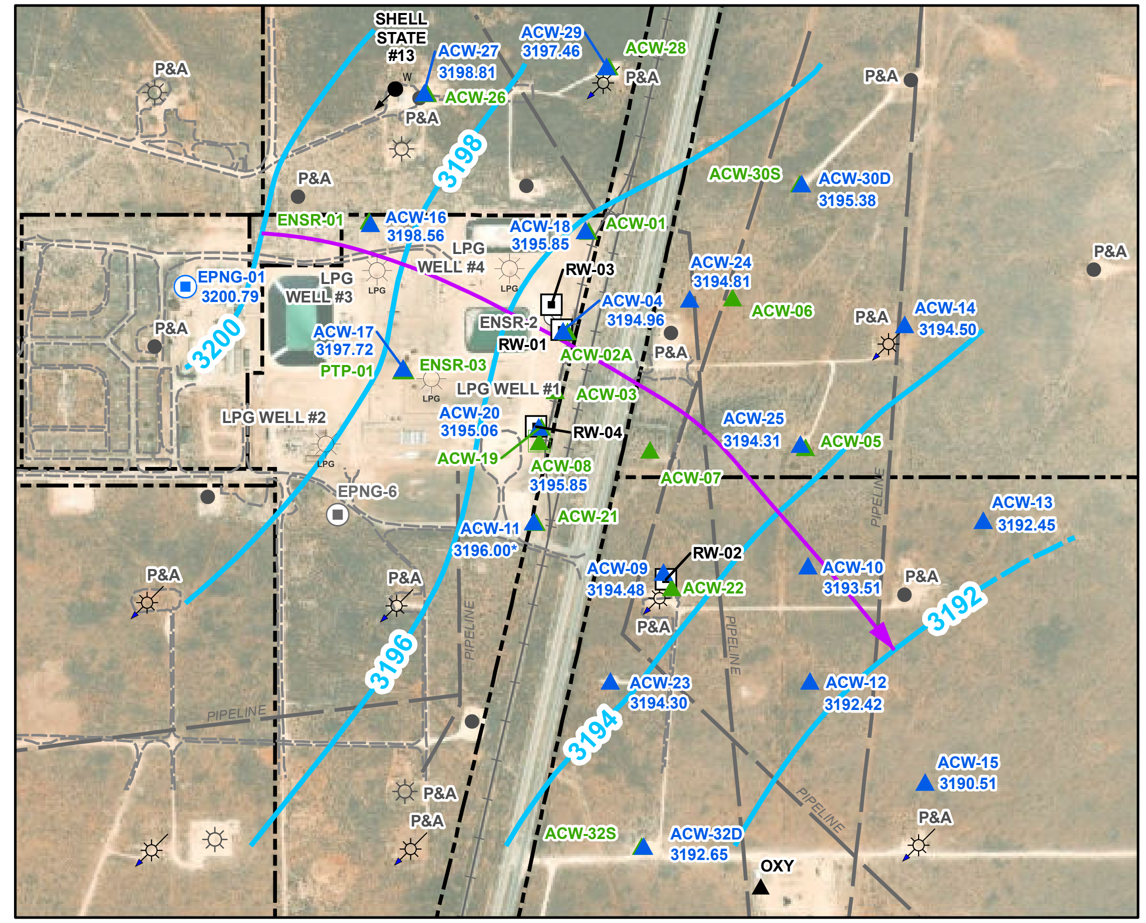

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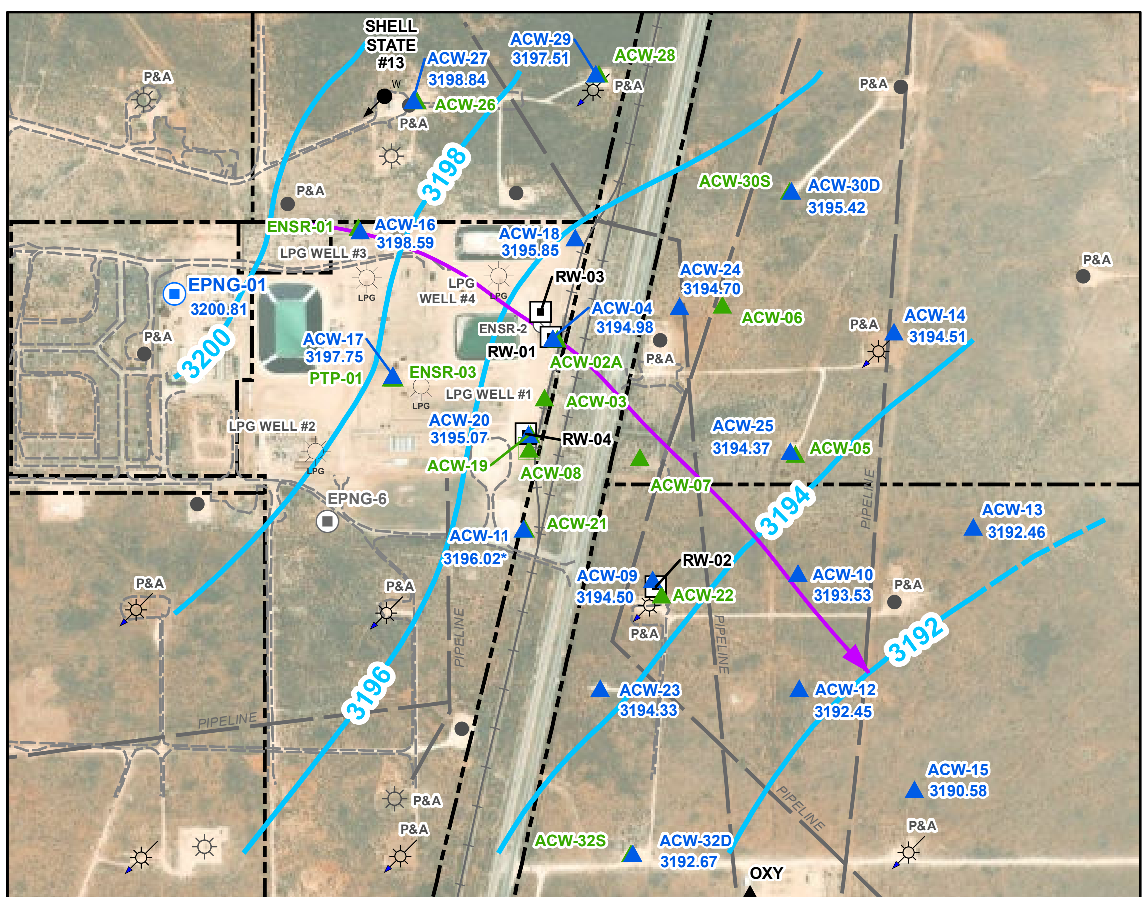

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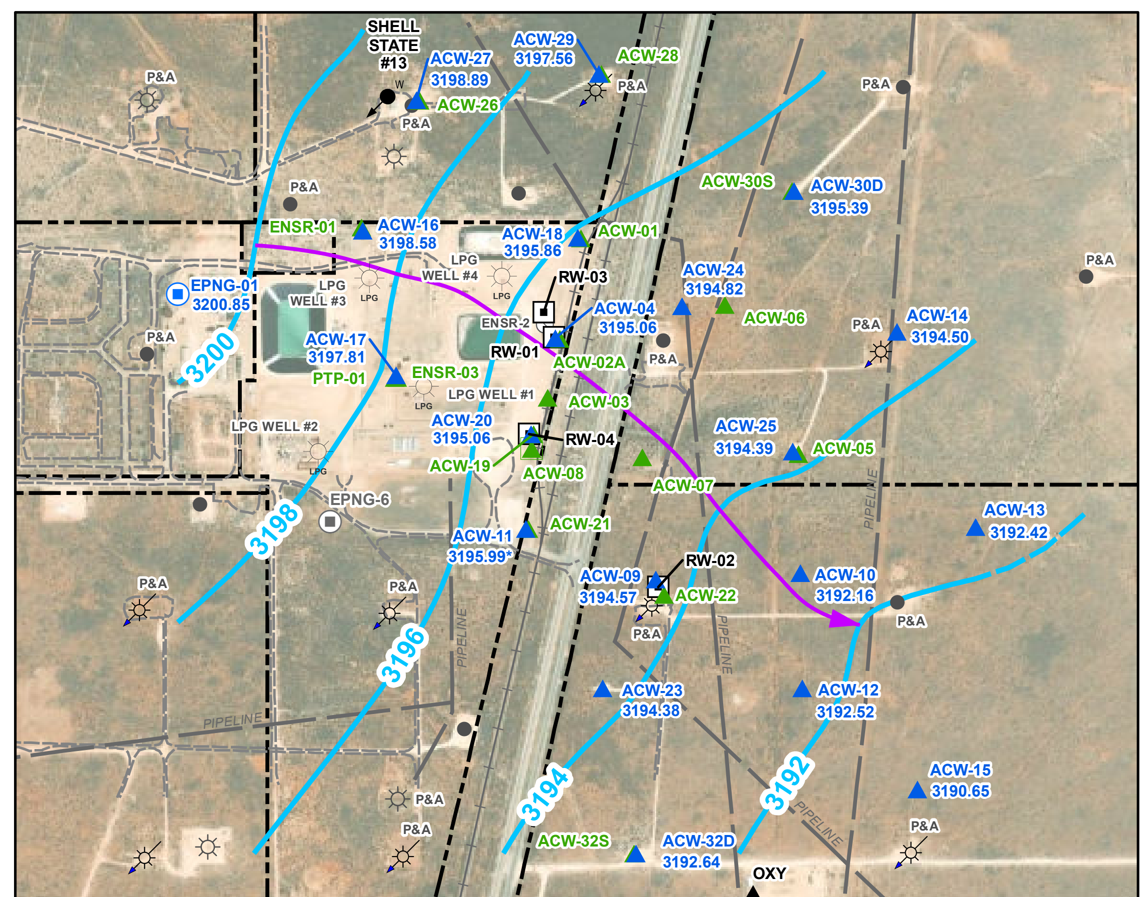

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- GROUNDWATER MONITOR WELL CONVERTED TO GROUNDWATER RECOVERY WELL
- WATER SUPPLY WELL
- GROUNDWATER RECOVERY WELL
- PLUGGED/ABANDONDED WATER SUPPLY WELL
- WATER SUPPLY WELL
- CONTOUR OF GROUNDWATER ELEVATION - FEET AMSL, WELLS SCREENED IN THE LOWER PORTION OF THE AQUIFER)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- SECONDARY ROAD
- RAILROAD TRACK
- APPROXIMATE PROPERTY BOUNDARY

NOTES:

1) JAL #4 PLANT PROPERTY IS LOCATED WITHIN SECTIONS 31 AND 32 OF TOWNSHIP 23 SOUTH, RANGE 37 EAST, AND SECTIONS 5 AND 6 OF TOWNSHIP 24 SOUTH, RANGE 37 EAST, LEA COUNTY, NEW MEXICO.

2) SITE BASE AREA DIGITIZED FROM 11/04/76 AERIAL PHOTOGRAPH WITH PLANT PROPERTY BOUNDARY, WELLS INSERTED FROM VARIOUS OTHER SOURCES, AND DRAWING FILES PROVIDED BY SAIC ENERGY, ENVIRONMENT & INFRASTRUCTURE, LLC OF TULSA, OKLAHOMA.

3) AERIAL PHOTO SOURCED FROM MAXOR, DATED 4/08/2021.

4) * - THE DATA FROM ACW-11 IS NOT USED TO CONSTRUCT THE POTENTIOMETRIC SURFACE CONTOURS.

N

0 500 1,000 2,000

Feet

AECOM

19219 KATY FREEWAY, SUITE 100
HOUSTON, TX 77094
PH: (281) 646-2400

Title:	2021 Groundwater Surface Elevation Map – Lower Groundwater			
Project:	2021 Groundwater Remediation Report El Paso Natural Gas Company JAL #4 Gas Plant - Lea County, New Mexico			
Scale: As Shown	Drawn by: KPL	Date: 3/29/2022	Client: Kinder Morgan	
	Chk'd by: WG	Date: 3/29/2022	Project No.: 60678485	File Name: Lower GWE Map 2021.mxd	Figure: 1-4

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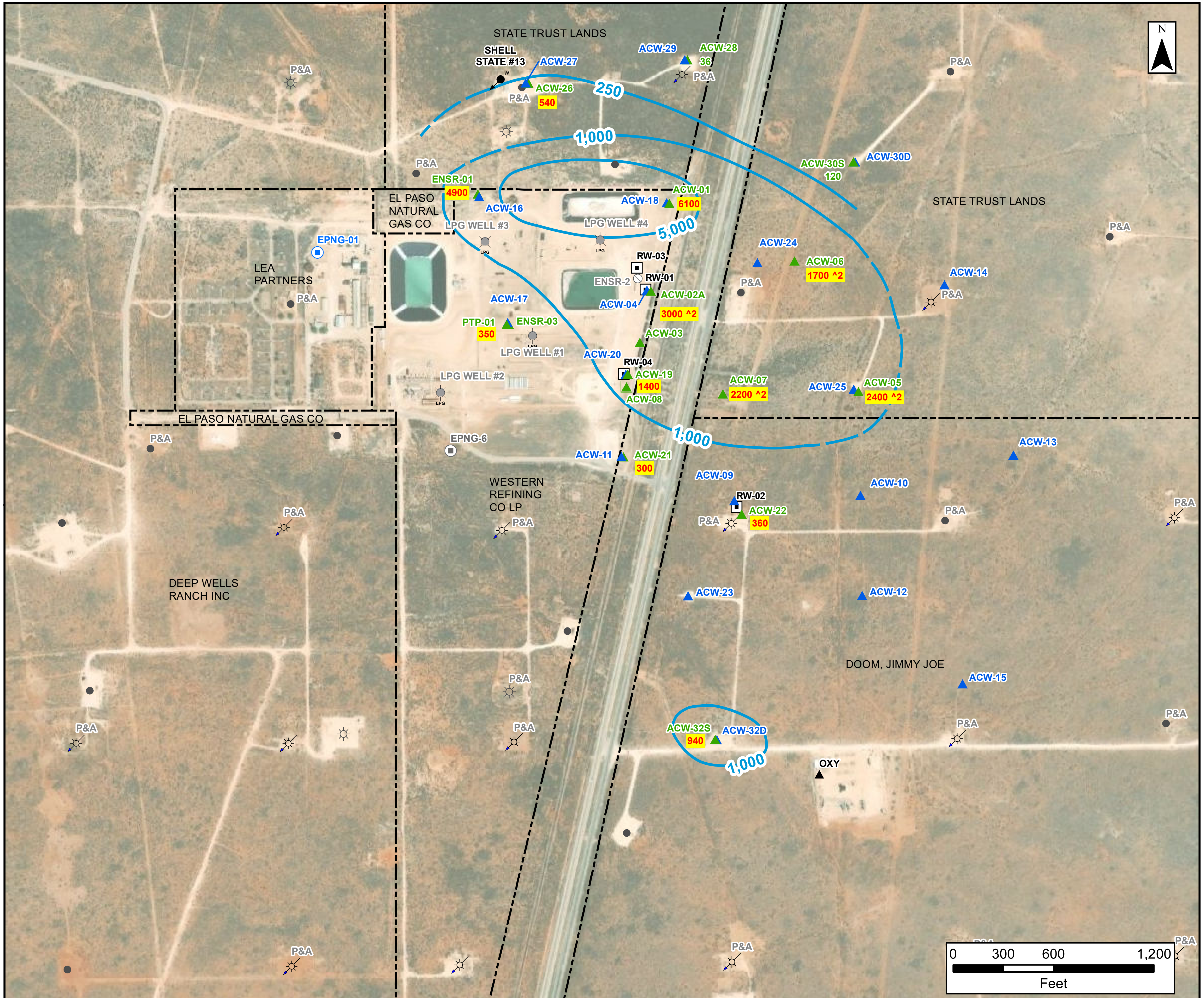

Legend

- DISPOSAL WELL
- GROUNDWATER MONITOR WELL, SCREENED IN THE UPPER PORTION OF THE AQUIFER
- GROUNDWATER MONITOR WELL, SCREENED IN THE LOWER PORTION OF THE AQUIFER
- GROUNDWATER RECOVERY WELL
- GROUNDWATER MONITOR WELL CONVERTED TO GROUNDWATER RECOVERY WELL
- WATER SUPPLY WELL
- PLUGGED/ABANDONED WATER SUPPLY WELL
- WATER SUPPLY WELL
- INJECTION WELL (WATER FLOOD)
- OIL WELL
- GAS WELL
- LPG STORAGE WELL
- PLUGGED/ABANDONED MAY 2012
- APPROXMATE PROPERTY BOUNDARY
- CONTOUR LINE SHOWING EQUAL CONCENTRATIONS OF CHLORIDE IN GROUNDWATER, mg/L
- INFERRED CONCENTRATIONS OF CHLORIDE IN GROUNDWATER, mg/L
- 17000 HIGHLIGHTED VALUES (in mg/L) INDICATE AN EXCEEDANCE

NOTES:

1) NEW MEXICO ENVIRONMENTAL DIVISION HAS ESTABLISHED OTHER STANDARDS FOR DOMESTIC WATER SUPPLY OF 250 mg/L FOR CHLORIDE IN GROUNDWATER CONTAINING TDS LEVELS OF 10,000 mg/L OR LESS.

2) EPA's SECONDARY DRINKING WATER STANDARD (SMCL) FOR CHLORIDE IN PUBLIC WATER SUPPLY SYSTEMS IS 250 MILLIGRAMS PER LITER (mg/L).

3) JAL #4 PLANT PROPERTY IS LOCATED WITHIN SECTIONS 31 AND 32 OF TOWNSHIP 23 SOUTH, RANGE 37 EAST, AND SECTIONS 5 AND 6 OF TOWNSHIP 24 SOUTH, RANGE 37 EAST, LEA COUNTY, NEW MEXICO.

4) SITE BASE AREA DIGITIZED FROM 11/04/76 AERIAL PHOTOGRAPH WITH PLANT PROPERTY BOUNDARY, WELLS INSERTED FROM VARIOUS OTHER SOURCES, AND DRAWING FILES PROVIDED BY SAIC ENERGY, ENVIRONMENT & INFRASTRUCTURE, LLC OF TULSA, OKLAHOMA.

5) RECOVERY SYSTEM HAS NOT BEEN OPERATED SINCE 2012.

6) AERIAL PHOTO SOURCED FROM MAXOR, DATED 4/08/2021.

7) SOURCE OF INDUSTRY-RELATED WELLS IS NMOCD OIL & GAS MAP.

AECOM
19219 KATY FREEWAY, SUITE 100
HOUSTON, TX 77094
PH: (281) 646-2400

Title:	Isopleth of Chloride Concentrations in Upper Groundwater December 2021
Project:	2021 Groundwater Remediation Report El Paso Natural Gas Company JAL #4 Gas Plant - Lea County, New Mexico
Client:	Kinder Morgan

Scale:	Drawn by:	Date:	Chk'd by:	Date:	Project No.:	File Name:	Fig:
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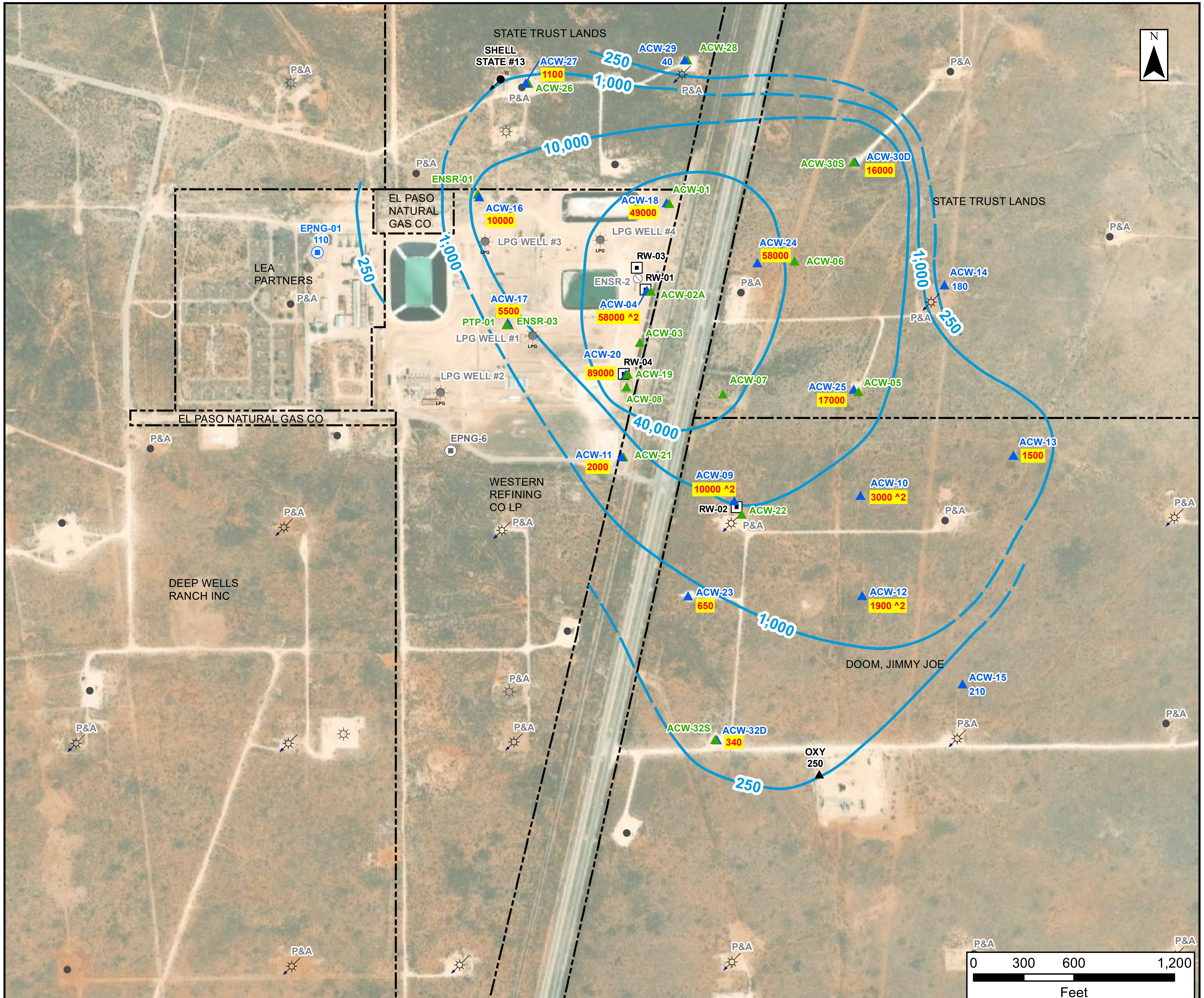

Legend

- DISPOSAL WELL
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- GROUNDWATER MONITOR WELL, SCREENED IN THE LOWER PORTION OF THE AQUIFER
- GROUNDWATER RECOVERY WELL
- GROUNDWATER MONITOR WELL CONVERTED TO GROUNDWATER RECOVERY WELL
- WATER SUPPLY WELL
- PLUGGED/ABANDONED WATER SUPPLY WELL
- WATER SUPPLY WELL
- INJECTION WELL (WATER FLOOD)
- OIL WELL
- GAS WELL
- LPG STORAGE WELL
- PLUGGED/ABANDONED MAY 2012
- APPROXMATE PROPERTY BOUNDARY
- CONTOUR LINE SHOWING EQUAL CONCENTRATIONS OF CHLORIDE IN GROUNDWATER, mg/L
- INFERRED CONCENTRATIONS OF CHLORIDE IN GROUNDDWATER, mg/L
- 17000 HIGHLIGHTED VALUES (in mg/L) INDICATE AN EXCEEDANCE

NOTES:

1) NEW MEXICO ENVIRONMENTAL DIVISION HAS ESTABLISHED OTHER STANDARDS FOR DOMESTIC WATER SUPPLY OF 250 mg/L FOR CHLORIDE IN GROUNDWATER CONTAINING TDS LEVELS OF 10,000 mg/L OR LESS.

2) EPA's SECONDARY DRINKING WATER STANDARD (SMCL) FOR CHLORIDE IN PUBLIC WATER SUPPLY SYSTEMS IS 250 MILLIGRAMS PER LITER (mg/L).

3) JAL #4 PLANT PROPERTY IS LOCATED WITHIN SECTIONS 31 AND 32 OF TOWNSHIP 23 SOUTH, RANGE 37 EAST, AND SECTIONS 5 AND 6 OF TOWNSHIP 24 SOUTH, RANGE 37 EAST, LEA COUNTY, NEW MEXICO.

4) SITE BASE AREA DIGITIZED FROM 11/04/76 AERIAL PHOTOGRAPH WITH PLANT PROPERTY BOUNDARY, WELLS INSERTED FROM VARIOUS OTHER SOURCES, AND DRAWING FILES PROVIDED BY SAIC ENERGY, ENVIRONMENT & INFRASTRUCTURE, LLC OF TULSA, OKLAHOMA.

5) RECOVERY SYSTEM HAS NOT BEEN OPERATED SINCE 2012.

6) AERIAL PHOTO SOURCED FROM MAXOR, DATED 4/08/2021.

7) SOURCE OF INDUSTRY-RELATED WELLS IS NMOCD OIL & GAS MAP.

AECOM
19219 KATY FREEWAY, SUITE 100
HOUSTON, TX 77094
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Title: Isopleth of Chloride Concentrations in Lower Groundwater December 2021

Project: 2021 Groundwater Remediation Report
El Paso Natural Gas Company
JAL #4 Gas Plant - Lea County, New Mexico

Scale:	Drawn by:	Date:	Client:		
As Shown	KPL	3/29/2022	Kinder Morgan		
	Chk'd by: WG	Date: 3/29/2022	Project No.: 60678485	File Name: Lower Chloride Dec2021.mxd	Fig: 1-6

Path: L:\DCS\Projects\ENV\60678485_KM_Jal_2021_GWM_Report\900_CAD_GIS\920_929_GIS_Graphics\MXD\Lower Chloride Dec2021.mxd

LEGEND

SHELL STATE #13	DISPOSAL WELL
ACW-5	GROUNDWATER MONITOR WELL, SCREENED IN THE UPPER PORTION OF THE AQUIFER
ACW-14	GROUNDWATER MONITOR WELL, SCREENED IN THE LOWER PORTION OF THE AQUIFER
RW-2	GROUNDWATER RECOVERY WELL
EPNG-1	WATER SUPPLY WELL
EPNG-6	PLUGGED/ABANDONED WATER SUPPLY WELL
OXY	WATER SUPPLY WELL
ACW-8	GROUNDWATER MONITOR WELL CONVERTED TO GROUNDWATER RECOVERY WELL
ENSR-2	PLUGGED/ABANDONED MAY 2012
BH-1	SOIL BORING
	GRAIN SIZE DATA COLLECTION POINT
	APPROXIMATE PROPERTY BOUNDARY
	INJECTION WELL (WATER FLOOD)
	OIL WELL
	GAS WELL
	LPG STORAGE WELL
4	FORMER POND LOCATION WITH POND NUMBER

NOTES

1) JAL #4 PLANT PROPERTY IS LOCATED WITHIN SECTIONS 31 AND 32 OF TOWNSHIP 23 SOUTH, RANGE 37 EAST, AND SECTIONS 5 AND 6 OF TOWNSHIP 24 SOUTH, RANGE 37 EAST, LEA COUNTY, NEW MEXICO.
2) SITE BASE AREA DIGITIZED FROM 11/04/76 AERIAL PHOTOGRAPH WITH PLANT PROPERTY BOUNDARY, WELLS INSERTED FROM VARIOUS OTHER SOURCES, AND DRAWING FILES PROVIDED BY SAIC ENERGY, ENVIRONMENT & INFRASTRUCTURE, LLC OF TULSA, OKLAHOMA.
3) RECOVERY SYSTEM WAS NOT OPERATED IN 2018.
4) AERIAL PHOTO SOURCED FROM GOOGLE PRO, DATED 2/20/2019.
5) SOURCE OF LAND OWNERSHIP IS THE LEA COUNTY APPRAISAL DISTRICT.
6) SOURCE OF INDUSTRY-RELATED WELLS IS NMOCD OIL & GAS MAP.
7) MONITORING WELLS ACW-26, ACW-27, ACW-28, AND ACW-29 WERE INSTALLED IN DECEMBER 2019.

0 300 600
SCALE IN FEET

AECOM
19219 KATY FREEWAY SUITE 100
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FAX: (281) 646-2401

Title: **Grain Size Data Locations**

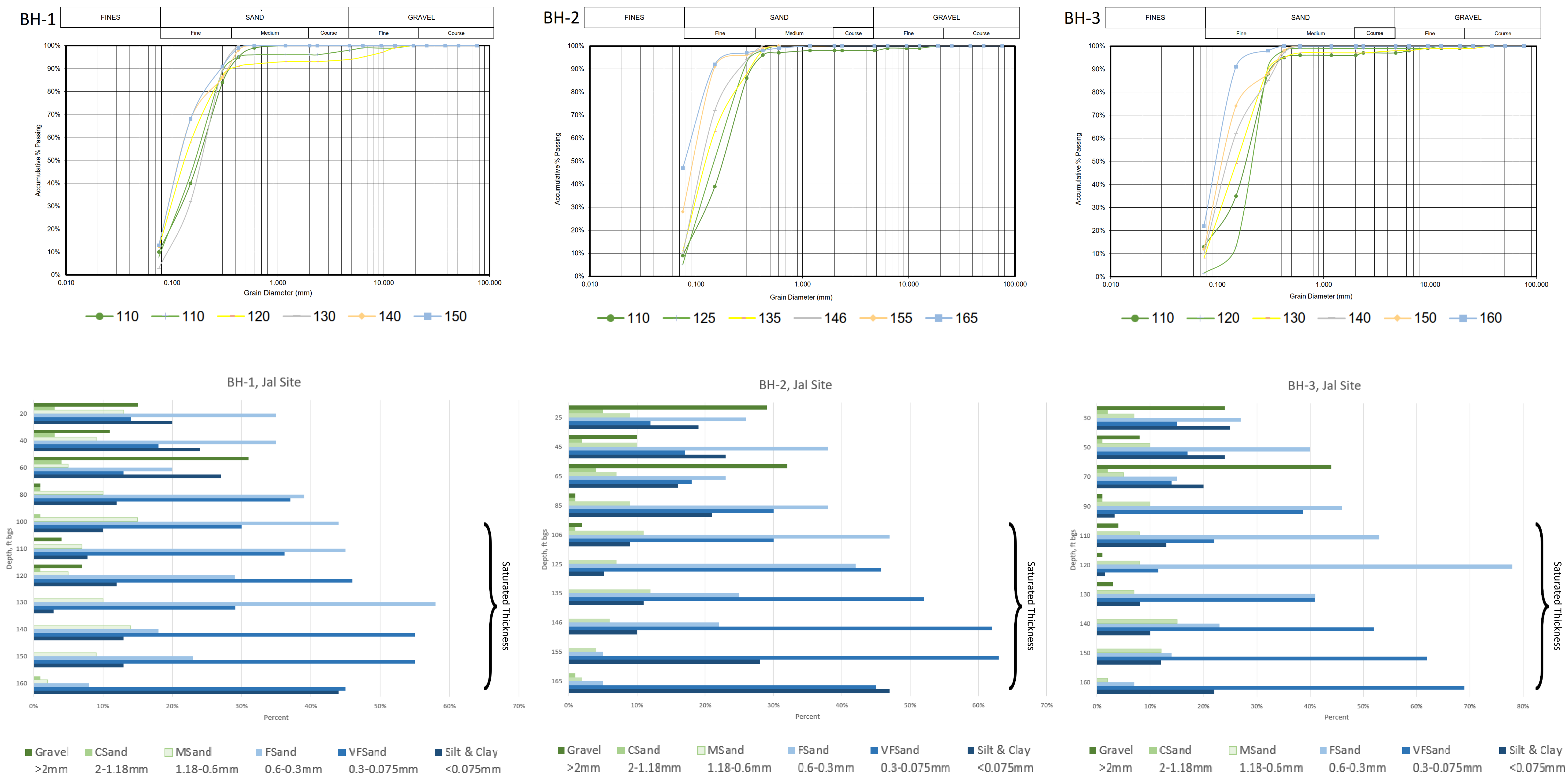
Project: EL PASO NATURAL GAS COMPANY
JAL #4 GAS PLANT - LEA COUNTY, NEW MEXICO
2020 ANNUAL GROUNDWATER REMEDIATION REPORT

Scale:	Drawn by:	Date:	Project No.:	Figure:
AS SHOWN	DB	2/26/2021	60644870	5-1
	Chk'd by: WG	Date: 2/26/2021		

I:\Projects\CADD\KINDER-MORGAN\Jal_NM\60641730\Site_Layout-Fig2_2020 - Jal_4 - 2021-02-23.dwg

Figure 5-2

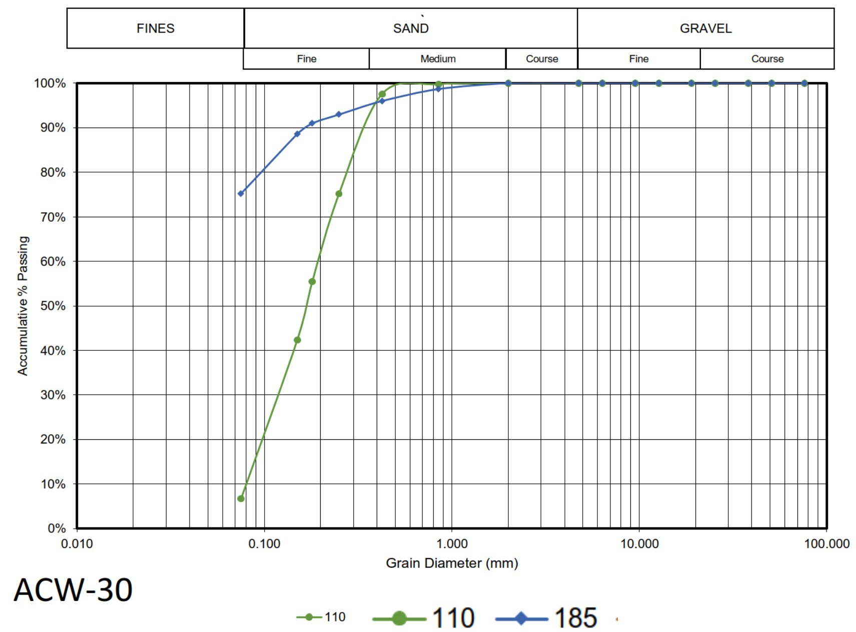
Results of Sieve Analyses for BH-1, BH-2, and BH-3

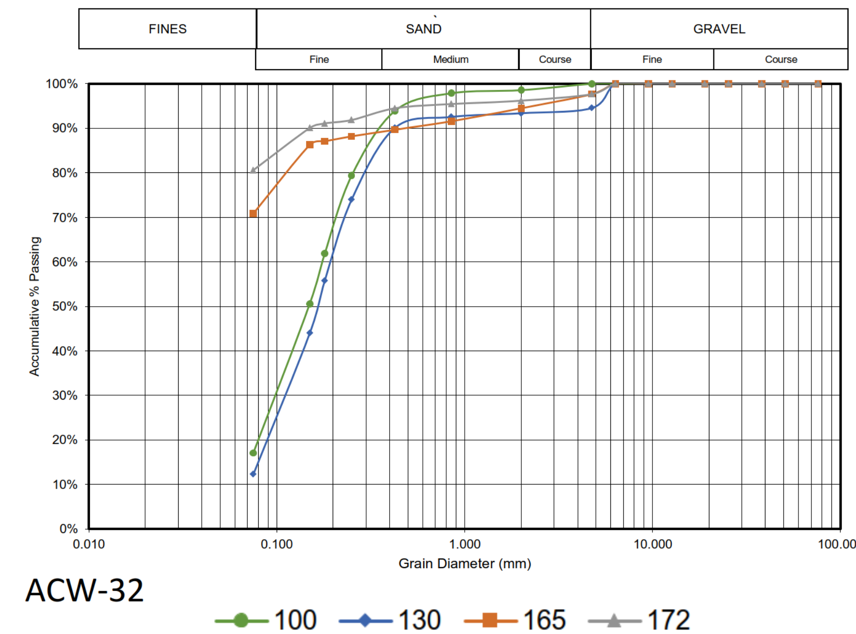


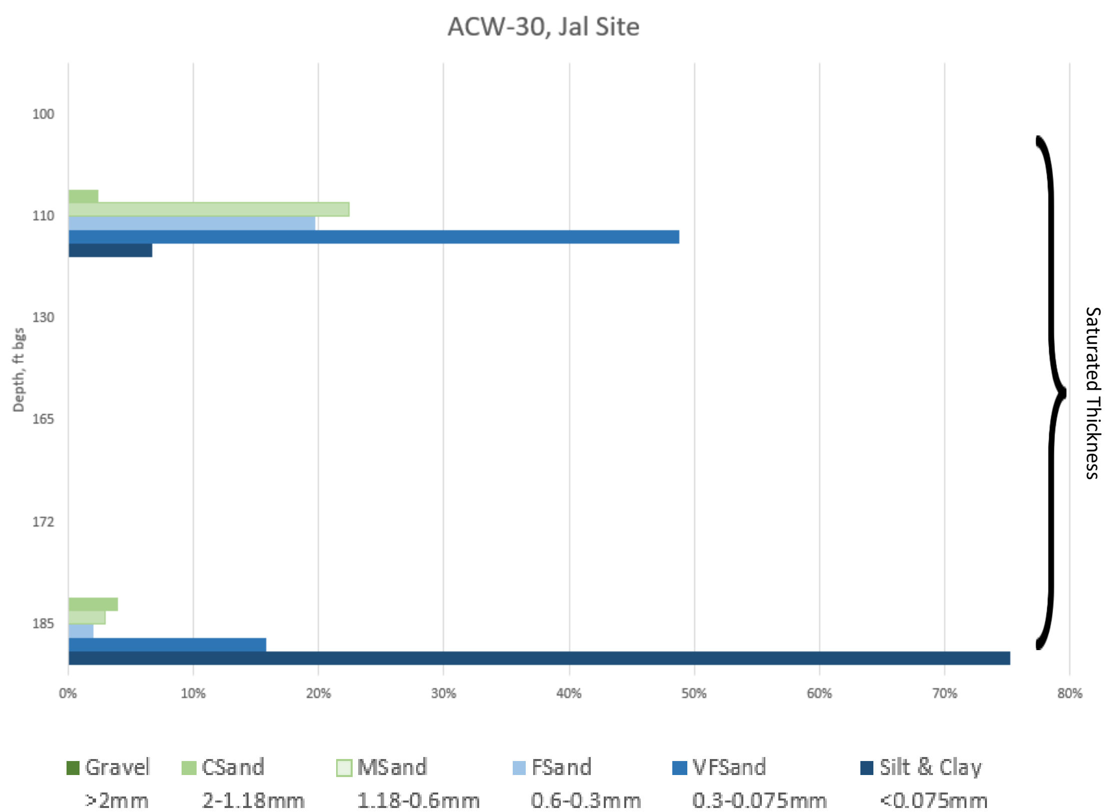
BH-1 **BH-2** **BH-3**

Figure 5-3

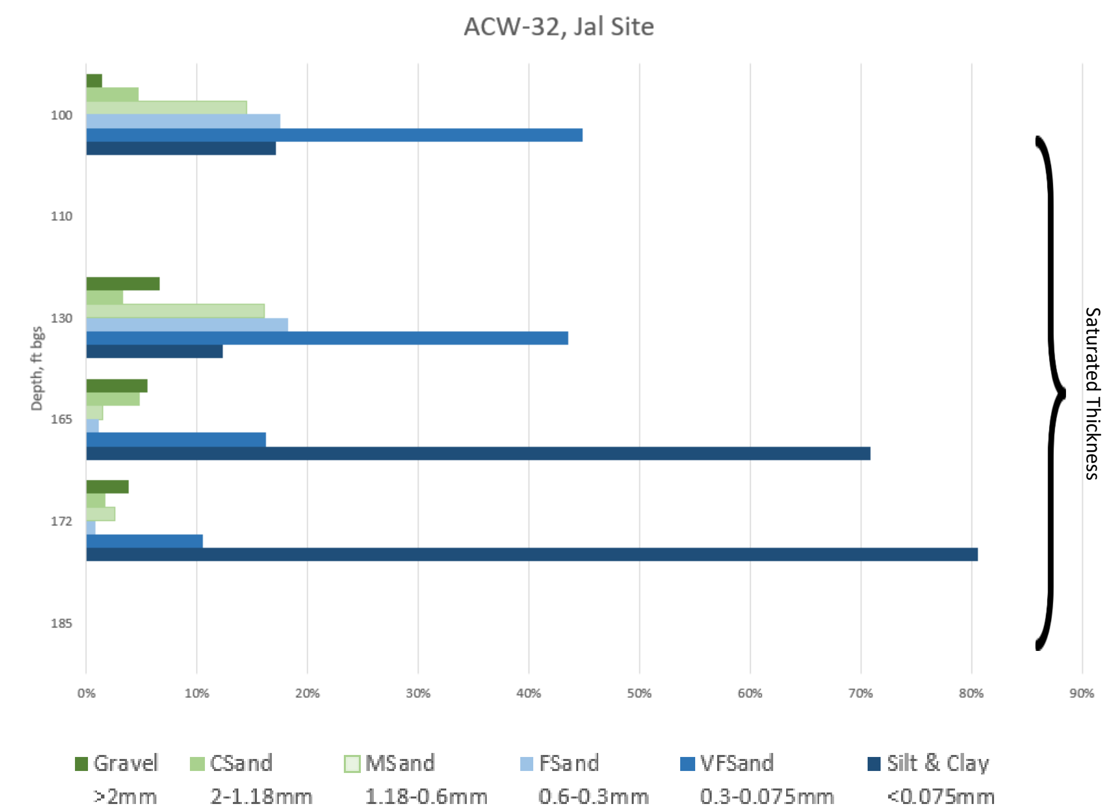
Results of Sieve Analyses for ACW-30 and ACW-32



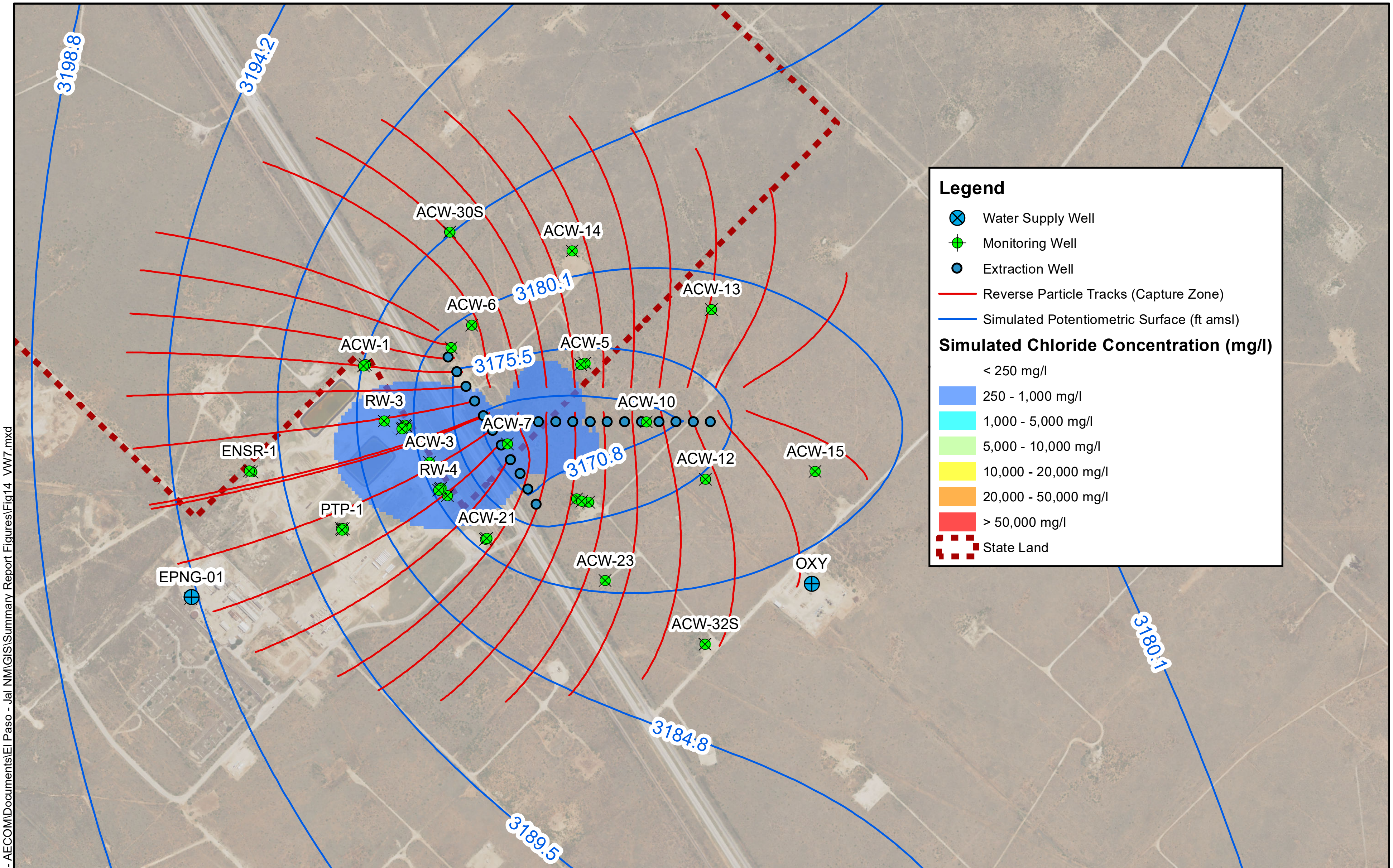




ACW-30



ACW-32



C:\Users\dave.estrella\OneDrive - AECOM\Documents\El Paso - Jal NM\GIS\Summary Report Figures\Fig14_VW7.mxd

1,000 500 0 500 1,000 Feet

References:
Aerial photo: USDA NAIP 2018

DRAWN BY:	DAE
DESIGNED BY:	DAE
CHECKED BY:	JZ
DATE:	11/15/2021
SCALE:	1:12,000

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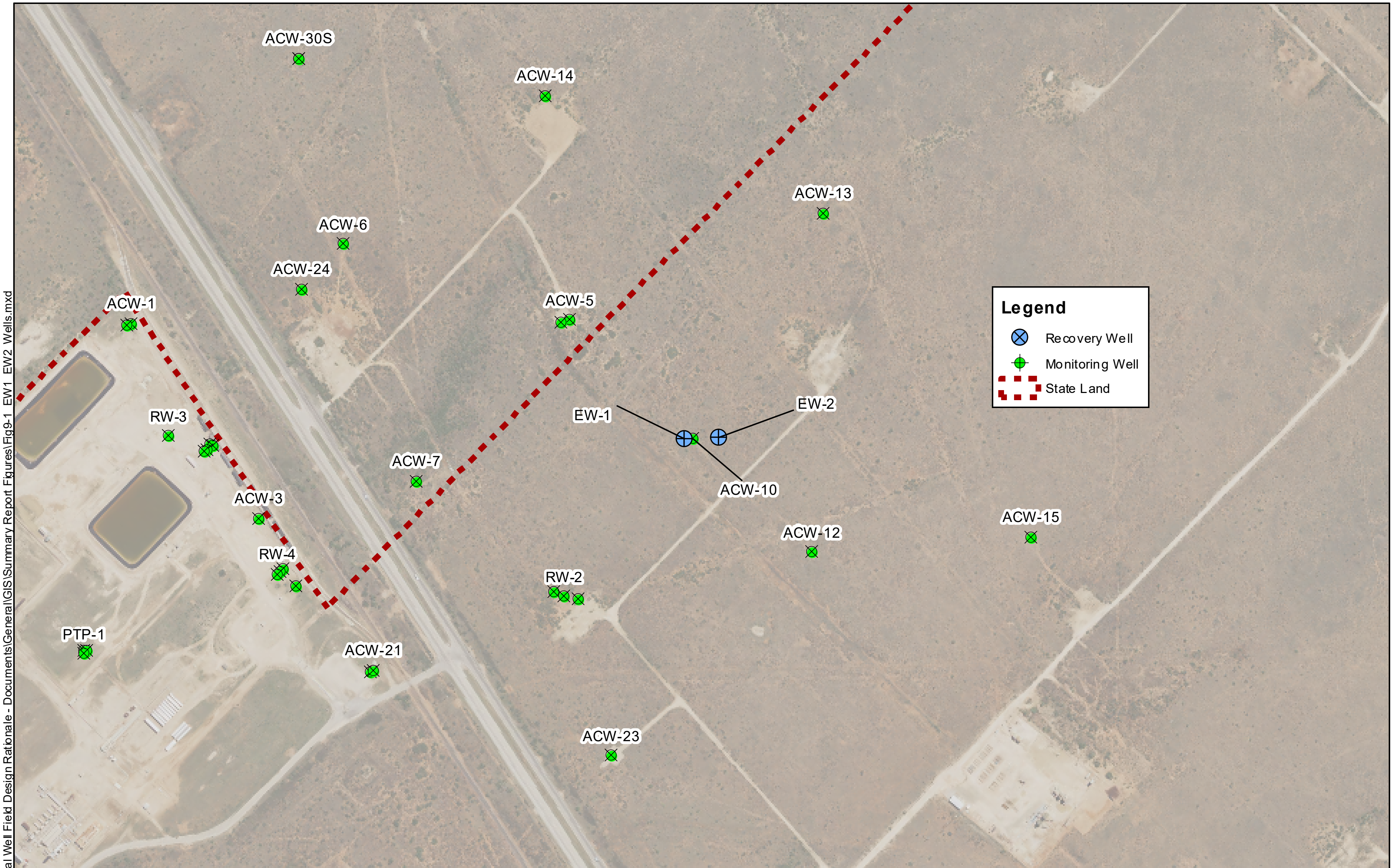
Houston, Texas 77094

KINDER MORGAN

Simulated Potentiometric Surface and Chloride Plume
After 30 Years - Alternative VW7
Former EPNG Jal No. 4 Plant Lea County, New Mexico

FIGURE 7-1



References:
Aerial photo: USDA NAIP 2018

DRAWN BY:	DAE
DESIGNED BY:	DAE
CHECKED BY:	JZ
DATE:	12/1/2022
SCALE:	1:6,000

AECOM
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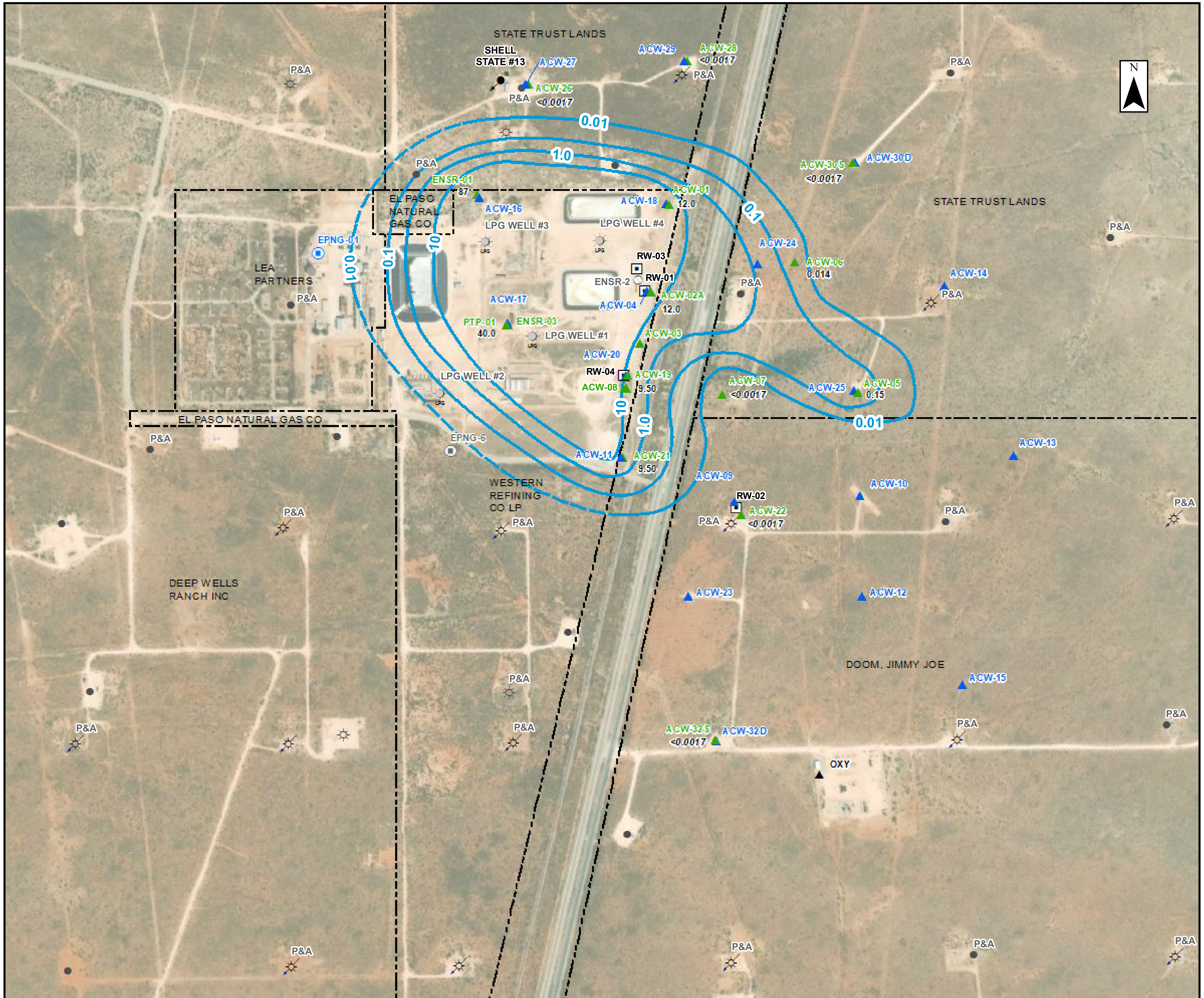
Houston, Texas 77094

KINDER MORGAN

Locations of Recovery Wells EW-1 and EW-2
Former EPNG Jal No. 4 Plant
Lea County, New Mexico

FIGURE 9-1

C:\Users\dave.estrella\AECOM\Jal Well Field Design Rationale - Documents\General\GIS\Summary Report Figures\Fig9-1 EW1 EW2 Wells.mxd



Legend

- DISPOSAL WELL
- GROUNDWATER MONITOR WELL, SCREENED IN THE UPPER PORTION OF THE AQUIFER
- GROUNDWATER MONITOR WELL, SCREENED IN THE LOWER PORTION OF THE AQUIFER
- GROUNDWATER RECOVERY WELL
- GROUNDWATER MONITOR WELL CONVERTED TO GROUNDWATER RECOVERY WELL
- WATER SUPPLY WELL
- PLUGGED/ABANDONDED WATER SUPPLY WELL
- WATER SUPPLY WELL
- INJECTION WELL (WATER FLOOD)
- OIL WELL
- GAS WELL
- LPG STORAGE WELL
- PLUGGED/ABANDONED MAY 2012
- CONTOUR LINE SHOWING EQUAL CONCENTRATIONS OF PROPANE IN GROUNDWATER, mg/L
- INFERRED PROPANE CONCENTRATION IN GROUNDWATER, mg/L
- APPROXMATE PROPERTY BOUNDARY

NOTES:

1) JAL #4 PLANT PROPERTY IS LOCATED WITHIN SECTIONS 31 AND 32 OF TOWNSHIP 23 SOUTH, RANGE 37 EAST, AND SECTIONS 5 AND 6 OF TOWNSHIP 24 SOUTH, RANGE 37 EAST, LEA COUNTY, NEW MEXICO.

2) SITE BASE AREA DIGITIZED FROM 11/04/76 AERIAL PHOTOGRAPH WITH PLANT PROPERTY BOUNDARY, WELLS INSERTED FROM VARIOUS OTHER SOURCES, AND DRAWING FILES PROVIDED BY SAIC ENERGY, ENVIRONMENT & INFRASTRUCTURE, LLC OF TULSA, OKLAHOMA.

3) RECOVERY SYSTEM HAS NOT OPERATED SINCE 2012.

4) AERIAL PHOTO SOURCED FROM MAXOR, DATED 4/08/2021.

5) SOURCE OF INDUSTRY-RELATED WELLS IS NMOCD OIL & GAS MAP.

0 300 600 1,200

Feet

AECOM

19219 KATY FREEWAY, SUITE 100
HOUSTON, TX 77094
PH: (281) 646-2400

Title: **Isopleth of Propane Concentrations in Upper Groundwater December 2021**

Project: 2021 Groundwater Remediation Report
El Paso Natural Gas Company
JAL #4 Gas Plant - Lea County, New Mexico

Scale:	Drawn by:	Date:	Client:		
As Shown	KPL	12/2/2022	Kinder Morgan		
	Chk'd by: WG	Date: 12/2/2022	Project No.: 60678485	File Name: Upper Propane Dec2021.mxd	Figure No.: 10-1

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Legend

- DISPOSAL WELL
- GROUNDWATER MONITOR WELL, SCREENED IN THE UPPER PORTION OF THE AQUIFER
- GROUNDWATER MONITOR WELL, SCREENED IN THE LOWER PORTION OF THE AQUIFER
- GROUNDWATER RECOVERY WELL
- GROUNDWATER MONITOR WELL CONVERTED TO GROUNDWATER RECOVERY WELL
- WATER SUPPLY WELL
- PLUGGED/ABANDONDED WATER SUPPLY WELL
- WATER SUPPLY WELL
- INJECTION WELL (WATER FLOOD)
- OIL WELL
- GAS WELL
- LPG STORAGE WELL
- PLUGGED/ABANDONED MAY 2012
- CONTOUR LINE SHOWING EQUAL CONCENTRATIONS OF PROPANE IN GROUNDWATER, mg/L
- INFERRED PROPANE CONCENTRATIONS IN GROUNDWATER, mg/L
- APPROXMATE PROPERTY BOUNDARY

NOTES:

1) JAL #4 PLANT PROPERTY IS LOCATED WITHIN SECTIONS 31 AND 32 OF TOWNSHIP 23 SOUTH, RANGE 37 EAST, AND SECTIONS 5 AND 6 OF TOWNSHIP 24 SOUTH, RANGE 37 EAST, LEA COUNTY, NEW MEXICO.

2) SITE BASE AREA DIGITIZED FROM 11/04/76 AERIAL PHOTOGRAPH WITH PLANT PROPERTY BOUNDARY, WELLS INSERTED FROM VARIOUS OTHER SOURCES, AND DRAWING FILES PROVIDED BY SAIC ENERGY, ENVIRONMENT & INFRASTRUCTURE, LLC OF TULSA, OKLAHOMA.

3) RECOVERY SYSTEM HAS NOT OPERATED SINCE 2012.

4) AERIAL PHOTO SOURCED FROM MAXOR, DATED 4/08/2021.

5) SOURCE OF INDUSTRY-RELATED WELLS IS NMOCD OIL & GAS MAP.

0 300 600 1,200
Feet

AECOM

19219 KATY FREEWAY, SUITE 100
HOUSTON, TX 77094
PH: (281) 646-2400

Title: **Isopleth of Propane Concentrations in Lower Groundwater December 2021**

Project: 2021 Groundwater Remediation Report
El Paso Natural Gas Company
JAL #4 Gas Plant - Lea County, New Mexico

Scale:	Drawn by:	Date:	Client:		
As Shown	KPL	12/2/2022	Kinder Morgan		
	Chk'd by: WG	Date: 12/2/2022	Project No.: 60678485	File Name: Lower Propane Dec2021.mxd	Figure No.: 10-2

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

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

CONDITIONS

Action 175076

CONDITIONS

Operator:	
El Paso Natural Gas Company, L.L.C 1001 Louisiana Street Houston, TX 77002	OGRID: 7046
	Action Number: 175076
	Action Type: [UF-GWA] Ground Water Abatement (GROUND WATER ABATEMENT)

CONDITIONS

Created By	Condition	Condition Date
nvelez	CD's review of the Summary of Project Activities 2018-2022: Content satisfactory. 1. El Paso Natural Gas Company's (EPNG) can proceed with the Project Path Forward Section in this report. 2. Please present abatement plan to OCD no later than 12/29/2023.	5/17/2023