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December 30, 2021
Mr. Ricardo Maestas
Acting Chief
Hazardous Waste Bureau
New Mexico Environment Department

Re: Response to Comments in the July 15, 2021 Letter of Disapproval, *Desktop Groundwater Receptor Survey and Vapor Intrusion Evaluation of Off-Site Receptors*, April 2019
HollyFrontier Navajo Refining LLC – Artesia Refinery
EPA ID NO. NMD048918817
HWB-NRC-19-003

Dear Mr. Maestas:

HollyFrontier Navajo Refining LLC (HFNR) is submitting this letter in response to the New Mexico Environment Department (NMED) letter dated July 15, 2019, regarding the April 2019 *Desktop Groundwater Receptor Survey and Vapor Intrusion Evaluation of Off-Site Receptors* memorandum (Memorandum). Below are HFNR's response to each of NMED's July 15, 2021 comments (shown in *italics*).

Response to NMED Comments

Comment 1

None of the figures included in the Memorandum identifies the south end of the Facility property boundary located across Highway 82. Provide an additional figure that depicts the full extent of the Facility property boundary to include the southern property.

Response 1

Figure 1 of the Memorandum was revised to include the south end of the Facility property boundary located to the south of Highway 82.

Comment 2

Volatile organic compounds (VOCs) have been detected in groundwater samples collected from the wells located in the vicinity of Eagle Creek. Although there are buildings/structures along Eagle Creek, receptors present in the area are not included in the discussion of the Memorandum. Revise the Memorandum to include Eagle Creek in the discussion.

Response 2

The Memorandum was revised to include a discussion of Eagle Creek (or Eagle Draw) and any potential receptors located in the vicinity of the creek. Eagle Creek enters the Refinery at the western boundary and runs to the northeast through the northern half of the Refinery, then eastward to the Pecos River. It is an ephemeral watercourse that primarily flows only following rain events. Stormwater in the Refinery is directed to the Refinery stormwater pond using berms and does not enter Eagle Creek except possibly during extreme rainfall events. Additionally, the Eagle Creek channel is cemented within the vicinity of the Refinery. Upstream of the Refinery, Eagle Creek functions as a major stormwater conveyance for the City of Artesia and drains outlying areas west of the city.

Eagle Creek is considered to be a major source of recharge for the shallow saturated zone. The shallow groundwater zone typically does not intersect Eagle Creek except for potentially historically high groundwater elevations observed in 2014. There are no buildings/structures located along Eagle Creek within the shallow groundwater plume or within 1-mile downgradient of the plume boundaries.

Comment 3

In the Groundwater Conditions - Hydrogeology Section, page 3, bullet 1, the Permittee states, "[s]tatic water levels in groundwater monitoring wells completed within this zone are three to five feet above the top of the shallow saturated zone, indicating groundwater in this zone is under confined conditions for some or most of the year." It is not clear if the Permittee's observation defines the top of the shallow saturated zone from the soil boring logs. Explain how the depth of the shallow saturated zone was determined and provide examples to justify the statement. In addition, provide a table that includes: (1) depths to water, (2) depths to soil saturation encountered during drilling and (3) depths to the screened interval for each well installed in the shallow saturated zone. Also, provide a discussion using data from the table to demonstrate that the aquifer is confined.

Response 3

The generalized depth of the top of the shallow saturated zone was determined based on the observed depth of the interbedded sand and gravel channels indicated on soil boring logs. Below are examples in each general area of the Facility:

- North Refinery (MW-59): The soil boring log indicates the top of the shallow saturated zone (clayey gravel underlying clay) to be at 15 feet below ground surface (bgs), or 3,344.44 feet above mean sea level (amsl), while measured groundwater elevations ranged from 3,344.32 feet amsl (October 2020) to 3,356.84 feet amsl (October 2015). The average groundwater elevation measured since 2010 was 3351.21 feet amsl which is 6.77 feet above the observed top of the shallow saturated zone.

- South Refinery (MW-102): The soil boring log indicates the top of the shallow saturated zone (sand and gravel underlying clay) to be at 15 feet bgs, or 3,350.51 feet amsl, while measured groundwater elevations in MW-102 have ranged from 3,350.64 feet amsl (October 2020) to 3,355.14 amsl (October 2016). The average groundwater elevation measured since 2010 was 3,351.57 feet amsl which is 1.22 feet above the observed top of the shallow saturated zone.

- Field East of Refinery (MW-129): The soil boring log indicates the top of the shallow saturated zone (silty gravel and silty sand underlying silty clay) to be at 23 feet bgs, or 3,340.10 feet amsl, while measured groundwater elevations ranged from 3,340.50 feet amsl (October 2020) to 3,345.87 feet amsl (November 2014). The average groundwater elevation measured since the well was installed in 2014 was 3,342.88 feet amsl, which is 2.78 feet above the observed top of the shallow saturated zone.

The requested information, including observed depths of saturation, measured water elevations following installation, and screened intervals, for wells completed in the shallow saturated zone is provided as

Attachment A to this letter. For many of the wells, the depth of saturation was either not noted or obvious based on the available soil boring or well completion log. Many of the logs only noted “moist” or “dry.” For the wells that did indicate the depth of saturation observed during drilling and for which the measured groundwater elevation following installation was available, the measured groundwater elevations were mostly higher than the observed saturation depth during drilling. Regardless, the statement regarding the confined nature of the shallow saturated zone within the Memorandum was originally provided for background purposes and did not affect the scope or results of the desktop groundwater receptor survey or vapor intrusion (VI) evaluation. The referenced statement was removed from the revised Memorandum.

Comment 4

In the Groundwater Conditions - Hydrocarbon Plumes Section, page 5, paragraph 2. The Permittee states, "[d]espite sometimes being under confined conditions, apparent PSH thicknesses in wells screened in the shallow saturated zone are generally inversely affected by fluctuations in groundwater elevations. Confined conditions result in the apparent in-well PSH elevation being higher than the actual PSH elevation in [the] formation." Based on the statement, the PSH column thickness appears to increase as the groundwater elevation decreases at the site. This phenomenon may be characterized by an unconfined or leaky confined aquifer; therefore, the shallow aquifer at the site may be characterized as a leaky confined aquifer demonstrating the characteristics of unconfined conditions or as unconfined. Provide additional information to support that the shallow aquifer is under confined conditions or revise the statement, as appropriate.

Response 4

The statement was revised to remove the statement regarding confined conditions.

Comment 5

In the Water Wells Section, page 6, paragraph 2, the Permittee states, "Table 1 summarizes the results of the AEA records search of potential shallow water [supply] wells located within 0.25 miles of the current extent of benzene and MTBE detections in shallow groundwater." Contaminant plumes are not necessarily stationary, and the full extent of the plumes is not defined; therefore, the AEA records search of potential groundwater receptors must be expanded for the radius up to one mile from the plume boundaries. Revise the appropriate sections of the Memorandum.

Response 5

HFNR expanded the radius search for water wells to one mile downgradient of the plume boundaries but did not extend the one mile search crossgradient or upgradient of the plume boundaries (with the plume defined as the critical groundwater screening level [CGWSL] exceedance area). The direction of groundwater flow in both the shallow saturated zone and the valley fill alluvium has consistently been to the east as observed over 15 years of facility-wide groundwater monitoring events. Additionally, crossgradient wells KWB-13 and MW-136 are located within 0.25 miles south and north of the shallow groundwater plumes, respectively, and target VOCs have historically not been detected in these wells based on at least seven years of monitoring data. Therefore, a 0.25-mile radius search is sufficient to evaluate potential receptors crossgradient of the shallow groundwater plumes.

Comment 6

In the Water Wells Section, page 6, paragraph 2, the Permittee states, "[t]he discrepancy between the [New Mexico Water Rights Reporting System (NMWRRS)] record locations and actual locations (based on Navajo sampling event data and records) can been [sic] seen on Figures 2 and 3 for the irrigation wells that *are currently included in the Navajo facility-wide groundwater monitoring program: RA-01227, RA-03156, RA-04196, and RA-04798." There appears to be a discrepancy with identifying the well locations in Figures 2 and 3. For example, two different locations for well RA-01227 are depicted in Figures 2 and 3. Therefore, it is not clear which wells identified on the figures are from the NMWRRS record locations or are the actual locations identified by the Facility. Identify the NMWRRS and actual well locations on the figures and indicate if they were NMWRRS or actual locations in the legend.*

Response 6

The actual well locations of water wells RA-01227, RA-03156, RA-04196, and RA-04798 were identified on Figures 2 and 3 with a yellow square symbol (indicating the well is in the monitoring program), while the New Mexico Water Rights Reporting System (NMWRRS) record locations are shown with a light blue circle. A clarifying note was added to the figure legend.

Comment 7

In the Water Wells Section, page 6, paragraph 3, the Permittee states, "[t]he only identified water wells that are located within the benzene and MTBE shallow groundwater plumes downgradient of the Facility are irrigation wells RA-04196 and RA-04798, which are sampled on a semiannual basis as part of the facility-wide groundwater monitoring program." However, water wells RA-03890, RA-00768, RA-02723, and RA-01097 are also located within the extent of the plumes where water well RA-02723 is located downgradient of the Facility. Revise the statement to include the additional water wells.

Response 7

The statement was revised to clarify water wells RA-03890, RA-00768, RA-02723, and RA-01097 are located within the extent of the plumes. All these water wells are located within the Facility, as defined for the Memorandum. The Refinery and HFNR-owned property are collectively referred to as “the Facility”, as stated in the first paragraph of the Memorandum.

Comment 8

In the Water Wells Section, page 7, paragraph 1, the Permittee states, "[w]ells RA-02342, RA- 23420, and RA-11688 are also located outside the historical target VOC CGWSLs exceedeance area." However, the Permittee has not been able to locate wells RA-02342 and RA-23420. According to the figures, wells RA-02342 and RA-23420 are located west of the leading edge of the plumes. If these wells can be located, they may provide useful data for plume delineation. Investigate whether or not wells RA-02342 and RA-23420 exist and use data from these wells to further delineate the plume. Revise the Memorandum accordingly.

Response 8

The NMWRSS location data places well records RA-02342 and RA-23420 within the southeastern corner of the Pecan Orchard, as shown on Figures 2 and 3 of the Memorandum. As stated in the Memorandum, HFNR confirmed these wells were not present in the Pecan Orchard based on visual survey and discussion with representatives of the Pecan Orchard. Also as stated in the Memorandum, the well records indicate this is likely one well with multiple well records/IDs that was reported as “failed” in 1960 and to be moved “100 feet west more or less to a more convenient location.” HFNR further investigated whether these wells exist per this NMED comment. Aerial photographs indicate there is a 1.7-acre land parcel (Parcel ID 4-154-098-252-511) on the southeastern corner of the Pecan Orchard that was not part of the Pecan Orchard prior to at least July 2005. Multiple buildings were present on this parcel in an aerial photograph dated January 2004, the buildings were no longer present in an aerial photograph dated July 2005, and the parcel appeared to be cultivated with pecan trees in line with the rest of the Pecan Orchard in an aerial photograph dated September 2006. These well records may have been associated with this parcel which is no longer zoned for residential use. The Memorandum has been updated to provide additional detail regarding efforts to identify and locate RA-02342/RA-23420.

Comment 9

In the Residences Section, page 7, paragraph 1, the Permittee states, "[a]erial imagery and Eddy County Tax Assessor records were used to identify potential residences located within 0.25 miles (1,320 feet) downgradient or [cross-gradient] of the current lateral extent of benzene and MTBE detections in shallow groundwater." Because of the mobility of the plume, all residences located up to a mile from the plume boundaries must be identified (see Comment 5). Revise the Memorandum accordingly.

Response 9

HFNR expanded the radius search for residences to one mile downgradient of the plume boundaries but did not extend the search crossgradient or upgradient of the plume boundaries. The direction of groundwater flow in both the shallow saturated zone and the valley fill alluvium has consistently been to the east as observed over 15 years of facility-wide groundwater monitoring events. Additionally, crossgradient wells KWB-13 and MW-136 are located within 0.25 miles south and north of the shallow groundwater plumes, respectively, and target VOCs have historically not been detected in these wells based on at least seven years of monitoring data. Therefore, a 0.25-mile radius search is sufficient to evaluate potential receptors crossgradient of the shallow groundwater plumes.

Comment 10

In the Residences Section, page 7, paragraph 1, the Permittee states, "[f]ive residential properties were identified, as summarized in Table 2, and their locations are shown on Figures 2, 3, and 4." The figures also depict two additional residences with access to the public water supply north and south of the Facility refinery fence line. Although there would be no potential exposure to the groundwater at these locations, the risk associated with vapor intrusion (VI) at these two locations must be evaluated because there are potential subsurface structures that may allow contaminants to enter these residences (e.g., piping). Include the discussion in the revised Memorandum.

Response 10

HFNR extended the VI evaluation to include a preferential pathway investigation which included an evaluation of recently collected data in the area. As detailed in the revised Memorandum, potential subsurface utilities present outside the Facility are not a concern for preferential pathways for VI based on the separation distance between groundwater/PSH sources and the typical subsurface utility depths. Additionally, these two residences are located more than 1,000 feet crossgradient of the shallow groundwater plumes and any piping connected to the residences would not run directly in or above the shallow groundwater plumes.

Comment 11

In the Residences Section, page 7, bullet 1, the Permittee states, "[b]ased on the direction of groundwater flow and the extensive conceptual site model for the Facility (i.e., preferential groundwater flow pathways within gravel channels to the south of this area, as described in the April 2017 Revised Contaminant Migration Evaluation Investigation Report [Revised CME Report]), it appears the presence of the MTBE *plume in the vicinity of NP-1 is isolated relative to the main groundwater plume." The referenced report is not an approved document. The reference must not be used and must be removed from the Memorandum. In addition, according to Figure 3, there are no groundwater monitoring wells located in the vicinity of well NP-1 to verify whether or not the MTBE plume is isolated around that well. The Permittee must provide additional information to support that the plume is isolated and must provide the work plan to install an additional monitoring well in accordance with the NMED's Disapproval Evaluation of Methyl Tert-Butyl Ether {MTBE) in Groundwater, dated May 7, 2021. Revise the Memorandum accordingly.*

Response 11

The reference to the Revised CME Report was removed from the Memorandum. A work plan to install an additional monitoring well to investigate MTBE in the area between NP-1 and MW-133 will be submitted to NMED by December 31, 2021.

Comment 12

In the Residences Section, page 7, bullet 2, the Permittee states, "[t]he extent of the benzene, MTBE, and PSH plumes in shallow groundwater to the west of this property [Parcel ID 4-154- 098-397-381] is not fully delineated." There is a shallow irrigation well located south of the property identified as RA 00400 or RA 01183. Evaluate the shallow irrigation well (RA 00400 or RA 01183) to determine whether the well is suitable for use in the delineation of the contaminant plumes.

Response 12

If either well RA-00400 or RA-01183 exists to the south of the referenced property (Parcel ID 4-154-098-397-381), they will not provide any additional delineation of the shallow groundwater plumes not already provided by new monitoring well MW-148 that was installed in September 2020. In addition, there are multiple NMWRRS database records with differing locations for both RA-00400 or RA-01183, as shown on Figures 2 and 3 of the Memorandum. One NMWRRS record places RA 00400 approximately 0.5 miles to the southwest near the residential property with Parcel ID 4 154 099 012 102, while another NMWRRS record places RA 01183 approximately 0.4 miles to the southeast.

Comment 13

In the Residences Section, page 8, bullet 2, the Permittee states, "Navajo observed one apparent domestic well (likely RA-03195) located near the residential structure on this parcel, but the well did not appear to be operable. As shown on Table 1 and in supplemental well records provided in Attachment C, the well record for RA-03195 is associated with the repair of irrigation well RA-00397 (completed in the deep artesian aquifer) and therefore this well may not exist." The information provided in this statement is not clear. Part of the statement indicates that well RA-03195 exists and was associated with the repair of irrigation well RA-00397 while the other part of the statement indicates that the well does not exist. The Permittee may be suggesting that wells RA-03195 and RA-00397 are the same well; however, these wells are more than 500 feet apart (as depicted on the figures) and are not likely to be the same well. Investigate whether or not both wells RA-03195 and RA-00397 exist and clarify the statement in the revised Memorandum.

Response 13

To clarify, the existence of a NMWRSS well record does not mean a well exists because a record can be created for just a well repair, a test hole, etc. Well record RA-03195 states, "This is old well RA-397. Well is to be tested for leakage." The NMWRSS records are based on applicant reports which are inherently subject to human error, including location information based on the Public Land Survey System (PLSS) information (section, township, range, quarter) instead of an exact location (such as coordinates or an address). Further, the NMWRSS database assigns default location data for well records at the center of the smallest quarter delineated in North American Datum (NAD) 83 Universe Transverse Mercator (UTM) Zone 13, which ranges from a 0.625-acre tract (5 quarters) to 10-acre tract (3 quarters). A majority of the NMWRRS database records provide location data at the center of a 10-acre tract. If an applicant provides the wrong PLSS information, then the NMWRSS data may be inaccurate by 660 feet or more, as depicted on the figures. HFNR does not believe it is necessary to determine if these wells exist as the benzene, MTBE, and PSH plumes in shallow groundwater are now fully delineated upgradient of the property associated with these NMWRSS well records, as described in the February 2021 *Downgradient Groundwater Investigation Report* that was approved with modifications by the NMED on September 9, 2021.

Comment 14

In the Pecan Orchard Section, page 8, paragraph 1, the Permittee states, "[t]he Pecan Orchard is located immediately downgradient to the east of the Facility and is present above the benzene and MTBE shallow groundwater plumes and the PSH plume. The Pecan Orchard operates a subsurface "pecan pit" where harvested pecans are temporarily deposited and then moved into the pecan plant by means of a conveyor belt system. This pit is located within an open-air structure along the western property boundary of the Pecan Orchard immediately downgradient of a Navajo recovery trench." Figure 5 depicts the location of the Pecan Orchard plant; however, the location of the subsurface pecan pit is not identified in the figure. In addition, the Memorandum states that the pecan pit is equipped with a French drain with pumps. Provide a revised figure with the location and dimensions of the pit, and a schematic of the pit including all equipment associated with its operation in the revised Memorandum. Provide the figure to scale, and if appropriate, a call out box with the details.

Response 14

The Pecan Orchard facility backfilled the subsurface pit on August 19, 2021. The pit was filled with clean soil and a concrete cap was placed on top of the area. HFNR personnel observed the backfilling activities and summarized the activities in the Memorandum provided as Attachment E to revised Memorandum. Figure 5A of the revised Memorandum identifies the former location of the pit.

Comment 15

In the Pecan Orchard Section, page 8, paragraph 1, the Permittee states, "[p]rior to liner installation, the pit was subject to fluctuating groundwater levels that could cause infiltration of shallow groundwater and PSH. The depth of the pit is approximately 16 feet bgs and is lined on the exterior." Due to the potential presence of PSH at the pit location, it would be beneficial if the liner is capable of preventing both polar and non-polar constituents from entering the pit (e.g., high-density polyethylene (HDPE) and ethylene vinyl alcohol (EVOH)). Verify the composition of the liner in the pit and provide a statement in the revised Memorandum about the liner's ability to prevent VOCs from entering the pit.

Response 15

Per HFNR's response to Comment #14, the pit was backfilled on August 19, 2021. HFNR does not have information regarding the composition of the liner that was installed in the pit by the Pecan Orchard facility, and following backfill, the composition of the liner is now moot.

Comment 16

In the Pecan Orchard Section, page 9, paragraph 1, the Permittee states, "RA-04196 is screened within the valley fill zone (from 280 to 292 feet bgs) and RA-04798 is screened in the deep artesian aquifer (from 840 to 850 feet bgs), as documented in Navajo's monitoring plans and reports. RA-04798 was misidentified as a shallow domestic water well within the [New Mexico Office of the State Engineer (NMOSE)] records search, but it is actually an irrigation well. No target VOCs have been detected in exceedance of CGWSLs in either of these irrigation wells based on sampling since 2006. In addition, the deep artesian aquifer is not considered to be hydraulically connected to the valley fill alluvium." MTBE has been detected below the applicable critical groundwater screening levels (CGWSLs) in groundwater samples collected from these wells. Therefore, it is premature to conclude that the deep artesian aquifer is not hydraulically connected to the valley fill alluvium based on the absence of exceedances of CGWSLs for the target VOCs. MTBE has a high solubility, making it the most mobile VOC and would be a better indicator for determining the hydraulic connectivity between the deep artesian aquifer and the valley fill alluvium. Re-evaluate the information using MTBE analytical data to demonstrate that the deep artesian aquifer is not hydraulically connected to the valley fill alluvium. The NMED's Disapproval Evaluation of Methyl Tert-Butyl Ether {MTBE) in Groundwater, dated May 7, 2021, requires a work plan to investigate the extent of MTBE in the valley fill and artesian aquifers. Revise the statement accordingly.

Response 16

HFNR is reevaluating the MTBE data relative to the hydraulic connectivity of the valley fill alluvium and the deep artesian aquifer, in accordance with the NMED’s May 7, 2021, letter. HFNR will also submit a work plan to investigate MTBE by December 31, 2021, in accordance with NMED’s May 7, 2021, letter. The statement in the Memorandum regarding the hydraulic connectivity of the valley fill alluvium and the deep artesian aquifer was revised to state investigation is ongoing.

Comment 17

In the Facility Groundwater Monitoring Network and Program Effectiveness Section, page 10, bullet 1, the Permittee states, "[t]he [cross-gradient] extent of [benzene and PSH] is not defined on the Facility to the south of monitoring wells MW-58 and MW-132. Navajo now owns a majority of the land and water rights to the south of these wells. Additional monitoring wells are not required in this area to monitor or control the PSH and benzene plumes as groundwater is consistently flowing to the east and PSH and benzene have not historically been detected in monitoring wells [KWB-13 and MW-57]." The statement is not accurate. Although the groundwater does appear to flow east, there are monitoring wells south of U.S. Highway 80 that contain PSH and benzene. Monitoring wells MW-109, MW-110, KWB-2R and MW-58 are south of U.S. Highway 80 and have reported MTBE detections. In addition, the benzene and PSH plumes have not been properly delineated in this area because there are not enough wells south of U.S. Highway 80 to fully characterize the benzene and PSH plumes. The Permittee did not include a statement about the lack of monitoring wells south of U.S. Highway 80 which would help to delineate the cross-gradient extent of benzene plume south of U.S. Highway 80. Revise the statement to clarify that the area south of U.S. Highway 80 is not fully delineated because of a lack of monitoring wells across U.S. Highway 80. In addition, NMED is aware that the Permittee has acquired the property south of the Facility and U.S. Highway 80. Propose to install additional monitoring wells to properly delineate the area south side of U.S. Highway 80.

Response 17

The statement was revised to clarify that the crossgradient extent of the shallow groundwater plumes is not fully defined to the south of Highway 82 and the relevant monitoring wells, including MW-58 (which is located south of Highway 82) and MW-132. HFNR also proposes to install two additional monitoring wells to fully delineate the crossgradient extent of the shallow groundwater plumes to the south of Highway 82.

Comment 18

In the Facility Groundwater Monitoring Network and Program Effectiveness Section, page 11, paragraph 1, the Permittee states, "[a]dditional monitoring wells installed to the west of monitoring well NP-1, near the southwestern and eastern corners of the upgradient residential property (Parcel ID 4-153-098-515-219), are recommended to better delineate the isolated MTBE plume." PSH is present in well MW-133 and there is no monitoring well located between well MW-133 and well NP-1. PSH in the vicinity of well MW-133 may potentially be a source of MTBE in well NP-1. Propose to install an additional monitoring well between well MW-133 and well NP-1 downgradient of the wells currently proposed in the area to delineate the MTBE plume.

Response 18

HFNR is submitting a work plan to install an additional monitoring well between MW-133 and NP-1 in accordance with the response to the NMED's May 7, 2021, letter. The work plan will be submitted to NMED by December 31, 2021 under separate cover from this revised Memorandum.

Comment 19

In the Dataset Used in the Vapor Intrusion Evaluation Section, page 12, paragraph 1, the Permittee states, "[t]he samples utilized in this [vapor intrusion (VI)] evaluation are presented in Table 3 and include groundwater data collected from 2016 through 2018." Table 3 does not include all of the data collected from the wells located within 100 feet of the building/structure where PSH is present or constituent concentrations exceed the screening levels (e.g., RW-12). All data that are relevant for the evaluation of VI must be included in the revised Memorandum.

Response 19

Table 3 identified only those off-site wells with compound-specific analytical data available that can be compared to appropriate screening levels. Recovery wells (e.g., RW-12 and RW-13) are located within the Facility and, therefore, were previously excluded from Table 3. HFNR revised Table 3 to ensure that all wells with compound-specific analytical data in close proximity (i.e., within 100 feet) to the offsite buildings are included.

Comment 20

The Selection of Constituents of Concern Section, pages 13 through 14, summarizes the discussion regarding the comparison of maximum detected concentrations (MDCs) to NMED vapor intrusion screening levels (VISLs). These comparisons are used to identify constituents of concern (COCs) that are retained for further evaluation. The comparisons yield six COCs, limited to wells KWB-7 and KWB-8. Section 2.5.2 (Evaluation of the Vapor Intrusion Pathway) from NMED's 2019 Evaluation of the Vapor Intrusion Pathway, of Risk Assessment Guidance for Site Investigations and Remediation Volume I Soil Screening Guidance for Human Health Risk Assessments (2019 NMED SSG) indicates site VI investigations should be classified as one of three designations: 1) incomplete pathway and no action required; 2) potentially complete pathway and a qualitative evaluation required; or 3) complete pathway and quantitative evaluation required. According to the information presented in the Memorandum, the VI pathway is potentially complete and must be subjected to a quantitative evaluation as described in Section 2.5.2.3 (Complete Pathway; Quantitative Assessment) of the 2019 NMED SSG (i.e., consistent detections of constituents with MDCs *that exceed the applicable VISLs, existence of potential exposure point for receptors, exceedances of applicable VISLs, suspected source of volatile and toxic constituents in groundwater at KWB-7 and KWB-8}. As described in Section 2.5.2.3 of the 2019 NMED SSG, the cumulative risk and hazard over all analytes at the two well locations must be calculated, and the results presented in the revised Memorandum. While not reported in the Memorandum, the six COCs that exceeded the groundwater VISLs at well KWB-8 represent relatively high estimates of cancer risk (8 x 10-3) and hazard (11). By itself, the benzene exceedance detected in well KWB-7 results in a risk of 2 x 10-s, which is higher than the NMED risk target level of 1 x 10-5. In addition, the results must be retained for summation with other sites risks impacting the same receptor populations (e.g., indoor/outdoor industrial workers at the Pecan Orchard Plant). Revise the Memorandum to include an estimate of cumulative risk and hazard for all applicable analytes at KWB-7 and KWB-8.*

Response 20

Those compounds detected in groundwater, but below their VISLs were further evaluated to determine if they are a human health concern. However, as stated in NMED's SSG, the NMED VISLs were not used as action standards or cleanup levels. Note, the depths to groundwater at both KWB-7 and KWB-8 have historically exceeded the 5-foot vertical separation distance for all dissolved-phase petroleum sources needed to complete the petroleum VI pathway. The Interstate Technology and Regulatory Council's (ITRC's) 2014 ITRC Petroleum Vapor Intrusion (PVI) guidance recommends 5-feet and 18-feet vertical separation distances for dissolved-phase and industrial phase-separated hydrocarbon (PSH) sources, respectively. ITRC's recommended vertical separation distances were derived using hundreds of paired data sets (soil gas/indoor air; source/indoor air) housed in USEPA's vapor intrusion database (https://www.epa.gov/vaporintrusion/vapor-intrusion-database). Therefore, the groundwater VI pathway would be considered incomplete and would not require further evaluation. However, PSH is present at both KWB-7 and KWB-8; therefore, the VI pathway requires further evaluation by first identifying whether these locations are within the 2002 and 2015 USEPA guidance-recommended 100-foot lateral inclusion zone of existing buildings (KWB-8 is within 100 feet of the Pecan Orchard Plant buildings). As a result, soil gas data were collected in the vicinity of KWB-8 and the Pecan Orchard Plant buildings to refine the VI evaluation, and the results are provided in the revised Memorandum.

Comment 21

The Lines of Evidence Approach Section, page 14, paragraph 2, lists the lines of evidence (LOE) considered in the Memorandum in evaluation of the off-site VI pathway that are VISL exceedances, separation distance between the groundwater source and building foundations, identification of buildings within 100 feet of the VISL exceedances, concentration trends in wells KWB-7 and KWB-8, and the presence of phase separated hydrocarbons (PSH) in wells as the applicable LOE. These LOE are discussed in detail in subsequent sections of the Memorandum. Section 2.5.2.3 of the 2019 NMED SSG states that the following LOE also be considered in cases where the applicable VISLs have been exceeded:

a) Information on vapor migration and attenuation in the vadose zone (e.g., soil gas data that represents spatial and vertical variations in soil gas concentrations, identification of any preferential pathways for vapor transport between the source and buildings).

b) Information on building foundations (e.g., information on construction materials, openings in the foundation, heating/cooling/ventilation system characteristics, photoionization detector readings at potential openings to the subsurface, indoor air samples, and information on building pressure gradients).

c} Information on the building interior including subslab soil gas measurements, results of site-specific transport modeling, comparisons of subslab soil gas and indoor air sampling results to determine site-specific attenuation factors.

d) Information on potential sources of VOCs within the building and in ambient air.

Other than noting slab on grade construction for the Pecan Orchard Plant buildings, the Permittee did not include information that addressed these bulleted items in the Memorandum. However, the Recommendations Section, pages 16 through 17, recommends collection of geotechnical parameters and information on existing buildings so that LOE for these four bulleted items can be developed for the site. Revise the Memorandum to indicate that the additional information identified in the Recommendations Section will be collected to develop LOE on vapor migration and attenuation, building construction features and interiors, and information on potential sources of VOCs within such buildings or in the ambient air for locations potentially affected by VI. The revised Memorandum must also state that all LOE will be used to refine the conceptual site model (CSM) and develop a thorough characterization of the subsurface vapor source. In addition, indicate that all LOE will be evaluated for concordance and note that further evaluation of VI concerns for the site will be informed by the evaluation of all developed LOE as outlined in the revised Recommendation Section.

Response 21

Despite the groundwater VI pathway being considered incomplete based on groundwater depths exceeding the 5-foot vertical separation distance at KWB-7 and KWB-8, additional soil gas data have been collected in the vicinity as part of a recent VI investigation of the Pecan Orchard Plant. These recent data and the conclusions of the expanded VI investigation were incorporated into the revised Memorandum and indicate that VI is not a human health concern at the Pecan Orchard Plant buildings. In addition, pecan processing will no longer be completed at the Pecan Orchard Plant and the processing pit was backfilled with clean soil and covered with a concrete cap in August 2021.

Comment 22

The Separation Distance Criteria Section, pages 14 through 15, states that the depth to groundwater for off-site groundwater monitoring/recovery wells with residential VISL exceedances was measured to determine whether adequate separation distance exists between the groundwater vapor source and site building foundations. The Permittee cites USEPA's Technical Guide for Addressing Petroleum Vapor Intrusion at Leaking Underground Storage Tank Sites, dated June 2015 (OUST VI Guidance) recommendation of six feet as the maximum vertical separation between a groundwater vapor source of concern and the bottom of the foundation of a potentially impacted building. However, page 3 of the OUST VI Guidance indicates that petroleum contamination at sites that are not comparable to underground storage tank sites should be addressed under USEPA's OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air, dated June 2015 (OSWER VI Guidance). Refineries are the first example listed as a type of facility not covered by the OUST VI Guidance. Therefore, the use of the vertical separation distance criterion from the OUST VI Guidance must not be used as an LOE as it is not appropriate for use at this type of facility. Revise the Memorandum to eliminate the use of a vertical separation distance of six feet between the water table and the bottom of potentially impacted buildings as a LOE for eliminating concerns related to the VI pathway. Revise all affected sections and tables (e.g., Table 8) accordingly.

Response 22

The use of a vertical separation distance to screen the VI pathway is a technically-sound and generally-accepted approach. Although the USEPA 2015 OUST VI guidance does indicate that the screening distance should be applied to underground storage tanks, the empirical data used to determine appropriate screening distances for USEPA, as well as ITRC, included several types of subsurface petroleum sources. In addition, the fate and transport of petroleum hydrocarbons is not dependent on source (e.g., a molecule of benzene does not bioattenuate differently when it is released from an underground storage tank versus a refinery). Groundwater depths at KWB-7 and KWB-8 exceed the 5-foot vertical separation distance needed to complete the petroleum VI pathway for all dissolved-phase petroleum sources (2014 ITRC PVI guidance). Therefore, the groundwater VI would be considered incomplete and would not require further evaluation. However, additional soil gas data have been collected in the vicinity as part of a recent VI investigation of the Pecan Orchard Plant. These recent data and the conclusions of the VI investigation were incorporated into the revised Memorandum and indicate that VI is not a human health concern at the Pecan Orchard Plant buildings. In addition, pecan processing will no longer be completed at the Pecan Orchard Plant and the processing pit was backfilled with clean soil and covered with a concrete cap in August 2021.

Comment 23

In the Building Distance Criteria Section, page 15, paragraph 2, the Permittee states that the OSWER VI Guidance recommends 100 feet as an adequate radial distance between a building and the location of a VISL exceedance to prevent the building from exerting enough advective force to pull vapors from the subsurface through cracks in the building's foundation. The Permittee applies this condition to exclude the VISL exceedances at well KWB-7 from further evaluation. Furthermore, Figure 5, Groundwater Vapor Intrusion Screening Level Exceedances and PSH Requiring Further Evaluation, depicts well KWB-8 within 100 feet of an existing building foundation at the Pecan Orchard Plant and also depicts well KWB-7 located east of well KWB-8; therefore, confirming that the 100-foot radius surrounding well KWB-7 does not capture any currently identified off-site receptors associated with the Peach Orchard Plant or nearby residences.

The OSWER VI Guidance indicates a buffer zone of approximately 100 feet can often be used to define an initial lateral inclusion zone for vapor intrusion assessment (i.e., for identifying buildings that are 'near' a subsurface vapor source and generally warrant assessment) where the 100-foot buffer represents a lateral or vertical distance between a building foundation and the boundary of subsurface vapor concentrations. The OSWER VI Guidance also notes that the 100-foot distance assumes no significant surface cover present and the existence of no preferential vapor migration routes in the subsurface. The OSWER VI Guidance also allows for determination of a site-specific lateral inclusion zone based on the evaluation of subsurface vapor migration characteristics. The OSWER VI Guidance acknowledges that anecdotal evidence at some sites indicates buildings greater than 100 feet from the boundary of subsurface vapor contamination are affected by vapor intrusion, even when diffusion is the presumed mechanism of vapor migration. Furthermore, the presence of conduits like sewer and drain lines that intercept and carry subsurface contamination, as well as permeable bedding for sewer lines or other utilities, constitute preferential hydrogeologic pathways that facilitate unattenuated vapor migration in the vadose zone. Also, uncertainties in delineating applicable boundaries may extend the recommended inclusion distance for a vapor intrusion investigation.

Figures 1, 2, and 3 indicate that wells KWB-7 and KWB-8 fall within the plumes defined by the historical extent of target VOC exceedances of CGWSLs, benzene concentrations of 0.0001 milligrams per liter (mg/L), and MTBE concentrations of 0.0001 mg/L, respectively. The figures also indicate that the two wells *are located within plume areas where PSH is present. In addition, the Memorandum does not present any information on vapor migration in the vadose zone, the possible existence of preferential vapor migration routes, or the impact of future changes in land use and/or future structure and receptor locations. Based on the information provided in the Memorandum, development of a site-specific lateral buffer zone appears warranted for areas within the plume boundaries potentially impacted by VI. Revise the Memorandum to clearly state that well KWB-7 can be eliminated from the initial VI evaluation because no buildings are present within 100 feet of the well location. In addition, revise the Memorandum to indicate that well KWB-7 will be considered in further VI evaluations and will ultimately be retained or eliminated based on vapor migration characteristics in the vadose zone and the potential for off-site receptors to locate within the plume boundaries in the vicinity of well KWB-7 in the future.*

Response 23

Despite the groundwater VI pathway being considered incomplete based on groundwater depths exceeding the 5-foot vertical separation distance at KWB-7 and KWB-8, soil gas data have been collected in the vicinity as part of a recent VI investigation of the Pecan Orchard Plant. These recent data and the conclusions of the VI investigation were incorporated into the revised Memorandum. In addition, pecan processing will no longer be completed at the Pecan Orchard Plant and the processing pit was backfilled with clean soil and covered with a concrete cap in August 2021.

The use of the 100-foot lateral inclusion zone is conservative, as USEPA first recommended it in USEPA's 2002 Draft OSWER Subsurface VI Guidance for chlorinated solvent sources; and ITRC's 2014 PVI guidance recommends only a 30-foot lateral inclusion zone for petroleum sources. Although USEPA's 2015 OSWER VI guidance does discuss how certain precluding factors could extend a lateral inclusion zone beyond 100 feet, those precluding factors (e.g., utilities creating preferential pathway for vapors, surface cover) do not exist between the Pecan Orchard Plant and KWB-7, which is located in the middle of the Pecan Orchard. Specifically, the Pecan Orchard does not have buried utilities and is only used for agricultural purposes. Additionally, there is limited potential for future off-site receptors, including subsurface utilities) to locate within the plume boundaries in the vicinity of KWB-7 as it is HFNR's understanding that the Pecan Orchard does not plan to sell the property or remove pecan trees in the foreseeable future. Therefore, the continued use of a 100-foot lateral inclusion zone is recommended.

Comment 24

In the Presence of PSH Section, page 15, paragraph 4, the Permittee states, "[a] final line of evidence evaluates whether PSH present in seven off-site groundwater monitoring/recovery wells (KWB-4, KWB-7, KWB-8, RW-15C, RW-20A, RW-20B and RW-22) may present a VI concern to nearby building occupants (within 100 feet laterally), which is summarized in Table 9." The Permittee must also include wells with PSH where the lateral distance from the nearest building/structure exceeds 100 feet but the extent of the PSH from the wells is not completely delineated (e.g., MW-132) in the VI evaluation. In addition, according to Figure 1, there appears to be more off-site buildings/structures approximately 100 feet north and northeast from well MW-58 where PSH is present. Identify these buildings/structures and evaluate VI risk for the buildings/structures, as appropriate.

Response 24

HFNR evaluated wells located more than 100 feet from buildings/structure in the VI evaluation if the extent of the PSH from the wells is not completely delineated (e.g., KWB-2R, KWB-4, RW-15, and RW-19). However, if the PSH exceeds ITRC's 18 feet separation distance for PSH (originating from refinery sites) needed to complete the petroleum VI pathway for free-phase petroleum sources (2014 ITRC PVI guidance), the PSH VI pathway is considered incomplete and does not require further evaluation. Well MW-132 was not evaluated because downgradient well RW-12R was evaluated and this well is in closer proximity to off-site potential receptors (i.e., RW-12R is more representative of potential impacts to indoor air). A VI evaluation in the vicinity of MW-58 was also conducted in the revised Memorandum, but this well is located more than 100 feet from the referenced buildings/structures which are located on-site.

Comment 25

In the Lines of Evidence Conclusions Section, page 16, paragraph 1, the Permittee states that only two wells, KWB-8 and RW-22, indicate a potential VI concern for off-site workers. The remaining wells currently identified as off-site receptors are not considered at-risk due to VI based on the LOE approach presented in the Memorandum. Further evaluation of KWB-8 and RW-22 in relation to the Pecan Orchard Plant buildings is recommended by the Permittee. While NMED agrees that further evaluation around wells KWB-8 and RW-22 is warranted, the VISL exceedance at well KWB-7 must not be excluded from the VI evaluation. The single exceedance represents an elevated level of risk via the VI pathway without consideration of the contribution of other target VOCs at well KWB-7. The well's location and the lack of sufficient LOE for dismissing the groundwater VISL exceedance supports further consideration of potential impacts from VI in the vicinity of well KWB-7. Revise the discussion to include well KWB-7 among the areas recommended for further evaluation of VI. The Permittee must provide sufficient LOE to support exclusion of the area around well KWB-7 from further VI evaluation.

Response 25

Despite the groundwater VI pathway being considered incomplete based on groundwater depths exceeding the 5-foot vertical separation distance at KWB-7 and KWB-8, soil gas data have been collected in the vicinity as part of a recent VI investigation of the Pecan Orchard Plant. These recent data and the conclusions of the VI investigation were incorporated into the revised Memorandum and indicate that VI is not a human health concern at the Pecan Orchard Plant buildings. In addition, pecan processing will no longer be completed at the Pecan Orchard Processing Plant and the processing pit was backfilled with clean soil and covered with a concrete cap in August 2021.

Comment 26

The Data Gaps and Limitations, Off-Site Vapor Intrusion Evaluation Section, page 16, paragraph 5, notes the need for geotechnical parameter values to further evaluate potential VI exposure and the information related to vapor migration in the vadose zone (possibly including collection of active soil vapor samples), information on the potential existence of preferred migration pathways in the subsurface, and information on potential future construction within the plume boundaries depicted in Figures 1, 2, and 3, to better characterize impacts to off-site receptors through the VI pathway. This information must be provided and the evaluation of the VI pathway updated based on the results. Revise the discussion of data gaps and limitations to include the need to obtain this type of information.

Response 26

Since the submission of the April 2019 Memorandum, soil gas sampling was conducted in the vicinity of the Pecan Orchard Plant as part of a formal VI investigation, which did not identify any unacceptable indoor air risks to a worker inside the Pecan Orchard Plant buildings. The data and conclusions were incorporated into the revised Memorandum.

Comment 27

In the Recommendations Section, pages 16 through 17, the Permittee recommends conducting VI modeling using groundwater data from well KWB-8 to determine any potential risk and hazard through the VI pathway at the Pecan Orchard Plant buildings. If the predicted indoor air risk based on VI modeling is unacceptable, the Permittee recommends collection of soil gas data and further VI modeling of the Pecan Orchard Plant buildings. Based on the information provided in the Memorandum (e.g., elevated risk and hazard levels at well KWB-8 stemming from groundwater VISL exceedances) it is not clear that the Permittee's recommendations for further evaluation of the VI pathway will address current conditions at the Pecan Orchard Plant buildings in a timely and effective manner. In addition, the recommendations do not appear to reflect the approach outlined in the NMED SSG and USEPA's OWSWER VI Guidance for further· evaluation of the VI pathway. Given the elevated preliminary risk and hazard estimates at well KWB-8, the potential for risks in excess of NMED's target level of 1 x 10-5 at well KWB-7, and the lack of information on subsurface vapor migration, building characteristics, and the potential for future construction within the plume boundaries, the discussion must be revised to indicate timely actions will be taken to fully assess current site conditions and that those actions (as well as any future actions related to VI that result from the assessment of current conditions in the vicinity of wells KWB-7 and KWB-8) will be communicated and agreed to beforehand by NMED, OCD, and the Permittee. To ensure expectations are met, indicate that the agreed to approach will be documented in a way that does not delay work at the site and clearly establishes a basis for reporting the result of all future VI evaluations at the site in the revised Memorandum.

Response 27

The groundwater VI pathway is considered incomplete based on groundwater depths exceeding the 5-foot vertical separation distance. However, in the interest of a timely response, HFNR completed a VI investigation at the Pecan Orchard Plant which meets EPA and NMED guidance. The investigation included the collection of soil gas in the vicinity of the Pecan Orchard Plant. These recent data and the conclusions of the VI investigation were incorporated into the revised Memorandum and indicate that VI is not a human health concern at the Pecan Orchard Plant buildings. In addition, pecan processing will no longer be completed at the Pecan Orchard Plant and the processing pit was backfilled with clean soil and covered with a concrete cap in August 2021.

Comment 28

In the Recommendations Section, page 17, paragraph 1, the Permittee proposes to, "[i]nstall two monitoring wells near the residential property with Parcel ID 4-153-098-515-219 as shown on Figures 2 and 3, to identify whether the potential domestic water well RA-10378 is affected by the dissolved-phase hydrocarbon plume." Propose to collect groundwater samples from well RA-10378 to identify if the well is affected in the revised Memorandum.

Response 28

HFNR proposes collecting a groundwater sample from water well RA-10378 in the revised Memorandum. Once access is obtained from the property owner, the water well will be sampled for volatile organic compounds (VOCs) by Method 8260B.

Comment 29

In the Recommendations Section, page 17, bullet 1, the Permittee proposes to, "[i]nstall one monitoring well to the north of monitoring well MW-133, near the southwestern corner of Parcel ID 4-153-098-515-219, *to better delineate the [cross-gradient] extent of the benzene and MTBE plumes." The proposed well is located more than 700 feet north of well MW-133 where the contaminants are detected; therefore, the location of the proposed well may be too far from the edge of the plumes and may be insufficient for delineation. Propose to install an additional well halfway between well MW-133 and the current location of the proposed well or propose another location for the proposed well to better define the plumes in the revised Memorandum.*

Response 29

HFNR is submitting a work plan to install an additional monitoring well between MW-133 and the previously proposed well (which was installed in September 2020 and named MW-145) in accordance with the response to the NMED's May 7, 2021, letter. The work plan will be submitted to NMED by December 31, 2021, under separate cover from this revised Memorandum.

Comment 30

In the Recommendations Section, page 17, bullet 2, the Permittee proposes to, "[i]nstall one monitoring well to the west of monitoring well NP-1, across Bolton Road from the eastern portion of Parcel ID 4-153-098-515-219, to better delineate the upgradient extent of the isolated MTBE plume near monitoring well NP-1." It is not appropriate to reference the area surrounding well NP-1 as the "isolated MTBE plume" because there has been no clear demonstration that the plume is isolated. There are currently no other groundwater monitoring wells in the area that would support the statement that the site as an "isolated plume." Propose to install a monitoring well between NP-1 and MW-133 to determine whether the plume is isolated. Revise the statement by removing "isolated" in the revised Memorandum.

Response 30

The Memorandum was revised to remove the term "isolated" to describe the MTBE plume in the vicinity of NP-1. HFNR is submitting a work plan to install an additional monitoring well between MW-133 and NP-1 in accordance with the response to the NMED's May 7, 2021, letter. The work plan will be submitted to NMED by December 31, 2021, under separate cover from this revised Memorandum.

Comment 31

In the Recommendations Section, page 17, bullet 5, the Permittee proposes to, "[c]ontinue mitigation activities at the Pecan Orchard pit to continue to ensure impacted groundwater and PSH do not infiltrate the pit." Include a description of on-going activities associated with mitigation of impacted groundwater and PSH in the revised Memorandum. Currently, the PSH recovery pilot test involving injection of the extracted groundwater was proposed and approved by NMED. Future remediation activities may affect the scope of the Memorandum. The mitigation activities may need to be modified based on the effects of future remediation activities and must be re-evaluated after remediation activities are completed.

Response 31

The Pecan Orchard facility backfilled the subsurface pit on August 19, 2021. Therefore, mitigation activities relative to the pit are no longer applicable. The PSH recovery and groundwater reinjection pilot test work is ongoing, with the recovery/reinjection pilot test system anticipated to start in early 2022.

Comment 32

According to Table 6 (Selection of Off-Site Residential Groundwater Vapor Intrusion COCs), the constituents with MDCs that exceed the VISLs are retained as COCs; however, the NMED SSG states, "[i]t is emphasized that the NMED VISLs are not meant to be used as action standards or cleanup levels. Rather, they should be used as a tool to estimate potential cumulative risks." Accordingly, the constituents detected below the VISLs must also be retained to estimate potential cumulative risks. The NMED SSG also states, "if multiple chemicals are present, a health threat may exist at a specific building or site even if none of the individual substances exceeds its VISL." Revise the Memorandum to follow the quantitative assessment method described in the NMED SSG.

Response 32

Those compounds detected in groundwater, but below their VISLs were further evaluated to determine if they are a human health concern. However, as stated in NMED's SSG, the NMED VISLs were not used as action standards or cleanup levels.

Comment 33

According to Figures 2 and 3, the benzene, MTBE and PSH plumes are present beneath the Pecan Orchard. Some trees readily absorb organic contaminants from the roots. Evaluate whether the roots of the pecan trees reach the depth of shallow groundwater zone. Include a discussion regarding the possibility of the accumulation of organic contaminants in the pecan trees if the roots reach the shallow groundwater zone in the revised Memorandum.

Response 33

The Memorandum was revised to include a discussion of the pecan trees and any potential for uptake of shallow groundwater and organic constituents from the tree roots. Pecan tree root systems consist of a long taproot and shallow feeder roots, where the taproot primarily provides support and stability, and the feeder roots absorb water and nutrients. Pecan tree feeder roots mostly grow in the top 18 inches of soil where water, nutrients, and oxygen are easily absorbed. Groundwater elevations at monitoring wells KWB-7, KWB-8, and KWB-11A located across the Pecan Orchard ranged from 12.69 feet bgs to 24.69 feet bgs since 2010. Therefore, the primary feed zone of the Pecan Orchard trees is above the shallow groundwater zone. Additionally, the Pecan Orchard utilizes flood irrigation allowing the trees feeder roots to easily access fresh water near the ground surface.

Comment 34

In Attachment B, Transmittal Letter RE: Limited Updated to Draft Report of Navajo Refining Company Possible Shallow Receptor Records Study Artesian, NM (February 2016), page 2, the Permittee states that, "[c]opies of the database query spreadsheets are attached. Cells with noted changes are highlighted yellow in both query iterations. Cells without changes are highlighted green in the 2019 queries." The Permittee did not provide a description for the status of wells that are not highlighted yellow or green. In the response letter, provide the status of the wells that are not highlighted by yellow or green.

Response 34

NMWRRS database query spreadsheets were provided for both the December 2015 query and the February 2019 query. The query spreadsheets were provided in an order that allowed easier comparison between each of the query dates for each of the four PLSS sections (Section 9, 10, 15, and 16 of Township

17 South, Range 26 East) – the 2015 query spreadsheet for a section was followed by the 2019 query spreadsheet for the same section. The wells that are not highlighted yellow or green were only in the 2015 query spreadsheets, indicating there was no change between the 2015 and 2019 queries. This allows to easier differentiate between the 2015 and 2019 query spreadsheets.

Comment 35

Chlorinated solvents (e.g., TCE) have been historically detected in the groundwater samples collected at the Facility. The Permittee must prepare to analyze for 1,4-dioxane using EPA Method 8270 SIM for the groundwater samples collected from all monitoring wells where chlorinated solvents have been detected within the past ten years. Propose to analyze for 1,4- dioxane for two consecutive events in the upcoming Facility-Wide Groundwater Monitoring Plan. NMED will review the results from the events and determine if additional sampling is required.

Response 35

HFNR proposed the requested analysis of 1,4-dioxane in Section 5.3.1 of the *2021 Facility-Wide Groundwater Monitoring Work Plan* that was submitted to NMED on June 30, 2021. The results will be presented in future annual groundwater monitoring reports.

Comment 36

Upon review of the Memorandum, it is clear that the off-site receptor survey is limited to current receptors and current buildings and structures: future conditions are not addressed. The Memorandum concluded that current conditions do not present a risk to existing downgradient, off-site receptors through direct contact (i.e., ingestion and dermal contact) with shallow groundwater. However, it could be possible for Pecan Orchard Plant workers to be exposed to COCs in the Plant buildings through the VI pathway. The lack of information in the Memorandum about future off-site land use, downgradient off-site receptors, and construction in relationship to future plume conditions has not been identified and is considered a data gap.

Response 36

Future off-site land use, downgradient off-site receptors, and construction in relationship to future plume conditions were added to the Memorandum's Data Gaps and Limitations section. The shallow groundwater plumes are primarily located within HFNR-owned property or the Pecan Orchard. The VI evaluation conducted at the Pecan Orchard facility, where VOCs above CGWSLs and PSH are present in shallow groundwater, indicate there should be no risk to surface activities at the Pecan Orchard facility and therefore other properties located further downgradient as shallow groundwater concentrations decrease with distance from the refinery. It is HFNR's understanding that the Pecan Orchard does not plan to sell the property in the foreseeable future. Additionally, subdividing or developing a property within one mile of the City of Artesia limits requires city approval according to the City of Artesia Department of Planning and Zoning.

Closing

If you should have any questions or comments regarding this response letter, please contact me at (575) 746-5487 or Jason Leik at (214) 970-8902.

Sincerely,

Kawika Tupou
Environmental Manager
HollyFrontier Navajo Refining LLC

cc: OCD: L. Barr
NMED: D. Cobrain, L. Tsinnajinnie
HFC: J. Leik
TRC: J. Speer, L. Trozzolo, D. Helbert, C. Smith

Attachments:

Attachment A – Table Summarizing Shallow Saturated Zone Well Installation Observations

Attachment A - Table Summarizing Shallow Saturated Zone Well Installation Observations

Refinery Area	Well ID	Well Type	Well Screen	Depth of Saturation during Well Installation[1]		Depth to Water (DTW) after Installation		Depth of Saturation - DTW after Installation[2]
			(feet bgs)	Date	(feet bgs)	Date	(feet bgs)	(feet)
Field E of Refinery	KWB-1A	Monitoring	18 to 32	2/11/1992	20.00	2/19/1992	14.70	5.30
Field E of Refinery	KWB-1B	Monitoring	18 to 32	2/15/1992	20.00	2/19/1992	14.40	5.60
Field E of Refinery	KWB-3AR	Monitoring	17 to 33	9/3/2003	21.50	NA	NA	--
Field E of Refinery	KWB-5	Monitoring	24.7 to 38.7	2/11/1992	NA, sheen at 31.00	2/19/1992	23.10	--
Field E of Refinery	KWB-6	Monitoring	17.5 to 36.5	2/12/1992	29.00	2/19/1992	24.80	4.20
Field E of Refinery	KWB-7	Monitoring	18 to 32	2/13/1992	17.00	2/19/1992	19.50	-2.50
Field E of Refinery	KWB-8	Monitoring	15 to 34	2/12/1992	23.00	2/19/1992	20.60	2.40
Field E of Refinery	KWB-9	Monitoring	20 to 34	2/13/1992	22.50	2/19/1992	24.90	-2.40
Field E of Refinery	KWB-10R	Monitoring	9 to 29	10/11/2010	25.00	10/12/2010	16.06	8.94
Field E of Refinery	KWB-11A	Monitoring	30 to 39.5	10/4/1992	20.50	NA	NA	--
Field E of Refinery	KWB-12A	Monitoring	15.5 to 24.5	10/4/1992	18.00	NA	NA	--
Field E of Refinery	KWB-P4	Monitoring	NA	NA	No Log Available	NA	NA	--
Field E of Refinery	MW-57	Monitoring	10 to 30	9/5/2003	23.60	9/5/2003	17.00	6.60
Field E of Refinery	MW-58	Monitoring	13 to 28	9/5/2003	18.00	9/5/2003	13.00	5.00
Field E of Refinery	MW-111	Monitoring	25 to 40	2/2/2013	44.00	3/21/2013	23.28	20.72
Field E of Refinery	MW-112	Monitoring	25 to 35	2/1/2013	39.00	3/21/2013	21.95	17.05
Field E of Refinery	MW-113	Monitoring	20 to 35	2/2/2013	34.00	3/21/2013	22.47	11.53
Field E of Refinery	MW-125	Monitoring	15 to 25	2/5/2014	20.00	2/6/2014	6.21	13.79
Field E of Refinery	MW-126A	Monitoring	19 to 34	1/29/2014	21.00	2/7/2014	11.64	9.36
Field E of Refinery	MW-127	Monitoring	20 to 50	1/23/2014	24.00	2/6/2014	16.93	7.07
Field E of Refinery	MW-128	Monitoring	15 to 35	1/29/2014	20.50	2/7/2014	16.87	3.63
Field E of Refinery	MW-129	Monitoring	20 to 50	1/22/2014	24.00	3/27/2014	22.34	1.66
Field E of Refinery	MW-131	Monitoring	20 to 50	1/23/2014	23.50	2/6/2014	21.26	2.24
Field E of Refinery	MW-132	Monitoring	15 to 40	1/30/2014	23.50	3/27/2014	18.52	4.98
Field E of Refinery	MW-133	Monitoring	15 to 35	2/4/2014	19.00	3/27/2014	14.42	4.58
Field E of Refinery	MW-134	Monitoring	20 to 30	2/4/2014	22.50	2/6/2014	10.28	12.22
Field E of Refinery	MW-135	Monitoring	35 to 65	2/11/2014	35.00	2/13/2014	32.83	2.17
Field E of Refinery	MW-145	Monitoring	9 to 29	9/22/2020	17.50	9/25/2020	17.09	0.41
Field E of Refinery	MW-146	Monitoring	10 to 30	9/22/2020	22.00	9/25/2020	21.33	0.67
Field E of Refinery	MW-147	Monitoring	20 to 40	9/24/2020	31.50	9/25/2020	31.10	0.40
Field E of Refinery	MW-148	Monitoring	20 to 40	9/24/2020	28.50	9/25/2020	35.00	-6.50

Attachment A - Table Summarizing Shallow Saturated Zone Well Installation Observations

Refinery Area	Well ID	Well Type	Well Screen	Depth of Saturation during Well Installation[1]		Depth to Water (DTW) after Installation		Depth of Saturation - DTW after Installation[2]
			(feet bgs)	Date	(feet bgs)	Date	(feet bgs)	(feet)
Field E of Refinery	RW-11	Recovery	17 to 32	10/4/2006	20.00	10/20/2006	19.83	0.17
Field E of Refinery	RW-12R	Recovery	15 to 35	8/21/2011	No Log Available	NA	NA	--
Field E of Refinery	RW-13R	Recovery	15 to 35	8/21/2011	No Log Available	NA	NA	--
Field E of Refinery	RW-14R	Recovery	15 to 35	8/21/2011	No Log Available	NA	NA	--
Field E of Refinery	RW-18	Recovery	NA	NA	No Log Available	NA	NA	--
Field E of Refinery	RW-20	Recovery	NA	NA	No Log Available	NA	NA	--
Field E of Refinery	RW-22	Recovery	11.5 to 39	8/23/2011	No Log Available	NA	NA	--
N Refinery	MW-23	Monitoring	15 to 20	1/27/1993	9.50	1/27/1993	10.74	-1.24
N Refinery	MW-29	Monitoring	9.75 to 19.25	1/10/1995	17.00	1/10/1995	11.07	5.93
N Refinery	MW-30	Monitoring	NA	NA	No Log Available	NA	NA	--
N Refinery	MW-39	Monitoring	14 to 24	6/13/1984	17.00	NA	NA	--
N Refinery	MW-40	Monitoring	NA	6/14/1984	11.50	NA	NA	--
N Refinery	MW-41	Monitoring	14 to 19	6/15/1984	13.50	NA	NA	--
N Refinery	MW-42	Monitoring	NA	6/18/1984	14.50	NA	NA	--
N Refinery	MW-43	Monitoring	15.5 to 20.5	7/17/1984	13.50	NA	NA	--
N Refinery	MW-59	Monitoring	15 to 30	9/4/2003	16.00	NA	8.00	8.00
N Refinery	MW-60	Monitoring	15 to 30	9/4/2003	Saturation not noted	NA	9.00	--
N Refinery	MW-61	Monitoring	14 to 29	4/27/2005	22.00	5/29/2005	10.17	11.83
N Refinery	MW-62	Monitoring	14 to 29	4/27/2005	20.00	NA	12.00	8.00
N Refinery	MW-62R	Monitoring	5 to 25	9/1/2020	Saturation not noted	9/3/2020	16.33	--
N Refinery	MW-67	Monitoring	12 to 27	4/25/2005	17.00	5/29/2005	8.41	8.59
N Refinery	MW-90	Monitoring	5 to 20	6/29/2007	Saturation not noted	7/22/2007	8.56	--
N Refinery	MW-91	Monitoring	7 to 22	6/28/2007	Saturation not noted	7/22/2007	8.70	--
N Refinery	MW-92	Monitoring	5 to 20	6/28/2007	Saturation not noted	7/22/2007	9.48	--
N Refinery	MW-93	Monitoring	5 to 20	6/28/2007	17.00	7/22/2007	6.94	10.06
N Refinery	MW-94	Monitoring	5 to 20	7/2/2007	14.00	7/23/2007	9.63	4.37
N Refinery	MW-95	Monitoring	7 to 22	7/2/2007	Saturation not noted	7/23/2007	9.98	--
N Refinery	MW-96	Monitoring	7 to 22	7/3/2007	14.00	7/22/2007	8.71	5.29
N Refinery	MW-97	Monitoring	8 to 23	7/3/2007	Saturation not noted	7/22/2007	10.17	--
N Refinery	MW-98	Monitoring	13 to 23	7/3/2007	Saturation not noted	7/22/2007	6.51	--
N Refinery	MW-137	Monitoring	10 to 30	11/19/2014	14.50	8/13/2015	13.27	1.23

Attachment A - Table Summarizing Shallow Saturated Zone Well Installation Observations

Refinery Area	Well ID	Well Type	Well Screen	Depth of Saturation during Well Installation[1]		Depth to Water (DTW) after Installation		Depth of Saturation - DTW after Installation[2]
			(feet bgs)	Date	(feet bgs)	Date	(feet bgs)	(feet)
N Refinery	MW-137A	Monitoring	5.5 to 15.5	9/2/2020	Saturation not noted	9/3/2020	Dry	--
N Refinery	MW-138	Monitoring	10 to 25	8/11/2015	12.50	8/13/2015	12.78	-0.28
N Refinery	MW-138A	Monitoring	5.5 to 15.5	9/2/2020	Saturation not noted	9/3/2020	Dry	--
N Refinery	RW-1R	Recovery	15 to 35	10/16/2013	14.00	10/25/2013	9.11	4.89
N Refinery	RW-2R	Recovery	14.5 to 34.5	10/15/2013	20.00	10/25/2013	12.55	7.45
N Refinery	RW-7R	Recovery	14.5 to 34.5	10/17/2013	15.00	10/25/2013	10.19	4.81
N Refinery	RW-8R	Recovery	14.5 to 34.5	10/18/2013	15.00	10/25/2013	12.35	2.65
N Refinery	RW-9	Recovery	NA	NA	No Log Available	NA	NA	--
N Refinery	RW-10	Recovery	NA	NA	No Log Available	NA	NA	--
N Refinery	RW-16	Recovery	NA	NA	No Log Available	NA	NA	--
N Refinery	RW-17	Recovery	NA	NA	No Log Available	NA	NA	--
N RO Reject Field	MW-117	Monitoring	10 to 25	1/31/2013	Saturation not noted	3/22/2013	6.88	--
N RO Reject Field	MW-118	Monitoring	10 to 25	2/4/2013	Saturation not noted	3/22/2013	7.83	--
N RO Reject Field	MW-119	Monitoring	10 to 25	2/4/2013	Saturation not noted	3/22/2013	7.99	--
NCL	MW-18	Monitoring	15 to 19	6/8/1982	16.00	NA	NA	--
NCL	MW-19	Monitoring	NA	NA	No Log Available	NA	NA	--
NCL	MW-45	Monitoring	10.5 to 15.5	8/22/1984	14.00	NA	NA	--
NCL	MW-53R	Monitoring	14 to 24	9/23/2020	Saturation not noted	9/25/2020	14.33	--
NCL	MW-54A	Monitoring	12.7 to 27.7	12/14/1995	20.00	12/22/1995	14.53	5.47
NCL	MW-55	Monitoring	13.7 to 23.7	6/25/1995	17.30	8/9/1995	12.49	4.81
NCL	MW-56	Monitoring	13.4 to 23.4	8/7/1995	16.60	8/7/1995	11.80	4.80
NCL	MW-108	Monitoring	9 to 24	7/17/2009	20.00	8/3/2009	10.57	9.43
NCL	NCL-31	Monitoring	13 to 18	10/19/1982	14.00	10/22/1982	10.16	3.84
NCL	NCL-32	Monitoring	17 to 22	10/20/1982	10.50	10/22/1982	9.70	0.80
NCL	NCL-33	Monitoring	13 to 18	10/20/1982	Saturation not noted	10/22/1982	9.81	--
NCL	NCL-34A	Monitoring	16 to 21	10/20/1982	16.00	10/22/1982	10.60	5.40
NCL	NCL-44	Monitoring	NA	NA	No Log Available	NA	NA	--
NCL	NCL-49	Monitoring	16.8 to 17.8	5/17/1990	22.50	NA	NA	--
S Refinery	KWB-2R	Monitoring	NA	NA	No Log Available	NA	NA	--
S Refinery	KWB-4	Monitoring	20 to 39	2/17/1992	30.00	2/19/1992	24.20	5.80
S Refinery	MW-28	Monitoring	25 to 30	7/8/1982	No Log Available	NA	NA	--

Attachment A - Table Summarizing Shallow Saturated Zone Well Installation Observations

Refinery Area	Well ID	Well Type	Well Screen	Depth of Saturation during Well Installation[1]		Depth to Water (DTW) after Installation		Depth of Saturation - DTW after Installation[2]
			(feet bgs)	Date	(feet bgs)	Date	(feet bgs)	(feet)
S Refinery	MW-48	Monitoring	19 to 34	12/14/1994	No Log Available	NA	NA	--
S Refinery	MW-50	Monitoring	12 to 27	12/21/1994	No Log Available	NA	NA	--
S Refinery	MW-52	Monitoring	19 to 34	1/14/1995	No Log Available	NA	NA	--
S Refinery	MW-64	Monitoring	15 to 30	4/28/2005	Saturation not noted	NA	NA	--
S Refinery	MW-65	Monitoring	14.5 to 29.5	4/26/2005	Saturation not noted	4/30/2005	14.77	--
S Refinery	MW-66	Monitoring	14.6 to 29.6	4/26/2005	19.00	4/30/2005	14.40	4.60
S Refinery	MW-99	Monitoring	12 to 27	7/5/2007	Saturation not noted	7/22/2007	15.50	--
S Refinery	MW-101	Monitoring	8 to 23	7/6/2007	Saturation not noted	7/22/2007	13.29	--
S Refinery	MW-102	Monitoring	12 to 27	7/6/2007	Saturation not noted	7/22/2007	8.01	--
S Refinery	MW-103	Monitoring	7 to 22	8/18/2008	22.00	9/26/2008	15.04	6.96
S Refinery	MW-104	Monitoring	3 to 18	8/19/2008	23.00	9/26/2008	9.70	13.30
S Refinery	MW-105	Monitoring	8 to 18	2/19/2009	12.50	2/23/2009	12.11	0.39
S Refinery	MW-106	Monitoring	11 to 26	2/9/2009	20.00	3/25/2009	9.49	10.51
S Refinery	MW-107	Monitoring	12 to 22	2/24/2009	20.00	2/24/2009	14.29	5.71
S Refinery	MW-109	Monitoring	15 to 29.5	1/5/2011	28.00	1/10/2011	19.13	8.87
S Refinery	MW-110	Monitoring	15 to 29.5	1/6/2011	19.00	1/10/2011	17.19	1.81
S Refinery	MW-130	Monitoring	30 to 45	2/7/2014	34.00	2/12/2014	22.76	11.24
S Refinery	MW-139	Monitoring	10 to 30	7/9/2019	Saturation not noted	7/10/2019	14.85	--
S Refinery	RW-4R	Recovery	14.5 to 34.5	10/21/2013	Saturation not noted	NA	NA	--
S Refinery	RW-5R	Recovery	13 to 33	8/24/2011	No Log Available	NA	NA	--
S Refinery	RW-6R	Recovery	14.5 to 34.5	10/22/2013	18.00	NA	NA	--
S Refinery	RW-15	Recovery	NA	NA	No Log Available	NA	NA	--
S Refinery	RW-19	Recovery	11 to 46	8/20/2011	Saturation not noted	NA	NA	--
S RO Reject Field	MW-114	Monitoring	20 to 35	1/28/2013	Saturation not noted	3/21/2013	2.47	--
S RO Reject Field	MW-115	Monitoring	10 to 25	1/29/2013	Saturation not noted	3/21/2013	0.37	--
S RO Reject Field	MW-116	Monitoring	10 to 25	1/30/2013	13.00	3/21/2013	2.83	--
TEL	MW-49	Monitoring	19 to 34	12/20/1994	No Log Available	NA	NA	--
TEL	TEL-1	Monitoring	13 to 23	5/1/1990	No Log Available	NA	NA	--
TEL	TEL-2	Monitoring	13 to 23	5/1/1990	No Log Available	NA	NA	--
TEL	TEL-3	Monitoring	13 to 23	5/1/1990	No Log Available	NA	NA	--
TEL	TEL-4	Monitoring	13 to 23	5/1/1990	No Log Available	NA	NA	--

Attachment A - Table Summarizing Shallow Saturated Zone Well Installation Observations

Refinery Area	Well ID	Well Type	Well Screen	Depth of Saturation during Well Installation[1]		Depth to Water (DTW) after Installation		Depth of Saturation - DTW after Installation[2]
			(feet bgs)	Date	(feet bgs)	Date	(feet bgs)	(feet)
TMD	MW-8	Monitoring	NA	6/20/1986	Saturation not noted	NA	NA	--
TMD	MW-9	Monitoring	NA	6/20/1986	Saturation not noted	NA	NA	--
TMD	MW-16	Monitoring	8.5 to 19	1/19/1993	12.00	1/26/1993	8.34	3.66
TMD	MW-20	Monitoring	9.5 to 23.5	1/21/1993	14.00	1/26/1993	10.18	3.82
TMD	MW-21	Monitoring	7.5 to 22	1/23/1993	12.00	1/27/1993	10.65	1.35
TMD	MW-25	Monitoring	15.75 to 25.25	1/13/1995	Saturation not noted	1/14/1995	12.71	--
TMD	MW-26	Monitoring	15.25 to 24.25	1/13/1995	23.00	1/15/1995	11.77	11.23
TMD	MW-27	Monitoring	18.25 to 27.75	1/12/1995	19.00	1/13/1995	13.05	5.95
TMD	MW-46R	Monitoring	3.5 to 18.5	10/18/2010	10.70	11/2/2010	6.62	4.08
TMD	MW-68	Monitoring	14.75 to 24.5	1/11/1995	20.00	1/15/1995	17.78	2.22
TMD	MW-71	Monitoring	9.75 to 19.5	1/10/1995	17.00	1/12/1995	11.05	5.95
TMD	MW-89	Monitoring	2 to 17	3/20/2007	13.00	NA	NA	--
TMD	NP-1	Monitoring	9.5 to 19	1/22/1993	14.00	2/10/1993	12.19	1.81
TMD	NP-2	Monitoring	9.5 to 18.5	1/21/1993	10.00	2/10/1993	11.13	-1.13
TMD	NP-3	Monitoring	9.5 to 18.5	1/22/1993	8.00	2/10/1993	13.32	-5.32
TMD	NP-4	Monitoring	24.5 to 33.5	1/23/1993	25.00	2/10/1993	18.58	6.42
TMD	NP-6	Monitoring	8.75 to 18.75	1/10/1995	13.00	1/10/1995	9.88	3.12
TMD	NP-8	Monitoring	NA	NA	No Log Available	NA	NA	--
TMD	NP-9	Monitoring	NA	NA	No Log Available	NA	NA	--
Up-gradient	UG-1	Monitoring	8 to 23	7/28/2008	15.00	8/6/2008	14.41	0.59
Up-gradient	UG-2	Monitoring	15 to 30	7/28/2008	24.00	8/6/2008	19.15	4.85
Up-gradient	UG-3R	Monitoring	17 to 37	9/8/2008	28.00	9/11/2008	26.66	1.34
Up-gradient	UG-4	Monitoring	19.5 to 39.5	9/2/2014	28.00	9/11/2014	23.78	4.22

Notes:

(1) Depth of saturation as noted on well or soil boring log.

(2) Difference between the depth of saturation observed during well installation and the depth to water within the well after installation. A positive number indicates the water level within the well was higher after well completion compared to saturation observed during drilling.

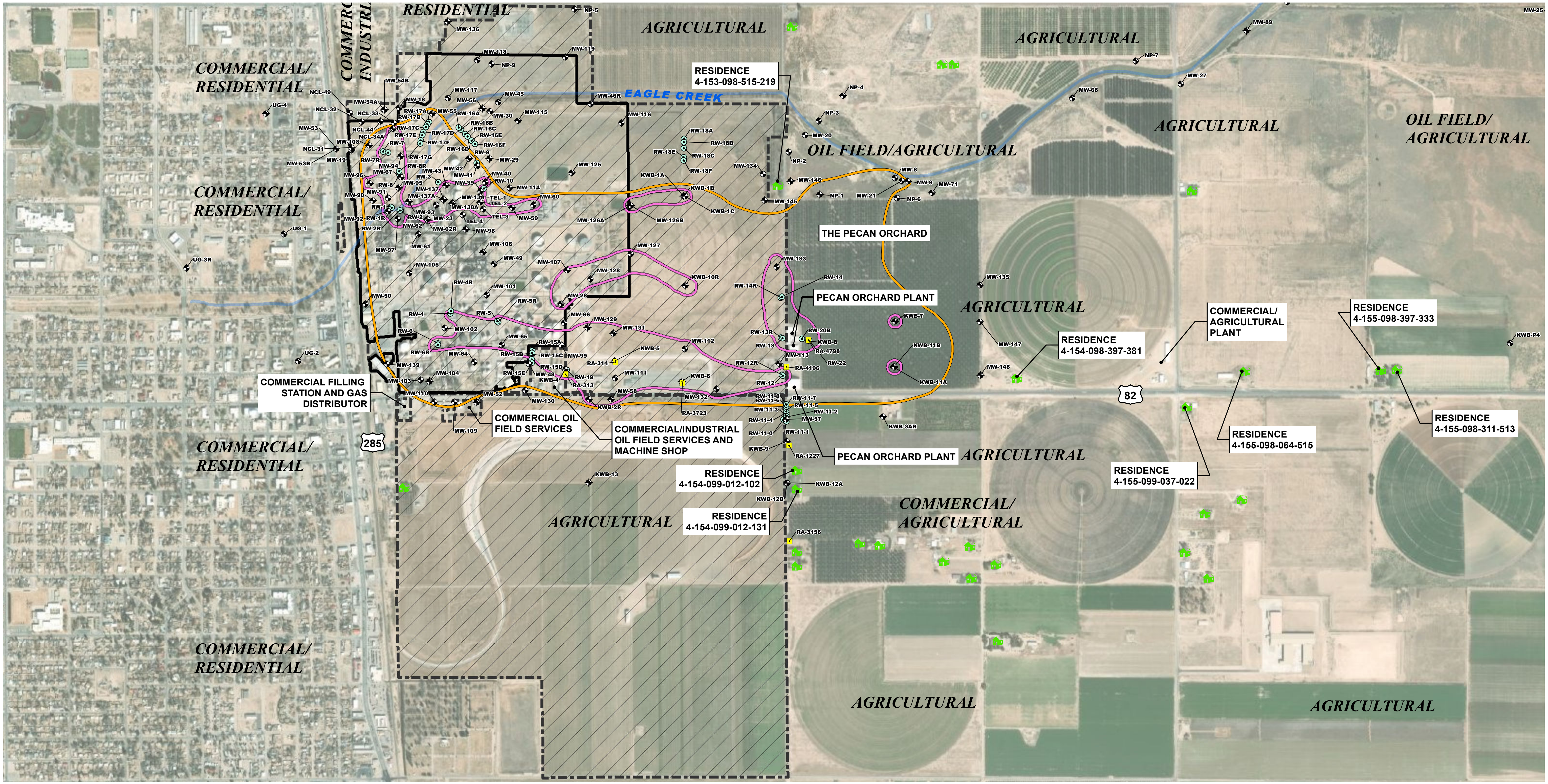
bgs = below ground surface

btoc = below top of casing

DTW = Depth to Water

NA = Not Available

TRC - GIS



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LEGEND

- MONITORING WELL
- RECOVERY WELL
- IRRIGATION WELL IN MONITORING PROGRAM
- RESIDENCE
- REFINERY FENCELINE
- FACILITY PROPERTY BOUNDARY (FENCELINE SHOWN WHERE COINCIDENT)
- PSH PRESENCE APRIL 2016-APRIL 2021
- HISTORICAL EXTENT OF TARGET VOCs IN EXCEEDANCE OF CGWSLs (SEE NOTE 2)

NOTES:

1. TARGET VOCs = BENZENE, TOLUENE, ETHYLBENZENE, XYLENES, MTBE, AND NAPHTHALENE.
2. HISTORICAL EXTENT SHOWN BASED ON MORE THAN ONE CGWSL EXCEEDANCE IN WELL OVER TIME. ANALYTICAL DATA AVAILABLE FOR MOST WELLS SINCE AT LEAST 2010 (FOR MANY WELLS SINCE 2006) OR THE WELL INSTALLATION DATE (WELLS MW-125 THROUGH MW-137 INSTALLED IN 2014; WELLS MW-53R, MW-62R, MW-137A, MW-138A, MW-139, AND MW-145 THROUGH MW-148 INSTALLED IN 2019-2020).THE FOLLOWING PERIMETER WELLS HAD ONE ISOLATED HISTORICAL CGWSL EXCEEDANCE AND THUS WERE NOT INCLUDED IN THE EXCEEDANCE AREA: MW-21 (BENZENE, OCT. 2006), MW-29 (BENZENE, OCT. 2006), MW-54A (XYLENES, APRIL 2011), MW-57 (BENZENE, NOV. 2014), NCL-33 (BENZENE, SEPT. 2006), AND NP-6 (BENZENE, OCT. 2006).
3. VOCs = VOLATILE ORGANIC COMPOUNDS
4. CGWSL = CRITICAL GROUNDWATER SCREENING LEVEL, SEE ANNUAL GROUNDWATER MONITORING REPORTS FOR SELECTION CRITERIA.
5. MTBE = METHYL TERT-BUTYL ETHER

AERIAL IMAGERY SOURCE: ESRI WORLD IMAGERY (10/1/20).

N

0 0.25 0.5 Miles

1 INCH = 0.25 MILE

1:15,840

PROJECT:
REVISED RECEPTOR SURVEY AND VAPOR INSTRUSION EVALUATION
HOLLYFRONTIER NAVAJO REFINERY LLC
ARTESIA REFINERY, EDDY COUNTY, NEW MEXICO

TITLE:
HISTORICAL TARGET VOC CGWSL EXCEEDANCE AREA AND SUROUNDING PROPERTY MAP

DRAWN BY:	MJAGOE	PROJ. NO.:	456061
CHECKED BY:	DHELBERT		
APPROVED BY:	JSPEER	FIGURE 1	
DATE:	NOVEMBER 2021		

TRC
505 East Huntland Drive, Suite 250
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FILE NO.: 456061_1_Property_Update.mxd

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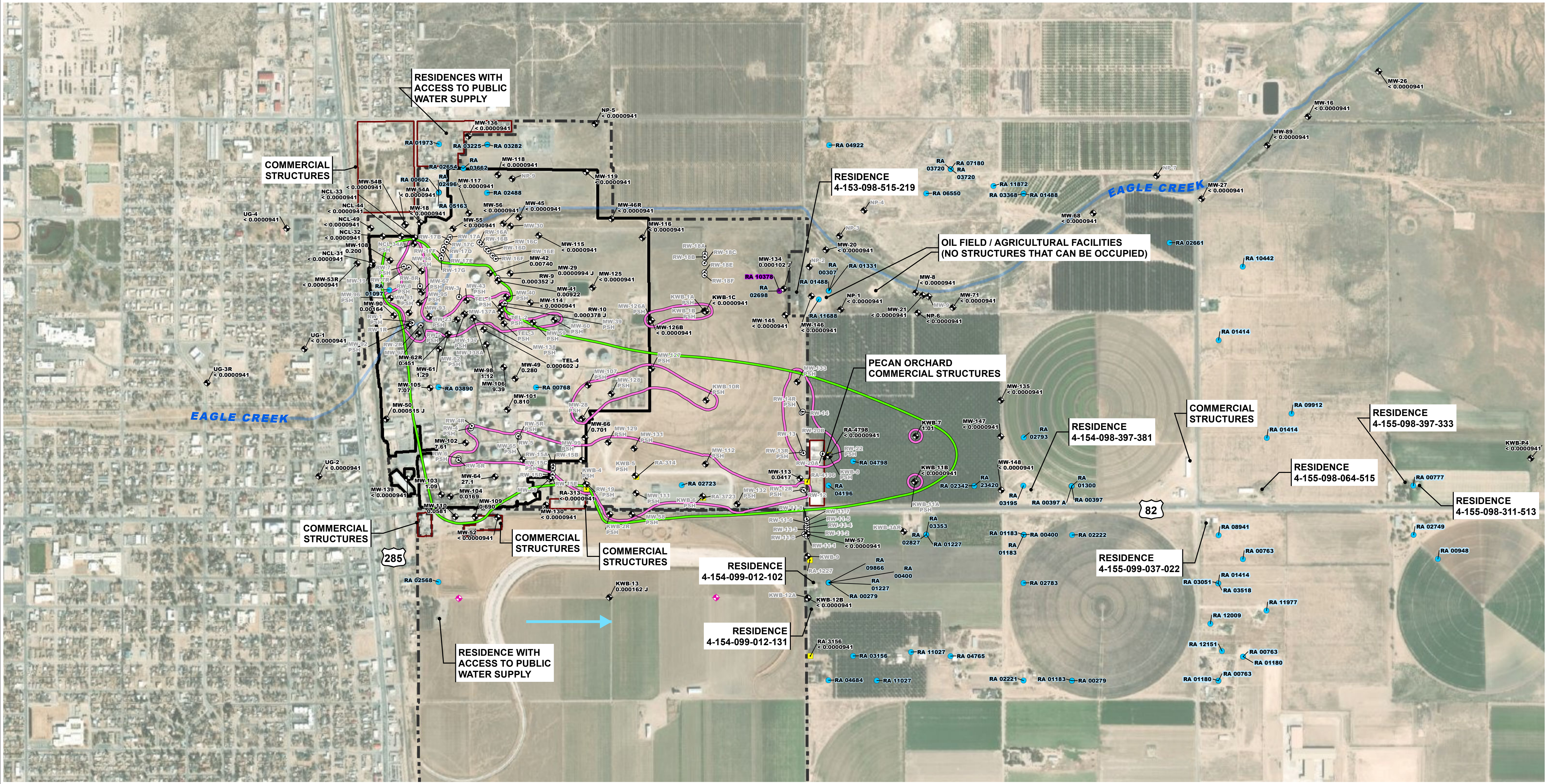
Coordinate System: NAD 1983 2011 StatePlane New Mexico East FIPS 3001 Ft US (Foot US)
Map Rotation: 0



LEGEND

- MONITORING WELL
- IRRIGATION WELL IN MONITORING PROGRAM
- RECOVERY WELL
- PROPOSED MONITORING WELL
- 1.75 — BENZENE CONCENTRATION
- <0.000331 — BENZENE NOT DETECTED ABOVE METHOD DETECTION LIMIT
- PSH — PHASE-SEPARATED HYDROCARBON PRESENT IN WELL (≥ 0.03 FEET THICK)
- KWB-9 — WELL NOT SAMPLED
- POTENTIAL SHALLOW WATER
- POTENTIAL DOMESTIC WATER WELL, FURTHER ASSESSMENT RECOMMENDED
- REFINERY FENCELINE
- FACILITY PROPERTY BOUNDARY (FENCELINE SHOWN WHERE COINCIDENT)
- GROUNDWATER FLOW
- PSH PRESENCE APRIL 2016-APRIL 2021
- FIRST 2021 SEMIANNUAL EVENT BENZENE CGWSL EXCEEDANCE AREA

NOTES:

1. ALL CONCENTRATIONS ARE IN MILLIGRAMS PER LITER (mg/L).
2. POTENTIAL SHALLOW WELLS IDENTIFIED IN RECORDS SEARCH BY ATKINS ENGINEERING ASSOCIATES INC. LOCATION SHOWN CONSISTENT WITH RECORDS.
3. J = CONCENTRATION QUALIFIED AS AN ESTIMATED VALUE.
4. ALL MONITORING AND RECOVERY WELLS ARE SCREENED IN THE SHALLOW SATURATED OR VALLEY FILL ZONES. IRRIGATION WELLS INCLUDED IN THE MONITORING PROGRAM ARE SCREENED IN EITHER THE VALLEY FILL ZONE OR THE DEEP ARTESIAN AQUIFER.
5. BENZENE CRITICAL GROUNDWATER SCREENING LEVEL (CGWSL) = 0.005 mg/L

AERIAL IMAGERY SOURCE: ESRI WORLD IMAGERY (10/1/20).

0 — 1,320 — 2,640 Feet
1 " = 1,320 '
1:15,840

PROJECT:	REVISED RECEPTOR SURVEY AND VAPOR INSTRUSION EVALUATION HOLLYFRONTIER NAVAJO REFINERY LLC ARTESIA REFINERY, EDDY COUNTY, NEW MEXICO
TITLE:	POTENTIAL GROUNDWATER RECEPTORS AND BENZENE ISOCONCENTRATION MAP (FIRST 2021 SEMIANNUAL EVENT)
DRAWN BY:	MJAGOE
PROJ. NO.:	456061
CHECKED BY:	DHELBERT
APPROVED BY:	JSPEER
DATE:	DECEMBER 2021
	FIGURE 2
FILE NO.:	456061_2_BenzSpring.mxd

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Plot Date: 12/30/2021, 12:57:32 PM by MJAGOE -- LAYOUT: ANSI B(11"x17")
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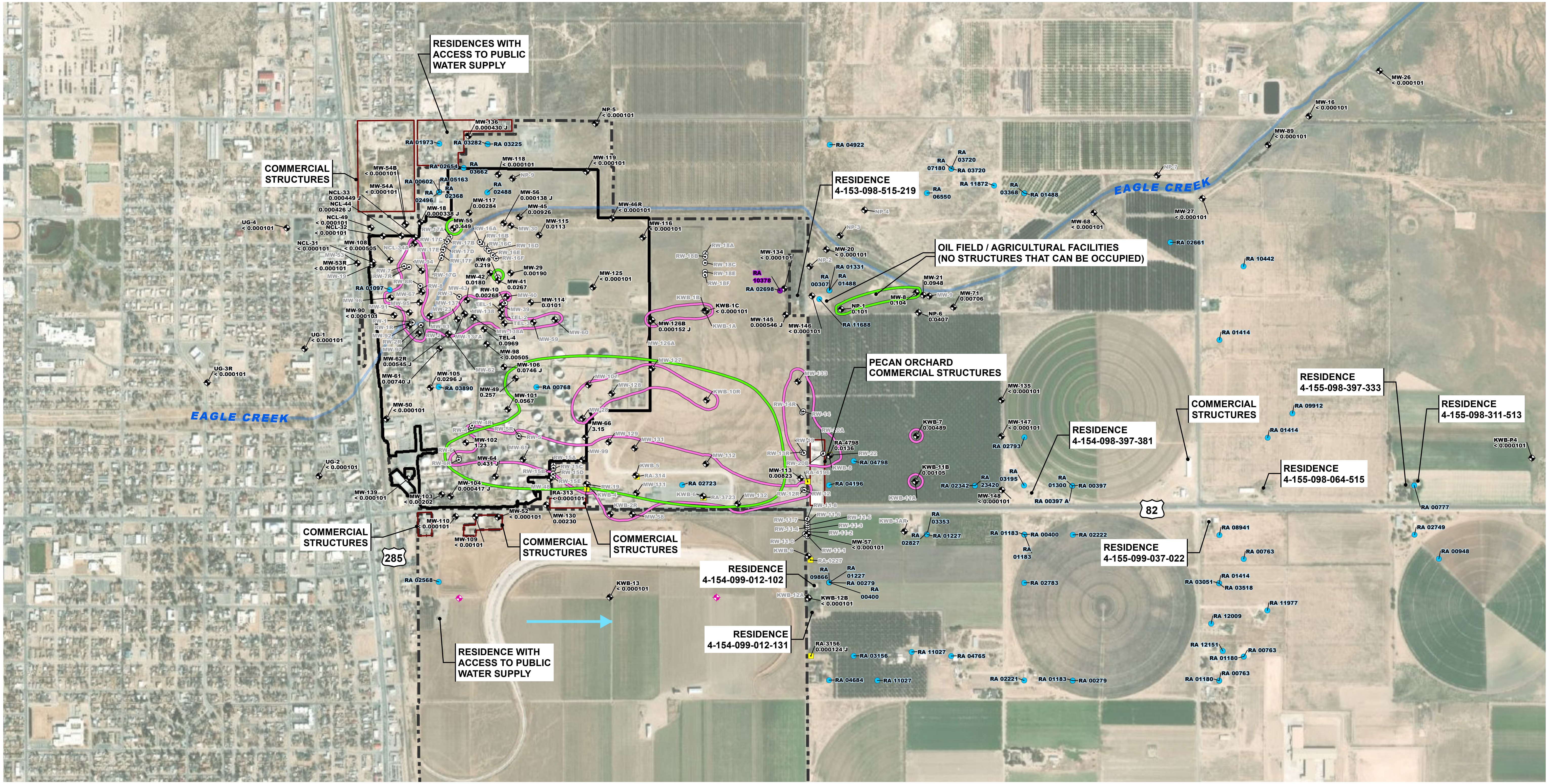
TRC - GIS

Coordinate System: NAD 1983 2011 StatePlane New Mexico East FIPS 3001 Ft US (Foot US)
Map Rotation: 0



LEGEND

- MONITORING WELL
- IRRIGATION WELL IN MONITORING PROGRAM
- RECOVERY WELL
- PROPOSED MONITORING WELL
- 1.19 MTBE CONCENTRATION
- <0.000367 MTBE NOT DETECTED ABOVE METHOD DETECTION LIMIT
- PSH PHASE-SEPARATED HYDROCARBON PRESENT IN WELL (≥ 0.03 FEET THICK)
- KWB-9 WELL NOT SAMPLED
- POTENTIAL SHALLOW WATER WELL
- POTENTIAL DOMESTIC WATER WELL, FURTHER ASSESSMENT RECOMMENDED
- REFINERY FENCELINE
- FACILITY PROPERTY BOUNDARY (FENCELINE SHOWN WHERE COINCIDENT)
- GROUNDWATER FLOW DIRECTION
- PSH PRESENCE APRIL 2016-APRIL 2021
- FIRST 2021 SEMIANNUAL EVENT MTBE CGWSL EXCEEDANCE AREA

NOTES:

1. ALL CONCENTRATIONS ARE IN MILLIGRAMS PER LITER (mg/L).
2. POTENTIAL SHALLOW WELLS IDENTIFIED IN RECORDS SEARCH BY ATKINS ENGINEERING ASSOCIATES INC. LOCATION SHOWN CONSISTENT WITH RECORDS.
3. J = CONCENTRATION QUALIFIED AS AN ESTIMATED VALUE.
4. MTBE = METHYL TERT-BUTYL ETHER
5. ALL MONITORING AND RECOVERY WELLS ARE SCREENED IN THE SHALLOW SATURATED OR VALLEY FILL ZONES. IRRIGATION WELLS INCLUDED IN THE MONITORING PROGRAM ARE SCREENED IN EITHER THE VALLEY FILL ZONE OR THE DEEP ARTESIAN AQUIFER.
6. MTBE CRITICAL GROUNDWATER SCREENING LEVEL (CGWSL) = 0.100 mg/L

AERIAL IMAGERY SOURCE: ESRI WORLD IMAGERY (10/1/20).

N

0 1,320 2,640 Feet

1 " = 1,320 '
1:15,840

PROJECT:
REVISED RECEPTOR SURVEY AND VAPOR INSTRUSION EVALUATION
HOLLYFRONTIER NAVAJO REFINERY LLC
ARTESIA REFINERY, EDDY COUNTY, NEW MEXICO

TITLE:
POTENTIAL GROUNDWATER RECEPTORS AND MTBE ISOCONCENTRATION MAP (FIRST 2021 SEMIANNUAL EVENT)

DRAWN BY:	MJAGOE	PROJ. NO.:	456061
CHECKED BY:	DHELBERT	FIGURE 3	
APPROVED BY:	JSPEER		
DATE:	DECEMBER 2021		

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FILE NO.: 456061_3_MTBESpring.mxd

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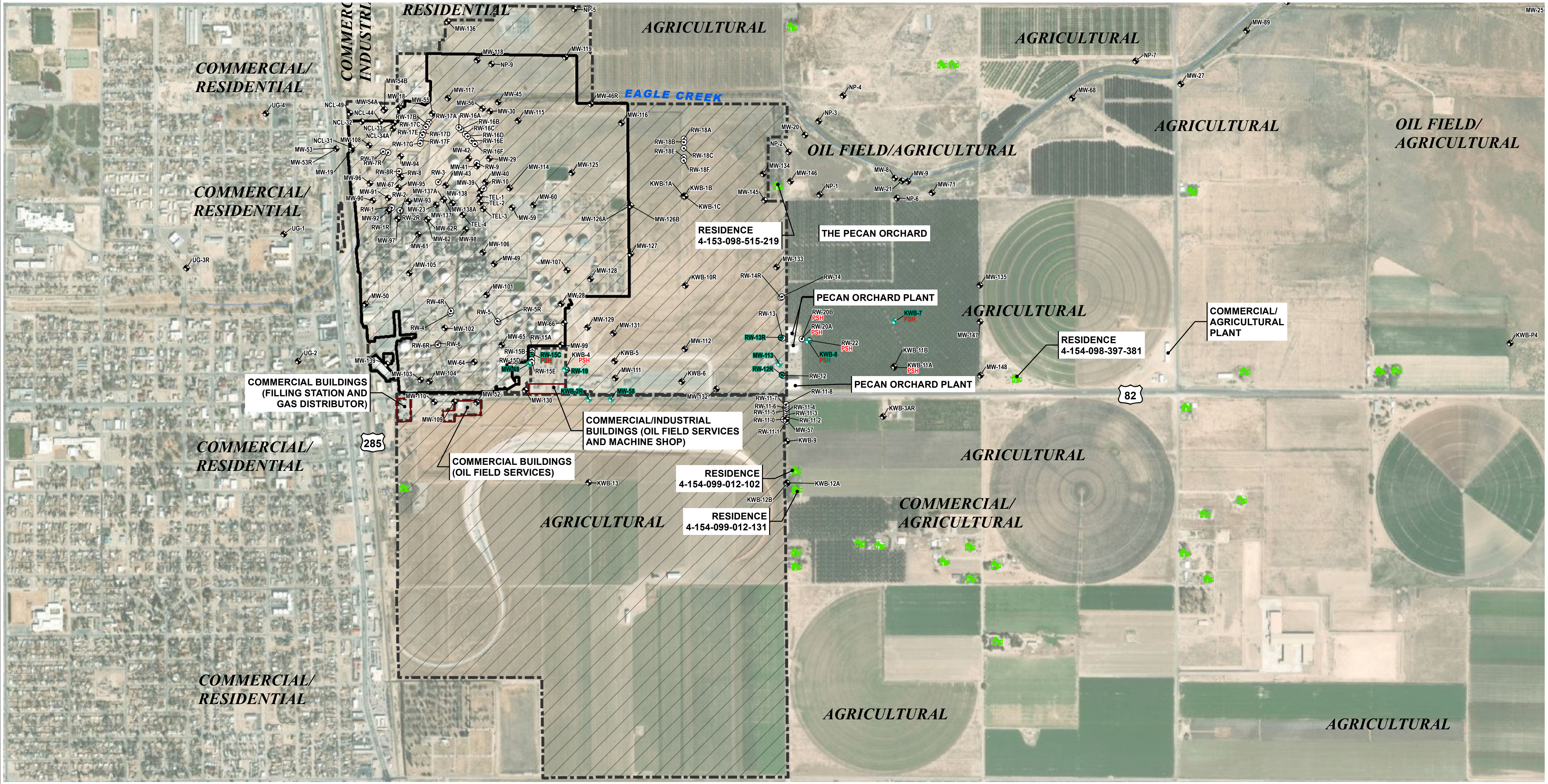
TRC - GIS



LEGEND

- MONITORING WELL EXCEEDED RESIDENTIAL GW VISL FOR OFFSITE EVALUATION
- RECOVERY WELL EXCEEDED RESIDENTIAL GW VISL FOR OFFSITE EVALUATION
- MONITORING WELL
- RECOVERY WELL
- RESIDENCE
- REFINERY FENCELINE
- FACILITY PROPERTY BOUNDARY (FENCELINE SHOWN WHERE COINCIDENT)
- PSH PHASE-SEPARATED HYDROCARBON OCCURRED IN OFF-SITE WELL BETWEEN 2016-2021 (≥ 0.01 FEET THICK)

NOTES:

1. GW VISL = GROUNDWATER VAPOR INTRUSION SCREENING LEVEL.
2. WELLS SHOWN AS EXCEEDING A RESIDENTIAL GW VISL EXCEEDED A GW VISL FOR AT LEAST ONE ANALYTE BETWEEN 2016 AND 2021.

0 1,320 2,640 Feet
1 " = 1,320 '
1:15,840

AERIAL IMAGERY SOURCE: ESRI WORLD IMAGERY (10/1/20).

PROJECT:
REVISED RECEPTOR SURVEY AND VAPOR INSTRUSION EVALUATION
HOLLYFRONTIER NAVAJO REFINERY LLC
ARTESIA REFINERY, EDDY COUNTY, NEW MEXICO

TITLE:
GROUNDWATER VAPOR INTRUSION SCREENING LEVEL EXCEEDANCES (APRIL 2016- APRIL 2021)

DRAWN BY:	MJAGOE	PROJ. NO.:	456061
CHECKED BY:	DHELBERT	FIGURE 4	
APPROVED BY:	JSPEER		
DATE:	DECEMBER 2021		

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FILE NO.: 456061_4_VISL.mxd

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Map Rotation: 0

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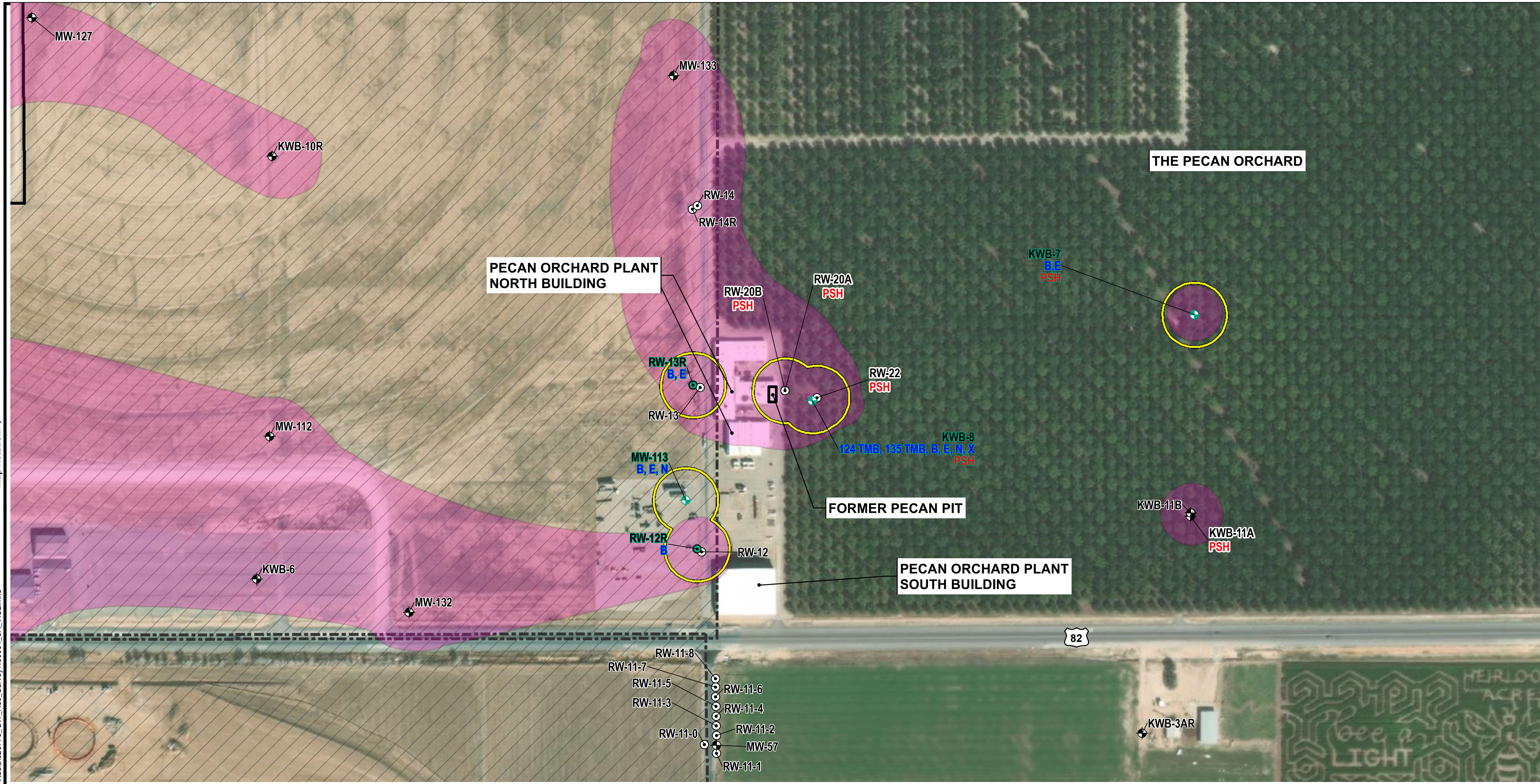


LEGEND

- MONITORING WELL EXCEEDED RESIDENTIAL GW VISL FOR OFFSITE EVALUATION
- RECOVERY WELL EXCEEDED RESIDENTIAL GW VISL FOR OFFSITE EVALUATION
- MONITORING WELL
- RECOVERY WELL
- REFINERY FENCELINE
- FACILITY PROPERTY BOUNDARY (FENCELINE SHOWN WHERE COINCIDENT)
- PSH PRESENCE APRIL 2016-APRIL 2021
- 100 FEET BUFFER ZONE

PSH PHASE-SEPARATED HYDROCARBON OCCURRED IN OFF-SITE WELL BETWEEN 2016-2021 (≥ 0.01 FEET THICK)
B- BENZENE
E- ETHYLBENZENE
N- NAPHTHALENE
X- XYLENES
124 TMB- 1,2,4-TRIMETHYLBENZENE
135 TMB- 1,3,5-TRIMETHYLBENZENE

NOTES:

1. GW VISL = GROUNDWATER VAPOR INTRUSION SCREENING LEVEL.
2. WELLS SHOWN AS EXCEEDING A RESIDENTIAL GW VISL EXCEEDED A GW VISL FOR AT LEAST ONE ANALYTE BETWEEN APRIL 2016 AND APRIL 2021.
3. APPROXIMATE LOCATION OF FORMER PECAN PIT SHOWN. OUTLINE OF FORMER PIT NOT TO SCALE.

N

0 150 300
Feet
1 " = 300 '
1:3,600

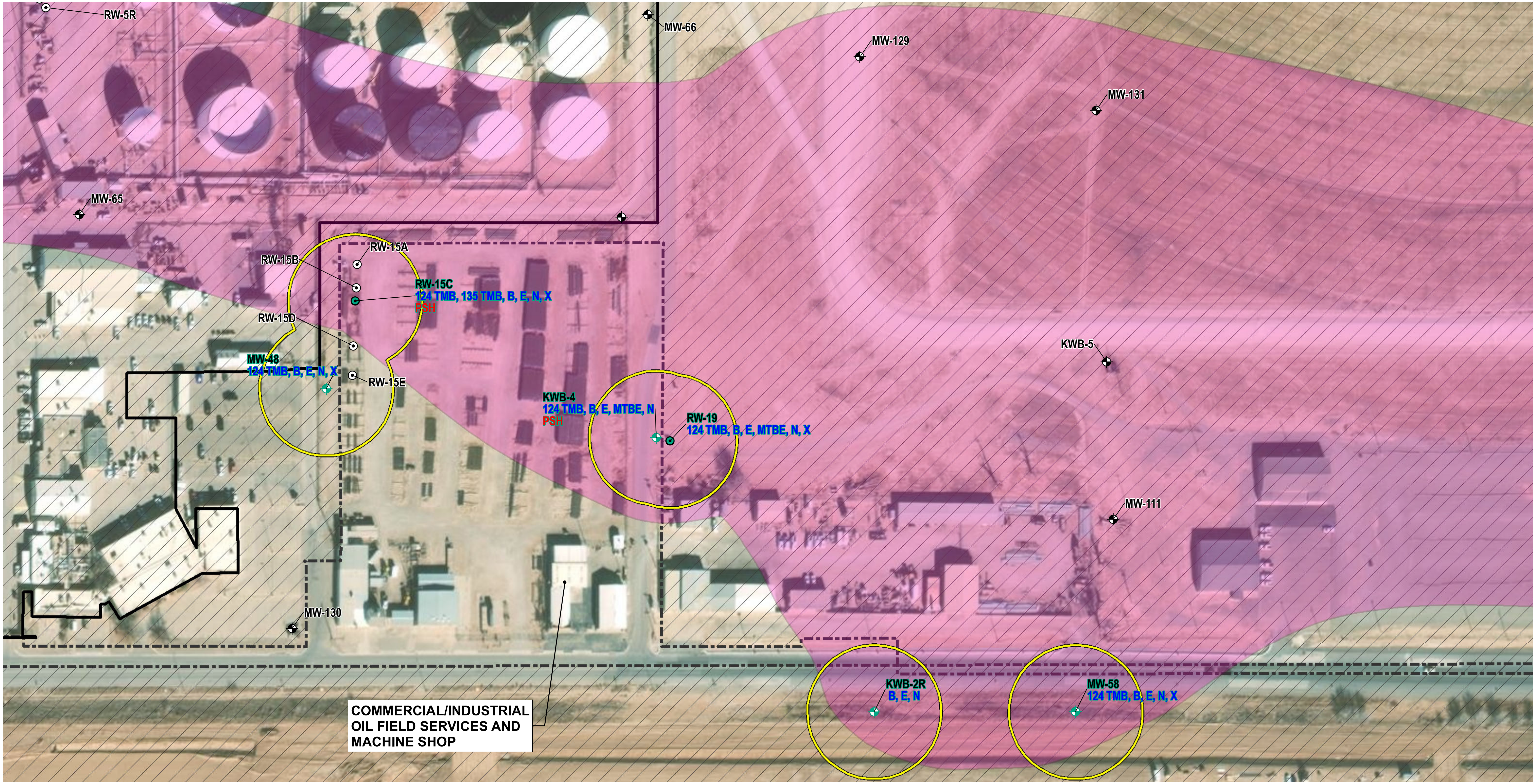
AERIAL IMAGERY SOURCE: ESRI WORLD IMAGERY (10/1/20).

PROJECT: REVISED RECEPTOR SURVEY AND VAPOR INSTRUSION EVALUATION HOLLYFRONTIER NAVAJO REFINERY LLC ARTESIA REFINERY, EDDY COUNTY, NEW MEXICO	
TITLE: GROUNDWATER VAPOR INTRUSION SCREENING LEVEL EXCEEDANCES AND PSH REQUIRING FURTHER EVALUATION PECAN ORCHARD PLANT AREA	
DRAWN BY: MJAGOE	PROJ. NO.: 456061
CHECKED BY: DHELBERT	FIGURE 5A
APPROVED BY: JSPEER	
DATE: DECEMBER 2021	
TRC	505 East Huntland Drive, Suite 250 Austin, TX 78752 Phone: 512.329.6080 www.trcsolutions.com
FILE NO.:	456061_5A_VISL.mxd

TRC - GIS

Coordinate System: NAD 1983 2011 StatePlane New Mexico East FIPS 3001 Ft US (Foot US)
Map Rotation: 0

Plot Date: 12/30/2021, 12:54:02 PM by MJAGOE -- LAYOUT: ANSI B(11"x17")
Path: S:\1-PROJECTS\HOLLY_ENERGY_PARTNERS\Artesia\326778_GW_Rec_Survey\456061_5A_VISL.mxd



TRC - GIS

Coordinate System: NAD 1983 2011 StatePlane New Mexico East FIPS 3001 Ft US (Foot US)
Map Rotation: 0

Plot Date: 12/30/2021, 12:52:58 PM by MJAGOE -- LAYOUT: ANSI B(11"x17")
Path: S:\1-PROJECTS\HOLLY_ENERGY_PARTNERS\Artesia\326778_GW_Rec_Survey\456061_5B_VISL.mxd

LEGEND

- MONITORING WELL EXCEEDED RESIDENTIAL GW VISL FOR OFFSITE EVALUATION
- RECOVERY WELL EXCEEDED RESIDENTIAL GW VISL FOR OFFSITE EVALUATION
- MONITORING WELL
- RECOVERY WELL
- REFINERY FENCELINE
- FACILITY PROPERTY BOUNDARY (FENCELINE SHOWN WHERE COINCIDENT)
- PSH PRESENCE APRIL 2016-APRIL 2021
- 100 FEET BUFFER ZONE

PSH PHASE-SEPARATED HYDROCARBON OCCURRED IN OFF-SITE WELL BETWEEN 2016-2021 (≥ 0.01 FEET THICK)
B- BENZENE
E- ETHYLBENZENE
N- NAPHTHALENE
X- XYLENES
124 TMB- 1,2,4-TRIMETHYLBENZENE
135 TMB- 1,3,5-TRIMETHYLBENZENE
MTBE- METHYL TERT-BUTYL ETHER

NOTES:
1. GW VISL = GROUNDWATER VAPOR INTRUSION SCREENING LEVEL.
2. WELLS SHOWN AS EXCEEDING A RESIDENTIAL GW VISL EXCEEDED A GW VISL FOR AT LEAST ONE ANALYTE BETWEEN APRIL 2016 AND APRIL 2021.

N

0 145 290 Feet
1 " = 145 '
1:1,740

AERIAL IMAGERY SOURCE: ESRI WORLD IMAGERY (10/1/20).

PROJECT:
REVISED RECEPTOR SURVEY AND VAPOR INSTRUSION EVALUATION
HOLLYFRONTIER NAVAJO REFINERY LLC
ARTESIA REFINERY, EDDY COUNTY, NEW MEXICO

TITLE:
GROUNDWATER VAPOR INTRUSION SCREENING LEVEL EXCEEDANCES AND PSH REQUIRING FURTHER EVALUATION
SOUTH REFINERY AREA

DRAWN BY:	MJAGOE	PROJ. NO.:	456061
CHECKED BY:	DHELBERT	FIGURE 5B	
APPROVED BY:	JSPEER		
DATE:	DECEMBER 2021		

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Memorandum

To:	Kawika Tupou HollyFrontier Navajo Refining LLC
From:	Julie Speer and Laura Trozzolo TRC Environmental Corporation (TRC)
Subject:	Artesia Refinery, Desktop Groundwater Receptor Survey and Vapor Intrusion Evaluation of Off-Site Receptors – Revised
Date:	December 30, 2021
CC:	HollyFrontier Corporation: Jason Leik, Mike Holder TRC: Catriona Smith, Scott Reed, Dana Helbert
Project No.:	456061.0000.0000

This revised memorandum summarizes the results of the desktop groundwater receptor survey and vapor intrusion (VI) evaluation for off-site receptors potentially impacted by the dissolved-phase hydrocarbon and phase-separated hydrocarbon (PSH) plumes present downgradient of the HollyFrontier Navajo Refining LLC (HFNR) Refinery (the Refinery) and HFNR-owned property in Artesia, New Mexico (the HFNR Property). The Refinery and the HFNR Property are collectively referred to as "the Facility" in this memorandum. The desktop groundwater receptor survey and VI evaluation of off-site receptors were conducted to achieve the following objectives:

- Identify potential off-site receptors downgradient of the Facility that may be impacted by the dissolved-phase hydrocarbon and/or PSH plumes;
- Determine whether such identified potential off-site receptors could be affected by dissolved-phase hydrocarbon and/or PSH plumes (i.e., affected by direct exposure to impacted groundwater and/or PSH, or vapors from the impacted groundwater and/or PSH);
- Evaluate the on-going NMED- and OCD-approved Facility groundwater monitoring network and program to assess its effectiveness in determining the potential of the dissolved-phase hydrocarbon and PSH plumes to affect potential off-site, downgradient receptors; and
- Identify data gaps and limitations of the desktop groundwater receptor survey and VI evaluation and recommend a path forward to address any identified data gaps and limitations.

SUMMARY

The receptor survey identified potential off-site receptors in the area of interest downgradient and crossgradient of the Facility, including one commercial pecan orchard (the Pecan Orchard), six residential properties, and 55 potential water well records. However, none of these receptors were determined to be impacted, affected, or at risk for direct exposure to dissolved-phase hydrocarbons or PSH in shallow groundwater. Target volatile organic compounds (VOCs) were evaluated,

including benzene, toluene, ethylbenzene, xylenes (BTEX), naphthalene, and methyl tert-butyl ether (MTBE), and none of the off-site receptors were identified to be impacted, affected, or at risk for direct exposure to groundwater with VOC concentrations in exceedance of critical groundwater screening levels (CGWSLs) based on the: (1) observed historical extent and distribution of the plumes relative to locations of identified off-site receptors, and (2) historical analytical results at downgradient irrigation wells (RA-04196 and RA-04798) located within the plumes. However, additional groundwater assessment is recommended to ensure potential domestic water well RA-10378 is not affected by the dissolved-phase hydrocarbon and PSH plumes in shallow groundwater.

Overall, the approved groundwater monitoring network and program are effective with respect to assessing the potential for the dissolved-phase hydrocarbon and PSH plumes to impact the identified potential off-site receptors. The network/program are comprehensive, thus no significant changes to the groundwater monitoring network and program are necessary other than those to support the additional groundwater assessment recommended above.

The VI evaluation indicates that virtually all of the identified potential receptors are not at risk from vapor intrusion. The initial groundwater screening identified one off-site monitoring well (KWB-8) and two on-site recovery wells (RW-12R, RW-13R) that may pose a potential VI concern for off-site workers at the Pecan Orchard Plant. Therefore, an expanded site-specific VI evaluation of the Pecan Orchard Plant buildings was conducted by modeling maximum detected groundwater and soil gas concentrations up through the unsaturated zone and into the Pecan Orchard Plant's North and South Buildings to determine cancer risks and noncancer health effects for personnel working inside the Pecan Orchard Plant buildings. Based on the modeling results, all indoor air cancer risks and noncancer health effects from groundwater and soil gas data indicate no potential VI concern for those personnel working exclusively inside the Pecan Orchard Plant sourced from groundwater and soil conditions in the vicinity of the Pecan Orchard Plant.

The available data are largely inclusive and only two data gaps or data limitation were identified: (1) the presence and location of key potential domestic well RA-10378 could not be confirmed within the scope of this survey due to inaccurate well location data in available records, but HFNR is currently working to obtain access to the associated residential property and will sample the well (if present and operable) to confirm it is not affected by the shallow groundwater plumes; and (2) future off-site land use, future downgradient off-site receptors, and construction relative to future plume conditions are not known, but are not expected to change within the foreseeable future in the immediate vicinity of the Facility.

GROUNDWATER RECEPTOR SURVEY

The groundwater receptor desktop survey included a review of HFNR documents, aerial imagery, public property records, and water well records to identify potential off-site receptors that could be affected by the dissolved-phase hydrocarbon and PSH plumes. Target VOCs – BTEX, naphthalene (in lieu of Diesel Range Organics [DRO]), and MTBE – were used to represent the extent of the dissolved-phase plume(s). These constituents were then used to evaluate the off-site extent of the dissolved-phase hydrocarbon plume and to assess whether potential downgradient off-site receptors could be affected. In conjunction with the dissolved-phase plume evaluation, the locations of off-site wells with PSH were identified relative to potential groundwater receptors.

Facility Location and Surrounding Land Use

The Facility is located immediately east of Highway 285 (North 1st Street) and north of Highway 82 (East Main Street) in Artesia, New Mexico. HFNR owns property that extends to the north, east, and south of the main plant. The Facility and surrounding properties are shown on **Figure 1**. Property to the west (upgradient) of the Facility is used for commercial/industrial or residential purposes. Property to the north (crossgradient) of the Facility is used for commercial/industrial, residential, or agricultural purposes. Property to the east (downgradient) of the Facility is primarily used for agricultural purposes, but there are also some residences present as shown on **Figure 1**. Property to the south (crossgradient) of the Facility is primarily used for commercial/industrial and agricultural purposes. HFNR's parent corporation, HollyFrontier, is currently constructing a Pretreatment Unit and Rail Loading area as part of a renewable diesel project on the south side of Highway 82 south of the refinery. The historical[1] extent of target VOCs present in shallow groundwater at concentrations in exceedance of their respective CGWSLs is also shown on **Figure 1**.

Groundwater Conditions – Hydrogeology

The principal aquifers in the Artesia area are within the valley fill alluvium (Quaternary alluvium) and the San Andres Formation. Two distinct water-bearing zones within the valley fill alluvium in the vicinity of the Facility are referred to as the "shallow saturated zone" and the "valley fill zone". The deeper carbonate aquifer within the San Andres Formation is referred to as the "deep artesian aquifer". The hydrogeology of each of these aquifers is summarized below.

- Shallow Saturated Zone: Occurs in interbedded sand and gravel channels at 10 to 30 feet below ground surface (bgs). Overlying clays, silts, and caliche undulate at and near the Facility and create intermittent confined and unconfined groundwater conditions in the shallow saturated zone. Groundwater in this zone generally flows to the east and is highly variable in quality and volume. The shallow saturated zone is not generally used for domestic or agricultural purposes.

- Valley Fill Zone: Underlies the shallow saturated zone and occurs in alluvial deposits of sand, silt, clay, and gravel that are approximately 300 feet thick near the Facility. Irrigation and water production wells completed in this zone are typically screened across one to five water-

[1] The historical extent of target VOCs in exceedance of CGWSLs shown on Figure 1 is based on more than one CGWSL exceedance in a monitoring or recovery well over time. The time frame of historical data evaluated for each off-site well is shown on the concentration time-series plots provided in **Attachment A**. The time frame of historical data evaluated for on-site wells is shown on the concentration time-series plots provided in Appendix D of the *2020 Annual Groundwater Monitoring Report* dated February 2021. The time frame for all wells includes analytical data from at least 2010 (with many wells from at least 2006) or the well installation date (if installed after 2010) through October 2020. Monitoring wells MW-125 through MW-137 were installed in 2014. Monitoring wells MW-53R, MW-62R, MW-137A, MW-138A, MW-139, and MW-145 through 148 were installed in 2019 to 2020.

producing intervals ranging in thickness from 20 to 170 feet, with most being approximately 20 feet thick. Production intervals are non-continuous, consist principally of sand and gravel, and are separated by less permeable lenses of silt and clay of varying thickness. In the immediate vicinity of the Facility, irrigation wells completed in this zone are typically screened between 240 to 320 feet bgs (e.g., irrigation wells RA-3723 and RA-04196). Groundwater in this zone generally flows to the east and is under confined conditions, with static water levels in monitoring wells completed in this zone being similar to or higher than that observed in shallow saturated zone wells. The valley fill zone has been developed for domestic and agricultural use.

- Deep Artesian Aquifer: Primarily occurs in the upper portion of San Andres Formation (limestone and dolomite with irregular and erratic solution cavities). The San Andres Formation underlies the Queen and Grayburg Formations, which primarily act as a confining bed between this aquifer and the valley fill zone. However, near the City of Artesia, the deep artesian aquifer includes the lower section of the Queen and Grayburg Formations (in localized fractures and secondary porosity). Near the Facility, the depth to the top of the water-producing interval is approximately 440 feet bgs. The deep artesian aquifer has been extensively developed for industrial, municipal, and agricultural use, but not domestic use.

The Facility's current facility-wide groundwater monitoring program includes 197 monitoring and recovery wells screened within the shallow saturated zone; 19 monitoring wells screened within the valley fill zone; 3 irrigation wells screened within the valley fill zone (wells RA-01227, RA-03156, and RA-04196); and 2 irrigation wells screened within the deep artesian aquifer (RA-0313 and RA-04798). Monitoring wells and recovery wells are gauged and sampled on a regular basis (primarily semiannually or annually, but a few select wells biennially). Of the 197 monitoring and recovery wells, 153 are located within the area of interest shown on **Figure 1** (the others in the monitoring program are located along the eastern side of Three Mile Ditch or are at the former Evaporation Ponds). Irrigation wells owned by HFNR (RA-313 – sampled regularly since 2008) and others (i.e., RA-03156, RA-04196, and RA-04798, which have been sampled regularly since 2006, and RA-01227, which was sampled in 2010 and 2011, but not since due to lack of access) are sampled on either a semiannual or annual basis. Groundwater monitoring results indicate that PSH is present in the shallow saturated zone and dissolved-phase hydrocarbons are present at concentrations exceeding their respective CGWSLs in the shallow saturated zone and the valley fill zone. The historical extent of target VOCs present in shallow groundwater at concentrations in exceedance of their respective CGWSLs is shown on **Figure 1**. Target VOCs have not been detected in the valley fill zone in exceedance of their respective CGWSLs over at least the last six semi-annual groundwater monitoring events conducted since April 2019. Dissolved-phase hydrocarbons have not been detected above the CGWSLs in the two irrigation wells (RA-0313 and RA-04798) screened within the deep artesian aquifer that have been sampled for VOCs since 2006.

Groundwater Conditions – Hydrocarbon Plumes

Concentrations of dissolved-phase hydrocarbons, specifically the target VOCs in the shallow saturated zone and valley fill zone, have generally exhibited a stable or decreasing trend over time, as documented in Annual Groundwater Monitoring Reports. Benzene and MTBE are the target VOCs that are most prevalent in shallow groundwater downgradient of the Facility[2]. Benzene and MTBE concentrations in shallow groundwater (shallow saturated and valley fill zones) during the semiannual monitoring event conducted in April 2021 (i.e., the most comprehensive recent monitoring event) are shown on **Figures 2** and **3**, respectively. The April 2021 extent of benzene and MTBE detections in shallow groundwater are generally consistent with the historical target VOC CGWSLs exceedance area shown on **Figure 1**.

The current maximum extent (April 2016 through April 2021) of PSH in the shallow saturated zone is shown on **Figures 1** through **3**. Apparent PSH thicknesses in wells screened in the shallow saturated zone are generally inversely affected by fluctuations in groundwater elevations.

As shown on **Figure 2**, the current extent of PSH and benzene detections in shallow groundwater are primarily contained within the Facility and a downgradient commercial pecan orchard (the Pecan Orchard). As shown on **Figure 3**, the current extent of MTBE detections in shallow groundwater is primarily contained within the Facility, the Pecan Orchard, and a portion of property to the northeast of the Facility that is primarily used for oilfield or pipeline surface facilities. Concentration time-series plots for wells located at off-site properties are provided as **Attachment A** (these are also included in Appendix D of the *2020 Annual Groundwater Monitoring Report* dated February 2021). Detailed analysis of concentration trends in these wells are provided in Section 5 of the *2020 Annual Groundwater Monitoring Report* dated February 2021 and show that dissolved-phase hydrocarbon concentrations have generally exhibited a stable or decreasing trend over time.

Potential Off-Site Downgradient Receptors

Public records and aerial imagery were used to identify potential receptors that are present within/above or immediately downgradient of the dissolved-phase hydrocarbon and PSH plumes. The results of the records review are discussed below.

Water Wells

In December 2015, Atkins Engineering Associates, Inc. (AEA) conducted a record search on behalf of HFNR to identify water wells in the Facility area that are potentially: (1) screened within the valley fill alluvium, and (2) used for non-monitoring purposes. Note, the New Mexico Office of the State Engineer (NMOSE) records referencing the "shallow" zone are referring to the valley

[2] Total Petroleum Hydrocarbons (TPH) Diesel Range Organics (DRO) is prevalent in shallow groundwater upgradient, crossgradient, and downgradient of the Facility. Naphthalene was used as an indicator compound for TPH DRO and demonstrated a smaller lateral extent than benzene or MTBE, and so the extent of benzene and MTBE were used for this receptor survey as more conservative (largest extent) indicators.

fill alluvium since water wells are not likely to be completed within the shallow saturated zone due to naturally poor quality and low productivity. Wells screened within the deep artesian aquifer were not included because the valley fill alluvium and deep artesian aquifer are not considered to be hydraulically connected (investigation is ongoing). AEA searched the following database and paper records available from the NMOSE: New Mexico Water Rights Reporting System (NMWRRS) database, well logs, and Hydrographic Surveys. AEA summarized the results of their records search in the February 2016 *Draft Report of Navajo Refining Company Possible Shallow Receptor Records Study, Artesia, NM*. At the request of TRC and HFNR, AEA conducted an updated search in February 2019 and November 2021 to identify any new wells or records and to determine if the status of any of the previously identified wells had changed since 2015. AEA summarized the updated search results in the *Limited Update to Draft Report of Navajo Refining Company Possible Shallow Receptor Records Study, Artesia, NM* dated February 17, 2019, and in the *Limited Update to Draft Report of Navajo Refining Company Possible Shallow Receptor Records Study Artesian, NM (February 2016) and Limited Update (February 2019)* dated November 5, 2021. The February 2016, February 2019, and November 2021 AEA documents are provided as **Attachment B**.

Table 1 summarizes the results of the AEA records search of potential shallow water wells located within 0.25 miles (1,320 feet) crossgradient and 1 mile (5,280 feet) downgradient of the current extent of benzene and MTBE CGWSL exceedances in shallow groundwater. **Table 1** also specifies the approximate distance of each potential water well from the benzene and MTBE shallow groundwater plumes (CGWSL exceedance areas) and provides further analysis of each water well record. The records search identified potential shallow water wells that are located off-site and within or in the downgradient proximity of the current extent of benzene and MTBE CGWSL exceedance areas in shallow groundwater. These wells are shown on **Figures 2** and **3**, respectively.

The available location data for most of the potential shallow water wells identified in the AEA records search is approximate and subject to applicant error. The NMWRRS database records that include location data based on the Public Land Survey System (PLSS) provide coordinate data for the center of the smallest quarter delineated in North American Datum (NAD) 83 Universe Transverse Mercator (UTM) Zone 13, which ranges from a 0.625-acre tract (5 quarters) to 10-acre tract (3 quarters). A majority of the NMWRRS database records are based on the PLSS and provide location data at the center of a 10-acre tract. Further, the NMWRRS database records are based on applicant (e.g., well driller or property owner) reports which are inherently subject to human error, especially considering many private citizens are not familiar with the PLSS. The discrepancy between the NMWRRS record locations and actual locations (based on HFNR monitoring program records) can been seen on **Figures 2** and **3** for the irrigation wells that are currently included in the HFNR facility-wide groundwater monitoring program: RA-01227, RA-03156, RA-04196, and RA-04798.

The only identified water wells that are located within the benzene and MTBE shallow groundwater plumes (CGWSL exceedance areas) are irrigation wells RA-03890, RA-00768, RA-02723, RA-01097, RA-04196, and RA-04798, of which only RA-04196 and RA-04798 are located downgradient of the Facility (or off-site). Wells RA-04196 and RA-04798 are both sampled on a semiannual basis as part of the facility-wide groundwater monitoring program. Historical analytical results indicate that benzene and MTBE are not present in these irrigation wells at concentrations that exceed their respective CGWSLs.

As highlighted on **Table 1** and shown on **Table 2**, NMWRRS records included one domestic water well (RA-10378) that: (1) potentially could intersect the PSH and/or MTBE plume downgradient of the Facility and (2) is located near residential structures with at least one apparent domestic well observed by HFNR during a visual drive-by survey. While there are monitoring wells that provide delineation of the PSH and MTBE plumes surrounding the residential structures on the property associated with RA-10378 (Parcel ID 4-153-098-515-219), the actual location of the potential domestic well is not known.

As shown on **Table 1**, and discussed further below, domestic wells RA-02342 and RA-23420 were confirmed to not be present within the Pecan Orchard based on visual survey and discussion with representatives of the Pecan Orchard. These wells probably no longer exist (note there likely was just one well with multiple records/IDs; records indicate well was reported as "failed" in 1960 and to be moved "100 feet west more or less to a more convenient location"– see supplemental records provided in **Attachment C**). Well RA-11688, located approximately 290 feet northwest (upgradient) of the MTBE plume at monitoring well NP-1, is listed as installed for non-consumptive use. Wells RA-02342 (if existing), RA-23420 (if existing), and RA-11688 are also located outside the historical target VOC CGWSLs exceedance area. Also as shown on **Table 1**, wells RA-02827 and RA-03353 are permitted as domestic water wells, but the vacant residence on the property that was associated with these well records was demolished in 2019 and the property is no longer zoned as residential (see property record for Parcel ID 4-154-099-146-071 provided in **Attachment D**).

Residences

Aerial imagery and Eddy County Tax Assessor records were used to identify potential residences located within 0.25 miles (1,320 feet) crossgradient and 1 mile (5,280 feet) downgradient of the historical target VOC CGWSLs exceedance area in shallow groundwater. Six residential properties were identified, as summarized in **Table 2,** and their locations are shown on **Figures 1, 2, and 3**. Eddy County property records for each of these residential properties are provided in **Attachment D**. Four of these six residential properties appear to be associated with at least one potential domestic shallow water well identified in the AEA records search. Apparent associated shallow domestic water wells for each property are noted in **Table 2**.

HFNR's extensive monitoring network and program provide comprehensive data for virtually all of the study area. None of the identified residential properties are located above the current or historical extent of benzene, MTBE, or PSH plumes in shallow groundwater. However, the extent of the plumes could be further delineated near one residential property (Parcel ID 4-153-098-515-219). Parcel ID 4-153-098-515-219 includes a residence and one potential domestic shallow water well (RA-10378). HFNR confirmed by visual survey that one domestic water well is present, and the well is likely RA-10378 (same registered owner as the property); however, the precise location of RA-10378 should be confirmed. This property is located immediately downgradient of a monitoring well (MW-134) with no detections of benzene or MTBE since April 2014 and immediately upgradient of a monitoring well (NP-1) that has historically exceeded the MTBE CGWSL. To further assess the extent of the MTBE plume in shallow groundwater to the south and east of this property and the extent of the benzene plume in shallow groundwater to the south of this property, monitoring wells MW-145 and MW-146 were installed in September 2020. Both wells were sampled in October 2020 and April 2021 – benzene and PSH were not detected in either well during either sampling event, and MTBE was only detected in MW-145 at estimated J-flagged concentrations three orders of magnitude below the CGWSL (0.100 milligrams per liter [mg/L]) during both sampling events. Based on the direction of groundwater flow and the extensive conceptual site model for the Facility (i.e., preferential groundwater flow pathways within gravel channels to the south of this area), it appears the MTBE plume in the vicinity of NP-1 may be isolated relative to the main groundwater plume. However, a work plan to install an additional monitoring well between NP-1 and MW-133 to further investigate MTBE in this area is in progress and will be submitted to the NMED by December 31, 2021. HFNR is also working to confirm the presence and location of water well RA-10378 on this residential property and obtain access to sample if the well is present and operable.

In the April 2019 *Desktop Groundwater Receptor Survey and Vapor Intrusion Evaluation of Off-Site Receptors* Memorandum, two additional residential properties (Parcel IDs 4-154-098-397-381 and 4-154-099-146-071) were identified downgradient or crossgradient of locations where the shallow groundwater plumes were potentially not fully delineated. However, the shallow groundwater plumes are now fully delineated upgradient of Parcel ID 4-154-098-397-381 and Parcel ID 4-154-099-146-071 is no longer a residential property, as described below.

- Parcel ID 4-154-098-397-381 includes a residence and potential domestic shallow water well (RA-03195) that is located downgradient of monitoring wells KWB-11A (contains PSH) and KWB-11B; and a potential domestic shallow water well (RA-02793) that is located downgradient of monitoring well KWB-7 (contains PSH). During a visual drive-by survey, HFNR observed one apparent domestic well (likely RA-03195) located near the residential structure on this parcel, but the well did not appear to be operable. As shown on **Table 1** and in supplemental well records provided in **Attachment C**, the well record for RA-03195 is associated with the repair of irrigation well RA-00397 (completed in the deep artesian aquifer) and therefore this well may not exist. In September 2020, monitoring wells MW-147 and MW-148 were installed in the shallow saturated zone upgradient of potential water wells RA-02793 and RA-03195 to further assess the downgradient extent of the benzene, MTBE, and PSH plumes in shallow groundwater to the west of this property. Monitoring well MW-145 was installed downgradient of wells KWB-11 and KWB-11B and monitoring well MW-148 was installed downgradient of KWB-7. Both wells were gauged and sampled in October 2020 and April 2021. As presented in the *2020 Annual Groundwater Monitoring Report*, benzene and PSH were not detected in either of these wells during either sampling event and MTBE was not detected in MW-147 during either sampling event. MTBE was detected in MW-148 in October 2020 at an estimated J-flagged concentration three orders of magnitude below the CGWSL (0.100 mg/L) but was not detected in MW-148 in April 2021. PSH has never been detected in the valley fill zone and no target VOCs have been detected in exceedance of CGWLs in monitoring well KWB-11B completed in the valley fill zone. Therefore, the benzene, MTBE, and PSH plumes are now fully delineated to the west of this property in both the shallow saturated and valley fill zones and no further assessment is recommended.

- Parcel ID 4-154-099-146-071 potentially includes two shallow water wells permitted as domestic (RA-02827 and RA-03353). However, as described in **Table 1**, well RA-02827 may not have been installed (permit approved in 1951 and cancelled in 1954; see supplemental well records provided in **Attachment C**) and well RA-03353 was removed from the Facility-wide groundwater monitoring program around 2010 because it was not operable due to lack of electricity. A residential structure formerly observed on this property was demolished sometime in 2019 based on aerial photographs. The former residential structure had appeared to be vacant since at least 2010 until it was demolished. The property is now zoned as nonresidential per the property record provided in **Attachment D**. The crossgradient to downgradient extent of the benzene and MTBE plumes is not currently delineated to the north and northwest of this property. Monitoring wells KWB-3AR and KWB-9 are located on this property, but they have not been sampled since 2011 due to lack of access. However, target VOCs were not historically detected in KWB-3AR and KWB-9.

Pecan Orchard

The Pecan Orchard is located immediately downgradient to the east of the Facility and is present above the benzene and MTBE shallow groundwater plumes and the PSH plume. Prior to August 2021, the Pecan Orchard operated a subsurface “pecan pit” where harvested pecans were temporarily deposited and then moved into the pecan plant by means of a conveyor belt system. This pit was located within an open-air structure along the western property boundary of the Pecan Orchard immediately downgradient of an HFNR recovery trench. Prior to liner installation, the pit was subject to fluctuating groundwater levels that could cause infiltration of shallow groundwater and PSH. The depth of the pit was approximately 16 feet bgs and was lined on the exterior. HFNR applied a spray-on liner to the interior. Both measures, and other routine activities conducted by HFNR that depressed groundwater elevations around the pit, mitigated the potential infiltration of shallow groundwater and PSH. The pit was only used and entered temporarily by Pecan Orchard employees for maintenance on an as-needed basis for short durations, primarily during the months of October through December of each year. The pit was taken out of service and backfilled with clean soil on August 19, 2021 by the owner, and a concrete cap was placed on top of the area.

HFNR personnel observed the backfilling activities and summarized the activities in a Memorandum provided as **Attachment E**.

Two irrigation wells (RA-04196 and RA-04798) within the Pecan Orchard operational area are sampled on a semiannual basis as part of the facility-wide groundwater monitoring program. RA-04196 is screened within the valley fill zone (from 280 feet bgs to 292 feet bgs) and RA-04798 is screened in the deep artesian aquifer (from 840 feet bgs to 850 feet bgs), as documented in HFNR's monitoring plans and reports. No target VOCs have been detected in exceedance of CGWSLs in either of these irrigation wells based on sampling since 2006. The deep artesian aquifer is not considered to be hydraulically connected to the valley fill alluvium, but investigation of the hydraulic connectivity is ongoing.

Two additional water wells (RA-23420 and RA-02342) were identified in AEA's record search to be present at the southeastern portion of the Pecan Orchard, as shown on **Figures 2** and **3**, but these wells are not present within the Pecan Orchard as determined by a visual survey of the area. As noted on **Table 1**, additional records indicate only well RA-02342 ever existed (multiple well record IDs likely resulted from typographical error) and the well was planned to be moved in 1960 as it had "failed". Aerial photographs indicate there is a 1.7-acre land parcel (Parcel ID 4-154-098-252-511) on the southeastern corner of the Pecan Orchard that was not part of the Pecan Orchard prior to at least July 2005. Multiple buildings were present on this parcel in an aerial photograph dated January 2004, the buildings were no longer present in an aerial photograph dated July 2005, and the parcel appeared to be cultivated with pecan trees in line with the rest of the Pecan Orchard in an aerial photograph dated September 2006. These well records may have been associated with this parcel prior to it being incorporated into the Pecan Orchard.

As shown on the concentration plots provided in **Attachment A**, benzene and MTBE concentrations in monitoring wells KWB-7, KWB-11A, and KWB-11B (located at the Pecan Orchard along the downgradient extent of the benzene and MTBE plumes) are stable. Monitoring wells MW-147 and MW-148 were installed along the eastern property boundary of the Pecan Orchard (downgradient of KWB-7, KWB-11, and KWB-11B) in September 2020, and sampled in October 2020 and April 2021. Benzene and PSH was not detected in either of these wells during either sampling event. MTBE was not detected in MW-147 during either sampling event. MTBE was detected in MW-148 in October 2020 at an estimated J-flagged concentration three orders of magnitude below the CGWSL (0.100 mg/L) but was not detected in MW-148 in April 2021. Apparent PSH thicknesses in monitoring and recovery wells located within the Pecan Orchard have generally decreased over time but are inversely affected by fluctuations in groundwater elevations.

The shallow groundwater plumes present within the Pecan Orchard are not expected to affect the pecan trees as there is negligible potential for uptake of shallow groundwater and organic constituents from the tree roots. Pecan tree root systems consist of a long taproot that grows vertically and shallow feeder roots that grow laterally. The taproot primarily provides support and stability, and the feeder roots absorb water and nutrients. Pecan tree feeder roots mostly grow in the top 18 inches of soil where water, nutrients, and oxygen are easily absorbed. Groundwater elevations at monitoring wells KWB-7, KWB-8, and KWB-11A located across the Pecan Orchard ranged from 12.69 feet bgs to 24.69 feet bgs since 2010. Therefore, the primary feed zone of the Pecan Orchard trees is greater than 10 feet above the shallow groundwater zone. Additionally, the Pecan Orchard utilizes flood irrigation allowing the trees feeder roots to easily access fresh water near the ground surface.

Eagle Creek

As shown on **Figures 1** through **3**, Eagle Creek (or Eagle Draw) is present along the northwestern and northern side of the Facility and runs to the east and northeast towards the Pecos River downgradient of the Facility. Eagle Creek enters the Refinery at the western boundary and runs to the northeast through the northern half of the Refinery. It is an ephemeral watercourse that primarily flows only following rain events. Stormwater in the Refinery is directed to the Refinery stormwater pond using berms and does not enter Eagle Creek except possibly during extreme rainfall events. Additionally, the Eagle Creek channel is cemented within the vicinity of the Refinery. Upstream of the Refinery, Eagle Creek functions as a major stormwater conveyance for the City of Artesia and drains outlying areas west of the city.

Eagle Creek is considered to be a major source of recharge for the shallow saturated zone. The shallow groundwater zone typically does not intersect Eagle Creek except for potentially historically high groundwater elevations observed at the Facility in 2014. The elevation of Eagle Creek is 3,360 feet amsl at its entrance to the Facility and decreases to approximately 3,305 feet amsl at its confluence with the Pecos River. As presented in Table 1 of the *2020 Annual Groundwater Monitoring Report* dated February 2021, groundwater elevations measured during 2020 in wells MW-92, RW-1, and RW-2, located adjacent to Eagle Creek near its entrance to the Facility, ranged from 3,355.50 feet amsl at MW-92 to 3,349.30 feet amsl at RW-1, which is below the elevation of Eagle Creek in this area (3,360 feet amsl).

As shown on **Figures 1** through **3**, Eagle Creek only runs through the shallow groundwater plume near the northwestern corner of the Facility and to the north of the Pecan Orchard. There are no buildings/structures located along Eagle Creek within the shallow groundwater plumes or within 0.25-miles crossgradient or 1-mile downgradient of the plume boundaries.

Facility Groundwater Monitoring Network and Program Effectiveness

As discussed above, HFNR's facility-wide groundwater monitoring program includes gauging and sampling monitoring wells and recovery wells on a semiannual, annual, or biennial basis; and sampling irrigation wells on semiannual or annual basis. The locations of the groundwater monitoring network wells in the receptor survey area are shown on **Figures 1** through **3**. A total of 140 wells are sampled in this area on a semiannual or annual basis, including wells located upgradient, crossgradient, and downgradient of the Facility (while the remaining 13 wells are gauged on a semiannual or annual basis, gauged on a biennial basis, or sampled on a biennial basis). Overall, the monitoring program is largely effective in monitoring the lateral extent of dissolved-phase hydrocarbons and PSH in shallow groundwater within and beyond the Facility, but could benefit from the addition of a few wells at select monitoring locations as discussed below:

- Due to a lack of landowner access for Parcel ID 4-154-099-146-071, monitoring wells KWB-3AR and KWB-9 and irrigation well RA-01227 have not been sampled since 2011. Target VOCs were not historically detected in these wells. Sampling KWB-3AR and KWB-9 would provide better, current delineation of the crossgradient extent of the benzene and MTBE shallow groundwater plumes to the south and southeast of Highway 82. HFNR will attempt to obtain an access agreement for this property. If unsuccessful, then HFNR will evaluate the feasibility and effectiveness of installing one monitoring well along Highway 82 north of this property (though access for such a well may also not be feasible).

- The crossgradient extent of the benzene CGWSL exceedance area is not fully defined on the Facility to the south of Highway 82 (or south of monitoring wells MW-58, MW-109, MW-110, MW-130, MW-132, and KWB-6). The crossgradient extent of PSH is not fully defined on the Facility to the south of Highway 82 (or south of monitoring wells MW-58, KWB-6, and MW-132). HFNR now owns a majority of the adjacent land and water rights to the south of these wells. HFNR's position is that additional monitoring wells are not required in this area to monitor or control the PSH and benzene plumes as groundwater is consistently flowing to the east, and PSH and benzene have not historically been detected in monitoring wells KWB-13 (located to the south of KWB-2R) and MW-57 (located along Bolton Road southeast of MW-132), indicating the crossgradient extent of the PSH and benzene plumes does not extend south of the Facility. Regardless, HFNR proposes to install two shallow groundwater monitoring wells to investigate the crossgradient extent of the benzene and PSH plumes south of Highway 82 – one well is proposed to be installed south of MW-109 and MW-110 and one well is proposed to be installed south of KWB-6 and MW-132. The proposed well locations are shown on **Figures 2** and **3**.

- The crossgradient extent of the MTBE CGWSL exceedance area is not fully defined on the Facility to the south of Highway 82 (or south of monitoring well MW-132 and KWB-6). HFNR now owns a majority of the adjacent land to the south of these wells. It is HFNR's position that additional monitoring wells are not required in this area to monitor or control the MTBE plume as groundwater is consistently flowing to the east and MTBE has not historically been detected in monitoring well KWB-13 (located to the south of KWB-2R) and MW-57 (located along Bolton Road southeast of MW-132) indicating the crossgradient extent of the MTBE plume does not extend south of the Facility. Regardless, HFNR proposes to install one shallow groundwater monitoring well to investigate the crossgradient extent of the MTBE plume south of Highway 82. One monitoring well is proposed to be installed south of KWB-6 and MW-132. The proposed well location is shown on **Figures 2** and **3**.

- The extent of the MTBE CGWSL exceedance area to the southwest of well NP-1 should be further evaluated to (1) determine if the MTBE plume in the vicinity of NP-1 is isolated from the MTBE plume in the southern portion of the Facility; and (2) confirm the residential property (Parcel ID 4-153-098-515-219) and potential shallow water well RA-10378 located upgradient of NP-1 are not at risk of exposure to the MTBE plume(s).

Potential for Direct Exposure to Groundwater and PSH Plumes

No off-site receptors were identified to be at risk for direct exposure (i.e., ingestion and dermal contact through domestic uses) of shallow groundwater containing PSH or target VOCs at concentrations in exceedance of CGWSLs based on the: (1) observed historical extent and distribution of the plumes relative to locations of identified off-site receptors and (2) historical analytical results for VOCs are below the CGWSLs at irrigation wells (RA-04196 and RA-04798) located within the plumes. Additional explanation is provided below.

- No domestic shallow water wells were identified to be present within the historical target VOC CGWSLs exceedance area. However, additional assessment is recommended to ensure potential domestic water well RA-10378 (Parcel ID 4-153-098-515-219) is not affected by the shallow groundwater plumes. HFNR is attempting to obtain access to sample RA-10378.
- The two groundwater irrigation wells (RA-04196 and RA-04798) located within the Pecan Orchard and the dissolved-phase hydrocarbon and PSH plumes are sampled on a semiannual basis, and historical analytical results (since 2006) indicate no target VOCs are present at concentrations in exceedance of CGWSLs. The historical monitoring results for these irrigation wells indicate that other potential water wells located downgradient of the Facility are not likely to be affected by PSH and target VOCs present in shallow groundwater at concentrations in exceedance of CGWSLs if they are screened at a depth of 275 feet bgs or lower (screened interval of RA-04196 that does not exceed CGWSLs). Well RA-03353 is screened from 232 to 295 feet bgs, well RA-10378 is screened from 115 to 190 feet bgs, and the screened intervals of potential domestic water wells RA-02827, RA-02793, and RA-03195 are unknown. However, PSH and target VOCs have not been detected in any monitoring wells screened in the Valley Fill zone crossgradient and downgradient of the Facility, including KWB-11B which is screened from 50 to 70 feet bgs.

VAPOR INTRUSION EVALUATION

A VI evaluation was conducted for identified potential off-site receptors within and downgradient of the dissolved-phase hydrocarbon and PSH plumes in accordance with New Mexico Environmental Department's (NMED's) June 2019 *Risk Assessment Guidance for Site Investigations and Remediation, Volume I, Soil Screening Guidance for Human Health Risk Assessments* (NMED 2019) and ITRC's *Petroleum Vapor Intrusion (PVI) Technical and Regulatory Guidance* (ITRC 2014), as well as the United States Environmental Protection Agency (USEPA) VI guidance document (USEPA 2015). The objectives were as follows:

- Evaluate the potential for vapors from the dissolved-phase hydrocarbon plume (i.e., volatilization of dissolved-phase constituents of concern [COCs]) to affect potential off-site receptors identified in the previous sections based on the following steps:
  - Compare concentrations of VOCs in off-site groundwater wells (and several on-site wells in close proximity to the Facility boundary) to appropriate vapor intrusion screening levels (VISLs) based on NMED's and USEPA's VI guidance;
  - Review the depth to groundwater in off-site areas where COCs exceed their VISLs (i.e., vertical separation distance for petroleum hydrocarbons); and
  - Identify off-site buildings/structures located within 100 feet of a groundwater sample exceeding VISLs, per NMED guidance.
- Identify the presence of PSH in off-site groundwater wells and use the distance from nearest building and vertical separation distance guidance presented in the Interstate Technology and Regulatory Council's (ITRC's) *Petroleum Vapor Intrusion (PVI) Technical and Regulatory Guidance* (ITRC 2014) to identify whether VI is a concern.
- Identify wells requiring further VI evaluation, including VI modeling of groundwater and soil gas to determine indoor air cancer risks and noncancer health effects for off-site receptors.

The approach, results, and recommendations of this off-site VI evaluation are discussed in detail below and in **Attachment F**.

Dataset Used in the Vapor Intrusion Evaluation

The Facility's facility-wide groundwater monitoring program includes gauging and sampling monitoring wells and recovery wells on a semiannual, annual, or biennial basis; and sampling irrigation wells on a semiannual or annual basis. The samples utilized in this VI evaluation are presented in **Table 3** and include off-site groundwater data, as well as several on-site locations in close proximity to the Facility boundary. The groundwater dataset includes samples collected from April 2016 through April 2021.

The area of VI interest includes off-site monitoring/recovery wells located predominantly east of the Facility (i.e., downgradient). Residential and agricultural buildings are located in these off-site areas, as well as several industrial properties located south of the Facility. To be conservative, the downgradient (off-site) VI evaluation assumes an unrestricted, residential scenario. The off-site groundwater dataset used in the VI evaluation is summarized in **Table 4**.

Nature and Extent of Dissolved-Phase Hydrocarbon Plume

As shown on **Figure 1**, the historical combined extent of target VOCs present in shallow groundwater at concentrations in exceedance of their respective CGWSLs (potential VI risk driver) extends in an easterly (downgradient) direction beyond the Facility boundary. Therefore, receptors located within these off-site areas and extending 100 feet from the off-site plume extent may have potential VI concerns according to USEPA's 2015 VI Guidance Document (USEPA 2015).

Selection of Constituents of Concern

Groundwater VISLs protective of residents were obtained from Table A-4 of NMED's *Risk Assessment Guidance for Site Investigations and Remediation: Volume 1 Soil Screening Guidance for Human Health Risk Assessments* (NMED 2019) and are presented in **Table 5**. In accordance with NMED 2019 guidance, groundwater VISLs are based on a cancer target risk level (TRL) of 1E-05 and non-cancer hazard quotient (HQ) of 1. Note, VISLs are only available for chemicals that are considered volatile (i.e., Henry's Law Constant greater than 1E-05 atm/m^3-mol and vapor pressure greater than 1 millimeter of mercury) and have inhalation toxicity data available.

The NMED VISLs were last updated in June 2019, and per industry standards and USEPA guidance, the latest toxicity criteria available were reviewed using the USEPA's Regional Screening Level (RSL) Table (USEPA, 2021a), which is available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables. NMED VISLs are not available for a handful of analytes (1,2,4-trimethylbenzene [1,2,4-TMB]; 1,3,5-trimethylbenzene [1,3,5-TMB]; 2-hexanone; and n-propylbenzene. Therefore, VISLs were calculated for these four analytes using USEPA's VISL calculator (USEPA 2021b), which is available online at: https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-level-calculator. Final residential groundwater VISLs used in the data screening process are summarized in **Table 5**.

An analyte's maximum detected concentration (MDC) identified in the VI groundwater datasets was compared to its VISL and retained as a COC if the analyte's MDC exceeded its VISL. Analytes detected at concentrations below their VISLs (or analytes that were not detected in groundwater) were eliminated from further quantitative analysis in the VI evaluation, as discussed further below. **Figure 4** identifies those monitoring wells with VISL exceedances. As shown in **Table 6**, the MDC of seven analytes detected in groundwater exceeded their residential VISLs. These seven groundwater COCs are identified as: 1,2,4-TMB; 1,3,5-TMB; benzene; ethylbenzene; MTBE; naphthalene; and total xylenes. Note, all groundwater VI COCs are petroleum hydrocarbons, which is important in evaluating separation distance, as discussed in the following section as part of a Lines of Evidence approach.

USEPA's RSLs are used to identify which contaminants require further evaluation and which contaminants do not require further study, as answered by USEPA's Frequently Asked Questions (FAQs) "Why are SLs used?" (available online at: https://www.epa.gov/risk/regional-screening-levels-frequent-questions) and provided below:

"They are used for site 'screening' and as initial cleanup goals, if applicable. SLs are not de facto cleanup standards and should not be applied as such. The SL's role in site 'screening' is to help identify areas, contaminants, and conditions that require further federal attention at a particular site. Generally, at sites where contaminant concentrations fall below SLs, no further action or study is warranted under the Superfund program, so long as the exposure assumptions at a site match those taken into account by the SL calculations. Chemical concentrations above the SL would not automatically designate a site as ‘dirty’ or trigger a response action; however, exceeding a SL suggests that further evaluation of the potential risks by site contaminants is appropriate.”

Table 6 provides the following further lines of evidence why analytes detected below their VISLs are not a human health concern and do not require further evaluation. As noted above, a total of seven analytes detected in groundwater were identified as COCs. However, an additional 21 analytes were detected at least once. Of these 21 analytes, four analytes do not have inhalation toxicity values available, which is a requirement to calculate individual noncancer Hazard Quotients (HQs) or cancer risks. Of the remaining 17 detected analytes, 10 analytes were detected at less than 5% of the total samples, which according to USEPA’s *Evaluating and Identifying Contaminants of Concern for Human Health (USEPA, 1994)* shows a limited occurrence, which would not require further risk evaluation. Of the remaining seven analytes, a worst-case risk evaluation was performed using the MDC as the Exposure Point Concentration (EPC) and calculating either noncancer HQs or cancer risks, depending on what the groundwater VISL is based. As shown in **Table 6**, the cumulative noncancer HQ [called the noncancer Hazard Index (HI)] and the cumulative cancer risk are at or below NMED’s target noncancer and cancer risk values of 1 and 1E-05, respectively. As a result, screening out analytes detected below their groundwater VISL is warranted, as they do not pose a human health concern.

Individual well locations with residential VISL exceedances are provided in **Table 7** and are limited to 11 well locations (KWB-2R, KWB-4, KWB-7, KWB-8, MW-48, MW-58, MW-113, RW-12R, RW-13R, RW-15C, and RW-19), which are presented in **Figure 4**.

The seven COCs identified above were retained for further off-site VI evaluation in the approach outlined below.

Lines of Evidence Approach

The VI exposure pathway was evaluated based on a hierarchy of lines of evidence (or criteria), which includes:

1. VISL exceedances (discussed above);
2. Adequate separation distance between the groundwater source and building foundation (or ground surface where no buildings are present) to allow for aerobic biodegradation to occur. Note that the buildings identified and evaluated did not appear to have subsurface structures (basements) other than the former Pecan Orchard pit, which had an open-air construction and would not have been considered a VI source because it was an open pit and vapors would not be drawn by advective force from the pit through cracks in a building’s foundation;
3. Identification of buildings within 100 feet of VISL exceedances;
4. Presence of PSH in wells; and

5. Presence of preferential pathways through utility or sewer lines.

The sequential lines of evidence/criteria are each discussed below, followed by a discussion of recommended next steps.

Separation Distance Criteria

Table 8 presents a refined VI evaluation of groundwater monitoring/recovery wells with residential VISL exceedances. Among these wells, the depth to groundwater was identified to determine whether adequate separation distance exists between the groundwater source and building foundation (or ground surface where no buildings are present) to allow for aerobic biodegradation to occur. According to Interstate Technology and Regulatory Council's (ITRC's) Petroleum Vapor Intrusion (PVI) Technical and Regulatory Guidance (ITRC 2014), five (5) feet is sufficient vertical separation distance between groundwater (from any petroleum source) and a building's foundation to allow adequate aerobic biodegradation of volatiles emanating from groundwater before reaching a building's foundation. When biodegradation occurs and the resulting vapor concentrations reaching the building's foundation are low to non-detect, the VI exposure pathway is no longer a health concern (ITRC 2014).

The concept and identification of a vertical separation distance for petroleum hydrocarbons is based on empirical data housed in USEPA's Vapor Intrusion database, which is available at: https://www.epa.gov/vaporintrusion/vapor-intrusion-database. The vertical separation distance established in ITRC's PVI guidance were part of ITRC's collaborative effort in creating technical guidance, which was overseen and peer-reviewed by multiple state regulatory agencies, including NMED. Specifically, NMED's own regulator, Susan von Gonten (NMED's Petroleum Storage Tank Bureau) was a contributing author of the PVI guidance.

Table 8 presents the minimum depth to groundwater observed since 2016 at each well with a VISL exceedance, which ranges from 13.43 feet bgs at KWB-7 to 19.34 feet bgs at RW-19. This depth to groundwater range is greater than 5 feet bgs (i.e., vertical separation distance between groundwater and building slab foundation is greater than 5 feet, which allows for adequate vertical distance for bioattenuation to occur). Therefore, the petroleum hydrocarbon groundwater COCs at all 11 wells were eliminated as a VI concern, as shown in **Table 8**.

Building Distance Criteria

The second screening criterion identifies whether the distance between the off-site groundwater well of interest with PSH and the nearest building is less than 100 feet. According to USEPA's 2015 Office of Solid Waste and Emergency Response (OSWER) VI guidance document, 100 feet is an adequate radius distance from a building, in which the building would not have enough advective force to pull vapors from the subsurface through cracks in the building's foundation (USEPA, 2015). **Table 8** identifies three groundwater monitoring wells (KWB-8, RW-12R, RW-13R) located less than 100 feet from buildings (Pecan Orchard Plant). All other wells presented in **Table 8** were eliminated from further VI evaluation, as no off-site buildings are located within 100 feet from these wells. **Figures 5A** and **5B** present this 100-foot radius around each groundwater monitoring well with VISL exceedances.

Presence of PSH

Another line of evidence evaluates whether PSH present in the identified groundwater monitoring/recovery wells may present a VI concern to nearby building occupants (within 100 feet laterally), which is summarized in **Table 8** and represented in **Figures 5a and 5b**. According to ITRC's PVI Technical and Regulatory Guidance (ITRC 2014), 18 feet is sufficient vertical separation distance between PSH from a refinery source and a building's foundation to allow adequate aerobic biodegradation of volatiles emanating from PSH before reaching a building's foundation. When biodegradation occurs and the resulting vapor concentrations reaching the building's foundation are low to non-detect, the VI exposure pathway is no longer a health concern (ITRC 2014). **Table 8** presents the current depth (April 2021) to PSH at each well with a VISL exceedance, which ranges from 21.69 feet bgs at RW-15C to 27.10 feet bgs at RW-12R. This depth to PSH range is greater than 18 feet bgs (i.e., vertical separation distance between groundwater and building slab foundation is greater than 18 feet, which allows for adequate vertical distance for bioattenuation to occur). Therefore, the petroleum hydrocarbon groundwater COCs at all 11 wells were eliminated as a VI concern, as shown in **Table 8**.

Presence of Preferential Pathways

A final line of evidence evaluates whether preferential pathways created by sewer lines or other subsurface piping may pose a VI concern. Specifically, this line of evidence identifies whether a preferential pathway for vapors exists between the 11 wells with groundwater VISL exceedances and potential PSH sources (identified in **Table 8**) and nearby buildings. Field monitoring data compiled by Beckley and McHugh (2020) from more than 30 sites identifies the interaction between sewer pipes and subsurface VOC sources as the predominant factor that determines whether preferential pathways are a VI concern. Their findings indicate that when sewer pipes are located above and separated from the VOC source, the risk of preferential pathways contributing to VI concerns is low. As shown in **Table 8**, the minimum depth to groundwater since 2016 is 13.49 feet bgs and the current minimum depth to PSH (April 2021) is 21.69 feet bgs. These depths are significantly deeper than conventional sewer lines, which are typically located between 5 feet bgs and 6 feet bgs. Given the distance between groundwater/PSH source and the sewer pipes, preferential pathways would not be a concern.

Lines of Evidence Conclusions

Based on the lines of evidence approach, virtually all potential receptors can be eliminated from the risk of vapor intrusion. As detailed in **Table 8**, only three monitoring/recovery wells (KWB-8, RW-12R, and RW-13R) indicate a potential VI concern for off-site workers at the Pecan Orchard Plant, but only because these wells are located within approximately 100 feet of off-site buildings.

Therefore, an expanded off-site VI evaluation of KWB-8, RW-12R, and RW-13R in relation to the Pecan Orchard Plant buildings was conducted, as detailed in **Attachment F**.

As shown in **Attachment F**, the result of the expanded off-site VI evaluation indicated that individual and cumulative indoor air risks were acceptable when modeling maximum detected groundwater and soil gas concentrations of COCs into the indoor air of two Pecan Orchard Plant Buildings (North and South Buildings). This modeling effort, along with empirical evidence that bioattenuation is occurring for petroleum hydrocarbons in the subsurface, provide robust lines of evidence that VI is not a human health concern at these buildings. As a result, further evaluation of the VI pathway is not required.

DATA GAPS AND LIMITATIONS

The data gaps and limitations identified/encountered during the desktop off-site groundwater receptor survey and off-site VI evaluation are described below.

- Inaccurate well location data in NMOSE records necessitate, to the degree feasible, confirmation of the presence and location of key potential domestic well RA-10378. HFNR is working on confirming the presence and location of this well and will attempt to obtain access to sample the well (if present and operable).
- Future off-site land use, future downgradient off-site receptors, and construction relative to future plume conditions are not known. HFNR does not have knowledge of future off-site conditions, but the shallow groundwater plumes are primarily located within HFNR-owned property or the Pecan Orchard. The downgradient extent of the plumes is not expected to change and will be monitored on a regular basis. Additionally, it is HFNR's understanding that the Pecan Orchard does not plan to sell the property in the foreseeable future.

RECOMMENDATIONS

- Confirm the presence and location of potential domestic water well RA-10378 on the residential property with Parcel ID 4-153-098-515-219. HFNR will attempt to obtain an access agreement to sample the well (if present and operable) to determine if it is affected by the dissolved-phase hydrocarbon plume.
- HFNR will attempt to obtain an access agreement for Parcel ID 4-154-099-146-071 to sample shallow monitoring wells KWB-3AR and KWB-9 and any operable water wells. If not successful, HFNR will evaluate the feasibility and effectiveness of installing one monitoring well along Highway 82 north of Parcel ID 4-154-099-146-071 (though access for a well may not be feasible).
- Install one shallow monitoring well between wells NP-1, MW-145, and MW-133 to further investigate MTBE in shallow groundwater in this area, in accordance with NMED directives in letters dated May 7, 2021, and July 15, 2021. A work plan to install the additional monitoring well in this area will be submitted to NMED by December 31, 2021.

- Install two shallow monitoring wells in the southern portion of the Facility to better define the crossgradient extent of the dissolved-phase and PSH plumes south of Highway 82. One well is proposed to be installed south of monitoring wells MW-109 and MW-110 and one well is proposed to be installed south of monitoring KWB-6 and MW-132. The proposed approximate well locations are shown on **Figures 2** and **3**.

ATTACHMENTS

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Memorandum

To:	~~Scott Denton, Robert Combs~~
	Kawika Tupou
	HollyFrontier Navajo Refining LLC
From:	Julie Speer and Laura Trozzolo~~, and Catriona Smith~~
	TRC ~~Companies~~Environmental Corporation (TRC)
Subject:	Artesia Refinery, Desktop Groundwater Receptor Survey and Vapor Intrusion Evaluation of Off-Site Receptors – Revised
Date:	~~April 12, 2019~~December 30, 2021
CC:	HollyFrontier Corporation: ~~Arsin Sahba~~Jason Leik, Mike Holder
	TRC: ~~Jason Leik~~Catriona Smith, Scott Reed, ~~Audrey Eljuri~~Dana Helbert
Project No.:	~~326778~~456061.0000.0000

This revised memorandum summarizes the results of the desktop groundwater receptor survey and vapor intrusion (VI) evaluation for off-site receptors potentially impacted by the dissolved-phase hydrocarbon and phase-separated hydrocarbon (PSH) plumes present downgradient of the HollyFrontier Navajo Refining LLC (~~Navajo~~HFNR) Refinery (the Refinery) and ~~Navajo~~HFNR-owned property in Artesia, New Mexico (the ~~Navajo~~HFNR Property). The Refinery and the ~~Navajo~~HFNR Property are collectively referred to as "the Facility" in this memorandum. The desktop groundwater receptor survey and VI evaluation of off-site receptors were conducted to achieve the following objectives:

- Identify potential off-site receptors downgradient of the Facility that may be impacted by the dissolved-phase hydrocarbon and/or PSH plumes;
- Determine whether such identified potential off-site receptors could be affected by dissolved-phase hydrocarbon and/or PSH plumes (i.e., affected by direct exposure to impacted groundwater and/or PSH, or vapors from the impacted groundwater and/or PSH);
- Evaluate the on-going NMED- and OCD-approved Facility groundwater monitoring network and program to assess its effectiveness in determining the potential of the dissolved-phase hydrocarbon and PSH plumes to affect potential off-site, downgradient receptors; and
- Identify data gaps and limitations of the desktop groundwater receptor survey and VI evaluation and recommend a path forward to address any identified data gaps and limitations.

SUMMARY

The receptor survey identified ~~a handful of~~ potential off-site receptors in the area of interest downgradient ~~receptors~~and crossgradient of the Facility, including one commercial pecan orchard (the Pecan Orchard), six residential properties, and 55 potential water well records. However, none

of these receptors were determined to be impacted, affected, or at risk for direct exposure to dissolved-phase hydrocarbons or PSH in shallow groundwater. Target volatile organic compounds (VOCs) were evaluated, including benzene, toluene, ethylbenzene, xylenes (BTEX), naphthalene, and methyl tert-butyl ether (MTBE), and none of the off-site receptors were identified to be impacted, affected, or at risk for direct exposure to groundwater with VOC concentrations in exceedance of critical groundwater screening levels (CGWSLs) based on the: (1) observed historical extent and distribution of the plumes relative to locations of identified off-site receptors, and (2) historical analytical results at downgradient irrigation wells (RA-04196 and RA-04798) located within the plumes~~, and (3) active monitoring and mitigation activities conducted to prevent exposure at the Pecan Orchard pit.~~. However, additional groundwater assessment is recommended to ~~delineate the extent of~~ensure potential domestic water well RA-10378 is not affected by the dissolved-phase hydrocarbon and PSH plumes in ~~the vicinity of potential domestic water wells RA-02793, RA-02827, RA-03195, RA-03353, and RA-10378~~shallow groundwater.

Overall, the approved groundwater monitoring network and program are effective with respect to assessing the potential for the dissolved-phase hydrocarbon and PSH plumes to impact the identified potential off-site receptors. The network/program are comprehensive, thus no significant changes to the groundwater monitoring network and program are necessary other than those to support the additional groundwater assessment recommended above.

The VI evaluation indicates that virtually all of the identified potential receptors are not at risk from vapor intrusion. ~~Only one off-site monitoring well and one recovery well (KWB-8 and RW-22) indicate a potential VI concern for off-site workers at the Pecan Orchard plant. This area will be examined in more detail using VI modeling at KWB-8 with potential soil gas sampling if results warrant further evaluation. The remaining receptors, including the residential properties, were confirmed to not be at risk for VI based on the lines of evidence approach~~The initial groundwater screening identified one off-site monitoring well (KWB-8) and two on-site recovery wells (RW-12R, RW-13R) that may pose a potential VI concern for off-site workers at the Pecan Orchard Plant. Therefore, an expanded site-specific VI evaluation of the Pecan Orchard Plant buildings was conducted by modeling maximum detected groundwater and soil gas concentrations up through the unsaturated zone and into the Pecan Orchard Plant's North and South Buildings to determine cancer risks and noncancer health effects for personnel working inside the Pecan Orchard Plant buildings. Based on the modeling results, all indoor air cancer risks and noncancer health effects from groundwater and soil gas data indicate no potential VI concern for those personnel working exclusively inside the Pecan Orchard Plant sourced from groundwater and soil conditions in the vicinity of the Pecan Orchard Plant.

The available data are largely inclusive and only ~~three~~two data gaps or data ~~limitations~~limitation were identified: (1) ~~confirm~~ the presence and location of key potential domestic ~~wells~~well ~~RA-02793, RA-02827, RA-03195, RA-03353, and~~ RA-10378 ~~to~~could not be confirmed within the ~~degree feasible through visual field~~scope of this survey due to inaccurate well location data in available records~~; (2) confirm building-specific construction details~~, but HFNR is currently working to obtain access to the associated residential property and will sample the well (if present and ~~worker occupancy information for the Pecan Orchard plant buildings to further evaluate potential for VI exposure~~operable) to confirm it is not affected by the shallow groundwater plumes; and ~~(3) identify geotechnical parameters such as soil bulk density, total porosity~~(2) future off-site land use, future downgradient off-site receptors, and ~~water-filled porosity for soils~~construction relative to future plume conditions are not known, but are not expected to change within the foreseeable future in the immediate vicinity of the Facility~~Pecan Orchard plant, KWB-8, and RW-22 to further evaluate potential for VI exposure~~.

GROUNDWATER RECEPTOR SURVEY

The groundwater receptor desktop survey included a review of ~~Navajo~~HFNR documents, aerial imagery, public property records, and water well records to identify potential off-site receptors that could be affected by the dissolved-phase hydrocarbon and PSH plumes. Target VOCs – BTEX, naphthalene (in lieu of Diesel Range Organics [DRO]), and MTBE – were used to represent the extent of the dissolved-phase plume(s). These constituents were then used to evaluate the off-site extent of the dissolved-phase hydrocarbon plume and to assess whether potential downgradient off-site receptors could be affected. In conjunction with the dissolved-phase plume evaluation, the locations of off-site wells with PSH were identified relative to potential groundwater receptors.

Facility Location and Surrounding Land Use

The Facility is located immediately east of Highway 285 (North 1st Street) and north of Highway 82 (East Main Street) in Artesia, New Mexico. ~~Navajo~~HFNR owns property that extends to the north, east, and south of the main plant. The Facility and surrounding properties are shown on **Figure 1**. Property to the west (upgradient) of the Facility is used for commercial/industrial or residential purposes. Property to the north (crossgradient) of the Facility is used for commercial/industrial, residential, or agricultural purposes. Property to the east (downgradient) of the Facility is primarily used for agricultural purposes, but there are also some residences present as shown on **Figure 1**. Property to the south (crossgradient) of the Facility is primarily used for commercial/industrial and agricultural purposes. HFNR's parent corporation, HollyFrontier, is currently constructing a Pretreatment Unit and Rail Loading area as part of a renewable diesel project on the south side of Highway 82 south of the refinery. The historical[1] extent of target VOCs

[1] The historical extent of target VOCs in exceedance of CGWSLs shown on Figure 1 is based on more than one CGWSL exceedance in a monitoring or recovery well over time. The time frame of historical data evaluated for each off-site well is shown on the concentration time-series plots provided in **Attachment A**. The time frame of historical data evaluated for on-site wells is shown on the concentration time-series plots provided in Appendix ~~C~~D of the *~~2018~~2020 Annual Groundwater Monitoring Report* dated February ~~2019~~2021. The time frame for all wells includes analytical data from at least 2010 (with many wells from at least 2006) or the well installation date (if installed after 2010) through October ~~2018~~2020. Monitoring wells MW-125 through MW-137 were installed in 2014. Monitoring wells MW-53R, MW-62R, MW-137A, MW-138A, MW-139, and MW-145 through 148 were installed in 2019 to 2020.

present in shallow groundwater at concentrations in exceedance of their respective CGWSLs is also shown on **Figure 1**.

Groundwater Conditions – Hydrogeology

The principal aquifers in the Artesia area are within the valley fill alluvium (Quaternary alluvium) and the San Andres Formation. Two distinct water-bearing zones within the valley fill alluvium in the vicinity of the Facility are referred to as the "shallow saturated zone" and the "valley fill zone". The deeper carbonate aquifer within the San Andres Formation is referred to as the "deep artesian aquifer". The hydrogeology of each of these aquifers is summarized below.

- Shallow Saturated Zone: Occurs in interbedded sand and gravel channels at 10 to 30 feet below ground surface (bgs). Overlying clays, silts, and caliche undulate at and near the Facility and create intermittent confined and unconfined groundwater conditions in the shallow saturated zone. ~~Static water levels in groundwater monitoring wells completed within this zone are three to five feet above the top of the shallow saturated zone, indicating groundwater in this zone is under confined conditions for some or most of the year.~~ Groundwater in this zone generally flows to the east and is highly variable in quality and volume. The shallow saturated zone is not generally used for domestic or agricultural purposes.

- Valley Fill Zone: Underlies the shallow saturated zone and occurs in alluvial deposits of sand, silt, clay, and gravel that are approximately 300 feet thick near the Facility. Irrigation and water production wells completed in this zone are typically screened across one to five water-producing intervals ranging in thickness from 20 to 170 feet, with most being approximately 20 feet thick. Production intervals are non-continuous, consist principally of sand and gravel, and are separated by less permeable lenses of silt and clay of varying thickness. In the immediate vicinity of the Facility, irrigation wells completed in this zone are typically screened between 240 to 320 feet bgs (e.g., irrigation wells RA-3723 and RA-04196). Groundwater in this zone generally flows to the east and is under confined conditions, with static water levels in monitoring wells completed in this zone being similar to or higher than that observed in shallow saturated zone wells. The valley fill zone has been developed for domestic and agricultural use.

- Deep Artesian Aquifer: Primarily occurs in the upper portion of San Andres Formation (limestone and dolomite with irregular and erratic solution cavities). The San Andres Formation underlies the Queen and Grayburg Formations, which primarily act as a confining bed between this aquifer and the valley fill zone. However, near the City of Artesia, the deep artesian aquifer includes the lower section of the Queen and Grayburg Formations (in localized fractures and secondary porosity). Near the Facility, the depth to the top of the water-producing interval is approximately 440 feet bgs. The deep artesian aquifer has been extensively developed for industrial, municipal, and agricultural use, but not domestic use.

The Facility's current facility-wide groundwater monitoring program includes ~~190~~197 monitoring and recovery wells screened within the shallow saturated zone; 19 monitoring wells screened within the valley fill zone; 3 irrigation wells screened within the valley fill zone (wells RA-01227, RA-03156, and RA-04196); and 2 irrigation wells screened within the deep artesian aquifer (RA-0313 and RA-04798). Monitoring wells and recovery wells are gauged and sampled on a regular basis (primarily semiannually or annually, but a few select wells biennially). Of the ~~190~~197 monitoring and recovery wells, ~~142~~153 are located within the area of interest shown on **Figure 1** (the others in the monitoring program are located along the eastern side of Three Mile Ditch or are at the former Evaporation Ponds). Irrigation wells owned by ~~Navajo~~HFNR (RA-313 – sampled regularly since 2008) and others (i.e., RA-03156, RA-04196, and RA-04798, which have been sampled regularly since 2006, and RA-01227, which was sampled in 2010 and 2011, but not since due to lack of access) are sampled on either a semiannual or annual basis. Groundwater monitoring results indicate that PSH is present in the shallow saturated zone and dissolved-phase hydrocarbons are present at concentrations exceeding their respective CGWSLs in the shallow saturated zone and the valley fill zone. The historical extent of target VOCs present in shallow groundwater at concentrations in exceedance of their respective CGWSLs is shown on **Figure 1**. Target VOCs have not been detected in the valley fill zone in exceedance of their respective CGWSLs over at least the last six semi-annual groundwater monitoring events conducted since April 2019. Dissolved-phase hydrocarbons have not been detected above the CGWSLs in the two irrigation wells (RA-0313 and RA-04798) screened within the deep artesian aquifer that have been sampled for VOCs since 2006.

Groundwater Conditions – Hydrocarbon Plumes

Concentrations of dissolved-phase hydrocarbons, specifically the target VOCs in the shallow saturated zone and valley fill zone, have generally exhibited a stable or decreasing trend over time, as documented in Annual Groundwater Monitoring Reports. Benzene and MTBE are the target VOCs that are most prevalent in shallow groundwater downgradient of the Facility[2]. ~~The distribution of benzene~~Benzene and MTBE concentrations in shallow groundwater (shallow saturated and valley fill zones) during the semiannual monitoring event conducted in April ~~2018~~2021 (i.e., the most comprehensive recent monitoring event) are shown on **Figures 2** and **3**, respectively. The April ~~2018 distribution and~~2021 extent of benzene and MTBE detections in shallow groundwater are generally consistent with the historical target VOC CGWSLs exceedance area shown on **Figure 1**.

The current maximum extent (April 2016 through ~~2018~~April 2021) of PSH in the shallow saturated zone is shown on **Figures 1** through **3**. ~~Despite sometimes being under confined conditions, apparent~~Apparent PSH thicknesses in wells screened in the shallow saturated zone are generally inversely affected by fluctuations in groundwater elevations. ~~Confined conditions result in the apparent in-well PSH elevation being higher than the actual PSH elevation in formation.~~

As shown on **Figure 2**, the current extent of PSH and benzene detections in shallow groundwater are primarily contained within the Facility and a downgradient commercial pecan orchard (the Pecan Orchard). As shown on **Figure 3**, the current extent of MTBE detections in shallow groundwater is primarily contained within the Facility, the Pecan Orchard, and a portion of property to the northeast of the Facility that is primarily used for oilfield or pipeline surface facilities. Concentration time-series plots for wells located at off-site properties are provided as **Attachment A** (these are also included in Appendix ~~C~~D of the ~~*2018*~~*2020 Annual Groundwater Monitoring Report* dated February ~~2019~~2021). Detailed analysis of concentration trends in these wells are provided in Section 5 of the ~~*2018*~~*2020 Annual Groundwater Monitoring Report* dated February ~~2019~~2021 and show that dissolved-phase hydrocarbon concentrations have generally exhibited a stable or decreasing trend over time.

Potential Off-Site Downgradient Receptors

Public records and aerial imagery were used to identify potential receptors that are present within/above or immediately downgradient of the dissolved-phase hydrocarbon and PSH plumes. The results of the records review are discussed below.

[2] Total Petroleum Hydrocarbons (TPH) Diesel Range Organics (DRO) is prevalent in shallow groundwater upgradient, crossgradient, and downgradient of the Facility. Naphthalene was used as an indicator compound for TPH DRO and demonstrated a smaller lateral extent than benzene or MTBE, and so the extent of benzene and MTBE were used for this receptor survey as more conservative (largest extent) indicators.

Water Wells

In December 2015, Atkins Engineering Associates, Inc. (AEA) conducted a record search on behalf of ~~Navajo~~HFNR to identify water wells in the Facility area that are potentially: (1) screened within the valley fill alluvium, and (2) used for non-monitoring purposes. Note, the New Mexico Office of the State Engineer (NMOSE) records referencing the "shallow" zone are referring to the valley fill alluvium since water wells are not likely to be completed within the shallow saturated zone due to naturally poor quality and low productivity. Wells screened within the deep artesian aquifer were not included because the valley fill alluvium and deep artesian aquifer are not considered to be hydraulically connected (investigation is ongoing). AEA searched the following database and paper records available from the NMOSE: New Mexico Water Rights Reporting System (NMWRRS) database, well logs, and Hydrographic Surveys. AEA summarized the results of their records search in the February 2016 *Draft Report of Navajo Refining Company Possible Shallow Receptor Records Study, Artesia, NM*. At the request of TRC and ~~Navajo~~HFNR, AEA conducted an updated search in February 2019 and November 2021 to identify any new wells or records and to determine if the status of any of the previously identified wells had changed since 2015. AEA summarized the updated search results in the ~~February 17, 2019~~ *Limited Update to Draft Report of Navajo Refining Company Possible Shallow Receptor Records Study, Artesia, NM* dated February 17, 2019, and in the *Limited Update to Draft Report of Navajo Refining Company Possible Shallow Receptor Records Study Artesian, NM (February 2016) and Limited Update (February 2019)* dated November 5, 2021. The February 2016~~ and~~, February 2019, and November 2021 AEA documents are provided as **Attachment B**.

Table 1 summarizes the results of the AEA records search of potential shallow water wells located within 0.25 miles (1,320 feet) crossgradient and 1 mile (5,280 feet) downgradient of the current extent of benzene and MTBE ~~detections~~CGWSL exceedances in shallow groundwater. **Table 1** also specifies the approximate distance of each potential water well from the benzene and MTBE shallow groundwater plumes (CGWSL exceedance areas) and provides further analysis of each water well record. The records search identified potential shallow water wells that are located off-site and within or in the downgradient proximity of the current extent of benzene and MTBE ~~detections~~CGWSL exceedance areas in shallow groundwater. These wells are shown on **Figures 2** and **3**, respectively.

The available location data for most of the ~~majority of these~~potential shallow water wells identified in the AEA records search is approximate and subject to applicant error. The NMWRRS database records that include location data based on the Public Land Survey System (PLSS) provide coordinate data for the center of the smallest quarter delineated in North American Datum (NAD) 83 Universe Transverse Mercator (UTM) Zone 13, which ranges from a 0.625-acre tract (5 quarters) to 10-acre tract (3 quarters). A majority of the NMWRRS database records are based on the PLSS and provide location data at the center of a 10-acre tract. Further, the NMWRRS database records are based on applicant (e.g., well driller or property owner) reports which are inherently subject to human error, especially considering many private citizens are not familiar with the PLSS. The discrepancy between the NMWRRS record locations and actual locations (based on ~~Navajo sampling event data and~~HFNR monitoring program records) can been seen on **Figures 2** and **3** for the irrigation wells that are currently included in the ~~Navajo~~HFNR facility-wide groundwater monitoring program: RA-01227, RA-03156, RA-04196, and RA-04798.

The only identified water wells that are located within the benzene and MTBE shallow groundwater plumes ~~downgradient of the Facility~~ (CGWSL exceedance areas) are irrigation wells RA-03890, RA-00768, RA-02723, RA-01097, RA-04196, and RA-04798, of which only RA-04196 and RA-04798 are located downgradient of the Facility (or off-site). Wells RA-04196 and RA-04798 are both sampled on a semiannual basis as part of the facility-wide groundwater monitoring program. Historical analytical results indicate that benzene and MTBE are not present in these irrigation wells at concentrations that exceed their respective CGWSLs.

As highlighted on **Table 1** and shown on **Table 2**, NMWRRS records included ~~five~~one domestic water ~~wells (RA-02793, RA-02827, RA-03353, RA-03195, and~~ well (RA-10378) that: (1) potentially could intersect the ~~benzene~~PSH and/or MTBE ~~plumes~~plume downgradient of the Facility ~~where these plumes are currently not delineated and~~ and (2) ~~are~~is located near residential structures with at least one apparent domestic well observed by ~~Navajo~~HFNR during a visual drive-by survey. While there are monitoring wells that provide delineation of the PSH and MTBE plumes surrounding the residential structures on the property associated with RA-10378 (Parcel ID 4-153-098-515-219), the actual location of the potential domestic well is not known.

As shown on **Table 1**, and discussed further below, domestic wells RA-02342 and RA-23420 were confirmed to not be present within the Pecan Orchard ~~and~~based on visual survey and discussion with representatives of the Pecan Orchard. These wells probably no longer exist (note there likely was just one well with multiple records/IDs; records indicate well was reported as "failed" in 1960 and to be moved –"100 feet west more or less to a more convenient location"– see supplemental records provided in **Attachment C**). Well RA-11688, located approximately ~~800~~290 feet ~~north (crossgradient~~northwest (upgradient) of the ~~benzene~~MTBE plume at monitoring well NP-1, is listed as installed for non-consumptive use. Wells RA-02342~~,~~ (if existing), RA-23420~~,~~ (if existing), and RA-11688 are also located outside the historical target VOC CGWSLs exceedance area. Also as shown on **Table 1**, wells RA-02827 and RA-03353 are permitted as domestic water wells, but the vacant residence on the property that was associated with these well records was demolished in 2019 and the property is no longer zoned as residential (see property record for Parcel ID 4-154-099-146-071 provided in **Attachment D**).

Residences

Aerial imagery and Eddy County Tax Assessor records were used to identify potential residences located within 0.25 miles (1,320 feet) ~~downgradient or~~ crossgradient and 1 mile (5,280 feet) downgradient of the ~~current lateral extent of benzene and MTBE detections~~historical target VOC

CGWSLs exceedance area in shallow groundwater. ~~Five~~Six residential properties were identified, as summarized in **Table 2,** and their locations are shown on **Figures 1, 2, ~~3,~~ and ~~4~~3**. Eddy County property records for each of these residential properties are provided in **Attachment D**. Four of these ~~five~~six residential properties appear to be associated with at least one potential domestic shallow water well identified in the AEA records search. Apparent associated shallow domestic water wells for each property are noted in **Table 2**.

~~Navajo's~~HFNR's extensive monitoring network and program provide comprehensive data for virtually all of the study area. None of the identified residential properties are located above the current or historical extent of benzene, MTBE, or PSH ~~detections~~plumes in shallow groundwater. However, the extent of the ~~benzene, MTBE, and PSH detections is not fully~~plumes could be further delineated near ~~the following three~~ one residential ~~properties:~~

property (Parcel ID 4-153-098-515-219). Parcel ID 4-153-098-515-219 includes a residence and one potential domestic shallow water well (RA-10378). ~~Navajo~~HFNR confirmed by visual survey that one domestic water well is present, and the well is likely RA-10378~~;~~ (same registered owner as the property); however, the precise location of RA-10378 should be confirmed. This property is located immediately downgradient of a monitoring well (MW-134) with no detections of benzene or MTBE since April 2014 and immediately upgradient of a monitoring well (NP-1) that has historically exceeded the MTBE CGWSL. To further assess the extent of the MTBE plume in shallow groundwater to the south and east of this property and the extent of the benzene plume in shallow groundwater to the south of this property, monitoring wells MW-145 and MW-146 were installed in September 2020. Both wells were sampled in October 2020 and April 2021 – benzene and PSH were not detected in either well during either sampling event, and MTBE was only detected in MW-145 at estimated J-flagged concentrations three orders of magnitude below the CGWSL (0.100 milligrams per liter [mg/L]) during both sampling events. Based on the direction of groundwater flow and the extensive conceptual site model for the Facility (i.e., preferential groundwater flow pathways within gravel channels to the south of this area~~, as described in the April 2017~~ ~~*Revised Contaminant Migration Evaluation Investigation Report*~~ ~~[Revised CME Report]),~~), it appears the ~~presence of the~~ MTBE plume in the vicinity of NP-1 ~~is~~may be isolated relative to the main groundwater plume. ~~The extent of the MTBE plume in shallow groundwater~~However, a work plan to ~~the south~~install an additional monitoring well between NP-1 and ~~east of~~ MW-133 to further investigate MTBE in this area is in progress and will be submitted to the NMED by December 31, 2021. HFNR is also working to confirm the presence and location of water well RA-10378 on this residential property and ~~the extent of the benzene plume in shallow groundwater to the south of this property is not fully delineated.~~ obtain access to sample if the well is present and operable.

~~Parcel ID 4-154-098-397~~ In the April 2019 *Desktop Groundwater Receptor Survey and Vapor Intrusion Evaluation of Off-Site Receptors* Memorandum, two additional residential properties (Parcel IDs 4-154-098-397-381 and 4-154-099-146-071) were identified downgradient or crossgradient of locations where the shallow groundwater plumes were potentially not fully delineated. However, the shallow groundwater plumes are now fully delineated upgradient of Parcel ID 4-154-098-397-381 and Parcel ID 4-154-099-146-071 is no longer a residential property, as described below.

- Parcel ID 4-154-098-397-381 includes a residence and potential domestic shallow water well (RA-03195) that is located downgradient of monitoring wells KWB-11A (contains PSH) and KWB-11B; and a potential domestic shallow water well (RA-02793) that is located downgradient of monitoring well KWB-7 (contains PSH). ~~The extent of the benzene, MTBE, and PSH plumes in shallow groundwater to the west of this property is not fully delineated.~~ During a visual drive-by survey, ~~Navajo~~HFNR observed one apparent domestic well (likely RA-03195) located near the residential structure on this parcel, but the well did not appear to be operable. As shown on **Table 1** and in supplemental well records provided in **Attachment C**, the well record for RA-03195 is associated with the repair of irrigation well RA-00397 (completed in the deep artesian aquifer) and therefore this well may not exist.

- ~~Parcel ID 4-154-099-146-071 includes a residence and potentially two domestic shallow~~In September 2020, monitoring wells MW-147 and MW-148 were installed in the shallow saturated zone upgradient of potential water wells ~~(~~RA-02793 and RA-03195 to further assess the downgradient extent of the benzene, MTBE, and PSH plumes in shallow groundwater to the west of this property. Monitoring well MW-145 was installed downgradient of wells KWB-11 and KWB-11B and monitoring well MW-148 was installed downgradient of KWB-7. Both wells were gauged and sampled in October 2020 and April 2021. As presented in the *2020 Annual Groundwater Monitoring Report*, benzene and PSH were not detected in either of these wells during either sampling event and MTBE was not detected in MW-147 during either sampling event. MTBE was detected in MW-148 in October 2020 at an estimated J-flagged concentration three orders of magnitude below the CGWSL (0.100 mg/L) but was not detected in MW-148 in April 2021. PSH has never been detected in the valley fill zone and no target VOCs have been detected in exceedance of CGWLs in monitoring well KWB-11B completed in the valley fill zone. Therefore, the benzene, MTBE, and PSH plumes are now fully delineated to the west of this property in both the shallow saturated and valley fill zones and no further assessment is recommended.

- Parcel ID 4-154-099-146-071 potentially includes two shallow water wells permitted as domestic (RA-02827 and RA-03353). However, as described in **Table 1**, well RA-02827 may not have been installed (permit approved in 1951 and cancelled in 1954; see supplemental well records provided in **Attachment C**) and well RA-03353 was removed from the ~~facility~~Facility-wide groundwater monitoring program around 2010 because it was not operable due to lack of electricity. A residential structure formerly observed on this property was demolished sometime in 2019 based on aerial photographs. The ~~residence has~~former residential structure had appeared to be vacant since at least 2010 until it was demolished. The property is now zoned as nonresidential per the property record provided in **Attachment D**. The crossgradient to downgradient extent of the benzene and MTBE plumes is not currently delineated to the north and northwest of this property. Monitoring ~~well~~wells KWB-3AR ~~is~~and KWB-9 are located on this property, but ~~it has~~they have not been sampled since 2011 due to lack of access. However, target VOCs were not historically detected in ~~exceedance of CGWSLs in~~ KWB-3AR and KWB-9.

Pecan Orchard

The Pecan Orchard is located immediately downgradient to the east of the Facility and is present above the benzene and MTBE shallow groundwater plumes and the PSH plume. ~~The~~Prior to August 2021, the Pecan Orchard ~~operates~~operated a subsurface “pecan pit” where harvested pecans ~~are~~were temporarily deposited and then moved into the pecan plant by means of a conveyor belt system. This pit ~~is~~was located within an open-air structure along the western property boundary of the Pecan Orchard immediately downgradient of ~~a Navajo~~an HFNR recovery trench. Prior to liner installation, the pit was subject to fluctuating groundwater levels that could cause infiltration of shallow groundwater and PSH. The depth of the pit ~~is~~was approximately 16 feet bgs and ~~is~~was lined on the exterior. ~~Navajo~~HFNR applied a spray-on liner to the interior. Both measures ~~mitigate~~, and other routine activities conducted by HFNR that depressed groundwater elevations around the pit, mitigated the potential infiltration of shallow groundwater and PSH. The pit ~~is~~was only used and entered temporarily by Pecan Orchard employees for maintenance on an as-needed basis for short durations, primarily during the months of October through December of each year. The pit was taken out of service and backfilled with clean soil on August 19, 2021 by the owner, and a concrete cap was placed on top of the area. HFNR personnel observed the backfilling activities and summarized the activities in a Memorandum provided as **Attachment E**.

~~Navajo also actively conducts the following additional activities to prevent shallow groundwater and PSH from infiltrating the pit:~~

- ~~Operates groundwater pumps within the French drain of the pit as necessary;~~
- ~~Operates recovery systems located immediately upgradient and downgradient of the pit to recover PSH and groundwater, and to lower groundwater elevations around the pit; and~~
- ~~Gauges recovery wells located immediately around the pit on a weekly basis to monitor groundwater and PSH elevations relative to the pit.~~

Two irrigation wells (RA-04196 and RA-04798) within the Pecan Orchard operational area are sampled on a semiannual basis as part of the facility-wide groundwater monitoring program. RA-04196 is screened within the valley fill zone (from 280 feet bgs to 292 feet bgs) and RA-04798 is screened in the deep artesian aquifer (from 840 feet bgs to 850 feet bgs), as documented in ~~Navajo's~~HFNR's monitoring plans and reports. ~~RA-04798 was misidentified as a shallow domestic water well within the NMOSE records search, but it is actually an irrigation well.~~ No target VOCs have been detected in exceedance of CGWSLs in either of these irrigation wells based on sampling since 2006. ~~In addition, the~~The deep artesian aquifer is not considered to be hydraulically connected to the valley fill alluvium, but investigation of the hydraulic connectivity is ongoing.

Two additional water wells (RA-23420 and RA-02342) were identified in AEA's record search to be present at the southeastern portion of the Pecan Orchard, as shown on **Figures 2** and **3**, but these wells are not present within the Pecan Orchard as determined by a visual survey of the area. As noted on **Table 1**, additional records indicate only well RA-02342 ever existed (multiple well record IDs likely resulted from typographical error) and the well was planned to be moved in 1960 as it had "failed". Aerial photographs indicate there is a 1.7-acre land parcel (Parcel ID 4-154-098-252-511) on the southeastern corner of the Pecan Orchard that was not part of the Pecan Orchard prior to at least July 2005. Multiple buildings were present on this parcel in an aerial photograph dated January 2004, the buildings were no longer present in an aerial photograph dated July 2005, and the parcel appeared to be cultivated with pecan trees in line with the rest of the Pecan Orchard in an aerial photograph dated September 2006. These well records may have been associated with this parcel prior to it being incorporated into the Pecan Orchard.

As shown on the concentration plots provided in **Attachment A**, benzene and MTBE concentrations in monitoring wells KWB-7, KWB-11A, and KWB-11B (located at the Pecan Orchard along the downgradient extent of the benzene and MTBE plumes) are stable~~ to decreasing over time, with the exception of occasional fluctuations.~~. Monitoring wells MW-147 and MW-148 were installed along the eastern property boundary of the Pecan Orchard (downgradient of KWB-7, KWB-11, and KWB-11B) in September 2020, and sampled in October 2020 and April 2021. Benzene and PSH was not detected in either of these wells during either sampling event. MTBE was not detected in MW-147 during either sampling event. MTBE was detected in MW-148 in October 2020 at an estimated J-flagged concentration three orders of magnitude below the CGWSL (0.100 mg/L) but was not detected in MW-148 in April 2021. Apparent PSH thicknesses in monitoring and recovery wells located within the Pecan Orchard have generally decreased over time but are inversely affected by fluctuations in groundwater elevations.

The shallow groundwater plumes present within the Pecan Orchard are not expected to affect the pecan trees as there is negligible potential for uptake of shallow groundwater and organic constituents from the tree roots. Pecan tree root systems consist of a long taproot that grows vertically and shallow feeder roots that grow laterally. The taproot primarily provides support and stability, and the feeder roots absorb water and nutrients. Pecan tree feeder roots mostly grow in the top 18 inches of soil where water, nutrients, and oxygen are easily absorbed. Groundwater elevations at monitoring wells KWB-7, KWB-8, and KWB-11A located across the Pecan Orchard ranged from 12.69 feet bgs to 24.69 feet bgs since 2010. Therefore, the primary feed zone of the Pecan Orchard trees is greater than 10 feet above the shallow groundwater zone. Additionally, the Pecan Orchard utilizes flood irrigation allowing the trees feeder roots to easily access fresh water near the ground surface.

Eagle Creek

As shown on **Figures 1** through **3**, Eagle Creek (or Eagle Draw) is present along the northwestern and northern side of the Facility and runs to the east and northeast towards the Pecos River downgradient of the Facility. Eagle Creek enters the Refinery at the western boundary and runs to the northeast through the northern half of the Refinery. It is an ephemeral watercourse that primarily flows only following rain events. Stormwater in the Refinery is directed to the Refinery stormwater pond using berms and does not enter Eagle Creek except possibly during extreme rainfall events. Additionally, the Eagle Creek channel is cemented within the vicinity of the Refinery. Upstream of the Refinery, Eagle Creek functions as a major stormwater conveyance for the City of Artesia and drains outlying areas west of the city.

Eagle Creek is considered to be a major source of recharge for the shallow saturated zone. The shallow groundwater zone typically does not intersect Eagle Creek except for potentially historically high groundwater elevations observed at the Facility in 2014. The elevation of Eagle Creek is 3,360 feet amsl at its entrance to the Facility and decreases to approximately 3,305 feet amsl at its confluence with the Pecos River. As presented in Table 1 of the *2020 Annual Groundwater Monitoring Report* dated February 2021, groundwater elevations measured during 2020 in wells MW-92, RW-1, and RW-2, located adjacent to Eagle Creek near its entrance to the Facility, ranged from 3,355.50 feet amsl at MW-92 to 3,349.30 feet amsl at RW-1, which is below the elevation of Eagle Creek in this area (3,360 feet amsl).

As shown on **Figures 1** through **3**, Eagle Creek only runs through the shallow groundwater plume near the northwestern corner of the Facility and to the north of the Pecan Orchard. There are no buildings/structures located along Eagle Creek within the shallow groundwater plumes or within 0.25-miles crossgradient or 1-mile downgradient of the plume boundaries.

Facility Groundwater Monitoring Network and Program Effectiveness

As discussed above, ~~Navajo's~~HFNR's facility-wide groundwater monitoring program includes gauging and sampling monitoring wells and recovery wells on a semiannual, annual, or biennial basis; and sampling irrigation wells on semiannual or annual basis. The locations of the groundwater monitoring network wells in the ~~vicinity of the Facility~~receptor survey area are shown on **Figures 1** through **3**. A total of ~~126~~140 wells are sampled in ~~the vicinity of the Facility~~this area on a semiannual or annual basis, including wells located upgradient, crossgradient, and downgradient of the Facility (while the remaining ~~16~~13 wells are gauged on a semiannual or annual basis, gauged on a biennial basis, or sampled on a biennial basis). Overall, the monitoring program is largely effective in monitoring the lateral extent of dissolved-phase hydrocarbons and PSH in shallow groundwater within and beyond the Facility, but could benefit from the addition of a few wells at select monitoring locations as discussed below:

- Due to a lack of landowner access for Parcel ID 4-154-099-146-071, monitoring wells KWB-3AR and KWB-9 and irrigation well RA-01227 have not been sampled since 2011. Target VOCs were not historically detected in these wells. Sampling KWB-3AR and KWB-9 would provide better, current delineation of the crossgradient extent of the benzene and MTBE ~~detections in~~ shallow groundwater plumes to the south and southeast of ~~the plume. Navajo~~Highway 82. HFNR will attempt to obtain an access agreement for this property. If unsuccessful, then ~~Navajo~~HFNR will evaluate the feasibility and effectiveness of installing one monitoring well along Highway 82 north of this property (though access for such a well may also not be feasible).

- The crossgradient extent of ~~benzene detections and~~ the benzene CGWSL exceedance area is not fully defined on the Facility to the south of Highway 82 (or south of monitoring wells ~~MW-52,~~ MW-58, MW-109, MW-110, MW-130, MW-132, and KWB-6). The crossgradient extent of PSH is not fully defined on the Facility to the south of Highway 82 (or south of monitoring wells MW-58, KWB-6, and MW-132~~. Navajo~~). HFNR now owns a majority of the adjacent land and water rights to the south of these wells. ~~Additional~~HFNR's position is that additional monitoring wells are not required in this area to monitor or control the PSH and benzene plumes as groundwater is consistently flowing to the east, and PSH and benzene have not historically been detected in monitoring wells KWB-13 (located to the south of KWB-2R) and MW-57 (located along Bolton Road southeast of MW-132), indicating the crossgradient extent of the PSH and benzene plumes does not extend south of the Facility. Regardless, HFNR proposes to install two shallow groundwater monitoring wells to investigate the crossgradient extent of the benzene and PSH plumes south of Highway 82 – one well is proposed to be installed south of MW-109 and MW-110 and one well is proposed to be installed south of KWB-6 and MW-132. The proposed well locations are shown on **Figures 2** and **3**.

- The crossgradient extent of ~~MTBE detections and~~ the MTBE CGWSL exceedance area is not fully defined on the Facility to the south of Highway 82 (or south of monitoring ~~wells MW-58, MW-130,~~well MW-132 and KWB-6~~. These wells are located along the southern Facility fence line, but Navajo~~). HFNR now owns a majority of the adjacent land to the south of these wells. ~~Additional~~It is HFNR's position that additional monitoring wells are not required in this area to monitor or control the MTBE plume as groundwater is consistently flowing to the east and MTBE has not historically been detected in monitoring well KWB-13 (located to the south of KWB-2R) and MW-57 (located along Bolton Road southeast of MW-132) indicating the crossgradient extent of the MTBE plume does not extend south of the Facility. Regardless, HFNR proposes to install one shallow groundwater monitoring well to investigate the crossgradient extent of the MTBE plume south of Highway 82. One monitoring well is proposed to be installed south of KWB-6 and MW-132. The proposed well location is shown on **Figures 2** and **3**.

- The ~~downgradient~~ extent of ~~detected benzene and MTBE concentrations is not defined to the east of monitoring wells KWB-7, KWB-11A and KWB-11B; and the downgradient extent of PSH is not defined to the east of monitoring well KWB-7. However, the downgradient extent of benzene and~~ the MTBE CGWSL exceedance ~~areas is defined in this area (see Figures 14, 15, 18, and 19 of the *2018 Annual Groundwater Monitoring Report* dated February 2019). Monitoring well MW-135 delineates the downgradient extent of the detected benzene and MTBE concentrations to the east/northeast of this area, but two additional monitoring wells located south of MW-135, as proposed in the Revised CME Report, are recommended to better delineate the plumes. The proposed monitoring wells would provide data to determine whether the potential shallow domestic water wells (RA-02793 and RA-03195) within the downgradient residential property (Parcel ID 4-154-098-397-381) are not at risk of exposure to the shallow groundwater plumes. The location of the two proposed monitoring wells are shown on **Figures 2** and **3**.~~

- ~~The upgradient extent of MTBE in exceedance of the CGWSL at monitoring~~area to the southwest of well NP-1 should be further evaluated to (1) determine if the MTBE plume in the vicinity of NP-1 is isolated from the MTBE plume in the southern portion of the Facility; and (2) confirm the residential property (Parcel ID 4-153-098-515-219) and potential shallow water well RA-10378 located upgradient of NP-1 are not at risk of exposure to the ~~isolated~~ MTBE plume(s). ~~MTBE has consistently exceeded the CGWSL in well NP-1, but has consistently not been detected in upgradient monitoring wells MW-134, RW-18A, and KWB-1A. Based on the direction of groundwater flow and the extensive conceptual site model for the Facility (preferential groundwater flow pathways within gravel channels to the south of this area, as identified in the Revised CME Report), it appears MTBE in the vicinity of NP-1 is isolated from the larger MTBE plume present to the south. Additional monitoring wells installed to the west of monitoring well NP-1, near the southwestern and eastern corners of the upgradient residential property (Parcel ID 4-153-098-515-219), are recommended to better delineate the isolated MTBE plume. The proposed monitoring wells would provide data to determine whether the upgradient residential property and potential shallow water well RA-10378 are not at risk of exposure to the shallow groundwater plumes. The location of the two proposed monitoring wells are shown on **Figures 2** and **3.**~~

Potential for Direct Exposure to Groundwater and PSH Plumes

No off-site receptors were identified to be at risk for direct exposure (i.e., ingestion and dermal contact through domestic uses) of shallow groundwater containing PSH or target VOCs at concentrations in exceedance of CGWSLs based on the: (1) observed historical extent and distribution of the plumes relative to locations of identified off-site receptors~~,~~ and (2) historical analytical results for VOCs are below the CGWSLs at irrigation wells (RA-04196 and RA-04798) located within the plumes~~, and (3) active monitoring and mitigation activities and engineering~~

~~controls installed to prevent exposure at the Pecan Orchard pit~~. Additional explanation is provided below.

- No domestic shallow water wells were identified to be present within the historical target VOC CGWSLs exceedance area. However, additional assessment is recommended to ~~delineate the dissolved-phase benzene and MTBE shallow groundwater plumes, as well as the PSH plumes, with the objective of determining whether the following~~ensure potential domestic water ~~wells intersect the plumes:~~ well RA-10378 (Parcel ID 4-153-098-515-219)~~(RA-10378), Parcel ID 4-154-098-397-381 (~~is not affected by the shallow groundwater plumes. HFNR is attempting to obtain access to sample RA-10378.~~-02793 and RA-03195), and Parcel ID 4-154-099-146-071 (RA-02827 and RA-03353).~~

- The two groundwater irrigation wells (RA-04196 and RA-04798) located within the Pecan Orchard and the dissolved-phase hydrocarbon and PSH plumes are sampled on a semiannual basis, and historical analytical results (since 2006) indicate no target VOCs are present at concentrations in exceedance of CGWSLs. The historical monitoring results for these irrigation wells indicate that other potential water wells located downgradient of the Facility are not likely to be affected by PSH and target VOCs present in shallow groundwater at concentrations in exceedance of CGWSLs if they are screened at a depth of 275 feet bgs or lower (screened interval of RA-04196 that does not exceed CGWSLs). Well RA-03353 is screened from 232 to 295 feet bgs, well RA-10378 is screened from 115 to 190 feet bgs, and the screened intervals of potential domestic water wells RA-02827, RA-02793, and RA-03195 are unknown. However, ~~due to the upward pressure gradient (upwelling caused by artesian conditions) observed~~PSH and target VOCs have not been detected in any monitoring wells screened ~~within~~in the ~~valley fill~~Valley Fill zone~~, it~~ crossgradient and downgradient of the Facility, including KWB-11B which is ~~unlikely that target VOCs would migrate to the~~ screened ~~depths of these domestic wells at concentrations in exceedance of the CGWSLs~~from 50 to 70 feet bgs.

- ~~Navajo actively conducts monitoring and mitigation activities and has installed engineering controls to prevent shallow groundwater and PSH from infiltrating the Pecan Orchard pit, as described above, to protect Pecan Orchard employees from potential exposure to impacted groundwater and PSH.~~

VAPOR INTRUSION EVALUATION

~~A screening-level~~A VI evaluation was conducted for identified potential off-site receptors within and downgradient of the dissolved-phase hydrocarbon and PSH plumes~~. The evaluation was conducted according to the~~ in accordance with New Mexico ~~Environment Department (NMED) 2017~~Environmental Department's (NMED's) June 2019 *Risk Assessment Guidance for Site Investigations and Remediation*~~(NMED, 2017~~, *Volume I, Soil Screening Guidance for Human Health Risk Assessments* (NMED 2019) and ITRC's *Petroleum Vapor Intrusion (PVI) Technical and*

Regulatory Guidance (ITRC 2014), as well as the United States Environmental Protection Agency (USEPA) VI guidance ~~documents~~document (USEPA~~, 2015a; 2015b~~ 2015). The objectives were as follows:

- Evaluate the potential for vapors from the dissolved-phase hydrocarbon plume (i.e., volatilization of dissolved-phase constituents of concern [COCs]) to affect potential off-site receptors identified in the previous sections based on the following steps:
  - Compare concentrations of VOCs in off-site groundwater wells (and several on-site wells in close proximity to the Facility boundary) to appropriate vapor intrusion screening levels (VISLs) based on NMED's and USEPA's VI guidance;
  - Review the depth to groundwater in off-site areas where COCs exceed their VISLs (i.e., ~~USEPA's~~ vertical separation distance for petroleum hydrocarbons); and
  - Identify off-site buildings/structures located within 100 feet of a groundwater sample exceeding VISLs, per NMED guidance.
- Identify the presence of PSH in off-site groundwater wells and use the distance from nearest building and ~~USEPA's~~ vertical separation distance guidance ~~for petroleum hydrocarbons~~presented in the Interstate Technology and Regulatory Council's (ITRC's) *Petroleum Vapor Intrusion (PVI) Technical and Regulatory Guidance* (ITRC 2014) to identify whether VI is a concern.
- Identify ~~data gaps and limitations of the~~wells requiring further VI evaluation, including ~~additional~~ VI modeling ~~or~~ of groundwater and soil gas ~~collection~~ to ~~better characterize VI potential~~determine indoor air cancer risks and noncancer health effects for off-site receptors.

The approach, results, and recommendations of this off-site VI evaluation are discussed in detail below and in **Attachment F**.

Dataset Used in the Vapor Intrusion Evaluation

The Facility's facility-wide groundwater monitoring program includes gauging and sampling monitoring wells and recovery wells on a semiannual, annual, or biennial basis; and sampling irrigation wells on a semiannual or annual basis. The samples utilized in this VI evaluation are presented in **Table 3** and include off-site groundwater data, as well as several on-site locations in close proximity to the Facility boundary. The groundwater dataset includes samples collected from April 2016 through ~~2018~~April 2021.

The area of VI interest includes off-site monitoring/recovery wells located predominantly east of the Facility (i.e., downgradient). Residential and agricultural buildings are located in these off-site areas, as well as several industrial properties located south of the Facility. To be conservative, the downgradient (off-site) VI evaluation assumes ~~a~~an unrestricted, residential scenario. The off-site groundwater ~~data~~dataset used in the VI evaluation is summarized in **Table 4**.

Nature and Extent of Dissolved-Phase Hydrocarbon Plume

As shown on **Figure 1**, the historical combined extent of target VOCs present in shallow groundwater at concentrations in exceedance of their respective CGWSLs (potential VI risk driver) extends in an easterly (downgradient) direction beyond the Facility boundary. Therefore, receptors located within these off-site areas and extending 100 feet from the off-site plume extent may have potential VI concerns according to USEPA's 2015 VI Guidance ~~Documents~~Document (USEPA~~, 2015a and 2015b~~ 2015).

Selection of Constituents of Concern

Groundwater VISLs protective of residents were obtained from Table ~~A-3~~A-4 of NMED's *Risk Assessment Guidance for Site Investigations and Remediation: Volume 1 Soil Screening Guidance for Human Health Risk Assessments* (NMED~~, 2017~~ 2019) and are presented in **Table 5**. In accordance with NMED ~~2017~~2019 guidance, groundwater VISLs are based on a cancer target risk level (TRL) of 1E-05 and non-cancer hazard quotient (HQ) of 1. Note, VISLs are only available for chemicals that are considered volatile (i.e., Henry's Law Constant greater than 1E-05 atm/m^3-mol and vapor pressure greater than 1 millimeter of mercury) and have inhalation toxicity data available.

The NMED VISLs were last updated in ~~2017~~June 2019, and per industry standards and USEPA guidance, the latest toxicity criteria available were reviewed using the USEPA's Regional Screening Level (RSL) Table (USEPA, ~~2018~~2021a), which is available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables. ~~The toxicity values~~NMED VISLs are not available for ~~six~~a handful of analytes (1,2,4-trimethylbenzene [1,2,4-TMB]; 1,3,5-trimethylbenzene [1,3,5-TMB]; 2-hexanone; ~~chloromethane;~~ and n-propylbenzene~~; and trans-1,2-dichloroethylene [trans-1,2-DCE]) have changed since 2017.~~. Therefore, VISLs were calculated for these ~~six~~four analytes using USEPA's VISL calculator (USEPA~~, 2019~~ 2021b), which is available online at: https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-level-calculator. ~~Note, inhalation toxicity values are no longer available for trans-1,2-DCE; therefore, according to the USEPA guidance, a VISL could not be calculated.~~ Final residential groundwater VISLs used in the data screening process are summarized in **Table 5**.

An analyte's maximum detected ~~concentrations (MDCs~~concentration (MDC) identified in ~~off-site~~the VI groundwater datasets ~~were~~was compared to its ~~VISLs~~VISL and retained as a COC if the analyte's MDC exceeded ~~a~~its VISL. Analytes detected at concentrations below their VISLs (or analytes that were not detected in groundwater) were eliminated from further ~~consideration~~quantitative analysis in the VI evaluation~~.~~, as discussed further below. **Figure 4** identifies ~~two off-site~~those monitoring wells with VISL exceedances~~(KWB-7 and KWB-8), which are both located on the Pecan Orchard property.~~

. As shown in **Table 6**, the MDC of ~~six~~seven analytes detected in ~~off-site~~ groundwater exceeded their residential VISLs. These ~~six off-site~~seven groundwater COCs are identified as: 1,2,4-TMB; 1,3,5-TMB; benzene; ethylbenzene; ~~m,p-xylene~~MTBE; naphthalene; and total xylenes. Note, all ~~off-site~~groundwater VI COCs are petroleum hydrocarbons, which is important in evaluating separation distance, as discussed in the following section as part of a Lines of Evidence approach. ~~Individual well locations with residential VISL exceedances are provided in **Table 7** and, as mentioned above, are limited to two well locations (KWB-7 and KWB-8), which are both located on the Pecan Orchard property.~~

~~The six off-site COCs identified above were retained for further~~USEPA's RSLs are used to identify which contaminants require further evaluation and which contaminants do not require further study, as answered by USEPA's Frequently Asked Questions (FAQs) "Why are SLs used?" (available online at: https://www.epa.gov/risk/regional-screening-levels-frequent-questions) and provided below:

"They are used for site 'screening' and as initial cleanup goals, if applicable. SLs are not de facto cleanup standards and should not be applied as such. The SL's role in site 'screening' is to help identify areas, contaminants, and conditions that require further federal attention at a particular site. Generally, at sites where contaminant concentrations fall below SLs, no further action or study is warranted under the Superfund program, so long as the exposure assumptions at a site match those taken into account by the SL calculations. Chemical concentrations above the SL would not automatically designate a site as 'dirty' or trigger a response action; however, exceeding a SL suggests that further evaluation of the potential risks by site contaminants is appropriate."

Table 6 provides the following further lines of evidence why analytes detected below their VISLs are not a human health concern and do not require further evaluation. As noted above, a total of seven analytes detected in groundwater were identified as COCs. However, an additional 21 analytes were detected at least once. Of these 21 analytes, four analytes do not have inhalation toxicity values available, which is a requirement to calculate individual noncancer Hazard Quotients (HQs) or cancer risks. Of the remaining 17 detected analytes, 10 analytes were detected at less than 5% of the total samples, which according to USEPA's *Evaluating and Identifying Contaminants of Concern for Human Health (USEPA, 1994)* shows a limited occurrence, which would not require further risk evaluation. Of the remaining seven analytes, a worst-case risk evaluation was performed using the MDC as the Exposure Point Concentration (EPC) and calculating either noncancer HQs or cancer risks, depending on what the groundwater VISL is based. As shown in **Table 6**, the cumulative noncancer HQ [called the noncancer Hazard Index (HI)] and the cumulative cancer risk are at or below NMED's target noncancer and cancer risk values of 1 and 1E-05, respectively. As a result, screening out analytes detected below their groundwater VISL is warranted, as they do not pose a human health concern.

Individual well locations with residential VISL exceedances are provided in **Table 7** and are limited to 11 well locations (KWB-2R, KWB-4, KWB-7, KWB-8, MW-48, MW-58, MW-113, RW-12R, RW-13R, RW-15C, and RW-19), which are presented in **Figure 4**.

The seven COCs identified above were retained for further off-site VI evaluation in the approach outlined below.

Lines of Evidence Approach

The VI exposure pathway was evaluated based on a hierarchy of lines of evidence (or criteria), which includes:

1. VISL exceedances (discussed above);
2. Adequate separation distance between the groundwater source and building foundation (or ground surface where no buildings are present) to allow for aerobic biodegradation to occur. Note that the buildings identified and evaluated did not appear to have subsurface structures (basements) other than the former Pecan Orchard pit~~ identified previously~~, which ~~has~~had an open-air construction and would not ~~be~~have been considered a VI source because it ~~is~~was an open pit and vapors would not be drawn by advective force from the pit through cracks in a building's foundation;
3. Identification of buildings within 100 feet of VISL exceedances;

~~4. Concentration trends in wells with VISL exceedances; and~~

4. Presence of PSH in wells; and
5. Presence of preferential pathways through utility or sewer lines.

The sequential lines of evidence/criteria are each discussed below, followed by a discussion of recommended next steps.

Separation Distance Criteria

Table 8 presents a refined VI evaluation of~~ off-site~~ groundwater monitoring/recovery wells with residential VISL exceedances. Among these wells, the depth to groundwater was identified to determine whether adequate separation distance exists between the groundwater source and building foundation (or ground surface where no buildings are present) to allow for aerobic biodegradation to occur. According to ~~USEPA's 2015 Office of Underground Storage Tanks (OUST) VI guidance, 6~~Interstate Technology and Regulatory Council's (ITRC's) Petroleum Vapor Intrusion (PVI) Technical and Regulatory Guidance (ITRC 2014), five (5) feet is ~~an adequate~~sufficient vertical separation distance ~~for dissolved-phase~~between groundwater (from any petroleum ~~hydrocarbons (USEPA, 2015b), which allows for elimination of~~ source) and a building's foundation to allow adequate aerobic biodegradation of volatiles emanating from groundwater before reaching a building's foundation. When biodegradation occurs and the ~~VI concern. As shown in **Table 8**,~~resulting vapor concentrations reaching the ~~only off-site buildings of concern~~building's foundation are ~~at~~low to non-detect, the ~~Pecan Orchard plant, which appear to have a slab-on-grade construction (~~VI exposure pathway is no ~~basement present),~~longer a health concern (ITRC 2014).

The concept and identification of a vertical separation distance for petroleum hydrocarbons is based on empirical data housed in USEPA's Vapor Intrusion database, which is available at: https://www.epa.gov/vaporintrusion/vapor-intrusion-database. The vertical separation distance established in ITRC's PVI guidance were part of ITRC's collaborative effort in creating technical guidance, which was overseen and peer-reviewed by multiple state regulatory agencies, including NMED. Specifically, NMED's own regulator, Susan von Gonten (NMED's Petroleum Storage Tank Bureau) was a contributing author of the PVI guidance.

Table 8 presents the minimum depth to groundwater observed since 2016 at each well with a ~~subsurface pecan processing pit. Therefore, monitoring wells KWB-7 and KWB-8, with groundwater greater than 6~~VISL exceedance, which ranges from 13.43 feet bgs ~~and petroleum hydrocarbon COCs~~at KWB-7 to 19.34 feet bgs at RW-19. This depth to groundwater range is greater than 5 feet bgs (i.e., vertical separation distance between groundwater and building slab foundation is greater than ~~6 feet), were~~ 5 feet, which allows for adequate vertical distance for bioattenuation to occur). Therefore, the petroleum hydrocarbon groundwater COCs at all 11 wells were eliminated as a VI concern, as shown in **Table 8**.

Building Distance Criteria

The second screening criterion identifies whether the distance between the off-site groundwater well of interest with PSH and the nearest building is less than 100 feet. According to USEPA's 2015 ~~OUST and~~ Office of Solid Waste and Emergency Response (OSWER) VI guidance ~~documents~~document, 100 feet is an adequate radius distance from a building, in which the building would not have enough advective force to pull vapors from the subsurface through cracks in the building's foundation (USEPA, ~~2015a and 2015b).~~ 2015). **Table 8** identifies ~~only one~~three groundwater monitoring ~~well~~wells (KWB-8, RW-12R, RW-13R) located less than 100 feet from buildings (Pecan Orchard ~~plant). Monitoring well KWB-7 was~~Plant). All other wells presented in **Table 8** were eliminated from further VI evaluation, as no off-site buildings are located within 100 feet from ~~the well. **Figure 5** presents~~these wells. **Figures 5A** and **5B** present this 100-foot radius around ~~off-site~~each groundwater monitoring ~~wells KWB-7 and KWB-8~~well with VISL exceedances.

~~Groundwater Data Trends~~

~~Monitoring well KWB-8 is recommended for further evaluation as shown above; therefore, groundwater concentration data trends were evaluated, and are provided in **Attachment A**. In general, groundwater concentration data over time indicates a range of concentrations, including non-detect results, as may be expected due to the fluctuating groundwater elevations and presence of PSH in these wells. Although groundwater trends are predominantly stable to decreasing, eliminating KWB-8 from further evaluation based on groundwater data trends is not recommended at this time due the presence of PSH, which requires further investigation.~~

Presence of PSH

~~A final~~Another line of evidence evaluates whether PSH present in ~~seven off-site~~the identified groundwater monitoring/recovery wells ~~(KWB-4, KWB-7, KWB-8, RW-15C, RW-20A, RW-20B and RW-22)~~ may present a VI concern to nearby building occupants (within 100 feet laterally), which is summarized in **Table** ~~9.~~ **8** and represented in **Figures 5a and 5b**. According to ~~USEPA's 2015 OUST VI guidance, 15~~ITRC's PVI Technical and Regulatory Guidance (ITRC 2014), 18 feet is ~~an adequate~~sufficient vertical separation distance between PSH from ~~PSH to~~ a ~~building~~refinery source and a building's foundation ~~for free-phase petroleum hydrocarbons (USEPA, 2015b). Of~~to allow adequate aerobic biodegradation of volatiles emanating from PSH before reaching a building's foundation. When biodegradation occurs and the resulting vapor concentrations reaching the ~~off-site buildings located near PSH (Pecan Orchard plant buildings and commercial/industrial buildings located in~~ building's foundation are low to non-detect,~~the vicinity of RW-15C and KWB-4), all appear to have slab foundations. Therefore, monitoring/recovery wells KWB-4, RW-15C, RW-20A, and RW-20B~~ the VI exposure pathway is no longer a health concern (ITRC 2014). **Table 8** presents the current depth (April 2021) to PSH at each well with ~~PSH present at depths~~ a VISL exceedance, which ranges from 21.69 feet bgs at RW-15C to 27.10 feet bgs at RW-12R. This depth to PSH range is greater than ~~15~~18 feet bgs (i.e., vertical separation distance between ~~PSH~~groundwater and building slab foundation is greater than ~~15 feet)~~ 18 feet, which allows for adequate vertical distance for bioattenuation to occur). Therefore, the petroleum hydrocarbon groundwater COCs at all 11 wells were eliminated ~~from further~~as a VI ~~evaluation~~concern, as shown in **Table 8** ~~9. As stated above,~~.

Presence of Preferential Pathways

A final line of evidence evaluates whether preferential pathways created by sewer lines or other subsurface piping may pose a VI concern. Specifically, this line of evidence identifies whether a preferential pathway for vapors exists between the 11 wells with groundwater VISL exceedances and potential PSH sources (identified in **Table 8**) and nearby buildings. Field monitoring ~~well KWB-7 was eliminated~~data compiled by Beckley and McHugh (2020) from ~~further VI evaluation as the Pecan Orchard plant buildings are greater~~more than ~~100 feet~~30 sites identifies the interaction between sewer pipes and subsurface VOC sources as the predominant factor that determines whether preferential pathways are a VI concern. Their findings indicate that when sewer pipes are located above and separated from the ~~well.~~VOC source, the risk of preferential pathways contributing to VI concerns is low. As shown in **Table 8**, the minimum depth to groundwater since 2016 is 13.49 feet bgs and the current minimum depth to PSH (April 2021) is 21.69 feet bgs. These depths are significantly deeper than conventional sewer lines, which are typically located between 5 feet bgs and 6 feet bgs. Given the distance between groundwater/PSH source and the sewer pipes, preferential pathways would not be a concern.

Lines of Evidence Conclusions

Based on the lines of evidence approach, virtually all potential receptors can be eliminated from the risk of vapor intrusion. As detailed in ~~**Tables**~~ **Table 8** ~~**and 9** for off-site groundwater and PSH, respectively~~, only ~~two~~three monitoring/recovery wells (KWB-8~~ and~~, ~~RW-22~~RW-12R, and RW-13R) indicate a potential VI concern for off-site workers~~. Specifically, KWB-8 may be a concern to~~ at the Pecan Orchard ~~plant worker~~Plant, but only because~~, although depth to groundwater is greater than 6 feet, PSH is present at less than 15 feet vertical separation distance and the plant building is~~ these wells are located ~~nearby. Likewise, RW-22, a recovery well, is located near the Pecan Orchard plant, and PSH is present at a depth~~within approximately 100 feet of ~~less than 15 feet vertical separation distance. Further~~off-site buildings. Therefore, an expanded off-site VI evaluation of KWB-8~~ and~~, ~~RW-22~~RW-12R, and RW-13R in relation to the Pecan Orchard ~~plant buildings is recommended. The remaining receptors were confirmed to not be at risk for vapor intrusion based on the lines of evidence approach~~Plant buildings was conducted, as detailed in **Attachment F**.

As shown in **Attachment F**, the result of the expanded off-site VI evaluation indicated that individual and cumulative indoor air risks were acceptable when modeling maximum detected groundwater and soil gas concentrations of COCs into the indoor air of two Pecan Orchard Plant Buildings (North and South Buildings). This modeling effort, along with empirical evidence that bioattenuation is occurring for petroleum hydrocarbons in the subsurface, provide robust lines of evidence that VI is not a human health concern at these buildings. As a result, further evaluation of the VI pathway is not required.

DATA GAPS AND LIMITATIONS

The data gaps and limitations identified/encountered during the desktop off-site groundwater receptor survey and off-site VI evaluation are described below.

~~Off-Site Groundwater Receptor Survey~~

- Inaccurate well location data in NMOSE records necessitate, to the degree feasible, confirmation of the presence and location of key potential domestic ~~wells RA-02793, RA-02827, RA-03195, RA-03353, and RA-10378 through visual field survey.~~ well RA-10378.

HFNR is working on confirming the presence and location of this well and will attempt to obtain access to sample the well (if present and operable).

~~Off-Site Vapor Intrusion Evaluation~~

- ~~Confirmation of building-specific construction details and worker occupancy information for the Pecan Orchard plant buildings to further evaluate potential for VI exposure.~~
- ~~Identify geotechnical parameters such as soil bulk density, total porosity, and water-filled porosity for soils in vicinity of the Pecan Orchard plant, KWB-8, and RW-22 to further evaluate potential for VI exposure.~~
- Future off-site land use, future downgradient off-site receptors, and construction relative to future plume conditions are not known. HFNR does not have knowledge of future off-site conditions, but the shallow groundwater plumes are primarily located within HFNR-owned property or the Pecan Orchard. The downgradient extent of the plumes is not expected to change and will be monitored on a regular basis. Additionally, it is HFNR's understanding that the Pecan Orchard does not plan to sell the property in the foreseeable future.

RECOMMENDATIONS

- ~~Install two monitoring wells south of monitoring well MW-135, as shown on **Figures 2**~~Confirm the presence and ~~**3**, to identify whether the downgradient residential property (Parcel ID 4-154-098-397-381) and~~ location of potential domestic water ~~wells~~well RA-10378~~-02793 and RA-03195 are affected by the dissolved-phase hydrocarbon and PSH plumes.~~
    - ~~Install one monitoring well west of domestic well RA-02793 and east of monitoring well KWB-7 to better define the downgradient extent of the benzene, MTBE and PSH plumes.~~
    - ~~Install one monitoring well west of domestic well RA-03195 and east of monitoring wells KWB-11A and KWB-11B to better define the downgradient extent of the benzene and MTBE plumes.~~
- ~~Install two monitoring wells near~~ on the residential property with Parcel ID 4-153-098-515-219~~as shown on **Figures 2** and **3**, to identify whether the potential domestic water well RA-10378~~. HFNR will attempt to obtain an access agreement to sample the well (if present and operable) to determine if it is affected by the dissolved-phase hydrocarbon plume~~ and to further delineate the extent of MTBE in exceedance of CGWSL at monitoring well NP-1:~~.
    - ~~Install one monitoring well to the north of monitoring well MW-133, near the southwestern corner of Parcel ID 4-153-098-515-219, to better delineate the crossgradient extent of the benzene and MTBE plumes.~~

- ~~Install one monitoring well to the west of monitoring well NP-1, across Bolton Road from the eastern portion of Parcel ID 4-153-098-515-219, to better delineate the upgradient extent of the isolated MTBE plume near monitoring well NP-1.~~

- ~~Navajo~~HFNR will attempt to obtain an access agreement for Parcel ID 4-154-099-146-071 to sample shallow monitoring wells KWB-3AR and KWB-9 and any operable water wells. If not successful, ~~Navajo~~HFNR will evaluate the feasibility and effectiveness of installing one monitoring well along Highway 82 north of Parcel ID 4-154-099-146-071 (though access for a well may not be feasible).

- ~~Conduct VI modeling using existing groundwater data from monitoring well KWB-8, which will also evaluate the area of recovery well RW-22, to determine any potential indoor air risk to the Pecan Orchard plant buildings.~~

- ~~If the predicted indoor air risk based on VI modeling is unacceptable, then collect multi-depth soil gas data from a nested soil gas probe(s) near the Pecan Orchard plant building(s). Soil gas data will be used to characterize bioattenuation and conduct further VI modeling for the Pecan Orchard plant buildings.~~

- ~~Continue mitigation activities at the Pecan Orchard pit to continue to ensure impacted groundwater and PSH do not infiltrate the pit.~~

- Install one shallow monitoring well between wells NP-1, MW-145, and MW-133 to further investigate MTBE in shallow groundwater in this area, in accordance with NMED directives in letters dated May 7, 2021, and July 15, 2021. A work plan to install the additional monitoring well in this area will be submitted to NMED by December 31, 2021.

- Install two shallow monitoring wells in the southern portion of the Facility to better define the crossgradient extent of the dissolved-phase and PSH plumes south of Highway 82. One well is proposed to be installed south of monitoring wells MW-109 and MW-110 and one well is proposed to be installed south of monitoring KWB-6 and MW-132. The proposed approximate well locations are shown on **Figures 2** and **3**.

ATTACHMENTS

Attachment E: HFNR August 19, 2021, Memorandum Documenting Closure of Pecan Pit

Attachment F: Expanded Off-Site Vapor Intrusion Evaluation

REFERENCES

Beckley, L; McHugh, T. A conceptual model for vapor intrusion from groundwater through sewer lines. *Sci. Total Environ,* 2020, 698, 134283.

ITRC 2014. *Petroleum Vapor Intrusion (PVI) Technical and Regulatory Guidance.* https://projects.itrcweb.org/PetroleumVI-Guidance/Content/Resources/PVIPDF.pdf. October 2014.

NMED~~. 2017~~ 2019. *Risk Assessment Guidance for Site Investigations and Remediation. Volume 1. Soil Screening Guidance for Human Health Risk Assessments.* ~~Table A-3: NMED Vapor Intrusion Screening Levels (VISLs). March~~February 2019, Revision 2, June 19, 2019.

~~USEPA. 2015a.~~USEPA 1994. Region 8, Superfund Technical Guidance. *Evaluating and Identifying Contaminants of Concern for Human Health.* United States Environmental Protection Agency, Hazardous Waste Management Division, Superfund Management Branch, Technical Section. September 1994.

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~~USEPA. 2018~~ 2021a. *Regional Screening Level (RSL) Table*. November ~~2018~~2021 update: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables.

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Attachment F
Expanded Off-Site Vapor Intrusion Evaluation

1.0 INTRODUCTION AND SUMMARY

As identified in **Table 8 of the main memorandum** (*Desktop Groundwater Receptor Survey and Vapor Intrusion Evaluation of Off-Site Receptors – Revised*, December 30, 2021), the initial vapor intrusion (VI) screening of current (2016-present) off-site groundwater data (and several on-site locations in close proximity to the Facility boundary) identified one off-site monitoring well (KWB-8) and two on-site recovery wells (RW-12R and RW-13R) with potential VI concerns. All three (3) wells may pose a VI concern to the neighboring Pecan Orchard Plant's indoor workers because these groundwater wells are located within approximately 100 feet of Pecan Orchard Plant buildings, even though there is sufficient vertical separation distance between groundwater/PSH and building foundations to allow adequate aerobic biodegradation, as discussed below.

According to Interstate Technology and Regulatory Council's (ITRC's) *Petroleum Vapor Intrusion (PVI) Technical and Regulatory Guidance* (ITRC 2014), five (5) feet is sufficient vertical separation distance between groundwater (from any petroleum source) and a building's foundation to allow adequate aerobic biodegradation of volatiles emanating from groundwater before reaching a building's foundation. Likewise, 18 feet is sufficient vertical separation distance between PSH from a refinery source and a building's foundation to allow adequate aerobic biodegradation of volatiles emanating from PSH before reaching a building's foundation. When biodegradation occurs and the resulting vapor concentrations reaching the building's foundation are low to non-detect, the VI exposure pathway is no longer a health concern (ITRC 2014).

The concept and identification of vertical separation distances for petroleum hydrocarbons is based on empirical data housed in USEPA's Vapor Intrusion database, which is available at: https://www.epa.gov/vaporintrusion/vapor-intrusion-database. The vertical separation distances established in ITRC's PVI guidance were part of ITRC's collaborative effort in creating technical guidance, which was overseen and peer-reviewed by multiple state regulatory agencies, including NMED. Specifically, NMED's own regulator, Susan von Gonten (NMED's Petroleum Storage Tank Bureau) was a contributing author of the PVI guidance.

Even though all three groundwater sampling locations meet the appropriate separation distances for groundwater and PSH, TRC conducted a site-specific VI evaluation of the Pecan Orchard Plant buildings by modeling maximum detected groundwater and soil gas concentrations up through the unsaturated zone and into the Pecan Orchard Plant's North and South Buildings, as shown in **Figure F-1**, to determine cancer risks and noncancer health effects for personnel working inside the Pecan Orchard Plant buildings. Based on the modeling results, all indoor air cancer risks and noncancer health effects from groundwater and soil gas data indicate no potential VI concern for those personnel working exclusively inside the Pecan Orchard Plant. The methodology, as well as modeling inputs, and results of the additional VI evaluation, are provided below.

2.0 METHODOLOGY

This VI evaluation was conducted in accordance with New Mexico Environmental Department's (NMED's) June 2019 Risk Assessment Guidance for Site Investigations and Remediation, Volume I, Soil Screening Guidance for Human Health Risk Assessments (NMED 2019) and ITRC's *Petroleum Vapor Intrusion (PVI) Technical and Regulatory Guidance* (ITRC 2014). Modeling of VI concerns was conducted using USEPA's Johnson and Ettinger's (J&E's) Advanced Models for Groundwater Contamination (GW-ADV-Feb04.xls) and Soil Gas Contamination (SG-ADV-Feb04.xls) version 3.1. Although a newer version of USEPA's J&E Model is available, multiple errors have been identified in the hard-wired calculations of that model. As a result, the previous J&E Model, version 3.1, was used to estimate indoor air risks, which incorporates site-specific geotechnical, exposure, and structural information. The J&E VI model is a one-dimensional model, which assumes steady-state conditions. As a result, the model represents the point in time when groundwater vapors reach the base of the building foundation at their maximum concentrations (most conservative scenario). Some specific assumptions are presented below:

- The Pecan Orchard Plant is composed of commercial structures, which assumes an 8-hour workday. The indoor air exchange rate for both the North and South Buildings is assumed to be 1.36 changes per hour, which is representative of a manufacturing facility.
- Workers in the Pecan Orchard Plant are conservatively assumed to spend 250 days per year indoors (USEPA 2014); however, harvesting and processing pecans only occurs during the autumn months, although it is not unreasonable for workers to be inside the buildings during other times of the year. Note, the Pecan Orchard Plant North Building will cease processing operations and is slated to be used for vehicle maintenance and storage.
- The building slabs may have utility penetrations and perimeter cracks in the foundation. The effect of the penetrations and foundation cracks was simulated in the model by assuming a typical number of cracks in the floor. Historically, the North Building housed an open pit used in pecan processing; however, this pit was filled and covered with a concrete slab on August 19, 2021.
- Based on the map of average shallow groundwater temperatures (USEPA 2004), the average soil temperature for Artesia, New Mexico, is 16.67 degrees Celsius.

3.0 J&E GROUNDWATER MODELING INPUTS

As stated above, wells KWB-8, RW-12R and RW-13R were further evaluated for potential VI concerns due to their proximity to Pecan Orchard Plant buildings. Specifically, both KWB-8 and RW-13R are located near the North Building, while RW-12R is closer to the South Building. Therefore, VI modeling was conducted using groundwater data from all three (3) wells, as summarized in **Table F-1**. The groundwater COCs presented in **Table F-1** include those analytes with screening level exceedances, which are presented in **Table 7 of the main memorandum**.

As highlighted in **Table F-1**, the maximum detected groundwater concentration for each COC was identified and used in the J&E model to characterize the most conservative exposure scenario for both

North Building and South Building indoor workers. The J&E model assumes a sandy clay soil type based on site-specific borings. Therefore, USEPA default values for sandy clay were assumed, as presented in **Table F-2**, and include:

- soil dry bulk density (1.63 grams per cubic centimeters [g/cm^3]),
- soil total porosity (0.385 unitless), and
- soil water-filled porosity (0.197 unitless).

The sandy clay stratum spans most of the lithology from grade to the minimum depth to groundwater, which ranges from 12.69 feet below ground surface (bgs) to23.74 feet bgs based on historical gauging measurements since April 2016. **Table F-3** provides the exposure assumptions for a typical Pecan Orchard Plant worker, who is assumed to work indoors exclusively. **Table F-3** also provides the building-specific assumptions for the North and South Buildings of the Pecan Orchard Plant, which are based on aerial measurements of the building footprints as well as USEPA's conservative default values for the building foundation, which assumes slab-on-grade construction. The modeling input also requires inhalation toxicity values for each COC, which are provided in **Table F-4.** All inhalation toxicity values are taken from USEPA's November 2021 Regional Screening Level (RSL) table (USEPA, 2021).

4.0 J&E GROUNDWATER MODELING RESULTS

The results of the groundwater J&E models for the North and South Buildings (provided as **Appendices F-1 and F-2, respectively**) were used to predict groundwater vapor migration into indoor air and estimate indoor air cancer risks and noncancer health effects to workers inside the North and South Buildings of the Pecan Orchard Plant. As shown in **Table F-5**, individual and cumulative groundwater risks were all significantly below NMED's acceptable cancer target risk level (TRL) of 1E-05 and noncancer target hazard quotient (THQ) of 1.0, indicating that VI is not a concern for Pecan Orchard Plant workers in either building. As a result, the groundwater VI pathway does not require further evaluation.

5.0 SOIL GAS EVALUATION

Although groundwater is not a VI concern for the Pecan Orchard Plant indoor worker, potential VI concerns related to PSH near the North Building were originally identified as a data gap. To fill this data gap, soil gas data were collected from five (5) locations near the North Building of the Pecan Orchard Plant: VP-1 through VP-5 (see **Figure F-1**) in October 2020 and July 2021. Three (3) nested soil vapor probes (VP) were installed at each soil gas location. The nested probes collected samples from a shallow (5 feet bgs), an intermediate (7 feet bgs), and a deep (12 feet bgs) interval to characterize the vertical profile of soil gas and determine any vertical trends, including whether biodegradation is occurring.

6.0 SOIL GAS SCREENING AND VERTICAL PROFILING

The October 2020 and July 2021 soil gas data collected across all three depth intervals (5, 7, and 12 feet bgs) at each vapor probe are summarized in **Table F-6** and screened against NMED's soil gas VISLs protective of the Pecan Orchard Plant worker, if available. Otherwise, USEPA's soil gas VISLs are used to screen data. Seven (7) soil gas COCs were detected at concentrations in exceedance of VISLs as follows:

- 2-propanol (VP-3 at deep depth);
- benzene (VP-2 & VP-3 at all depths; VP-4 & VP-5 at intermediate and deep depths);
- cyclohexane (VP-2 at intermediate and deep depths);
- ethylbenzene (VP-3 at shallow depth; VP-4 at deep depth);
- heptane (VP-2 at intermediate and deep depths);
- n-hexane (VP-2 at all depths); and
- 1,2,4-trimethylbenzene (VP-4 at deep depth).

Note, there were no soil gas VISL exceedances at VP-1.

As summarized in **Table F-7**, although 2-propanol has one VISL exceedance at VP-3's deepest interval (12 feet bgs) in October 2020, both the shallow and intermediate VP-3 intervals are acceptable in October 2020 and July 2021, indicating that 2-propanol is not a VI concern at VP-3, and further evaluation is not required. Similarly, shallow interval concentrations of cyclohexane and heptane at VP-2 are acceptable in both October 2020 and July 2021 samples, even though their intermediate and deeper interval concentrations exceeded VISLs. As a result, neither cyclohexane nor heptane are a VI concern at VP-3, and further evaluation is not required. Lastly, 1,2,4-trimethylbenzene recently exceeded its soil gas VISL in the deepest interval (12 feet bgs) of VP-4; however, intermediate and shallow interval concentrations were acceptable. Therefore, 1,2,4-trimethylbenzene is not a concern at VP-4 and does not require further evaluation.

While n-hexane is not identified as a groundwater COC, soil gas collected from VP-2 exceeds n-hexane's soil gas VISL at all depths. Therefore, n-hexane was identified as a soil gas COC and requires further evaluation.

Vertical concentration profiles at VP-1, VP-2, VP-4, and VP-5 indicate that bioattenuation is occurring due to decreasing concentrations from deep to shallow soil gas intervals for many petroleum hydrocarbons. In fact, the shallow interval at VP-4 and VP-5 is acceptable for all soil gas COCs. VP-3 shows inconsistent results, with some analytes showing increasing concentrations as depth decreases indicating that groundwater and/or PSH are not the source of the VISL exceedances in the shallow interval. **Table F-7** presents the trends for each soil vapor probe, including specific soil gas VISL exceedances (VP-2, VP-3, VP-4, and VP-5).

7.0 SOIL GAS MODELING

Similar to the groundwater screening process, VI potential from soil gas COCs near the North Building of the Pecan Orchard Plant was evaluated for remaining soil gas COCs (benzene, ethylbenzene, and n-hexane) using USEPA's J&E Advanced Model for Soil Gas Contamination (SG-ADV-Feb04.xls), which incorporates site-specific geotechnical, exposure, inhalation toxicity, and structural information, as discussed above.

The results of the soil gas J&E model (provided in **Appendix F-3**) were used to predict soil gas migration into indoor air at the North Building of the Pecan Orchard Plant and estimate indoor air cancer risks and noncancer health effects to North Building workers. As shown in **Table F-8**, individual and cumulative soil gas risks were all significantly below NMED's acceptable cancer TRL of 1E-05 and noncancer THQ of 1.0, indicating that VI is not a concern for Pecan Orchard Plant workers. As a result, the soil gas VI pathway does not require further evaluation.

8.0 SUMMARY AND CONCLUSIONS

The purpose of this expanded VI evaluation is to provide a thorough evaluation of off-site VI concerns. Both groundwater and soil gas data were initially screened to identify COCs requiring further evaluation through VI modeling. Based on the modeled indoor air risks from maximum detected groundwater and soil gas concentrations, individual and cumulative risks were acceptable, indicating that VI is not a concern for indoor workers at the Pecan Orchard Plant. This information, along with empirical evidence that bioattenuation is occurring for petroleum hydrocarbons in the subsurface, provide robust lines of evidence that VI is not a human health concern. As a result, further evaluation of the VI pathway is not required.

9.0 REFERENCES

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Tables

Table F-1
Summary of Groundwater COC
Requiring Further Evaluation
HollyFrontier Navajo Refining LLC, Artesia, NM

Pecan Orchard Plant	Sample Name	Sample Date	COC	CAS Number	Concentration (µg/L)
North Building	**KWB-08**	**10/6/2020**	**1,2,4-Trimethylbenzene**	**95-63-6**	**833**
	KWB-08	4/25/2017	1,2,4-Trimethylbenzene	95-63-6	380
	KWB-08	**10/6/2020**	**1,3,5-Trimethylbenzene**	**108-67-8**	**191**
	KWB-08	**10/6/2020**	**Benzene**	**71-43-2**	**17,800**
	KWB-08	10/3/2017	Benzene	71-43-2	12,500
	KWB-08	10/5/2016	Benzene	71-43-2	11,500
	KWB-08	4/25/2017	Benzene	71-43-2	5,620
	RW-13R	4/27/2016	Benzene	71-43-2	878
	RW-13R	4/4/2018	Benzene	71-43-2	77
	KWB-08	**10/6/2020**	**Ethylbenzene**	**100-41-4**	**2,890**
	KWB-08	4/25/2017	Ethylbenzene	100-41-4	1,240
	KWB-08	10/5/2016	Ethylbenzene	100-41-4	828
	KWB-08	10/3/2017	Ethylbenzene	100-41-4	617
	RW-13R	4/27/2016	Ethylbenzene	100-41-4	69.1
	KWB-08	**10/6/2020**	**Naphthalene**	**91-20-3**	**539**
	KWB-08	4/25/2017	Naphthalene	91-20-3	141
	KWB-08	10/3/2017	Naphthalene	91-20-3	51.9
	KWB-08	**10/6/2020**	**Xylenes, total**	**1330-20-7**	**4,190**
	KWB-08	4/25/2017	Xylenes, total	1330-20-7	2,070
	KWB-08	10/5/2016	Xylenes, total	1330-20-7	1,160
	KWB-08	10/3/2017	Xylenes, total	1330-20-7	795
South Building	**RW-12R**	**4/28/2016**	**Benzene**	**71-43-2**	**424**
	RW-12R	4/27/2017	Benzene	71-43-2	335
	RW-12R	6/17/2020	Benzene	71-43-2	154
	RW-12R	4/2/2019	Benzene	71-43-2	76.4
	RW-12R	4/4/2018	Benzene	71-43-2	35.8

Notes:
Bold and highlight indicates maximum detected concentration.
GW VISL = groundwater vapor intrusion screening level
µg/L = micrograms per liter

Table F-2
Summary of Site-Specific Geotechnical Input Parameters
HollyFrontier Navajo Refining LLC, Artesia, NM

Modeling Input Parameters	Depth to GW [a]	Soil Type	Total Soil Porosity (θ_T)	Air-Filled Porosity (θ_A)	Water-Filled Porosity (θ_W) (calculated) = moisture content x ρ_b	Stratum Soil Particle Density (ρ_s)	Stratum Soil Bulk Density (ρ_b) (calculated) = ρ_s x (1-θ_T)	Average Soil/ GW Temperature
	cm (ft)	NA	Unitless	Unitless	Unitless	g/cm^3	g/cm^3	degrees C (F)
North Building	411.16 (13.49)	Sandy Clay (SC)	0.385 [b]	0.188 [b]	0.197 [b]	2.65 [b]	1.63 [b]	16.67 (62) [c]
South Building	543.43 (17.83)							

Notes:

[a] Location-specific minimum depth to groundwater since 2016; KWB-8 and RW-12R represent minimum groundwater depths for North and South Buildings, repsectively.

[b] Default assumption for sandy clay soil, as presented in USEPA, 2004.

[c] Based on Figure 8 (USEPA, 2004)

C = Celsius

cm = centimeters

F = Fahrenheit

ft = feet

g/cm^3 = grams per cubic centimeter

GW = groundwater

Reference:

USEPA, 2004. U.S. Environmental Protection Agency. User's Guide for the Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings. Office of Emergency and Remedial Response, Toxics Integration Branch (5202G), Washington, D.C. Feb

Table F-3
Summary of Exposure and Building-Specific Assumptions
HollyFrontier Navajo Refining LLC, Artesia, NM

General Assumptions	Value	Reference
AT (averaging times):		
Carcinogenic effects	70 yrs	EPA recommended life expectancy value [USEPA, 2014]
Chronic effects (noncarc.)	25 yrs	EPA recommended industrial value [USEPA, 2014]
Exposure Assumptions		
EF (exposure frequency)	250 days/yr	EPA recommended industrial value (USEPA, 2014)
EF (exposure frequency) - ADJUSTED	83 days/yr	The J&E model does not allow modifications to ET or IR; therefore, the EF was modified using the following equation: *ADJUSTED EF (days/year) = [ET (8 hrs/day)]/24 hrs/day] x EF (250 days/yr)*
ED (exposure duration)	25 yrs	EPA recommended industrial value (USEPA, 2014)
Inhalation of Subsurface Volatiles in Indoor Air		
IR (inhalation rate)	20 m^3/day	EPA recommended daily inhalation rate (USEPA, 2004)
ET (exposure time)	8 hrs/day	standard default exposure factor for commercial/industrial workers (professional judgement)
Pecan Orchard Building Assumptions		
Depth below grade to bottom of enclosed space floor, both buildings	15 cm	slab-on-grade default value (USEPA, 2004)
Enclosed space floor thickness, both buildings	10 cm	default value (USEPA, 2004)
Soil-building pressure differential, both buildings	40 g/cm-s^2	default value (USEPA, 2004)
Enclosed space floor length, North Building	7,437 cm (244 ft)	Assumes site-specific building length of 244 ft (professional judgement)
Enclosed space floor width, North Building	4,861 cm (159.5 ft)	Assumes site-specific building width of 159.5 ft (professional judgement)
Enclosed space floor length, South Building	4,224.3 cm (138.6 ft)	Assumes site-specific building length of 138.6 ft (professional judgement)
Enclosed space floor width, South Building	5,498.3 cm (180.4 ft)	Assumes site-specific building width of 180.4 ft (professional judgement)
Enclosed space height, both buildings	609.6 cm (20 ft)	Assumes site-specific building height of 20 feet (professional judgement)
Indoor air exchange rate, both buildings	1.36 changes/hr	Geometric mean of manufacturing facility building (USEPA, 2002; Table 6-15)
Floor-wall seam crack width, both buildings	0.1 cm	default value (USEPA, 2004)

Notes:
cm = centimeters
g/cm-s^2 = grams per centimeter-square seconds
hr = hour
m^3/day = cubic meters per day
yr = year

References:
USEPA, 2004. User's Guide for the Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings. Office of Emergency and Remedial Response, Toxics Integration Branch (5202G), Washington, D.C. Feb
USEPA, 2014. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9200.1-120. February 6.

Table F-4
Summary of Inhalation Toxicity Values
HollyFrontier Navajo Refining LLC, Artesia, NM

Analytes of Concern [a]	CAS	Inhalation Unit Risk Factor $(\mu g/m^3)^{-1}$	Reference	Inhalation Reference Concentration (mg/m^3)	Reference
1,2,4-Trimethylbenzene	95-63-6	NA		6.00E-02	IRIS
1,3,5-Trimethylbenzene	108-67-8	NA		6.00E-02	IRIS
Benzene	71-43-2	7.80E-06	IRIS	3.00E-02	IRIS
Ethylbenzene	100-41-4	2.50E-06	CalEPA	1.00E+00	IRIS
Naphthalene	91-20-3	3.40E-05	CalEPA	3.00E-03	IRIS
n-Hexane	110-54-3	NA		7.00E-01	IRIS
Xylene, Total	1330-20-7	NA		1.00E-01	IRIS

Notes:

[a] All toxicity values taken from NMED's 2019 Risk Assessment Guidance (NMED, 2019) and USEPA's November 2021 Screening Level Table (USEPA, 2021).

COC = chemical of concern

$\mu g/m^3$ = micrograms per cubic meter

mg/m^3 = milligrams per cubic meter

References:

CalEPA = California Environmental Protection Agency value.

IRIS = Integrated Risk Information System Database. Available online at: www.epa.gov/iris

NMED, 2019. Risk Assessment Guidance for Investigations and Remediation. Volume 1, Soil Screening Guidance for Human Health Risk Assessments. February 2019, Revision 2, June 19. Table C-1.

USEPA, 2021. Regional Screening Level (RSL) Table, November 2021 update. Available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Table F-5
Summary of Modeled Groundwater Risks
HollyFrontier Navajo Refining LLC, Artesia, NM

North Building COC	Cas Number	Maximum Detect Groundwater Concentration [a] (µg/L)	USEPA J&E Groundwater Modeling Results Version 3.1	
			Cancer Risk, Indoor Worker	Noncancer Hazard Quotient, Indoor Worker
1,2,4-Trimethylbenzene	95-63-6	833	NA	0.0003
1,3,5-Trimethylbenzene	108-67-8	191	NA	0.0001
Benzene	71-43-2	17,800	1.3E-06	0.0160
Ethylbenzene	100-41-4	2,890	7.9E-08	0.0001
Naphthalene	91-20-3	539	1.6E-08	0.0004
Xylenes, Total	1330-20-7	4,190	NA	0.0012
Cumulative Cancer Risk / Noncancer Hazard Index (HI)			**1.4E-06**	**0.018**

South Building COC	Cas Number	Maximum Detect Groundwater Concentration [a] (µg/L)	USEPA J&E Groundwater Modeling Results Version 3.1	
			Cancer Risk, Indoor Worker	Noncancer Hazard Quotient, Indoor Worker
Benzene	71-43-2	424	3.6E-08	0.0004
Cumulative Cancer Risk / Noncancer Hazard Index (HI)			**3.6E-08**	**0.0004**

Notes:
[a] As identified in Table F-1
Acceptable cancer risk = 1E-05 and noncancer hazard index (HI) = 1.0, consistent with NMED VI guidance (NMED, 2019).
µg/L = micrograms per liter

References:
NMED, 2019. Risk Assessment Guidance for Investigations and Remediation. Volume 1, Soil Screening Guidance for Human Health Risk Assessments. February 2019, Revision 2, June 19.

Table F-6, Summary of Soil Gas Data

HollyFrontier Navajo Refining LLC, Artesia, NM

Chemical Name		Sample ID:	VP-01-5	VP-01-5	VP-01-7	VP-01-7	VP-01-12	VP-01-12	VP-02-5	VP-02-5	VP-02-7	DUP-01	VP-02-7	DUP-01	VP-02-12	VP-02-12
		Date:	10/22/2020	7/18/2021	10/22/2020	7/18/2021	10/22/2020	7/18/2021	10/22/2020	7/18/2021	10/22/2020	10/22/2020	7/18/2021	7/18/2021	10/22/2020	7/18/2021
		Dup:										FD		FD		
		Sample Depth (ft bgs):	5	5	7	7	12	12	5	5	7	7	7	7	12	12
	Industrial Soil Gas VISL (µg/m^3) [a]		µg/m^3		µg/m^3		µg/m^3		µg/m^3		µg/m^3				µg/m^3	
1,1,1-Trichloroethane	**819,304**	NMED	<1.09	<698	<1.09	<328	<43.5	<4540	<43.5	<9110	<87	<87	<4540	<6820	<2180	<22800
1,1,2,2-Tetrachloroethane	**79.11**	NMED	<1.37	<879	<1.37	<413	<55	<5720	<55	<11500	<110	<110	<5720	<8580	<2750	<28600
1,1,2-Trichloroethane	**32.77**	NMED	<1.09	<698	<1.09	<328	<43.5	<4540	<43.5	<9110	<87	<87	<4540	<6820	<2180	<22800
1,1,2-Trichlorotrifluoroethane	**4,915,825**	NMED	<1.53	<981	<1.53	<461	<61.3	<6380	<61.3	<12800	<123	<123	<6380	<9580	<3070	<32000
1,1-Dichloroethane	**2,868**	NMED	<0.802	<518	<0.802	<244	<32.1	<3370	<32.1	<6760	<64.1	<64.1	<3370	<5060	<1600	<16900
1,1-Dichloroethene	**32,772**	NMED	<0.793	<507	<0.793	<239	<31.7	<3300	<31.7	<6620	<63.4	<63.4	<3300	<4960	<1590	<16500
1,2,4-Trichlorobenzene	**328**	NMED	<4.66	<950	<4.66	<447	<187	<6180	<187	<12400	<373	<373	<6180	<9280	<9330	<31000
1,2,4-Trimethylbenzene	**8,760**	USEPA	**1.75**	<629	**3.9**	<296	<39.3	<4100	<39.3	<8210	<78.5	<78.5	<4100	<6150	<1960	<20500
1,2-Dibromoethane	**7.65**	NMED	<1.54	<984	<1.54	<463	<61.5	<6400	<61.5	<12800	<123	<123	<6400	<9610	<3080	<32000
1,2-Dichlorobenzene	**32,772**	NMED	<1.2	<770	<1.2	<362	<48.1	<5010	<48.1	<10000	<96.2	<96.2	<5010	<7520	<2400	<25100
1,2-Dichloroethane	**176**	NMED	<0.81	<518	<0.81	<244	<32.4	<3370	<32.4	<6760	<64.8	<64.8	<3370	<5060	<1620	<16900
1,2-Dichloropropane	**459**	NMED	<0.924	<592	<0.924	<278	<37	<3850	<37	<7720	<73.9	<73.9	<3850	<5780	<1850	<19300
1,2-Dichlorotetrafluoroethane	**NA**	NMED	<1.4	<895	<1.4	<421	<56	<5820	<56	<11700	<112	<112	<5820	<8740	<2800	<29100
1,3,5-Trimethylbenzene	**8,760**	USEPA	**1.21**	<629	**1.51**	<296	<39.3	<4100	<39.3	<8210	<78.5	<78.5	<4100	<6150	<1960	<20500
1,3-Butadiene	**153**	NMED	<4.43	<283	<4.43	<133	<177	<1840	<177	<3690	<354	<354	<1840	<2770	<8850	<9230
1,3-Dichlorobenzene	**NA**	NMED	<1.2	<770	**1.81**	<362	<48.1	<5010	<48.1	<10000	<96.2	<96.2	<5010	<7520	<2400	<25100
1,4-Dichlorobenzene	**417**	NMED	<1.2	<770	<1.2	<362	<48.1	<5010	<48.1	<10000	<96.2	<96.2	<5010	<7520	<2400	<25100
1,4-Dioxane	**918**	NMED	<0.721	<461	<0.721	<217	<28.8	<3000	<28.8	<6020	<57.7	<57.7	<3000	<4500	<1440	<15000
2,2,4-Trimethylpentane	**NA**	NMED	**14.1**	**261,000**	**114**	**287,000**	**434,000**	**1,200,000**	**293,000**	**3,460,000**	**547,000**	**579,000**	**2,660,000**	**4,900,000**	**491,000**	**3,340,000**
2-Butanone (MEK)	**819,304**	NMED	**8.35**	<944	**100**	<445	<147	<6130	<147	<12300	<295	<295	<6130	<9200	<7370	<30700
2-Chlorotoluene	**NA**	NMED	<1.03	<663	<1.03	<312	<41.2	<4310	<41.2	<8650	<82.5	<82.5	<4310	<6470	<2060	<21600
2-Propanol	**29,200**	USEPA	**4.72**	<787	**7.35**	<371	**2,000**	<5110	**4,230**	<10300	**2,730**	**3,740**	<5110	<7670	**25,100**	<25600
4-Ethyltoluene	**NA**	NMED	<0.982	<629	**3.89**	<296	<39.3	<4100	<39.3	<8210	<78.5	<78.5	<4100	<6150	<1960	<20500
4-Methyl-2-pentanone (MIBK)	**491,582**	NMED	<5.12	<1310	**6.55**	<619	<205	<8520	<205	<17100	<409	<409	<8520	<12800	<10200	<42600
Acetone	**5,079,686**	NMED	**87.7**	<1520	**368**	<715	**594**	<9910	**454**	<19800	**634**	**542**	<9910	<14800	<5940	<49400
Acrylonitrile	**67.47**	NMED	<10.8	<694	<10.8	<328	<434	<4510	<434	<9050	<867	<867	<4510	<6770	<21700	<22600
Allyl chloride	**146**	USEPA	<0.626	<401	<0.626	<188	<25	<2610	<25	<5230	<50.1	<50.1	<2610	<3910	<1250	<13100
Benzene	**588**	NMED	**3.93**	<409	**21.5**	<192	<25.6	<2660	**21,100**	**265,000**	**124,000**	**119,000**	**534,000**	**524,000**	**260,000**	**2,440,000**
Benzyl Chloride	**83.4**	USEPA	<1.04	<663	<1.04	<312	<41.6	<4310	<41.6	<8650	<83.1	<83.1	<4310	<6470	<2080	<21600
Bromodichloromethane	**124**	NMED	<1.34	<858	**5.81**	<403	<53.7	<5580	<53.7	<11200	<107	<107	<5580	<8370	<2680	<27900
Bromoform	**4,171**	NMED	<6.21	<1320	<6.21	<622	<248	<8610	<248	<17300	<497	<497	<8610	<12900	<12400	<43100
Bromomethane	**819**	NMED	<0.776	<497	<0.776	<234	<31.1	<3230	<31.1	<6480	<62.1	<62.1	<3230	<4850	<1550	<16200
Carbon disulfide	**114,703**	NMED	**4.73**	<399	**154**	<187	<24.9	<2590	<24.9	<5200	<49.8	<49.8	<2590	<3890	<1240	<13000
Carbon tetrachloride	**765**	NMED	<1.26	<805	<1.26	<379	<50.4	<5240	<50.4	<10500	<101	<101	<5240	<7860	<2520	<26200
Chlorobenzene	**8,193**	NMED	<0.924	<589	<0.924	<277	<37	<3840	<37	<7690	<73.9	<73.9	<3840	<5760	<1850	<19200
Chlorodifluoromethane	**8,193,042**	NMED	<0.708	<453	<0.708	<213	<28.3	<2950	<28.3	<5910	<56.6	<56.6	<2950	<4420	<1420	<14700
Chloroethane	**1,638,608**	NMED	<0.528	<338	<0.528	<159	<21.1	<2200	<21.1	<4410	<42.2	<42.2	<2200	<3300	<1060	<11000
Chloroform	**199**	NMED	<0.973	<625	<0.973	<294	<38.9	<4070	<38.9	<8160	<77.9	<77.9	<4070	<6100	<1950	<20400
Chloromethane	**2,549**	NMED	**1.55**	<264	**0.512**	<124	<16.5	<1720	<16.5	<3450	<33	<33	<1720	<2580	<826	<8610
cis-1,2-Dichloroethene	**NA**	NMED	<0.793	<507	<0.793	<239	<31.7	<3300	<31.7	<6620	<63.4	<63.4	<3300	<4960	<1590	<16500
cis-1,3-Dichloropropene	**1,147**	NMED	<0.908	<581	<0.908	<273	<36.3	<3780	<36.3	<7580	<72.6	<72.6	<3780	<5670	<1820	<18900
Cyclohexane	**876,000**	USEPA	**7.44**	**1750**	<0.689	**1,890**	<27.6	<2870	**99,500**	**647,000**	**610,000**	**644,000**	**774,000**	**978,000**	**312,000**	**2,590,000**
Dibromochloromethane	**170**	NMED	<1.7	<1090	<1.7	<513	<68.1	<7100	<68.1	<14200	<136	<136	<7100	<10600	<3400	<35500
Dichlorodifluoromethane	**16,386**	NMED	**2.11**	<633	**1.35**	<298	<39.6	<4120	<39.6	<8260	<79.1	<79.1	<4120	<6180	<1980	<20600
Ethanol	**NA**	NMED	**139**	<6030	**113**	<2850	**943**	<39200	**886**	<78600	**1,030**	**1,900**	<39200	<58800	**6,660**	<196000
Ethyl acetate	**11,470**	NMED	<0.72	<1150	<0.72	<544	<28.8	<7500	<28.8	<15000	<57.6	<57.6	<7500	<11200	<1440	<37500
Ethylbenzene	**1,835**	NMED	**1.71**	<556	**8.76**	<261	**36**	<3620	**39.1**	<7250	**122**	**111**	<3620	<5430	<1730	<18100
Heptane	**58,400**	USEPA	**3.07**	<525	**15.2**	<247	<32.7	<3410	<32.7	**39,400**	**22,800**	<65.4	**65,600**	**120,000**	<1640	**652,000**

Table F-6, Summary of Soil Gas Data

HollyFrontier Navajo Refining LLC, Artesia, NM

Chemical Name		Sample ID:	VP-01-5	VP-01-5	VP-01-7	VP-01-7	VP-01-12	VP-01-12	VP-02-5	VP-02-5	VP-02-7	DUP-01	VP-02-7	DUP-01	VP-02-12	VP-02-12
		Date:	10/22/2020	7/18/2021	10/22/2020	7/18/2021	10/22/2020	7/18/2021	10/22/2020	7/18/2021	10/22/2020	10/22/2020	7/18/2021	7/18/2021	10/22/2020	7/18/2021
		Dup:										FD		FD		
	Sample Depth (ft bgs):		5	5	7	7	12	12	5	5	7	7	7	7	12	12
	Industrial Soil Gas VISL (µg/m^3) [a]		µg/m^3		µg/m^3		µg/m^3		µg/m^3		µg/m^3				µg/m^3	
Hexachloro-1,3-butadiene	**209**	NMED	<6.73	<538	<6.73	<538	<269	<538	<269	<538	<538	<538	<538	<538	<13500	<538
Isopropylbenzene	**65,544**	NMED	<0.983	<629	<0.983	<296	<39.3	<4100	**44.8**	<8210	**139**	**121**	<4100	<6150	<1970	**26,900**
m&p-Xylene	**16,386**	NMED	**4.06**	<1110	**24.3**	<521	**75.9**	<7250	**84.1**	<14500	**141**	<139	<7250	<10900	<3470	<36200
Methyl Butyl Ketone	**4,380**	USEPA	<5.11	<525	**15.8**	<247	<204	<3410	<204	<6840	<409	<409	<3410	<5120	<10200	<17100
Methyl Cyclohexane	**491,582**	NMED	**5.46**	NS	<0.803	NS	<32.1	NS	**43,000**	NS	**220,000**	**227,000**	NS	NS	**196,000**	NS
Methyl methacrylate	**114,703**	NMED	<0.819	<1310	<0.819	<618	<32.8	<8520	<32.8	<17100	<65.5	<65.5	<8520	**96200**	<1640	**528000**
Methylene Chloride	**98,316**	NMED	**0.944**	<1110	**1.73**	<525	<27.8	<7230	<27.8	<14500	<55.6	<55.6	<7230	<10800	<1390	<36100
MTBE	**17,647**	NMED	<0.721	<461	<0.721	<217	<28.8	<3000	<28.8	<6020	<57.7	<57.7	<3000	<4510	<1440	<15000
Naphthalene	**135**	NMED	<3.3	<671	<3.3	<316	<132	<4370	<132	<8760	<264	<264	<4370	<6550	<6600	<21900
n-Hexane	**114,703**	NMED	**11.6**	<451	**10**	**244**	**1,770**	<2940	**83,900**	**444,000**	**1,230,000**	**1,260,000**	**518,000**	**789,000**	**356,000**	**2,720,000**
o-Xylene	**16,386**	NMED	**1.99**	<556	**8.24**	<261	**37.8**	<3620	<34.7	<7250	<69.4	<69.4	<3620	<5430	<1730	<18100
Propene	**438,000**	USEPA	<0.689	<551	**12**	<260	**132**	<3580	**413**	<7180	**637**	**436**	<3580	<5370	<1380	<17900
Styrene	**163,861**	NMED	<0.851	<545	<0.851	<256	**55.7**	<3550	**83.8**	<7110	<68.1	<68.1	<3550	<5320	<1700	<17800
Tetrachloroethylene	**6,554**	NMED	<1.36	<868	<1.36	<408	**57.2**	<5650	<54.3	<11300	<109	<109	<5650	<8480	<2720	<28300
Tetrahydrofuran	**292,000**	USEPA	<0.59	<944	<0.59	<445	<23.6	<6130	<23.6	<12300	<47.2	<47.2	<6130	<9200	<1180	<30700
Toluene	**819,304**	NMED	**16.9**	<482	**938**	<227	**433**	<3140	**222**	<6290	**501**	**478**	<3140	<4710	<3770	<15700
trans-1,2-Dichloroethene	**9,832**	NMED	<0.793	<507	<0.793	<239	<31.7	<3300	<31.7	<6620	<63.4	<63.4	<3300	<4960	<1590	<16500
trans-1,3-Dichloropropene	**1,147**	NMED	<0.908	<581	<0.908	<273	<36.3	<3780	<36.3	<7580	<72.6	<72.6	<3780	<5670	<1820	<18900
Trichloroethylene	**328**	NMED	<1.07	<42.9	<1.07	<42.9	<42.9	<42.9	<42.9	<42.9	<85.7	<85.7	<42.9	<42.9	<2140	<42.9
Trichlorofluoromethane	**114,703**	NMED	**1.24**	<719	<1.12	<338	<45	<4680	<45	<9380	<89.9	<89.9	<4680	<7020	<2250	<23400
Vinyl acetate	**32,772**	NMED	<0.704	<2260	<0.704	<1060	<28.2	<14700	<28.2	<29300	<56.3	<56.3	<14700	<22000	<1410	<73200
Vinyl Bromide	**143**	NMED	<0.875	<70	<0.875	<70	<35	<70	<35	<70	<70	<70	<70	<70	<1750	<70
Vinyl chloride	**1,043**	NMED	<0.511	<40.9	<0.511	<40.9	<20.4	<40.9	<20.4	<40.9	<40.9	<40.9	<40.9	<40.9	<1020	<40.9

Table F-6, Summary of Soil Gas Data

HollyFrontier Navajo Refining LLC, Artesia, NM

Chemical Name		Sample ID:	VP-03-5	VP-03-5	VP-03-7	VP-03-7	VP-03-12	VP-03-12	VP-04-5	VP-04-5	VP-04-7	VP-04-7	VP-04-12	VP-04-12	DUP-02
		Date:	#########	7/18/2021	10/22/2020	7/18/2021	10/22/2020	7/18/2021	10/22/2020	7/18/2021	10/22/2020	7/18/2021	10/22/2020	7/18/2021	7/18/2021
		Dup:													
	Sample Depth (ft bgs):		5	5	7	7	12	12	5	5	7	7	12	12	12
	Industrial Soil Gas VISL (μg/m³) [a]		μg/m³		μg/m³		μg/m³		μg/m³		μg/m³		μg/m³		
1,1,1-Trichloroethane	**819,304**	NMED	<43.5	<666	<43.5	<1010	<43.5	<1430	<1.09	<6820	<87	<3410	<2180	<3.19	<505
1,1,2,2-Tetrachloroethane	**79.11**	NMED	<55	<838	<55	<1270	<55	<1810	<1.37	<8580	<110	<4290	<2750	<4.01	<636
1,1,2-Trichloroethane	**32.77**	NMED	<43.5	<666	<43.5	<1010	<43.5	<1430	<1.09	<6820	<87	<3410	<2180	<3.19	<505
1,1,2-Trichlorotrifluoroethane	**4,915,825**	NMED	<61.3	<935	<61.3	<1420	<61.3	<2020	<1.53	<9580	<123	<4790	<3070	<4.48	<710
1,1-Dichloroethane	**2,868**	NMED	<32.1	<494	<32.1	<749	<32.1	<1060	<0.802	<5060	<64.1	<2530	<1600	<2.36	<375
1,1-Dichloroethene	**32,772**	NMED	<31.7	<484	<31.7	<733	<31.7	<1040	<0.793	<4960	<63.4	<2480	<1590	<2.32	<367
1,2,4-Trichlorobenzene	**328**	NMED	<187	<906	<187	<1370	<187	<1950	<4.66	<9280	<373	<4640	<9330	<4.34	<687
1,2,4-Trimethylbenzene	**8,760**	USEPA	**360**	<600	<39.3	<909	<39.3	<1290	**1.52**	<6150	<78.5	<3070	<1960	<2.87	**17,000**
1,2-Dibromoethane	**7.65**	NMED	<61.5	<938	<61.5	<1420	<61.5	<2020	<1.54	<9610	<123	<4800	<3080	<4.49	<712
1,2-Dichlorobenzene	**32,772**	NMED	<48.1	<733	<48.1	<1110	<48.1	<1580	<1.2	<7520	<96.2	<3760	<2400	<3.51	<557
1,2-Dichloroethane	**176**	NMED	<32.4	<494	<32.4	<749	<32.4	<1060	<0.81	<5060	<64.8	<2530	<1620	<2.36	<375
1,2-Dichloropropane	**459**	NMED	<37	<564	<37	<855	<37	<1220	<0.924	<5780	<73.9	<2890	<1850	<2.7	<428
1,2-Dichlorotetrafluoroethane	**NA**	NMED	<56	<853	<56	<1290	<56	<1840	<1.4	<8740	<112	<4370	<2800	<4.08	<647
1,3,5-Trimethylbenzene	**8,760**	USEPA	<39.3	<600	<39.3	<909	<39.3	<1290	<0.982	<6150	<78.5	<3070	<1960	<2.87	**2530**
1,3-Butadiene	**153**	NMED	<177	<270	<177	<409	<177	<582	<4.43	<2770	<354	<1380	<8850	<1.29	<205
1,3-Dichlorobenzene	**NA**	NMED	<48.1	<733	<48.1	<1110	<48.1	<1580	<1.2	<7520	<96.2	<3760	<2400	<3.51	<557
1,4-Dichlorobenzene	**417**	NMED	<48.1	<733	<48.1	<1110	<48.1	<1580	<1.2	<7520	<96.2	<3760	<2400	<3.51	<557
1,4-Dioxane	**918**	NMED	<28.8	<440	<28.8	<667	<28.8	<948	<0.721	<4500	<57.7	<2250	<1440	<2.1	<334
2,2,4-Trimethylpentane	**NA**	NMED	**124,000**	**193,000**	**207,000**	**404,000**	**177,000**	**354,000**	**2,820**	**1,770,000**	**1,280,000**	**1,770,000**	**645,000**	**1,210**	**584,000**
2-Butanone (MEK)	**819,304**	NMED	<147	<900	**160**	<1370	<147	<1940	**16.1**	<9200	<295	<4600	<7370	<4.31	<684
2-Chlorotoluene	**NA**	NMED	<41.2	<632	<41.2	<958	<41.2	<1360	<1.03	<6470	<82.5	<3240	<2060	<3.02	<479
2-Propanol	**29,200**	USEPA	**8,730**	<750	**3,810**	<1140	**187,000**	<1620	**5.8**	<7670	**6,780**	<3830	**18,600**	<3.59	<570
4-Ethyltoluene	**NA**	NMED	**161**	<600	<39.3	<909	<39.3	<1290	**1.73**	<6150	<78.5	<3070	<1960	<2.87	**723**
4-Methyl-2-pentanone (MIBK)	**491,582**	NMED	<205	<1250	<205	<1900	<205	<2700	<5.12	<12800	<409	<6390	<10200	<5.98	<951
Acetone	**5,079,686**	NMED	**501**	<1450	**751**	<2200	**839**	<3140	**223**	<14800	**1,180**	<7410	<5940	<6.94	<1100
Acrylonitrile	**67.47**	NMED	<434	<662	<434	<1000	<434	<1430	<10.8	<6770	<867	<3390	<21700	<3.17	<503
Allyl chloride	**146**	USEPA	<25	<382	<25	<579	<25	<823	<0.626	<3910	<50.1	<1960	<1250	<1.83	<290
Benzene	**588**	NMED	**26,300**	**11,600**	**2,480**	**12,300**	**8,850**	**5,110**	**80.8**	<3990	**2,390**	**2,160**	**93,000**	**364**	**206,000**
Benzyl Chloride	**83.4**	USEPA	<41.6	<632	<41.6	<958	<41.6	<1360	<1.04	<6470	<83.1	<3240	<2080	<3.02	<479
Bromodichloromethane	**124**	NMED	<53.7	<817	<53.7	<1240	<53.7	<1760	<1.34	<8370	<107	<4190	<2680	<3.91	<620
Bromoform	**4,171**	NMED	<248	<1260	<248	<1910	<248	<2720	<6.21	<12900	<497	<6460	<12400	<6.04	<957
Bromomethane	**819**	NMED	<31.1	<474	<31.1	<718	<31.1	<1020	<0.776	<4850	<62.1	<2430	<1550	<2.27	<360
Carbon disulfide	**114,703**	NMED	**73.8**	<380	**185**	<576	**588**	<819	**52.9**	<3890	<49.8	<1950	<1240	<1.82	<288
Carbon tetrachloride	**765**	NMED	<50.4	<767	<50.4	<1160	<50.4	<1650	<1.26	<7860	<101	<3930	<2520	<3.67	<582
Chlorobenzene	**8,193**	NMED	<37	<562	<37	<852	<37	<1210	<0.924	<5760	<73.9	<2880	<1850	<2.69	<426
Chlorodifluoromethane	**8,193,042**	NMED	<28.3	<431	<28.3	<654	<28.3	<930	<0.708	<4420	<56.6	<2210	<1420	<2.07	<327
Chloroethane	**1,638,608**	NMED	<21.1	<322	<21.1	<488	<21.1	<694	<0.528	<3300	<42.2	<1650	<1060	<1.54	<244
Chloroform	**199**	NMED	<38.9	<596	<38.9	<903	<38.9	<1280	<0.973	<6100	<77.9	<3050	<1950	<2.85	<452
Chloromethane	**2,549**	NMED	<16.5	<252	<16.5	<382	<16.5	<543	**1.85**	<2580	<33	<1290	<826	**1.39**	<191
cis-1,2-Dichloroethene	**NA**	NMED	<31.7	<484	<31.7	<733	<31.7	<1040	<0.793	<4960	<63.4	<2480	<1590	<2.32	<367
cis-1,3-Dichloropropene	**1,147**	NMED	<36.3	<554	<36.3	<840	<36.3	<1190	<0.908	<5670	<72.6	<2840	<1820	<2.65	<420
Cyclohexane	**876,000**	USEPA	**34,000**	**39,200**	<27.6	<637	**7,510**	<905	**105**	<4300	**10,700**	<2150	**102,000**	**84**	**18,900**
Dibromochloromethane	**170**	NMED	<68.1	<1040	<68.1	<1580	<68.1	<2240	<1.7	<10600	<136	<5320	<3400	<4.98	<789
Dichlorodifluoromethane	**16,386**	NMED	<39.6	<603	<39.6	<915	<39.6	<1300	**2.32**	<6180	<79.1	<3090	<1980	<2.89	<458
Ethanol	**NA**	NMED	**1,670**	<5750	**1,510**	<8720	**2,790**	<12400	**94.8**	<58800	**2,150**	<29400	**5,170**	<27.5	<4370
Ethyl acetate	**11,470**	NMED	<28.8	<1100	<28.8	<1670	<28.8	<2370	<0.72	<11200	<57.6	<5620	<1440	<5.26	<836
Ethylbenzene	**1,835**	NMED	**2,510**	**1,090**	**129**	<804	**750**	<1140	**13.1**	<5430	**305**	<2710	**19,600**	**50.8**	**94,700**
Heptane	**58,400**	USEPA	<32.7	<500	<32.7	<758	<32.7	<1080	**35.5**	<5120	<65.4	<2560	**17,000**	**8.61**	<379

Table F-6, Summary of Soil Gas Data

HollyFrontier Navajo Refining LLC, Artesia, NM

Chemical Name		Sample ID:	VP-03-5	VP-03-5	VP-03-7	VP-03-7	VP-03-12	VP-03-12	VP-04-5	VP-04-5	VP-04-7	VP-04-7	VP-04-12	VP-04-12	DUP-02
		Date:	#########	7/18/2021	10/22/2020	7/18/2021	10/22/2020	7/18/2021	10/22/2020	7/18/2021	10/22/2020	7/18/2021	10/22/2020	7/18/2021	7/18/2021
		Dup:													
		Sample Depth (ft bgs):	5	5	7	7	12	12	5	5	7	7	12	12	12
	Industrial Soil Gas VISL (µg/m^3) [a]		µg/m^3		µg/m^3		µg/m^3		µg/m^3		µg/m^3		µg/m^3		
Hexachloro-1,3-butadiene	**209**	NMED	<269	<538	<269	<538	<269	<538	<6.73	<538	<538	<538	<13500	<538	<538
Isopropylbenzene	**65,544**	NMED	**399**	<600	<39.3	<909	**62.4**	<1290	**1.81**	<6150	<78.7	<3070	**2,580**	**4.71**	**17600**
m&p-Xylene	**16,386**	NMED	**288**	<1060	**94.5**	<1610	**112**	<2280	**11.3**	<10900	**199**	<5430	**6,500**	<5.08	<804
Methyl Butyl Ketone	**4,380**	USEPA	<204	<500	<204	<758	<204	<1080	<5.11	<5120	<409	<2560	<10200	<2.39	<379
Methyl Cyclohexane	**491,582**	NMED	**12,900**	NS	**1,370**	NS	**2,840**	NS	**72.3**	NS	**7,030**	NS	**80,700**	NS	NS
Methyl methacrylate	**114,703**	NMED	<32.8	<1250	<32.8	<1900	<32.8	<2690	<0.819	<12800	<65.5	<6390	<1640	<5.98	<950
Methylene Chloride	**98,316**	NMED	<27.8	<1060	<27.8	<1610	<27.8	<2290	<0.694	<10800	<55.6	<5420	<1390	<5.07	<806
MTBE	**17,647**	NMED	<28.8	<440	<28.8	<667	<28.8	<948	<0.721	<4510	<57.7	<2250	<1440	<2.11	<334
Naphthalene	**135**	NMED	<132	<640	<132	<970	<132	<1380	<3.3	<6550	<264	<3280	<6600	<3.06	<486
n-Hexane	**114,703**	NMED	**8,180**	**437**	**3,040**	<652	**7,690**	<927	**65.9**	**4,550**	**12,100**	**3,880**	**82,100**	**15**	**2,540**
o-Xylene	**16,386**	NMED	**46.8**	<530	**40.8**	<804	**50.7**	<1140	**2.09**	<5430	<69.4	<2710	<1730	<2.54	<402
Propene	**438,000**	USEPA	<27.6	<525	**84**	<797	**632**	<1130	**118**	<5370	**375**	<2680	<1380	<2.51	<399
Styrene	**163,861**	NMED	**102**	<519	**43**	<788	**105**	<1120	<0.851	<5320	**102**	<2660	<1700	<2.49	<394
Tetrachloroethylene	**6,554**	NMED	**65**	<827	**67.2**	<1250	**75.4**	<1780	<1.36	<8480	<109	<4240	<2720	<3.96	<628
Tetrahydrofuran	**292,000**	USEPA	<23.6	<900	<23.6	<1370	<23.6	<1940	<0.59	<9200	<47.2	<4600	<1180	<4.31	<684
Toluene	**819,304**	NMED	**175**	<460	**128**	<697	**214**	<991	**6.78**	<4710	**176**	<2360	<3770	<2.2	<349
trans-1,2-Dichloroethene	**9,832**	NMED	<31.7	<484	<31.7	<733	<31.7	<1040	<0.793	<4960	<63.4	<2480	<1590	<2.32	<367
trans-1,3-Dichloropropene	**1,147**	NMED	<36.3	<554	<36.3	<840	<36.3	<1190	<0.908	<5670	<72.6	<2840	<1820	<2.65	<420
Trichloroethylene	**328**	NMED	<42.9	<42.9	<42.9	<42.9	<42.9	<42.9	<1.07	<42.9	<85.7	<42.9	<2140	<42.9	<42.9
Trichlorofluoromethane	**114,703**	NMED	<45	<686	<45	<1040	<45	<1480	**1.29**	<7020	<89.9	<3510	<2250	<3.28	<520
Vinyl acetate	**32,772**	NMED	<28.2	<2150	<28.2	<3260	<28.2	<4650	<0.704	<22000	<56.3	<11000	<1410	<10.3	<1630
Vinyl Bromide	**143**	NMED	<35	<70	<35	<70	<35	<70	<0.875	<70	<70	<70	<1750	<70	<70
Vinyl chloride	**1,043**	NMED	<20.4	<40.9	<20.4	<40.9	<20.4	<40.9	<0.511	<40.9	<40.9	<40.9	<1020	<40.9	<40.9

Table F-6, Summary of Soil Gas Data

HollyFrontier Navajo Refining LLC, Artesia, NM

Chemical Name		Sample ID:	VP-05-5	VP-05-5	DUP-02	VP-05-7	VP-05-7	VP-05-12	VP-05-12
		Date:	10/24/2020	7/18/2021	10/24/2020	10/23/2020	7/18/2021	10/22/2020	7/18/2021
		Dup:			FD				
		Sample Depth (ft bgs):	5	5	5	7	7	12	12
	Industrial Soil Gas VISL (µg/m^3) [a]		µg/m^3			µg/m^3		µg/m^3	
1,1,1-Trichloroethane	**819,304**	NMED	<87	<9110	<87	<21.8	<6820	<21.8	<1240
1,1,2,2-Tetrachloroethane	**79.11**	NMED	<110	<11500	<110	<27.5	<8580	<27.5	<1560
1,1,2-Trichloroethane	**32.77**	NMED	<87	<9110	<87	<21.8	<6820	<21.8	<1240
1,1,2-Trichlorotrifluoroethane	**4,915,825**	NMED	<123	<12800	<123	<30.7	<9580	<30.7	<1740
1,1-Dichloroethane	**2,868**	NMED	<64.1	<6760	<64.1	<16	<5060	<16	<919
1,1-Dichloroethene	**32,772**	NMED	<63.4	<6620	<63.4	<15.9	<4960	<15.9	<900
1,2,4-Trichlorobenzene	**328**	NMED	<373	<12400	<373	<93.3	<9280	<93.3	<1690
1,2,4-Trimethylbenzene	**8,760**	USEPA	<78.5	<8210	<78.5	<19.6	<6150	<19.6	<1120
1,2-Dibromoethane	**7.65**	NMED	<123	<12800	<123	<30.8	<9610	<30.8	<1740
1,2-Dichlorobenzene	**32,772**	NMED	<96.2	<10000	<96.2	<24	<7520	<24	<1360
1,2-Dichloroethane	**176**	NMED	<64.8	<6760	<64.8	<16.2	<5060	<16.2	<919
1,2-Dichloropropane	**459**	NMED	<73.9	<7720	<73.9	<18.5	<5780	<18.5	<1050
1,2-Dichlorotetrafluoroethane	**NA**	NMED	<112	<11700	<112	<28	<8740	<28	<1590
1,3,5-Trimethylbenzene	**8,760**	USEPA	<78.5	<8210	<78.5	<19.6	<6150	<19.6	<1120
1,3-Butadiene	**153**	NMED	<354	<3690	<354	<88.5	<2770	<88.5	<502
1,3-Dichlorobenzene	**NA**	NMED	<96.2	<10000	<96.2	<24	<7520	<24	<1360
1,4-Dichlorobenzene	**417**	NMED	<96.2	<10000	<96.2	<24	<7520	<24	<1360
1,4-Dioxane	**918**	NMED	<57.7	<6020	<57.7	<14.4	<4500	<14.4	<818
2,2,4-Trimethylpentane	**NA**	NMED	**3,350,000 J**	**2,800,000**	**9,860,000 J**	**1,470,000**	**2,960,000**	**229,000**	**3,400,000**
2-Butanone (MEK)	**819,304**	NMED	<295	<12300	<295	<73.7	<9200	<73.7	<1680
2-Chlorotoluene	**NA**	NMED	<82.5	<8650	<82.5	<20.6	<6470	<20.6	<1180
2-Propanol	**29,200**	USEPA	**1,760**	<10300	**2,030**	<61.5	<7670	<61.5	<1400
4-Ethyltoluene	**NA**	NMED	<78.5	<8210	<78.5	<19.6	<6150	<19.6	<1120
4-Methyl-2-pentanone (MIBK)	**491,582**	NMED	<409	<17100	<409	<102	<12800	<102	<2330
Acetone	**5,079,686**	NMED	741 J	<19800	1250 J	**456**	<14800	**252**	<2710
Acrylonitrile	**67.47**	NMED	<867	<9050	<867	<217	<6770	<217	<1230
Allyl chloride	**146**	USEPA	<50.1	<5230	<50.1	<12.5	<3910	<12.5	<711
Benzene	**588**	NMED	<51.1	<5340	<51.1	<12.8	**6,900**	<12.8	**63,300**
Benzyl Chloride	**83.4**	USEPA	<83.1	<8650	<83.1	<20.8	<6470	<20.8	<1180
Bromodichloromethane	**124**	NMED	<107	<11200	<107	<26.8	<8370	<26.8	<1520
Bromoform	**4,171**	NMED	<497	<17300	<497	<124	<12900	<124	<2350
Bromomethane	**819**	NMED	<62.1	<6480	<62.1	<15.5	<4850	<15.5	<881
Carbon disulfide	**114,703**	NMED	<49.8	<5200	<49.8	**520**	<3890	<12.4	<707
Carbon tetrachloride	**765**	NMED	<101	<10500	<101	<25.2	<7860	<25.2	<1430
Chlorobenzene	**8,193**	NMED	<73.9	<7690	<73.9	<18.5	<5760	<18.5	<1050
Chlorodifluoromethane	**8,193,042**	NMED	<56.6	<5910	<56.6	<14.2	<4420	<14.2	<803
Chloroethane	**1,638,608**	NMED	<42.2	<4410	<42.2	<10.6	<3300	<10.6	<599
Chloroform	**199**	NMED	<77.9	<8160	<77.9	<19.5	<6100	<19.5	<1110
Chloromethane	**2,549**	NMED	<33	<3450	<33	<8.26	<2580	<8.26	<469
cis-1,2-Dichloroethene	**NA**	NMED	<63.4	<6620	<63.4	<15.9	<4960	<15.9	<900
cis-1,3-Dichloropropene	**1,147**	NMED	<72.6	<7580	<72.6	<18.2	<5670	<18.2	<1030
Cyclohexane	**876,000**	USEPA	<55.1	<5750	<55.1	<13.8	**37500**	**17,200**	**134,000**
Dibromochloromethane	**170**	NMED	<136	<14200	<136	<34	<10600	<34	<1930
Dichlorodifluoromethane	**16,386**	NMED	<79.1	<8260	<79.1	<19.8	<6180	<19.8	<1120
Ethanol	**NA**	NMED	**605**	<78600	**675**	**341**	<58800	**109**	<10700
Ethyl acetate	**11,470**	NMED	<57.6	<15000	<57.6	<14.4	<11200	<14.4	<2050
Ethylbenzene	**1,835**	NMED	<69.4	<7250	<69.4	<17.3	<5430	<17.3	<986
Heptane	**58,400**	USEPA	<65.4	<6840	<65.4	<16.4	<5120	<16.4	<930

Table F-6, Summary of Soil Gas Data

HollyFrontier Navajo Refining LLC, Artesia, NM

Chemical Name		Sample ID:	VP-05-5	VP-05-5	DUP-02	VP-05-7	VP-05-7	VP-05-12	VP-05-12
		Date:	10/24/2020	7/18/2021	10/24/2020	10/23/2020	7/18/2021	10/22/2020	7/18/2021
		Dup:			FD				
		Sample Depth (ft bgs):	5	5	5	7	7	12	12
	Industrial Soil Gas VISL (µg/m³) [a]		µg/m³			µg/m³		µg/m³	
Hexachloro-1,3-butadiene	**209**	NMED	<538	<538	<538	<135	<538	<135	<538
Isopropylbenzene	**65,544**	NMED	<78.7	<8210	<78.7	<19.7	<6150	**52.1**	**13,000**
m&p-Xylene	**16,386**	NMED	<139	<14500	<139	<34.7	<10900	<34.7	<1970
Methyl Butyl Ketone	**4,380**	USEPA	<409	<6840	<409	<102	<5120	<102	<930
Methyl Cyclohexane	**491,582**	NMED	<64.3	NS	<64.3	<16.1	NS	**3,880**	NS
Methyl methacrylate	**114,703**	NMED	<65.5	<17100	<65.5	<16.4	<12800	<16.4	<2330
Methylene Chloride	**98,316**	NMED	<55.6	<14500	<55.6	<13.9	<10800	<13.9	<1970
MTBE	**17,647**	NMED	<57.7	<6020	<57.7	<14.4	<4510	<14.4	<818
Naphthalene	**135**	NMED	<264	<8760	<264	<66	<6550	<66	<1190
n-Hexane	**114,703**	NMED	**709**	<5890	**924**	**430**	<4410	**1,330**	**7,580**
o-Xylene	**16,386**	NMED	<69.4	<7250	<69.4	<17.3	<5430	<17.3	<986
Propene	**438,000**	USEPA	**75.9**	<7180	**101**	**137**	<5370	**143**	<978
Styrene	**163,861**	NMED	<68.1	<7110	<68.1	<17	<5320	<17	<966
Tetrachloroethylene	**6,554**	NMED	<109	<11300	<109	<27.2	<8480	<27.2	<1540
Tetrahydrofuran	**292,000**	USEPA	<47.2	<12300	<47.2	<11.8	<9200	<11.8	<1680
Toluene	**819,304**	NMED	**177**	<6290	**261**	**49**	<4710	<37.7	<855
trans-1,2-Dichloroethene	**9,832**	NMED	<63.4	<6620	<63.4	<15.9	<4960	<15.9	<900
trans-1,3-Dichloropropene	**1,147**	NMED	<72.6	<7580	<72.6	<18.2	<5670	<18.2	<1030
Trichloroethylene	**328**	NMED	<85.7	<42.9	<85.7	<21.4	<42.9	<21.4	<42.9
Trichlorofluoromethane	**114,703**	NMED	<89.9	<9380	<89.9	<22.5	<7020	<22.5	<1280
Vinyl acetate	**32,772**	NMED	<56.3	<29300	<56.3	<14.1	<22000	<14.1	<4010
Vinyl Bromide	**143**	NMED	<70	<70	<70	<17.5	<70	<17.5	<70
Vinyl chloride	**1,043**	NMED	<40.9	<40.9	<40.9	<10.2	<40.9	<10.2	<40.9

Notes:

[a] VISL assumes cancer target risk level (TRL) = 1E-05 and noncancer hazard quotient (HQ) of 1.0, consistent with NMED VI guidance.

Bold indicates detected concentration

Shading indicates VISL exceedance

< = not detected

ft bgs = feet below ground surface

µg/m³ = micrograms per liter

Dup = duplicate

FD = field duplicate

NA = VISL not available

NMED = New Mexico Environment Department

USEPA = United States Environmental Protection Agency

VISL = Vapor Intrusion Screening Level

NS = Not Sampled

Reference:

NMED, 2019. Risk Assessment Guidance for Investigations and Remediation. Volume 1, Soil Screening Guidance for Human Health Risk Assessments. February 2019, Revision 2, June 2019.

USEPA, 2021. Regional Screening Level (RSL) Table, November 2021 update. Available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Table F-7
Soil Gas Screening Results and Vertical Profile
Artesia Refinery, Navajo Refining Company, Artesia, NM

Sample ID	VP-2	VP-3	VP-4	VP-5
Likely Source	Subsurface	Surface	Subsurface	Subsurface
Is Biodegradation Occurring?	YES	Unclear due to surface impacts	YES	YES
2-Propanol	No depths exceed	Deep exceeds; shallow/int acceptable	No depths exceed	No depths exceed
Benzene	All depths exceed	All depths exceed	Int/Deep exceed; shallow acceptable	Int/Deep exceed; shallow acceptable
Cyclohexane [a]	Int/Deep exceed; shallow acceptable	No depths exceed	No depths exceed	No depths exceed
Ethylbenzene	No depths exceed	Only shallow exceeds	Deep exceeds; shallow/int acceptable	No depths exceed
Heptane [a]	Int/Deep exceed; shallow acceptable	No depths exceed	No depths exceed	No depths exceed
n-Hexane	All depths exceed	No depths exceed	No depths exceed	No depths exceed
1,2,4-Trimethylbenzene [a]	No depths exceed	No depths exceed	Deep exceeds; shallow/int acceptable	No depths exceed
IS VI A CONCERN AT THIS LOCATION?	YES, but Bioattenuation Occurring	YES	NO (bioattenuation occurring; shallow interval acceptable)	NO (bioattenuation occurring; shallow interval acceptable)
NEXT STEPS	VI Modeling of benzene and n-hexane	Identify historic surface release(s) near VP-3; VI Modeling of benzene and ethylbenzene	Writeup with lines of evidence why VP-4 is not a VI concern	Writeup with lines of evidence why VP-5 is not a VI concern

Notes:
VI = vapor intrusion
[a] VISL exceedances only occurred in July 2021 sampling event

Table F-8
Summary of Modeled Soil Gas Risks
Artesia Refinery, Navajo Refining Company, Artesia, NM

Analyte	Cas Number	Maximum Detect Soil Gas Conc [a] (µg/m^3)		USEPA J&E Soil Gas Modeling Results	
				Cancer Risk, Indoor Worker	Noncancer Hazard Quotient, Indoor Worker
Benzene	71-43-2	265,000	VP-2 @ 5 ft bgs (152.4cm)	1.8E-07	0.002
Ethylbenzene	100-41-4	2,510	VP-3 @ 5 ft bgs (152.4cm)	5.4E-10	0.0000006
n-Hexane	110-54-3	444,000	VP-2 @-5 ft bgs (152.4cm)	NA	0.00015
Cumulative Cancer Risk / Noncancer Hazard Index (HI)				**1.8E-07**	**0.002**

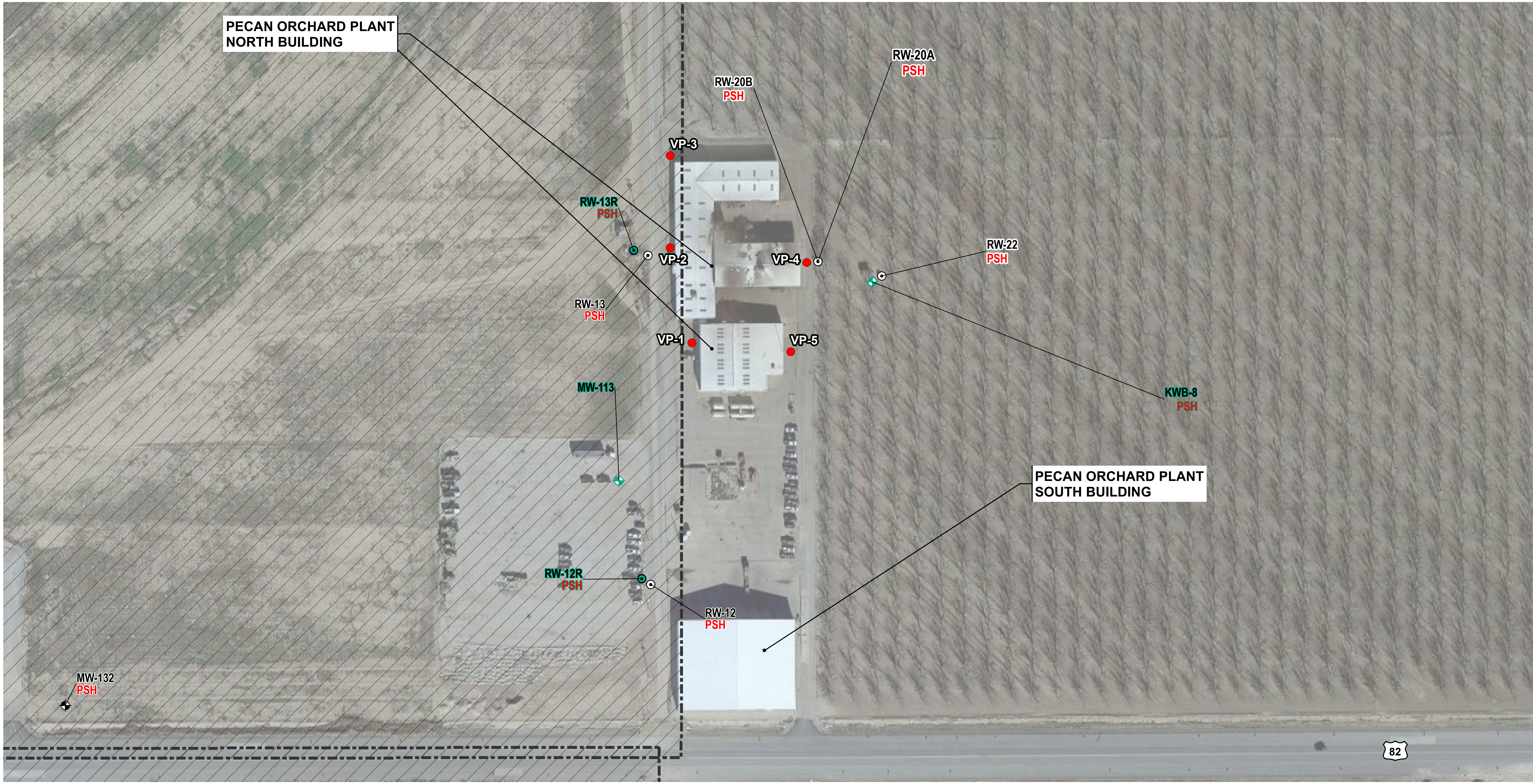
Notes:
Acceptable cancer risk = 1E-05 and noncancer hazard index (HI) = 1.0, consistent with NMED VI guidance (NMED, 2019).
[a] Shallowest depth interval with VISL exceedance chosen for modeling purposes.

References:
NMED, 2019. Risk Assessment Guidance for Investigations and Remediation. Volume 1, Soil Screening Guidance for Human Health Risk Assessments. February 2019, Revision 2, June 19.

Figure

TRC - GIS

Coordinate System: NAD 1983 2011 StatePlane New Mexico East FIPS 3001 Ft US (Foot US)
Map Rotation: 0



LEGEND

- SOIL VAPOR PROBE
- MONITORING WELL, EXCEEDED RESIDENTIAL GW VISL FOR OFFSITE EVALUATION
- RECOVERY WELL, EXCEEDED RESIDENTIAL GW VISL FOR OFFSITE EVALUATION
- MONITORING WELL
- RECOVERY WELL
- FACILITY PROPERTY BOUNDARY

PSH PHASE-SEPARATED HYDROCARBON OCCURRED IN WELL BETWEEN 2016-2021 (≥ 0.01 FEET THICK)

NOTES:
1. GW VISL = GROUNDWATER VAPOR INTRUSION SCREENING LEVEL.
2. WELLS SHOWN AS EXCEEDING A RESIDENTIAL GW VISL EXCEEDED A GW VISL FOR AT LEAST ONE ANALYTE BETWEEN 2016-2021.

0 75 150 Feet
1 " = 150 '
1:1,800

AERIAL IMAGERY SOURCE: GOOGLE EARTH PRO AND THEIR DATA PARTNERS, 12/29/2019.

PROJECT:
VAPOR INTRUSION EVALUATION OF OFF-SITE PECAN ORCHARD BUILDING
HOLLYFRONTIER NAVAJO REFINING LLC, ARTESIA, NM

TITLE:
SOIL VAPOR PROBE AND WELL LOCATIONS

DRAWN BY:	MJAGOE	PROJ. NO.:	456061
CHECKED BY:	LTOROZZO		
APPROVED BY:	JSPEER	**FIGURE F-1**	
DATE:	DECEMBER 2021		

TRC
505 East Huntland Drive, Suite 250
Austin, TX 78752
Phone: 512.329.6080
www.trcsolutions.com

FILE NO.: 456061_F1_SVPL.mxd

Plot Date: 12/30/2021, 15:55:18 PM by MJAGOE -- LAYOUT: ANSI B(11"x17")
Path: S:\1-PROJECTS\HOLLY_ENERGY_PARTNERS\Artesia\326778_GW_Rec_Survey\456061_F1_SVPL.mxd

Appendix F-1
Johnson-Ettinger Groundwater Vapor Intrusion Modeling of North Building

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
108383	4.19E+03	m-Xylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
16.7	15	411.16	411.16	0	0	A	SC	SC		

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
SC	1.63	0.385	0.197	LS	1.62	0.39	0.076	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	7,437	4,861	609.6	0.1	1.36	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	83	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.00E-02	7.80E-06	7.32E-03	25	8,523	412.27	617.05	4.07E+02	1.61E+02	0.0E+00	1.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	396.16	0.188	0.314	0.244	0.299	1.76E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	24,596

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
8.33E+06	3.65E+07	6.73E-05	15	10,177	4.48E-03	1.88E-01	1.77E-04	1.81E-03	0.00E+00	0.00E+00	1.30E-05	1.57E-04	396.16

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	7.89E+05	0.10	9.01E+00	1.81E-03	2.46E+03	6.24E+08	6.67E-07	**5.26E-01**	NA	1.0E-01

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.61E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.2E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Appendix F-2
Johnson-Ettinger Groundwater Vapor Intrusion Modeling of South Building

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
71432	4.24E+02	Benzene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
16.7	15	543.43	543.43	0	0	A	SC	SC		

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SC	1.63	0.385	0.197	LS	1.62	0.39	0.076	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	4,224	5,498	609.6	0.1	1.36	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	83	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	5.89E+01	1.79E+03	7.8E-06	3.0E-02

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	528.43	0.188	0.314	0.244	0.299	1.76E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	19,445

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.35E+06	2.35E+07	8.27E-05	15	8,053	3.75E-03	1.58E-01	1.77E-04	2.27E-03	0.00E+00	0.00E+00	1.84E-05	2.86E-04	528.43

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)	Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	6.69E+04	0.10	7.12E+00	2.27E-03	1.94E+03	9.89E+06	8.54E-07	**5.71E-02**	7.8E-06	3.0E-02

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.79E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
3.6E-08	4.3E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Appendix F-3
Johnson-Ettinger Soil Gas Vapor Intrusion Modeling

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
110543	4.44E+05			Hexane

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	152.4	16.67	213.3	0	0	SC		

Totals must add up to value of Ls (cell F24)

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SC	1.63	0.385	0.197	C	1.43	0.459	0.215	C	1.43	0.459	0.215

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	7437	4861	609.6	0.1	1.36	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	83

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
2.00E-01	7.77E-06	1.66E+00	25	6,895	341.70	508.00	86.18	0.0E+00	7.0E-01

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	137.4	0.188	0.244	0.244	0.299	1.76E-09	0.837	1.48E-09	24,596	4.44E+05	8.33E+06

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
3.65E+07	6.73E-05	15	7,648	1.15E+00	4.82E+01	1.77E-04	5.16E-03	0.00E+00	0.00E+00	3.58E-03	137.4

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	4.44E+05	0.10	9.01E+00	5.16E-03	2.46E+03	1.20E+03	1.07E-06	4.76E-01	NA	7.0E-01

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.5E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

ERROR: Stratum A must be = sampling depth.

END

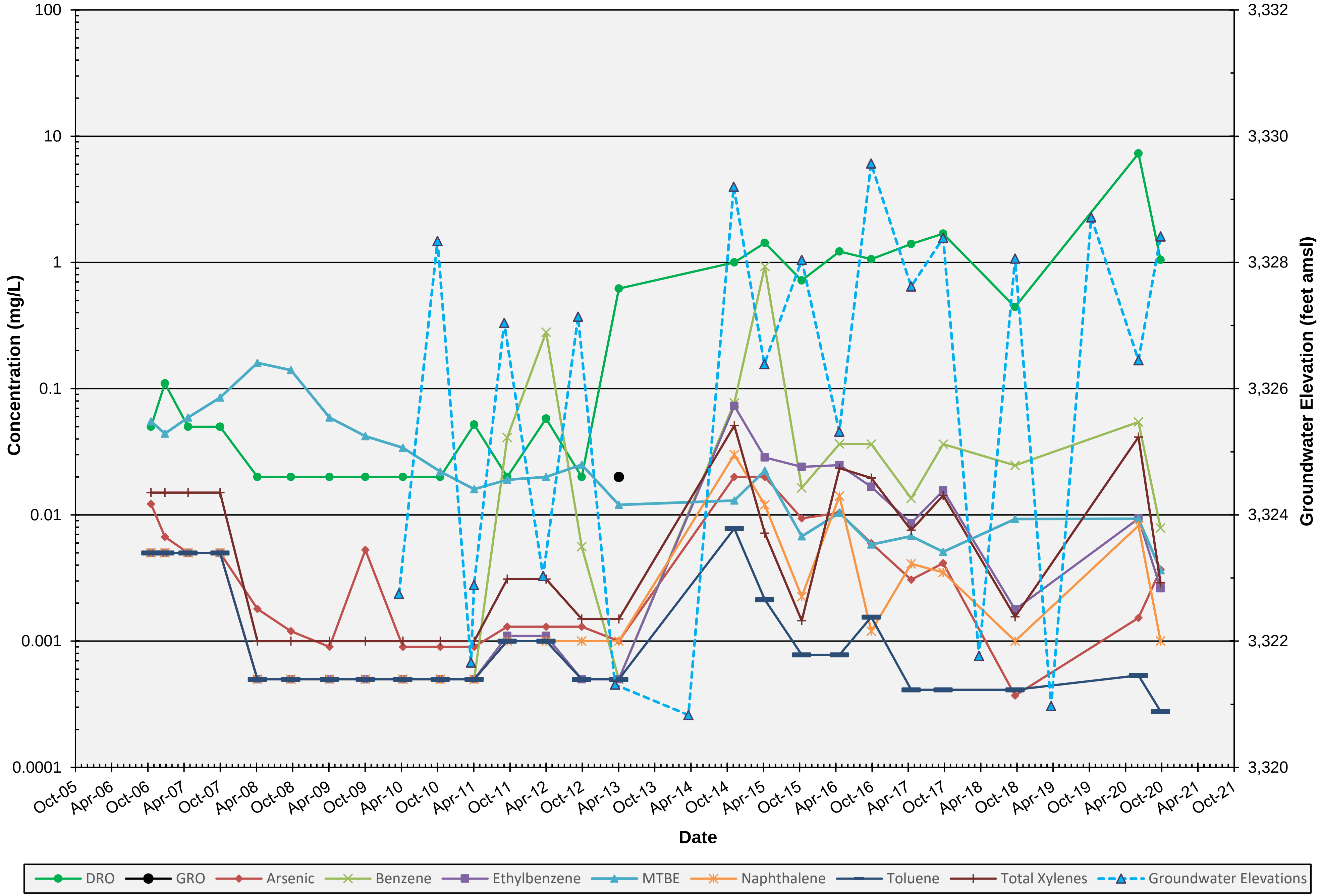
ATTACHMENT A

COC Concentration and Groundwater Elevation Plots for Off-Site Wells

KWB-7: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

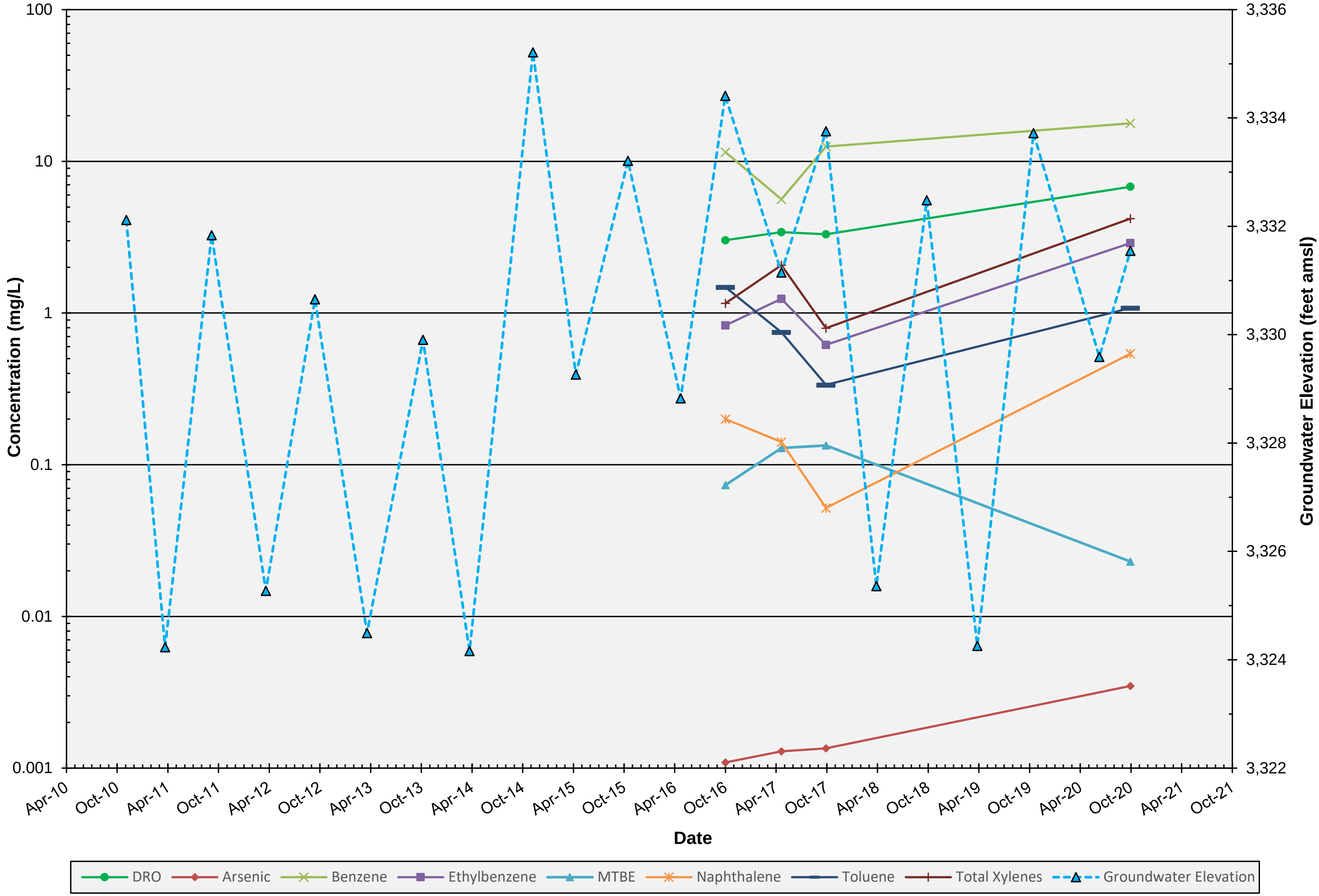
Field East of Refinery



KWB-8: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

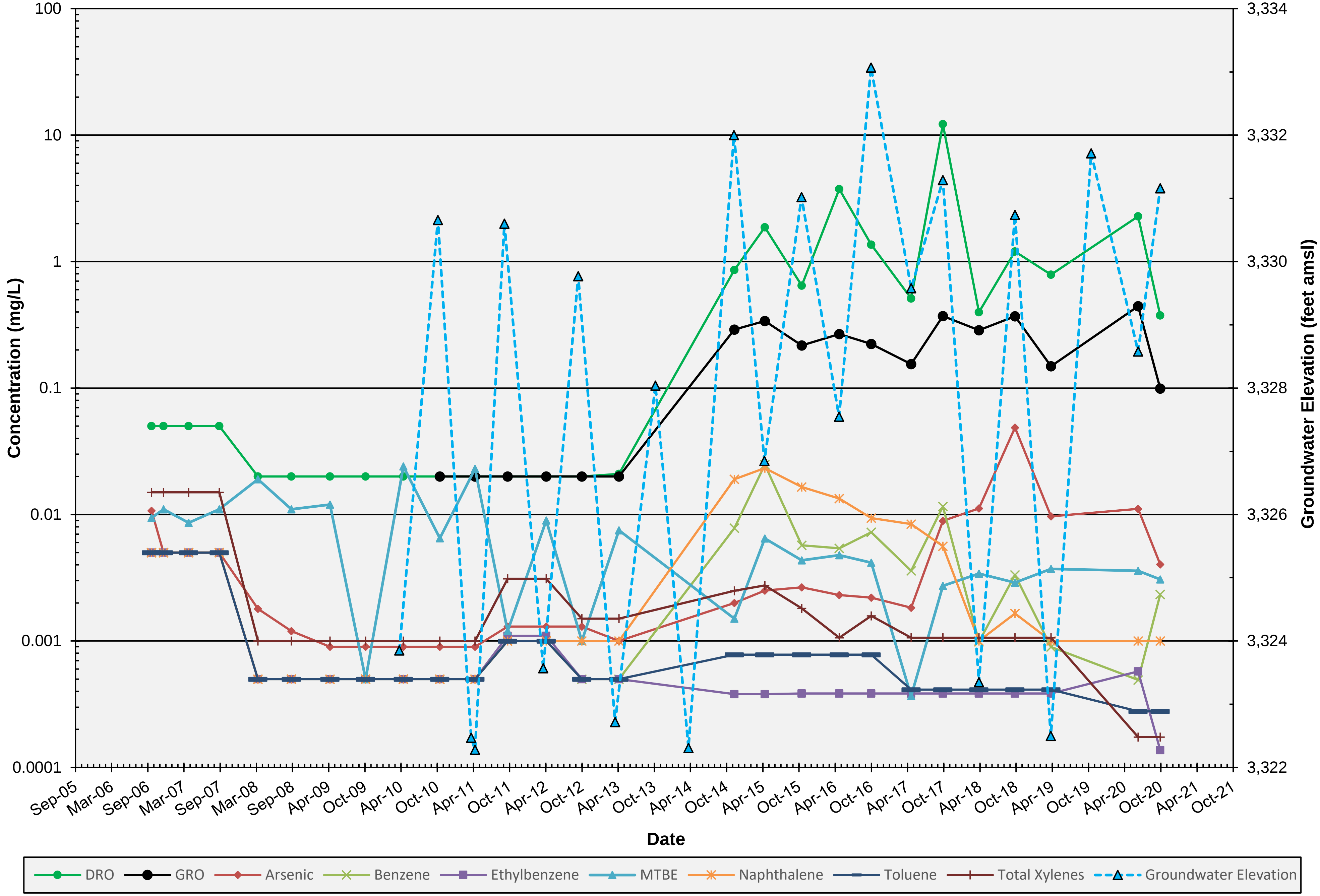
Field East of Refinery

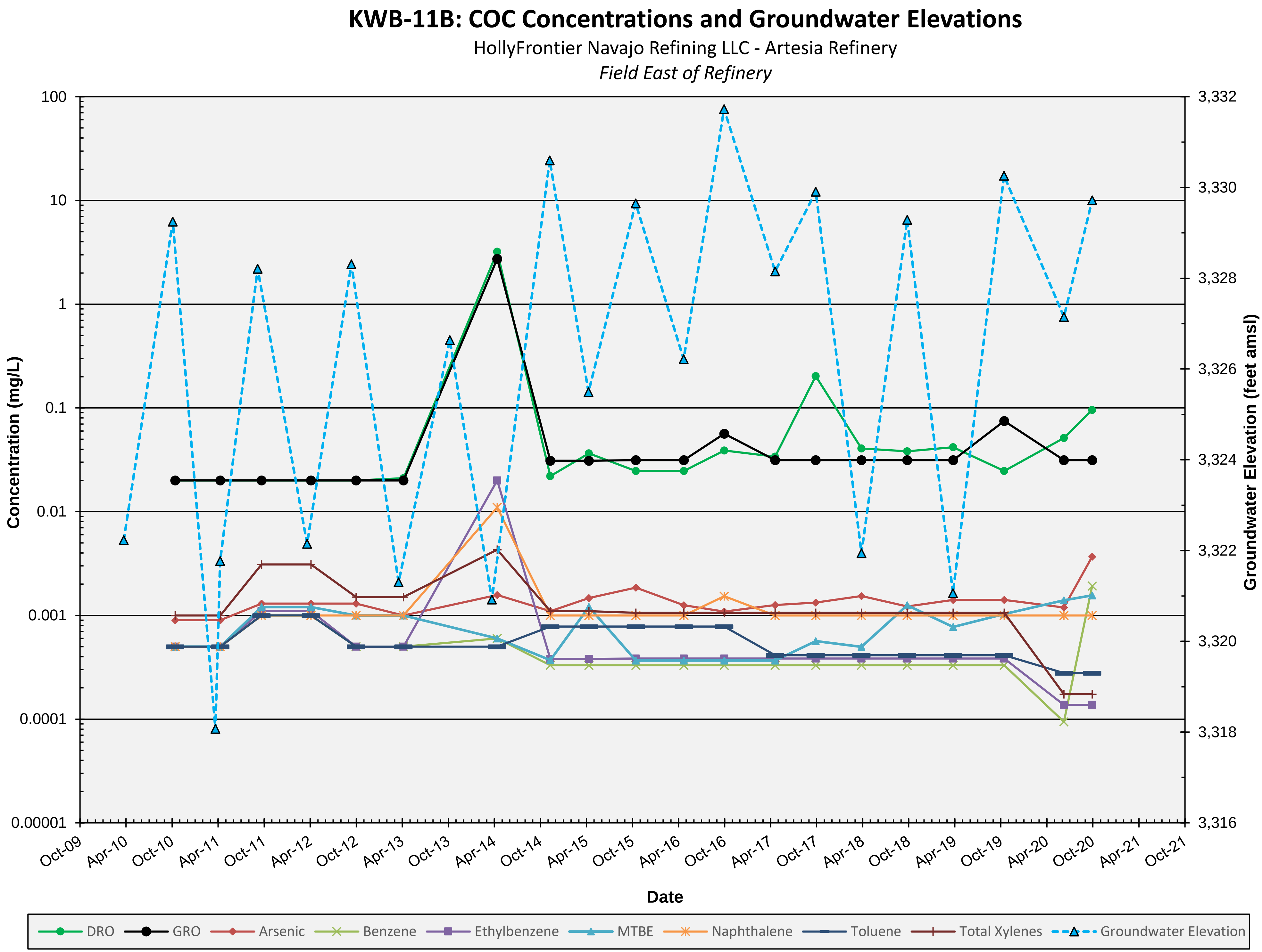


KWB-11A: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

Field East of Refinery

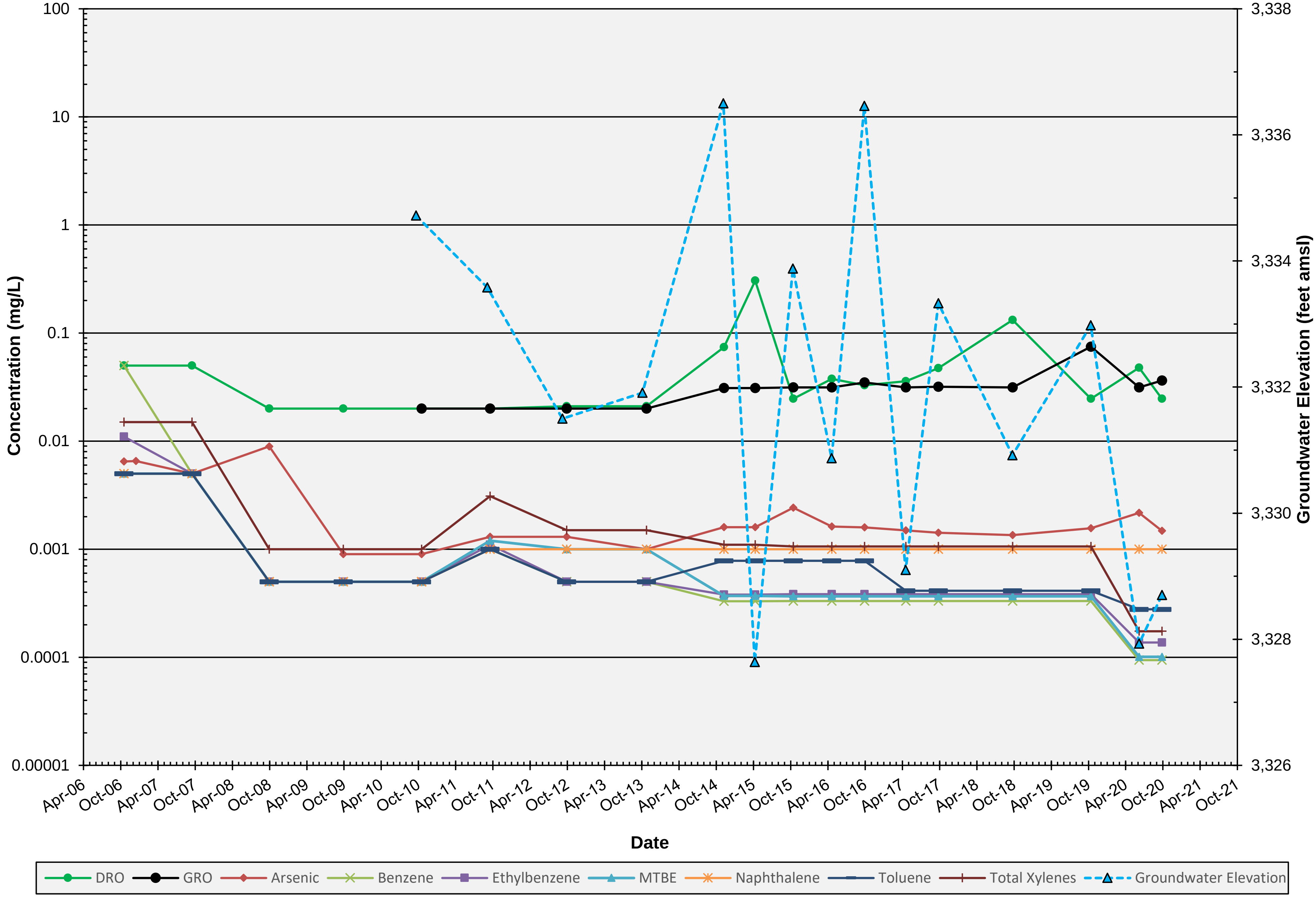



KWB-11B: COC Concentrations and Groundwater Elevations
HollyFrontier Navajo Refining LLC - Artesia Refinery
Field East of Refinery
Concentration (mg/L)
100
10
1
0.1
0.01
0.001
0.0001
0.00001
Groundwater Elevation (feet amsl)
3,332
3,330
3,328
3,326
3,324
3,322
3,320
3,318
3,316
Oct-09
Apr-10
Oct-10
Apr-11
Oct-11
Apr-12
Oct-12
Apr-13
Oct-13
Apr-14
Oct-14
Apr-15
Oct-15
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Date
DRO
GRO
Arsenic
Benzene
Ethylbenzene
MTBE
Naphthalene
Toluene
Total Xylenes
Groundwater Elevation

KWB-12A: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

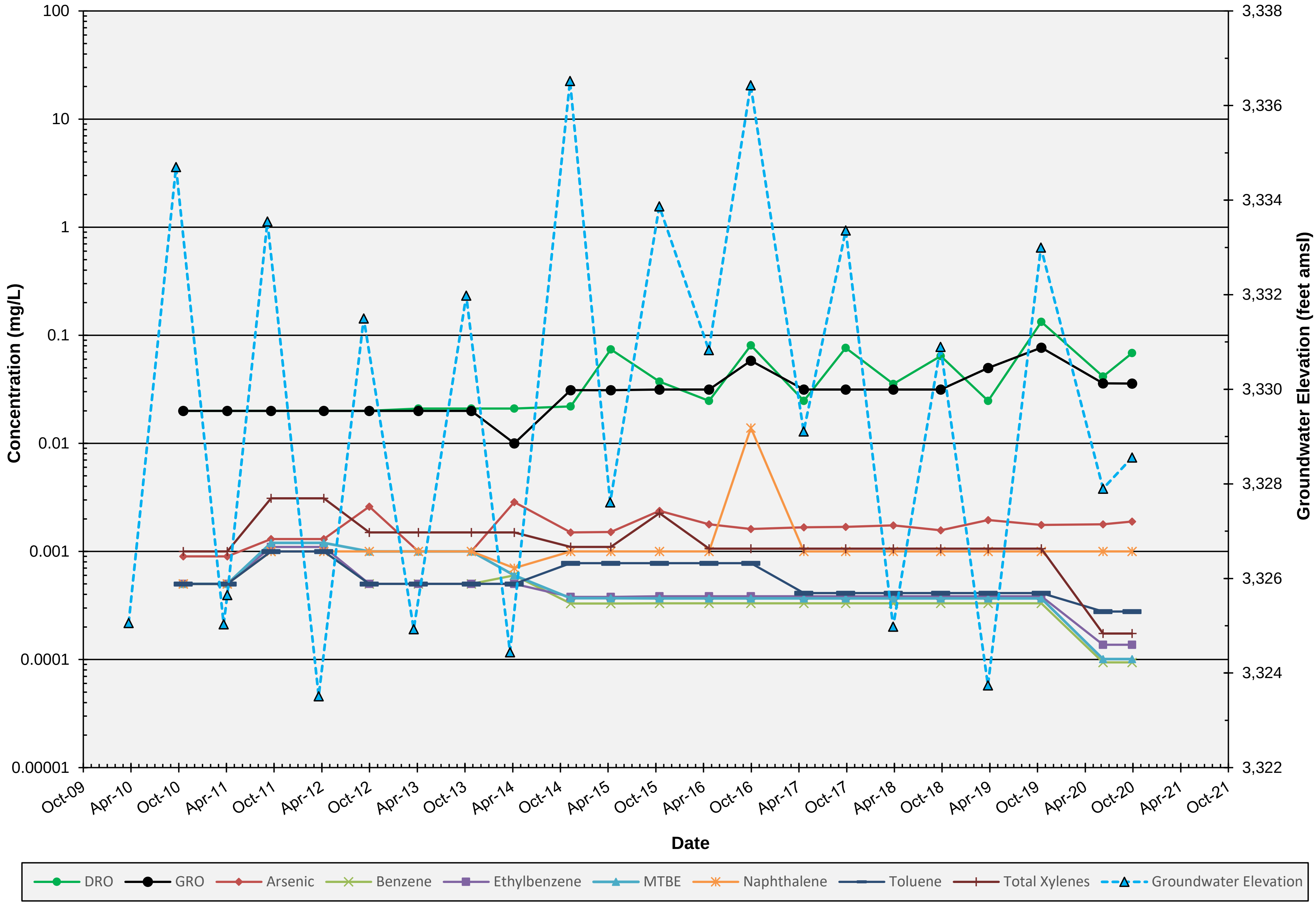
Field East of Refinery



KWB-12B: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

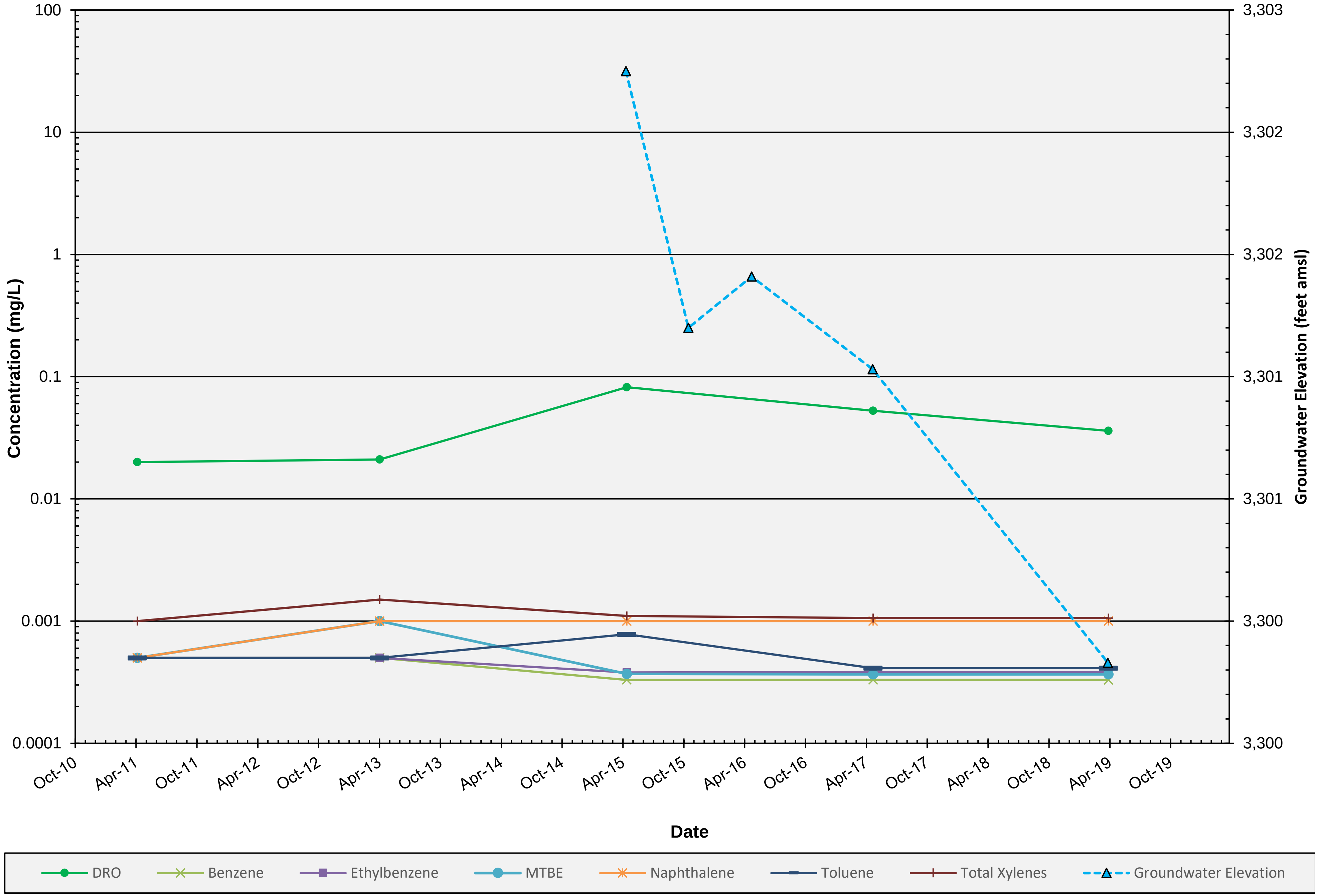
Field East of Refinery



KWB-P4: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

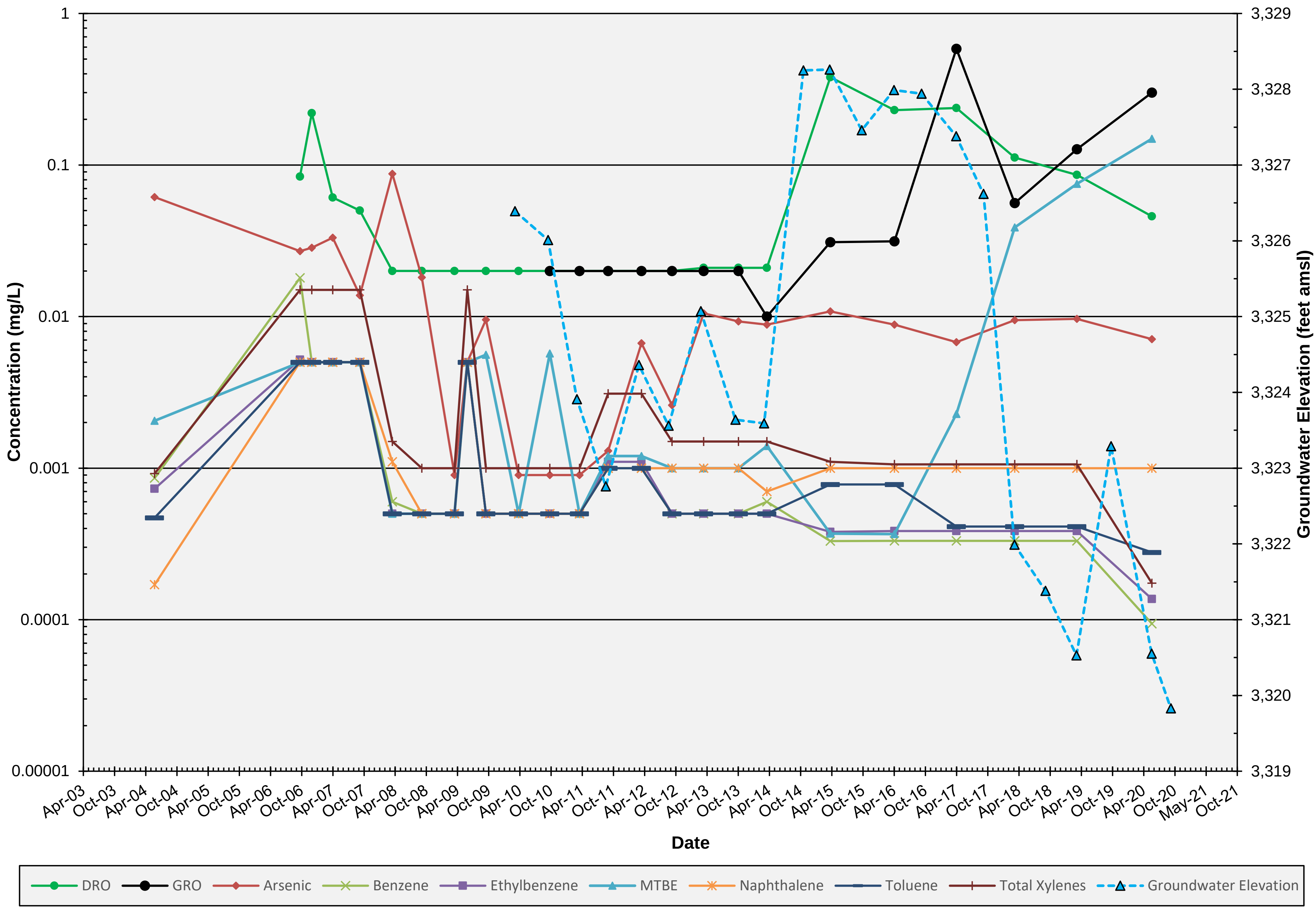
Field East of Refinery



MW-8: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

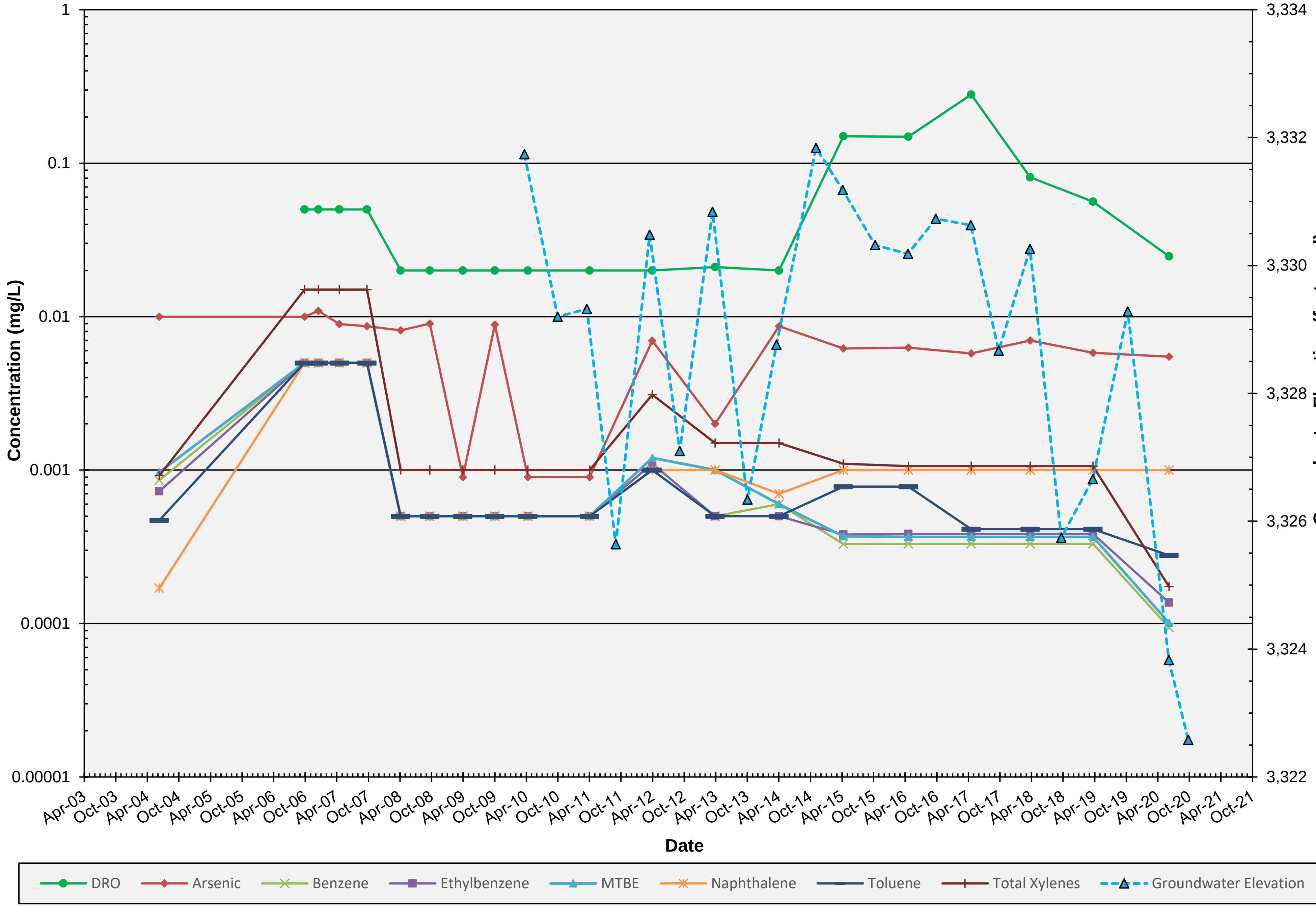
Three Mile Ditch



MW-20: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

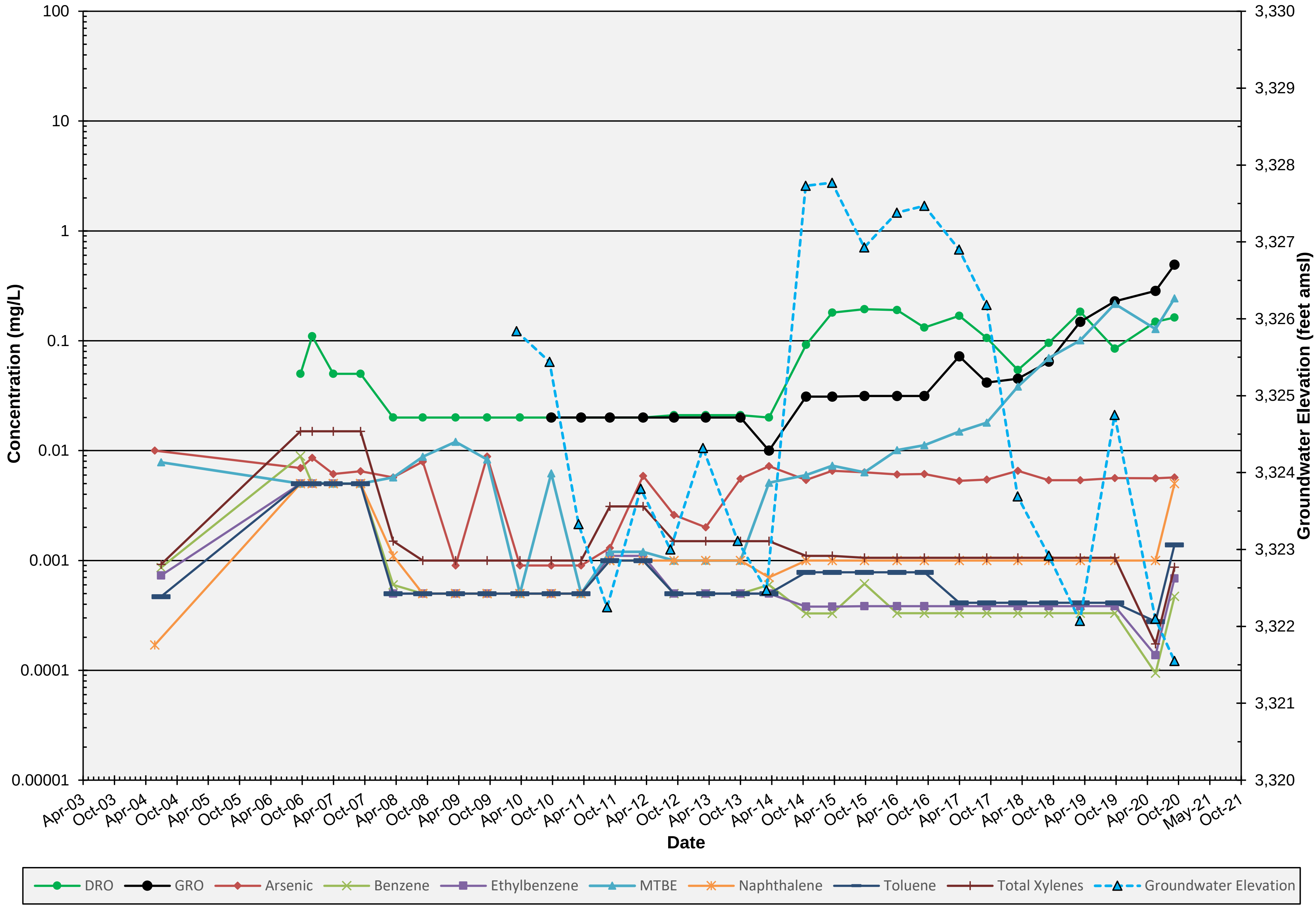
Three Mile Ditch



MW-21: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

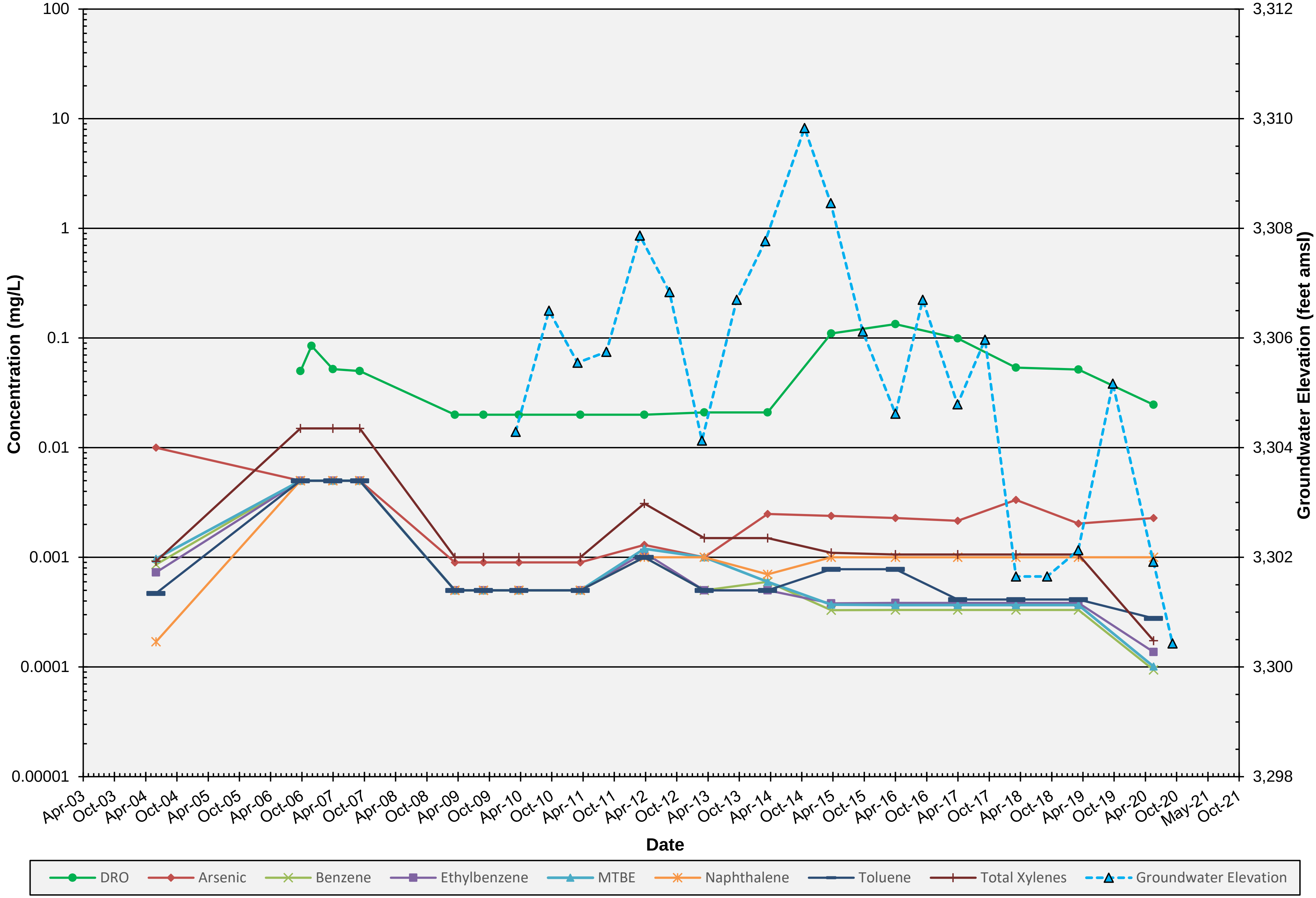
Three Mile Ditch



MW-27: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

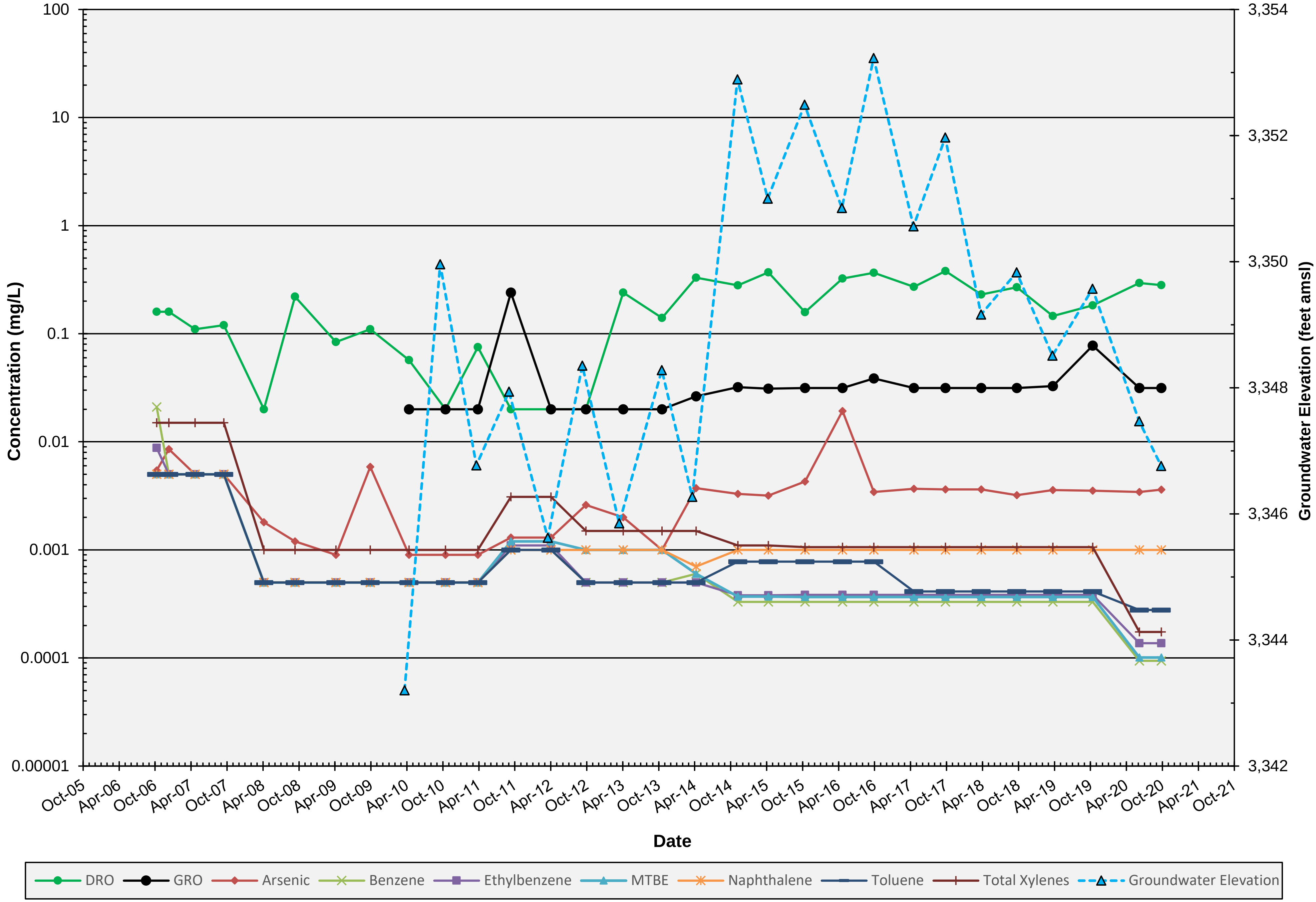
Three Mile Ditch



MW-52: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

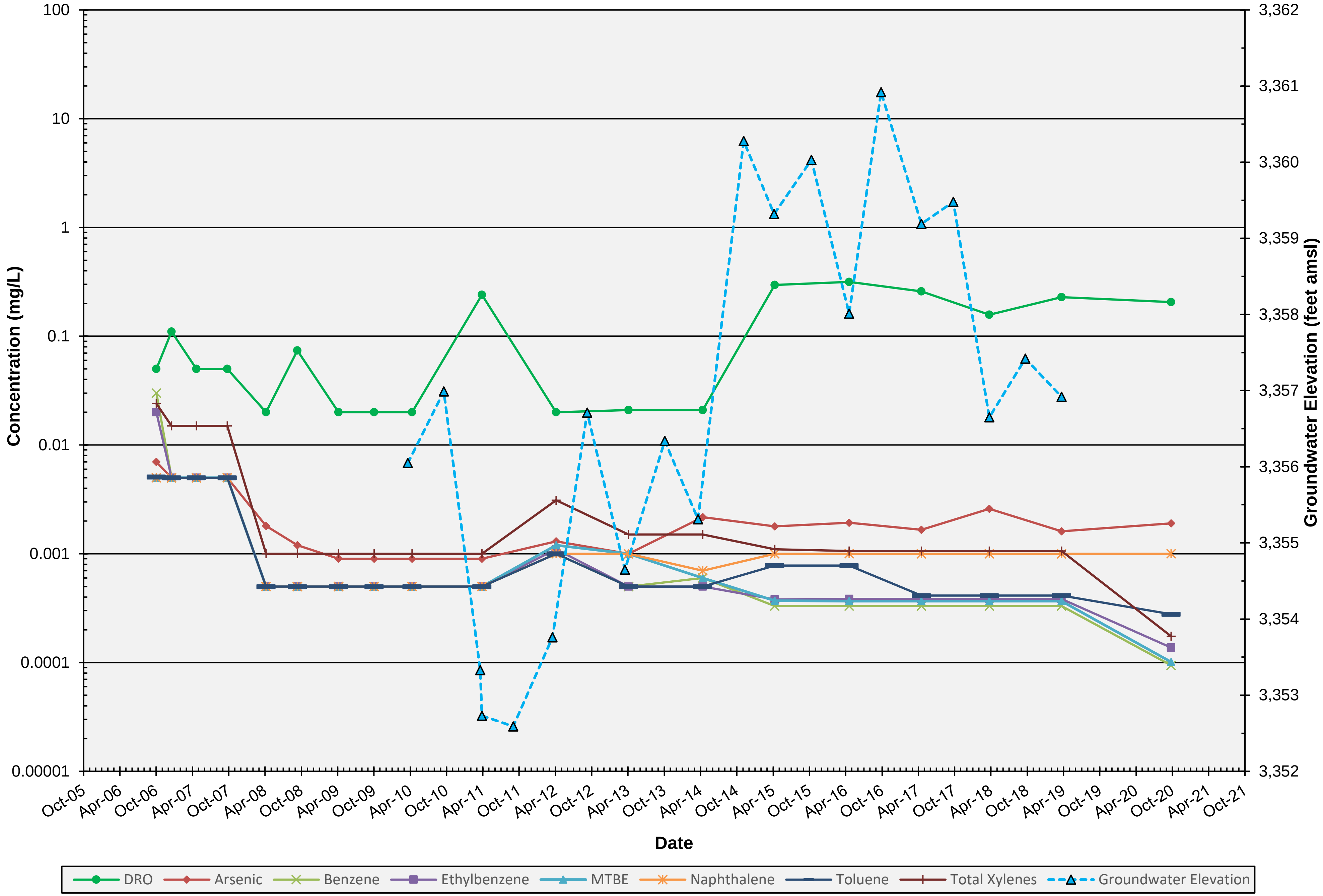
South Refinery Area



MW-53/MW-53R: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

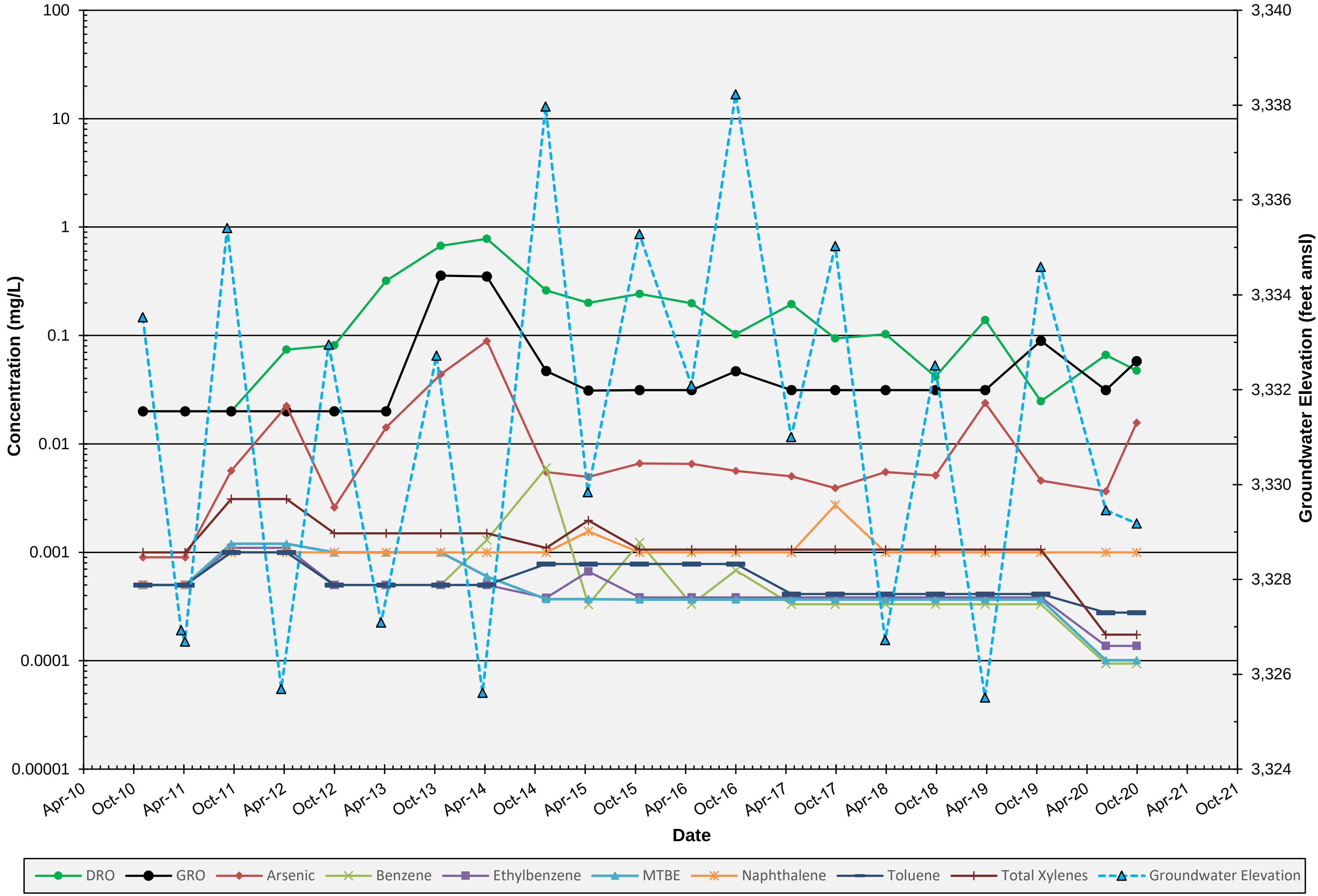
North Colony Landfarm



MW-57: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

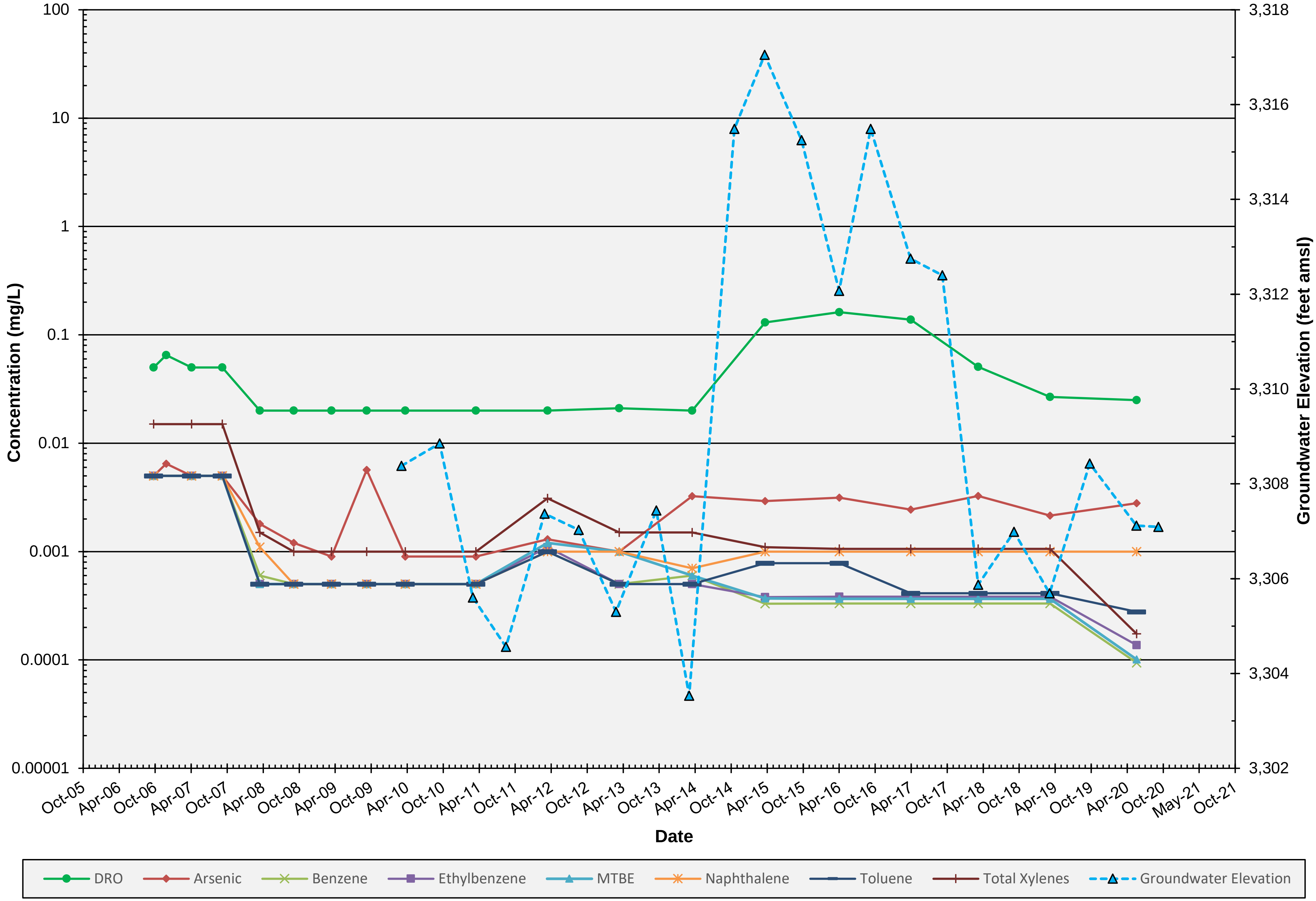
Field East of Refinery



MW-68: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

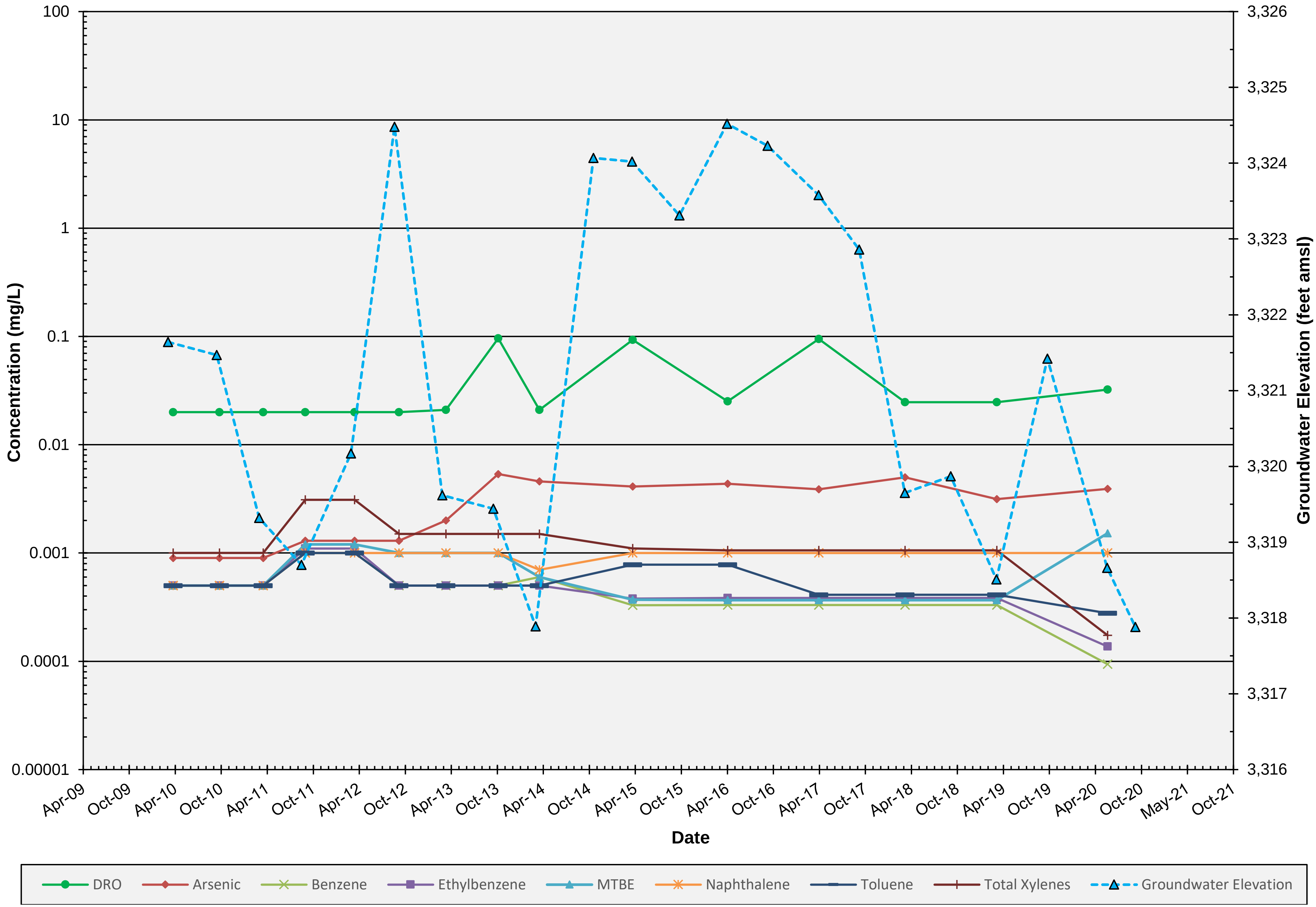
Three Mile Ditch



MW-71: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

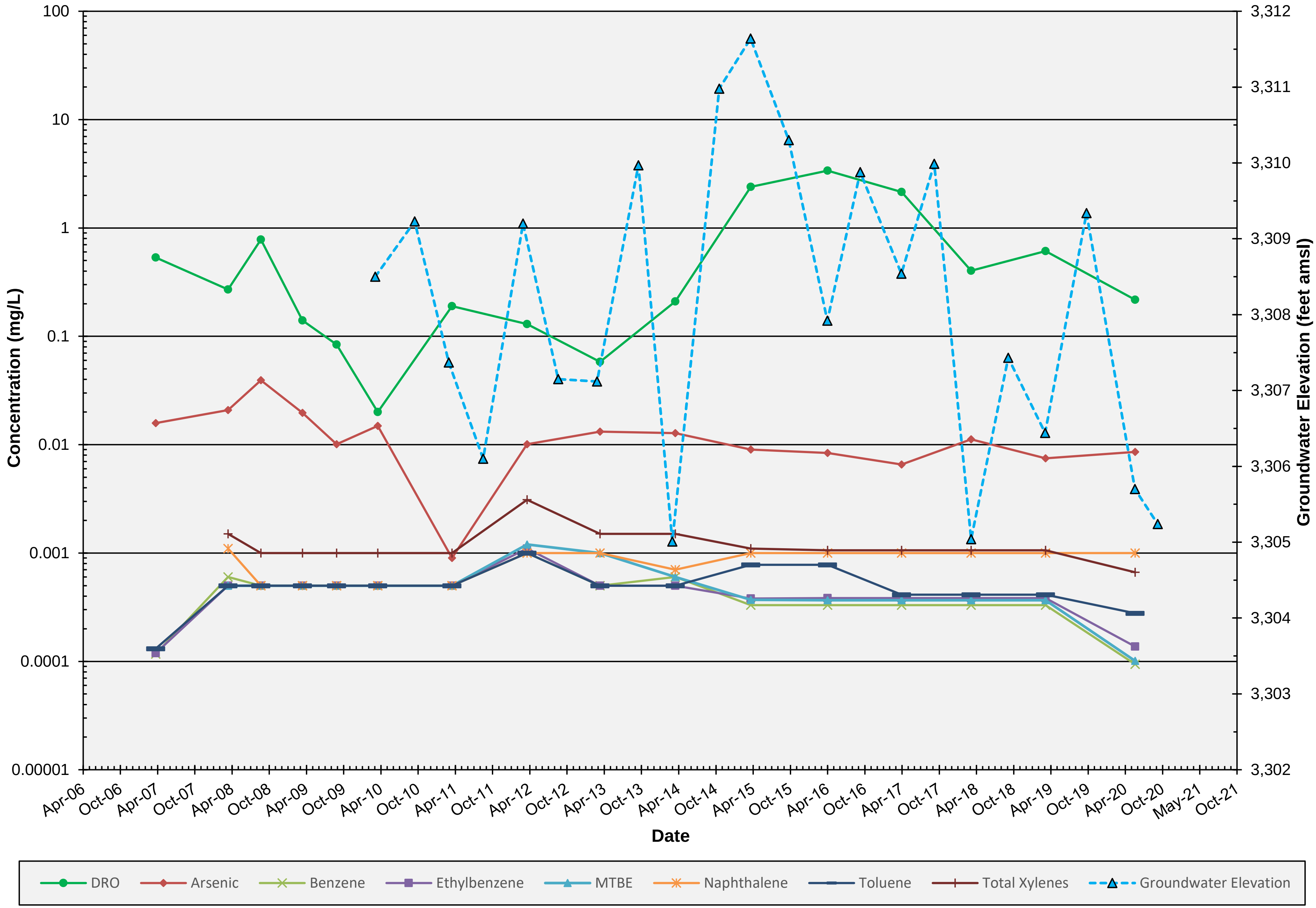
Three Mile Ditch



MW-89: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

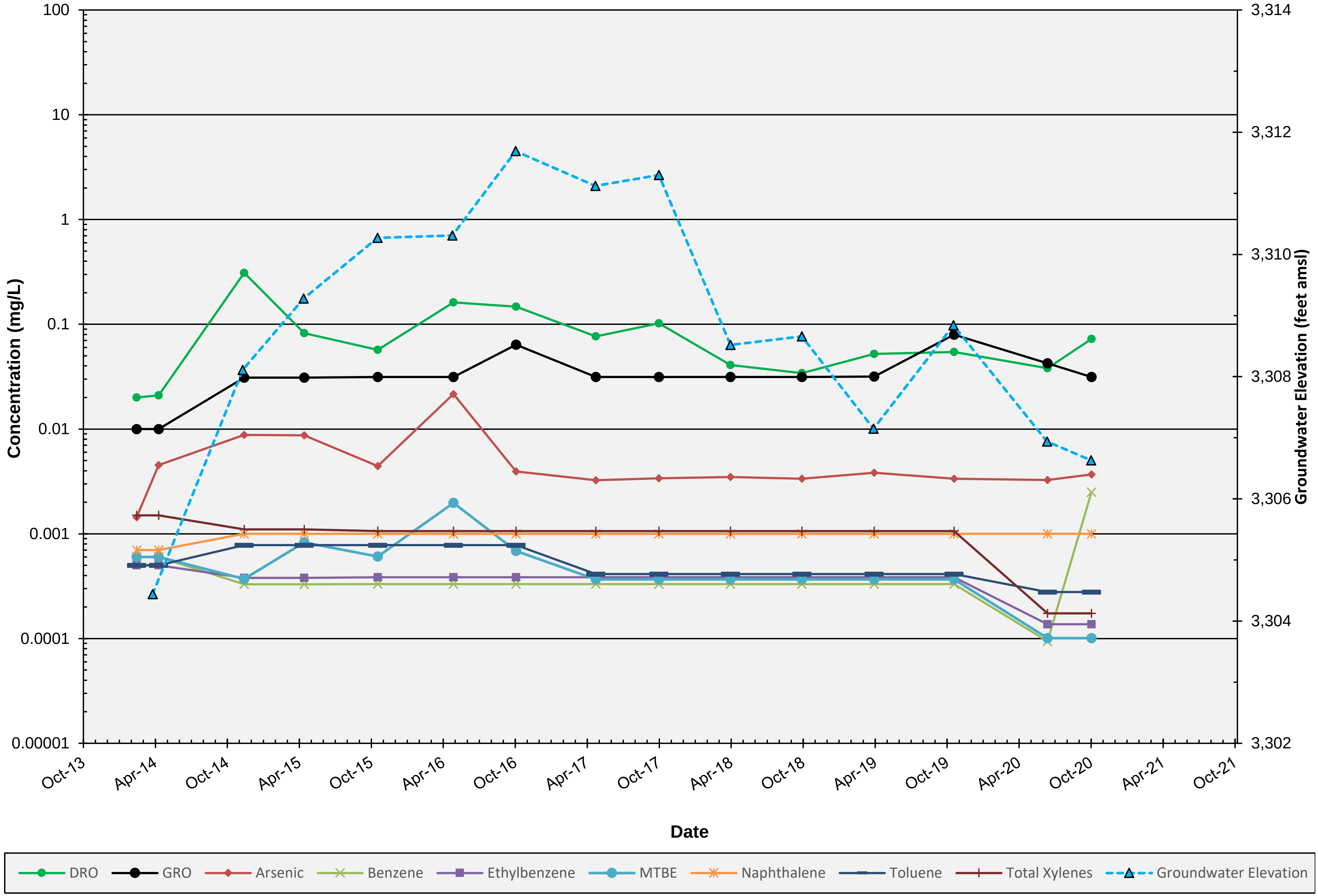
Three Mile Ditch

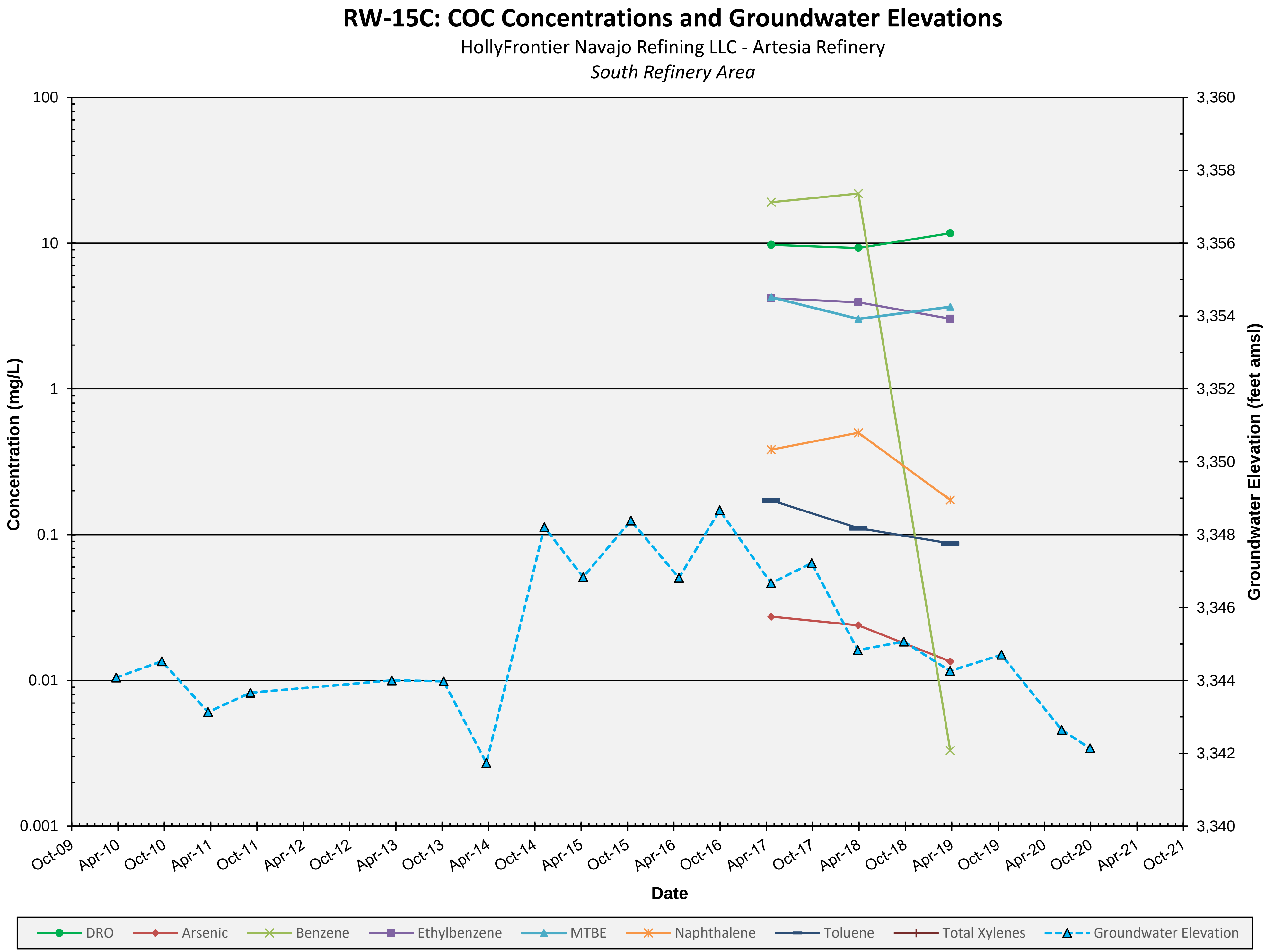


MW-135: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

Field East of Refinery

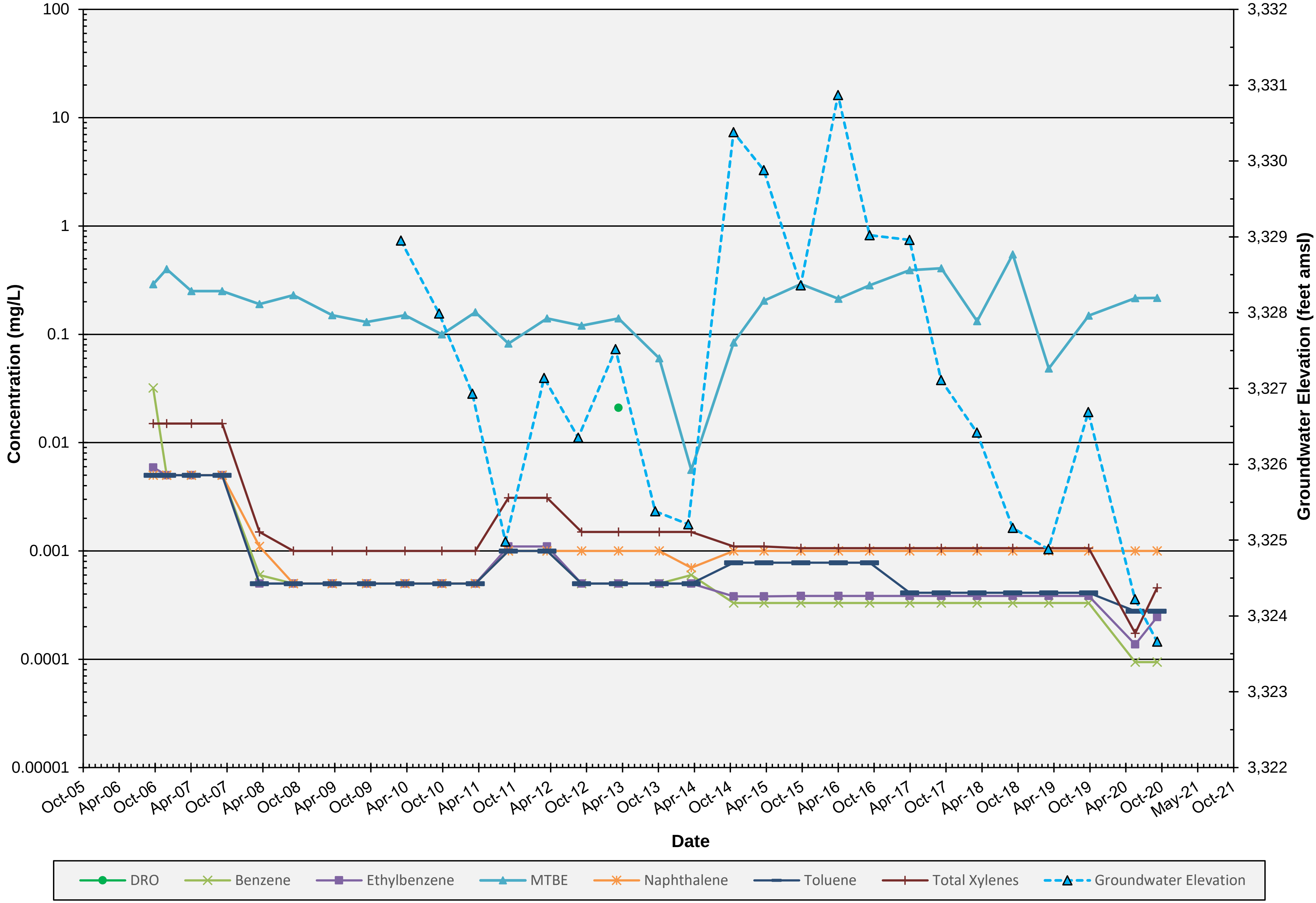



RW-15C: COC Concentrations and Groundwater Elevations
HollyFrontier Navajo Refining LLC - Artesia Refinery
South Refinery Area
Concentration (mg/L)
Groundwater Elevation (feet amsl)
100
10
1
0.1
0.01
0.001
3,360
3,358
3,356
3,354
3,352
3,350
3,348
3,346
3,344
3,342
3,340
Oct-09
Apr-10
Oct-10
Apr-11
Oct-11
Apr-12
Oct-12
Apr-13
Oct-13
Apr-14
Oct-14
Apr-15
Oct-15
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Date
DRO
Arsenic
Benzene
Ethylbenzene
MTBE
Naphthalene
Toluene
Total Xylenes
Groundwater Elevation

NP-1: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

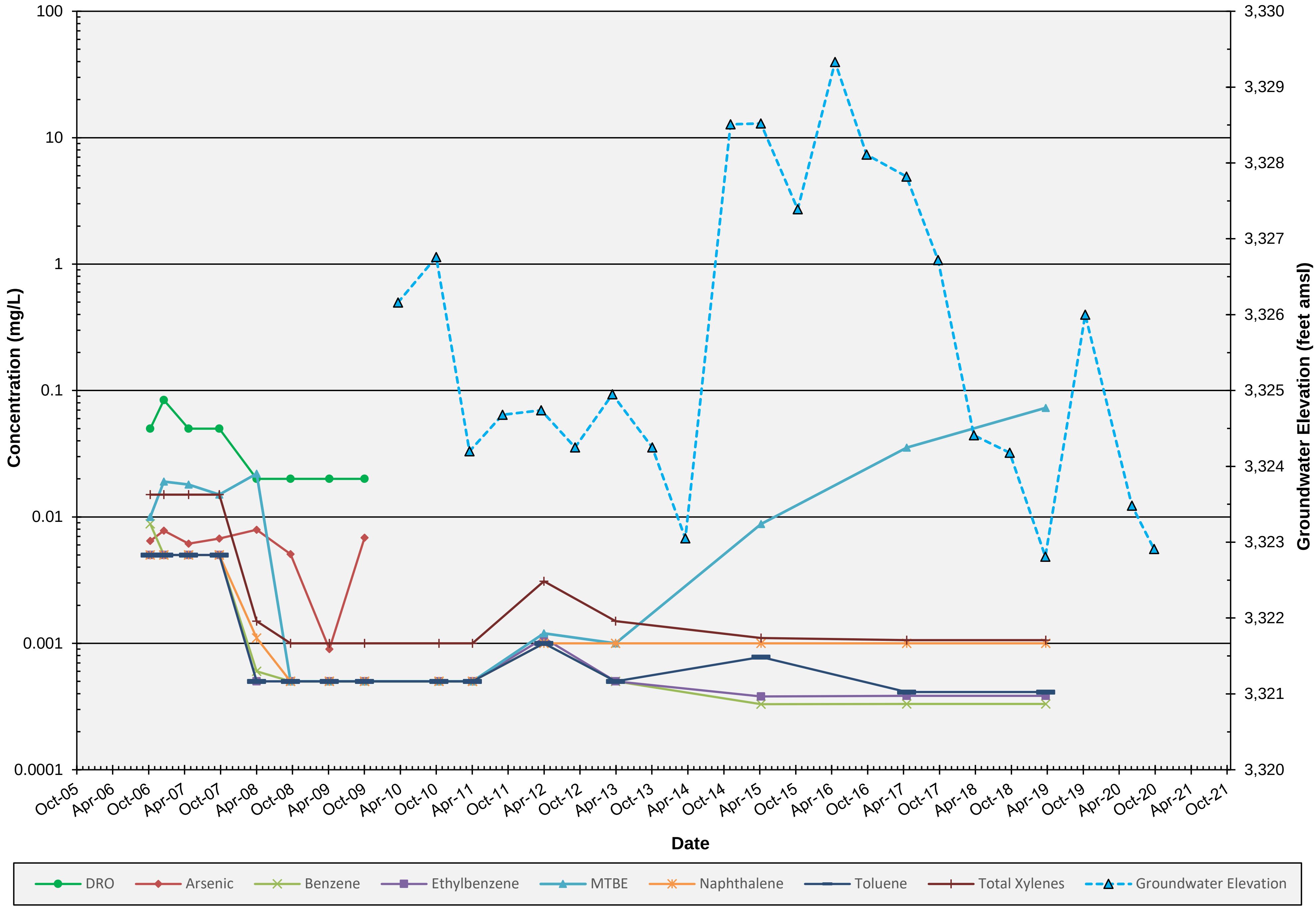
Three Mile Ditch



NP-6: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

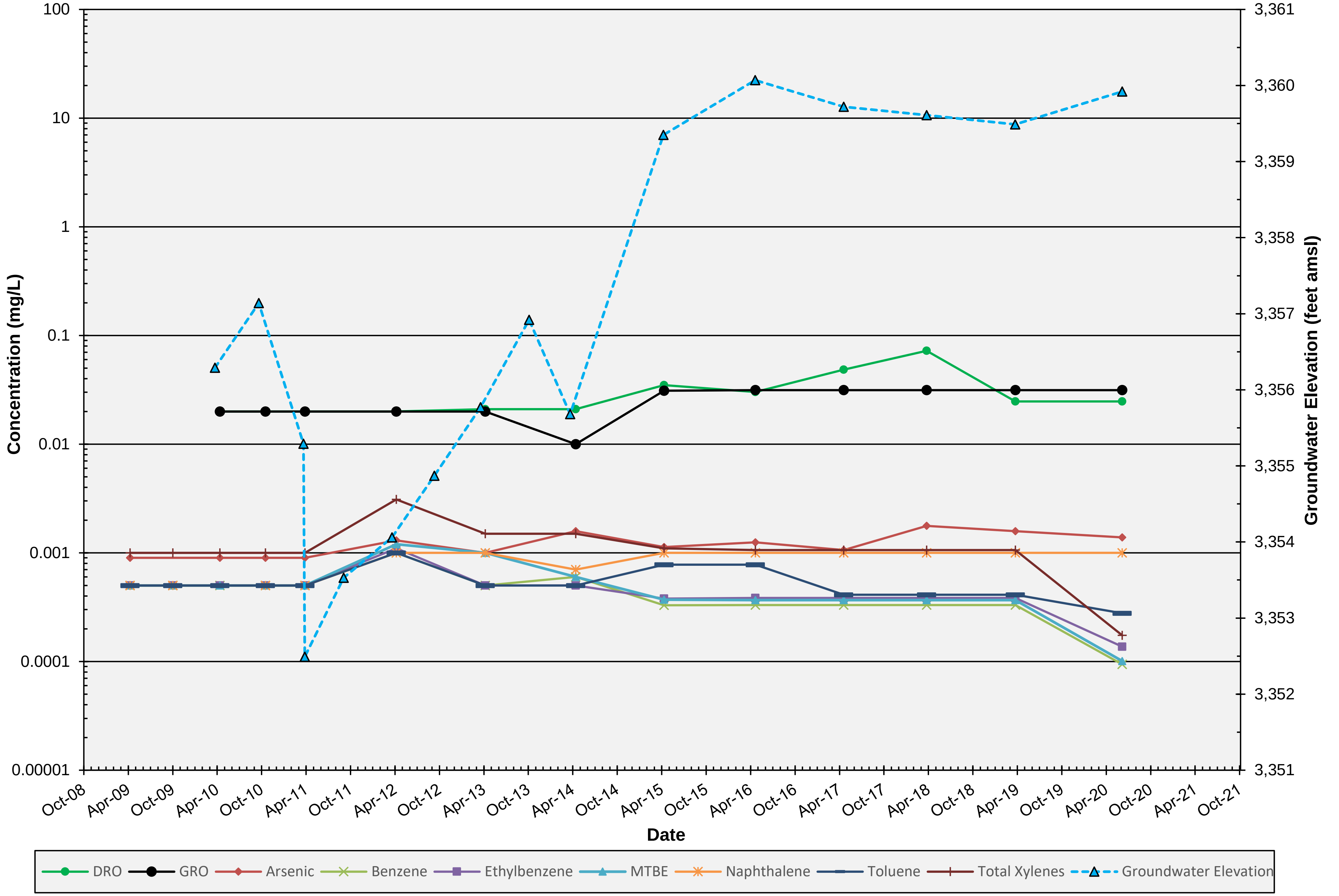
Three Mile Ditch



UG-1: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

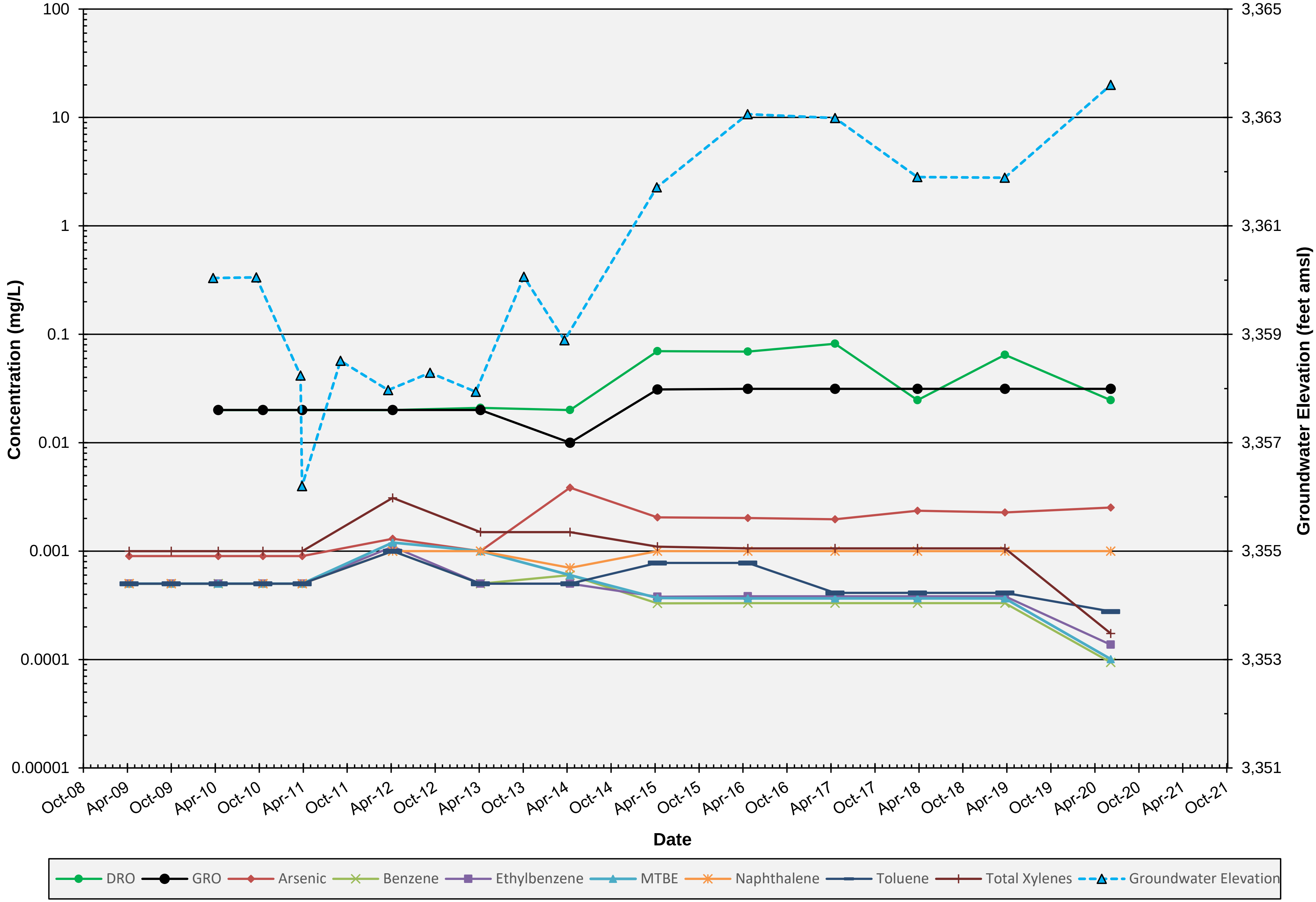
Up-Gradient of Refinery



UG-2: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

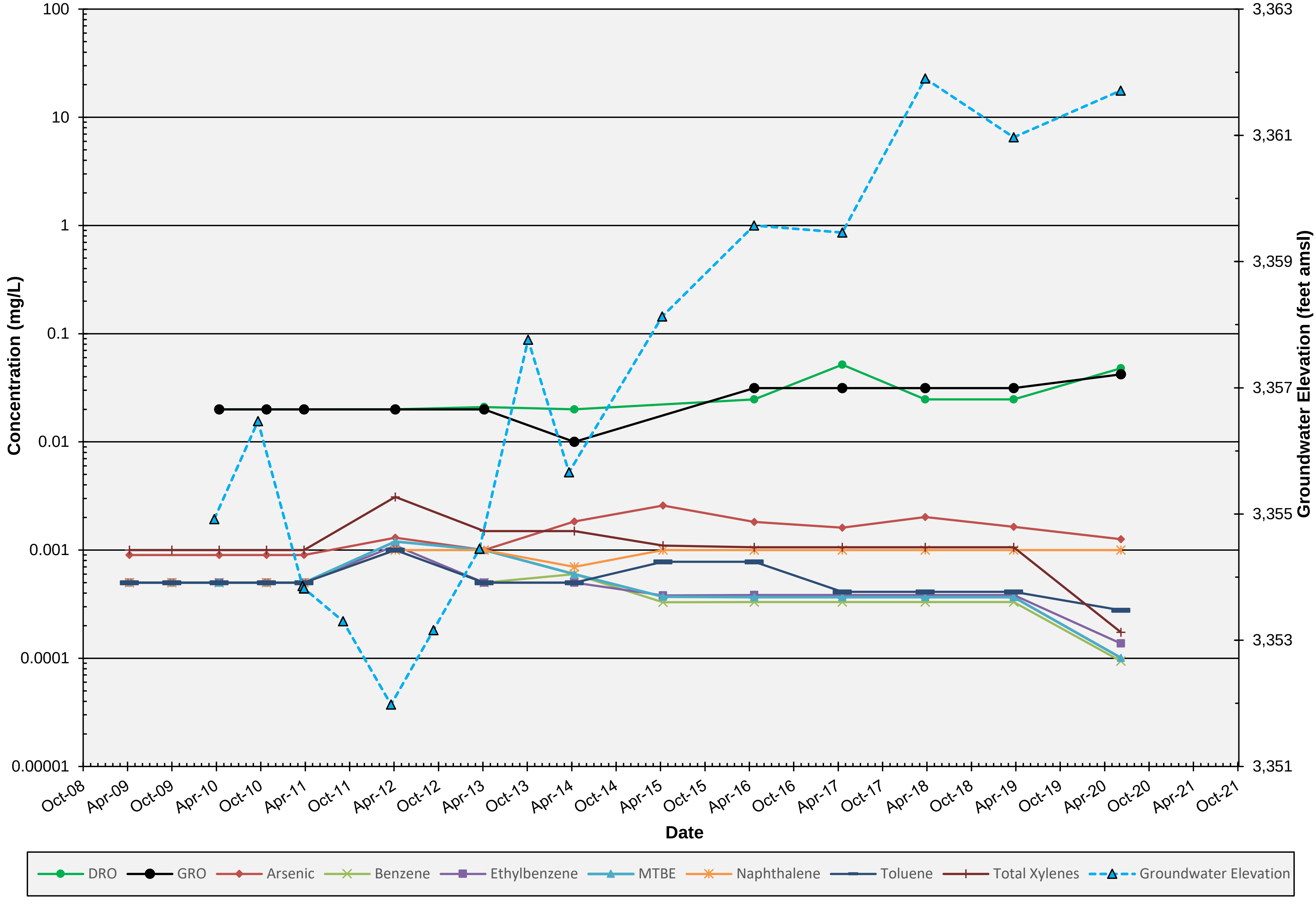
Up-Gradient of Refinery



UG-3R: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

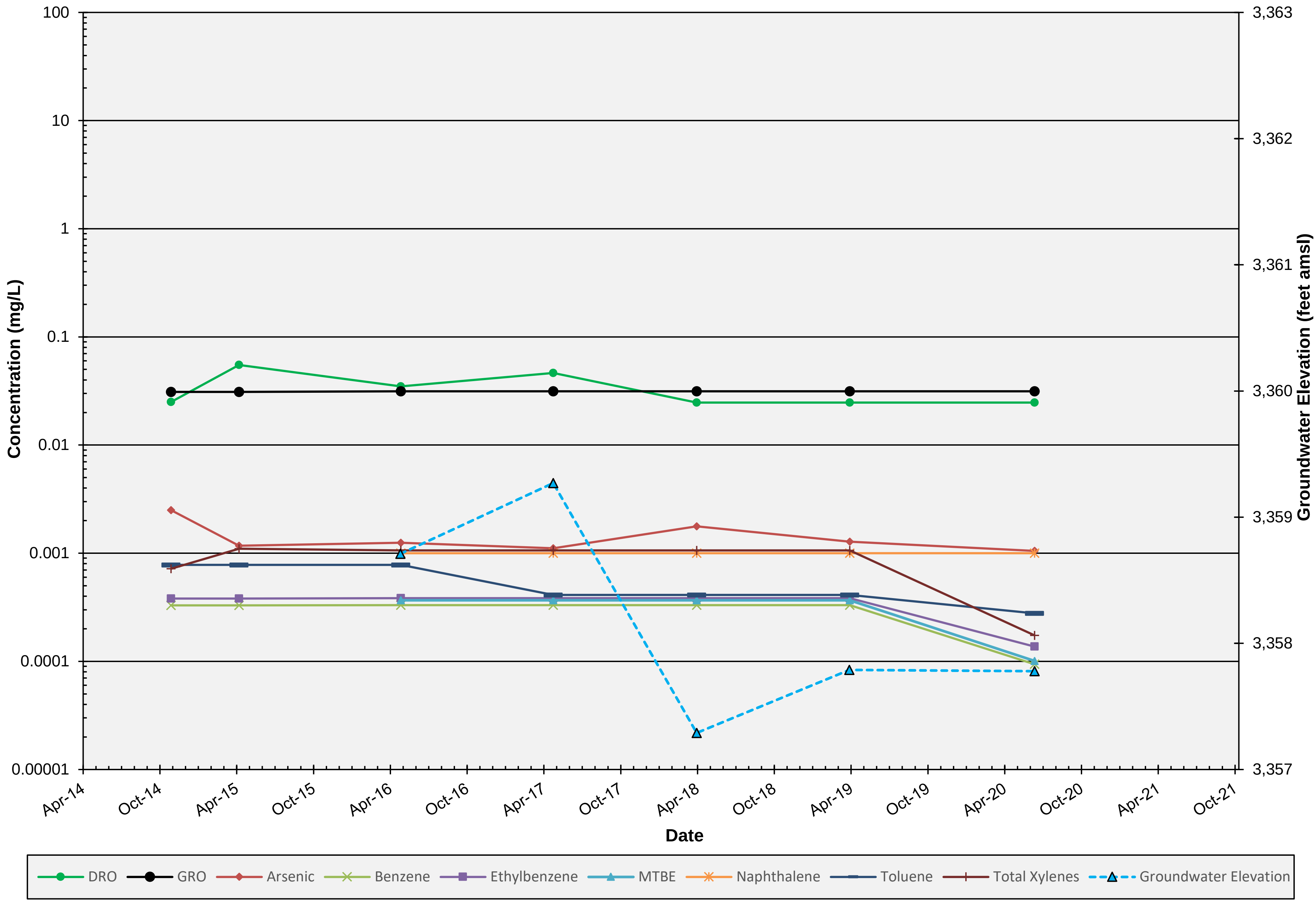
Up-Gradient of Refinery



UG-4: COC Concentrations and Groundwater Elevations

HollyFrontier Navajo Refining LLC - Artesia Refinery

Up-Gradient of Refinery



Report of Navajo Refining Company Possible Shallow Receptor Records Study Artesia, NM

Prepared for Navajo Refining Company, L.L.C.

February 2016

Atkins ENGINEERING ASSOCIATES

2904 W 2nd St
Roswell, NM 88201

Tables and Figures in Report Body

Executive Summary

Atkins Engineering Associates (AEA) has completed the receptor study for Navajo Refining Company, L.L.C. (NRC).

From New Mexico Office of the State Engineer (NMOSE) records–New Mexico Water Rights Reporting System database, well logs and Hydrographic Surveys–AEA determined there were **112** possible shallow wells with receptor-type uses in the NRC provided AOI. See Table A3 and Figure A1 in Appendix A: Data Tables and Figure.

This study is limited to database and paper records searches, and the quality and accuracy of the data provided therein. This report is not a substitute for field checks and verification of well locations, uses, construction and water quality in the AOI.

The data provided in this study could be used to guide a detailed field survey of the NRC AOI. That study could determine the actual disposition of wells in the AOI with regards to location, construction, uses, exposure pathways, and water quality.

Scope of Work

Atkins Engineering Associates, Inc. (AEA) was contracted by Navajo Refining Company L.L.C. (NRC) to conduct a receptor database study to locate possible **shallow** wells in the vicinity of the Navajo Refinery located in Artesia, New Mexico. The following sections discuss the results of that study.

Limitations

This study is limited to database and paper records searches. Information found is limited by the quality and accuracy of the data available. This report is not a substitute for field checks and verification of well locations, uses, and water quality in the AOI.

Area of Interest

The NRC study Area of Interest (AOI) was plotted on a USGS topographic map (Figure 1) and aerial photography (Figure 2) as shown on the following pages.

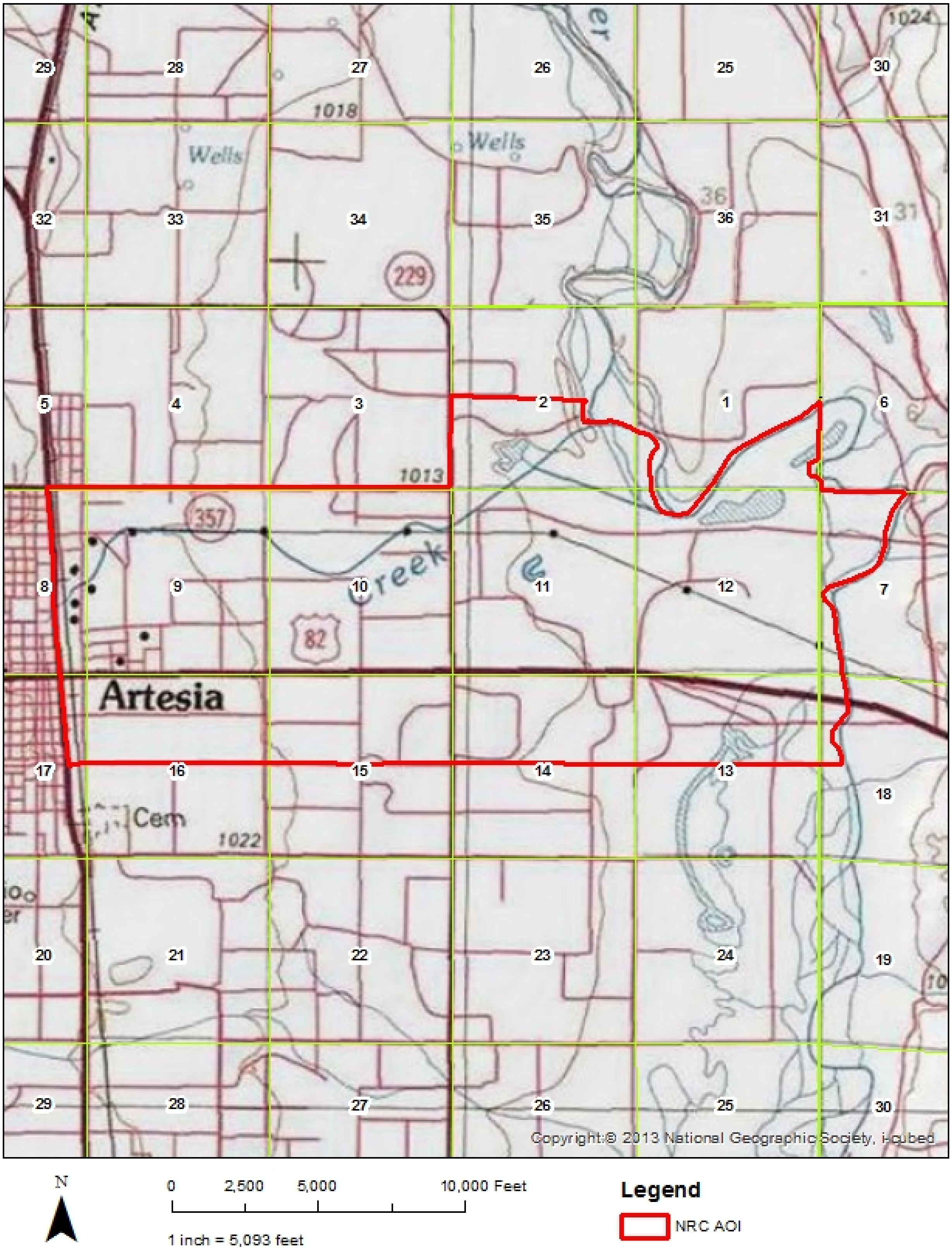


Figure 1 NRC AOI on Topographic Map with Sections

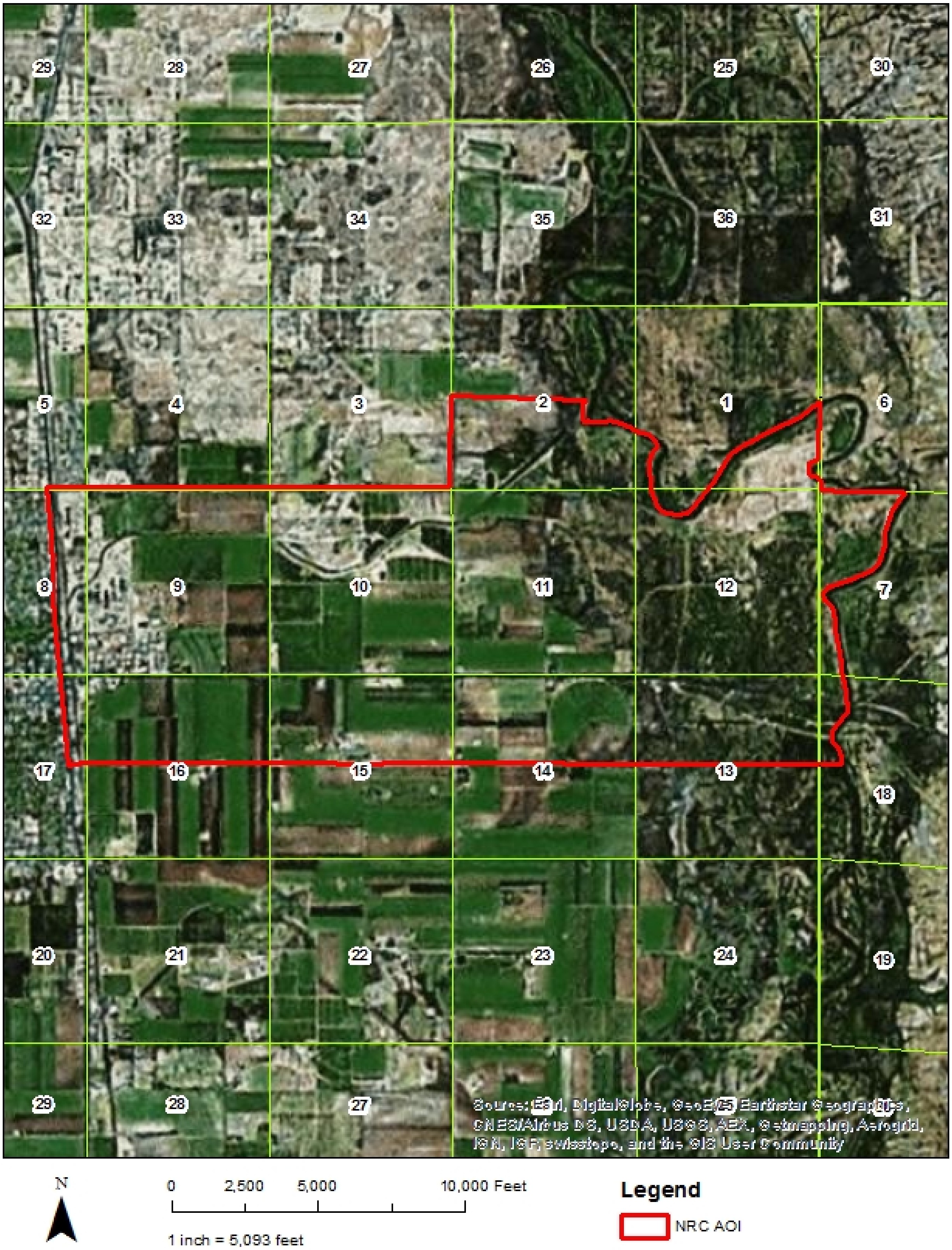


Figure 2 NRC AOI on aerial

The AOI covers portions of fifteen (15) sections being more particularly described in Table 1:

Table 1 Legal Descriptions in the NRC AOI

ID	Township	Range	Section	Portion
01	17 South	26 East	01	south of the Pecos River
02	17 South	26 East	02	south of the Pecos River
03	17 South	26 East	08	east of US Highway 285
04	17 South	26 East	09	all
05	17 South	26 East	10	all
06	17 South	26 East	11	all
07	17 South	26 East	12	south of the Pecos River
08	17 South	26 East	13	North half
09	17 South	26 East	14	North half
10	17 South	26 East	15	North half
11	17 South	26 East	16	North half
12	17 South	26 East	17	east of US Highway 285
13	17 South	27 East	06	south and west of the Pecos River
14	17 South	27 East	07	west of the Pecos River
15	17 South	27 East	18	west of the Pecos River

Data Gathering

Two New Mexico Office of the State Engineer (NMOSE) sources were used to identify possible wells in an area of interest:

1. NMOSE New Mexico Water Rights Reporting System (NMWRRS) database found on the web at http://nmwrrs.ose.state.nm.us/nmwrrs/index.html.
2. Paper well logs located at the NMOSE DII Office in Roswell, NM.

The following sections describe the methodology and results of each search.

NMWRRS Database

Currently, the NMWRRS states that the Roswell Artesian Basin (RA) has not been fully abstracted. In our experience, the database is a good tool but cannot be relied on for either completeness or accuracy.

On 12/09/2015, AEA staff extracted point of diversion (PODs, wells) from the NMWRRS in the AOI sections of interest. Any well drilled and reported after that date will not be present. This baseline extraction yielded up to 354 PODS in the AOI sections as shown in Table 2.

Table 2 NMWRRS PODs by AOI Sections

ID	PLSS	# of NMWRSS Entries
01	17S 26E Sec 01	12
02	17S 26E Sec 02	12
03	17S 26E Sec 08	41
04	17S 26E Sec 09	58
05	17S 26E Sec 10	43
06	17S 26E Sec 11	09
07	17S 26E Sec 12	26
08	17S 26E Sec 13	02
09	17S 26E Sec 14	22
10	17S 26E Sec 15	43
11	17S 26E Sec 16	08
12	17S 26E Sec 17	73
13	17S 27E Sec 06	00
14	17S 27E Sec 07	01
15	17S 27E Sec 18	04
	Total Possible Wells in General AOI	**354**

Each entry does not necessarily represent a unique well, because sometimes repairs (cleanouts and deepenings) were recorded. A sample entry is shown as Figure 3.

WR File Nbr	Use	Diversion	Owner	POD Numbe	Sourc	q64	q16	q4	Sec	Twn	Rng	X	Y	PLSS
RA 01587 D	IRR	87.5	LESLIE MARTIN	RA 01587 S		2	1	1	1	17S	26E	561697	3637157	Y

Figure 3: Sample NMWRRS Entry

Unless recently drilled, the NMWRRS stores most well locations by Public Land Survey System (PLSS). For an entry, if the PLSS column contains a “Y”, the coordinate shown is derived from PLSS. The OSE database provides coordinate data for the center of the smallest quarter delineated in NAD 83 Universe Transverse Mercator (UTM) Zone 13 in meters. If the PLSS column contains an “N”, the coordinate provided is likely derived from handheld GPS coordinates reported on the well record.

PLSS Quarter sections use the following coded designations:

NW Quarter=1	NE Quarter=2
SW Quarter=3	SE Quarter=4

For example sample POD entry (Figure 3) falls in the NE ¼ of the NW ¼ of the NW ¼ of Section 1 Township 17S Range 26E, N.M.P.M. For a standard section, the number of quarters provided for an entry isolates the location to increasingly smaller areas.

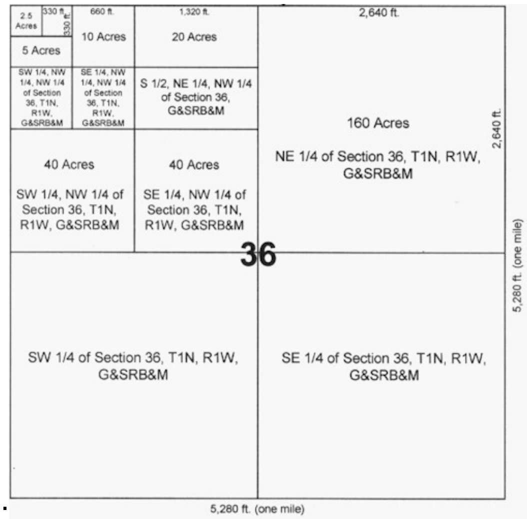


Figure 4: Example Section Breakdown

The OSE databases generally list three (3) quarter sections (locating the POD in a 10-acre tract). Sometimes paper logs provide fewer, but often more precise section breakdowns–With four quarters listed, the location is refined to 2.5 acres, with 5 quarters to .625 acres, etc.

To help with data interpretation, the12/09/2015 NMWRRS data extraction was expanded as follows:

1) Numerical quarter representations were converted to their direction descriptions (NW, NE, etc.) and those columns were added.
2) PODS with blank WR File No. were filled in using the POD prefixes, if available.

Table A1 contains the initial NMWRRS Data Extraction with AEA applied refinements.

NMWRRS Database Scrubbing

The goal of the NRC receptor study is to identify shallow receptor wells in the AOI. To achieve this, the initial NMWRRS extraction was further “scrubbed” using the following methodology:

1) Remove PODs listed as Artesian. PODs listed as shallow and blank were left in as possibilities.
2) Remove PODs with uses that would not suggest consumption or other receptor type pathways. Prior to completing this filter, PODS with blank uses were filled in using the first entry under that WR file No., if available; if not, blank uses were left blank. Uses that were retained are shown in Table 3.

Table 3 Retained POD Uses

Code	Description
COM	Commercial
DOL	72-12-1 Domestic And Livestock Watering
DOM	72-12-1 Domestic One Household
IND	Industrial
IRR	Irrigation
MUL	72-12-1 Multiple Domestic Households
MUN	Municipal - City Or County Supplied Water
NON	Non-Profit Organizational Use
EXP	Exploratory (Could be Monitoring or converted to another use)
PUB	72-12-1 Construction Of Public Works

Exploratory uses were included because these types of permits can sometimes be “converted” to other receptor type uses. Exploratory permits that were clearly monitor well uses were removed. Public works uses were included because they can sometimes indicate permits taken out of existing wells with other uses; or because after the public works project, the well may remain and be potentially repurposed.

3) Remove wells not located in the specific AOI. For example, the NRC AOI Section Index ID 08 (see Table 1) is the listed as the North half of Section 08, Township 17 South, Range 26 East. Therefore POD entries listed in either the SW or SE quarters of said section were filtered out.

This scrubbed list was projected onto the AOI, using the listed coordinates for each entries.

NMWRRS Database Results

Of the original 354 possible PODs, the number of likely shallow wells with receptor-type uses in the AOI was reduced to 87. Table 4 on the following page shows the refined count by section.

Table 4 NMWRRS All PODs v. Possible Shallow Wells with Receptor-type uses in AOI

ID	PLSS	# of NMWRSS Entries	Possible Shallow wells with receptor type uses after Data Scrubbing
01	17S 26E Sec 01	12	02
02	17S 26E Sec 02	12	02
03	17S 26E Sec 08	41	01
04	17S 26E Sec 09	58	15
05	17S 26E Sec 10	43	22
06	17S 26E Sec 11	09	05
07	17S 26E Sec 12	26	02
08	17S 26E Sec 13	02	00
09	17S 26E Sec 14	22	14
10	17S 26E Sec 15	43	20
11	17S 26E Sec 16	08	01
12	17S 26E Sec 17	73	02
13	17S 27E Sec 06	00	00
14	17S 27E Sec 07	01	00
15	17S 27E Sec 18	04	01
	Totals	**354**	**87**

Table A2 lists the possible PODs meeting the criteria of this Study that **may** fall in the AOI. Figure A1 shows this list plotted against the AOI. Because a POD listed by PLSS description could be located anywhere in that the smallest described quarter, when that description intersected the AOI– the POD entry was retained as a possibility.

For example, two of the POD entries listed the smallest PLSS description as Section 1, Township 17S, Range 26E, N.M.P.M. Because, portions of the AOI fall in the Section, absent any additional information, these entries are shown as possibly falling in the AOI. Furthermore, if the same PLSS description was given multiple wells can plot in the same location.

This list is based on the information obtained from the NMWRRS, and may not reflect actual conditions. PODs listed, or not listed, may be misrepresented in the database, plugged and abandoned, not in use, or not being used as originally listed.

NMOSE Paper Well Logs

The week of 12/14, AEA staff scanned all the physical logs for the fifteen (15) sections in the AOI from the District II NMOSE office. Any well drilled and reported after that date will not be present. The following table enumerates the number of paper logs by section in the AOI after filtering out portion of the sections not included in the AOI.

Table 5 Paper Well logs by Section

ID	PLSS	# of Paper Logs
01	17S 26E Sec 01	02
02	17S 26E Sec 02	03
03	17S 26E Sec 08	13
04	17S 26E Sec 09	35
05	17S 26E Sec 10	22
06	17S 26E Sec 11	07
07	17S 26E Sec 12	13
08	17S 26E Sec 13	00
09	17S 26E Sec 14	10
10	17S 26E Sec 15	15
11	17S 26E Sec 16	05
12	17S 26E Sec 17	21
13	17S 27E Sec 06	00
14	17S 27E Sec 07	00
15	17S 27E Sec 18	00
	Total	**146**

Each log does not necessarily represent a unique well, because sometimes repairs (cleanouts and deepenings) were recorded. For reference all the well logs in the AOI from the NMOSE are included as a complete packet in Appendix D.

NMOSE Paper Well Logs Scrubbing

Remaining NMOSE paper well logs were reviewed and sorted into two categories: Artesian (39 logs) and Shallow (107 logs). Shallow logs for PODs with uses not suggesting a receptor, for example monitoring and observation, were removed.

NMOSE Paper Well Logs Results

After filtering, the remaining shallow logs were tabulated and if possible details on total depths and perforations were tabulated for the 49 remaining possible receptors in the AOI as shown on Table 6

Table 6 Shallow well logs in AOI with receptor-type uses

POD Number	Sec	Twn	Rng	Perforation Depth
RA-02219	002	17S	26E	Not Listed
RA-04308	002	17S	26E	108-139
RA-05945	002	17S	26E	lower 30 (hard to determine)
RA-00602&RA-2324	009	17S	26E	Not Listed
RA-01440	009	17S	26E	Not listed
RA-01533	009	17S	26E	Not Listed
RA-02488	009	17S	26E	140-200
RA-02654	009	17S	26E	Not Listed
RA-02698	009	17S	26E	Not Listed
RA-02723	009	17S	26E	240-318
RA-03225	009	17S	26E	65-94
RA-03282	009	17S	26E	105-125
RA-10378	009	17S	26E	115-190
RA-01300	010	17S	26E	Not Listed
RA-01331	010	17S	26E	Not Listed
RA-01331-EXPL	010	17S	26E	100-300
RA-01331-POD2	010	17S	26E	93-268
RA-01488&RA-1668-A-COMB	010	17S	26E	100-250
RA-03368	010	17S	26E	192-215
RA-04196	010	17S	26E	275-294
RA-04922	010	17S	26E	Not Listed
RA-06550	010	17S	26E	90-120
RA-07180	010	17S	26E	180-220
RA-01414	011	17S	26E	Not Listed
RA-09912	011	17S	26E	45-170,158-249
RA-10442	011	17S	26E	60-170
RA-02034	012	17S	26E	70-90
RA-02649	012	17S	26E	114-130
RA-02896	012	17S	26E	?-237
RA-04438	012	17S	26E	185-228
RA-	014	17S	26E	251.5-261.5
RA-01414-S	014	17S	26E	Not Listed
RA-02749	014	17S	26E	214-241
RA-03518	014	17S	26E	Void?
RA-03522	014	17S	26E	342-365
RA-08941	014	17S	26E	60-100
RA-11977	014	17S	26E	140-200
RA-	015	17S	26E	lower joint
RA-01183	015	17S	26E	Not Listed
RA-01227-RAS-5	015	17S	26E	lower 52'
RA-01503	015	17S	26E	States from entire length?
RA-02221	015	17S	26E	133-180
RA-02222	015	17S	26E	141-170
RA-03353	015	17S	26E	232-295
RA-04684	015	17S	26E	185-220
RA-04765	015	17S	26E	155-185
RA-09866	015	17S	26E	Not Listed
RA-02568	016	17S	26E	lower 30
RA-00820	017	17S	26E	Not Listed

NMOSE Hydrographic Surveys

The Roswell Artesian Underground water basin was adjudicated in 1966. During this process, the NMOSE conducted surveys of the basin, and prepared hydrographic map sheets by section. Though dated, these sheets are a useful source to located wells.

AEA scanned all available Hydrographic map sheets, georeferenced them, and overlaid the AOI versus the sheets. Sections 6, 7 and 18 of Township 17 South, Range 27 East N.M.P.M did not have Hydrographic Map sheets available.

Table 7 provides a count of possible shallow wells by section including shallow wells with and without RA numbers, shallow wells listed as “V” (violations) or shallow wells listed as “out.” ;

Table 7 Possible Shallow Wells on Hydrographic Sheets in AOI

ID	PLSS	Possible Shallow Wells
01	17S 26E Sec 01	00
02	17S 26E Sec 02	00
03	17S 26E Sec 08	00
04	17S 26E Sec 09	07
05	17S 26E Sec 10	04
06	17S 26E Sec 11	03
07	17S 26E Sec 12	01
08	17S 26E Sec 13	00
09	17S 26E Sec 14	02
10	17S 26E Sec 15	06
11	17S 26E Sec 16	01
12	17S 26E Sec 17	00
13	17S 27E Sec 06	--
14	17S 27E Sec 07	--
15	17S 27E Sec 18	--
	Totals	**24**

Table 8 enumerates the RA numbers (when available) of shallow wells shown on the map sheets. Map Sheets can be found in Appendix C Hydrographic Map Sheets by Section

Table 8 Shallow wells on Hydrographic Map Sheets

POD	Section	TWN	RNG
RA 2654	9	17S	26E
RA 1973	9	17S	26E
RA 3225	9	17S	26E
RA 2496	9	17S	26E
RA 2468	9	17S	26E
RA 2723	9	17S	26E
No RA	9	17S	26E
RA1331	10	17S	26E
No RA	10	17S	26E
RA 2793	10	17S	26E
RA 1300	10	17S	26E
RA 1414	11	17S	26E
No RA	11	17S	26E
No RA	11	17S	26E
No RA	12	17S	26E
RA 3051	14	17S	26E
Unreadable RA	14	17S	26E
RA 3156	15	17S	26E
RA 2221	15	17S	26E
RA 1503 E	15	17S	26E
RA 1183	15	17S	26E
RA 222	15	17S	26E
Unreadable RA	15	17S	26E
RA 2568	16	17S	26E

Data Comparison and Results

A comparison of the results from the NMWRRS, Well Records and Hydrographic Surveys searches is shown in Table 8

Table 9 Comparison of Three Sources

ID	PLSS	Possible Shallow Wells after NMWRRS Scrubbing	Possible Shallow Wells after Paper Log Scrubbing	Possible Shallow Wells from Hydrographic Map Sheet
01	17S 26E Sec 01	02	00	00
02	17S 26E Sec 02	02	03	00
03	17S 26E Sec 08	01	00	00
04	17S 26E Sec 09	15	10	07
05	17S 26E Sec 10	22	10	04
06	17S 26E Sec 11	05	03	03
07	17S 26E Sec 12	02	04	01
08	17S 26E Sec 13	00	00	00
09	17S 26E Sec 14	14	07	02
10	17S 26E Sec 15	20	10	06
11	17S 26E Sec 16	01	01	01
12	17S 26E Sec 17	02	01	00
13	17S 27E Sec 06	00	00	--
14	17S 27E Sec 07	00	00	--
15	17S 27E Sec 18	01	00	--
	Totals	**87**	**49**	**24**

Tabulations of all three sources were “merged” to identify unique values. Duplicate values across all three tables were removed, and the NMWRRS data was updated to include total depth and perforation information from well logs when matches across the tables were present.

Cross checking the Hydrographic map sheets allowed the removal of two (2) PODS, RA-1735 and RA-1538, which were both located via limited PLSS coordinates on the NMWRRS but shown to be outside of the AOI on the hydrographic map sheets.

Table A3 in Appendix A: Data Tables presents the merged data from the three sources listing unique values. From the database searches there is evidence of **112** potential shallow wells in the NRC AOI.

Additional analysis of this list(s) could refine the locations, uses, and well construction details including perforations and annular seals. Other data sources like title records and assessor data could further refine the list.

The data provided in this study could be used to guide a detailed field survey of the NRC AOI. That study could determine the actual disposition of wells in the AOI with regards to location, construction, uses, exposure pathways, and water quality.

Appendix A: Data Tables and Figure

Table A-1 NMWRRS Initial Data Extraction

WR File Nbr	Use	Diversion	Owner	POD Number	Source	q64-	q16-	q4-	q64	q16	q4	Sec	Twn	Rng	X	Y	PLSS
RA 01587	NON	0	MRS. LOUIESE GOTT	RA 01587	Shallow							1	17S	26E	562206	3636450	Y
RA 01587				RA 01587 -S1	Shallow	1	1	1	NW	NW	NW	1	17S	26E	561497	3637157	Y
RA 01587				RA 01587 SUP	Shallow	1	1	2	NW	NW	NE	1	17S	26E	562304	3637163	Y
RA 01587				RA 01587 SUP-2	Shallow	1	1	1	NW	NW	NW	1	17S	26E	561497	3637157	Y
RA 01587 D	IRR	87.5	LESLIE MARTIN	RA 01587 S		2	1	1	NE	NW	NW	1	17S	26E	561697	3637157	Y
RA 01587 D	IRR			RA 01587 S1		2	1	1	NE	NW	NW	1	17S	26E	561697	3637157	Y
RA 06143 X9	OBS	0	NAVAJO REFINING COMPANY	RA 06143 X9	Shallow	4	2	2	SE	NE	NE	1	17S	26E	562908	3636966	Y
RA 06143 X5	OBS	0	NAVAJO REFINING COMPANY	RA 06143 X5		1	3	4	NW	SW	SE	1	17S	26E	562310	3635952	Y
RA 06143 X6	OBS	0	NAVAJO REFINING COMPANY	RA 06143 X6		1	3	4	NW	SW	SE	1	17S	26E	562310	3635952	Y
RA 06143 X7	OBS	0	NAVAJO REFINING COMPANY	RA 06143 X7	Shallow	2	4	4	NE	SE	SE	1	17S	26E	562914	3635954	Y
RA 06143 X83	OBS	0	NAVAJO REFINING COMPANY	RA 06143 X83		2	4	4	NE	SE	SE	1	17S	26E	562914	3635954	Y
RA 06168	DOM	3	RYAN LETCHER	RA 06168	Shallow							1	17S	26E	562206	3636450	Y
RA 01606	COM	299.384	BILL & ELAINE HORNER	RA 01606 S	Shallow	1	3	1	NW	SW	NW	2	17S	26E	559883	3636739	Y
RA 01606	COM			RA 01606 S2	Shallow	1	3	1	NW	SW	NW	2	17S	26E	559883	3636739	Y
RA 10062	PUB	3	EDDY COUNTY ROAD DEPARTMENT	RA 01606 S	Shallow	1	3	1	NW	SW	NW	2	17S	26E	559883	3636739	Y
RA 10063	PUB	3	EDDY COUNTY ROAD DEPARTMENT	RA 01606 S2	Shallow	1	3	1	NW	SW	NW	2	17S	26E	559883	3636739	Y
RA 10263	PUB	3	EDDY COUNTY ROAD DEPT. DIST. 2	RA 01606 S	Shallow	1	3	1	NW	SW	NW	2	17S	26E	559883	3636739	Y
RA 10264	PUB	3	EDDY COUNTY ROAD DEPT. DIST. 2	RA 01606 S2	Shallow	1	3	1	NW	SW	NW	2	17S	26E	559883	3636739	Y
RA 05815	PRO	0	U.S. BUREAU OF RECLAMATION	RA 05815	Shallow	4	1	2	SE	NW	NE	2	17S	26E	560888	3636949	Y
RA 05815 RECOR	OBS	3	U.S. BUREAU OF RECLAMATION	RA 05815 RECO	Shallow	2	1	2	NE	NW	NE	2	17S	26E	560888	3637149	Y
RA 02219	DOM	3	E.P. MANN	RA 02219	Shallow	1	1	3	NW	NW	SW	2	17S	26E	559886	3636336	Y
RA 04308	DOM	3	CITY OF ARTESIA	RA 04308	Shallow	3	3	3	SW	SW	SW	2	17S	26E	559888	3635733	Y
RA 12073	MON	0	NAVAJO REFINING CO	RA 12073 POD19		3	4	3	SW	SE	SW	2	17S	26E	560241	3635654	N
RA 12073	MON	0	NAVAJO REFINING CO	RA 12073 POD20		3	4	3	SW	SE	SW	2	17S	26E	560370	3635769	N
RA 01097	IND	318.91	NAVAJO REFINING COMPANY	RA 01097		4	4	2	SE	SE	NE	8	17S	26E	556460	3634907	N
RA 06970	OBS	0	NAVAJO REFINING COMPANY	RA 06970	Shallow	2	4	2	NE	SE	NE	8	17S	26E	556460	3635107	N
RA 07098 -X6	OBS	3	NAVAJO REFINING COMPANY	RA 07098 -X6	Shallow	2	4	2	NE	SE	NE	8	17S	26E	556460	3635107	N
RA 12035	MON			RA 12035 POD5		2	4	2	NE	SE	NE	8	17S	26E	556517	3635004	N
RA 12144	MON	0	NAVAJO REFINING CO LLC	RA 12144 POD1	Shallow	2	3	2	NE	SW	NE	8	17S	26E	556043	3635154	N
RA 12196	MON	0	NAVAJO REFINING COMPANY LLC	RA 12196 POD1		2	4	2	NE	SE	NE	8	17S	26E	556443	3635118	N
RA 12196	MON			RA 12196 POD2		2	4	2	NE	SE	NE	8	17S	26E	556382	3635100	N
RA 12196	MON			RA 12196 POD3		2	4	2	NE	SE	NE	8	17S	26E	556454	3635103	N
RA 12196	MON			RA 12196 POD4		2	4	2	NE	SE	NE	8	17S	26E	556502	3635104	N
RA 12196	MON			RA 12196 POD5		2	4	2	NE	SE	NE	8	17S	26E	556525	3635105	N
RA 12197	MON	0	NAVAJO REFINING COMPANY LLC	RA 12197 POD1		2	4	2	NE	SE	NE	8	17S	26E	556406	3635086	N
RA 12197	MON			RA 12197 POD2		2	4	2	NE	SE	NE	8	17S	26E	556413	3635119	N
RA 12197	MON			RA 12197 POD3		2	4	2	NE	SE	NE	8	17S	26E	556439	3635086	N
RA 12197	MON			RA 12197 POD4		2	4	2	NE	SE	NE	8	17S	26E	556409	3635055	N
RA 12197	MON			RA 12197 POD5		2	4	2	NE	SE	NE	8	17S	26E	556475	3635087	N
RA 12198	MON	0	NAVAJO REFINING COMPANY LLC	RA 12198 POD1		2	4	2	NE	SE	NE	8	17S	26E	556500	3635039	N
RA 12198	MON			RA 12198 POD2		2	4	2	NE	SE	NE	8	17S	26E	556550	3635041	N
RA 12198	MON			RA 12198 POD3		2	4	2	NE	SE	NE	8	17S	26E	556412	3635029	N
RA 12198	MON			RA 12198 POD4		2	4	2	NE	SE	NE	8	17S	26E	556526	3635029	N
RA 12199	MON	0	NAVAJO REFINING COMPANY LLC	RA 12199 POD1		2	4	2	NE	SE	NE	8	17S	26E	556550	3635074	N
RA 12199	MON			RA 12199 POD2		2	4	2	NE	SE	NE	8	17S	26E	556391	3635055	N
RA 12199	MON			RA 12199 POD3		2	4	2	NE	SE	NE	8	17S	26E	556498	3635054	N

WR File Nbr	Use	Diversion	Owner	POD Number	Source	q64-	q16-	q4-	q64	q16	q4	Sec	Twn	Rng	X	Y	PLSS
RA 12199	MON			RA 12199 POD4		2	4	2	NE	SE	NE	8	17S	26E	556383	3635036	N
RA 12199	MON			RA 12199 POD5		2	4	2	NE	SE	NE	8	17S	26E	556456	3635036	N
RA 12200	MON	0	NAVAJO REFINING COMPANY LLC	RA 12200 POD1		2	4	2	NE	SE	NE	8	17S	26E	556486	3635088	N
RA 12200	MON			RA 12200 POD2		2	4	2	NE	SE	NE	8	17S	26E	556532	3635088	N
RA 12200	MON			RA 12200 POD3		2	4	2	NE	SE	NE	8	17S	26E	556543	3635099	N
RA 12200	MON			RA 12200 POD4		2	4	2	NE	SE	NE	8	17S	26E	556555	3635102	N
RA 12200	MON			RA 12200 POD5		2	4	2	NE	SE	NE	8	17S	26E	556455	3635070	N
RA 12201	MON	0	NAVAJO REFINING COMPANY LLC	RA 12201 POD1		2	4	2	NE	SE	NE	8	17S	26E	556543	3635075	N
RA 12201	MON			RA 12201 POD2		2	4	2	NE	SE	NE	8	17S	26E	556543	3635051	N
RA 12201	MON			RA 12201 POD3		2	4	2	NE	SE	NE	8	17S	26E	556513	3635045	N
RA 12201	MON			RA 12201 POD4		2	4	2	NE	SE	NE	8	17S	26E	556503	3635067	N
RA 01382 B	IRR	6.27	HAZEL LEWIS	RA 01382		1	1	3	NW	NW	SW	8	17S	26E	555049	3634700	N
RA 01513 A	MUN	6	CITY OF ARTESIA	RA 01513 A		4	3	3	SE	SW	SW	8	17S	26E	555251	3634097	N
RA 02380	DOM	0	C. C. GRIMLAN	RA 02380		1	1	3	NW	NW	SW	8	17S	26E	555049	3634700	N
RA 03894	MUN	1500	CITY OF ARTESIA	RA 03894		1	4	3	NW	SE	SW	8	17S	26E	555455	3634298	N
RA 06975 X8	OBS	3	NAVAJO REFINING COMPANY	RA 06975 X8	Shallow	2	3	3	NE	SW	SW	8	17S	26E	555251	3634297	N
RA 02231 A	MUN	0	CONSERVANCY DISTRICT PECOS VALLEY ARTESIAN	RA 02231	Shallow	1	3	4	NW	SW	SE	8	17S	26E	555859	3634300	N
RA 12035	MON	0	NAVAJO REFINING COMPANY	RA 12035 POD1		2	2	4	NE	NE	SE	8	17S	26E	556547	3634773	N
RA 12214	MON	0	STRIPES LLC (SUSSER HOLDINGS)	RA 12214 POD1		3	4	4	SW	SE	SE	8	17S	26E	556329	3633995	N
RA 00602	IRR	0	NAVAJO REFINING COMPANY	RA 00602		3	1	1	SW	NW	NW	9	17S	26E	556662	3635312	Y
RA 01973	DOM	0.56	J.O. SAVOIE	RA 01973	Shallow	1	1	1	NW	NW	NW	9	17S	26E	556662	3635512	Y
RA 02368	IRR	45	& W.D. PIKE, J.F. LOWER	RA 02368		3	1	1	SW	NW	NW	9	17S	26E	556662	3635312	Y
RA 02488	DOM	3	C. S. POWELL	RA 02488	Shallow	4	1	1	SE	NW	NW	9	17S	26E	556862	3635312	Y
RA 02496	DOM	3	CLYDE BOULDEN	RA 02496		3	1	1	SW	NW	NW	9	17S	26E	556662	3635312	Y
RA 02654	DOM	3	D.G. WINKLES	RA 02654	Shallow		1	1		NW	NW	9	17S	26E	556763	3635413	Y
RA 03225	DOM	3	J.C. GOLEMON	RA 03225	Shallow	2	1	1	NE	NW	NW	9	17S	26E	556862	3635512	Y
RA 03282	DOM	3	CECIL G. STANDARD	RA 03282	Shallow	2	1	1	NE	NW	NW	9	17S	26E	556862	3635512	Y
RA 03662	DOM	3	FRED MORGAN	RA 03662			1	1		NW	NW	9	17S	26E	556763	3635413	Y
RA 05163	DOM	3	J.B. MULCOCK	RA 05163		3	1	1	SW	NW	NW	9	17S	26E	556662	3635312	Y
RA 06969	OBS	0	NAVAJO REFINING COMPANY	RA 06969	Shallow	1	3	1	NW	SW	NW	9	17S	26E	556664	3635109	Y
RA 06972	OBS	0	NAVAJO REFINING COMPANY	RA 06972	Shallow	3	3	1	SW	SW	NW	9	17S	26E	556664	3634909	Y
RA 06975 X7	OBS	3	NAVAJO REFINING COMPANY	RA 06975 X7	Shallow	4	3	1	SE	SW	NW	9	17S	26E	556864	3634909	Y
RA 07098	OBS	0	NAVAJO REFINING COMPANY	RA 07098	Shallow	1	3	1	NW	SW	NW	9	17S	26E	556664	3635109	Y
RA 07098	OBS			RA 07098 X2	Shallow	1	3	1	NW	SW	NW	9	17S	26E	556664	3635109	Y
RA 07098	OBS			RA 07098 X3	Shallow	4	3	1	SE	SW	NW	9	17S	26E	556864	3634909	Y
RA 07098 -X2	OBS	3	NAVAJO REFINING COMPANY	RA 07098 -X2	Shallow	4	3	1	SE	SW	NW	9	17S	26E	556864	3634909	Y
RA 07098 -X3	OBS	3	NAVAJO REFINING COMPANY	RA 07098 -X3	Shallow	4	3	1	SE	SW	NW	9	17S	26E	556864	3634909	Y
RA 07098 -X4	OBS	3	NAVAJO REFINING COMPANY	RA 07098 -X4	Shallow	4	3	1	SE	SW	NW	9	17S	26E	556864	3634909	Y
RA 12035	MON			RA 12035 POD6		3	3	1	SW	SW	NW	9	17S	26E	556586	3634909	N
RA 12073	MON	0	ARCADIS US	RA 12073 POD1		2	3	1	NE	SW	NW	9	17S	26E	556808	3635138	N
RA 12073	MON			RA 12073 POD2		4	1	1	SE	NW	NW	9	17S	26E	556963	3635210	N
RA 12073	MON			RA 12073 POD3		3	2	1	SW	NE	NW	9	17S	26E	557023	3635219	N
RA 12073	MON			RA 12073 POD4		4	2	1	SE	NE	NW	9	17S	26E	557208	3635208	N
RA 12073	MON			RA 12073 POD5		4	2	1	SE	NE	NW	9	17S	26E	557208	3635208	N
RA 12141	MON	0	NAVAJO REFINING COMPANY LLC	RA 12141 POD1	Shallow	2	1	1	NE	NW	NW	9	17S	26E	556786	3635546	N
RA 12192	MON			RA 12192 POD2		3	3	1	SW	SW	NW	9	17S	26E	556773	3634812	N

WR File Nbr	Use	Diversion	Owner	POD Number	Source	q64-	q16-	q4-	q64	q16	q4	Sec	Twn	Rng	X	Y	PLSS
RA 00007	IRR	544.25	CHASE FARMS	RA 00007	Artesian	3	1	2	SW	NW	NE	9	17S	26E	557470	3635315	Y
RA 00007	IRR			RA 00007 S	Artesian		1	2		NW	NE	9	17S	26E	557571	3635416	Y
RA 01488	IRR	665	CHASE FARMS, A NEW MEXICO GENERAL PARTNERSHIP	RA 00007	Artesian	3	1	2	SW	NW	NE	9	17S	26E	557470	3635315	Y
RA 01488	IRR			RA 00007 S	Artesian		1	2		NW	NE	9	17S	26E	557571	3635416	Y
RA 02698	DOM	3	BRITTON COLL	RA 02698	Shallow	4	4	2	SE	SE	NE	9	17S	26E	558076	3634913	Y
RA 10378	DOM	3	SUE C. PEMBERTON	RA 10378	Shallow	4	4	2	SE	SE	NE	9	17S	26E	558076	3634913	Y
RA 12073	MON			RA 12073 POD6		4	1	2	SE	NW	NE	9	17S	26E	557683	3635229	N
RA 12073	MON			RA 12073 POD7		3	2	2	SW	NE	NE	9	17S	26E	557860	3635227	N
RA 12073	MON			RA 12073 POD8		2	4	2	NE	SE	NE	9	17S	26E	558188	3635192	N
RA 00313	IRR	529.9	NAVAJO REFINING COMPANY, LLC	RA 00313	Artesian	4	4	3	SE	SE	SW	9	17S	26E	557272	3634104	Y
RA 00768	IND	169.61	NAVAJO REFINING COMPANY	RA 00768		3	2	3	SW	NE	SW	9	17S	26E	557070	3634507	Y
RA 01892	IND	170.52	NAVAJO REFINING CO A DEL CORP	RA 01892	Artesian	3	2	3	SW	NE	SW	9	17S	26E	557070	3634507	Y
RA 03890	MUN	57.9	CITY OF ARTESIAN	RA 03890		3	1	3	SW	NW	SW	9	17S	26E	556666	3634506	Y
RA 06971	OBS	0	NAVAJO REFINING COMPANY	RA 06971	Shallow	2	1	3	NE	NW	SW	9	17S	26E	556866	3634706	Y
RA 07098	OBS			RA 07098 X4	Shallow	2	1	3	NE	NW	SW	9	17S	26E	556866	3634706	Y
RA 07098	OBS			RA 07098 X5	Shallow	2	1	3	NE	NW	SW	9	17S	26E	556866	3634706	Y
RA 07098	OBS			RA 07098 X6	Shallow	2	1	3	NE	NW	SW	9	17S	26E	556866	3634706	Y
RA 07098 -X5	OBS	3	NAVAJO REFINING COMPANY	RA 07098 -X5	Shallow	2	1	3	NE	NW	SW	9	17S	26E	556866	3634706	Y
RA 11747	POL	0	NAVAJO REFINING COMPANY	RA 11747 POD1		1	4	3	NW	SE	SW	9	17S	26E	556996	3634303	N
RA 11750	POL	0	NAVAJO REFINING COMPANY	RA 11750 POD1		4	4	3	SE	SE	SW	9	17S	26E	557278	3634110	N
RA 12035	MON	0	TALON/LPE	RA 12035 POD2		1	1	3	NW	NW	SW	9	17S	26E	556592	3634761	N
RA 12035	MON			RA 12035 POD3		2	3	3	NE	SW	SW	9	17S	26E	556797	3634334	N
RA 12035	MON			RA 12035 POD4		1	3	3	NW	SW	SW	9	17S	26E	556743	3634205	N
RA 12192	MON	0	NAVAJO REFINING COMPANY LLC	RA 12192 POD1	Shallow	2	1	3	NE	NW	SW	9	17S	26E	556808	3634793	N
RA 00313	IRR			RA 00314	Artesian	3	3	4	SW	SW	SE	9	17S	26E	557476	3634106	Y
RA 02723	DOM	3	BRITTON COLL	RA 02723	Shallow	4	3	4	SE	SW	SE	9	17S	26E	557676	3634106	Y
RA 11746	POL	0	NAVAJO REFINING COMPANY	RA 11746 POD1		4	4	4	SE	SE	SE	9	17S	26E	558180	3634090	N
RA 11748	POL	0	SAFETY & ENVIRONMENTAL SOLUTIO	RA 11748 POD1		2	4	4	NE	SE	SE	9	17S	26E	558178	3634244	N
RA 11749	POL	0	NAVAJO REFINING COMPANY	RA 11749 POD1		4	2	4	SE	NE	SE	9	17S	26E	558175	3634410	N
RA 06975	MON	0	NAVAJO REFINING CO	RA 06975								9	17S	26E	557372	3634807	Y
RA 06975 X9	OBS	3	NAVAJO REFINING COMPANY	RA 06975 X9	Shallow							9	17S	26E	557372	3634807	Y
RA 00307	IRR			RA 01331	Shallow	3	3	1	SW	SW	NW	10	17S	26E	558280	3634915	Y
RA 01331	EXP	0	CHASE FARMS	RA 01331	Shallow	3	3	1	SW	SW	NW	10	17S	26E	558280	3634915	Y
RA 01488	IRR			RA 01331	Shallow	3	3	1	SW	SW	NW	10	17S	26E	558280	3634915	Y
RA 03720	DOM	0	D.M. MCFARLAND	RA 03720			2	1		NE	NW	10	17S	26E	558782	3635422	Y
RA 03720 D	DOM	0	D.M. MCFARLAND	RA 03720 D			2	1		NE	NW	10	17S	26E	558782	3635422	Y
RA 04922	DOM	3	AS MORTGAGEE FARM CREDIT BANK OF WICHITA	RA 04922	Shallow	1	1	1	NW	NW	NW	10	17S	26E	558278	3635518	Y
RA 06550	DOM	3	LEE DILBECK	RA 06550	Shallow	3	2	1	SW	NE	NW	10	17S	26E	558681	3635321	Y
RA 07180	DOM	3	BOB SMITH	RA 07180	Shallow		2	1		NE	NW	10	17S	26E	558782	3635422	Y
RA 11688		0	CHASE FARMS, LLC	RA 11688 POD1		2	2	1	NE	NE	NW	10	17S	26E	558239	3634879	N
RA 11714	EXP	0	ATKINS ENGR ASSOC INC	RA 11714		1	3	1	NW	SW	NW	10	17S	26E	558181	3635066	N
RA 11714	EXP			RA 11714 POD1		1	3	1	NW	SW	NW	10	17S	26E	558181	3635066	N
RA 11872	MUL	0	CHASE FARMS, LLC	RA 11872 POD1		4	2	1	SE	NE	NW	10	17S	26E	558959	3635354	N
RA 11926	MON	0	NAVAJO REFINING COMPANY, LLC	RA 11926 POD1	Shallow	3	3	1	SW	SW	NW	10	17S	26E	558226	3634846	N
RA 12073	MON	0	NAVAJO REFINING CO	RA 12073 POD10		1	3	1	NW	SW	NW	10	17S	26E	558376	3635030	N
RA 12073	MON			RA 12073 POD11		3	3	1	SW	SW	NW	10	17S	26E	558452	3634941	N

WR File Nbr	Use	Diversion	Owner	POD Number	Source	q64-	q16-	q4-	q64	q16	q4	Sec	Twn	Rng	X	Y	PLSS
RA 12073	MON			RA 12073 POD12		4	3	1	SE	SW	NW	10	17S	26E	558452	3634941	N
RA 12073	MON			RA 12073 POD13		3	4	1	SW	SE	NW	10	17S	26E	558670	3634884	N
RA 12073	MON			RA 12073 POD14		3	4	1	SW	SE	NW	10	17S	26E	558730	3634866	N
RA 12073	MON			RA 12073 POD15		4	4	1	SE	SE	NW	10	17S	26E	558881	3634879	N
RA 12073	MON			RA 12073 POD9		1	3	1	NW	SW	NW	10	17S	26E	558305	3635070	N
RA 12195	MON	0	NAVAJO REFINING COMPANY LLC	RA 12195 POD1		4	4	1	SE	SE	NW	10	17S	26E	558881	3634879	N
RA 01488	IRR			RA 01488 S	Shallow	3	1	2	SW	NW	NE	10	17S	26E	559084	3635323	Y
RA 02661	DOM	3	IVA JONES	RA 02661		2	4	2	NE	SE	NE	10	17S	26E	559690	3635123	Y
RA 03368	DOM	3	A.T. WOELK	RA 03368	Shallow	3	1	2	SW	NW	NE	10	17S	26E	559084	3635323	Y
RA 12073	MON			RA 12073 POD16		3	3	2	SW	SW	NE	10	17S	26E	559016	3634976	N
RA 12073	MON			RA 12073 POD17		3	2	2	SW	NE	NE	10	17S	26E	559507	3635299	N
RA 00307	IRR	871	CHASE FARMS, A NEW MEXICO GENERAL PARTNERSHIP	RA 00307	Artesian	3	3	3	SW	SW	SW	10	17S	26E	558284	3634109	Y
RA 01488	IRR	665	CHASE FARMS, A NEW MEXICO GENERAL PARTNERSHIP	RA 00307	Artesian	3	3	3	SW	SW	SW	10	17S	26E	558284	3634109	Y
RA 02342	DOM	3	LEROY SUMRULD	RA 02342	Shallow	4	4	3	SE	SE	SW	10	17S	26E	558888	3634111	Y
RA 04196	DOM	3	BRUCE HARRIS	RA 04196		3	3	3	SW	SW	SW	10	17S	26E	558284	3634109	Y
RA 04798	DOM	3	A.B. HARRIS	RA 04798	Shallow		3	3		SW	SW	10	17S	26E	558385	3634210	Y
RA 11751	POL	0	NAVAJO REFINING COMPANY	RA 11751 POD1		1	3	3	NW	SW	SW	10	17S	26E	558290	3634230	N
RA 12066	MON	0	NAVAJO REFINING COMPANY LLC	RA 12066 POD1	Shallow	3	1	3	SW	NW	SW	10	17S	26E	558295	3634417	N
RA 12066	MON			RA 12066 POD2	Shallow	1	4	3	NW	SE	SW	10	17S	26E	558619	3634400	N
RA 12066	MON			RA 12066 POD3	Shallow	2	4	3	NE	SE	SW	10	17S	26E	558980	3634464	N
RA 23420	DOM	3	O.C. ROGERS	RA 23420	Shallow	4	4	3	SE	SE	SW	10	17S	26E	558888	3634111	Y
RA 00397	IRR	269.85	JOHN R GRAY, LLC	RA 00397	Artesian	3	3	4	SW	SW	SE	10	17S	26E	559091	3634113	Y
RA 00397	IRR			RA 01300	Shallow	4	3	4	SE	SW	SE	10	17S	26E	559291	3634113	Y
RA 00397 A	IRR	0	SARAH KATE SULLIVAN	RA 00397	Artesian	3	3	4	SW	SW	SE	10	17S	26E	559091	3634113	Y
RA 00397 A	IRR			RA 01300	Shallow	4	3	4	SE	SW	SE	10	17S	26E	559291	3634113	Y
RA 01300	COM	269.15	JOHN R GRAY, LLC	RA 01300	Shallow	4	3	4	SE	SW	SE	10	17S	26E	559291	3634113	Y
RA 02793	DOM	3	R. W. (ROGERS BROTHERS) ROGERS	RA 02793		1	3	4	NW	SW	SE	10	17S	26E	559091	3634313	Y
RA 03195	DOM	3	D.D. SULLIVAN	RA 03195		3	3	4	SW	SW	SE	10	17S	26E	559091	3634113	Y
RA 10442	DOL	0	WILLIAM BARON CHANDLER	RA 10442	Shallow		3	1		SW	NW	11	17S	26E	559994	3635026	Y
RA 12073	MON	0	NAVAJO REFINING CO	RA 12073 POD18		2	1	1	NE	NW	NW	11	17S	26E	560034	3635481	N
RA 12073	MON			RA 12073 POD21		1	2	2	NW	NE	NE	11	17S	26E	561086	3635641	N
RA 01414	IRR	1540.7	WILLIAM VANCE HALDEMAN	RA 01414	Shallow	1	1	3	NW	NW	SW	11	17S	26E	559896	3634721	Y
RA 01414	IRR			RA 01414 S2	Shallow	2	3	3	NE	SW	SW	11	17S	26E	560098	3634317	Y
RA 09912	EXP	0	VANCE HALDEMAN	RA 09912				3			SW	11	17S	26E	560200	3634419	Y
RA 00777	IRR	581.35	BLAINE BAINES	RA 00777	Artesian	3	3	4	SW	SW	SE	11	17S	26E	560706	3634123	Y
RA 00777	IRR			RA 00777 B		3	3	4	SW	SW	SE	11	17S	26E	560706	3634123	Y
RA 00777	IRR			RA 00777 RA 77	Artesian	3	3	4	SW	SW	SE	11	17S	26E	560706	3634123	Y
RA 06143	OBS	0	NAVAJO REFINING CO.	RA 06143		3	2	1	SW	NE	NW	12	17S	26E	561909	3635345	Y
RA 06143 X	OBS	0	NAVAJO REFINING COMPANY	RA 06143 X		3	2	1	SW	NE	NW	12	17S	26E	561909	3635345	Y
RA 06143 X13	OBS	0	NAVAJO REFINING COMPANY	RA 06143 X13	Shallow	4	4	1	SE	SE	NW	12	17S	26E	562112	3634940	Y
RA 06143 X14	OBS	0	NAVAJO REFINING COMPANY	RA 06143 X14		4	4	1	SE	SE	NW	12	17S	26E	562112	3634940	Y
RA 06143 X2	OBS	0	NAVAJO REFINING COMPANY	RA 06143 X2		1	1	1	NW	NW	NW	12	17S	26E	561505	3635542	Y
RA 06143 X3	OBS	0	NAVAJO REFINING COMPANY	RA 06143 X3		1	1	1	NW	NW	NW	12	17S	26E	561505	3635542	Y
RA 06143 X4	OBS	0	NAVAJO REFINING COMPANY	RA 06143 X4		3	2	1	SW	NE	NW	12	17S	26E	561909	3635345	Y
RA 06775 -E	OBS		NAVAJO REFINING COMPANY	RA 06775 -E	Shallow	4	2	1	SE	NE	NW	12	17S	26E	562109	3635345	Y
RA 06775 E	EXP	0	NAVAJO REFINING CO	RA 06775 E	Shallow		2	1		NE	NW	12	17S	26E	562010	3635446	Y

WR File Nbr	Use	Diversion	Owner	POD Number	Source	q64-	q16-	q4-	q64	q16	q4	Sec	Twn	Rng	X	Y	PLSS
RA 11926	MON	0	NAVAJO REFINING COMPANY, LLC	RA 11926 POD2	Shallow	3	2	1	SW	NE	NW	12	17S	26E	561840	3635369	N
RA 11926	MON			RA 11926 POD3	Shallow	3	2	1	SW	NE	NW	12	17S	26E	561938	3635409	N
RA 11926	MON			RA 11926 POD4	Shallow	2	2	1	NE	NE	NW	12	17S	26E	562094	3635539	N
RA 11926	MON			RA 11926 POD7	Shallow	2	2	1	NE	NE	NW	12	17S	26E	562064	3635481	N
RA 11926	MON			RA 11926 POD8	Shallow	2	2	1	NE	NE	NW	12	17S	26E	562064	3635481	N
RA 11926	MON			RA 11926 POD9	Shallow	2	2	1	NE	NE	NW	12	17S	26E	562064	3635481	N
RA 12073	MON	0	NAVAJO REFINING CO	RA 12073 POD22		1	1	1	NW	NW	NW	12	17S	26E	561432	3635508	N
RA 12073	MON			RA 12073 POD23		3	1	1	SW	NW	NW	12	17S	26E	561594	3635438	N
RA 12073	MON			RA 12073 POD24		4	1	1	SE	NW	NW	12	17S	26E	561742	3635389	N
RA 12073	MON			RA 12073 POD25		3	2	1	SW	NE	NW	12	17S	26E	561826	3635356	N
RA 04438	DOM	3	GEO H. SETTLEMIRE	RA 04438	Shallow	4	4	2	SE	SE	NE	12	17S	26E	562920	3634946	Y
RA 06143 X10	OBS	0	NAVAJO REFINING COMPANY	RA 06143 X10		4	2	2	SE	NE	NE	12	17S	26E	562917	3635350	Y
RA 06143 X11	OBS	0	NAVAJO REFINING COMPANY	RA 06143 X11		4	3	2	SE	SW	NE	12	17S	26E	562516	3634943	Y
RA 06143 X12	OBS	0	NAVAJO REFINING COMPANY	RA 06143 X12	Shallow	4	4	2	SE	SE	NE	12	17S	26E	562920	3634946	Y
RA 06776 E	OBS	0	NAVAJO REFINING CO.	RA 06776 E	Shallow			2			NE	12	17S	26E	562618	3635245	Y
RA 02896 REPAR	DOM	3	WENDEL E. & MAXINE PARHAM	RA 02896 REPA	Shallow		3	3		SW	SW	12	17S	26E	561616	3634230	Y
RA 11926	MON			RA 11926 POD5	Shallow	2	3	4	NE	SW	SE	12	17S	26E	562467	3634384	N
RA 04066	STK	3	R. H. MCASHAN	RA 04066	Artesian		1	1		NW	NW	13	17S	26E	561619	3633826	Y
RA 02034	DOM	3	G.E. SHARP	RA 02034	Shallow			3			SW	13	17S	26E	561828	3632816	Y
RA 00596 A	IRR	350	VIVIAN MARIE, I.V. TRUST TIDWELL	RA 00763 RA 11	Artesian	3	3	1	SW	SW	NW	14	17S	26E	559904	3633310	Y
RA 00596 A	IRR			RA 00763 RA 11	Artesian	3	3	1	SW	SW	NW	14	17S	26E	559904	3633310	Y
RA 00763	IRR	350	VIVIAN MARIE TIDWELL INTER VIVOS TRUST	RA 00763			3	1		SW	NW	14	17S	26E	560005	3633411	Y
RA 00763	IRR			RA 00763 S		3	3	1	SW	SW	NW	14	17S	26E	559904	3633310	Y
RA 00763	IRR			RA 05395 A			1	1		NW	NW	14	17S	26E	560002	3633814	Y
RA 01180		0	WILLIAM T. HALDEMAN	RA 01180			3	1		SW	NW	14	17S	26E	560005	3633411	Y
RA 01180				RA 01180 S		3	3	1	SW	SW	NW	14	17S	26E	559904	3633310	Y
RA 01414	IRR	1540.7	WILLIAM VANCE HALDEMAN	RA 00763 RA 11	Artesian	3	3	1	SW	SW	NW	14	17S	26E	559904	3633310	Y
RA 01414	IRR			RA 00763 RA 11	Artesian	3	3	1	SW	SW	NW	14	17S	26E	559904	3633310	Y
RA 01414	IRR			RA 01414 S	Shallow	3	1	1	SW	NW	NW	14	17S	26E	559901	3633713	Y
RA 03051	DOM	3	W.T. HALDEMAN	RA 03051	Shallow	3	1	1	SW	NW	NW	14	17S	26E	559901	3633713	Y
RA 03518	DOM	3	W. T. HALDERMAN	RA 03518	Shallow	3	1	1	SW	NW	NW	14	17S	26E	559901	3633713	Y
RA 03522	DOM	3	VICTOR C HALDEMAN, JR	RA 03522	Artesian	3	3	1	SW	SW	NW	14	17S	26E	559904	3633310	Y
RA 08941	DOM	0	DENNIS TIDWELL	RA 08941		1	1	1	NW	NW	NW	14	17S	26E	559901	3633913	Y
RA 11977	DOL	3	TERRY MAUPIN	RA 11977 POD1	Shallow	2	3	1	NE	SW	NW	14	17S	26E	560101	3633602	N
RA 12009	DOL	3	BIANCA LOPEZ	RA 12009		1	3	1	NW	SW	NW	14	17S	26E	559869	3633546	N
RA 12151	DOL	0	DAVID COLLINS	RA 12151 POD1		1	3	1	NW	SW	NW	14	17S	26E	559918	3633433	N
RA 00777	IRR	581.35	BLAINE BAINES	RA 00895	Artesian	1	1	2	NW	NW	NE	14	17S	26E	560709	3633919	Y
RA 00948	DOM	3	LYDIA A. BRUCE	RA 00948			1	2		NW	NE	14	17S	26E	560810	3633820	Y
RA 02749	DOM	3	SHARP. G. E.	RA 02749	Shallow	1	1	2	NW	NW	NE	14	17S	26E	560709	3633919	Y
RA 00786	IRR	410.55	JIMMIE DWIGHT JOY	RA 00786	Artesian	1	3	3	NW	SW	SW	14	17S	26E	559911	3632702	Y
RA 00785	IRR	273.9	YATES BROTHERS	RA 00785	Artesian	3	4	4	SW	SE	SE	14	17S	26E	561122	3632511	Y
RA 00279	IRR			RA 01227	Shallow	3	1	1	SW	NW	NW	15	17S	26E	558287	3633706	Y
RA 00400	IRR			RA 01227	Shallow	3	1	1	SW	NW	NW	15	17S	26E	558287	3633706	Y
RA 01227	IRR	109.24	T.D. JOY	RA 01227	Shallow	3	1	1	SW	NW	NW	15	17S	26E	558287	3633706	Y
RA 01227	IRR			RA 01227 S		1	2	1	NW	NE	NW	15	17S	26E	558690	3633908	Y
RA 02050	IRR	127.05	RICHARD L CHASE	RA 02050	Artesian	1	4	1	NW	SE	NW	15	17S	26E	558630	3633421	N

WR File Nbr	Use	Diversion	Owner	POD Number	Source	q64-	q16-	q4-	q64	q16	q4	Sec	Twn	Rng	X	Y	PLSS
RA 02050 B	IRR	52.5	JIMMY G. & BARBARA MASON	RA 02050	Artesian	1	4	1	NW	SE	NW	15	17S	26E	558630	3633421	N
RA 02827	DOM	0	T.D. JOY	RA 02827		1	2	1	NW	NE	NW	15	17S	26E	558690	3633908	Y
RA 02871	IRR	47.95	RICHARD L CHASE	RA 02871	Artesian	3	3	1	SW	SW	NW	15	17S	26E	558289	3633302	Y
RA 02871 A	IRR			RA 02871	Artesian	3	3	1	SW	SW	NW	15	17S	26E	558289	3633302	Y
RA 03156	DOM	3	CLYDE DUNGAN	RA 03156	Shallow		3	1		SW	NW	15	17S	26E	558390	3633403	Y
RA 03353	DOM	3	T.D. JOY	RA 03353	Shallow	1	2	1	NW	NE	NW	15	17S	26E	558690	3633908	Y
RA 04684	DOM	3	WALTER NUGENT	RA 04684		3	3	1	SW	SW	NW	15	17S	26E	558289	3633302	Y
RA 04765	DOM	3	BENNIE J. MASON	RA 04765	Shallow		4	1		SE	NW	15	17S	26E	558794	3633405	Y
RA 09866	DOM	3	EDDIE C. LARUE	RA 09866	Shallow	3	1	1	SW	NW	NW	15	17S	26E	558287	3633706	Y
RA 11027	DOL	3	RICHARD CHASE	RA 11027 POD1	Shallow	4	3	1	SE	SW	NW	15	17S	26E	558489	3633302	Y
RA 11027				RA 11027 POD4		1	4	1	NW	SE	NW	15	17S	26E	558630	3633421	N
RA 00279	IRR	156.45	T.D. & DOROTHY ELIZABETH JOY	RA 00279		4	3	2	SE	SW	NE	15	17S	26E	559297	3633306	Y
RA 00400	IRR	245.35	JACKIE & DIANA JOY	RA 00400	Artesian	3	4	2	SW	SE	NE	15	17S	26E	559501	3633308	Y
RA 00400	IRR			RA 01183	Shallow	1	1	2	NW	NW	NE	15	17S	26E	559094	3633910	Y
RA 01183	IRR	268.45	FARM CREDIT BANK OF WICHITA	RA 00400 279		4	3	2	SE	SW	NE	15	17S	26E	559297	3633306	Y
RA 01183	IRR			RA 01183	Shallow	1	1	2	NW	NW	NE	15	17S	26E	559094	3633910	Y
RA 01183	IRR			RA 01183 S		1	1	2	NW	NW	NE	15	17S	26E	559094	3633910	Y
RA 02221	DOM	3	J.M. VOGLE	RA 02221	Shallow	3	3	2	SW	SW	NE	15	17S	26E	559097	3633306	Y
RA 02222	DOM	3	J.M. VOGLE	RA 02222	Shallow	2	1	2	NE	NW	NE	15	17S	26E	559294	3633910	Y
RA 02783	DOM	3	G. E. KEY	RA 02783	Shallow	3	1	2	SW	NW	NE	15	17S	26E	559094	3633710	Y
RA 00300	IRR	389.2	DIANA JOY	RA 00300	Artesian	3	1	3	SW	NW	SW	15	17S	26E	558292	3632899	Y
RA 00300	IRR			RA 01251	Shallow	3	1	3	SW	NW	SW	15	17S	26E	558292	3632899	Y
RA 00617	IRR			RA 01578 S	Shallow	1	2	3	NW	NE	SW	15	17S	26E	558696	3633101	Y
RA 01503 E	IRR	28	CHASE FARMS, A NEW MEXICO GENERAL PARTNERSHIP	RA 01503 E	Shallow	1	2	3	NW	NE	SW	15	17S	26E	558696	3633101	Y
RA 01578	IRR			RA 01578 S	Shallow	1	2	3	NW	NE	SW	15	17S	26E	558696	3633101	Y
RA 02051	IRR	0	BLANCH P. DAWSON	RA 02051	Shallow	1	3	3	NW	SW	SW	15	17S	26E	558294	3632696	Y
RA 02871 A	IRR	25.9	MORTGAGEE FARM CREDIT OF NM, FLCA	RA 01503 E	Shallow	1	2	3	NW	NE	SW	15	17S	26E	558696	3633101	Y
RA 00400	IRR			RA 00401	Artesian	3	1	4	SW	NW	SE	15	17S	26E	559100	3632902	Y
RA 00401	IRR	0	JACKIE L. AND DIANA L. JOY	RA 00401	Artesian	3	1	4	SW	NW	SE	15	17S	26E	559100	3632902	Y
RA 00617	IRR	523.95	FIRST NATIONAL BANK	RA 00617	Artesian	3	1	4	SW	NW	SE	15	17S	26E	559100	3632902	Y
RA 00617	IRR			RA 00617 S		3	1	4	SW	NW	SE	15	17S	26E	559100	3632902	Y
RA 00617	IRR			RA 01578	Shallow	3	1	4	SW	NW	SE	15	17S	26E	559100	3632902	Y
RA 01183	IRR			RA 00401	Artesian	3	1	4	SW	NW	SE	15	17S	26E	559100	3632902	Y
RA 01578	IRR	147	FIRST NANTIONAL BANK	RA 01578	Shallow	3	1	4	SW	NW	SE	15	17S	26E	559100	3632902	Y
RA 05039	DOM	3	W. M. JACKSON	RA 05039	Artesian	2	1	4	NE	NW	SE	15	17S	26E	559300	3633102	Y
RA 10385	DOM	0	LA CLARA VISTA FARM	RA 10385		3	1	4	SW	NW	SE	15	17S	26E	559100	3632902	Y
RA 11027				RA 11027 POD2	Shallow	1	3	4	NW	SW	SE	15	17S	26E	559198	3632719	N
RA 11027				RA 11027 POD3	Shallow	1	3	4	NW	SW	SE	15	17S	26E	559198	3632719	N
RA 01044	IRR			RA 01090	Artesian	3	1	1	SW	NW	NW	16	17S	26E	556671	3633699	Y
RA 01090	IRR	0	G. G. ARMSTRONG & SON	RA 01090	Artesian	3	1	1	SW	NW	NW	16	17S	26E	556671	3633699	Y
RA 02568	DOM	3	G. G. & SONS ARMSTRONG	RA 02568	Shallow	3	1	1	SW	NW	NW	16	17S	26E	556671	3633699	Y
RA 01044	IRR	1975.4	G.G. ARMSTRONG & SON, LLC	RA 01044	Artesian	1	1	3	NW	NW	SW	16	17S	26E	556676	3633093	Y
RA 01044	IRR			RA 01045	Artesian	1	1	4	NW	NW	SE	16	17S	26E	557484	3633096	Y
RA 01045	IRR	0	G. G. ARMSTRONG & SON	RA 01045	Artesian	1	1	4	NW	NW	SE	16	17S	26E	557484	3633096	Y
RA 04110	DOM	3	G.G. ARMSTRONG & SON	RA 04110	Shallow	1	1	4	NW	NW	SE	16	17S	26E	557484	3633096	Y
RA 04110 CLW	DOM	3	G.G. ARMSTRONG & SON	RA 04110 CLW	Shallow	1	1	4	NW	NW	SE	16	17S	26E	557484	3633096	Y

WR File Nbr	Use	Diversion	Owner	POD Number	Source	q64-	q16-	q4-	q64	q16	q4	Sec	Twn	Rng	X	Y	PLSS
RA 01727	DOM	3	B E SPENCER	RA 01727	Artesian		1	1		NW	NW	17	17S	26E	555154	3633795	Y
RA 01905	IRR	103.95	MORTGAGEE FIRST NATIONAL BANK -ARTESIA	RA 01491 A	Artesian	1	2	1	NW	NE	NW	17	17S	26E	555458	3633895	Y
RA 02925	MUN	23.1	CITY OF ROSWELL	RA 02925 CLW	Shallow	3	1	1	SW	NW	NW	17	17S	26E	555053	3633694	Y
RA 02948	DOM	3	J.P. COLE	RA 02948	Shallow	3	1	1	SW	NW	NW	17	17S	26E	555053	3633694	Y
RA 06776 EXPL	OBS	3	NAVAJO REFINING CO	RA 06776 EXPL	Shallow	2	2	1	NE	NE	NW	17	17S	26E	555658	3633895	Y
RA 12065	MON			RA 12065 POD2		2	1	1	NE	NW	NW	17	17S	26E	555917	3633914	N
RA 12136	MON	0	BELL GAS INC	RA 12136 POD1		2	3	1	NE	SW	NW	17	17S	26E	555353	3633562	N
RA 12136	MON			RA 12136 POD2		2	3	1	NE	SW	NW	17	17S	26E	555348	3633572	N
RA 12136	MON			RA 12136 POD3		2	3	1	NE	SW	NW	17	17S	26E	555371	3633575	N
RA 00820	MUN	484.23	CITY OF ARTESIA	RA 00820		3	3	2	SW	SW	NE	17	17S	26E	555865	3633294	Y
RA 01292 B	MUN	13.14	CITY OF ARTESIA	RA 02151 A		1	1	2	NW	NW	NE	17	17S	26E	555862	3633897	Y
RA 02151 A	MUN	408	CITY OF ARTESIA	RA 02151 A		1	1	2	NW	NW	NE	17	17S	26E	555862	3633897	Y
RA 11880	MON	0	NATIONAL EWP	RA 11880 POD1		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11880	MON			RA 11880 POD10		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11880	MON			RA 11880 POD11		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11880	MON			RA 11880 POD2		1	1	2	NW	NW	NE	17	17S	26E	555281	3744783	N
RA 11880	MON			RA 11880 POD3		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11880	MON			RA 11880 POD4		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11880	MON			RA 11880 POD5		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11880	MON			RA 11880 POD6		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11880	MON			RA 11880 POD7		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11880	MON			RA 11880 POD8		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11880	MON			RA 11880 POD9		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11899	MON	0	ARCADIS U.S.	RA 11899 POD1		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11899	MON			RA 11899 POD2		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11899	MON			RA 11899 POD3		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11899	MON			RA 11899 POD4		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11899	MON			RA 11899 POD5		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11899	MON			RA 11899 POD6		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11899	MON			RA 11899 POD7		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11899	MON			RA 11899 POD8		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11899	MON			RA 11899 POD9		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 11926	MON	0	NAVAJO REFINING COMPANY, LLC	RA 11926 POD1		1	1	2	NW	NW	NE	17	17S	26E	555918	3633914	N
RA 12058	MON	0	NAVAJO REFINING COMPANY LLC	RA 12058 POD1		1	1	2	NW	NW	NE	17	17S	26E	555918	3633914	N
RA 12058	MON			RA 12058 POD1	Shallow	1	1	2	NW	NW	NE	17	17S	26E	557295	3634924	N
RA 12058	MON			RA 12058 POD2	Shallow	1	1	2	NW	NW	NE	17	17S	26E	557363	3634277	N
RA 12058	MON			RA 12058 POD3	Shallow	1	1	2	NW	NW	NE	17	17S	26E	557200	3633982	N
RA 12058	MON			RA 12058 POD4	Shallow	1	1	2	NW	NW	NE	17	17S	26E	557478	3634251	N
RA 12058	MON			RA 12058 POD5	Shallow	1	1	2	NW	NW	NE	17	17S	26E	557905	3633980	N
RA 12058	MON			RA 12058 POD6	Shallow	1	1	2	NW	NW	NE	17	17S	26E	557295	3634924	N
RA 12058	MON			RA 12058 POD7	Shallow	1	1	2	NW	NW	NE	17	17S	26E	557545	3634788	N
RA 12058	MON			RA 12058 POD8	Shallow	1	1	2	NW	NW	NE	17	17S	26E	557545	3634788	N
RA 12058	MON			RA 12058 POD9	Shallow	1	1	2	NW	NW	NE	17	17S	26E	557551	3633973	N
RA 12059	MON	0	NAVAJO REFINING COMPANY	RA 12059 POD1	Shallow	1	1	2	NW	NW	NE	17	17S	26E	557490	3633792	N
RA 12059	MON			RA 12059 POD2	Shallow	1	1	2	NW	NW	NE	17	17S	26E	557487	3633795	N
RA 12061	MON	0	ARCADIS U.S.	RA 12061 POD1	Shallow	1	1	2	NW	NW	NE	17	17S	26E	558160	3634540	N

WR File Nbr	Use	Diversion	Owner	POD Number	Source	q64-	q16-	q4-	q64	q16	q4	Sec	Twn	Rng	X	Y	PLSS
RA 12061	MON			RA 12061 POD2	Shallow	1	1	2	NW	NW	NE	17	17S	26E	558095	3634921	N
RA 12061	MON			RA 12061 POD3		1	1	2	NW	NW	NE	17	17S	26E	555918	3633914	N
RA 12061	MON			RA 12061 POD4		1	1	2	NW	NW	NE	17	17S	26E	555918	3633914	N
RA 12061	MON			RA 12061 POD5		1	1	2	NW	NW	NE	17	17S	26E	555918	3633914	N
RA 12061	MON			RA 12061 POD6		1	1	2	NW	NW	NE	17	17S	26E	555918	3633914	N
RA 12061	MON			RA 12061 POD7		1	1	2	NW	NW	NE	17	17S	26E	555918	3633914	N
RA 12065	MON	0	ARCADIS U.S.	RA 12065 POD1		1	1	2	NW	NW	NE	17	17S	26E	555917	3633914	N
RA 12209	MON	0	GEOMECHANICS SOUTHWEST INC	RA 12209 POD1	Shallow	2	2	2	NE	NE	NE	17	17S	26E	556545	3633942	N
RA 12209	MON			RA 12209 POD2	Shallow	2	2	2	NE	NE	NE	17	17S	26E	556564	3633954	N
RA 12209	MON			RA 12209 POD3	Shallow	2	2	2	NE	NE	NE	17	17S	26E	556562	3633942	N
RA 12209	MON			RA 12209 POD4	Shallow	2	2	2	NE	NE	NE	17	17S	26E	556550	3633933	N
RA 12209	MON			RA 12209 POD5	Shallow	2	2	2	NE	NE	NE	17	17S	26E	556539	3633945	N
RA 00776	MUN	75	CITY OF ARTESIA	RA 00776				3			SW	17	17S	26E	555363	3632788	Y
RA 00778	IRR	0	RICE ESTATE	RA 00778		1	1	3	NW	NW	SW	17	17S	26E	555058	3633088	Y
RA 01381 A	IRR	15	A. O. DOUGLAS	RA 01381 A				3			SW	17	17S	26E	555363	3632788	Y
RA 00769	IRR	0	CITY OF ARTESIA, NEW MEXICO	RA 00769		3	3	4	SW	SW	SE	17	17S	26E	555870	3632488	Y
RA 00770	IRR	0	CITY OF ARTESIA, NEW MEXICO	RA 00770		3	3	4	SW	SW	SE	17	17S	26E	555870	3632488	Y
RA 01381	IRR	21.9	H. A. DENTON	RA 01381	Shallow		4	4		SE	SE	17	17S	26E	556375	3632590	Y
RA 01381 B	DOM	-35	H. A. DENTON	RA 01381 B	Shallow		4	4		SE	SE	17	17S	26E	556375	3632590	Y
RA 01749	DOM	1.34	J.B. WALLACE	RA 01749				4			SE	17	17S	26E	556172	3632790	Y
RA 01755	DOM	0.17	W.R., CLAY, ELMO MCCULLOUGH	RA 01755			4	4		SE	SE	17	17S	26E	556375	3632590	Y
RA 01965	DOM	3	P. A. HANCOX	RA 01965	Shallow			4			SE	17	17S	26E	556172	3632790	Y
RA 12091	MON	0	MANUEL DUENEZ	RA 12091 POD1	Shallow	2	2	4	NE	NE	SE	17	17S	26E	556419	3633171	N
RA 12091	MON			RA 12091 POD2		2	2	4	NE	NE	SE	17	17S	26E	556434	3633174	N
RA 12091	MON			RA 12091 POD3	Shallow	2	2	4	NE	NE	SE	17	17S	26E	556436	3633156	N
RA 01735	DOM	3	G. W. BEADLE	RA 01735	Shallow							17	17S	26E	555765	3633190	Y
RA 01757	DOM	3	B. H. HOWTON	RA 01757								17	17S	26E	555765	3633190	Y
RA 03279	DOM	3	EMIL P. BACH	RA 03279			3	2		SW	NE	7	17S	27E	564020	3635011	Y
RA 05881	PUB	0	WOODS CONSTRUCTION CO.	RA 05881			1	1		NW	NW	18	17S	27E	563232	3633837	Y
RA 11926	MON	0	NAVAJO REFINING COMPANY, LLC	RA 11926 POD6	Shallow	4	1	1	SE	NW	NW	18	17S	27E	563316	3633803	N
RA 04786	DOM	3	DAVE COLLIER	RA 04786	Artesian	4	3	2	SE	SW	NE	18	17S	27E	564133	3633277	Y
RA 06635	DOM	3	RANGER C. KARR	RA 06635	Shallow	2	2	2	NE	NE	NE	18	17S	27E	564531	3633852	Y

Table A2 Possible Shallow wells in the AOI with receptor-type uses

MapID	WR_File_Nbr	Use	Diversion	Owner	POD_Number	Source	q64	q16	q4	q64_text	q162	q42	Sec	Twn	Rng	X	Y	PLSS
01	RA 01587	NON	0	MRS. LOUIESE GOTT	RA 01587	Shallow							1	17S	26E	562206	3636450	Y
02	RA 06168	DOM	3	RYAN LETCHER	RA 06168	Shallow							1	17S	26E	562206	3636450	Y
03	RA 02219	DOM	3	E.P. MANN	RA 02219	Shallow	1	1	3	NW	NW	SW	2	17S	26E	559886	3636336	Y
04	RA 04308	DOM	3	CITY OF ARTESIA	RA 04308	Shallow	3	3	3	SW	SW	SW	2	17S	26E	559888	3635733	Y
05	RA 01097	IND	318.91	NAVAJO REFINING COMPANY	RA 01097		4	4	2	SE	SE	NE	8	17S	26E	556460	3634907	N
06	RA 00602	IRR	0	NAVAJO REFINING COMPANY	RA 00602		3	1	1	SW	NW	NW	9	17S	26E	556662	3635312	Y
07	RA 01973	DOM	0.56	J.O. SAVOIE	RA 01973	Shallow	1	1	1	NW	NW	NW	9	17S	26E	556662	3635512	Y
08	RA 02368	IRR	45	& W.D. PIKE, J.F. LOWER	RA 02368		3	1	1	SW	NW	NW	9	17S	26E	556662	3635312	Y
09	RA 02488	DOM	3	C. S. POWELL	RA 02488	Shallow	4	1	1	SE	NW	NW	9	17S	26E	556862	3635312	Y
10	RA 02496	DOM	3	CLYDE BOULDEN	RA 02496		3	1	1	SW	NW	NW	9	17S	26E	556662	3635312	Y
11	RA 02654	DOM	3	D.G. WINKLES	RA 02654	Shallow		1	1		NW	NW	9	17S	26E	556763	3635413	Y
12	RA 03225	DOM	3	J.C. GOLEMON	RA 03225	Shallow	2	1	1	NE	NW	NW	9	17S	26E	556862	3635512	Y
13	RA 03282	DOM	3	CECIL G. STANDARD	RA 03282	Shallow	2	1	1	NE	NW	NW	9	17S	26E	556862	3635512	Y
14	RA 03662	DOM	3	FRED MORGAN	RA 03662			1	1		NW	NW	9	17S	26E	556763	3635413	Y
15	RA 05163	DOM	3	J.B. MULCOCK	RA 05163		3	1	1	SW	NW	NW	9	17S	26E	556662	3635312	Y
16	RA 02698	DOM	3	BRITTON COLL	RA 02698	Shallow	4	4	2	SE	SE	NE	9	17S	26E	558076	3634913	Y
17	RA 10378	DOM	3	SUE C. PEMBERTON	RA 10378	Shallow	4	4	2	SE	SE	NE	9	17S	26E	558076	3634913	Y
18	RA 03890	MUN	57.9	CITY OF ARTESIAN	RA 03890		3	1	3	SW	NW	SW	9	17S	26E	556666	3634506	Y
19	RA 00768	IND	169.61	NAVAJO REFINING COMPANY	RA 00768		3	2	3	SW	NE	SW	9	17S	26E	557070	3634507	Y
20	RA 02723	DOM	3	BRITTON COLL	RA 02723	Shallow	4	3	4	SE	SW	SE	9	17S	26E	557676	3634106	Y
21	RA 04922	DOM	3	AS MORTGAGEE FARM CREDIT BANK OF WICHITA	RA 04922	Shallow	1	1	1	NW	NW	NW	10	17S	26E	558278	3635518	Y
22	RA 03720	DOM	0	D.M. MCFARLAND	RA 03720			2	1		NE	NW	10	17S	26E	558782	3635422	Y
23	RA 03720 D	DOM	0	D.M. MCFARLAND	RA 03720 D			2	1		NE	NW	10	17S	26E	558782	3635422	Y
24	RA 06550	DOM	3	LEE DILBECK	RA 06550	Shallow	3	2	1	SW	NE	NW	10	17S	26E	558681	3635321	Y
25	RA 07180	DOM	3	BOB SMITH	RA 07180	Shallow		2	1		NE	NW	10	17S	26E	558782	3635422	Y
26	RA 11688		0	CHASE FARMS, LLC	RA 11688 POD1		2	2	1	NE	NE	NW	10	17S	26E	558239	3634879	N
27	RA 11872	MUL	0	CHASE FARMS, LLC	RA 11872 POD1		4	2	1	SE	NE	NW	10	17S	26E	558959	3635354	N
28	RA 00307	IRR			RA 01331	Shallow	3	3	1	SW	SW	NW	10	17S	26E	558280	3634915	Y
29	RA 01488	IRR			RA 01331	Shallow	3	3	1	SW	SW	NW	10	17S	26E	558280	3634915	Y
30	RA 01331	EXP	0	CHASE FARMS	RA 01331	Shallow	3	3	1	SW	SW	NW	10	17S	26E	558280	3634915	Y
31	RA 01488	IRR			RA 01488 S	Shallow	3	1	2	SW	NW	NE	10	17S	26E	559084	3635323	Y
32	RA 03368	DOM	3	A.T. WOELK	RA 03368	Shallow	3	1	2	SW	NW	NE	10	17S	26E	559084	3635323	Y
33	RA 02661	DOM	3	IVA JONES	RA 02661		2	4	2	NE	SE	NE	10	17S	26E	559690	3635123	Y
34	RA 04196	DOM	3	BRUCE HARRIS	RA 04196		3	3	3	SW	SW	SW	10	17S	26E	558284	3634109	Y
35	RA 04798	DOM	3	A.B. HARRIS	RA 04798	Shallow		3	3		SW	SW	10	17S	26E	558385	3634210	Y
36	RA 02342	DOM	3	LEROY SUMRULD	RA 02342	Shallow	4	4	3	SE	SE	SW	10	17S	26E	558888	3634111	Y
37	RA 23420	DOM	3	O.C. ROGERS	RA 23420	Shallow	4	4	3	SE	SE	SW	10	17S	26E	558888	3634111	Y
38	RA 00397	IRR			RA 01300	Shallow	4	3	4	SE	SW	SE	10	17S	26E	559291	3634113	Y
39	RA 00397 A	IRR			RA 01300	Shallow	4	3	4	SE	SW	SE	10	17S	26E	559291	3634113	Y
40	RA 01300	COM	269.15	JOHN R GRAY, LLC	RA 01300	Shallow	4	3	4	SE	SW	SE	10	17S	26E	559291	3634113	Y
41	RA 02793	DOM	3	R. W. (ROGERS BROTHERS) ROGERS	RA 02793		1	3	4	NW	SW	SE	10	17S	26E	559091	3634313	Y
42	RA 03195	DOM	3	D.D. SULLIVAN	RA 03195		3	3	4	SW	SW	SE	10	17S	26E	559091	3634113	Y
43	RA 10442	DOL	0	WILLIAM BARON CHANDLER	RA 10442	Shallow		3	1		SW	NW	11	17S	26E	559994	3635026	Y
44	RA 01414	IRR	1540.7	WILLIAM VANCE HALDEMAN	RA 01414	Shallow	1	1	3	NW	NW	SW	11	17S	26E	559896	3634721	Y
45	RA 01414	IRR			RA 01414 S2	Shallow	2	3	3	NE	SW	SW	11	17S	26E	560098	3634317	Y
46	RA 09912	EXP	0	VANCE HALDEMAN	RA 09912				3			SW	11	17S	26E	560200	3634419	Y

MapID	WR_File_Nbr	Use	Diversion	Owner	POD_Number	Source	q64	q16	q4	q64_text	q162	q42	Sec	Twn	Rng	X	Y	PLSS
47	RA 00777	IRR			RA 00777 B		3	3	4	SW	SW	SE	11	17S	26E	560706	3634123	Y
48	RA 04438	DOM	3	GEO H. SETTLEMIRE	RA 04438	Shallow	4	4	2	SE	SE	NE	12	17S	26E	562920	3634946	Y
49	RA 02896 REPAR	DOM	3	WENDEL E. & MAXINE PARHAM	RA 02896 REPAR	Shallow		3	3		SW	SW	12	17S	26E	561616	3634230	Y
50	RA 00763	IRR			RA 05395 A			1	1		NW	NW	14	17S	26E	560002	3633814	Y
51	RA 01414	IRR			RA 01414 S	Shallow	3	1	1	SW	NW	NW	14	17S	26E	559901	3633713	Y
52	RA 03051	DOM	3	W.T. HALDEMAN	RA 03051	Shallow	3	1	1	SW	NW	NW	14	17S	26E	559901	3633713	Y
53	RA 03518	DOM	3	W. T. HALDERMAN	RA 03518	Shallow	3	1	1	SW	NW	NW	14	17S	26E	559901	3633713	Y
54	RA 08941	DOM	0	DENNIS TIDWELL	RA 08941		1	1	1	NW	NW	NW	14	17S	26E	559901	3633913	Y
55	RA 00763	IRR	350	VIVIAN MARIE TIDWELL INTER VIVOS TRUST	RA 00763			3	1		SW	NW	14	17S	26E	560005	3633411	Y
56	RA 00763	IRR			RA 00763 S		3	3	1	SW	SW	NW	14	17S	26E	559904	3633310	Y
57	RA 01180		0	WILLIAM T. HALDEMAN	RA 01180			3	1		SW	NW	14	17S	26E	560005	3633411	Y
58	RA 01180				RA 01180 S		3	3	1	SW	SW	NW	14	17S	26E	559904	3633310	Y
59	RA 11977	DOL	3	TERRY MAUPIN	RA 11977 POD1	Shallow	2	3	1	NE	SW	NW	14	17S	26E	560101	3633602	N
60	RA 12009	DOL	3	BIANCA LOPEZ	RA 12009		1	3	1	NW	SW	NW	14	17S	26E	559869	3633546	N
61	RA 12151	DOL	0	DAVID COLLINS	RA 12151 POD1		1	3	1	NW	SW	NW	14	17S	26E	559918	3633433	N
62	RA 00948	DOM	3	LYDIA A. BRUCE	RA 00948			1	2		NW	NE	14	17S	26E	560810	3633820	Y
63	RA 02749	DOM	3	SHARP. G. E.	RA 02749	Shallow	1	1	2	NW	NW	NE	14	17S	26E	560709	3633919	Y
64	RA 00279	IRR			RA 01227	Shallow	3	1	1	SW	NW	NW	15	17S	26E	558287	3633706	Y
65	RA 00400	IRR			RA 01227	Shallow	3	1	1	SW	NW	NW	15	17S	26E	558287	3633706	Y
66	RA 01227	IRR	109.24	T.D. JOY	RA 01227	Shallow	3	1	1	SW	NW	NW	15	17S	26E	558287	3633706	Y
67	RA 09866	DOM	3	EDDIE C. LARUE	RA 09866	Shallow	3	1	1	SW	NW	NW	15	17S	26E	558287	3633706	Y
68	RA 01227	IRR			RA 01227 S		1	2	1	NW	NE	NW	15	17S	26E	558690	3633908	Y
69	RA 02827	DOM	0	T.D. JOY	RA 02827		1	2	1	NW	NE	NW	15	17S	26E	558690	3633908	Y
70	RA 03353	DOM	3	T.D. JOY	RA 03353	Shallow	1	2	1	NW	NE	NW	15	17S	26E	558690	3633908	Y
71	RA 03156	DOM	3	CLYDE DUNGAN	RA 03156	Shallow		3	1		SW	NW	15	17S	26E	558390	3633403	Y
72	RA 04684	DOM	3	WALTER NUGENT	RA 04684		3	3	1	SW	SW	NW	15	17S	26E	558289	3633302	Y
73	RA 11027	DOL	3	RICHARD CHASE	RA 11027 POD1	Shallow	4	3	1	SE	SW	NW	15	17S	26E	558489	3633302	Y
74	RA 04765	DOM	3	BENNIE J. MASON	RA 04765	Shallow		4	1		SE	NW	15	17S	26E	558794	3633405	Y
75	RA 11027				RA 11027 POD4		1	4	1	NW	SE	NW	15	17S	26E	558630	3633421	N
76	RA 00400	IRR			RA 01183	Shallow	1	1	2	NW	NW	NE	15	17S	26E	559094	3633910	Y
77	RA 01183	IRR			RA 01183	Shallow	1	1	2	NW	NW	NE	15	17S	26E	559094	3633910	Y
78	RA 01183	IRR			RA 01183 S		1	1	2	NW	NW	NE	15	17S	26E	559094	3633910	Y
79	RA 02222	DOM	3	J.M. VOGLE	RA 02222	Shallow	2	1	2	NE	NW	NE	15	17S	26E	559294	3633910	Y
80	RA 02783	DOM	3	G. E. KEY	RA 02783	Shallow	3	1	2	SW	NW	NE	15	17S	26E	559094	3633710	Y
81	RA 00279	IRR	156.45	T.D. & DOROTHY ELIZABETH JOY	RA 00279		4	3	2	SE	SW	NE	15	17S	26E	559297	3633306	Y
82	RA 01183	IRR	268.45	FARM CREDIT BANK OF WICHITA	RA 00400 279		4	3	2	SE	SW	NE	15	17S	26E	559297	3633306	Y
83	RA 02221	DOM	3	J.M. VOGLE	RA 02221	Shallow	3	3	2	SW	SW	NE	15	17S	26E	559097	3633306	Y
84	RA 02568	DOM	3	G. G. & SONS ARMSTRONG	RA 02568	Shallow	3	1	1	SW	NW	NW	16	17S	26E	556671	3633699	Y
85	RA 01735	DOM	3	G. W. BEADLE	RA 01735	Shallow							17	17S	26E	555765	3633190	Y
86	RA 01757	DOM	3	B. H. HOWTON	RA 01757								17	17S	26E	555765	3633190	Y
87	RA 05881	PUB	0	WOODS CONSTRUCTION CO.	RA 05881			1	1		NW	NW	18	17S	27E	563232	3633837	Y

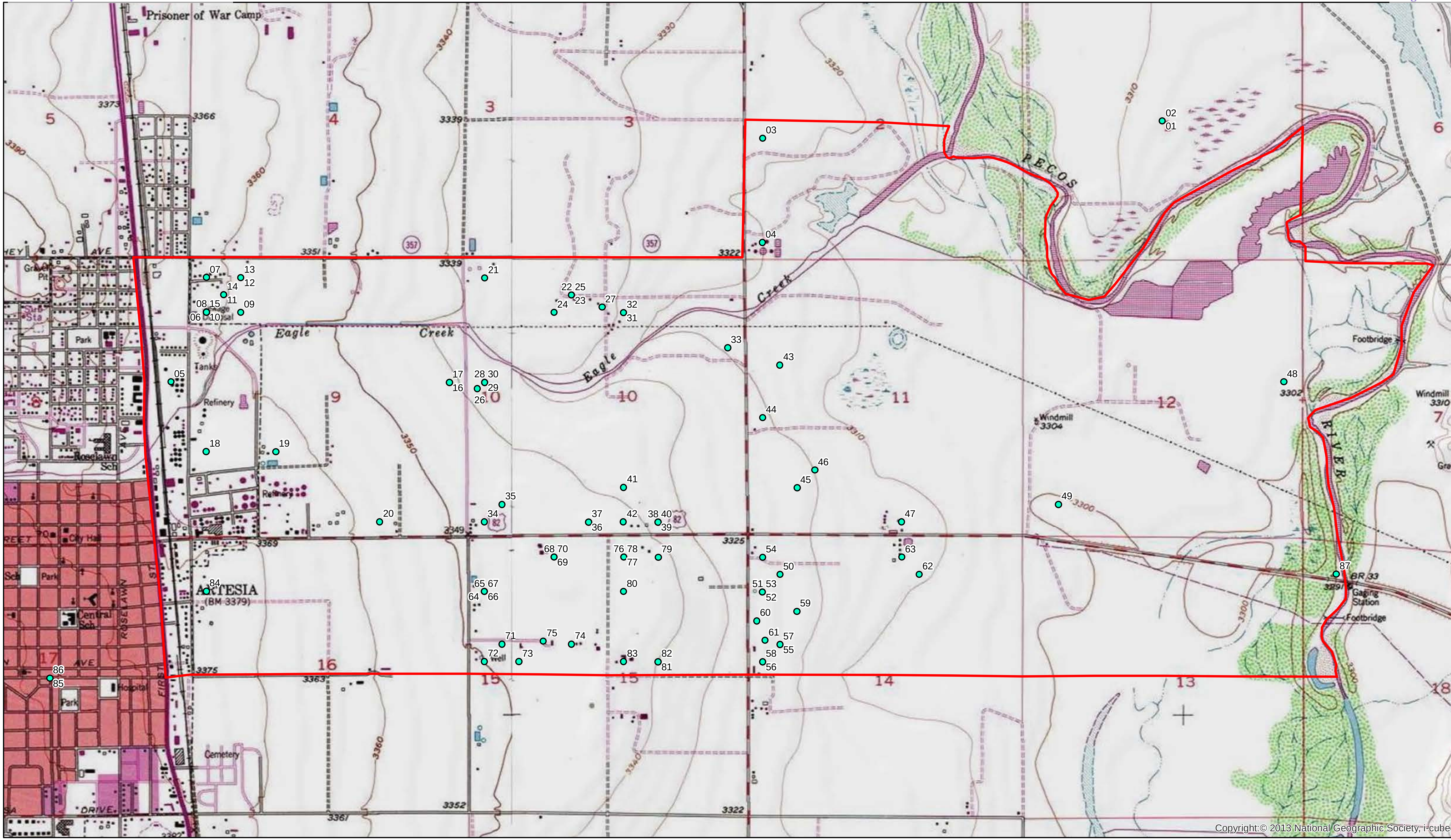


Figure A1 NMWRRS Scrubbed data showing possible shallow wells with receptor type uses in the NRC AOI

February 2016

Legend

Possible Shallow Wells with receptor-type uses

NRC AOI

N

0 1,000 2,000 4,000 Feet

1 inch = 2,000 feet

Atkins
ENGINEERING ASSOCIATES

WR File Nbr	Use	Diversio	Owner	POD Number	q64	q16	q4	q64_te	q162	q42	Sec	Twn	Rng	X	Y	PL	TD	Perforation Depth
RA 06168	DOM	3	RYAN LETCHER	RA 06168							1	17S	26E	562206	3636450	Y		
RA 02219	DOM	3	E.P. MANN	RA 02219	1	1	3	NW	NW	SW	2	17S	26E	559886	3636336	Y	Not Listed	Not Listed
RA 04308	DOM	3	CITY OF ARTESIA	RA 04308	3	3	3	SW	SW	SW	2	17S	26E	559888	3635733	Y	138	108-139
RA 01097	IND	318.91	NAVAJO REFINING COMPANY	RA 01097	4	4	2	SE	SE	NE	8	17S	26E	556460	3634907	N		
RA 00602	IRR	0	NAVAJO REFINING COMPANY	RA 00602	3	1	1	SW	NW	NW	9	17S	26E	556662	3635312	Y		
RA 01973	DOM	0.56	J.O. SAVOIE	RA 01973	1	1	1	NW	NW	NW	9	17S	26E	556662	3635512	Y		
RA 02368	IRR	45	& W.D. PIKE, J.F. LOWER	RA 02368	3	1	1	SW	NW	NW	9	17S	26E	556662	3635312	Y		
RA 02488	DOM	3	C. S. POWELL	RA 02488	4	1	1	SE	NW	NW	9	17S	26E	556862	3635312	Y	200	140-200
RA 02496	DOM	3	CLYDE BOULDEN	RA 02496	3	1	1	SW	NW	NW	9	17S	26E	556662	3635312	Y		
RA 02654	DOM	3	D.G. WINKLES	RA 02654		1	1		NW	NW	9	17S	26E	556763	3635413	Y	115	Not Listed
RA 03225	DOM	3	J.C. GOLEMON	RA 03225	2	1	1	NE	NW	NW	9	17S	26E	556862	3635512	Y	100	65-94
RA 03282	DOM	3	CECIL G. STANDARD	RA 03282	2	1	1	NE	NW	NW	9	17S	26E	556862	3635512	Y	125	105-125
RA 03662	DOM	3	FRED MORGAN	RA 03662		1	1		NW	NW	9	17S	26E	556763	3635413	Y		
RA 05163	DOM	3	J.B. MULCOCK	RA 05163	3	1	1	SW	NW	NW	9	17S	26E	556662	3635312	Y		
RA 02698	DOM	3	BRITTON COLL	RA 02698	4	4	2	SE	SE	NE	9	17S	26E	558076	3634913	Y	140	Not Listed
RA 10378	DOM	3	SUE C. PEMBERTON	RA 10378	4	4	2	SE	SE	NE	9	17S	26E	558076	3634913	Y	190	115-190
RA 03890	MUN	57.9	CITY OF ARTESIAN	RA 03890	3	1	3	SW	NW	SW	9	17S	26E	556666	3634506	Y		
RA 00768	IND	169.61	NAVAJO REFINING COMPANY	RA 00768	3	2	3	SW	NE	SW	9	17S	26E	557070	3634507	Y		
RA 02723	DOM	3	BRITTON COLL	RA 02723	4	3	4	SE	SW	SE	9	17S	26E	557676	3634106	Y	318	240-318
RA 04922	DOM	3	AS MORTGAGEE FARM CREDIT BANK OF WICHITA	RA 04922	1	1	1	NW	NW	NW	10	17S	26E	558278	3635518	Y	218	Not Listed
RA 03720	DOM	0	D.M. MCFARLAND	RA 03720		2	1		NE	NW	10	17S	26E	558782	3635422	Y		
RA 03720 D	DOM	0	D.M. MCFARLAND	RA 03720 D		2	1		NE	NW	10	17S	26E	558782	3635422	Y		
RA 06550	DOM	3	LEE DILBECK	RA 06550	3	2	1	SW	NE	NW	10	17S	26E	558681	3635321	Y	125	90-120
RA 07180	DOM	3	BOB SMITH	RA 07180		2	1		NE	NW	10	17S	26E	558782	3635422	Y	220	180-220
RA 11688		0	CHASE FARMS, LLC	RA 11688 POD1	2	2	1	NE	NE	NW	10	17S	26E	558239	3634879	N		
RA 11872	MUL	0	CHASE FARMS, LLC	RA 11872 POD1	4	2	1	SE	NE	NW	10	17S	26E	558959	3635354	N		
RA 00307	IRR			RA 01331	3	3	1	SW	SW	NW	10	17S	26E	558280	3634915	Y	278	Not Listed
RA 01488	IRR			RA 01331	3	3	1	SW	SW	NW	10	17S	26E	558280	3634915	Y	278	Not Listed
RA 01488	IRR			RA 01488 S	3	1	2	SW	NW	NE	10	17S	26E	559084	3635323	Y		
RA 03368	DOM	3	A.T. WOELK	RA 03368	3	1	2	SW	NW	NE	10	17S	26E	559084	3635323	Y	215	192-215
RA 02661	DOM	3	IVA JONES	RA 02661	2	4	2	NE	SE	NE	10	17S	26E	559690	3635123	Y		
RA 04196	DOM	3	BRUCE HARRIS	RA 04196	3	3	3	SW	SW	SW	10	17S	26E	558284	3634109	Y	294	275-294
RA 04798	DOM	3	A.B. HARRIS	RA 04798		3	3		SW	SW	10	17S	26E	558385	3634210	Y		
RA 02342	DOM	3	LEROY SUMRULD	RA 02342	4	4	3	SE	SE	SW	10	17S	26E	558888	3634111	Y		
RA 23420	DOM	3	O.C. ROGERS	RA 23420	4	4	3	SE	SE	SW	10	17S	26E	558888	3634111	Y		
RA 00397	IRR			RA 01300	4	3	4	SE	SW	SE	10	17S	26E	559291	3634113	Y	210	Not Listed
RA 00397 A	IRR			RA 01300	4	3	4	SE	SW	SE	10	17S	26E	559291	3634113	Y	210	Not Listed
RA 01300	COM	269.15	JOHN R GRAY, LLC	RA 01300	4	3	4	SE	SW	SE	10	17S	26E	559291	3634113	Y	210	Not Listed
RA 02793	DOM	3	R. W. (ROGERS BROTHERS) ROGERS	RA 02793	1	3	4	NW	SW	SE	10	17S	26E	559091	3634313	Y		
RA 03195	DOM	3	D.D. SULLIVAN	RA 03195	3	3	4	SW	SW	SE	10	17S	26E	559091	3634113	Y		
RA 10442	DOL	0	WILLIAM BARON CHANDLER	RA 10442		3	1		SW	NW	11	17S	26E	559994	3635026	Y	170	60-170
RA 01414	IRR	1540.7	WILLIAM VANCE HALDEMAN	RA 01414	1	1	3	NW	NW	SW	11	17S	26E	559896	3634721	Y	105	Not Listed
RA 01414	IRR			RA 01414 S2	2	3	3	NE	SW	SW	11	17S	26E	560098	3634317	Y		
RA 00777	IRR			RA 00777 B	3	3	4	SW	SW	SE	11	17S	26E	560706	3634123	Y		
RA 04438	DOM	3	GEO H. SETTLEMIRE	RA 04438	4	4	2	SE	SE	NE	12	17S	26E	562920	3634946	Y	228	185-228
RA 02896 REPAR	DOM	3	WENDEL E. & MAXINE PARHAM	RA 02896 REPAR		3	3		SW	SW	12	17S	26E	561616	3634230	Y		

WR File Nbr	Use	Diversio	Owner	POD Number	q64	q16	q4	q64_te	q162	q42	Sec	Twn	Rng	X	Y	PL	TD	Perforation Depth
RA 00763	IRR			RA 05395 A		1	1		NW	NW	14	17S	26E	560002	3633814	Y		
RA 01414	IRR			RA 01414 S	3	1	1	SW	NW	NW	14	17S	26E	559901	3633713	Y	94?	Not Listed
RA 03051	DOM	3	W.T. HALDEMAN	RA 03051	3	1	1	SW	NW	NW	14	17S	26E	559901	3633713	Y		
RA 03518	DOM	3	W. T. HALDERMAN	RA 03518	3	1	1	SW	NW	NW	14	17S	26E	559901	3633713	Y	220	Void?
RA 08941	DOM	0	DENNIS TIDWELL	RA 08941	1	1	1	NW	NW	NW	14	17S	26E	559901	3633913	Y	100	60-100
RA 00763	IRR	350	VIVIAN MARIE TIDWELL INTER VIVOS TRUST	RA 00763		3	1		SW	NW	14	17S	26E	560005	3633411	Y		
RA 00763	IRR			RA 00763 S	3	3	1	SW	SW	NW	14	17S	26E	559904	3633310	Y		
RA 01180		0	WILLIAM T. HALDEMAN	RA 01180		3	1		SW	NW	14	17S	26E	560005	3633411	Y		
RA 01180				RA 01180 S	3	3	1	SW	SW	NW	14	17S	26E	559904	3633310	Y		
RA 11977	DOL	3	TERRY MAUPIN	RA 11977 POD1	2	3	1	NE	SW	NW	14	17S	26E	560101	3633602	N		
RA 12009	DOL	3	BIANCA LOPEZ	RA 12009	1	3	1	NW	SW	NW	14	17S	26E	559869	3633546	N		
RA 12151	DOL	0	DAVID COLLINS	RA 12151 POD1	1	3	1	NW	SW	NW	14	17S	26E	559918	3633433	N		
RA 00948	DOM	3	LYDIA A. BRUCE	RA 00948		1	2		NW	NE	14	17S	26E	560810	3633820	Y		
RA 02749	DOM	3	SHARP. G. E.	RA 02749	1	1	2	NW	NW	NE	14	17S	26E	560709	3633919	Y	241	214-241
RA 00279	IRR			RA 01227	3	1	1	SW	NW	NW	15	17S	26E	558287	3633706	Y		
RA 00400	IRR			RA 01227	3	1	1	SW	NW	NW	15	17S	26E	558287	3633706	Y		
RA 01227	IRR	109.24	T.D. JOY	RA 01227	3	1	1	SW	NW	NW	15	17S	26E	558287	3633706	Y		
RA 09866	DOM	3	EDDIE C. LARUE	RA 09866	3	1	1	SW	NW	NW	15	17S	26E	558287	3633706	Y	165	Not Listed
RA 01227	IRR			RA 01227 S	1	2	1	NW	NE	NW	15	17S	26E	558690	3633908	Y		
RA 02827	DOM	0	T.D. JOY	RA 02827	1	2	1	NW	NE	NW	15	17S	26E	558690	3633908	Y		
RA 03353	DOM	3	T.D. JOY	RA 03353	1	2	1	NW	NE	NW	15	17S	26E	558690	3633908	Y	295	232-295
RA 03156	DOM	3	CLYDE DUNGAN	RA 03156		3	1		SW	NW	15	17S	26E	558390	3633403	Y		
RA 04684	DOM	3	WALTER NUGENT	RA 04684	3	3	1	SW	SW	NW	15	17S	26E	558289	3633302	Y	220	185-220
RA 11027	DOL	3	RICHARD CHASE	RA 11027 POD1	4	3	1	SE	SW	NW	15	17S	26E	558489	3633302	Y		
RA 04765	DOM	3	BENNIE J. MASON	RA 04765		4	1		SE	NW	15	17S	26E	558794	3633405	Y	185	155-185
RA 11027				RA 11027 POD4	1	4	1	NW	SE	NW	15	17S	26E	558630	3633421	N		
RA 00400	IRR			RA 01183	1	1	2	NW	NW	NE	15	17S	26E	559094	3633910	Y	225	Not Listed
RA 01183	IRR			RA 01183	1	1	2	NW	NW	NE	15	17S	26E	559094	3633910	Y	225	Not Listed
RA 01183	IRR			RA 01183 S	1	1	2	NW	NW	NE	15	17S	26E	559094	3633910	Y		
RA 02222	DOM	3	J.M. VOGLE	RA 02222	2	1	2	NE	NW	NE	15	17S	26E	559294	3633910	Y	171	141-170
RA 02783	DOM	3	G. E. KEY	RA 02783	3	1	2	SW	NW	NE	15	17S	26E	559094	3633710	Y		
RA 00279	IRR	156.45	T.D. & DOROTHY ELIZABETH JOY	RA 00279	4	3	2	SE	SW	NE	15	17S	26E	559297	3633306	Y		
RA 01183	IRR	268.45	FARM CREDIT BANK OF WICHITA	RA 00400 279	4	3	2	SE	SW	NE	15	17S	26E	559297	3633306	Y		
RA 02221	DOM	3	J.M. VOGLE	RA 02221	3	3	2	SW	SW	NE	15	17S	26E	559097	3633306	Y	180	133-180
RA 02568	DOM	3	G. G. & SONS ARMSTRONG	RA 02568	3	1	1	SW	NW	NW	16	17S	26E	556671	3633699	Y	220	lower 30
RA 01757	DOM	3	B. H. HOWTON	RA 01757							17	17S	26E	555765	3633190	Y		
RA 05881	PUB	0	WOODS CONSTRUCTION CO.	RA 05881		1	1		NW	NW	18	17S	27E	563232	3633837	Y		
RA 01331	EXP	0	CHASE FARMS	RA 01331	3	3	1	SW	SW	NW	10	17S	26E	558280	3634915	Y	278	Not Listed
RA 09912	EXP	0	VANCE HALDEMAN	RA 09912			3			SW	11	17S	26E	560200	3634419	Y	250	45-170,158-249
				RA 05945							2	17S	26E				95	lower 30 (hard to determine)
				RA 00602&RA 2324							9	17S	26E				115	Not Listed
				RA 01440							9	17S	26E				320	Not listed
				RA 01533							9	17S	26E				258	Not Listed
				RA 01331 EXPL							10	17S	26E				300	100-300
				RA 01331 POD2							10	17S	26E				310	93-268
				RA 01488&RA 1668 A COMB							10	17S	26E				250	100-250

WR File Nbr	Use	Diversio	Owner	POD Number	q64	q16	q4	q64_te	q162	q42	Sec	Twn	Rng	X	Y	PL TD	Perforation Depth
				RA 02034							12	17S	26E			90	70-90
				RA 02649							12	17S	26E			150	114-130
				RA 02896							12	17S	26E			237	?-237
				RA							14	17S	26E			261	251.5-261.5
				RA 03522							14	17S	26E			365	342-365
				RA 11977							14	17S	26E			200	140-200
				RA							15	17S	26E			182	lower joint
				RA 01227 RAS 5							15	17S	26E			240	lower 52'
				RA 01503							15	17S	26E			240	States from entire length?
				RA 00820							17	17S	26E			Not Listed	Not Listed
				RA 02468							9	17S	26E				
				No RA							9	17S	26E				
				No RA							10	17S	26E				
				No RA							11	17S	26E				
				No RA							11	17S	26E				
				No RA							12	17S	26E				
				Unreadable RA							14	17S	26E				
				RA 01503 E							15	17S	26E				
				RA 00222							15	17S	26E				
				Unreadable RA							15	17S	26E				

Appendix B Shallow Paper Well Logs in AOI

WELL RECORD

FILE NO. ______

INSTRUCTIONS: This form should be typewrttten, and filed in the office of the State Engineer, (P.O. Box 1079) Santa Fe, New Mexico, unless the well is situated in the Roswell Artesian Basin, in which case it should be filed in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.

SEC. 1

N.W.	N.E.
S.W.	S.E.

(Plat of 640 acres)
Locate Well Accurately

Owner of well ______

Street and Number ______

Post Office ______

Well was drilled under Permit No. RA-2219 and

is located in the NW ¼ SW ¼ ______ ¼ of Section 2

Township 17 SOUTH, Range 026 EAST.

Drilling Contractor E. A. Blevins

Street and Number Gilbert Hotel

Post Office Artesia N. M.

Drilling was commenced 10-17 1946 Drilling was completed 10-18 1946

Elevation at top of casing in feet above sea level ______

State whether well is shallow or artesian ______

SEC. 2

PRINCIPAL WATER-BEARING STRATA

No. 1, from 18 to 21, Thickness in feet 3, Formation Gravel & sand

No. 2, from ______ to ______, Thickness in feet ______, Formation ______

No. 3, from 46 to 56, Thickness in feet 10, Formation sand

No. 4, from ______ to ______, Thickness in feet ______, Formation ______

No. 5, from ______ to ______, Thickness in feet ______, Formation ______

SEC. 3

RECORD OF CASING

DIAMETER IN INCHES	POUNDS PER FOOT	THREADS PER INCH	NAME OF MANUFACTURER	FEET OF CASING	TYPE OF SHOE	PERFORATED FROM	PERFORATED TO	PURPOSE

SEC. 4

RECORD OF MUDDING AND CEMENTING

DIAMETER OF HOLE IN INCHES	NUMBER OF SACKS OF CEMENT	METHODS USED	SPECIFIC GRAVITY OF MUD	TONS OF CLAY USED

SEC. 5

PLUGGING RECORD OF OLD WELL

Well is located in the ______ ¼ ______ ¼ ______ ¼ of Section ______, Township ______,

Range ______. Name of plugging contractor ______

Street and Number ______ Post Office ______

Tons of clay used ______ Tons of roughage used ______ Type of roughage ______

______ Was plugging approved by Artesian Well Supervisor ______

Cement plugs were placed as follows:

No. 1 was placed at ______ feet Number of sacks of cement used ______

No. 2 was placed at ______ feet Number of sacks of cement used ______

No. 3 was placed at ______ feet Number of sacks of cement used ______

No. 4 was placed at ______ feet Number of sacks of cement used ______

No. 5 was placed at ______ feet Number of sacks of cement used ______

(OVER)

RA-2219

17.26.2.310

LOG OF WELL

FROM (DEPTH IN FEET)	TO (DEPTH IN FEET)	THICKNESS IN FEET	CLASSIFICATION OF FORMATION

I, E. P. Mann do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this 3 day of Dec., A. D., 19 46

[signature]
Notary Public

My Commission Expires 11-12-47

Signed E. P. Mann

Position

Street and Number

Post Office

Form WR-23

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well E. P. Mann

Street and Number

City Artesia, State New Mexico

Well was drilled under Permit No. RA-2219 and is located in the NW ¼ NW ¼ SW ¼ of Section 2 Twp. 17 Rge. 26

(B) Drilling Contractor E. A. Blevins License No.

Street and Number

City State

Drilling was commenced October 17, 19 45

Drilling was completed October 18, 19 45

Elevation at top of casing in feet above sea level Total depth of well 55'

State whether well is shallow or artesian Depth to water upon completion

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				
2				
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
8					53			

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. RA-2219 Use Location No. 17.26.2.311

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	18			Soil
18	21			Gravel and sand
21	45			Gravel and sand
45	55			Sand

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

E. A. Blevins
Well Driller

FIELD ENGR. LOG

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well City of Artesia

Street and Number

City Artesia State N. Mex.

Well was drilled under Permit No. RA-4308 and is located in the SW ¼ SW ¼ SW ¼ of Section 2 Twp. 17S Rge. 26E

(B) Drilling Contractor Willard Beaty License No. WD-62

Street and Number 1102 Merchant St.

City Artesia State N. Mex.

Drilling was commenced November 15 1960

Drilling was completed November 18 1960

Elevation at top of casing in feet above sea level Total depth of well 138

State whether well is shallow or artesian shallow Depth to water upon completion 17

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	17	20	3	water sand
2	115	133	18	water sand
3				
4				
5				

Section 3

RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
7OD	24	8		138	139		108	139

Section 4

RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5

PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received

STATE ENGINEER OFFICE DISTRICT II

1960 DEC 19 AM 8:30

File No. RA-4308 Use Dom. Location No. 17.26.2.333

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	7	7	brown	top soil
7	17	10	red	clay
17	20	3	red	water sand
20	96	76	red	sand
96	115	19	red	sand
115	133	18	red	water sand
133	138	5	red	sand

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Willard Beaty by JDB
Well Driller

Plugged out & deepened record also

Revised June 1972

STATE ENGINEER OFFICE

FIELD ENGR. LOG

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well George Johnson Owner's Well No. RA 5945
Street or Post Office Address Route 1 Box 50
City and State Artesia, New Mexico 88210

Well was drilled under Permit No. RA 5945 and is located in the:

SWSW a. NW W1/2 ¼ NW ¼ SW ¼ ____ ¼ of Section 2 Township 17 Range 26E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in Chaves County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor J. W. Givens License No. WD 337

Address Route 2 Box 286 Roswell, New Mexico

Drilling Began Sept 3, 1974 Completed Sept 6, 1974 Type tools cabletool Size of hole 7 in.

Elevation of land surface or 0-95 at well is 95 ft. Total depth of well 95 ft.

Completed well is ☑ shallow ☐ artesian. Depth to water upon completion of well ______ ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______
State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ______ FWL ______ FSL ______

File No. RA-5945 Use STK & Dom Location No. 17.26.2.311331

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
			Set rig up Sept. 3. & pulled 10" pipe out which was setting over 8 5/8 pipe. Pipe Then went in with 7" bit and dug hole to 95 ft. All sand except the last 15 ft. which was gravel. Then ran 7" pipe all the way. Preforated 30 ft. of 7".

Section 7. REMARKS AND ADDITIONAL INFORMATION

1974 SEP 12 PM 3:26
STATE ENGINEER OFFICE
DISTRICT II
ROSWELL, N. M.

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

J.L. Gibson
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All questions, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

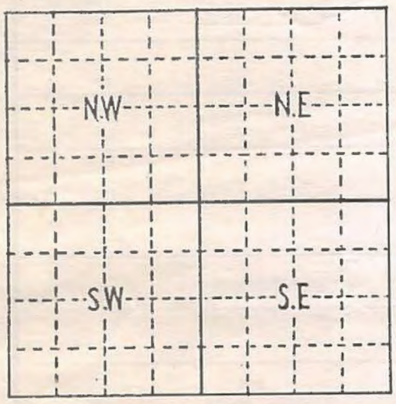
L B

WELL RECORD

File No.__________

INSTRUCTIONS: This form should be typewritten, and filed in the office of the State Engineer, (P.O. Box 1079) Santa Fe, New Mexico, unless the well is situated in the Roswell Artesian Basin, in which case it should be filed in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.

Sec. 1



(Plat of 640 acres)
Locate Well Accurately

Owner of well .... J. B. Mulcock

Street and Number ... 801 Texas St.

Post Office .... Artesia, New Mex.

Well was drilled under Permit No. RA-602 and RA 2324 ...... and

is located in the SW ¼ NW ¼ NW ¼ of Section 9

Township 17 South, Range 26 East

Drilling Contractor D. M. Gray

Street and Number 1007 Missouri St.

Post Office Artesia, New Mex.

Drilling was commenced .... 19...... Drilling was completed .... 19......

Elevation at top of casing in feet above sea level ....

State whether well is shallow or artesian ....

Total depth of well .... feet.

Sec. 2 PRINCIPAL WATER-BEARING STRATA

No. 1, from .... to ...., Thickness in feet ...., Formation ....

No. 2, from .... to ...., Thickness in feet ...., Formation ....

No. 3, from .... to ...., Thickness in feet ...., Formation ....

No. 4, from .... to ...., Thickness in feet ...., Formation ....

No. 5, from .... to ...., Thickness in feet ...., Formation ....

Sec. 3 RECORD OF CASING

DIAMETER IN INCHES	POUNDS PER FOOT	THREADS PER INCH	NAME OF MANUFACTURER	FEET OF CASING	TYPE OF SHOE	PERFORATED		PURPOSE
						FROM	TO	
10				115'6"	Steel			

Sec. 4 RECORD OF MUDDING AND CEMENTING

DIAMETER OF HOLE IN INCHES	NUMBER OF SACKS OF CEMENT	METHODS USED	SPECIFIC GRAVITY OF MUD	TONS OF CLAY USED

Sec. 5 PLUGGING RECORD OF OLD WELL

Well is located in the ....¼..........¼..........¼ of Section ...., Township ....,

Range .... Name of plugging contractor ....

Street and Number .... Post Office ....

Tons of clay used .... Tons of roughage used .... Type of roughage ....

.... Was plugging approved by Artesian Well Supervisor ....

FILED JUL 29 1952 OFFICE ARTESIAN WELL SUPERVISOR ROSWELL, NEW MEXICO

Cement plugs were placed as follows:

No. 1 was placed at .... feet Number of sacks of cement used ....

No. 2 was placed at .... feet Number of sacks of cement used ....

No. 3 was placed at .... feet Number of sacks of cement used ....

No. 4 was placed at .... feet Number of sacks of cement used ....

No. 5 was placed at .... feet Number of sacks of cement used ....

(OVER)

RA-602 + 2324

17.26.9.113

9.

Sec. 6

LOG OF WELL

FROM (depth in feet)	TO (depth in feet)	THICKNESS IN FEET	CLASSIFICATION OF FORMATION

Placed 115' 6" of 10-inch casing over 6-inch. Six inch casing cut off and removed at depth of 111 ft. Lead seal placed between six and ten-inch casings.

I, ...do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this ...... Signed D. N. Gray

day of ...., A. D., 19...... Position ....

.... Notary Public Street and Number 1007 Mo. St.

My Commission Expires .... Post Office Artesia, N. M.

L.B.

WELL RECORD

FILE NO. RA-1440

INSTRUCTIONS: This form should be typewrttten, and filed in the office of the State Engineer, (P.O. Box 1079) Santa Fe, New Mexico, unless the well is situated in the Roswell Artesian Basin, in which case it should be filed in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.

SEC. 1

NW X | NE
SW | SE

(Plat of 640 acres)
Locate Well Accurately

Owner of well W. J. Jackson

Street and Number

Post Office Artesia, New Mexico

Well was drilled under Permit No. RA-1440 and

is located in the SW ¼ NW ¼ NE ¼ of Section 9

Township 17S/, Range 26E.

Drilling Contractor Roe L. Newberry and W. P. Black

Street and Number

Post Office

Drilling was commenced February 10 19 41 Drilling was completed February 26th 19 41

Elevation at top of casing in feet above sea level

State whether well is shallow or artesian Shallow 320'

SEC. 2

PRINCIPAL WATER-BEARING STRATA

No. 1, from ______ to ______, Thickness in feet ______, Formation ______

No. 2, from ______ to ______, Thickness in feet ______, Formation ______

No. 3, from ______ to ______, Thickness in feet ______, Formation ______

No. 4, from ______ to ______, Thickness in feet ______, Formation ______

No. 5, from ______ to ______, Thickness in feet ______, Formation ______

SEC. 3

RECORD OF CASING

DIAMETER IN INCHES	POUNDS PER FOOT	THREADS PER INCH	NAME OF MANUFACTURER	FEET OF CASING	TYPE OF SHOE	PERFORATED FROM	PERFORATED TO	PURPOSE
12½				202				
10				106				
	Pipe slit with torch ,6 slits per circle.							

SEC. 4

RECORD OF MUDDING AND CEMENTING

DIAMETER OF HOLE IN INCHES	NUMBER OF SACKS OF CEMENT	METHODS USED	SPECIFIC GRAVITY OF MUD	TONS OF CLAY USED

SEC. 5

PLUGGING RECORD OF OLD WELL

Well is located in the ______ ¼ ______ ¼ ______ ¼ of Section ______, Township ______,

Range ______. Name of plugging contractor ______

Street and Number ______ Post Office ______

Tons of clay used ______ Tons of roughage used ______ Type of roughage ______

______ Was plugging approved by Artesian Well Supervisor ______

Cement plugs were placed as follows:

No. 1 was placed at ______ feet Number of sacks of cement used ______

No. 2 was placed at ______ feet Number of sacks of cement used ______

No. 3 was placed at ______ feet Number of sacks of cement used ______

No. 4 was placed at ______ feet Number of sacks of cement used ______

No. 5 was placed at ______ feet Number of sacks of cement used ______

(OVER)

RA-1440

17.26.9.213

LOG OF WELL

FROM (DEPTH IN FEET)	TO (DEPTH IN FEET)	THICKNESS IN FEET	CLASSIFICATION OF FORMATION
35	80	45	Yellow Sandy Clay
80	110	30	Pink Clay
110	130	20	Red Sand - water
130	150	20	Red Sandy Clay
150	170	20	Yellow, sandy clay
170	196	26	Red sand clay, some gravel
196	210	14	Pink Water Sand
210	225	15	White water Sand
225	245	20	Red Sandy Clay
245	260	15	Water Sand
260	285	25	Red Clay
285	320	35	Water Sand, bottomed at red clay.

I, ______________________ do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this ________ Signed W. J. Jackson

day of ______________________, A. D., 19 ______ Position ______________________

______________________ Notary Public Street and Number ______________________

My Commission Expires ______________________ Post Office ______________________

Form WR-23

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well New Mexico Refinery

Street and Number % John Boyd

City Pina Blanca, State New Mexico

Well was drilled under Permit No. RA-1533 and is located in the Blk 2 East Main Addn. ¼ ¼ ¼ of Section 9 Twp. 17 Rge. 26

(B) Drilling Contractor License No.

Street and Number

City State

Drilling was commenced February 2, 19 37

Drilling was completed February 12, 19 37

Elevation at top of casing in feet above sea level Total depth of well 258 ft.

State whether well is shallow or artesian Depth to water upon completion

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation
	From	To		
1				
2				
3				
4				
5				

Section 3

RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth		Feet	Type Shoe	Perforations	
			Top	Bottom			From	To
8					246			

Section 4

RECORD OF MUDDING AND CEMENTING

Depth in Feet		Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used
From	To				

Section 5

PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug		No. of Sacks Used
	From	To	

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. RA-1533 Use Location No. 17.26.9.

Section 6 LOG OF WELL

Depth in Feet		Thickness in Feet	Color	Type of Material Encountered
From	To			
0	10			Soil
10	20			Sandy clay (some water)
20	180			Yellow clay
180	238			Sand, gravel and clay (possibly some water)
238	258			Water sand and gravel

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Well Driller

 Or 65f

Form WR-23

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Flora D. Powell

Street and Number RT. 1. Box 203

City Artesia State N. Mex.

Well was drilled under Permit No. RA-2488 and is located in the SE ¼ NW ¼ NW ¼ of Section 9 Twp. 17 Rge. 26

(B) Drilling Contractor Willard Beaty License No. W.D.62

Street and Number 1102 Merchant St.

City Artesia State N. Mex.

Drilling was commenced 7-27 19 57

Drilling was completed 7-28 19 57

Elevation at top of casing in feet above sea level ____ Total depth of well 200

State whether well is shallow or artesian shallow Depth to water upon completion 70

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	150	160	10	sand
2	180	192	12	sand
3				
4				
5				

Section 3

RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
liner 5	14	11	130	200	70	none	140	200
7 od	17	10	140					

Section 4

RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5

PLUGGING RECORD

Name of Plugging Contractor ____ License No. ____

Street and Number ____ City ____ State ____

Tons of Clay used ____ Tons of Roughage used ____ Type of roughage ____

Plugging method used ____ Date Plugged ____ 19__

Plugging approved by:

____
Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FILED
AUG 5 1957
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

FOR USE OF STATE ENGINEER ONLY

Date Received August 5, 1957

File No. RA-2488 Use Dom. Location No. 17.26.9.114

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
Cleaned out old well.				
140	200	60	red and brown	sand and clay

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Willard Beaty
Well Driller

L. B.

WELL RECORD

File No. ____________

INSTRUCTIONS: This form should be typewritten, and filed in the office of the State Engineer, (P.O. Box 1079) Santa Fe, New Mexico, unless the well is situated in the Roswell Artesian Basin, in which case it should be filed in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.

Sec. 1

NW	NE
SW	SE

(Plat of 640 acres)
Locate Well Accurately

Owner of well D. G. Winkles

Street and Number Box # 344

Post Office Artesia, New Mexico

Well was drilled under Permit No. RA-2654 and

is located in the N½ N½ ¼ NW¼ ¼ NW¼ ¼ of Section 9

Township 17, Range 26E

Drilling Contractor D. G. Winkles

Street and Number Artesia, New Mexico

Post Office Box # 344

Drilling was commenced Aug. 15 19 50 Drilling was completed Aug. 25 19 50

Elevation at top of casing in feet above sea level ....

State whether well is shallow or artesian shallow

Total depth of well 200 feet.

Sec. 2 PRINCIPAL WATER-BEARING STRATA

No. 1, from 0 to 20, Thickness in feet 20, Formation Adobe

No. 2, from 20 to 23, Thickness in feet 3, Formation Rock & Red Clay

No. 3, from 23 to 100, Thickness in feet 77, Formation Rock & Red Clay

No. 4, from 100 to 130, Thickness in feet 30, Formation Red Bed

No. 5, from 130 to 140, Thickness in feet 10, Formation Water Sand

140 to 190, 50, Gray rock

190 to 200, 10, Red Bed

Sec. 3 RECORD OF CASING

DIAMETER IN INCHES	POUNDS PER FOOT	THREADS PER INCH	NAME OF MANUFACTURER	FEET OF CASING	TYPE OF SHOE	PERFORATED FROM	PERFORATED TO	PURPOSE
6 5/8				89'				
5"				115'				

Sec. 4 RECORD OF MUDDING AND CEMENTING

DIAMETER OF HOLE IN INCHES	NUMBER OF SACKS OF CEMENT	METHODS USED	SPECIFIC GRAVITY OF MUD	TONS OF CLAY USED

Sec. 5 PLUGGING RECORD OF OLD WELL

Well is located in the ....¼ ....¼ ....¼ of Section ...., Township ....,

Range .... Name of plugging contractor ....

Street and Number .... Post Office ....

Tons of clay used .... Tons of roughage used .... Type of roughage ....

.... Was plugging approved by Artesian Well Supervisor ....

Cement plugs were placed as follows:

No. 1 was placed at .... feet Number of sacks of cement used ....

No. 2 was placed at .... feet Number of sacks of cement used ....

No. 3 was placed at .... feet Number of sacks of cement used ....

No. 4 was placed at .... feet Number of sacks of cement used ....

No. 5 was placed at .... feet Number of sacks of cement used ....

FILED
SEP 13 1950
OFFICE
ARTESIAN WELL SUPERVISOR
ROSWELL, NEW MEXICO

(OVER)

17.26.9.110

Sec. 6

LOG OF WELL

FROM (depth in feet)	TO (depth in feet)	THICKNESS IN FEET	CLASSIFICATION OF FORMATION

I, D. G. Winkles ....do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this 11th ... Signed D. G. Winkles

day of September, A. D., 1950 Position 344 Artesia

Jeanne N. Lewis
Notary Public

Street and Number ....

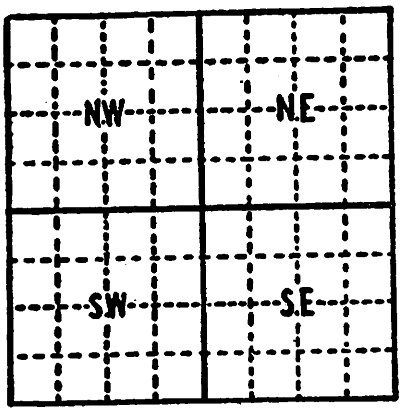
My Commission Expires My Commission Expires June.6,.1954 Post Office ....

L, Rf

WELL RECORD

File No.:

INSTRUCTIONS: This form should be typewritten, and filed in the office of the State Engineer, P. O. Box 1079, Santa Fe, New Mexico, or in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.



(Plat of 640 Acres)
Locate Well Accurately

Owner of well: Britton Coll

Street and Number: Route 1 Box 30

Post Office: Artesia, New Mexico

Well was drilled under Permit No. RA 2698 and

is located in the SE ¼ SE ¼ NE ¼ of Section 9

Township 17 S., Range 26 E.

Drilling Contractor: Blount & Coll

Street and Number: Route 1 Box 30

Post Office: Artesia, New Mexico

Drilling was commenced July 28, 1951. Drilling was completed July 31, 1951

Elevation at top of casing in feet above sea level

State whether well is shallow or artesian: Shallow, Stock well

Total depth of well 140 feet. Water level upon completion of well 10 feet below land surface.

Sec. 2 PRINCIPAL WATER-BEARING STRATA

No. 1, from 18 to 30, Thickness in feet 12, Formation Gyp

No. 2, from 50 to 80, Thickness in feet 30, Formation Clay & Gravel

No. 3, from 130 to 140, Thickness in feet 10, Formation Gravel

No. 4, from to, Thickness in feet, Formation

No. 5, from to, Thickness in feet, Formation

Sec. 3 RECORD OF CASING

Diameter in Inches	Pounds per Foot	Threads per Inch	Name of Manufacturer	Feet of Casing	Type of Shoe	Perforated From	Perforated To	Purpose
8				40				Shut off surface water.
7				23				Meet domestic well requirements.

Sec. 4 RECORD OF MUDDING AND CEMENTING

Diameter of Hole in Inches	Number of Sacks of Cement	Methods Used	Specific Gravity of Mud	Tons of Clay Used

Sec. 5 PLUGGING RECORD OF OLD WELL

Well is located in the ¼ ¼ ¼ of Section, Township,

Range. Name of plugging contractor

Street and Number. Post Office

Tons of clay used. Tons of roughage used. Type of roughage

Was plugging approved by Artesian Well Supervisor?

Cement plugs were placed as follows:

No. 1 was placed at feet. Number of sacks of cement used

No. 2 was placed at feet. Number of sacks of cement used

No. 3 was placed at feet. Number of sacks of cement used

No. 4 was placed at feet. Number of sacks of cement used

No. 5 was placed at feet. Number of sacks of cement used

FILED
DEC 12 1951
OFFICE
ARTESIAN WELL SUPERVISOR
ROSWELL, NEW MEXICO

(over)

RA-2698

17.26.9.244

Sec. 6

LOG OF WELL

FROM (Depth in Feet)	TO (Depth in Feet)	THICKNESS IN FEET	CLASSIFICATION OF FORMATION
0	18	18	Topsoil & Clay
18	30	12	Gyp
30	50	20	Clay
50	80	30	Gravel & Clay
80	130	50	Sand rock
130	140	10	Sand & Gravel

I, ..., do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this ....day of..., A.D., 19........

....
Notary Public

My Commission Expires..

Signed..

Position..

Street and Number..

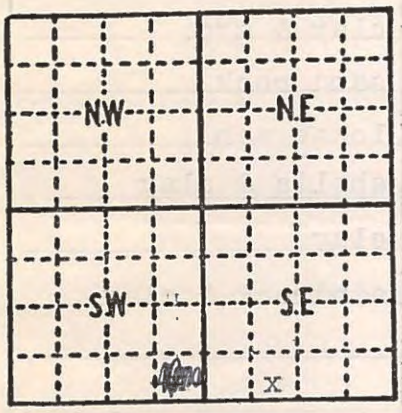
Post Office...

L.B

WELL RECORD

File No.

INSTRUCTIONS: This form should be typewritten, and filed in the office of the State Engineer, P. O. Box 1079, Santa Fe, New Mexico, or in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.



(Plat of 640 Acres)
Locate Well Accurately

Owner of well Britton Coll

Street and Number Rt. 1 Box 30

Post Office Artesia New Mexico

Well was drilled under Permit No. RA-2723 and

is located in the SE ¼ SW ¼ SE ¼ of Section 9

Township 17 South, Range 26 EASt

Drilling Contractor Blount & Coll

Street and Number Rt. 1 Box 30

Post Office Artesia New Mexico

Drilling was commenced July 9, 19 51. Drilling was completed July 23 1951, 19

Elevation at top of casing in feet above sea level

State whether well is shallow or artesian Shallow , Domestic

Total depth of well 318 feet. Water level upon completion of well 40 feet below land surface.

Sec. 2 PRINCIPAL WATER-BEARING STRATA

No. 1, from 240 to 318, Thickness in feet 78, Formation Sand rock

No. 2, from to, Thickness in feet, Formation

No. 3, from to, Thickness in feet, Formation

No. 4, from to, Thickness in feet, Formation

No. 5, from to, Thickness in feet, Formation

Sec. 3 RECORD OF CASING

Diameter in Inches	Pounds per Foot	Threads per Inch	Name of Manufacturer	Feet of Casing	Type of Shoe	Perforated From	Perforated To	Purpose
7" OD				240				
5" OD	Perforated			85				Liner

Sec. 4 RECORD OF MUDDING AND CEMENTING

Diameter of Hole in Inches	Number of Sacks of Cement	Methods Used	Specific Gravity of Mud	Tons of Clay Used

Sec. 5 PLUGGING RECORD OF OLD WELL

Well is located in the ¼ ¼ ¼ of Section, Township,

Range Name of plugging contractor

Street and Number Post Office

Tons of clay used Tons of roughage used Type of roughage

Was plugging approved by Artesian Well Supervisor?

Cement plugs were placed as follows:

No. 1 was placed at feet. Number of sacks of cement used

No. 2 was placed at feet. Number of sacks of cement used

No. 3 was placed at feet. Number of sacks of cement used

No. 4 was placed at feet. Number of sacks of cement used

No. 5 was placed at feet. Number of sacks of cement used

(over)

RA-2723

17.26.9.434

Sec. 6

LOG OF WELL

From (Depth in Feet)	To (Depth in Feet)	Thickness in Feet	Classification of Formation
0 - 30			Surface & clay
30 - 40			gravel & gyp
40 - 164			clay & gyp
164 - 200			sand rock
200 - 225			loose sand
225 - 260			shells & clay
260 - 274			clay
274 - 318			sandrock & clay

I, ..., do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this 7 day of August, A.D., 19 51

Gene Dallas
Notary Public

My Commission Expires 10 Aug. 1952

Signed Britton Call

Position Driller

Street and Number Route 1, Box 30

Post Office Artesia, New Mexico

22

(This form to be executed in triplicate)

WELL RECORD

Date of Receipt .... Permit No. RA-3225

Name of permittee, J. C. Coleman

Street or P. O. Rt. 1, Box 367, City and State Artesia, New Mexico

1. Well location and description: The Shallow well is located in NE ¼, NW ¼,
(shallow or artesian)

NW ¼ of Section 9, Township 17S, Range 26E; Elevation of top of casing above sea level, ... feet; diameter of hole, 8 inches; total depth, 100 feet; depth to water upon completion, 25 feet; drilling was commenced May 17, 1954 and completed May 19, 1954; name of drilling contractor Willard Beaty 1102 Merchant; Address, Artesia, New Mexico; Driller's License No. WD 62

2. Principal Water-bearing Strata:

	Depth in Feet From	To	Thickness	Description of Water-bearing Formation
No. 1	65	70	5	Sand
No. 2	80	94	14	Sand
No. 3				
No. 4				
No. 5				

3. Casing Record:

Diameter in inches	Pounds per ft.	Threads per inch	Depth of Casing or Liner Top	Bottom	Feet of Casing	Type of Shoe	Perforation From	To
6 ID	17	11			100	None	65	94

4. If above construction replaces old well to be abandoned, give location: .... ¼, ... ¼, ... ¼ of Section ...., Township ...., Range ....; name and address of plugging contractor, ...

date of plugging ...., 19......; describe how well was plugged: ....

FILED
JUN 28 1954
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

RA-3225

17.26.9.112

5. Log of Well:

Depth in Feet From	To	Thickness in feet	Description of Formation
0	3	3	Top Soil
3	10	7	Cleachie
10	26	16	Red Clay
26	42	16	Yellow Clay
42	50	8	Red Clay
50	65	15	Red Bed
65	70	5	Water Sand
70	80	10	Red Clay
80	94	14	Water Sand
94	100	6	Red Clay

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Willard Beaty
Licensed Well Driller

Instructions

This form shall be executed, preferably typewritten, in triplicate and filed with the State Engineer's Office at Roswell, New Mexico, within 10 days after drilling has been completed. Data on water-bearing strata and on all formations encountered should be as complete and accurate as possible.

Form WR-23

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

	x		

(Plat of 640 acres)

(A) Owner of well Cecil C. Standard

Street and Number Box 232

City Loco Hills State New Mexico

Well was drilled under Permit No. RA 3282 and is located in the

NE ¼ NW ¼ NW ¼ of Section 9 Twp. 17S Rge. 26E

(B) Drilling Contractor Willard Beaty License No. WD-62

Street and Number Box 382 1102 Merchant

City Artesia State New Mexico

Drilling was commenced August 28 19 54

Drilling was completed September 2 19 54

Elevation at top of casing in feet above sea level Total depth of well 125

State whether well is shallow or artesian Shallow Depth to water upon completion 60

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	80	92	8	Fine Sand
2	105	123	18	Water Sand & Gravel
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
7"OD	17	11	0	125	125	collar	105	125

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

FILED AUG 31 1955 OFFICE GROUND WATER SUPERVISOR ROSWELL, NEW MEXICO

Date Received

File No. RA-3282 Use Location No. 17.26.9.112

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	2	2	Brown	Top Soil
2	12	10	White	Cleachie
12	50	38	Red	Clay
50	60	10	Brown	Sand, Showing of Water
60	80	20	Red	Clay
80	92	12	Brown	Water Sand
92	105	13	Red	Clay
105	123	18	Brown	Water, Sand & Gravel
123	125	2	Red	Clay

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Willard Beaty
Well Driller

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well JOE & SUE PEMBERTON Owner's Well No. RA 10378
Street or Post Office Address 803 EAST MAIN
City and State ARTESIA, N M. 88210

Well was drilled under Permit No. 261358 and is located in the:

a. SE ¼ SE ¼ NE ¼ ___ ¼ of Section 9 Township 17-S Range 26-E N.M.P.M.

b. Tract No. ___ of Map No. ___ of the ___

c. Lot No. ___ of Block No. ___ of the ___
Subdivision, recorded in EDDY County.

d. X= ___ feet, Y= ___ feet, N.M. Coordinate System ___ Zone in the ___ Grant.

(B) Drilling Contractor DENNIS TIDWELL License No. WD 823

Address 105 S. HALDEMAN ARTESIA NM

Drilling Began 3/20/03 Completed 4/5/03 Type tools CABLE Size of hole 10 in.

Elevation of land surface or ___ at well is ___ ft. Total depth of well 190 ft.

Completed well is ☑ shallow ☐ artesian. Depth to water upon completion of well 30 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
164	170		SAND & GRAVEL	

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
10"	34	NONE	0	80	80	NONE	NONE	
6"	24	10	0	190	190	NONE	115	190

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO
2003 APR 10 AM 8:43

Section 5. PLUGGING RECORD

Plugging Contractor ___
Address ___
Plugging Method ___
Date Well Plugged ___
Plugging approved by:

___
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 4/10/2003

Quad ___ FWL ___ FSL ___

File No. RA 10378 Use DOM Location No. 17.26.9.244

261358

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	3		TOP SOIL
3	85		CLAY + STREAKS of GRAVEL
85	90		GRAVEL + SAND
90	164		GYP + CLAY
164	170		SAND + GRAVEL
170	190		CLAY

Section 7. REMARKS AND ADDITIONAL INFORMATION

GRAVEL PACKED WELL WITH 7 YARDS of 1/4 INCH RIVER GRAVEL. SHUT SUB WATER off WITH 10" CASING AND CEMENT

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Dennis Tidwell
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Form WR-23

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well D. D. Sullivan

Street and Number

City Artesia, State New Mexico

Well was drilled under Permit No. RA-1300 and is located in the SW ¼ SE ¼ ¼ of Section 10 Twp. 17 Rge. 26

(B) Drilling Contractor R & R Drilling Co. License No.

Street and Number

City State

Drilling was commenced March 24, 19 37

Drilling was completed April 2, 19 37

Elevation at top of casing in feet above sea level Total depth of well 210 ft.

State whether well is shallow or artesian Depth to water upon completion

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1		18'	1st flow	
2		36 to 40	2nd flow	
3				
4				
5				

Section 3

RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To

Section 4

RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5

PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. RA-1300 Use Location No. 17.26.10.430

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	23			Gypsum rock
23	25			Water sand
25	36			Sand and gravel
36	40			Gravel (water)
40	43			Water sand
43	48			White clay
48	55			White clay
55	70			Water sand
70	76			White clay
76	80			Sand
80	90			White clay
90	125			White clay
125	132			Sand rock
132	145			White clay
145	150			Sand
150	157			Sand rock
157	175			Water sand
175	195			White clay
195	206			Sand rock
206	210			Water sand

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

R & R Drilling Co.
Well Driller

Form WR-23

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well V. L. Gates

Street and Number

City Artesia, State New Mexico

Well was drilled under Permit No. RA-1331 and is located in the SW ¼ SW ¼ SW ¼ of Section 10 Twp. 17 Rge. 26

(B) Drilling Contractor D. N. Gray License No.

Street and Number

City State

Drilling was commenced December 19 38

Drilling was completed January 19 39

Elevation at top of casing in feet above sea level Total depth of well 278 ft.

State whether well is shallow or artesian Depth to water upon completion

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				
2				
3				
4				
5				

Section 3

RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
					278			

Section 4

RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5

PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. RA-1331 Use Location No. 17.26.10.333

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	20			Clay
20	27			Gravel
27	178			Clay
178	186			Sand
186	205			Clay
205	222			Sand
222	242			Clay
242	276			Sand
276	278			Clay

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

D. N. Gray
Well Driller

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Chase Farms Owner's Well No. ______
Street or Post Office Address P. O. Box 658
City and State Artesia, NM 88211-0658

Well was drilled under Permit No. RA-1331-Expl. and is located in the:

a. SW ¼ SW ¼ NW ¼ ____ ¼ of Section 10 Township 17S Range 26E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in ______ County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor Hi Plains Drilling, Inc. License No. WD-637

Address P. O. Box 730, Abernathy, TX 79311

Drilling Began 10/29/03 Completed 10/30/03 Type tools rotary Size of hole 18 in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well 300 ft.

Completed well is [x] shallow [ ] artesian. Depth to water upon completion of well ______ ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
102	152	50	sandy clay, sand, rock streaks	1100 total
158	181	23	sand, gravel, clay	
246	269	23	sand, gravel, clay and rock streaks	
280	286	6	sand, gravel	

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
12 3/4	49.56	n/a	+1	300	301	n/a	100	300

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
n/a					

2003 NOV 14 PM 1:21
STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 11-14-2003

Quad ______ FWL ______ FSL ______

File No. RA-1331 Use Expl Location No. 17S.26E.10.31111

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
0	4	4	soil
4	28	24	clay and caliche
28	56	28	sticky clay tan
56	77	21	rock and clay
77	91	14	sandy clay, rock streaks
91	102	11	sand, rock
102	128	26	sandy clya, rock streaks
128	152	24	sand, rock streaks
152	158	6	clay
158	181	23	sand, gravel, clay
18	246	65	fine sand, clay, rock streaks
246	269	23	sand, gravel, clay and rock streaks
269	280	11	clay
280	286	6	sand, gravel
286	294	8	red clay and rock streaks
294	300	6	blue clay and rock

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer ... sections ex... Section 5 shall be answered as completely ...

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): RA-1331-POD 2	OSE FILE NUMBER(S):
WELL OWNER NAME(S): Chase Farms, LLC	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: PO Box 658	CITY: Artesia STATE: NM ZIP: 88211

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS		
	LATITUDE	32	51	6.9726	N	* ACCURACY REQUIRED: ONE TENTH OF A SECOND
	LONGITUDE	104	22	40.3602	W	* DATUM REQUIRED: WGS 84

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

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1632	Caleb Curry	Hopper Pump & Drilling Inc.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
3/27/2013	6/7/2013	310	310	35

COMPLETED WELL IS: ( ) ARTESIAN ( ) DRY HOLE (•) SHALLOW (UNCONFINED)

STATIC WATER LEVEL IN COMPLETED WELL (FT): 61

DRILLING FLUID: ( ) AIR (•) MUD ADDITIVES – SPECIFY:

DRILLING METHOD: (•) ROTARY ( ) HAMMER ( ) CABLE TOOL ( ) OTHER – SPECIFY:

DEPTH (feet bgl) FROM	TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
+1	113	36	steel	weld	22.75	.625	
+2	93	22	steel	weld	13.5	.250	
93	268	22	steel	weld	13.5	.250	.125

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	114	36	cement	400	tremie
228	268	22	cement	85	tremie

STATE ENGINEER OFFICE 2013 JUN 18 A 11:35

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER RA-1331	POD NUMBER 2	TRN NUMBER
LOCATION 17S.26E.10.131		PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	35	35	Brown Sandy Clay	N	
35	40	5	Sand	Y	
40	50	10	Brown Clay	N	
50	70	20	Red Clay & Fine Sand	Y	
70	95	25	Red Sandy Clay & Gravel	Y	
95	115	20	Fine Red Sand	Y	
115	145	30	Brown Sand & Small Gravel	Y	100
145	155	10	Red Sandy Clay	N	
155	170	15	Coarse Sand & Gravel	Y	200
170	180	10	Tan Clay	N	
180	230	50	Sand & Gravel	Y	300
230	245	15	Fine Red Sand	Y	
245	260	15	White Chalk Streaks Red Clay	Y	100
260	268	8	Blue Clay	N	
268	310	42	White Chalk Streaks Clay	Y	500
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ◯ PUMP ◯ AIR LIFT ◯ BAILER ◯ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm): 1200

5. TEST; RIG SUPERVISION

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

MISCELLANEOUS INFORMATION:

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

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

[signature] 6/16/2013

SIGNATURE OF DRILLER / PRINT SIGNEE NAME DATE

FOR OSE INTERNAL USE WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		PAGE 2 OF 2

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well CHASE FARMS Owner's Well No. RA-1488 & RA-1668-A-Comb.
Street or Post Office Address P. O. Box 693
City and State Artesia, NM 88210

Well was drilled under Permit No. RA-1488 & RA-1668-A-Comb. and is located in the:

a. ____ ¼ SW ¼ NW ¼ NE ¼ of Section 10 Township 17 Range 26 N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in ____ County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Ray Stephens Welding & Drilling License No. WD-784

Address P. O. Box 91, Hagerman, NM 88232

Drilling Began 3-15-96 Completed 3-26-96 Type tools Rotary Size of hole 18" in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 250 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 80 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
110	150	40	Fine Sand	
160	242	82	Fine Sand	500

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
12 3/4	49	0	0	250	250	none	100	250

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received March 29, 1996

Quad ____ FWL ____ FSL ____

File No. RA-1488 & RA-1668-A-Comb. Use IRRIGATION ~~CHANGE LOCATION~~ Location No. 17S.26E.10.21333

17.26.10.21333

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	5	5	Top Soil
5	45	40	Calichi
45	110	65	Brown Clay
110	150	40	Fine Sand
150	160	10	Brown Clay
160	242	82	Fine Sand
242	250	8	Brown Clay

Section 7. REMARKS AND ADDITIONAL INFORMATION

Gravel Pack: 35 Yards of 3/4" Rock

'96 MAR 29 AM 11 42
STATE ENGINEER OFFICE
ROSWELL NEW MEXICO

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Ray Stephens
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. A[illegible]tions, except Section 5, shall be answered as completely and accurate[illegible]possible when any well is drilled, repaired or deepe[illegible]hen this form is used as a plugging record, only Section 1(a) and Sectio[illegible]d be completed.

(This form to be executed in triplicate)

WELL RECORD

Date of Receipt .... Permit No. RA-3368

Name of permittee, A. T. Woelk

Street or P. O. 607 S. Roselawn, City and State Artesia, N. M.

1. Well location and description: The Shallow (shallow or artesian) well is located in SW ¼, NW ¼, NE ¼ of Section 10, Township 17 S., Range 26 E.; Elevation of top of casing above sea level, ... feet; diameter of hole, 8" inches; total depth, 240 feet; depth to water upon completion, 40 feet; drilling was commenced December 28, 1954 and completed January 5, 1955; name of drilling contractor Willard Beaty 1102 Merchant; Address, Artesia, N. M.; Driller's License No. WD-62

2. Principal Water-bearing Strata:

	Depth in Feet From	To	Thickness	Description of Water-bearing Formation
No. 1	193	215	22	Sand & Gravel
No. 2				
No. 3				
No. 4				
No. 5				

3. Casing Record:

Diameter in inches	Pounds per ft.	Threads per inch	Depth of Casing or Liner Top	Bottom	Feet of Casing	Type of Shoe	Perforation From	To
6ID	18	8	0	215	215	Collar	193	215

4. If above construction replaces old well to be abandoned, give location: .... ¼, ... ¼, ... ¼ of Section ...., Township ...., Range ....; name and address of plugging contractor, ...

....

date of plugging ...., 19....; describe how well was plugged: ....

....

....

FILED
FEB 14 1955
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

gg

17.26.10.213

5. Log of Well:

Depth in Feet From	To	Thickness in feet	Description of Formation
0	2	2	Top Soil
2	22	20	Red Clay
22	60	38	Sand
60	65	5	Red Clay
65	140	75	Sand
140	160	20	Red Clay
160	180	20	Sand & Gravel
180	193	13	Blue Clay
193	215	22	Water Sand & Gravel
215	240	25	Red Clay

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Willard Beaty
Licensed Well Driller

Instructions

This form shall be executed, preferably typewritten, in triplicate and filed with the State Engineer's Office at Roswell, New Mexico, within 10 days after drilling has been completed. Data on water-bearing strata and on all formations encountered should be as complete and accurate as possible.

Form WR-23 FIELD F R. LOG

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Bruce Harris
Street and Number Box 842
City Artesia State New Mexico
Well was drilled under Permit No. RA-4196 and is located in the SW ¼ SW ¼ SW ¼ of Section 10 Twp. 17-S Rge. 26E

(B) Drilling Contractor Willard Beaty License No. WD-62
Street and Number 1102 Merchant
City Artesia State New Mexico
Drilling was commenced April 26 19 60
Drilling was completed May 12 19 60

Elevation at top of casing in feet above sea level ______ Total depth of well 294
State whether well is shallow or artesian Shallow Depth to water upon completion 80

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	280	292	12	Sand & Gravel
2				
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
7"OD	20	8 Round		294	294	Steel	275	294

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used
		8"			

Section 5 PLUGGING RECORD

Name of Plugging Contractor ______ License No. ______
Street and Number ______ City ______ State ______
Tons of Clay used ______ Tons of Roughage used ______ Type of roughage ______
Plugging method used ______ Date Plugged ______ 19 ______
Plugging approved by:

______
Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received STATE ENGINEER OFFICE DISTRICT II '60 JUN 8 AM 8:19

File No. RA-4196 Use Dom. Location No. 17.26.10.333

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	2	2	Brown	Top Soil
2	25	23	Red	Clay
25	30	5	Gray	Gravel
30	40	10	Red	Clay
40	70	30	Red	Sandy Clay
70	140	70	Red	Clay
140	160	20	Brown	Sand
160	200	40	Red	Clay
200	240	40	Brown	Sand
240	250	10	Red	Clay
250	270	20	Brown	Sand
270	280	10	Red	Clay
280	292	12	Brown	Sand & Gravel
292	294	2	Red	Elay

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Willard Beaty
Well Driller

Form WR-23

FIELD ENGR. LOG

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well R. J. Heard

Street and Number Box 127

City Artesia State N. Mex.

Well was drilled under Permit No. RA 4922 and is located in the NW ¼ NW ¼ ¼ of Section 10 Twp. 17S Rge. 26E

(B) Drilling Contractor A. F. Smith License No. WD 28

Street and Number Box 1202

City Artesia State N. Mex.

Drilling was commenced Oct 30 1967

Drilling was completed Nov 1 1967

Elevation at top of casing in feet above sea level Total depth of well 218

State whether well is shallow or artesian Domestic Depth to water upon completion 65

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				Cleaned out from
2				125 to 218
3				
4				
5				

Section 3

RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To

Section 4

RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5

PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received 1967 NOV 20 AM 8:27

STATE ENGINEER OFFICE

File No. RA-4922 Use Dom & Stock (Rep) Location No. 17.26.10.110

Section 6 **LOG OF WELL**

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

R. F. Smith
Well Driller

Form WR-23

FIELD ENGR. LOG

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well R. J. Heard
Street and Number Box 416
City Loco Hills State N. M.
Well was drilled under Permit No. RA-4922 and is located in the NW ¼ NW ¼ ¼ of Section 10 Twp. 17S Rge. 26E
(B) Drilling Contractor A. J. Smith License No. WD 28
Street and Number Box 1202
City Artesia State N. M.
Drilling was commenced Dec. 1963
Drilling was completed Dec. 1963

Elevation at top of casing in feet above sea level Total depth of well 218'
State whether well is shallow or artesian domestic Depth to water upon completion 25'

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	25	35	10	sand
2	96	139	43	sand
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
7"					139	None	118	139

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.
Street and Number City State
Tons of Clay used Tons of Roughage used Type of roughage
Plugging method used Date Plugged 19
Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received

ROSWELL N. MEX. DISTRICT II STATE ENGINEER OFFICE 1963 DEC 24 AM 8:26

File No. RA 4922 Use Dom. Location No. 17.26.10.110

Dom-ok

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	25	25		red Clay
25	35	10		Sand
35	96	61		red Clay
96	139	43		sand
139	218	79		red Clay

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

A. F. Smith
Well Driller

Phone 251 746-

Revised June 1972

FIELD ENGR. LOG

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Lee Dilbeck Owner's Well No. RA 6550
Street or Post Office Address 210 Centre
City and State Artesia, New Mexico 88210

Well was drilled under Permit No. RA-6550 and is located in the:

a. SW ¼ NE ¼ ~~NE~~ NE ¼ ___ ¼ of Section 10 Township 17S Range 26E N.M.P.M.

b. Tract No. ___ of Map No. ___ of the ___

c. Lot No. ___ of Block No. ___ of the ___
Subdivision, recorded in ___ County.

d. X= ___ feet, Y= ___ feet, N.M. Coordinate System ___ Zone in the ___ Grant.

(B) Drilling Contractor H & W Enterprises License No. WD675

Address P.O. Box 437 Artesia NM 88210 E. of Artesia 746-4516

Drilling Began 8-1-79 Completed 8-10-79 Type tools Cable Size of hole 7" in.

Elevation of land surface or ___ at well is ___ ft. Total depth of well 125 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 50 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
95	120	25	Water Sand	10

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
7"	29 lb	P/E	1	125	126	P/E	90	120

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor ___
Address ___
Plugging Method ___
Date Well Plugged ___
Plugging approved by:

___
State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 8/16/79

Quad ___ FWL ___ FSL ___

File No. RA-6550 Use D-S Location No. 17.26.10.12323

.73 From E Line
.20 S From N Line

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
0	20	20	Top Soil
20	60	40	Calicher- Clay
60	85	25	Fine Brown Sand
85	95	10	Coarse Sand
95	120	25	Water & Sand
120	125	5	Red Bed TD

Section 7. REMARKS AND ADDITIONAL INFORMATION

STATE ENGINEER OFFICE
ROSWELL, N.M.
'79 AUG 16 AM 8 15

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This for[illegible]ould be executed in triplicate, preferably typewritten, and submitted to [illegible]ppropriate district office of the State Engineer. Al[illegible]ons, except Section 5, shall be answered as completely and accurately [illegible]ssible when any well is drilled, repaired or deepened[illegible]hen this form is used as a plugging record, only Section 1(a) and Section [illegible]ed be completed.

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

FIELD ENGR. LOG

Section 1. GENERAL INFORMATION

(A) Owner of well Bob Smith Owner's Well No. RA-7180
Street or Post Office Address C/o Ray Stephens
City and State Box 91 Hagerman, NM

Well was drilled under Permit No. RA-7180 and is located in the:

a. Ne ¼ NW ¼ ____ ¼ ____ ¼ of Section 10 Township 17S Range 26E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in Eddy County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in
the ____ Grant.

(B) Drilling Contractor Ray Stephens License No. WD-784

Address Box 91 Hagerman, NM 88232

Drilling Began 8-2-83 Completed 8-10-83 Type tools Rotary Size of hole 10 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 220 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 80 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
100	210	110	Fine Sand	20

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
6 5/8	17	0	0	220	220	None	180	220

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received August 12, 1983

Quad ____ FWL ____ FSL ____

File No. RA-7180 Use Domestic Location No. 17.26.10.12323

Off SE Corner

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	5	5	Top Soil
5	40	35	Coliche
40	65	25	Brown & Blue clay
65	90	25	Fine Sand
90	100	10	Brown clay
100	210	10	Fine Sand
210	220	110	Brown Clay

Section 7. REMARKS AND ADDITIONAL INFORMATION

Set packer at 100 ft.

Mud off top water

AUG 12 8 51 AM '83

STATE ENGINEER
ROSWELL, NM

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Ray Stephens
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Form WR-23

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Wesley Sperry

Street and Number

City Artesia, State New Mexico

Well was drilled under Permit No. RA-1414 and is located in the N½ ¼ NW ¼ SW ¼ of Section 11 Twp. 17 Rge. 26

(B) Drilling Contractor David Gray License No.

Street and Number

City State

Drilling was commenced March 1, 19 39

Drilling was completed March 10, 19 39

Elevation at top of casing in feet above sea level Total depth of well 105 ft.

State whether well is shallow or artesian Depth to water upon completion

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				
2				
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
12½	40				105			

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. RA-1414 Use Location No. 17.26.11.310

Section 6

LOG OF WELL

Depth in Feet		Thickness in Feet	Color	Type of Material Encountered
From	To			
0	35			Soil
35	50			Fine sand
50	51			Gravel
51	52			Clay
52	74			Sand
74	75			Clay
75	100			Sand
100	105			Clay

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

David Gray
Well Driller

Form WR-23

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well W.T.Haldeman
Street and Number 306 Xe Box 1042
City Artesia, State N.M.
Well was drilled under Permit No. RA 1414 and is located in the N½ ¼ NW ¼ SW ¼ of Section 11 Twp. 17S Rge. 26E
(B) Drilling Contractor A.F.S mith License No. WD 28
Street and Number 306 west Chisum Street
City Artesia, State N.M.
Drilling was commenced November 1 1956
Drilling was completed November 23 1956

Elevation at top of casing in feet above sea level ________ Total depth of well 295'
State whether well is shallow or artesian shallow Depth to water upon completion 11'

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	To	Thickness in Feet	Description of Water-Bearing Formation
1				Cleaned out from 172' to 295'
2				Run 8" liner
3				Top of 8" liner 141'
4				Bottom of 8" liner 288'.
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Bottom	Feet	Type Shoe	Perforations From	To

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor ________ License No. ________
Street and Number ________ City ________ State ________
Tons of Clay used ________ Tons of Roughage used ________ Type of roughage ________
Plugging method used ________ Date Plugged ________ 19__
Plugging approved by:

________ Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received DEC 10 19__

GROUND WATER ... ROSWELL, NEW MEXICO

File No. RA-1414 Use Irr. Location No. 17.26.11.310

Section 6

LOG OF WELL

Depth in Feet		Thickness in Feet	Color	Type of Material Encountered
From	To			

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

A F Smith

Well Driller

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well VANCE HALDEMAN Owner's Well No. RA 9912
Street or Post Office Address PO BOX 113
City and State ARTESIA, N.M. 8821~~1~~ - 0113 88211

Well was drilled under Permit No. RA 9912 TRN 179356 and is located in the:

a. ___ ¼ ___ ¼ ___ ¼ SW ¼ of Section 11 Township 17 S Range 26 E N.M.P.M.

b. Tract No. ___ of Map No. ___ of the ___

c. Lot No. ___ of Block No. ___ of the ___
Subdivision, recorded in EDDY County.

d. X= ___ feet, Y= ___ feet, N.M. Coordinate System ___ Zone in the ___ Grant.

(B) Drilling Contractor DENNIS TIDWELL License No. WD 823

Address 105 S. HALDEMAN RD ARTESIA NM

Drilling Began 5/18/2000 Completed 6/14/2000 Type tools ___ Size of hole 20 in.

Elevation of land surface or ___ at well is ___ ft. Total depth of well 250 ft.

Completed well is ☑ shallow ☐ artesian. Depth to water upon completion of well 16 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
40	200		SAND + STREAKS of CLAY	
			and SMALL STREAKS of	
			GRAVEL	
200	250		FIRM SAND	

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
13 3/8	71	WELDED	0	170	170	NONE	45	170
10 3/4	47	8	159	250	91	NONE	158	249

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor ___
Address ___
Plugging Method ___
Date Well Plugged ___
Plugging approved by:

___
State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ___ FWL ___ FSL ___

File No. RA-9912 (Renumbered 1414-S-2) Use ___ Location No. 17S.26E.11.33223

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	4		TOP SOIL
4	40		CLAY
40	200		SAND WITH STREAKS of CLAY and
			STREAKS of GRAVEL
200	250		(HARD) SAND

Section 7. REMARKS AND ADDITIONAL INFORMATION

GRAVEL PACKED WELL WITH 1½ INCH RIVER GRAVEL 18 YARDS

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Dennis Tidwell
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section and Section need be completed.

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Wm Baron chandler Owner's Well No. ______
Street or Post Office Address 808 Nth Halderman
City and State Artesia NM 88210

Well was drilled under Permit No. RA 10442 and is located in the:

a. SW ¼ NW ¼ ____ ¼ ____ ¼ of Section 11 Township 17S Range 26E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in Eddy County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor SouthEast License No 1400

Address PO Box 1765, Artesia NM 88210

Drilling Began 5-20-05 Completed 5-23-05 Type tools CAble Size of hole 11" in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well 170 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 23 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
22	40	17	TAN SAND gravel	30 T
130	160	30	TAN Sand-Brown	unknown

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
7"	26	8	2	170	172	none	60	170

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______
State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY 309099

Date Received 5-26-06

Quad ______ FWL ______ FSL ______ ✓

RA 10442 Dom/Stk 17S.26E.11.13

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	7	7	Soil
7	22	15	Sandy clay
22	40	17	TAN Sand gravel
40	130	90	Sand small shale streaks
130	160	30	TAN -Brown fine sand
160	170	10	Red - yellow clay

Section 7. REMARKS AND ADDITIONAL INFORMATION

gravel packed

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

309099

INSTRUCTIONS: This form [illegible] be executed in triplicate preferabl[illegible]

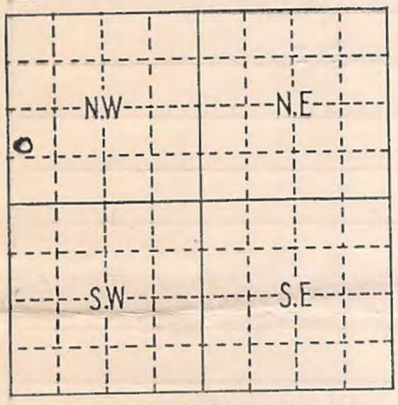
L. B.

WELL RECORD

FILE No. RA-2034

INSTRUCTIONS: This form should be typewrttten, and filed in the office of the State Engineer, (P.O. Box 1079) Santa Fe, New Mexico, unless the well is situated in the Roswell Artesian Basin, in which case it should be filed in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.

SEC. 1



(Plat of 640 acres)
Locate Well Accurately

Owner of well G. E. SHARP.

Street and Number

Post Office

Well was drilled under Permit No. RA-2034 and

is located in the N ½ ¼ SW ¼ ¼ of Section 13

Township 17, Range 26 E.

Drilling Contractor Harvy Everett

Street and Number

Post Office Hope, New Mexico.

Drilling was commenced March 28 19 42 Drilling was completed April 2 19 42

Elevation at top of casing in feet above sea level

State whether well is shallow or artesian Shallow 90' TD

SEC. 2

PRINCIPAL WATER-BEARING STRATA

No. 1, from ______ to ______, Thickness in feet ______, Formation ______

No. 2, from ______ to ______, Thickness in feet ______, Formation ______

No. 3, from ______ to ______, Thickness in feet ______, Formation ______

No. 4, from ______ to ______, Thickness in feet ______, Formation ______

No. 5, from ______ to ______, Thickness in feet ______, Formation ______

SEC. 3

RECORD OF CASING

DIAMETER IN INCHES	POUNDS PER FOOT	THREADS PER INCH	NAME OF MANUFACTURER	FEET OF CASING	TYPE OF SHOE	PERFORATED FROM	PERFORATED TO	PURPOSE
7 In		10		90		70	90	Keep Sand Out.

SEC. 4

RECORD OF MUDDING AND CEMENTING

DIAMETER OF HOLE IN INCHES	NUMBER OF SACKS OF CEMENT	METHODS USED	SPECIFIC GRAVITY OF MUD	TONS OF CLAY USED
No				

SEC. 5

PLUGGING RECORD OF OLD WELL

No.

Well is located in the ______ ¼ ______ ¼ ______ ¼ of Section ______, Township ______,

Range ______. Name of plugging contractor ______

Street and Number ______ Post Office ______

Tons of clay used ______ Tons of roughage used ______ Type of roughage ______

______ Was plugging approved by Artesian Well Supervisor ______

Cement plugs were placed as follows:

No. 1 was placed at ______ feet Number of sacks of cement used ______

No. 2 was placed at ______ feet Number of sacks of cement used ______

No. 3 was placed at ______ feet Number of sacks of cement used ______

No. 4 was placed at ______ feet Number of sacks of cement used ______

No. 5 was placed at ______ feet Number of sacks of cement used ______

(OVER)

RA-2034 17.26.13.300

LOG OF WELL

FROM (DEPTH IN FEET)	TO (DEPTH IN FEET)	THICKNESS IN FEET	CLASSIFICATION OF FORMATION
-	12 Ft		Water
12	27		Gravel
27	70		Quick Sand
70	80		Light Clay
80	90		Sand
90			Water

I, G E Sharp do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this 18 day of June, A. D. 19 43

My Comm Exp. 9-10-1944

Notary Public

My Commission Expires

Signed G. E. Sharp

Position Owner

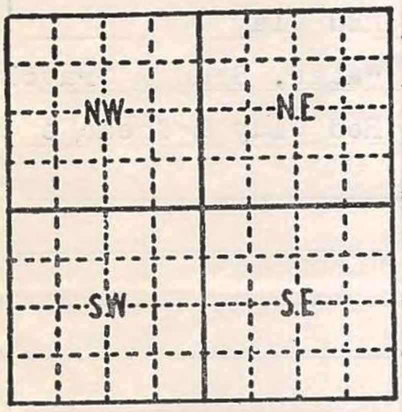
Street and Number

Post Office Artesia N. M.

WELL RECORD

File No. RA-2649

INSTRUCTIONS: This form should be typewritten, and filed in the office of the State Engineer, P. O. Box 1079, Santa Fe, New Mexico, or in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.



(Plat of 640 Acres)
Locate Well Accurately

Owner of well W. L. Webb

Street and Number 1801 Oak Street

Post Office Artesia, New Mexico

Well was drilled under Permit No. RA-2649 and

is located in the SW ¼ SW ¼ SE ¼ of Section 12

Township 17 South, Range 26 East

Drilling Contractor Willard Beaty

Street and Number 1102 Merchant St.

Post Office Artesia, New Mexico

Drilling was commenced 7/20, 19 50. Drilling was completed 8/5, 19 50

Elevation at top of casing in feet above sea level

State whether well is shallow or artesian Shallow

Total depth of well 150 feet. Water level upon completion of well 85 feet below land surface.

Sec. 2 PRINCIPAL WATER-BEARING STRATA

No. 1, from 114 to 130, Thickness in feet 16, Formation Water, Sand & Gravel

No. 2, from to, Thickness in feet, Formation

No. 3, from to, Thickness in feet, Formation

No. 4, from to, Thickness in feet, Formation

No. 5, from to, Thickness in feet, Formation

Sec. 3 RECORD OF CASING

Diameter in Inches	Pounds per Foot	Threads per Inch	Name of Manufacturer	Feet of Casing	Type of Shoe	Perforated From	Perforated To	Purpose
6	12	Welded		150		114	130	

Sec. 4 RECORD OF MUDDING AND CEMENTING

Diameter of Hole in Inches	Number of Sacks of Cement	Methods Used	Specific Gravity of Mud	Tons of Clay Used

FILED
AUG 15 1950
OFFICE
ARTESIAN WELL SUPERVISOR
ROSWELL, NEW MEXICO

Sec. 5 PLUGGING RECORD OF OLD WELL

Well is located in the ¼ ¼ ¼ of Section, Township,

Range Name of plugging contractor

Street and Number Post Office

Tons of clay used Tons of roughage used Type of roughage

Was plugging approved by Artesian Well Supervisor?

Cement plugs were placed as follows:

No. 1 was placed at feet. Number of sacks of cement used

No. 2 was placed at feet. Number of sacks of cement used

No. 3 was placed at feet. Number of sacks of cement used

No. 4 was placed at feet. Number of sacks of cement used

No. 5 was placed at feet. Number of sacks of cement used

(over)

17.26.12.411

Sec. 6 LOG OF WELL

From (Depth in Feet)	To (Depth in Feet)	Thickness in Feet	Classification of Formation
0	2	2	Top Soil
2	20	18	Cleache & Gravel
20	80	60	Red Clay
80	90	10	Sand
90	114	24	Red Clay
114	130	16	Water, Sand & Gravel
130	150	20	Red Clay & Cheache

I, Willard Beaty, do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this 14th day of August, A.D., 19 50

Mrs. Johnnie Keith
Mrs. Johnnie Keith Notary Public

My Commission Expires March 2, 1952

Signed Willard Beaty

Position Drilling Contractor

Street and Number 1102 W. Merchant St.

Post Office Artesia, New Mexico

Form WR-23

STATE ENGINEER OFFICE

FIELD ENGR. LOG

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well: Mr. Wendel E. Farham

Street and Number: Box 453

City: Artesia, New Mexico State: New Mexico

Well was drilled under Permit No. RA-2896 and is located in the N½ ¼ W½ ¼ SW-SW ¼ of Section 12 Twp. 17S Rge. 26 E

(B) Drilling Contractor: Lloyd W. Osbourn License No. WD-353

Street and Number: 1811 Hermosa Drive

City: Artesia, State: New Mexico

Drilling was commenced 7-16 19 66

Drilling was completed 7-19 19 66

Elevation at top of casing in feet above sea level: 22 Total depth of well: 237 ft.

State whether well is shallow or artesian: Shallow Depth to water upon completion: 150 ft.

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	200	235	35	Yellow Sand & Gravel
2				
3				
4				
5				

Section 3

RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
5½" o.d.	24	Plain	126	237	111	None	90	237

Section 4

RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5

PLUGGING RECORD

Name of Plugging Contractor ______ License No. ______

Street and Number ______ City ______ State ______

Tons of Clay used ______ Tons of Roughage used ______ Type of roughage ______

Plugging method used ______ Date Plugged ______ 19 ______

Plugging approved by:

______
Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received

STATE ENGINEER OFFICE
DISTRICT II
ROSWELL, N. MEX.
1966 JUL 28 AM 8:26

File No. RA-2896 Use Dom Location No. 17.26.12.330

Section 6 LOG OF WELL

Depth in Feet From	To	Thickness in Feet	Color	Type of Material Encountered
165	200	35	Red	Sand & Gravel
200	235	35	Yellow	Sand & Gravel & Water
235	237	2	Red	Clay

(Old Well was 165 ft. T.D. Now 237 ft.)

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

T. M. Osborn
Well Driller

Form WR-23

STATE ENGINEER OFFICE

FIELD ENGR. LOG

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Mr. George H. Gottleston

Street and Number Box 252

City Artesia, State New Mexico

Well was drilled under Permit No. RA-4438 and is located in the SE ¼ SE ¼ NE ¼ of Section 12 Twp. 17S Rge. 26E

(B) Drilling Contractor Floyd H. Osbourn License No. WD-353

Street and Number 1811 Hermosa Drive

City Artesia, State New Mexico

Drilling was commenced ~~28~~ 7-21 19 66

Drilling was completed 7-23 19 66

Elevation at top of casing in feet above sea level Total depth of well 228 ft.

State whether well is shallow or artesian Shallow Depth to water upon completion 140 ft.

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	190	228	38	Yellow Sand & Gravel
2				
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
5½ O.D.	24	Plain	178	228	50	None	185	228

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received 1966 JUL 28 AM 8:26

STATE ENGINEER OFFICE ROSWELL N. MEX. DISTRICT II

File No. RA-4438 Use Dom Location No. 17.26.12.244

Section 6 **LOG OF WELL**

Depth in Feet		Thickness in Feet	Color	Type of Material Encountered
From	To			
175	190	15	Red	Sand
190	228	38	Yellow	Sand Gravel & Water
(Old Well Was 175 ft. Now T.D. 228 ft.)				

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Well Driller

Form WR-23

FIELD ENGR. LOG

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well George H. [illegible]

Street and Number Box 253

City Artesia State New Mexico

Well was drilled under Permit No. RA-4438 and is located in the

SE. ¼ SE. ¼ NE. ¼ of Section 12 Twp. 17 So. Rge. 26 East

(B) Drilling Contractor Roy Monk License No. WD-342

Street and Number P.O. Box 112

City Artesia State New Mexico

Drilling was commenced June 30 19 62

Drilling was completed July 3 19 62

Elevation at top of casing in feet above sea level ________ Total depth of well 175 feet

State whether well is shallow or artesian Shallow Depth to water upon completion 130 ft.

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	140	160	20	Sand and Gravel
2				
3				
4				
5				

Section 3

RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
7"OD	17#		0	167ft.	167	None	130 ft.	167 ft.

Section 4

RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used
155	160		1 Ton		Dry

Section 5

PLUGGING RECORD

Name of Plugging Contractor ________ License No. ________

Street and Number ________ City ________ State ________

Tons of Clay used ________ Tons of Roughage used ________ Type of roughage ________

Plugging method used ________ Date Plugged ________ 19____

Plugging approved by:

____

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received STATE ENGINEER OFFICE DISTRICT II ROSWELL, N.M. 1961 JUL 11 AM 8:32

File No. RA-4438 Use Dom. Location No. 17.26.12.244

Section 6

LOG OF WELL

Depth in Feet		Thickness in Feet	Color	Type of Material Encountered
From	To			
0	10	10	white	Calechie and Gravel
10	78	68	white	White Clay and Gravel
78	90	12	white	Sand and Gravel
90	125	35	white	Clay and Gravel
125	140	15	Brown	Sand and Gravel
140	155	15	Grey	Conglomerate
155	160	5	Brown	Sand and Gravel (water)
160	175	15	Red	Clay

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Ray Monk

Well Driller

(This form to be executed in triplicate)

WELL RECORD

Date of Receipt April 28 1953 Permit No.

Name of permittee, W. T. Haldeman

Street or P.O., Route 1, City and State Artesia, New Mexico

1. Well location and description: The shallow (shallow or artesian) well is located in SW ¼, NW ¼, NW ¼ of Section 14, Township 17 S., Range 26 E.; Elevation of top of casing above sea level, ______ feet; diameter of hole, 10 inches; total depth, 261' 5" feet; depth to water upon completion, 30 feet; drilling was commenced April 27, 1953, and completed May 6, 1953; name of drilling contractor Blount & Coll ______; Address, Artesia, New Mexico; Driller's License No. WD 77

2. Principal Water-bearing Strata:

	Depth in Feet From	To	Thickness	Description of Water-bearing Formation
No. 1	190	210-220		Sand and gravel
No. 2	230	261	31'	Sand and gravel
No. 3				
No. 4				
No. 5				

3. Casing Record:

Diameter in Inches	Pounds per ft.	Threads per inch	Depth of Casing or Liner Top	Bottom	Feet of Casing	Type of Shoe	Perforations From	To
7" OD	20	8	0	261'5"	261'5"	Regular	251'5"	261'5"

4. If above construction replaces old well to be abandoned, give location: ______ ¼, ______ ¼, ______ ¼ of Section ______, Township ______, Range ______; name and address of plugging contractor, ______

date of plugging ______, 19____; describe how well was plugged: ______

FILED
DEC 7 1953
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

Copy to S.F.
11-15-55

17.26.14.113

5. Log of Well:

Depth in feet From	Depth in feet To	Thickness in feet	Description of Formation
135	160	25	Clay
160	180	20	Sand and clay
180	190	10	Clay
190	210	20	Sand and gravel
210	230	20	Sand and clay
230	261	31	Sand and gravel

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Licensed Well Driller

Instructions

This form shall be executed, preferably typewritten, in triplicate and filed with the State Engineer's Office at Roswell, New Mexico, within 10 days after drilling has been completed. Data on water-bearing strata and on all formations encountered should be as complete and accurate as possible.

Form WR-23

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well W T Haldeman
Street and Number Artesia
City ______ State N. M.
Well was drilled under Permit No. RA-1414-S and is located in the SW ¼ SW ¼ NW ¼ of Section 14 Twp. 17 Rge. 26 E
(B) Drilling Contractor Paul Woody License No. 196
Street and Number R 1
City Dexter State N. M.
Drilling was commenced July 20 1956
Drilling was completed ______ 19__

Elevation at top of casing in feet above sea level ______ Total depth of well ______
State whether well is shallow or artesian ______ Depth to water upon completion ______

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				
2				
3				
4				
5				

Section 3

RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To

Section 4

RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5

PLUGGING RECORD

Name of Plugging Contractor ______ License No. ______
Street and Number ______ City ______ State ______
Tons of Clay used ______ Tons of Roughage used ______ Type of roughage ______
Plugging method used ______ Date Plugged ______ 19__
Plugging approved by:

______
Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received

FILED
JAN 23 1957
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

File No. RA-1414-S Use Irr. Location No. 17.26.14.113

Section 6

LOG OF WELL

Depth in Feet		Thickness in Feet	Color	Type of Material Encountered
From	To			

Cased 7 in casing and set
9 ft 17.

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Paul [illegible]
Well Driller

L. B.

WELL RECORD

e No. ____________

INSTRUCTIONS: This form should be typewritten, and filed in the office of the Sta. eer, (P.O. Box 1079) Santa Fe, New Mexico, unless the well is situated in the Roswell Artesian Basin, in which case it should be filed in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.

Sec. 1

NW	NE
SW	SE

(Plat of 640 acres)
Locate Well Accurately

Owner of well: G. E. Sharp

Street and Number: East Star Route

Post Office: Artesia, New Mexico

Well was drilled under Permit No. RA2749 and

is located in the NW ¼ NW ¼ NE ¼ of Section 14

Township 17 South, Range 26 East

Drilling Contractor: D. N. Gray

Street and Number: 1007 Mo. St.

Post Office: Artesia, New Mex.

Drilling was commenced July 19 51 Drilling was completed Aug. 18 19 51

Elevation at top of casing in feet above sea level ....

State whether well is shallow or artesian: Shallow

Total depth of well 241 feet.

Sec. 2 PRINCIPAL WATER-BEARING STRATA

No. 1, from 213 to 241, Thickness in feet 27, Formation Sand

No. 2, from .... to ...., Thickness in feet ...., Formation ....

No. 3, from .... to ...., Thickness in feet ...., Formation ....

No. 4, from .... to ...., Thickness in feet ...., Formation ....

No. 5, from .... to ...., Thickness in feet ...., Formation ....

Sec. 3 RECORD OF CASING

DIAMETER IN INCHES	POUNDS PER FOOT	THREADS PER INCH	NAME OF MANUFACTURER	FEET OF CASING	TYPE OF SHOE	PERFORATED FROM	PERFORATED TO	PURPOSE
8"ID		8		15488"	Collar			Water Shut-off
7"OD				214"	Larkin			Water Shut*off
5"ID				34'	Collar	214	241	

Sec. 4 RECORD OF MUDDING AND CEMENTING

DIAMETER OF HOLE IN INCHES	NUMBER OF SACKS OF CEMENT	METHODS USED	SPECIFIC GRAVITY OF MUD	TONS OF CLAY USED

FILED
AUG 27 1951
OFFICE
ARTESIAN WELL SUPERVISOR
ROSWELL, NEW MEXICO

Sec. 5 PLUGGING RECORD OF OLD WELL

Well is located in the .... ¼ .... ¼ .... ¼ of Section .... Township ....,

Range .... Name of plugging contractor ....

Street and Number .... Post Office ....

Tons of clay used .... Tons of roughage used .... Type of roughage ....

.... Was plugging approved by Artesian Well Supervisor ....

Cement plugs were placed as follows:

No. 1 was placed at .... feet Number of sacks of cement used ....

No. 2 was placed at .... feet Number of sacks of cement used ....

No. 3 was placed at .... feet Number of sacks of cement used ....

No. 4 was placed at .... feet Number of sacks of cement used ....

No. 5 was placed at .... feet Number of sacks of cement used ....

(OVER)

RA-2749

17.26.14.211

Sec. 8

LOG OF WELL

FROM (depth in feet)	TO (depth in feet)	THICKNESS IN FEET	CLASSIFICATION OF FORMATION
0	5	5	Soil
5	18	13	Caleche
18	55	37	Sand
55	70	15	Clay
70	180	110	Sand
180	184	4	Clay
184	241	57	Sand

I, ...do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this ...... Signed x D. M. Gray

day of ...., A. D., 19...... Position Contractor

Notary Public

Street and Number 1007 Mo. St,

My Commission Expires .... Post Office Artesia, N. M.

(This form to be executed in triplicate)

WELL RECORD

RA-3518

Date of Receipt .... Permit No. ~~RA-1414-S~~

Name of permittee, W. T. Halderman

Street or P. O. Box 1042, City and State Artesia, New Mexico

1. Well location and description: The Shallow (shallow or artesian) well is located in SW ¼, NW ¼, NW ¼ of Section 14, Township 17S, Range 26E; Elevation of top of casing above sea level, ... feet; diameter of hole, 7" inches; total depth, 260 feet; depth to water upon completion, 240 feet; drilling was commenced December 20, 1955, and completed December 27, 1955; name of drilling contractor Willard Beaty 1102 Merchant; Address, Artesia, New Mexico; Driller's License No. WD-62

2. Principal Water-bearing Strata: Well deepened from 220 to 260

	Depth in Feet From	To	Thickness	Description of Water-bearing Formation
No. 1	240	255	15	Water Sand
No. 2		Well deepened from 220 to 260 then plugged back to		
No. 3		220 because of bad water. No good ~~from~~ for house water.		
No. 4				
No. 5				

Void

3. Casing Record:

Diameter in inches	Pounds per ft.	Threads per inch	Depth of Casing or Liner Top	Bottom	Feet of Casing	Type of Shoe	Perforation From	To
7.O.D.	17	10	0	200	200	shoe	None	

4. If above construction replaces old well to be abandoned, give location: .... ¼, ... ¼, ... ¼ of Section ...., Township ...., Range ....; name and address of plugging contractor, ...

date of plugging ...., 19....; describe how well was plugged: ....

15 M

DEC 26 1956
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

17.26.14.113

5. **Log of Well:** Old Well Deepened

Depth in Feet From	To	Thickness in feet	Description of Formation
220	230	10	Sand
230	240	10	Red Clay
240	255	15	Water Sand
255	260	5	Red Clay

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Willard Beaty
Licensed Well Driller

Instructions

This form shall be executed, preferably typewritten, in triplicate and filed with the State Engineer's Office at Roswell, New Mexico, within 10 days after drilling has been completed. Data on water-bearing strata and on all formations encountered should be as complete and accurate as possible.

(This form to be executed in triplicate)

WELL RECORD

Date of Receipt .... Permit No. RA 3518 ~~RA-1414-S~~

Name of permittee, W. T. Halderman

Street or P. O. Box 1042, City and State Artesia, New Mexico

1. Well location and description: The Shallow (shallow or artesian) well is located in SW ¼, NW ¼, NW ¼ of Section 14, Township 17S, Range 26E; Elevation of top of casing above sea level, ... feet; diameter of hole, 7" inches; total depth, 260 feet; depth to water upon completion, 240 feet; drilling was commenced December 20, 1955, and completed December 27, 1955; name of drilling contractor Willard Beaty 1102 Merchant; Address, Artesia, New Mexico; Driller's License No. WD-62

2. Principal Water-bearing Strata: Well deepened from 220 to 260

	Depth in Feet From	To	Thickness	Description of Water-bearing Formation
No. 1	240	255	15	Water Sand
No. 2		Well deepened from 220 to 260 then plugged back to		
No. 3		220 because of bad water. No good for ~~from~~ house water.		
No. 4				
No. 5				

3. Casing Record:

Diameter in Inches	Pounds per ft.	Threads per inch	Depth of Casing or Liner Top	Bottom	Feet of Casing	Type of Shoe	Perforation From	To
7.O.D.	17	10	0	200	200	shoe	None	

4. If above construction replaces old well to be abandoned, give location: .... ¼, ... ¼, ... ¼ of Section ...., Township ...., Range ....; name and address of plugging contractor, ...

date of plugging ...., 19....; describe how well was plugged: ....

DEC 26 1956
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO
RH

RA-3518

17.26.14.113

5. Log of Well: Old Well Deepened

Depth in Feet From	Depth in Feet To	Thickness in feet	Description of Formation
220	230	10	Sand
230	240	10	Red Clay
240	255	15	Water Sand
255	260	5	Red Clay

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Willard Beaty
Licensed Well Driller

Instructions

This form shall be executed, preferably typewritten, in triplicate and filed with the State Engineer's Office at Roswell, New Mexico, within 10 days after drilling has been completed. Data on water-bearing strata and on all formations encountered should be as complete and accurate as possible.

Joy Jack

(This form to be executed in triplicate)

Renumbered RA-1414-S

WELL RECORD

Date of Receipt .... Permit No. RA-3518

Name of permittee, W. T. Halderman

Street or P. O. Box 1042, City and State Artesia, New Mexico

1. Well location and description: The Shallow well is located in SW ¼, NW ¼, (shallow or artesian) NW ¼ of Section 14, Township 17S, Range 26E; Elevation of top of casing above sea level, ... feet; diameter of hole, 8" inches; total depth, 290 feet; depth to water upon completion, 15 feet; drilling was commenced December 22, 1955, and completed December 27, 1955; name of drilling contractor Willard Beaty 1102 Merchant; Address, Artesia, New Mexico; Driller's License No. WD-62

2. Principal Water-bearing Strata:

	Depth in Feet From	To	Thickness	Description of Water-bearing Formation
No. 1	263	270	7	Sand & Gravel
No. 2	282	290	8	Sand
No. 3				
No. 4				
No. 5		Water No Good To Drink		

3. Casing Record:

Diameter in Inches	Pounds per ft.	Threads per inch	Depth of Casing or Liner Top	Bottom	Feet of Casing	Type of Shoe	Perforation From	To
7.O.D.	24	8	0	263	263	Steel		None

4. If above construction replaces old well to be abandoned, give location: .... ¼, ... ¼, ... ¼ of Section ...., Township ...., Range ....; name and address of plugging contractor, ...

date of plugging ...., 19....; describe how well was plugged: ....

FILED
FEB 23 1956
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

RA-1414-S

17S, 26E, 14.113

5. Log of Well: Old Well Drilled Deeper

Depth in Feet From	To	Thickness in feet	Description of Formation
263	270	8	Sand & Gravel
270	282	12	Blue Clay
282	290	8	Brown Sand
Plugged Back To 270			

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Willard Beaty
Licensed Well Driller

Instructions

This form shall be executed, preferably typewritten, in triplicate and filed with the State Engineer's Office at Roswell, New Mexico, within 10 days after drilling has been completed. Data on water-bearing strata and on all formations encountered should be as complete and accurate as possible.

(This form to be executed in triplicate)

WELL RECORD

Date of Receipt .... Permit No. RA-3522

Name of permittee, W. T. Haldeman

Street or P. O. East of Artesia, City and State Artesia, New Mexico

1. Well location and description: The Shallow (shallow or artesian) well is located in SW ¼, SW ¼, NW ¼ of Section 14, Township 17-S, Range 26-E; Elevation of top of casing above sea level, ... feet; diameter of hole, ... inches; total depth, 365 feet; depth to water upon completion, 30 feet; drilling was commenced DECEMBER 27, 19 55 and completed January 10, 19 56; name of drilling contractor Willard Beaty 1102 Merchant; Address, Artesia, New Mexico; Driller's License No. WD-62

2. Principal Water-bearing Strata:

	Depth in Feet From	To	Thickness	Description of Water-bearing Formation
No. 1	35	45	10	Sand , No Good
No. 2	60	80	20	Sand, No Good
No. 3	175	187	12	Sand, No Good
No. 4	355	365	10	Sand & Gravel, Good Water
No. 5				

3. Casing Record:

Diameter in Inches	Pounds per ft.	Threads per inch	Depth of Casing or Liner Top	Bottom	Feet of Casing	Type of Shoe	Perforation From	To
7.O.D	24	8	0	332	332	Steel	None	
43 Ft. 5 Inch Liner							42	65

4. If above construction replaces old well to be abandoned, give location: .... ¼, ... ¼, ... ¼ of Section ...., Township ...., Range ....; name and address of plugging contractor, ...

date of plugging ...., 19....; describe how well was plugged: ....

FILED
MAR 16 1956
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

Copy To S.F.
2-19-56

RA-3522

17.26.14.133

5. Log of Well:

Depth in Feet From	To	Thickness in feet	Description of Formation
0	3	3	Top Soil
3	35	32	Gray Clay
35	45	10	Water Sand
45	60	15	Red Clay
60	80	20	Water Sand
80	107	27	Red Clay
107	125	18	Sand
125	175	50	Red Clay
175	187	12	Water Sand
187	220	33	Red Clay
220	240	20	Blue Clay
240	280	40	Sand
280	305	25	Blue Clay
305	323	18	Red Clay
323	355	22	Blue Clay
355	365	10	Water Sand, Good Water

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Willard Beaty
Licensed Well Driller

Instructions

This form shall be executed, preferably typewritten, in triplicate and filed with the State Engineer's Office at Roswell, New Mexico, within 10 days after drilling has been completed. Data on water-bearing strata and on all formations encountered should be as complete and accurate as possible.

175231

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well VIVIAN MARIE TIDWELL TRUST By DENNIS TIDWELL Owner's Well No. RA 8941
Street or Post Office Address 105 S. HALDEMAN RD
City and State ARTESIA N.M. 88210

Well was drilled under Permit No. RA 8941 and is located in the:

a. NW ¼ NW ¼ NW ¼ ____ ¼ of Section 14 Township 17S Range 26 E N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in EDDY County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor DENNIS TIDWELL License No. WD 823

Address 105 S. HALDEMAN RD ARTESIA N.M.

Drilling Began 8/1/97 Completed 8/26/97 Type tools CABLE Size of hole 5 in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 100 ft.

Completed well is ☑ shallow ☐ artesian. Depth to water upon completion of well ____ ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
25	70		SAND	
75	100		SAND	

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
9 5/8	34	8	0	75	75	TEXAS PATTERN	NONE	
5 1/2	17	8	0	100	100		60	100

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
0	75	12	~~20 SK~~	20 SCKS	

Section 5. PLUGGING RECORD

Plugging Contractor ____
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received August 28, 1997

Quad ____ FWL ____ FSL ____

File No. RA-8941 Use Domestic/Stock Location No. 17.26.14.11131

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	5		TOP SOIL
5	15		CLAY
15	70		SAND
70	75		CLAY
75	100		SAND

Section 7. REMARKS AND ADDITIONAL INFORMATION

gravel packed well with 4 yards of ¼ inch round gravel

'97 AU 28 AM 10 42

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Dennis Tidwell
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. A ons, except Section 5, shall be answered as completely and accurate ossible when any well is drilled, repaired or deepene hen this form is used as a plugging record, only Section 1(a) and Section d be completed.

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE ENGINEER OFFICE ROSWELL

2013 AUG 22 A 11:09

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): RA-11977	OSE FILE NUMBER(S):
WELL OWNER NAME(S): Chance Sexton	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 1501 Zydeco Place	CITY: Artesia STATE: NM ZIP: 88210

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS		
	LATITUDE	32	50	20.89	N	* ACCURACY REQUIRED: ONE TENTH OF A SECOND
	LONGITUDE	104	21	30.31	W	* DATUM REQUIRED: WGS 84

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

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1632	Caleb Curry	Hopper Pump & Drilling Inc.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
8/19/2013	8/19/2013	200	200	53

COMPLETED WELL IS: ( ) ARTESIAN ( ) DRY HOLE (•) SHALLOW (UNCONFINED)

STATIC WATER LEVEL IN COMPLETED WELL (FT): 53

DRILLING FLUID: ( ) AIR ( ) MUD   ADDITIVES – SPECIFY:

DRILLING METHOD: (•) ROTARY ( ) HAMMER ( ) CABLE TOOL ( ) OTHER – SPECIFY:

DEPTH (feet bgl) FROM	TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
+2	140	8.75	pvc	spline	5	.25	
140	200	8.75	pvc	spline	5	.25	.032

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	120	8.75	3/8 bentonite chip		
120	200	8.75	8/16 silica sand		

FOR OSE INTERNAL USE   WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER RA-11977	POD NUMBER 1	TRN NUMBER 528481
LOCATION Domestic/Livestock		PAGE 1 OF 2

17S.26E.14. 1-1

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	20	20	Brown Clay	N	
20	50	30	Brown Sand	N	
50	60	10	Brown Sand & Clay	Y	
60	105	45	Brown Sand	Y	
105	120	15	Red Clay	N	
120	200	80	Brown Sand	Y	80
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: PUMP AIR LIFT BAILER OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm): 80

5. TEST; RIG SUPERVISION

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

MISCELLANEOUS INFORMATION:

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

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Caleb Carey

SIGNATURE OF DRILLER / PRINT SIGNEE NAME

8/23/2013

DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		PAGE 2 OF 2

(This form is to be executed in triplicate)

WELL RECORD

Date of Receipt .... Permit No. RA_?

Name of permitee, Clyde Dungan

Street or P. O. Box 1324, City and State Artesia, N.M.

1. Well location and description: The Shallow (shallow or artesian) well is located in ~~SW~~ N^2N^2 ¼, SW ~~SW~~ ¼, ~~SW~~ NW ¼ of Section 15, Township 17 S, Range 26E; Elevation of top of casing above sea level, ... feet; diameter of hole, 4" inches; total depth, 182 feet; depth to water upon completion, 128 feet; drilling was commenced Nov.28, 1953, and completed Nov.28, 1953; name of drilling contractor A.F.Smith 306 W. Chisum; Address, Artesia, N.M.; Driller's License No. WD_28

2. Principal Water-bearing Strata:

	Depth in Feet From	To	Thickness	Description of Water-bearing Formation
No. 1		No log on well .		
No. 2		Run 182 ft.4" pipe in old well, with collar on bottom of pipe.		
No. 3		Perforated bottom joint and gravel packed casing.		
No. 4				
No. 5				

3. Casing Record:

Diameter in Inches	Pounds per ft.	Threads per inch	Depth of Casing or Liner Top	Bottom	Feet of Casing	Type of Shoe	Perforation From	To

4. If above construction replaces old well to be abandoned, give location: .... ¼, ... ¼, ... ¼ of Section ...., Township ...., Range ....; name and address of plugging contractor, ...

date of plugging ...., 19....; describe how well was plugged: ....

Copy to SE
1-11-56

FILED
NOV 30 1953
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

RA-? 3176

17.26.15.130

NO LOG

5. Log of Well:

Depth in Feet From	To	Thickness in feet	Description of Formation

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

C.F. Smith
Licensed Well Driller

Instructions

This form shall be executed, preferably typewritten, in triplicate and filed with the State Engineer's Office at Roswell, New Mexico, within 10 days after drilling has been completed. Data on water-bearing strata and on all formations encountered should be as complete and accurate as possible.

Form WR-23

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well J. M. Vogel

Street and Number

City Artesia, State New Mexico

Well was drilled under Permit No. RA-1183 and is located in the NW ¼ NE ¼ ¼ of Section 15 Twp. 17 Rge. 26

(B) Drilling Contractor Gray Bros. License No.

Street and Number

City State

Drilling was commenced July 30, 19 34

Drilling was completed August 7, 19 34

Elevation at top of casing in feet above sea level Total depth of well 225 ft.

State whether well is shallow or artesian Depth to water upon completion

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				
2				
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
10					220			

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. RA-1183 Use Location No. 17.26.15.120

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	18			Gravel
18	20			Sand
20	25			Water gravel
25	30			Red bed
30	90			White clay
90	115			Red clay
115	122			Gyp
122	135			Sandy clay
135	145			Sand rock
145 q	155			Fine sand
155	225			Water gravel

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Gray Bros.
Well Driller

Form WR-23 Orig in S.F.

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Charles L. Allison

Street and Number

City Roswell, State New Mexico

Well was drilled under Permit No. RA-1227 RAS-5 and is located in the NW ¼ NW ¼ NW ¼ of Section 15 Twp. 17S, Rge. 26E,

(B) Drilling Contractor E.C & D.N.Gray License No.

Street and Number

City State

Drilling was commenced December 30, 1935 19

Drilling was completed January 13, 1936 19

Elevation at top of casing in feet above sea level Total depth of well 240'

State whether well is shallow or artesian Depth to water upon completion

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation
	From	To		
1				
2				
3				
4				
5				

Section 3

RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth		Feet	Type Shoe	Perforations	
			Top	Bottom			From	To
10	194							
8	52							

Section 4

RECORD OF MUDDING AND CEMENTING

Depth in Feet		Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used
From	To				

Section 5

PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug		No. of Sacks Used
	From	To	

FOR USE OF STATE ENGINEER ONLY

Date Received October 20, 1958

File No. RA-1227 Use Location No. 17.26.15.111

Section 6

LOG OF WELL

Depth in Feet		Thickness in Feet	Color	Type of Material Encountered
From	To			
0	10	10		soil
10	15	5		white clay and water
15	58	43		white clay
58	61	3		shell rock
61	75	14		clay
75	110	35		clay and shell rock
110	115	5		shell rock
115	138	23		clay
138	175	37		sandy clay
175	240	65		water sand
				set 194' of 10" casing. Set 52' of 8" perforated casing in bottom.

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Well Driller

L.B.

WELL RECORD

FILE No. 5-13 RA-1503-F

INSTRUCTIONS: This form should be typewrttten, and filed in the office of the State Engineer, (P.O. Box 1079) Santa Fe, New Mexico, unless the well is situated in the Roswell Artesian Basin, in which case it should be filed in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.

SEC. 1

M. C. Parrish Jr.

N.W.	N.E.
S.W.	S.E.

(Plat of 640 acres)
Locate Well Accurately

Owner of well Bill Jackson

Street and Number

Post Office

Well was drilled under Permit No. RA-1503 and

is located in the SW ¼ SW ¼ NW ¼ of Section 15

Township 17, Range 26.

Drilling Contractor W. P. Black

Street and Number

Post Office Box 743 Artesia

Drilling was commenced Oct 2 1944 Drilling was completed Oct 11 1944

Elevation at top of casing in feet above sea level

State whether well is shallow or artesian Shallow

SEC. 2

PRINCIPAL WATER-BEARING STRATA

No. 1, from 0 to 10, Thickness in feet 10, Formation Surface.

No. 2, from 10 to 15, Thickness in feet 05, Formation Sand - Water

No. 3, from 15 to 73, Thickness in feet 58, Formation Clay

No. 4, from 73 to 83, Thickness in feet 10, Formation Sand - Water

No. 5, from 83 to 95, Thickness in feet 12, Formation Sand

SEC. 3

RECORD OF CASING

DIAMETER IN INCHES	POUNDS PER FOOT	THREADS PER INCH	NAME OF MANUFACTURER	FEET OF CASING	TYPE OF SHOE	PERFORATED FROM	PERFORATED TO	PURPOSE
14		8		180	Welded Collar	1	180	Irrigating
10		8		78	Collar	1	78	Irrigating

SEC. 4

RECORD OF MUDDING AND CEMENTING

DIAMETER OF HOLE IN INCHES	NUMBER OF SACKS OF CEMENT	METHODS USED	SPECIFIC GRAVITY OF MUD	TONS OF CLAY USED

SEC. 5

PLUGGING RECORD OF OLD WELL

Well is located in the ______ ¼ ______ ¼ ______ ¼ of Section ______, Township ______,

Range ______. Name of plugging contractor ______

Street and Number ______ Post Office ______

Tons of clay used ______ Tons of roughage used ______ Type of roughage ______

______ Was plugging approved by Artesian Well Supervisor ______

Cement plugs were placed as follows:

No. 1 was placed at ______ feet Number of sacks of cement used ______

No. 2 was placed at ______ feet Number of sacks of cement used ______

No. 3 was placed at ______ feet Number of sacks of cement used ______

No. 4 was placed at ______ feet Number of sacks of cement used ______

No. 5 was placed at ______ feet Number of sacks of cement used ______

(OVER)

RA-1503

17.26.15.133

SEC. 6

LOG OF WELL

FROM (DEPTH IN FEET)	TO (DEPTH IN FEET)	THICKNESS IN FEET	CLASSIFICATION OF FORMATION
95	125	30	Sand - Clay
125	140	15	Sand
140	180	40	Sand - Gravel
180	190	10	Clay
190	210	20	Sand - Gravel
210	237	27	Sand
237	240	3	Clay

I, W. P. Black do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this 2 day of March, A. D., 19 45

Mildred Hudson
Notary Public

My Commission Expires 4/3/48
in & for Eddy County, N.M.

Signed W P Black

Position Driller

Street and Number Box 743

Post Office Artesia, N.M.

WELL RECORD

FILE NO. RA-2221

INSTRUCTIONS: This form should be typewrttten, and filed in the office of the State Engineer, (P.O. Box 1079) Santa Fe, New Mexico, unless the well is situated in the Roswell Artesian Basin, in which case it should be filed in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.

SEC. 1

N.W. N.E. S.W. S.E.

(Plat of 640 acres)
Locate Well Accurately

Owner of well J. M. Vogel

Street and Number Box 632

Post Office Artesia, N. M.

Well was drilled under Permit No. RA-2221 and

is located in the SW ¼ SW ¼ NE ¼ of Section 15

Township 17S., Range 26E.

Drilling Contractor D. N. Gray

Street and Number Artesia, N. M.

Post Office

Drilling was commenced ______ 19 ___ Drilling was completed November 19 45

Elevation at top of casing in feet above sea level

State whether well is shallow or artesian Shallow

SEC. 2

PRINCIPAL WATER-BEARING STRATA

No. 1, from 133 to 180, Thickness in feet 47, Formation Sand

No. 2, from ______ to ______, Thickness in feet ______, Formation

No. 3, from ______ to ______, Thickness in feet ______, Formation

No. 4, from ______ to ______, Thickness in feet ______, Formation

No. 5, from ______ to ______, Thickness in feet ______, Formation

SEC. 3

RECORD OF CASING

DIAMETER IN INCHES	POUNDS PER FOOT	THREADS PER INCH	NAME OF MANUFACTURER	FEET OF CASING	TYPE OF SHOE	PERFORATED FROM	PERFORATED TO	PURPOSE
8 5/8				59		none		Shut off top water
7				180		133	180	

SEC. 4

RECORD OF MUDDING AND CEMENTING

DIAMETER OF HOLE IN INCHES	NUMBER OF SACKS OF CEMENT	METHODS USED	SPECIFIC GRAVITY OF MUD	TONS OF CLAY USED

SEC. 5

PLUGGING RECORD OF OLD WELL

Well is located in the ______ ¼ ______ ¼ ______ ¼ of Section ______, Township ______,

Range ______. Name of plugging contractor

Street and Number ______ Post Office

Tons of clay used ______ Tons of roughage used ______ Type of roughage

______ Was plugging approved by Artesian Well Supervisor ______

Cement plugs were placed as follows:

No. 1 was placed at ______ feet Number of sacks of cement used

No. 2 was placed at ______ feet Number of sacks of cement used

No. 3 was placed at ______ feet Number of sacks of cement used

No. 4 was placed at ______ feet Number of sacks of cement used

No. 5 was placed at ______ feet Number of sacks of cement used

(OVER)

17.26.15.233

LOG OF WELL

FR[illegible] IN [illegible]	TO [illegible]PTH IN FEET)	THICKNESS IN FEET	CLASSIF[illegible] OF FORMATI[illegible]
0	30	30	Clay
30	180	150	Sand.

I, ______________________________ do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this ________ Signed ______________________________

day of ______________________, A. D., 19 ______ Position ______________________________

____
Notary Public

Street and Number ______________________________

My Commission Expires ______________________________ Post Office ______________________________

WELL RECORD

FILE NO. RA-2222

INSTRUCTIONS: This form should be typewrttten, and filed in the office of the State Engineer, (P.O. Box 1079) Santa Fe, New Mexico, unless the well is situated in the Roswell Artesian Basin, in which case it should be filed in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.

SEC. 1

NW NE SW SE

(Plat of 640 acres)
Locate Well Accurately

Owner of well J. M. Vogel

Street and Number Box 632, Artesia, N.M.

Post Office

Well was drilled under Permit No. RA-2222 and

is located in the ~~NW~~ NE ¼ NW ¼ NE ¼ of Section 15

Township 17S., Range 26E.

Drilling Contractor D. N. Gray

Street and Number

Post Office Artesia

Drilling was commenced 19 Drilling was completed December 1945

Elevation at top of casing in feet above sea level

State whether well is shallow or artesian Shallow 171 TD

SEC. 2

PRINCIPAL WATER-BEARING STRATA

No. 1, from 141 to 171, Thickness in feet 30, Formation Sand

No. 2, from to, Thickness in feet, Formation

No. 3, from to, Thickness in feet, Formation

No. 4, from to, Thickness in feet, Formation

No. 5, from to, Thickness in feet, Formation

SEC. 3

RECORD OF CASING

DIAMETER IN INCHES	POUNDS PER FOOT	THREADS PER INCH	NAME OF MANUFACTURER	FEET OF CASING	TYPE OF SHOE	PERFORATED FROM	PERFORATED TO	PURPOSE
8 5/8				45		none		Shut off top water
7'				171		141	170	

SEC. 4

RECORD OF MUDDING AND CEMENTING

DIAMETER OF HOLE IN INCHES	NUMBER OF SACKS OF CEMENT	METHODS USED	SPECIFIC GRAVITY OF MUD	TONS OF CLAY USED

SEC. 5

PLUGGING RECORD OF OLD WELL

Well is located in the ¼ ¼ ¼ of Section, Township,

Range. Name of plugging contractor

Street and Number Post Office

Tons of clay used Tons of roughage used Type of roughage

Was plugging approved by Artesian Well Supervisor

Cement plugs were placed as follows:

No. 1 was placed at feet Number of sacks of cement used

No. 2 was placed at feet Number of sacks of cement used

No. 3 was placed at feet Number of sacks of cement used

No. 4 was placed at feet Number of sacks of cement used

No. 5 was placed at feet Number of sacks of cement used

(OVER)

17.26.15.212

LOG OF WELL

FROM (DEPTH IN FEET)	TO (DEPTH IN FEET)	THICKNESS IN FEET	CLASSIFICATION OF FORMATION
0	25	~~Caliche~~ 25	Caliche
25	35	10	Rock
35	40	5	Sand & Gravel
40	60		Clay
60	65		Sand
65	80		Sandy clay
80	90		Clay
90	115		Sand Clay
115	120		Clay
120	170		Sand

I, ______________________________ do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this ________ Signed ______________________

day of ______________________, A. D., 19 ______ Position ______________________

____
Notary Public

Street and Number ______________________

My Commission Expires ______________________ Post Office ______________________

(This form to be executed in triplicate)

WELL RECORD

Date of Receipt .... Permit No. RA-3353

Name of permittee, T. D. Joy

Street or P. O., ..., City and State Artesia, N. M.

1. Well location and description: The shallow (shallow or artesian) well is located in NW ¼, NE ¼, NW ¼ of Section 15, Township 17S, Range 26E; Elevation of top of casing above sea level, ... feet; diameter of hole, 7"OD inches; total depth, 295 feet; depth to water upon completion, ... feet; drilling was commenced Dec. 14, 19 51 and completed Jan. 8, 19 52 name of drilling contractor D. H. Gray ......; Address, Artesia, New Mex.; Driller's License No. WD.-19

2. Principal Water-bearing Strata:

	Depth in Feet From	To	Thickness	Description of Water-bearing Formation
No. 1	260	295	35	Sand & Clay streaks
No. 2				
No. 3				
No. 4				
No. 5				

3. Casing Record:

Diameter in inches	Pounds per ft.	Threads per inch	Depth of Casing or Liner Top	Bottom	Feet of Casing	Type of Shoe	Perforation From	To
8" ~~10¾x8"~~					167'8"			
7"OD					257'9"			
5"ID					62'9"		232	to 295

4. If above construction replaces old well to be abandoned, give location: ...... ¼, ... ¼, ... ¼ of Section ......, Township ......, Range ......; name and address of plugging contractor, ...

date of plugging ...., 19......; describe how well was plugged: ....

FILED
DEC 3 1954
OFFICE
GROUND WATER SUPERVISOR
ROSWELL, NEW MEXICO

RA-3353

17.26.15.121

5. Log of Well:

Depth in feet From	To	Thickness in feet	Description of Formation
0	35	35	Clay
35	40	5	Rock & Gravel
40	100	60	Clay & Rock streaks
100	120	20	Sand & Gravel
120	125	5	Clay
125	131	6	Sand
131	134	3	Clay
134	155	21	Sand
155	164	9	Clay
164	200	36	Sand
200	208	8	Clay
208	236	28	Sand
236	237	1	Clay
237	258	21	Sand
258	260	2	Clay
260	295	35	Sand & Clay streaks

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

D N Gray
Licensed Well Driller

Instructions

This form shall be executed, preferably typewritten, in triplicate and filed with the State Engineer's Office at Roswell, New Mexico, within 10 days after drilling has been completed. Data on water-bearing strata and on all formations encountered should be as complete and accurate as possible.

Form WR-23

FIELD ENGR. LOG

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Walter Nugent
Street and Number 305 W Chisum
City Artesia State N.M.
Well was drilled under Permit No. RA-4684 and is located in the SW ¼ SW ¼ NW ¼ of Section ______ Twp. ______ Rge. ______
(B) Drilling Contractor A. F. Smith License No. WD28
Street and Number 306 W Chisum
City Artesia State N.M.
Drilling was commenced Aug 25 1962
Drilling was completed Aug 28 1962

Elevation at top of casing in feet above sea level ______ Total depth of well 220'
State whether well is shallow or artesian domestic Depth to water upon completion 50'

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1	25'	30'	5	sand
2	185'	200'	15	sand + gravel
3				
4				
5				

Section 3

RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
7"					220'	none	185'	220'

Section 4

RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5

PLUGGING RECORD

Name of Plugging Contractor ______ License No. ______
Street and Number ______ City ______ State ______
Tons of Clay used ______ Tons of Roughage used ______ Type of roughage ______
Plugging method used ______ Date Plugged ______ 19____
Plugging approved by:

______
Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received 1962 SEP 17 AM 8:38 STATE ENGINEER OFFICE DISTRICT II ROSWELL, N. MEX.

File No. RA-4684 Use Dom. Location No. 17.26.15.133

Dom - MK

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	5	5		soil
5	25	20		Clay
25	30	5		sand
30	185	155		Clay
185	200	15		sand & gravel
200	220	20		red Clay

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

A. F. Smith
Well Driller

Form WR-23

STATE ENGINEER OFFICE

FIELD ENGR. LOG

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres) N½

(A) Owner of well Benny Mason
Street and Number 205 W. main
City artesia State N. M.
Well was drilled under Permit No. RA-4765 and is located in the S½ ¼ SE ¼ NW ¼ of Section 15 Twp. 17S Rge. 26E
(B) Drilling Contractor A. G. Smith License No. wd. 28
Street and Number 306 W Chisum
City artesia State N. M.
Drilling was commenced Feb 14 1963
Drilling was completed " 16 1963

Elevation at top of casing in feet above sea level ______ Total depth of well 185'
State whether well is shallow or artesian domestic Depth to water upon completion 70'

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	To	Thickness in Feet	Description of Water-Bearing Formation
1	20	50	30	sand
2	150	185	35	sand
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
7"					185'	none	155'	185'

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor ______ License No. ______
Street and Number ______ City ______ State ______
Tons of Clay used ______ Tons of Roughage used ______ Type of roughage ______
Plugging method used ______ Date Plugged ______ 19____
Plugging approved by:

______
Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received ✓ STATE ENGINEER OFFICE DISTRICT II ROSWELL, N. MEX. 1963 FEB 26 AM 8:15

File No. RA-4765 Use Dom. Location No. 17.26.15.140

 KK

Section 6

LOG OF WELL

Depth in Feet		Thickness in Feet	Color	Type of Material Encountered
From	To			
0	5	5		Soil
5	20	15		Gyp
20	50	30		Sand
50	150	100		red Clay
150	185	35		Sand

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

A. F. Smith
Well Driller

173309

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well EDDIE C LARUE Owner's Well No. ______
Street or Post Office Address PO BOX 1370
City and State ARTESIA NM 88211-1370

Well was drilled under Permit No. RA-9866 ...cated in the

a. S/2 ¼ S/2 NW ¼ NW ¼ ______ ¼ of ...n 15 ...hip 17S Range 26E N.M.P.M.

b. Tract No. 2 of Map No. A Slive 725-1 of the EDDY COUNTY RECORDS

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in ______ County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor L&M DRILLING License No. WD-1132

Address ______

Drilling Began 6/8/00 Completed 6/12/00 Type tools CABLE Size of hole 7 7/8 in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well 165 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 145 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
145	162	17	SAND & SMALL GRAVEL	200

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
8 5/8"	20	8	0	140	140	Collar		

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				
0	140	12 3/4"	0	3 YRD	FROM SURFACE
0	165	7 7/8"	0	0	GRAVEL

Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______
State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ______ FWL ______ FSL ______

File No. ~~RA-9866~~ Use ~~Domestic~~ Location No. ~~17S.26E.15.11331~~

Section 6. LOG OF HOLE

Depth in Feet From	To	Thickness in Feet	Color and Type of Material Encountered
0	37	37	SURFACE FORMATION
37	41	4	TAN SAND
41	60	19	LIGHT RED MUD
60	66	6	TAN SAND & RED SAND
66	90	24	LIGHT RED & RED MUD
90	100	10	RED & YELLOW SAND w/ SMALL GRAVEL
100	110	10	GRAY & RED MUD
110	135	25	YELLOW SAND
135	145	10	ANAHYDRITE
145	162	17	PINK YELLOW & BLACK SAND
162	165	3	ANAHYDRITE

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

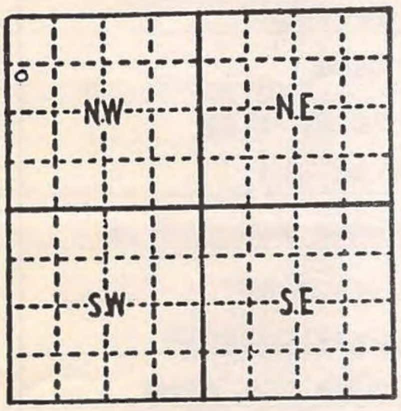
Eddie Solis
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

WELL RECORD

File No. RA2568

INSTRUCTIONS: This form should be typewritten, and filed in the office of the State Engineer, P. O. Box 1079, Santa Fe, New Mexico, or in the office of the Artesian Well Supervisor, Roswell, New Mexico. Section 5 should be answered only if an old artesian well has been plugged. All other sections should be answered in full in every case, regardless of whether the well drilled is shallow or artesian in character. This report must be subscribed and sworn to before a Notary Public.



(Plat of 640 Acres)
Locate Well Accurately

Owner of well: G. G. Armstrong & Son ~~Armstrong and Armstrong~~

Street and Number: P. O. Box 873, Roswell, New Mexico

Post Office: Roswell, New Mexico

Well was drilled under Permit No. RA- 2568 and

is located in the SW ¼ NW ¼ NW ¼ of Section 16

Township 17S, Range 26E

Drilling Contractor: Keyes Drilling Co.

Street and Number: 1012 South Penn. Ave.

Post Office: Roswell, New Mexico

Drilling was commenced January 21, 1950 Drilling was completed January 26, 1950

Elevation at top of casing in feet above sea level

State whether well is shallow or artesian Shallow

Total depth of well 232 feet. Water level upon completion of well 42 feet below land surface.

Sec. 2 PRINCIPAL WATER-BEARING STRATA

No. 1, from 216 to 220, Thickness in feet 4, Formation Water Sand

No. 2, from .... to ...., Thickness in feet ...., Formation ....

No. 3, from .... to ...., Thickness in feet ...., Formation ....

No. 4, from .... to ...., Thickness in feet ...., Formation ....

No. 5, from .... to ...., Thickness in feet ...., Formation ....

Sec. 3 RECORD OF CASING

Diameter in Inches	Pounds per Foot	Threads per Inch	Name of Manufacturer	Feet of Casing	Type of Shoe	Perforated From	Perforated To	Purpose
7"	24	8	Used	216'	Texas	None		Surface
5 3/16	18	8	used	30'	none	all		Liner

Sec. 4 RECORD OF MUDDING AND CEMENTING

Diameter of Hole in Inches	Number of Sacks of Cement	Methods Used	Specific Gravity of Mud	Tons of Clay Used

Sec. 5 PLUGGING RECORD OF OLD WELL

Well is located in the .... ¼ .... ¼ .... ¼ of Section ...., Township ....,

Range .... Name of plugging contractor ....

Street and Number .... Post Office ....

Tons of clay used .... Tons of roughage used .... Type of roughage ....

.... Was plugging approved by Artesian Well Supervisor? ....

Cement plugs were placed as follows:

No. 1 was placed at .... feet. Number of sacks of cement used ....

No. 2 was placed at .... feet. Number of sacks of cement used ....

No. 3 was placed at .... feet. Number of sacks of cement used ....

No. 4 was placed at .... feet. Number of sacks of cement used ....

No. 5 was placed at .... feet. Number of sacks of cement used ....

(over)

RA 2568

17.26.16.113

Sec. 6

LOG OF WELL

FROM (Depth in Feet)	TO (Depth in Feet)	THICKNESS IN FEET	CLASSIFICATION OF FORMATION
0	4	4	Top Soil
4	18	14	Sandstone
18	40	22	Sandy clay
40	56	16	Sand and clay
56	60	4	Gravel
60	118	58	Sand
118	140	22	Sandy clay
140	148	8	Red clay
148	170	22	Sand and Gravel
170	172	2	Red clay
172	190	18	Conglomerate
190	200	10	Sand and clay
200	216	16	Sandstone
216	220	4	Water sand
220	232	12	Conglomerate

I, Conrad G. Keyes, do solemnly swear that, to the best of my knowledge and belief, the foregoing information is a true and correct record of the well for which report is hereby made, insofar as can be determined from all available records.

SUBSCRIBED AND SWORN TO BEFORE ME this .... day of ...., A.D., 19....

.... Notary Public

My Commission Expires........

Signed ....

Position Driller

Street and Number 1012 So. Penn. Ave.

Post Office........

Form WR-23

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Albert T. Woods, Inc.

Street and Number

City Artesia, State New Mexico

Well was drilled under Permit No. RA-2568 and is located in the SW ¼ NW ¼ NW ¼ of Section 16 Twp. 17 Rge. 26

(B) Drilling Contractor Pearl Johnson License No.

Street and Number

City State

Drilling was commenced 19

Drilling was completed June, 19 33

Elevation at top of casing in feet above sea level Total depth of well 200

State whether well is shallow or artesian Depth to water upon completion

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				
2				
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
15¼					200			

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. RA-2568 (205-3) Use Location No. 17.26.16.113

Section 6 LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	17			Soil and dobe
17	200			Sand and conglomerate gravel

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Pearl Johnson
Well Driller

Form WR-23

STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well Artesia Water, Power & Light Co.
Street and Number
City Artesia, State New Mexico
Well was drilled under Permit No. RA-820 and is located in the NE ¼ NE ¼ ¼ of Section 17 Twp. 17 Rge. 26

(B) Drilling Contractor Haeth & Chambers License No.
Street and Number
City State
Drilling was commenced 19
Drilling was completed 19

Elevation at top of casing in feet above sea level Total depth of well
State whether well is shallow or artesian Depth to water upon completion

Section 2

PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				
2				
3				
4				
5				

Section 3

RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To

Section 4

RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5

PLUGGING RECORD

Name of Plugging Contractor License No.
Street and Number City State
Tons of Clay used Tons of Roughage used Type of roughage
Plugging method used Date Plugged 19
Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. RA-820 Use Location No. 17.26.17.~~220~~ 233

Section 6

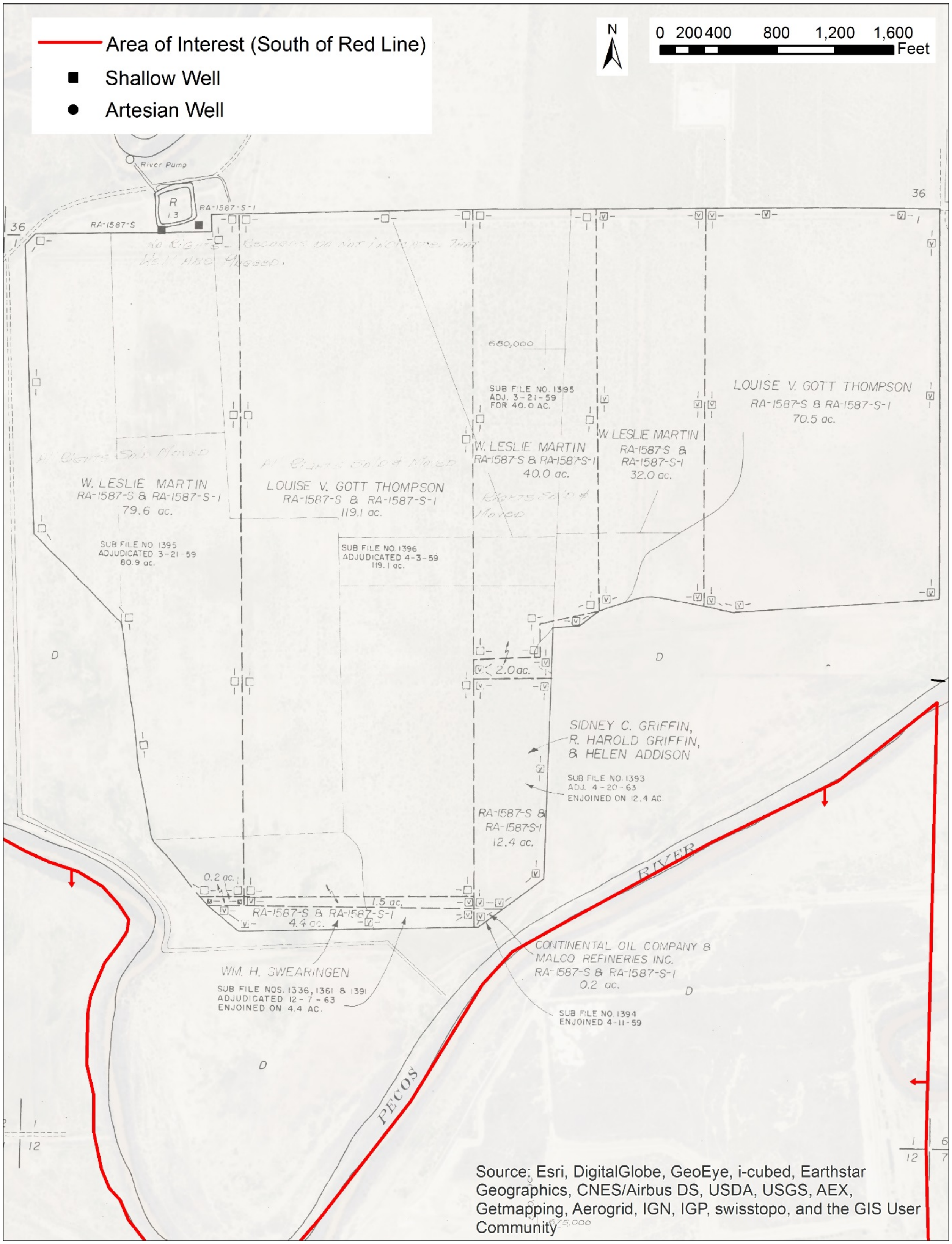
LOG OF WELL

Depth in Feet		Thickness in Feet	Color	Type of Material Encountered
From	To			

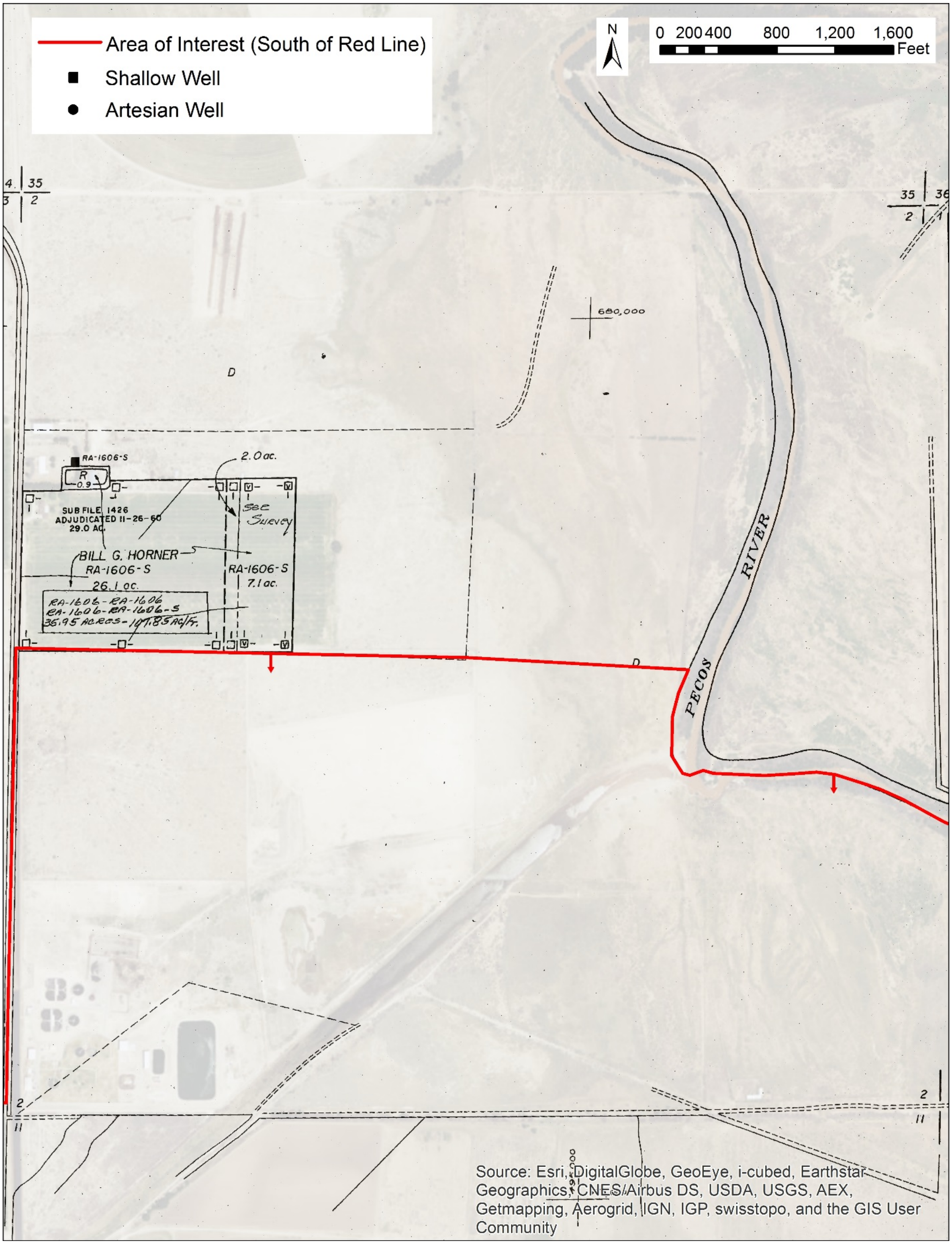
The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

Well Driller

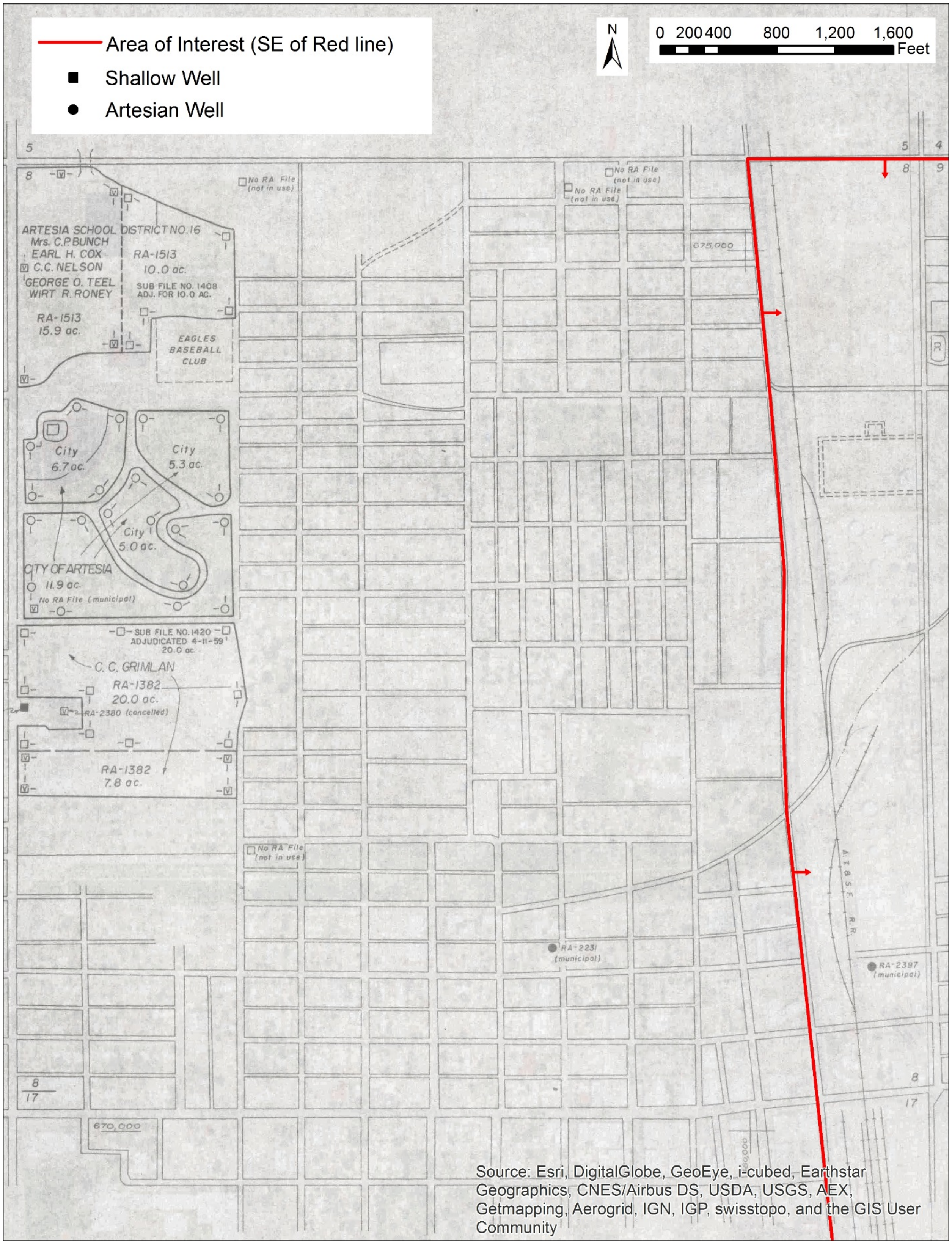
Appendix C Hydrographic Map Sheets by Section



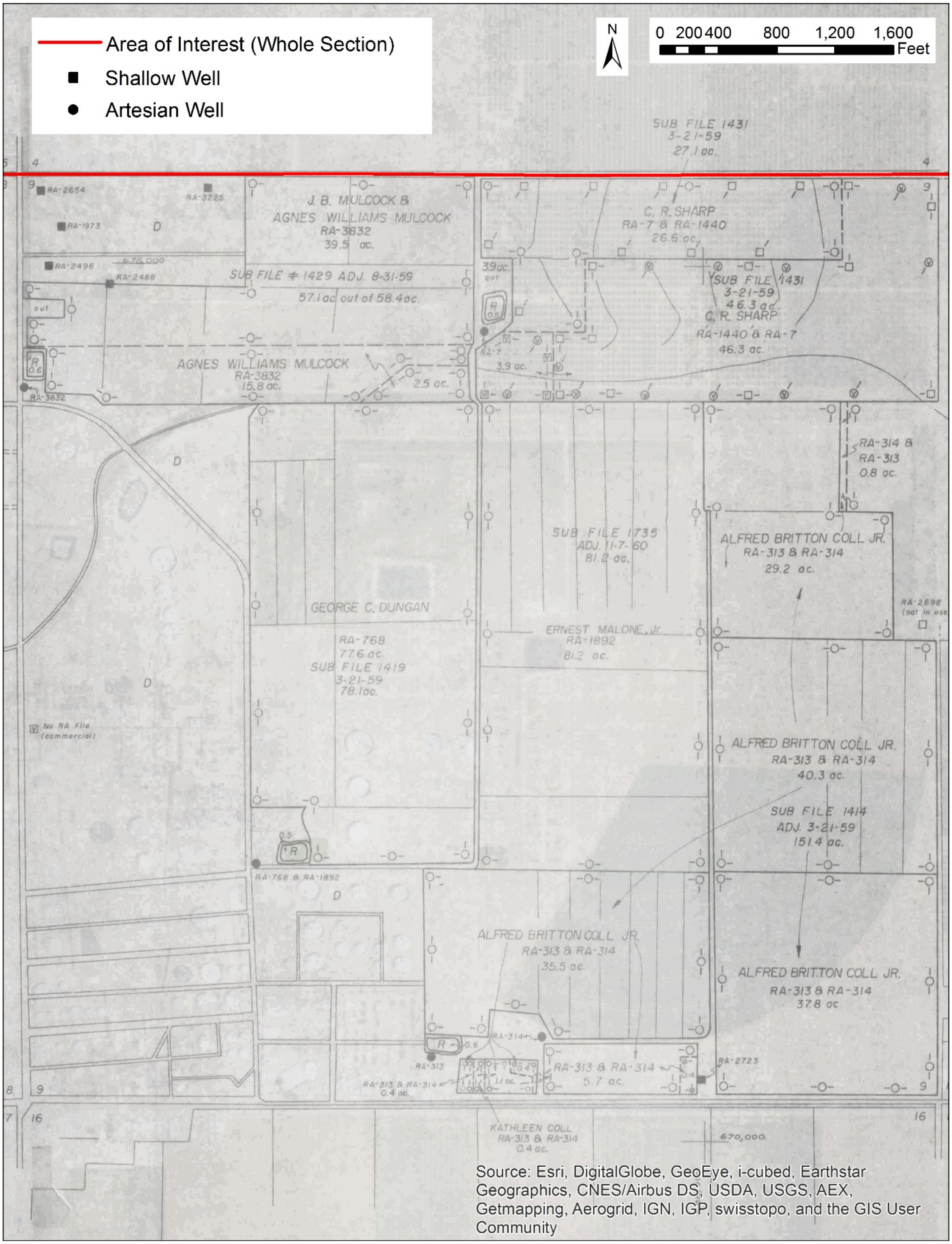
Map Sheet 1 NMOSE RA Hydrographic Survey. Township 17S, Range 26E, Sec. 01, N.M.P.M.



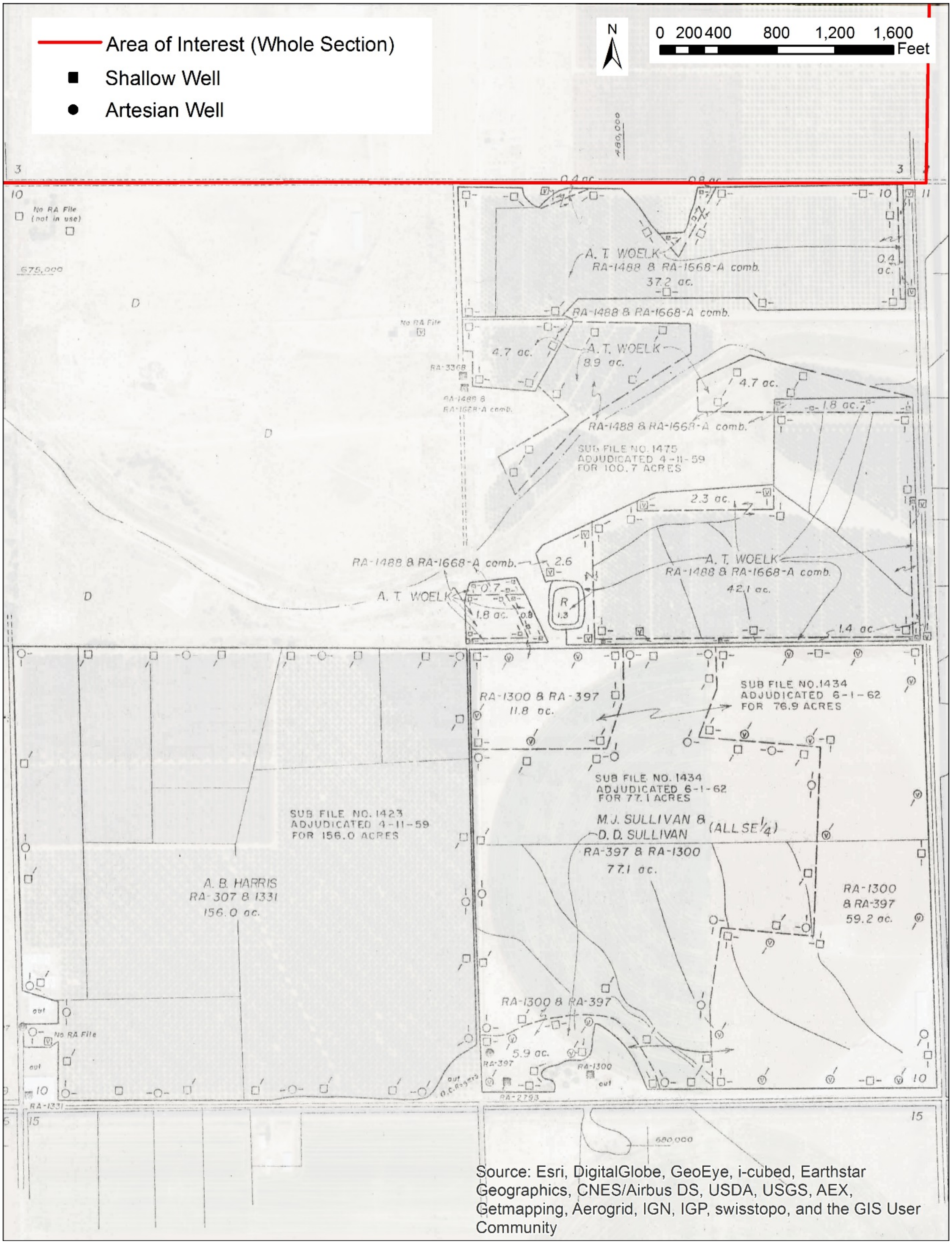
Map Sheet 2 NMOSE RA Hydrographic Survey. Township 17S, Range 26E, Sec. 02, N.M.P.M.



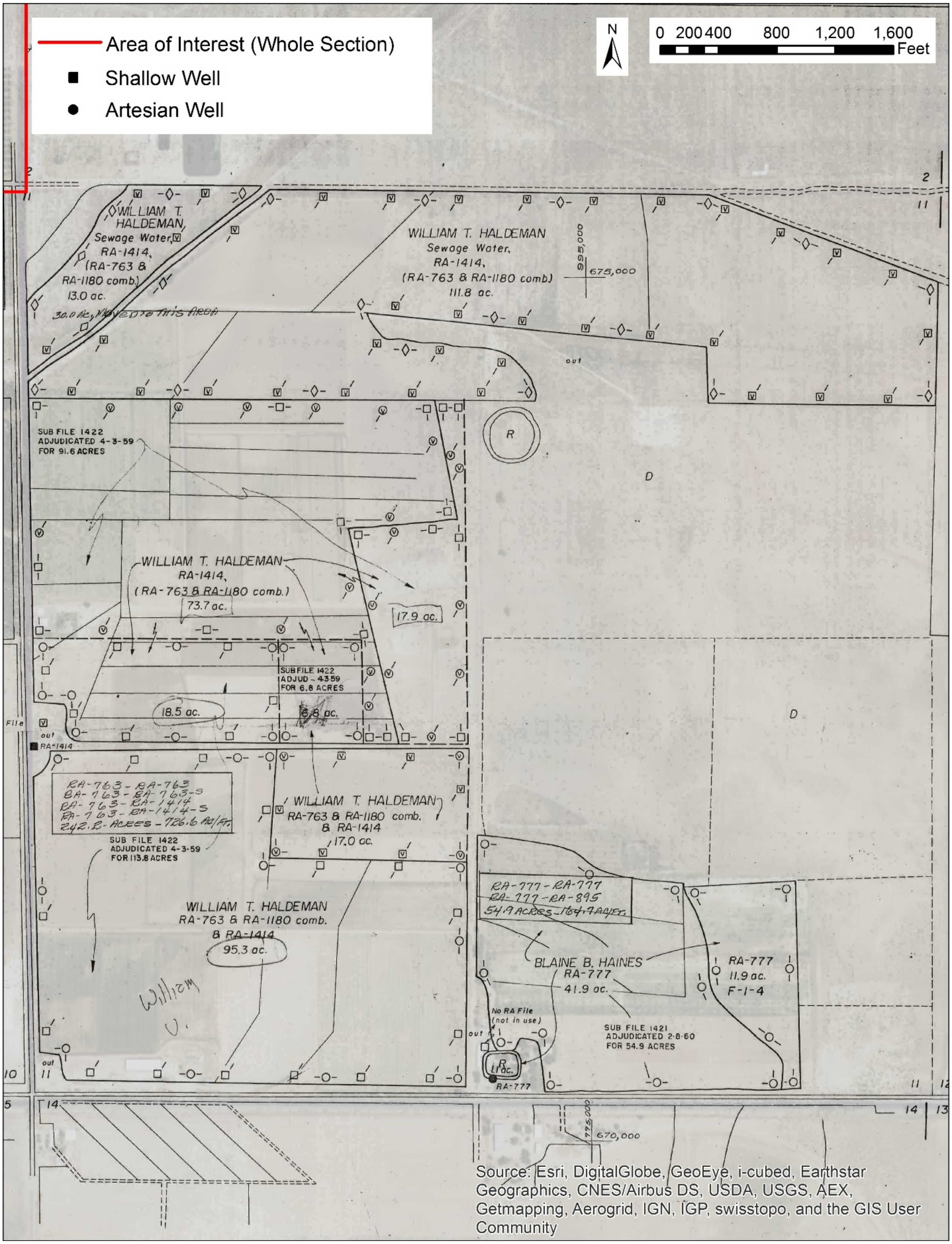
Map Sheet 3 NMOSE RA Hydrographic Survey. Township 17S, Range 26E, Sec. 08, N.M.P.M.



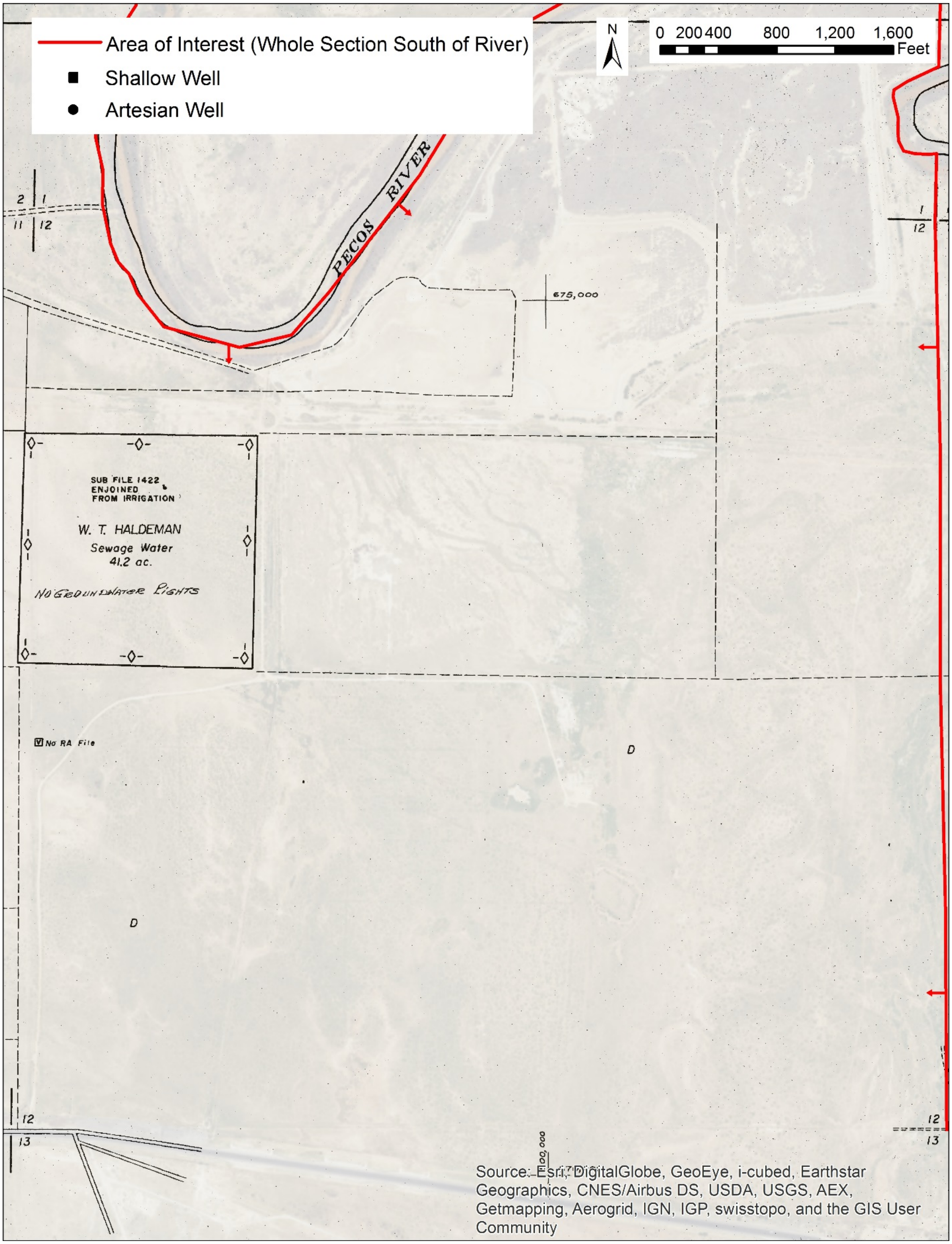
Map Sheet 4 NMOSE RA Hydrographic Survey. Township 17S, Range 26E, Sec. 09, N.M.P.M.



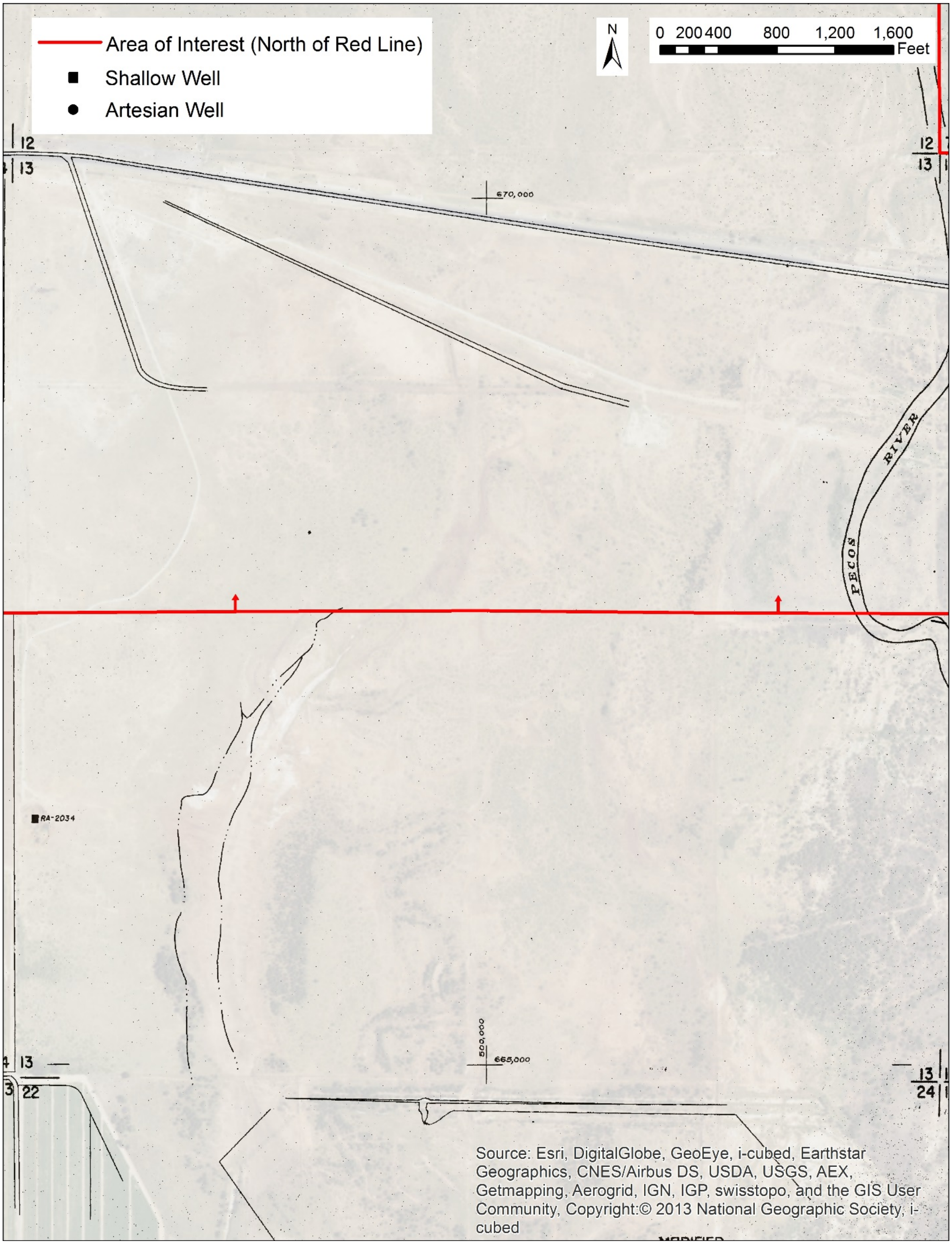
Map Sheet 5 NMOSE RA Hydrographic Survey. Township 17S, Range 26E, Sec. 10, N.M.P.M.



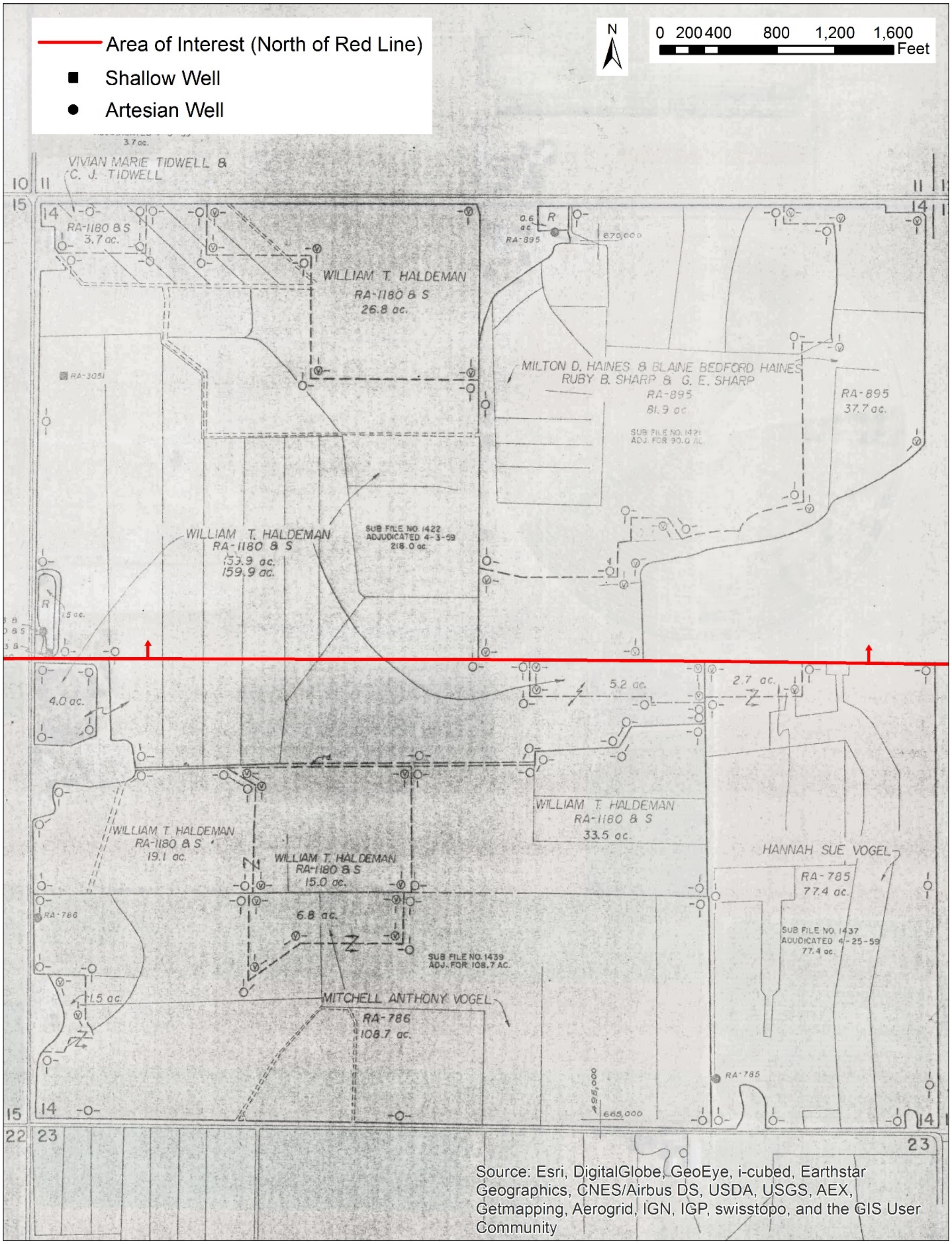
Map Sheet 6 NMOSE RA Hydrographic Survey. Township 17S, Range 26E, Sec. 11, N.M.P.M.



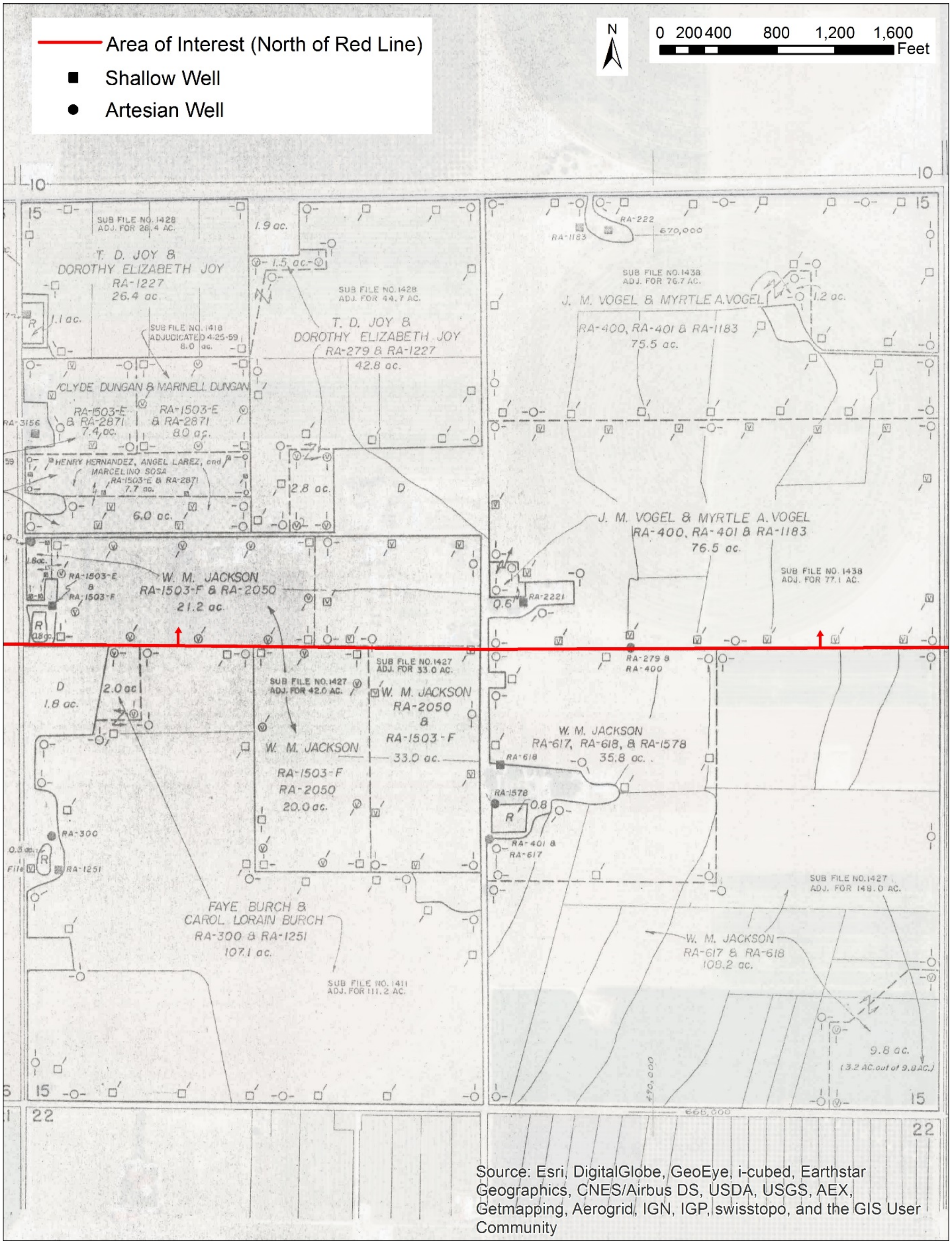
Map Sheet 7 NMOSE RA Hydrographic Survey. Township 17S, Range 26E, Sec. 12, N.M.P.M.



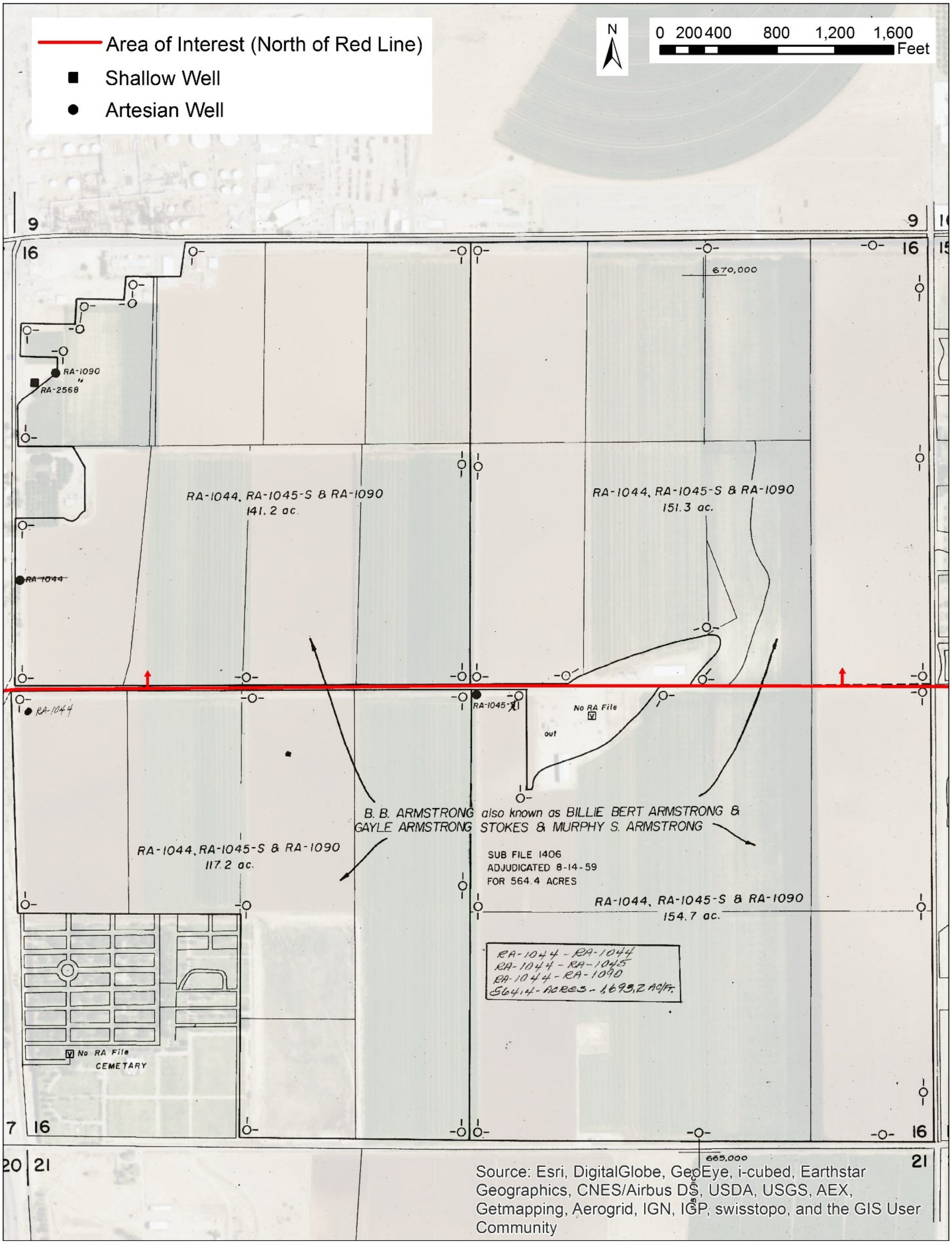
Map Sheet 8 NMOSE RA Hydrographic Survey. Township 17S, Range 26E, Sec. 13, N.M.P.M.



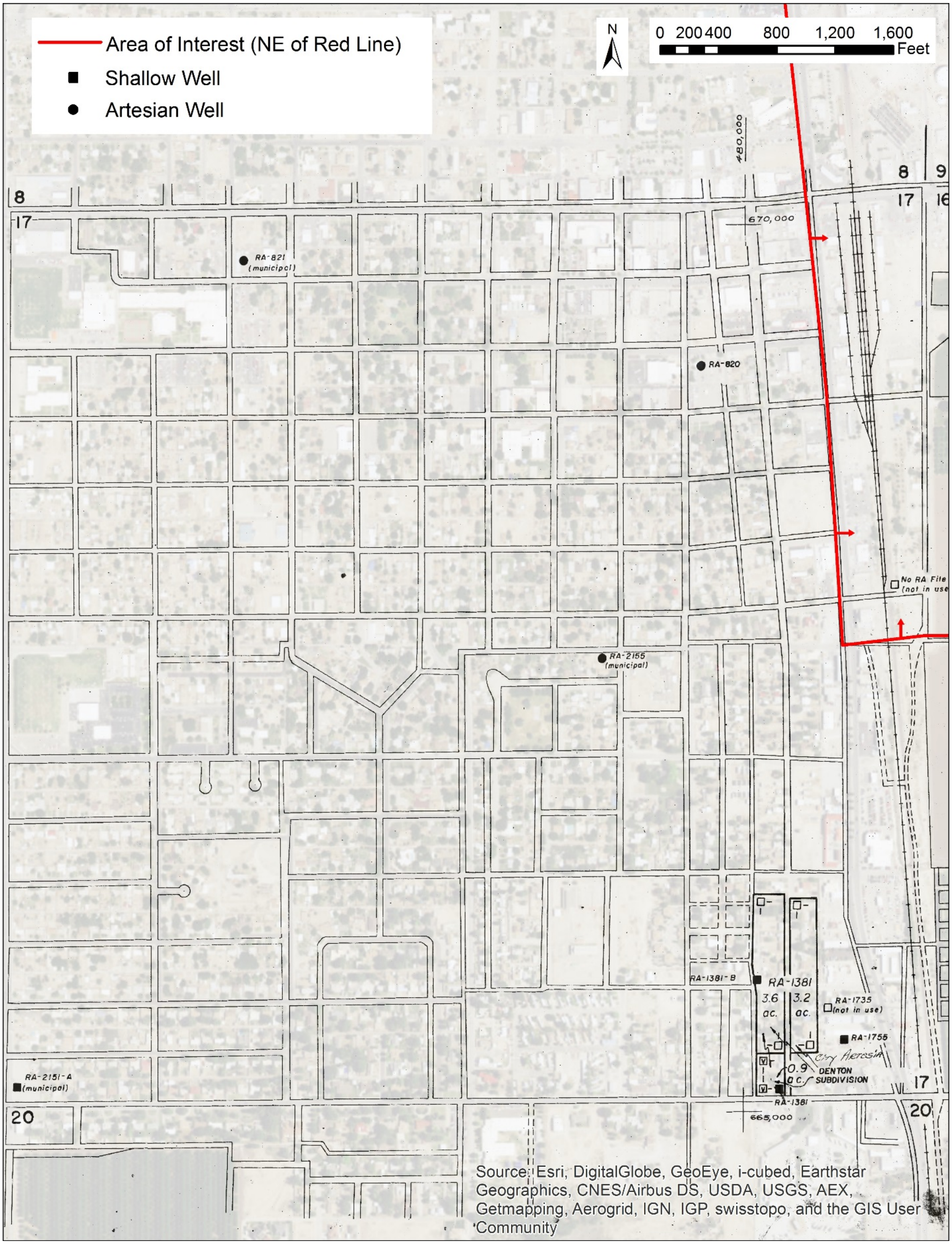
Map Sheet 9 NMOSE RA Hydrographic Survey Township 17S, Range 26E, Sec. 14, N.M.P.M.



Map Sheet 10 NMOSE RA Hydrographic Survey.Township 17S, Range 26E, Sec. 15, N.M.P.M.



Map Sheet 11 NMOSE RA Hydrographic Survey. Township 17S, Range 26E, Sec. 16, N.M.P.M.



Map Sheet 12 NMOSE RA Hydrographic Survey. Township 17S, Range 26E, Sec. 17, N.M.P.M.

Appendix D: All Well Records

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
ROSWELL

Tom Blaine, P.E.
State Engineer

DISTRICT II
1900 West Second St.
Roswell, New Mexico 88201
Phone: (575) 622-6521
Fax: (575) 623-8559

July 23 2018

Navajo Refinery
P.O Box 159
Artesia, NM 88211

RECEIVED
JUL 31 2018
BY RDade

RE: OSE Well Plugging Record RA-1097.

Greetings:

Enclosed is your copy of the Well Plugging Record RA-1097, received and filed in our office on June 5, 2018.

Sincerely,

C Guillen

Claudia K. Guillen
Domestic Well Technician

cc Santa Fe OSE

Office of the State Engineer

PLUGGING RECORD

GREAT SEAL OF THE STATE OF NEW MEXICO · CRESCIT EUNDO · 1912

NOTE: A Well Plugging Plan of Operations shall be approved by the State Engineer prior to plugging - 19.27.4 NMAC

I. GENERAL / WELL OWNERSHIP:

State Engineer Well Number: RA 1097

Well owner: NAVAJO REFINERY Phone No.: 575-746-5382

Mailing address: PO BOX 159

City: ARTESIA State: NM Zip code: 88211-0159

II. WELL PLUGGING INFORMATION:

1) Name of well drilling company that plugged well: PECOS VALLEY ARTESIAN CONSERVANCY DISTRICT

2) New Mexico Well Driller License No.: WD-190 Expiration Date: MAY 2020

3) Well plugging activities were supervised by the following well driller(s)/rig supervisor(s): WESLEY NEEDHAM JR., JOE NIECE, DANNY CASTRO, ROBERT CALLAWAY

4) Date well plugging began: JUNE 25, 2018 Date well plugging concluded: JULY 3, 2018

5) GPS Well Location: Latitude: N32 deg, 51 min, 02.16 sec
Longitude: W104 deg, 23 min, 49.14 sec, WGS 84

6) Depth of well confirmed at initiation of plugging as: 1123 ft below ground level (bgl), by the following manner: WELL LOG

7) Static water level measured at initiation of plugging: 137 ft bgl

8) Date well plugging plan of operations was approved by the State Engineer: 6-19-18

9) Were all plugging activities consistent with an approved plugging plan? YES If not, please describe differences between the approved plugging plan and the well as it was plugged (attach additional pages as needed):

STATE ENGINEER OFFICE
ROSWELL NEW MEXICO
2018 JUL -5 PM 2:23

10) Log of Plugging Activities - Label vertical scale with depths, and indicate separate plugging intervals with horizontal lines as necessary to illustrate material or methodology changes. Attach additional pages if necessary.

For each interval plugged, describe within the following columns:

Depth (ft bgl)	Plugging Material Used (include any additives used)	Volume of Material Placed (gallons)	Theoretical Volume of Borehole/ Casing (gallons)	Placement Method (tremie pipe, other)	Comments ("casing perforated first", "open annular space also plugged", etc.)
495'	PORTLAND I-II CEMENT SLURRY	2020 GALLONS	1941 GALLONS	TREMIE PIPE	OPEN ANNULAR ALSO PLUGGED
625'	PORTLAND I-II CEMENT SLURRY	1818 GALLONS	1818 GALLONS	TREMIE PIPE	OPEN ANNULAR ALSO PLUGGED

MULTIPLY		BY		AND OBTAIN
cubic feet	x	7.4805	=	gallons
cubic yards	x	201.97	=	gallons

III. SIGNATURE:

I, WESLEY NEEDHAM JR. , say that I am familiar with the rules of the Office of the State Engineer pertaining to the plugging of wells and that each and all of the statements in this Plugging Record and attachments are true to the best of my knowledge and belief.

Wesley Needham
Signature of Well Driller

JULY 5, 2018
Date

New Mexico Office of the State Engineer
Transaction Summary

72121 All Applications Under Statute 72-12-1

Transaction Number: 199642 **Transaction Desc:** RA 02342 **File Date:** 09/22/1960

Primary Status: EXP Expired Permit
Secondary Status: EXP Expired
Person Assigned: *******
Applicant: LEROY SUMRULD

Events

Date	Type	Description	Comment	Processed By
09/22/1960	APP	Application Received	*	*******
09/29/1960	FIN	Final Action on application		*******
09/29/1960	WAP	General Approval Letter		*******
10/16/1960	EXP	Expired Permit (well log late)		*******

Change To:

WR File Nbr	Acres	Diversion	Consumptive	Purpose of Use
RA 02342		3		DOM 72-12-1 DOMESTIC ONE HOUSEHOLD

****Point of Diversion**

RA 02342	R	558888	3634111*

***An (*) after northing value indicates UTM location was derived from PLSS - see Help**

Remarks

EXISTING WELL RA-2342 HAS FAILED AND IS TO BE MOVED 100 FEET WEST MORE OR LESS TO A MORE CONVENIENT LOCATION.

Conditions

4 Use shall be limited to household, non-commercial trees, lawn and garden not to exceed one acre and/or stock use.

Action of the State Engineer

**** See Image For Any Additional Conditions of Approval ****

Approval Code: A - Approved
Action Date: 09/29/1960
Log Due Date: 10/15/1960
State Engineer:

New Mexico Office of the State Engineer

Water Right Summary

WR File Number: RA 02342   **Subbasin:** RA   **Cross Reference:** -

Primary Purpose: DOM 72-12-1 DOMESTIC ONE HOUSEHOLD

Primary Status: PMT PERMIT

Total Acres: **Subfile:** -

Total Diversion: 3   **Cause/Case:** -

Owner: LEROY SUMRULD

Documents on File

Trn #	Doc	File/Act	Status 1	Status 2	Transaction Desc.	From/ To	Acres	Diversion	Consumptive
199642	72121	1960-09-29	EXP	EXP	RA 02342	T		3	
199639	COWNF	1960-09-22	CHG	PRC	RA 02342	T		3	
199637	72121	1947-08-25	PMT	LOG	RA 02342	T		3	

Current Points of Diversion

(NAD83 UTM in meters)

POD Number	Well Tag	Source	Q 64	Q 16	Q 4	Sec	Tws	Rng	X	Y	Other Location Desc
RA 02342		Shallow	4	4	3	10	17S	26E	558888	3634111*	

***An (*) after northing value indicates UTM location was derived from PLSS - see Help**

New Mexico Office of the State Engineer
Transaction Summary

72121 All Applications Under Statute 72-12-1

Transaction Number: 199637 **Transaction Desc:** RA 02342 **File Date:** 08/20/1947

Primary Status: PMT Permit
Secondary Status: LOG Well Log Received
Person Assigned: *******
Applicant: O.C. ROGERS

Events

Date	Type	Description	Comment	Processed By
08/20/1947	APP	Application Received	*	*******
08/25/1947	FIN	Final Action on application		*******
08/25/1947	WAP	General Approval Letter		*******
08/25/1948	LOG	Well Log Received	*NO WELL RECORD FILED,PCW FILE	*******

Change To:

WR File Nbr	Acres	Diversion	Consumptive	Purpose of Use
RA 02342		3		DOM 72-12-1 DOMESTIC ONE HOUSEHOLD

****Point of Diversion**

RA 02342 558888 3634111*

***An (*) after northing value indicates UTM location was derived from PLSS - see Help**

Conditions

4 Use shall be limited to household, non-commercial trees, lawn and garden not to exceed one acre and/or stock use.

Action of the State Engineer

**** See Image For Any Additional Conditions of Approval ****

Approval Code: A - Approved
Action Date: 08/25/1947
Log Due Date: 08/25/1948

State Engineer:

New Mexico Office of the State Engineer

Water Right Summary

WR File Number: RA 23420 **Subbasin:** RA **Cross Reference:** -

Primary Purpose: DOM 72-12-1 DOMESTIC ONE HOUSEHOLD

Primary Status: PMT PERMIT

Total Acres: **Subfile:** -

Total Diversion: 3 **Cause/Case:** -

Owner: O.C. ROGERS

Documents on File

Trn #	Doc	File/Act	Status 1	Status 2	Transaction Desc.	From/ To	Acres	Diversion	Consumptive
113719	72121	1947-08-25	PMT	APR	CONVERSION RA 23420	T		3	

---For more infomation on Conversion Transactions, please see Help---

Current Points of Diversion

(NAD83 UTM in meters)

POD Number	Well Tag	Source	Q 64	Q 16	Q 4	Sec	Tws	Rng	X	Y	Other Location Desc
RA 23420		Shallow	4	4	3	10	17S	26E	558888	3634111*	

***An (*) after northing value indicates UTM location was derived from PLSS - see Help**

New Mexico Office of the State Engineer
Point of Diversion Summary

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

Well Tag	POD Number	Q64	Q16	Q4	Sec	Tws	Rng	X	Y
	RA 23420	4	4	3	10	17S	26E	558888	3634111*

Driller License:		**Driller Company:**			
Driller Name:	A.F. SMITH				
Drill Start Date:	09/15/1947	**Drill Finish Date:**		**Plug Date:**	
Log File Date:	08/25/1948	**PCW Rcv Date:**		**Source:**	Shallow
Pump Type:		**Pipe Discharge Size:**		**Estimated Yield:**	
Casing Size:		**Depth Well:**	125 feet	**Depth Water:**	72 feet

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

New Mexico Office of the State Engineer
Transaction Summary

72121 All Applications Under Statute 72-12-1

Transaction Number: 259058 **Transaction Desc:** RA 02827 **File Date:** 11/21/1951

Primary Status: CAN Cancelled Permit
Secondary Status: FIN Finalized
Person Assigned: *******
Applicant: T.D. JOY

Events

Date	Type	Description	Comment	Processed By
11/21/1951	APP	Application Received		*******
11/26/1951	FIN	Final Action on application		*******
11/26/1951	WAP	General Approval Letter		*******
11/12/1954	FCN	Finalize Cancel of permit		*******
11/12/1954	FCN	Finalize Cancel of permit		*******

Change To:

WR File Nbr	Acres	Diversion	Consumptive	Purpose of Use
RA 02827		3		DOM 72-12-1 DOMESTIC ONE HOUSEHOLD

****Point of Diversion**

RA 02827 558690 3633908*

***An (*) after northing value indicates UTM location was derived from PLSS - see Help**

Conditions

4 Use shall be limited to household, non-commercial trees, lawn and garden not to exceed one acre and/or stock use.

Action of the State Engineer

**** See Image For Any Additional Conditions of Approval ****

Approval Code: A - Approved
Action Date: 11/26/1951
Log Due Date: 11/26/1952
State Engineer:

New Mexico Office of the State Engineer
Transaction Summary

72121 All Applications Under Statute 72-12-1

Transaction Number: 258042 **Transaction Desc:** RA 03195 **File Date:** 02/23/1954

Primary Status: PMT Permit
Secondary Status: APR Approved
Person Assigned: *******
Applicant: D.D. SULLIVAN
Contact: AGENT VICTOR CLACK

Events

Date	Type	Description	Comment	Processed By
02/23/1954	APP	Application Received		*******
03/08/1954	FIN	Final Action on application		*******
03/08/1954	WAP	General Approval Letter		*******

Change To:

WR File Nbr	Acres	Diversion	Consumptive	Purpose of Use
RA 03195		3		DOM 72-12-1 DOMESTIC ONE HOUSEHOLD

****Point of Diversion**

RA 03195 559091 3634113*

***An (*) after northing value indicates UTM location was derived from PLSS - see Help**

Remarks

This is old well RA-397. Well is to be tested for leakage. If well is leaking it will be plugged back to shallow water.

Conditions

4 Use shall be limited to household, non-commercial trees, lawn and garden not to exceed one acre and/or stock use.

Action of the State Engineer

**** See Image For Any Additional Conditions of Approval ****

Approval Code: A - Approved
Action Date: 03/08/1954
Log Due Date: 03/08/1955
State Engineer:

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Horner Farms Owner's Well No. RA-397

Street or Post Office Address 326 N. Bolton Rd.

City and State Artesia, N.M. 88210

Well was drilled under Permit No. TRN NO: 328730 and is located in the:

a. SW ¼ SW ¼ SE ¼ ¼ of Section 20 Township 17 S Range 26 E N.M.P.M.

b. Tract No. ______ of Map No. ______ of the ______

c. Lot No. ______ of Block No. ______ of the ______
Subdivision, recorded in Eddy County.

d. X= ______ feet, Y= ______ feet, N.M. Coordinate System ______ Zone in the ______ Grant.

(B) Drilling Contractor South East Drilling License No. 1400

Address ______

Drilling Began 3-28-05 Completed 4-14-05 Type tools Cable Size of hole 10¼ 7⅞ in.

Elevation of land surface or ______ at well is ______ ft. Total depth of well orginal depth 1095 ft.

Completed well is ☐ shallow ☒ artesian. Depth to water upon completion of well 71 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
			unknown	

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
OD 10 3/4	40.50	weld	0	194	194	Swedge 10x8	0	0
OD 8 5/8	24.43	weld	194	218.5	24.5	none	0	0

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
0	218.5	12¼	20	50SKS	pressure pumped
		10¼			circulated 10sks pit

Section 5. PLUGGING RECORD

Plugging Contractor ______
Address ______
Plugging Method ______
Date Well Plugged ______
Plugging approved by:

______
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 5-26-05

Quad ______ FWL ______ FSL ______

File No. RA397 Use Repair/Deepen Location No. 17S.26E.20.433

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		

Section 7. REMARKS AND ADDITIONAL INFORMATION

Squeeze split in casing

Run 194 FT $10\frac{3}{4}$ swedge down to $8\frac{5}{8}$

Total casing 218.5

Circulated cement, Drill cement out to 237

Hole ok

Original 196 FT $13\frac{3}{8}$ swedge X $10\frac{3}{4}$

see original log

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the described hole.

Driller

REVISED FEBRUARY 1969

2-19295
$5

(EXECUTE IN TRIPLICATE ACCOMPANIED BY $ 5 FILING FEE)

APPLICATION FOR PERMIT TO REPAIR OR DEEPEN WELL

File No. RA 397 + RA 1300 Comb A

1. Name of Water Right Owner Horner Farms
Mailing address 326 N. Bolton Rd.
City and State Artesia, N.M. 88210

2. Describe well location under one of the following subheadings:

a. SW ¼ SW ¼ SE ¼ of Sec. 10 Twp. 17S Rge. 26E N. M. P. M. in ______ County.

b. Tract No. ______ of Map No. ______ of the ______ District.

c. Lot No. ______ of Block No. ______ of the ______ Subdivision, of record in ______ County.

3. Source of supply Artesian (State whether artesian or non-artesian)

4. Right was acquired for irrigation purposes.

5. Type of repair contemplated: a. ☐ Clean out well to original depth b. ☐ Deepen well from 180 to 230 feet c. ☐ Other ______

6. Name of driller, if known: Mark Hammond

7. Additional statements or explanations: Split in casing from 180 to 230 ft. Attempting to pump cement into fracture and repair the problem.

I, Robert Horner affirm that the foregoing statements are true to the best of my knowledge and belief and that development shall not commence until approval of the permit has been obtained.

Robert Horner, Applicant

By: ______ Date: ______

ACTION OF STATE ENGINEER

This application is approved for the work indicated, subject to all general conditions and to the specific conditions numbered SACC 317 on the reverse side hereof. This permit will automatically expire unless work specified is completed and the well record filed on or before 3-31-04.

S. E. Reynolds, State Engineer:

By: ______

✓

Date: ______

Trn # 325736

GENERAL CONDITIONS OF APPROVAL

A. This application is approved provided it is not exercised to the detriment of any others having existing rights; further provided the use of water from the well is limited to that permitted, licensed, vested or adjudicated.

B. Work shall be done only by a licensed driller in the State of New Mexico in accordance with Section 75–11–13 New Mexico Statutes.

C. Driller's log must be filed in the office of the State Engineer within 10 days after well is repaired or deepened. Failure to file log within that time shall result in automatic cancellation of the permit. Log forms will be provided by the State Engineer upon request.

SPECIFIC CONDITIONS OF APPROVAL

(Applicable only when so indicated on the other side of this form.)

1. Depth of well in no event to exceed the thickness of the valley fill or Ogallala formation.

2. Well to be constructed to artesian well specifications and State Engineer Office to be notified before casing is landed or cemented.

3. Final approval for the use of said well dependent upon the results of a leakage test to be made by the State Engineer Office before and after repairs are made.

GENERAL INSTRUCTIONS

Application shall be executed in triplicate and forwarded with a $5.00 filing fee to the appropriate office of the State Engineer.

A separate application must be filed for each well to be repaired or deepened.

Requests for application or well log forms or for information in the following basins should be addressed to the State Engineer at the Office indicated:

Rio Grande, Bluewater, Estancia and Sandia Basins–
DISTRICT NO. 1
Room 1023
505 Marquette Avenue, N.W.
Albuquerque, New Mexico 87106

Roswell, Lea, Portales, Carlsbad, Capitan, Hondo, Penasco, Jal and Fort Sumner Basins–
DISTRICT NO. 2
Box 1717
Roswell, New Mexico 88201

Mimbres, Hot Springs, Virden Valley, Animas, Playas, Gila-San Francisco, San Simon, Lordsburg, Nutt-Hockett and Las Animas Basins–
DISTRICT NO. 3
Box 844
Deming, New Mexico 88030

NEW MEXICO STATE ENGINEER OFFICE
APPLICATION TO REPAIR WELL

SPECIFIC CONDITIONS OF APPROVAL

2 The well shall be constructed to artesian well specifications and the State Engineer shall be notified before casing is landed or cemented

7 The Permittee shall utilize the highest and best technology available to ensure conservation of water to the maximum extent practical.

B The well shall be drilled by a driller licensed in the State of New Mexico in accordance with Section 72-12-12 New Mexico Statutes Annotated.

C Driller's well record must be filed with the State Engineer within 10 days after the well is drilled or driven. Well record forms will be provided by the State Engineer upon request.

LOG The Point of Diversion RA 00397 must be completed and the Well Log filed on or before 03/31/2006.

ACTION OF STATE ENGINEER

Notice of Intention Rcvd:		Date Rcvd. Corrected:	
Formal Application Rcvd:	03/08/2005	Pub. of Notice Ordered:	
Date Returned - Correction:		Affidavit of Pub. Filed:	

This application is approved provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare of the state; and further subject to the specific conditions listed previously.

Witness my hand and seal this 23 day of Mar A.D., 2005

John R. D Antonio, Jr., P.E., State Engineer

By: Craig Hipple

Trn Desc: RA 00397 RA 1300 COMB A REPAIR

File Number: RA 00397

Trn Number: 328730

STATE OF NEW MEXICO

OFFICE OF THE STATE ENGINEER

ROSWELL

JOHN R. D'ANTONIO, JR. P.E.
State Engineer

DISTRICT II
1900 West Second St.
Roswell, New Mexico 88201
(505) 622-6521

March 25, 2005

TRN NBR: 328730
FILE NBR: RA-00397

HORNER FARMS
326 N BOLTON RD
ARTESIA, NM 88210

Greetings:

Enclosed is your copy of Application for Permit to Repair or Deepen Well, as numbered above, which has been approved subject to the conditions stated on the permit.

In accordance with General Condition C, a well record shall be filed in this office within ten (10) days after completion of drilling. The well record is proof of completion of the well. IT IS YOUR RESPONSIBILITY TO ASSURE THAT THE WELL LOG IS FILED WITHIN 10 DAYS OF DRILLING THE WELL.

This permit will expire on March 31, 2006, unless the well has been drilled and the well log filed in this office.

Sincerely,

/m Craig Hipple

Enclosure
cc: Santa Fe Office

File No.

NEW MEXICO OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO DRILL A WELL WITH NO CONSUMPTIVE USE OF WATER

(check applicable box):

For fees, see State Engineer website: http://www.ose.state.nm.us/ 02-29294 #5

☒ Exploratory	☐ De-Watering	☐ Geo-Thermal
☐ Monitoring	☐ Pollution Control And / Or Recovery	
☐ Temporary Request - Requested Start Date:	Requested End Date:	

1. APPLICANT(S)

Name: **Chase Farms, LLC**	Name: **Atkins Engineering Associates, Inc.**
Contact or Agent: check here if Agent ☐ **Richard Chase**	Contact or Agent: check here if Agent ☒ **Richard C. Cibak**
Mailing Address: **P.O. Box 658**	Mailing Address: **P.O. Box 3156**
City: **Artesia**	City: **Roswell**
State: **NM** Zip Code: **88211-0658**	State: **NM** Zip Code: **88202-3156**
Phone: ☐ Home ☐ Cell Phone (Work): **575-748-1299**	Phone: ☐ Home ☐ Cell Phone (Work): **575-624-2420**
E-mail:	E-mail: **richard@atkinseng.com**

STATE ENGINEER OFFICE ROSWELL, NEW MEXICO 2011 FEB 9 AM 9 09

OSE Date Stamp:

FOR OSE INTERNAL USE Application for Permit, Form wr-07, Rev 1/20/11

File Number: RA-11688	Trn Number: 473578
Trans Description (optional):	
Sub-Basin:	
PCW/LOG Due Date: 2-29-12	PBU Due Date:

Describe the well applicable to this application.

2. PROPOSED WELL
NOTE: If more than one (1) well, complete Attachment 1

OSE Well No. (if existing):						
Location (Required): Coordinate location must be New Mexico State Plane (NAD 83), UTM (NAD 83), **or** Lat/Long (WGS84)						
NM State Plane (NAD83) - In feet	NM West Zone ☐ NM Central Zone ☐ NM East Zone ☐			X (in feet): Y (in feet):		
UTM (NAD83) - In meters	UTM Zone 13N ☐ UTM Zone 12N ☐			Easting (in meters): Northing (in meters):		
Lat/Long (WGS84) - To 1/10th of second	Latitude:	**32** deg	**51** min	**1.6** sec		
	Longitude:	**104** deg	**22** min	**38.4** sec		
Land Grant (if applicable):						
Well is on Land Owned by (required): **Chase Farms, Llc**						
Other Location Information (complete the below, if applicable):						
PLSS Quarters or Halves: **SW¼SW¼NW¼**	Section: **10**	Township: **17S**	Range: **26E**	County: **Eddy**		
Lot No:	Block No:	Unit/Tract:	Subdivision:			
Hydrographic Survey:	Map:	Tract:				
Other description relating well to common landmarks, streets, or other:						
Well Information:						
Approximate depth of well (feet): **1000.00**	Outside Diameter of Well Casing (inches): **14.625**					
Driller Name: **Stewart Brothers Drilling Co.**	Driller License Number: **WD-331**					
Additional well descriptions are attached: ☐ **Yes** ☐ **No**	If yes, how many________					

3. ADDITIONAL STATEMENTS OR EXPLANATIONS

This application seeks to drill a well that will ultimately be permitted under OSE File No. RA-307-POD2. A driller is available now and the Emergency Request, dated January 20, 2011, under Section 72-12-24 NMSA has yet to be acted upon.

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO
2011 FEB 9 AM 9 09

FOR OSE INTERNAL USE | Application for Permit, Form wr-07

File Number: RA-11688	Trn Number: 473578

SPECIFIC REQUIREMENTS

The applicant must include the following, as applicable to each well type. Please check the appropriate boxes, to indicate the information has been included and/or attached to this application:

Exploratory:	Monitoring:	Pollution Control And / Or Recovery:	De-Watering:	Geo-Thermal:
☒ include a description of any proposed pump test, if applicable.	☐ include the reason for the monitoring well, and, ☐ the duration of the planned monitoring.	☐ include a plan for pollution control/recovery, that includes the following: ☐ a description of the need for the pollution control or recovery operation. ☐ the estimated maximum period of time for completion of the operation. ☐ the annual diversion amount. ☐ the annual consumptive use amount. ☐ the maximum amount of water to be diverted and injected for the duration of the operation. ☐ the method and place of discharge. ☐ the method of measurement of water produced and discharged. ☐ the source of water to be injected. ☐ the method of measurement of water injected. ☐ the characteristics of the aquifer. ☐ the method of determining the resulting annual consumptive use of water and depletion from any related stream system. ☐ proof of any permit required from the New Mexico Environment Department. ☐ an access agreement if the applicant is not the owner of the land on which the pollution plume control or recovery well is to be located.	☐ include a description of the proposed dewatering operation, ☐ the estimated duration of the operation, ☐ the maximum amount of water to be diverted, ☐ a description of the need for the dewatering operation, and, ☐ a description of how the diverted water will be disposed of.	☐ include a description of the geothermal heat exchange project, ☐ the amount of water to be diverted and re-injected for the project, ☐ the time frame for constructing the geothermal heat exchange project, and, ☐ the duration of the project. ☐ preliminary surveys, design data, and additional information shall be included to provide all essential facts relating to the request.

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO
2011 FEB 9 AM 9 09

ACKNOWLEDGEMENT

I, We (name of applicant(s)), **Atkins Engineering Associates, Inc. - agent for Chase Farms, LLC**
Print Name(s)

affirm that the forgoing statements are true to the best of (my, our) knowledge and belief.

Applicant Signature Applicant Signature

ACTION OF THE STATE ENGINEER

This application is (check one):

☐ approved ☐ partially approved ☐ denied

provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare and further subject to the attached conditions of approval (*please see attachment*).

Witness my hand and seal this 14 day of Feb 20 11 , for the State Engineer,

By: Andy Morley
Signature

Andy Morley
Print

Title: Staff Manager
Print

FOR OSE INTERNAL USE Application for Permit, Form wr-07

File Number: RA-11688	Trn Number: 473578

NEW MEXICO STATE ENGINEER OFFICE
PERMIT TO EXPLORE

SPECIFIC CONDITIONS OF APPROVAL

4 No water shall be appropriated and beneficially used under this permit.

C Driller's well record must be filed with the State Engineer within 20 days after the well is drilled or driven. Well record forms will be provided by the State Engineer upon request.

C2 No water shall be diverted from this well except for testing purposes which shall not exceed twenty (20) cumulative days, and well shall be plugged or capped on or before , unless a permit to use water from this well is acquired from the Office of the State Engineer.

LOG The Point of Diversion RA 11688 POD1 must be completed and the Well Log filed on or before 02/29/2012.

WELL SHALL BE CONSTRUCTED TO ARTESIAN WELL SPECIFICATIONS. OSE SHALL BE NOTIFIED 48 HRS PRIOR TO THE WELL LANDED &/OR CEMENTED WELL SHALL BE CONSTURCTED, MAINTAINED & OPERATED THAT EACH WATER SHALL BE CONFINED TO THE AQUIFER IT IS ENCOUNTERED

ACTION OF STATE ENGINEER

Notice of Intention Rcvd: | Date Rcvd. Corrected:
Formal Application Rcvd: 02/09/2011 | Pub. of Notice Ordered:
Date Returned - Correction: | Affidavit of Pub. Filed:

This application is approved provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare of the state; and further subject to the specific conditions listed previously.

Witness my hand and seal this 14 day of Feb A.D., 2011

John R. D Antonio, Jr., P.E. , State Engineer

By: Andy Morley
Andy Morley

Trn Desc: RA 11688

File Number: RA 11688
Trn Number: 473578

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
District 2 Office, Roswell, NM

John R. D'Antonio, Jr., P.E.
State Engineer

1900 West Second Street
Roswell, New Mexico 88201
(575) 622-6521
FAX: (575) 623-8559

February 14, 2011

Trn Nbr: 473578
File Nbr: RA-11688

Chase Farms, LLC
c/o Atkins Engineering Associates, Inc
2904 W Second Street
Roswell, NM 88201

Greetings:

Enclosed is your copy of the Exploratory Permit, which has been approved. In accordance with the conditions of approval, the well can only be tested for 10 cumulative days, and the well is to be capped or plugged on or before **02/29/12**, unless a permit to use the water is acquired from this office.

Sincerely,

Andy Morley

Andy Morley
Staff Manger
(505) 622-6521

Enclosure
cc: Santa Fe Office

Locator Tool Report

General Information:

Application ID: 31   Date: 02-14-2011   Time: 11:01:26

WR File Number: RA
Purpose: PLACE OF USE

Applicant First Name: CHASE FARMS, LLC
Applicant Last Name: ATKINS ENG ASS

GW Basin: ROSWELL ARTESIAN
County: EDDY

Critical Management Area Name(s): NONE
Special Condition Area Name(s): NONE
Land Grant Name: NON GRANT

PLSS Description (New Mexico Principal Meridian):

SW 1/4 of SW 1/4 of SW 1/4 of NW 1/4 of Section 10, Township 17S, Range 26E.

Coordinate System Details:

Geographic Coordinates:

Latitude:	32 Degrees	51 Minutes	1.6 Seconds	N
Longitude:	104 Degrees	22 Minutes	38.4 Seconds	W

Universal Transverse Mercator Zone: 13N

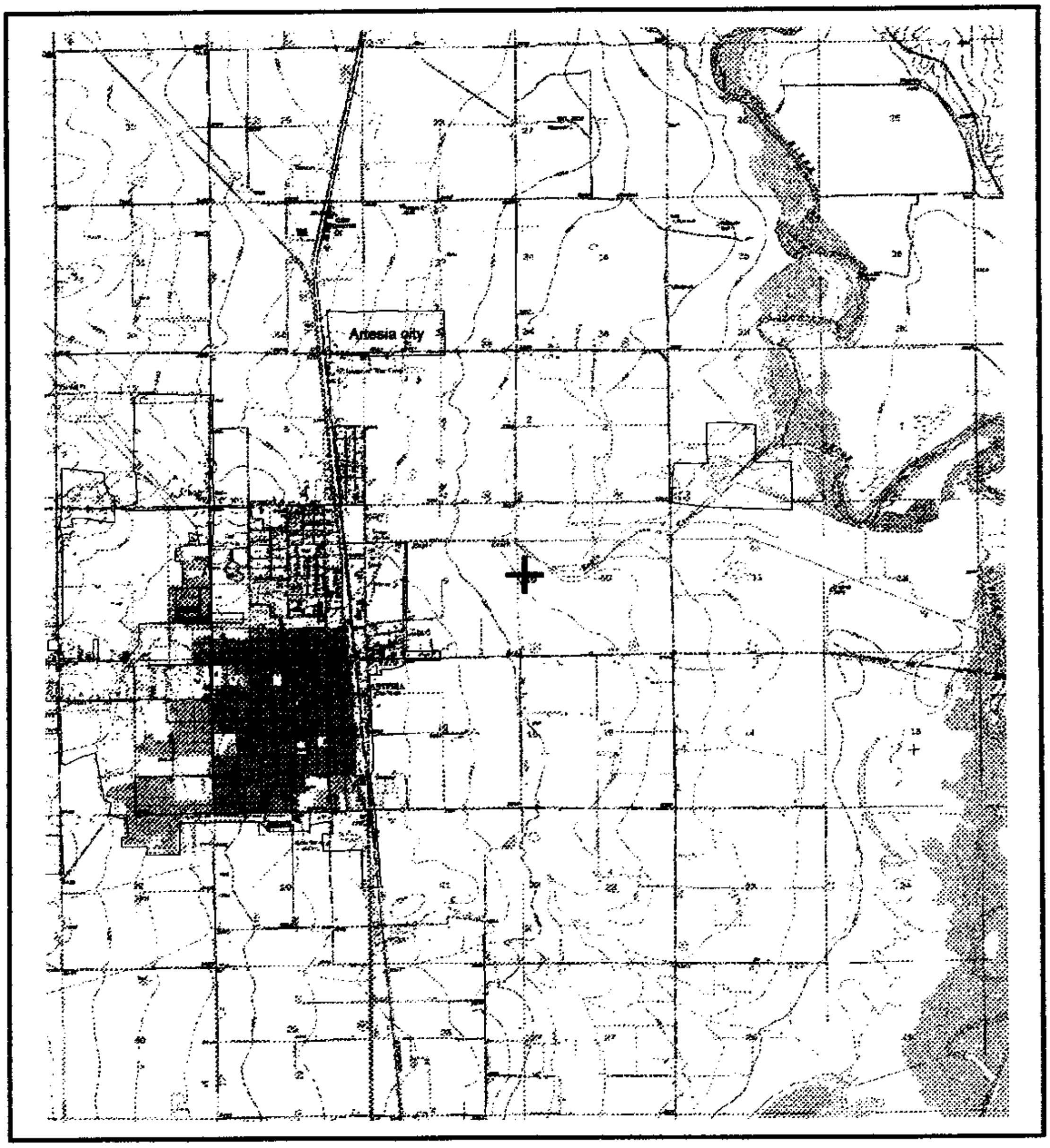
NAD 1983(92) (Meters)	N: 3,634,879	E: 558,265
NAD 1983(92) (Survey Feet)	N: 11,925,433	E: 1,831,576
NAD 1927 (Meters)	N: 3,634,676	E: 558,315
NAD 1927 (Survey Feet)	N: 11,924,767	E: 1,831,739

State Plane Coordinate System Zone: New Mexico East

NAD 1983(92) (Meters)	N: 205,170	E: 160,882
NAD 1983(92) (Survey Feet)	N: 673,128	E: 527,825
NAD 1927 (Meters)	N: 205,151	E: 148,330
NAD 1927 (Survey Feet)	N: 673,065	E: 486,647

NEW MEXICO OFFICE OF STATE ENGINEER

Locator Tool Report



WR File Number: RA Scale: 1:75,491

Northing/Easting: UTM83(92) (Meter): N: 3,634,879 E: 558,265

Northing/Easting: SPCS83(92) (Feet): N: 673,128 E: 527,825

GW Basin: Roswell Artesian

 Print Date: 02/14/2011

Atkins
ENGINEERING ASSOCIATES INC.

2904 W 2nd St.
Roswell, NM 88201
voice: 575.624.2420
fax: 575.624.2421
www.atkinseng.com

February 10, 2011

District 2 Office of the State Engineer
1900 West 2nd Street
Roswell, New Mexico 88201

Hand-delivered

Re: Artesian Well Plan of Operations for RA-307 POD2 (Chase Farms, LLC)

Greetings:

Enclosed with this letter is an Artesian Well Plan of Operations for well RA-307 POD2, which is being filed in anticipation of prompt approval of the emergency authorization request pursuant to 72-12-24 NMSA for Application for Permit to Drill a Supplemental Well to Supplement Underground Water No. RA-307 POD2, which was filed on January 20, 2011, and/or Application for Permit to Drill an Exploratory Well No. RA-307 POD2-Expl, which was filed on February 9, 2011.

Please contact this firm with any questions.

Sincerely,

James Reese, PE
Atkins Engineering Associates, Inc.
jim@atkinseng.com

Enclosure

cc: Chase Farms, LLC
Stewart Brothers Drilling Co.

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO
2011 FEB 10 P 3:19

Form WR-23

STATE ENGINEER OFFICE

FIELD ENGR. LOG

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed.

Section 1

(Plat of 640 acres)

(A) Owner of well A. B. Harris
Street and Number Box 842
City Artesia State N.M.
Well was drilled under Permit No. RA 4798 and is located in the SW ¼ SW ¼ ¼ of Section 10 Twp. 17 Rge. 26 NMPM
(B) Drilling Contractor C. T. Smith License No. WD 28
Street and Number 306 W Chisum
City Artesia State
Drilling was commenced May 23 19 63
Drilling was completed " 26 19 63

Elevation at top of casing in feet above sea level Total depth of well 850'
State whether well is shallow or artesian domestic Purpose Depth to water upon completion 120'

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				Perforated from 840' to 850'
2				
3				originally drilled for oil well
4				test
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To
7"								

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.
Street and Number City State
Tons of Clay used Tons of Roughage used Type of roughage
Plugging method used Date Plugged 19
Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received STATE ENGINEER OFFICE ROSWELL N.M. 1963 JUN -6 AM 8:21

File No. RA-4798 Use Dom. Location No. 17.26.10.330

Section 6

LOG OF WELL

Depth in Feet		Thickness in Feet	Color	Type of Material Encountered
From	To			

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

A. F. Smith
Well Driller

Table 1

Potential Shallow Water Well Receptors Identified within Area of Interest[1]

AEA Map ID[2]	Well ID[3]	Use[3]	Owner	Total Depth (feet bgs)	Perforation Depth (feet bgs) [4]	Source Zone[5]	Approximate Lateral Distance and Direction from Plume[6]	Comments/Further Analysis
5	RA-01097	Industrial	Navajo Refining Company	--	--	--	0 feet; within Refinery fence line and benzene plume	Well plugged and abandoned in 2018; see associated documentation provided in **Attachment C**.
6	RA-00602	Irrigation	Navajo Refining Company	--	--	--	460 feet NW (UG/CG) of MTBE plume; 700 feet N (CG) of benzene plume	--
7	RA-01973	Domestic One Household	J.O. Savoie	--	--	Shallow	1,080 feet N (CG) of MTBE plume	City of Artesia public water supply available for residences in this area.
8	RA-02368	Irrigation	& W.D. Pike, J.F. Lower	--	--	--	460 feet NW (UG/CG) of MTBE plume; 700 feet N (CG) of benzene plume	--
9	RA-02488	Domestic One Household	C. S. Powell	200	140 - 200	Shallow	570 feet NE (CG/DG) of MTBE plume; 1,050 feet N (CG) of benzene plume	Well not present at this location (within HFNR Property). City of Artesia public water supply available for residences to the NW of this area.
10	RA-02496	Domestic One Household	Clyde Boulden	--	--	--	460 feet NW (UG/CG) of MTBE plume; 700 feet N (CG) of benzene plume	Domestic well not present at this location (within HFNR Property). City of Artesia public water supply available for residences to the N of this area.
11	RA-02654	Domestic One Household	D.G. Winkles	115	--	Shallow	690 feet N (CG) of MTBE plume; 1,200 feet NE (CG) of benzene plume	Well not present at this location (within HFNR Property). City of Artesia public water supply available for residences to the NW of this area.
12	RA-03225	Domestic One Household	J.C. Golemon	100	65 - 94	Shallow	1,050 feet NE (CG) of MTBE plume; 1,600 feet north/NE (CG) of benzene plume	City of Artesia public water supply available for residences in this area.
13	RA-03282	Domestic One Household	Cecil G. Standard	125	105 - 125	Shallow		City of Artesia public water supply available for residences in this area.
14	RA-03662	Domestic One Household	Fred Morgan	--	--	--	690 feet N (CG) of MTBE plume; 1,200 feet NE (CG) of benzene plume	Well not present at this location (within HFNR Property). City of Artesia public water supply available for residences to the NW of this area.
15	RA-05163	Domestic One Household	J.B. Mulcock	--	--	--	460 feet NW (UG/CG) of MTBE plume; 700 feet N (CG) of benzene plume	Domestic well not present at this location (within HFNR Property). City of Artesia public water supply available for residences to the N of this area.
16	RA-02698	Domestic One Household	Britton Coll	140	--	Shallow	790 feet NW (UG) and 1,100 feet N (CG) of MTBE plumes; 1,050 feet N (CG) of benzene plume	No well present at this location (within HFNR Property). Well either does not exist or location data is inaccurate based on Refinery knowledge.
17	RA-10378	Domestic One Household	Sue C. Pemberton	190	115 - 190	Shallow		NMOSE well location data inaccurate based on Refinery knowledge; well is likely located to east on Parcel 4 153-098-515-219. HFNR confirmed presence of one domestic well at this property in visual, drive-by survey.
18	RA-03890	Municipal	City of Artesia	--	--	--	0 feet; within Refinery fence line and benzene plume	No well present at this location (within HFNR Property). No City of Artesia municipal well present within HFNR Property.
19	RA-00768	Industrial	Navajo Refining Company	--	--	--	0 feet; within Refinery fence line and MTBE/benzene plumes	Active Refinery industrial water supply well referred to as "Collier Well". Screened within Deep Artesian Aquifer.
20	RA-02723	Domestic One Household	Britton Coll	318	240 - 318	Shallow	0 feet; within Refinery fence line and MTBE/benzene plumes	Well is likely RA-3723 that was included in the facility-wide groundwater monitoring program, but is no longer sampled. No domestic well present at this location (within HFNR Property).
24	RA-06550	Domestic One Household	Lee Dilbeck	125	90 - 120	Shallow	1,290 feet N (CG) of MTBE plume	--
26	RA-11688	Non-Consumptive	Chase Farms, LLC	--	--	--	290 feet NW (UG) and 1,450 feet NE (CG) of MTBE plumes; 1,000 feet N (CG) of benzene plume	Well installed for non-consumptive use; see associated documentation provided in **Attachment C**.
28	RA-00307	Irrigation	--	278	--	Shallow	200 feet NW (UG) and 1,640 feet NE (CG) of MTBE plumes; 1,200 feet N (CG) of benzene plume	Potentially one well with multiple IDs resulting from well maintenance records. RA-01488 has two records with different locations (AEA Map IDs 29 and 31). Well(s) are not used for domestic purposes.
29	RA-01488	Irrigation	--	278	--	Shallow		
30	RA-01331	Exploratory	Chase Farms	278	--	Shallow		
31	RA-01488	Irrigation	--	--	--	Shallow	1,890 feet NE (CG) of MTBE plume	RA-01488 has two records with different locations (AEA Map IDs 29 and 31).
32	RA-03368	Domestic One Household	A.T. Woelk	215	192-215	Shallow		Well record located within an orchard, location likely not accurate if used for domestic purposes.

Table 1

Potential Shallow Water Well Receptors Identified within Area of Interest[1]

AEA Map ID[2]	Well ID[3]	Use[3]	Owner	Total Depth (feet bgs)	Perforation Depth (feet bgs) [4]	Source Zone[5]	Approximate Lateral Distance and Direction from Plume[6]	Comments/Further Analysis
33	RA-02661	Domestic One Household	Iva Jones	--	--	--	3,500 feet E/NE (DG) of MTBE plume	Well record located within an orchard, location likely not accurate if used for domestic purposes.
34	RA-04196	Domestic One Household	Bruce Harris	294	275 - 294	--	600 feet E (DG) of MTBE plume; within the Pecan Orchard and benzene plume	Well location data inaccurate; well is currently in facility-wide groundwater monitoring program. HFNR records indicate this well is screened from 280-292. Well is used for irrigation purposes.
35	RA-04798	Domestic One Household	A.B. Harris	--	--	Shallow	900 feet E (DG) of MTBE plume; within the Pecan Orchard and benzene plume	Well location data inaccurate; well is currently in facility-wide groundwater monitoring program. HFNR records indicate this well is screened from 840-850 feet bgs within the Deep Artesian Aquifer; see associated documentation provided in **Attachment C**. Well is used for irrigation purposes.
36	RA-02342	Domestic One Household	Leroy Sumruld	--	--	Shallow	2,800 feet E (DG) of MTBE plume; 650 feet E (DG) of benzene plume	Likely multiple records for the same well resulting from typographical error (same installation dates and depths, etc. for these records). Well reported as "failed" and to be moved in 1960; see associated documentation provided in **Attachment C**. No wells present within the Pecan Orchard at this location.
37	RA-23420	Domestic One Household	O.C. Rogers	--	--	Shallow		
38	RA-00397	Irrigation	--	210	--	Shallow	4,000 feet E (DG) of MTBE plume; 1,800 feet E (DG) of benzene plume	Potentially one well with multiple IDs resulting from well maintenance records. Well(s) are not used for domestic purposes.
39	RA-00397A	Irrigation	--	210	--	Shallow		
40	RA-01300	Commerical	John R Gray, LLC	210	--	Shallow		
41	RA-02793	Domestic One Household	R.W. (Rogers Brothers) Rogers	--	--	--	3,400 feet E (DG) of MTBE plume; 1,000 feet E (DG) of benzene plume	In a visual drive-by survey, HFNR confirmed presence of a domestic well to the south of the NMOSE location data for this well record (near Highway 82, unable to determine if observed well was RA-02793 or RA-03195), but the observed well did not appear to be in operable condition. Plumes now fully delineated upgradient of the property associated with this well record.
42	RA-03195	Domestic One Household	D.D. Sullivan	--	--	--	3,300 feet E (DG) of MTBE plume; 1,100 feet E (DG) of benzene plume	Well record associated with shallow repair of irrigation well RA-00397 (Deep Artesian well with total depth 1,095 feet) in 2005, but NMOSE location data is not consistent with RA-00397. Repair successfully made between 194 to 218.5 feet, see associated documentation provided in **Attachment C**. In a visual drive-by survey, HFNR confirmed presence of a domestic well near the NMOSE location data for this well record (unable to determine if observed well was RA-02793 or RA-03195), but the observed well did not appear to be in operable condition. Plumes now fully delineated upgradient of the property associated with this well record.
44	RA-01414	Irrigation	William Vance Haldeman	105	--	Shallow	3,800 feet NE (CG/DG) of benzene plume	RA-01414 has three records with different locations (AEA Map ID 44, 45, and 51).
45	RA-01414	Irrigation	--	--	--	Shallow	4,200 feet E (DG) of benzene plume	
46	RA-09912	Exploratory	Vance Haldeman	250	45-170, 158-249	--	4,200 feet E (DG) of benzene plume	--
50	RA-00763	Irrigation	--	--	--	--	4,500 feet SE (DG/CG) of benzene plume	RA-00763 has three records with different locations (AEA Map ID 50, 55, and 56).
51	RA-01414	--	--	--	--	Shallow	4,180 feet E/SE (DG/CG) of benzene plume	RA-01414 has three records with different locations (AEA Map ID 44, 45, and 51).
52	RA-03051	Domestic One Household	W.T. Haldeman	--	--	Shallow		--
53	RA-03518	Domestic One Household	W. T. Haldeman	220	--	Shallow		--
54	RA-08941	Domestic One Household	Dennis Tidwell	100	60-100	--	4,000 feet SE (DG/CG) of benzene plume	--

Table 1

Potential Shallow Water Well Receptors Identified within Area of Interest[1]

AEA Map ID[2]	Well ID[3]	Use[3]	Owner	Total Depth (feet bgs)	Perforation Depth (feet bgs) [4]	Source Zone[5]	Approximate Lateral Distance and Direction from Plume[6]	Comments/Further Analysis
59	RA-11977	Domestic & Livestock	Chance Sexton	200	140-200	--	4,890 feet SE (DG/CG) of benzene plume	--
64	RA-00279	Irrigation	--	--	--	Shallow	1,300 feet S/SE of MTBE plume; 990 feet S (CG) of benzene plume	Potentially just one well with multiple IDs resulting from multiple well maintenance records. There are 2 records for RA-01227 (AEA Map IDs 66 and 68) and this occurrence (AEA Map ID 66) is likely the known well RA-1227 that is included in the groundwater monitoring program, but has not been sampled since 2011 due to lack of property access. RA-00400 also has two records with different locations (AEA Map IDs 65 and 76).
65	RA-00400	Irrigation	--	--	--	Shallow		
66	RA-01227	Irrigation	T.D. Joy	--	--	Shallow		
67	RA-09866	Domestic One Household	Eddie C. Larue	165	--	Shallow		Well location likely inaccurate; well is likely located to west on Parcel 4-154-099-012-102. "LA RUE WELL" previously sampled as part of facility-wide groundwater monitoring program.
68	RA-01227	Irrigation	--	--	--	--	2,000 feet SE (CG/DG) of MTBE plume; 550 feet S (CG) of benzene plume	There are 2 records for RA-01227 (AEA Map IDs 66 and 68) and this occurrence (AEA Map ID 68) is not located close to the known RA-1227 that is included in the groundwater monitoring program.
69	RA-02827	Domestic One Household	T.D. Joy	--	--	--		Permit was approved in 1951 and cancelled in 1954; unable to determine if this well was ever installed. See associated documentation provided in **Attachment C**.
70	RA-03353	Domestic One Household	T.D. Joy	295	232 - 295	Shallow		This well was historically sampled as part of the facility-wide groundwater monitoring program, but was removed around 2010 since it was inoperable with no electricity. Former associated residence was demolished in 2019 and the property is no longer zoned as residential (see property record provided in **Attachment D**).
76	RA-00400	Irrigation	--	225	--	Shallow	3,300 feet SE/E (CG/DG) of MTBE plume; 1,450 feet SE/E (CG/DG) benzene plume	RA-00400 has two records with different locations (AEA Map ID 65 and 76).
77	RA-01183	Irrigation	--	225	--	Shallow		RA-01183 has three records with different locations (AEA Map ID 77, 78, and 82).
78	RA-01183	Irrigation	--	--	--	--		RA-01183 has three records with different locations (AEA Map ID 77, 78, and 82).
79	RA-02222	Domestic One Household	J.M. Vogle	171	141-170	Shallow	4,000 feet SE/E (CG/DG) of MTBE plume; 2,100 feet SE/E (CG/DG) of benzene plume	--
80	RA-02783	Domestic One Household	G. E. Key	--	--	Shallow	3,500 feet SE (CG/DG) of MTBE plume; 1,900 feet SE (CG/DG) of benzene plume	--
84	RA-02568	Domestic One Household	HollyFrontier Navajo Refining	220	lower 30	Shallow	1,300 feet S (CG) of MTBE plume; 800 feet S (CG) of benzene plume	--

Notes:

[1] Area of Interest = 0.25-mile (1,320 feet) Crossgradient and 1-mile (5,280 feet) Downgradient of Current (April 2021) MTBE and Benzene CGWSL Exceedance Area in Shallow Groundwater

[2] Map identification number shown on Figure 1A of Appendix A of Atkins Engineering & Associates Inc. "Report of Navajo Refining Company Possible Shallow Receptor Records Study Artesia, NM" dated February 2016.

[3] Well identification and documented use per New Mexico Office of the State Engineer (NMOSE), New Mexico Water Rights Reporting System (NMWRRS).

[4] Perforation depth provided according to NMOSE, NMWRRS records and may differ from HollyFrontier Navajo Refining LLC (HFNR) records.

[5] Source zone according to NMOSE; "shallow" is equivalent to the valley fill zone.

[6] Distance according to NMOSE well location data and April 2021 semiannual groundwater monitoring results (see Figures 2 and 3 of accompanying report). "Plume" defined as April 2021 Critical Groundwater Screening Level (CGWSL) exceedance area.

Yellow highlighted domestic wells indicate additional assessment recommended.

-- = Not Available or Not Applicable

AEA = Atkins Engineering Associates Inc. (see Attachment B of accompanying report)

CG = Crossgradient
DG = Downgradient
E = east
feet bgs = feet below ground surface
HFNR = HollyFrontier Navajo Refining LLC
MTBE = methyl tert-butyl ether
N = north
NE = northeast
NW = northwest
S = south
SW= southwest
UG = Upgradient

Table 2

Residential Properties within Area of Interest [1]

Parcel ID[1]	Address	Owner	Comments
4-153-098-515-219	807 N Bolton Rd Artesia, NM 88210	Sue C. Pemberton	Domestic well RA-10378 likely present on this property (same owner). HFNR confirmed presence of domestic well at this property in visual, drive-by survey.
4-154-098-397-381	2109 E Main St Artesia, NM 88210	Gray Farm LLC	Large parcel with apparent agricultural and residential use. Residential structure present on the southwest corner of this property. Domestic well records RA-02793 and RA-03195 are associated with this property. HFNR confirmed the presence of at least one domestic well (potentially RA-02793 or RA-03195) near the residential structure during visual, drive-by survey (but well did not appear in operable condition). However, NMOSE record for RA-03195 appears to be associated with a shallow repair of irrigation well RA-00397 (completed in the Deep Artesian Aquifer) and therefore this domestic well may not exist (see associated documentation in **Attachment C**). Irrigation well records RA-00397, RA-00397A, and RA-01300 are also associated with this property.
4-154-099-012-102	307 S Bolton Rd Artesia, NM 88210	Eddie C. & Becky L. Larue	Domestic well RA-09866 likely present on this property (same owner).
4-154-099-012-131	401 S Bolton Rd Artesia, NM 88210	Gayla Sue & Sherrill (TJ) Gurley	No water well records identified for this property or property owner.
4-155-098-064-515	11002 Lovington Highway, Artesia, NM 88210	Haldeman Enterprises Inc.	Small residential structure located in the eastern portion of this property. No water well records associated with this parcel.
4-155-099-037-022	105 S. Haldeman Rd, Artesia, NM 88210	Linda K. Tidwell	Small parcel with residential and possibly some agricultural use. Residential structure located in northwest corner of this property. Domestic well record RA-08941 likely associated with this property. Well RA-08941 is registered to Dennis Tidwell and is located on the southeastern corner of this property.

Notes:

[1] Area of Interest = 0.25-mile Crossgradient and 1-mile Downgradient of Current (April 2021) MTBE and Benzene CGWSL Exceedance Area in Shallow Groundwater

[2] Eddy County, New Mexico Parcel Identification.

CGWSL = Critical Groundwater Screening Level

MTBE = methyl tert-butyl ether

NMOSE = New Mexico Office of the State Engineer

A previous version of this table (included in the April 2019 *Desktop Groundwater Receptor Survey and Vapor Intrusion Evaluation of Off-Site Receptors* memorandum) included an additional residential property (Parcel 4-154-099-146-071) that contained a vacant residence at the time. This parcel is no longer zoned as residential and the vacant residential structure has been demolished. The parcel has been removed from this table and the residence information removed from associated figures.

Table 3
Summary of Groundwater Sample Locations Used for Off-Site Vapor Intrusion Evaluation

Site ID	Screen Interval (ft bgs)	Groundwater Zone
KWB-2R	Unknown	Shallow
KWB-4	20 to 39	Shallow
KWB-7	18 to 32	Shallow
KWB-8	15 to 34	Shallow
KWB-11A	30 to 39.5	Shallow
KWB-11B	50 to 69.5	Valley Fill
KWB-12A	15.5 to 24.5	Shallow
KWB-12B	25.5 to 39.5	Valley Fill
MW-8	Unknown	Shallow
MW-20	9.5 to 23.5	Shallow
MW-21	7.5 to 22	Shallow
MW-48	Unknown	Shallow
MW-52	19 to 34	Shallow
MW-53	13.8 to 23.8	Shallow
MW-57	10 to 30	Shallow
MW-58	13 to 28	Shallow
MW-68	14.75 to 24.5	Shallow
MW-71	9.75 to 19.5	Shallow
MW-113	20 to 35	Shallow
MW-130	30 to 45	Shallow
MW-132	15 to 40	Shallow
MW-133	15 to 35	Shallow
MW-135	35 to 65	Shallow
NP-1	9.5 to 19	Shallow
NP-6	8.75 to 18.75	Shallow
RA-313	904 to 1157	Artesian
RA-3156	182	Artesian
RA-4196	280 to 292	Artesian
RA-4798	840 to 850	Artesian
RW-12/12R	15 to 35	Shallow
RW-13/13R	15 to 35	Shallow
RW-15[a]	Unknown	Shallow
RW-19	11 to 46	Shallow
RW-20	Unknown	Shallow
RW-22	11.5 to 39	Shallow
UG-1	8 to 23	Shallow
UG-2	15 to 30	Shallow
UG-3R	17 to 37	Shallow
UG-4	19.5 to 39.5	Shallow

Notes:
[a] Recovery trench RW-15 has multiple access points for gauging and sampling.
RW-15C is the gauging/sampling point used during monitoring.
ft bgs = feet below ground surface

Table 4

Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

		Well ID:	KWB-2R		KWB-2R		KWB-2R		KWB-2R		KWB-2R		KWB-2R		KWB-4		KWB-7		KWB-7		KWB-7		KWB-7		KWB-7		KWB-7	
		Sample Date:	4/28/2016		10/5/2016		4/25/2017		10/4/2017		4/3/2019		10/22/2019		11/20/2020		4/27/2016		10/5/2016		4/25/2017		10/3/2017		10/2/2018		6/16/2020	
		Field Duplicate:																										
Chemical Name	**CAS**	**Units**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	µg/L	< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385				< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147	
1,1,1-Trichloroethane	71-55-6	µg/L	< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319				< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.149	
1,1,2,2-Tetrachloroethane	79-34-5	µg/L	< 0.130		< 0.130		0.160	J	< 0.130		< 0.130		< 0.130				< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133	
1,1,2-Trichloroethane	79-00-5	µg/L	< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383	J4			< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.158	
1,1-Dichloroethane	75-34-3	µg/L	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259				< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100	
1,1-Dichloroethene	75-35-4	µg/L	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398				< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188	
1,2,4-Trimethylbenzene	95-63-6	µg/L	49.7		34.7		34.1		150		148		139		254		48.2		7.00		11.5		25.8		1.86		87.6	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	µg/L	< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381	J4			< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.126	
1,2-Dichloroethane	107-06-2	µg/L	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361				< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819	
1,2-Dichloropropane	78-87-5	µg/L	< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306				< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149	
1,3,5-Trimethylbenzene	108-67-8	µg/L	0.489	J	0.427	J	< 0.387		< 0.387		1.72		2.33		45.5	J	9.03		0.877	J	< 0.387		< 0.387		< 0.387		< 0.104	
2-Butanone (MEK)	78-93-3	µg/L	< 3.93		< 3.93		16.4		< 3.93		< 3.93		< 3.93				< 3.93	J4	< 3.93		16.1		< 3.93		< 3.93		160	
2-Hexanone	591-78-6	µg/L	< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82				< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787	
4-Isopropyltoluene	99-87-6	µg/L	0.603	J	0.596	J	< 0.350		1.98		1.60		1.15				0.952	J	< 0.350		< 0.350		0.418	J	< 0.350		1.61	
4-Methyl-2-pentanone	108-10-1	µg/L	< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14				< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478	
Acetone	67-64-1	µg/L	< 10.0		< 10.0		< 10.0		< 10.0		< 10.0		< 10.0				< 10.0		< 10.0		< 10.0		< 10.0		< 10.0		< 11.3	
Benzene	71-43-2	µg/L	55.8		398		26.0		1120		177		920		2060		36.5		36.4		13.5		36.3		24.7		54.5	
Bromodichloromethane	75-27-4	µg/L	< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380				< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.136	
Bromoform	75-25-2	µg/L	< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469				< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129	
Bromomethane	74-83-9	µg/L	< 0.866		< 0.866		< 0.866		< 0.866		< 0.866	J3	< 0.866				< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.605	
Carbon disulfide	75-15-0	µg/L	0.363	J	< 0.275		0.332	J	0.367	J	< 0.275		< 0.275				< 0.275		< 0.275		< 0.275		< 0.275		8.91		1.18	
Carbon tetrachloride	56-23-5	µg/L	< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379				< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128	
Chlorobenzene	108-90-7	µg/L	< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348				< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116	
Chloroethane	75-00-3	µg/L	< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453				< 0.453		< 0.453		< 0.453		< 0.453		< 0.453	J4	< 0.192	
Chloroform	67-66-3	µg/L	< 0.324		< 0.324		3.60	J	< 0.324		< 0.324		< 0.324				< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.111	
Chloromethane	74-87-3	µg/L	< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276				< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960	
cis-1,2-Dichloroethene	156-59-2	µg/L	< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260				< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126	
cis-1,3-Dichloropropene	10061-01-5	µg/L	< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418				< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111	
Cyanide	57-12-5	µg/L															5.00	JP1	< 1.80		< 1.80		< 1.80		< 1.80	P1	< 1.80	
Dibromochloromethane	124-48-1	µg/L	< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327	J4			< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.140	
Ethylbenzene	100-41-4	µg/L	48.3		13.0		5.43		325		686		264		632		24.8		16.7		8.58		15.6		1.78		9.36	
Isopropylbenzene	98-82-8	µg/L	18.7		33.0		8.16		63.5		40.3		72.4				14.0		22.8		13.6		10.3		5.04		40.9	
m,p-Xylene	179601-23-1	µg/L	49.6		27.0		27.3		183		175		109		440		21.8		19.6		7.00		13.2		1.56	J	39.0	
Mercury	7439-97-6	µg/L															< 0.0490		< 0.0490		< 0.0490		< 0.0490		0.134	J	< 0.100	
Methyl tert-butyl ether	1634-04-4	µg/L	23.1		18.4		19.2		20.2		23.5		21.6		5270		10.4		5.82		6.78		5.10		9.28		9.32	
Methylene chloride	75-09-2	µg/L	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00				< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430	
Naphthalene	91-20-3	µg/L	8.06		4.40	J	6.09		67.5		9.93	J4	32.3		120	J	14.1		1.20	JJ4	4.09	J	3.50	J	< 1.00		8.22	
n-Butylbenzene	104-51-8	µg/L	2.05		3.03		< 0.361		4.53		1.47		3.15				3.65		0.757	J	< 0.361		0.456	J	< 0.361		0.580	J
n-Propylbenzene	103-65-1	µg/L	31.4		54.4		12.1		111		54.8		101				19.3		15.8		9.92		10.5		3.33		20.5	
o-Xylene	95-47-6	µg/L	1.89		1.85		0.772	J	9.77		5.00		6.08		46.9	J	1.67		< 0.341		0.576	J	1.12		< 0.341		2.26	
sec-Butylbenzene	135-98-8	µg/L	3.50		5.88		2.79		9.96		4.53		8.57				6.07		6.91		7.14		5.91		3.14		8.79	
Styrene	100-42-5	µg/L	< 0.307		< 0.307		< 0.307		< 0.307		0.710	J	3.48				< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118	
Tetrachloroethene	127-18-4	µg/L	< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372				< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300	
Toluene	108-88-3	µg/L	1.52	J	2.90	J	< 0.412		16.1		8.20		14.0	J4	52.7	J	< 0.780		1.55	J	< 0.412		< 0.412		< 0.412		0.536	J
trans-1,2-Dichloroethene	156-60-5	µg/L	< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396				< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149	
trans-1,3-Dichloropropene	10061-02-6	µg/L	< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419				< 0.419	J4	< 0.419		< 0.419		< 0.419		< 0.419		< 0.118	
Trichloroethene	79-01-6	µg/L	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398				< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190	
Vinyl chloride	75-01-4	µg/L	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259				< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.234	
Xylenes, total	1330-20-7	µg/L	51.5		28.9		28.1		193		180		115		487		23.5		19.6		7.57		14.3		1.56	J	41.3	

Table 4

Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

Samp Field D		KWB-7 10/6/2020		KWB-7 4/14/2021		KWB-8 10/5/2016		KWB-8 4/25/2017		KWB-8 10/3/2017		KWB-8 10/6/2020		KWB-11A 4/27/2016		KWB-11A 10/5/2016		KWB-11A 4/25/2017		KWB-11A 10/3/2017		KWB-11A 4/3/2018		KWB-11A 10/2/2018		KWB-11A 4/2/2019	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.147		< 0.147		< 77.0		< 38.5		< 0.385		< 29.4		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385	J4
1,1,1-Trichloroethane	71-55-6	< 0.149		< 0.149		< 63.8		< 31.9		< 0.319		< 29.8		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.133		< 0.133		< 26.0		< 13.0		< 0.130		< 26.6		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130	
1,1,2-Trichloroethane	79-00-5	< 0.158		< 0.158		< 76.6		< 38.3		< 0.383		< 31.6		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383	
1,1-Dichloroethane	75-34-3	< 0.100		< 0.100		< 51.8		< 25.9		< 0.259		< 20.0		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	
1,1-Dichloroethene	75-35-4	< 0.188		< 0.188		< 79.6		< 39.8		< 0.398		< 37.6		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398	
1,2,4-Trimethylbenzene	95-63-6	2.87		212		170	J	380		114		833		25.6		34.1		14.2		23.0		2.90		5.00		0.467	J
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.126		< 0.126		< 76.2		< 38.1		< 0.381		< 25.2		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.00240	J4
1,2-Dichloroethane	107-06-2	< 0.0819		< 0.0819		< 72.2		< 36.1		< 0.361		< 16.4		< 0.361		< 0.361		0.409	J	< 0.361		< 0.361		< 0.361		< 0.361	
1,2-Dichloropropane	78-87-5	< 0.149		< 0.149		< 61.2		< 30.6		< 0.306		< 29.8		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306	
1,3,5-Trimethylbenzene	108-67-8	< 0.104		5.56		< 77.4		86.3	J	22.5		191	J	1.22		0.945	J	< 0.387		1.29		< 0.387		< 0.387		< 0.387	
2-Butanone (MEK)	78-93-3	< 1.19		< 1.19		< 786		< 393		88.5	V3	< 238		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93	
2-Hexanone	591-78-6	< 0.787		< 0.787		< 764		< 382		5.15	J	< 157		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82	
4-Isopropyltoluene	99-87-6	0.201	J	2.85		< 70.0		< 35.0		1.12		< 24.0		0.374	J	< 0.350		< 0.350		< 0.350		< 0.350		0.647	J	< 0.350	
4-Methyl-2-pentanone	108-10-1	< 0.478		< 0.478		< 428		< 214		< 2.14		< 95.6		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14	
Acetone	67-64-1	< 11.3		< 11.3		< 2000		< 1000		80.1	V3	< 2260		< 10.0		< 10.0		< 10.0		< 10.0		< 10.0		< 10.0		< 10.0	J4
Benzene	71-43-2	7.89		1010		11500		5620		12500		17800		5.41		7.25		3.59		11.6		0.985	J	3.33		0.898	J
Bromodichloromethane	75-27-4	< 0.136		< 0.136		< 76.0		< 38.0		< 0.380		< 27.2		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380	
Bromoform	75-25-2	< 0.129		< 0.129		< 93.8		< 46.9		< 0.469		< 25.8		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469	
Bromomethane	74-83-9	< 0.605		< 0.605		< 173		< 86.6		< 0.866		< 121		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866	
Carbon disulfide	75-15-0	0.319	JB	0.668	J	< 55.0		< 27.5		4.27	V3	66.4	JB	< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275	
Carbon tetrachloride	56-23-5	< 0.128		< 0.128		< 75.8		< 37.9		< 0.379		< 25.6		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379	
Chlorobenzene	108-90-7	< 0.116		< 0.116		< 69.6		< 34.8		< 0.348		< 23.2		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348	
Chloroethane	75-00-3	< 0.192		< 0.192		< 90.6		< 45.3		< 0.453		< 38.4		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453	J4	< 0.453	
Chloroform	67-66-3	< 0.111		< 0.111		< 64.8		< 32.4		< 0.324		< 22.2		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324	
Chloromethane	74-87-3	< 0.960		< 0.960		< 55.2		< 27.6		< 0.276		< 192		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276	
cis-1,2-Dichloroethene	156-59-2	< 0.126		< 0.126		< 52.0		< 26.0		< 0.260		< 25.2		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260	
cis-1,3-Dichloropropene	10061-01-5	< 0.111		< 0.111		< 83.6		< 41.8		< 0.418		< 22.2		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418	
Cyanide	57-12-5	< 1.80	J6	< 45.0		< 9.00		< 1.80		< 1.80		< 18.0		23.0		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80	
Dibromochloromethane	124-48-1	< 0.140		< 0.140		< 65.4		< 32.7		< 0.327		< 28.0		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327	J4
Ethylbenzene	100-41-4	2.62		459		828		1240		617		2890		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384	
Isopropylbenzene	98-82-8	18.8		55.4		< 65.2		46.7	J	18.2		93.7	J	0.412	J	2.44		< 0.326		5.18		0.355	J	3.90		1.05	
m,p-Xylene	179601-23-1	2.49		167		1010		1920		782		4050		< 0.719		1.10		< 0.719		0.852	J	< 0.719		< 0.719		< 0.719	
Mercury	7439-97-6	< 0.100		< 0.100		< 0.0490	J6	< 0.0490		< 0.0490		< 0.100		< 0.0490		< 0.0490	J3J6O1	< 0.0490		< 0.0490		< 0.0490		0.140	J	< 0.0490	
Methyl tert-butyl ether	1634-04-4	3.65		4.89		< 73.4		129		134	V3	23.0	J	4.77		4.16		< 0.367		2.73		3.41		2.90		3.71	
Methylene chloride	75-09-2	< 0.430		< 0.430		< 200		< 100		< 1.00		< 86.0		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	
Naphthalene	91-20-3	< 1.00		30.6		< 200	J4	141	J	51.9		539	J	13.4		9.36	J4	8.41		5.63		< 1.00		1.65	J	< 1.00	
n-Butylbenzene	104-51-8	0.270	J	1.70		< 72.2		< 36.1		2.09		< 31.4		1.34		0.858	J	< 0.361		1.51		< 0.361		0.730	J	< 0.361	
n-Propylbenzene	103-65-1	14.0		65.9		< 69.8		85.2	J	21.7		168	J	< 0.349		< 0.349		< 0.349		0.796	J	< 0.349		< 0.349		< 0.349	
o-Xylene	95-47-6	0.402	J	11.6		150	J	145		13.3		139	J	0.423	J	0.483	J	< 0.341		< 0.341		< 0.341		< 0.341		< 0.341	
sec-Butylbenzene	135-98-8	5.55		7.93		< 73.0		< 36.5		< 0.365		< 25.0		3.53		4.74		4.19		< 0.365		3.28		4.66		1.35	
Styrene	100-42-5	< 0.118		< 0.118		< 61.4		< 30.7		< 0.307		< 23.6		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307	
Tetrachloroethene	127-18-4	< 0.300		< 0.300		< 74.4		< 37.2		< 0.372		< 60.0		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372	
Toluene	108-88-3	< 0.278		25.5		1480		747		336		1080		< 0.780		< 0.780		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412	
trans-1,2-Dichloroethene	156-60-5	< 0.149		< 0.149		< 79.2		< 39.6		< 0.396		< 29.8		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396	
trans-1,3-Dichloropropene	10061-02-6	< 0.118		< 0.118		< 83.8		< 41.9		< 0.419		< 23.6		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419	
Trichloroethene	79-01-6	< 0.190		< 0.190		< 79.6		< 39.8		< 0.398		< 38.0		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398	
Vinyl chloride	75-01-4	< 0.234		< 0.234		< 51.8		< 25.9		< 0.259		< 46.8		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	
Xylenes, total	1330-20-7	2.89	J	179		1160		2070		795		4190		< 1.06		1.58	J	< 1.06		< 1.06		< 1.06		< 1.06		< 1.06	

Table 4
Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

Sample	Field D	KWB-11A 6/16/2020		KWB-11A 10/6/2020		KWB-11B 4/27/2016		KWB-11B 10/5/2016		KWB-11B 4/25/2017		KWB-11B 10/3/2017		KWB-11B 4/3/2018		KWB-11B 10/2/2018		KWB-11B 4/2/2019		KWB-11B 10/22/2019		KWB-11B 6/16/2020		KWB-11B 10/6/2020		KWB-11B 4/13/2021	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.147		< 0.147		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385	J4	< 0.385		< 0.147		< 0.147		< 0.147	
1,1,1-Trichloroethane	71-55-6	< 0.149		< 0.149		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.149		< 0.149	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.133		< 0.133		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.133		< 0.133	
1,1,2-Trichloroethane	79-00-5	< 0.158		< 0.158		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.158		< 0.158		< 0.158	
1,1-Dichloroethane	75-34-3	< 0.100		< 0.100		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.100		< 0.100	
1,1-Dichloroethene	75-35-4	< 0.188		< 0.188		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.188		< 0.188	
1,2,4-Trimethylbenzene	95-63-6	48.6		1.51		< 0.373		0.394	J	< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.322		< 0.322		< 0.322	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.126		< 0.126		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381	J4	< 0.381		< 0.126		< 0.126		< 0.126	
1,2-Dichloroethane	107-06-2	< 0.0819		< 0.0819		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		0.210	J	< 0.0819		< 0.0819	
1,2-Dichloropropane	78-87-5	< 0.149		< 0.149		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.149		< 0.149	
1,3,5-Trimethylbenzene	108-67-8	< 0.104		< 0.104		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.104		< 0.104		< 0.104	
2-Butanone (MEK)	78-93-3	< 1.19		< 1.19		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 1.19		< 1.19		< 1.19	
2-Hexanone	591-78-6	< 0.787		< 0.787		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787		< 0.787		< 0.787	
4-Isopropyltoluene	99-87-6	< 0.120		< 0.120		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.120		< 0.120		< 0.120	
4-Methyl-2-pentanone	108-10-1	< 0.478		< 0.478		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478		< 0.478		< 0.478	
Acetone	67-64-1	< 11.3		< 11.3		< 10.0		< 10.0		< 10.0		< 10.0		< 10.0		< 10.0		< 10.0	J4	< 10.0		< 11.3		< 11.3		< 11.3	
Benzene	71-43-2	0.492	J	2.34		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.0941		1.92		< 0.0941	
Bromodichloromethane	75-27-4	< 0.136		< 0.136		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.136		< 0.136	
Bromoform	75-25-2	< 0.129		< 0.129		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.129		< 0.129	
Bromomethane	74-83-9	< 0.605		< 0.605		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.605		< 0.605		< 0.605	
Carbon disulfide	75-15-0	< 0.0962		0.169	JB	< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.0962		0.191	JB	< 0.0962	
Carbon tetrachloride	56-23-5	< 0.128		< 0.128		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.128		< 0.128	
Chlorobenzene	108-90-7	< 0.116		< 0.116		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116		< 0.116		< 0.116	
Chloroethane	75-00-3	< 0.192		< 0.192		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453	J4	< 0.453		< 0.453		< 0.192		< 0.192		< 0.192	
Chloroform	67-66-3	< 0.111		< 0.111		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.111		< 0.111		< 0.111	
Chloromethane	74-87-3	< 0.960		< 0.960		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960		< 0.960		< 0.960	
cis-1,2-Dichloroethene	156-59-2	< 0.126		< 0.126		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.126		< 0.126	
cis-1,3-Dichloropropene	10061-01-5	< 0.111		< 0.111		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111		< 0.111		< 0.111	
Cyanide	57-12-5	< 1.80		< 1.80		< 1.20		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80	J6	< 1.80		< 1.80		< 1.80	
Dibromochloromethane	124-48-1	< 0.140		< 0.140		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327	J4	< 0.327		< 0.140		< 0.140		< 0.140	
Ethylbenzene	100-41-4	0.576	J	< 0.137		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137		< 0.137		< 0.137	
Isopropylbenzene	98-82-8	3.60		0.380	J	< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.105		< 0.105		< 0.105	
m,p-Xylene	179601-23-1	< 0.430		< 0.430		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430		< 0.430		< 0.430	
Mercury	7439-97-6	< 0.100		< 0.100		< 0.0490		< 0.0490	J3	< 0.0490		< 0.0490		0.0648	JB	0.180	J	< 0.0490		0.0867	JB	< 0.100		< 0.100		< 0.100	
Methyl tert-butyl ether	1634-04-4	3.59		3.07		< 0.367		< 0.367		< 0.367		0.565	J	0.498	J	1.25		0.774	J	1.03		1.40		1.56		1.05	
Methylene chloride	75-09-2	< 0.430		< 0.430		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 0.430		< 0.430	
Naphthalene	91-20-3	< 1.00		< 1.00		< 1.00		1.53	JJ4	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	
n-Butylbenzene	104-51-8	< 0.157		< 0.157		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.157		< 0.157		< 0.157	
n-Propylbenzene	103-65-1	1.25		< 0.0993		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993		< 0.0993	
o-Xylene	95-47-6	< 0.174		< 0.174		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.174		< 0.174		< 0.174	
sec-Butylbenzene	135-98-8	2.10		2.79		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.125		< 0.125		< 0.125	
Styrene	100-42-5	< 0.118		< 0.118		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.118		< 0.118	
Tetrachloroethene	127-18-4	< 0.300		< 0.300		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300		< 0.300		< 0.300	
Toluene	108-88-3	< 0.278		< 0.278		< 0.780		< 0.780		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.278		< 0.278		< 0.278	
trans-1,2-Dichloroethene	156-60-5	< 0.149		< 0.149		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.149		< 0.149	
trans-1,3-Dichloropropene	10061-02-6	< 0.118		< 0.118		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.118		< 0.118	
Trichloroethene	79-01-6	< 0.190		< 0.190		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190		< 0.190		< 0.190	
Vinyl chloride	75-01-4	< 0.234		< 0.234		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.234		< 0.234		< 0.234	
Xylenes, total	1330-20-7	< 0.174		< 0.174		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174		< 0.174		< 0.174	

Table 4

Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

Samp Field D		KWB-12A 4/27/2016		KWB-12A 10/5/2016		KWB-12A 4/26/2017		KWB-12A 10/3/2017		KWB-12A 10/3/2018		KWB-12A 10/23/2019		KWB-12A 6/16/2020		KWB-12A 10/6/2020		KWB-12B 4/27/2016 FD		KWB-12B 4/27/2016		KWB-12B 10/5/2016 FD		KWB-12B 10/5/2016		KWB-12B 4/26/2017 FD	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147		< 0.147		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385	
1,1,1-Trichloroethane	71-55-6	< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.149		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.133		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130	
1,1,2-Trichloroethane	79-00-5	< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.158		< 0.158		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383	
1,1-Dichloroethane	75-34-3	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.100		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	
1,1-Dichloroethene	75-35-4	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.188		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398	
1,2,4-Trimethylbenzene	95-63-6	< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.322		< 0.322		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.126		< 0.126		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381	
1,2-Dichloroethane	107-06-2	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819		< 0.0819		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361	
1,2-Dichloropropane	78-87-5	< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.149		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306	
1,3,5-Trimethylbenzene	108-67-8	< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.104		< 0.104		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387	
2-Butanone (MEK)	78-93-3	< 3.93		< 3.93		< 3.93		< 3.93		< 3.93	J3J4	< 3.93		< 1.19		< 1.19		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93	
2-Hexanone	591-78-6	< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787		< 0.787		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82	
4-Isopropyltoluene	99-87-6	< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.120		< 0.120		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350	
4-Methyl-2-pentanone	108-10-1	< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478		< 0.478		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14	
Acetone	67-64-1	< 10.0		< 10.0		< 10.0		< 10.0		< 10.0	J3	< 10.0		< 11.3		< 11.3		< 10.0		< 10.0		< 10.0		< 10.0		< 10.0	
Benzene	71-43-2	< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.0941		< 0.0941		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331	
Bromodichloromethane	75-27-4	< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.136		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380	
Bromoform	75-25-2	< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.129		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469	
Bromomethane	74-83-9	< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.605		< 0.605	J4	< 0.866		< 0.866		< 0.866		< 0.866		< 0.866	
Carbon disulfide	75-15-0	< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.0962		< 0.0962		< 0.275		< 0.275		0.435	J	< 0.275		< 0.275	
Carbon tetrachloride	56-23-5	< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.128		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379	
Chlorobenzene	108-90-7	< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116	J4	< 0.116		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348	
Chloroethane	75-00-3	< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.192		< 0.192		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453	
Chloroform	67-66-3	< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.111		< 0.111		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324	
Chloromethane	74-87-3	< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960		< 0.960		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276	
cis-1,2-Dichloroethene	156-59-2	< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.126		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260	
cis-1,3-Dichloropropene	10061-01-5	< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111	J4	< 0.111		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418	
Cyanide	57-12-5	< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.20		< 1.20		< 1.80		< 1.80		< 1.80	
Dibromochloromethane	124-48-1	< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.140		< 0.140		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327	
Ethylbenzene	100-41-4	< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137		< 0.137		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384	
Isopropylbenzene	98-82-8	< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.105		< 0.105		< 0.326		< 0.326		0.337	J	< 0.326		< 0.326	
m,p-Xylene	179601-23-1	< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430		< 0.430		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719	
Mercury	7439-97-6	< 0.0490		< 0.0490	J3	< 0.0490		< 0.0490		< 0.0490		0.0672	JB	< 0.100		< 0.100		< 0.0490		< 0.0490		< 0.0490	J3	< 0.0490	J3	< 0.0490	
Methyl tert-butyl ether	1634-04-4	< 0.367		< 0.367		< 0.367		< 0.367		< 0.367		< 0.367		< 0.101		< 0.101		< 0.367		< 0.367		< 0.367		< 0.367		< 0.367	
Methylene chloride	75-09-2	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 0.430		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	
Naphthalene	91-20-3	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		13.9		< 1.00		< 1.00	
n-Butylbenzene	104-51-8	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.157		< 0.157		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361	
n-Propylbenzene	103-65-1	< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993		< 0.349		< 0.349		0.638	J	< 0.349		< 0.349	
o-Xylene	95-47-6	< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.174		< 0.174		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341	
sec-Butylbenzene	135-98-8	< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.125		< 0.125		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365	
Styrene	100-42-5	< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.118		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307	
Tetrachloroethene	127-18-4	< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300		< 0.300		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372	
Toluene	108-88-3	< 0.780		< 0.780		< 0.412		< 0.412		< 0.412		< 0.412		< 0.278		< 0.278		< 0.780		< 0.780		< 0.780		< 0.780		< 0.412	
trans-1,2-Dichloroethene	156-60-5	< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.149		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396	
trans-1,3-Dichloropropene	10061-02-6	< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.118		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419	
Trichloroethene	79-01-6	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190	J4	< 0.190	J4	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398	
Vinyl chloride	75-01-4	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	J3	< 0.259		< 0.234		< 0.234		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	
Xylenes, total	1330-20-7	< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174		< 0.174		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06	

Table 4
Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

	Samp	KWB-12B 4/26/2017		KWB-12B 10/3/2017		KWB-12B 10/3/2017		KWB-12B 4/4/2018		KWB-12B 4/4/2018		KWB-12B 10/3/2018		KWB-12B 10/3/2018		KWB-12B 4/2/2019		KWB-12B 4/2/2019		KWB-12B 10/23/2019		KWB-12B 10/23/2019		KWB-12B 6/16/2020		KWB-12B 6/16/2020	
	Field D			FD				FD				FD						FD		FD				FD			
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147		< 0.147	
1,1,1-Trichloroethane	71-55-6	< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.149	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.133	
1,1,2-Trichloroethane	79-00-5	< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.158		< 0.158	
1,1-Dichloroethane	75-34-3	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.100	
1,1-Dichloroethene	75-35-4	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.188	
1,2,4-Trimethylbenzene	95-63-6	< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		0.508	J	< 0.373		< 0.322		< 0.322	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.126		< 0.126	
1,2-Dichloroethane	107-06-2	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819		< 0.0819	
1,2-Dichloropropane	78-87-5	< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.149	
1,3,5-Trimethylbenzene	108-67-8	< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.104		< 0.104	
2-Butanone (MEK)	78-93-3	< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93	J3J4	< 3.93		< 3.93		< 3.93		< 3.93		< 1.19		< 1.19	
2-Hexanone	591-78-6	< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787		< 0.787	
4-Isopropyltoluene	99-87-6	< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.120		< 0.120	
4-Methyl-2-pentanone	108-10-1	< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478		< 0.478	
Acetone	67-64-1	< 10.0		< 10.0		< 10.0		< 10.0		< 10.0		< 10.0		< 10.0	J3	< 10.0		< 10.0		< 10.0		< 10.0		< 11.3		< 11.3	
Benzene	71-43-2	< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.0941		< 0.0941	
Bromodichloromethane	75-27-4	< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.136	
Bromoform	75-25-2	< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.129	
Bromomethane	74-83-9	< 0.866		< 0.866	J3	< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.605		< 0.605	
Carbon disulfide	75-15-0	< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.0962		< 0.0962	
Carbon tetrachloride	56-23-5	< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.128	
Chlorobenzene	108-90-7	< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116		< 0.116	J4
Chloroethane	75-00-3	< 0.453		< 0.453		< 0.453		< 0.453	J4	< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.192		< 0.192	
Chloroform	67-66-3	< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.111		< 0.111	
Chloromethane	74-87-3	< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960		< 0.960	
cis-1,2-Dichloroethene	156-59-2	< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.126	
cis-1,3-Dichloropropene	10061-01-5	< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111		< 0.111	J4
Cyanide	57-12-5	< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80	
Dibromochloromethane	124-48-1	< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.140		< 0.140	
Ethylbenzene	100-41-4	< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137		< 0.137	
Isopropylbenzene	98-82-8	< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.105		< 0.105	
m,p-Xylene	179601-23-1	< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430		< 0.430	
Mercury	7439-97-6	< 0.0490		< 0.0490		< 0.0490		< 0.0490		0.0606	J	< 0.0490		< 0.0490		< 0.0490		0.152	J	0.0574	JB	0.0601	JB	< 0.100		< 0.100	
Methyl tert-butyl ether	1634-04-4	< 0.367		< 0.367		< 0.367		< 0.367		< 0.367		< 0.367		< 0.367		< 0.367		< 0.367		< 0.367		< 0.367		< 0.101		< 0.101	
Methylene chloride	75-09-2	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 0.430	
Naphthalene	91-20-3	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	
n-Butylbenzene	104-51-8	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.157		< 0.157	
n-Propylbenzene	103-65-1	< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993	
o-Xylene	95-47-6	< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.174		< 0.174	
sec-Butylbenzene	135-98-8	< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.125		< 0.125	
Styrene	100-42-5	< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.118	
Tetrachloroethene	127-18-4	< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300		< 0.300	
Toluene	108-88-3	< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.278		< 0.278	
trans-1,2-Dichloroethene	156-60-5	< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.149	
trans-1,3-Dichloropropene	10061-02-6	< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.118	
Trichloroethene	79-01-6	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190		< 0.190	J4
Vinyl chloride	75-01-4	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	J3	< 0.259		< 0.259		< 0.259		< 0.259		< 0.234		< 0.234	
Xylenes, total	1330-20-7	< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174		< 0.174	

Table 4
Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

	Samp	KWB-12B		KWB-12B		KWB-12B		KWB-12B		MW-8		MW-8		MW-8		MW-8		MW-8		MW-8		MW-20		MW-20		MW-20	
		10/6/2020		10/6/2020		4/13/2021		4/13/2021		4/28/2016		4/27/2017		4/4/2018		4/3/2019		6/17/2020		4/14/2021		4/28/2016		4/27/2017		4/4/2018	
	Field D			FD				FD																			
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.147		< 0.147		< 0.147		< 0.147		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147		< 0.147		< 0.385		< 0.385		< 0.385	
1,1,1-Trichloroethane	71-55-6	< 0.149		< 0.149		< 0.149		< 0.149		< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.149		< 0.319		< 0.319		< 0.319	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.133		< 0.133		< 0.133		< 0.133		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.133		< 0.130		< 0.130		< 0.130	
1,1,2-Trichloroethane	79-00-5	< 0.158		< 0.158		< 0.158		< 0.158		< 0.383		< 0.383	J4	< 0.383		< 0.383		< 0.158		< 0.158		< 0.383		< 0.383	J4	< 0.383	
1,1-Dichloroethane	75-34-3	< 0.100		< 0.100		< 0.100		< 0.100		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.100		< 0.259		< 0.259		< 0.259	
1,1-Dichloroethene	75-35-4	< 0.188		< 0.188		< 0.188		< 0.188		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.188		< 0.398		< 0.398		< 0.398	
1,2,4-Trimethylbenzene	95-63-6	< 0.322		< 0.322		< 0.322		< 0.322		< 0.373		< 0.373		< 0.373		< 0.373		< 0.322		< 0.322		< 0.373		< 0.373		< 0.373	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.126		< 0.126		< 0.126		< 0.126		< 0.381		< 0.381		< 0.381		< 0.381		< 0.126		< 0.126		< 0.381		< 0.381		< 0.381	
1,2-Dichloroethane	107-06-2	< 0.0819		< 0.0819		< 0.0819		< 0.0819		< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819		< 0.0819		< 0.361		< 0.361		< 0.361	
1,2-Dichloropropane	78-87-5	< 0.149		< 0.149		< 0.149		< 0.149		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.149		< 0.306		< 0.306		< 0.306	
1,3,5-Trimethylbenzene	108-67-8	< 0.104		< 0.104		< 0.104		< 0.104		< 0.387		< 0.387		< 0.387		< 0.387		< 0.104		< 0.104		< 0.387		< 0.387		< 0.387	
2-Butanone (MEK)	78-93-3	< 1.19		< 1.19		< 1.19		< 1.19		< 3.93		< 3.93		< 3.93		< 3.93		< 1.19		< 1.19		< 3.93	J4	< 3.93		< 3.93	
2-Hexanone	591-78-6	< 0.787		< 0.787		< 0.787		< 0.787		< 3.82		< 3.82	J3J4	< 3.82		< 3.82		< 0.787		< 0.787		< 3.82		< 3.82	J3J4	< 3.82	
4-Isopropyltoluene	99-87-6	< 0.120		< 0.120		< 0.120		< 0.120		< 0.350		< 0.350		< 0.350		< 0.350		< 0.120		< 0.120		< 0.350		< 0.350		< 0.350	
4-Methyl-2-pentanone	108-10-1	< 0.478		< 0.478		< 0.478		< 0.478		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478		< 0.478		< 2.14		< 2.14		< 2.14	
Acetone	67-64-1	< 11.3		< 11.3		< 11.3		< 11.3		< 10.0		< 10.0		< 10.0		< 10.0		< 11.3		< 11.3		< 10.0		< 10.0		< 10.0	
Benzene	71-43-2	< 0.0941		< 0.0941		< 0.0941		< 0.0941		< 0.331		< 0.331		< 0.331		< 0.331		< 0.0941		< 0.0941		< 0.331		< 0.331		< 0.331	
Bromodichloromethane	75-27-4	< 0.136		< 0.136		< 0.136		< 0.136		< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.136		< 0.380		< 0.380		< 0.380	
Bromoform	75-25-2	< 0.129		< 0.129		< 0.129		< 0.129		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.129		< 0.469		< 0.469		< 0.469	
Bromomethane	74-83-9	< 0.605	J4	< 0.605		< 0.605		< 0.605		< 0.866		< 0.866		< 0.866		< 0.866		< 0.605		< 0.605		< 0.866		< 0.866		< 0.866	
Carbon disulfide	75-15-0	< 0.0962		< 0.0962		< 0.0962		< 0.0962		< 0.275		< 0.275		< 0.275		< 0.275		< 0.0962		< 0.0962		< 0.275		< 0.275		< 0.275	
Carbon tetrachloride	56-23-5	< 0.128		< 0.128		< 0.128		< 0.128		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.128		< 0.379		< 0.379		< 0.379	
Chlorobenzene	108-90-7	< 0.116		< 0.116		< 0.116		< 0.116		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116		< 0.116		< 0.348		< 0.348		< 0.348	
Chloroethane	75-00-3	< 0.192		< 0.192		< 0.192		< 0.192		< 0.453		< 0.453		< 0.453		< 0.453		< 0.192		< 0.192		< 0.453		< 0.453		< 0.453	
Chloroform	67-66-3	< 0.111		< 0.111		< 0.111		< 0.111		< 0.324		< 0.324		< 0.324		< 0.324		< 0.111		< 0.111		< 0.324		< 0.324		< 0.324	
Chloromethane	74-87-3	< 0.960		< 0.960		< 0.960		< 0.960		< 0.276		< 0.276	J4	< 0.276		< 0.276		< 0.960		< 0.960		< 0.276		< 0.276	J4	< 0.276	
cis-1,2-Dichloroethene	156-59-2	< 0.126		< 0.126		< 0.126		< 0.126		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.126		< 0.260		< 0.260		< 0.260	
cis-1,3-Dichloropropene	10061-01-5	< 0.111		< 0.111		< 0.111	J4	< 0.111	J4	< 0.418		< 0.418	J4	< 0.418		< 0.418		< 0.111		< 0.111		< 0.418		< 0.418	J4	< 0.418	
Cyanide	57-12-5	5.96		56.5		< 1.80		< 1.80																			
Dibromochloromethane	124-48-1	< 0.140		< 0.140		< 0.140		< 0.140		< 0.327		< 0.327		< 0.327		< 0.327		< 0.140		< 0.140		< 0.327		< 0.327		< 0.327	
Ethylbenzene	100-41-4	< 0.137		< 0.137		< 0.137		< 0.137		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137		< 0.137		< 0.384		< 0.384		< 0.384	
Isopropylbenzene	98-82-8	< 0.105		< 0.105		< 0.105		< 0.105		< 0.326		< 0.326		< 0.326		< 0.326		< 0.105		< 0.105		< 0.326		< 0.326		< 0.326	
m,p-Xylene	179601-23-1	< 0.430		< 0.430		< 0.430		< 0.430		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430		< 0.430		< 0.719		< 0.719		< 0.719	
Mercury	7439-97-6	< 0.100		< 0.100		< 0.100		< 0.100																			
Methyl tert-butyl ether	1634-04-4	< 0.101		< 0.101		< 0.101		< 0.101		< 0.367		2.28		38.8		75.0		149		104		< 0.367		< 0.367		< 0.367	
Methylene chloride	75-09-2	< 0.430		< 0.430		< 0.430		< 0.430		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 0.430		< 1.00		< 1.00		< 1.00	
Naphthalene	91-20-3	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	J4	< 1.00		< 1.00	J3J4	< 1.00	J4	< 1.00		< 1.00		< 1.00	J4	< 1.00	
n-Butylbenzene	104-51-8	< 0.157		< 0.157		< 0.157		< 0.157		< 0.361		< 0.361		< 0.361		< 0.361		< 0.157		< 0.157		< 0.361		< 0.361		< 0.361	
n-Propylbenzene	103-65-1	< 0.0993		< 0.0993		< 0.0993		< 0.0993		< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993		< 0.349		< 0.349		< 0.349	
o-Xylene	95-47-6	< 0.174		< 0.174		< 0.174		< 0.174		< 0.341		< 0.341		< 0.341		< 0.341		< 0.174		< 0.174		< 0.341		< 0.341		< 0.341	
sec-Butylbenzene	135-98-8	< 0.125		< 0.125		< 0.125		0.261	J	< 0.365		< 0.365		< 0.365		< 0.365		< 0.125		< 0.125		< 0.365		< 0.365		< 0.365	
Styrene	100-42-5	< 0.118		< 0.118		< 0.118		< 0.118		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.118		< 0.307		< 0.307		< 0.307	
Tetrachloroethene	127-18-4	< 0.300		< 0.300		< 0.300		< 0.300		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300		< 0.300		< 0.372		< 0.372		< 0.372	
Toluene	108-88-3	< 0.278		< 0.278		< 0.278		< 0.278		< 0.780		< 0.412		< 0.412		< 0.412		< 0.278		< 0.278		< 0.780		< 0.412		< 0.412	
trans-1,2-Dichloroethene	156-60-5	< 0.149		< 0.149		< 0.149		< 0.149		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.149		< 0.396		< 0.396		< 0.396	
trans-1,3-Dichloropropene	10061-02-6	< 0.118		< 0.118		< 0.118		< 0.118		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.118		< 0.419	J4	< 0.419		< 0.419	
Trichloroethene	79-01-6	< 0.190	J4	< 0.190	J4	< 0.190		< 0.190		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190		< 0.190		< 0.398		< 0.398		< 0.398	
Vinyl chloride	75-01-4	< 0.234		< 0.234		< 0.234		< 0.234		< 0.259		< 0.259		< 0.259		< 0.259		< 0.234		< 0.234		< 0.259		< 0.259		< 0.259	
Xylenes, total	1330-20-7	< 0.174		< 0.174		< 0.174		< 0.174		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174		< 0.174		< 1.06		< 1.06		< 1.06	

Table 4

Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

	Samp Field D	MW-20 4/3/2019		MW-20 6/17/2020		MW-20 4/14/2021		MW-21 4/28/2016		MW-21 10/4/2016		MW-21 4/27/2017		MW-21 10/4/2017		MW-21 4/4/2018		MW-21 10/2/2018		MW-21 4/3/2019		MW-21 10/23/2019		MW-21 6/17/2020		MW-21 10/6/2020	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.385		< 0.147		< 0.147		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147		< 0.735	
1,1,1-Trichloroethane	71-55-6	< 0.319		< 0.149		< 0.149		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.745	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.130		< 0.133		< 0.133		< 0.130		< 0.130	J4	< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.665	
1,1,2-Trichloroethane	79-00-5	< 0.383		< 0.158		< 0.158		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.158		< 0.790	
1,1-Dichloroethane	75-34-3	< 0.259		< 0.100		< 0.100		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.500	
1,1-Dichloroethene	75-35-4	< 0.398		< 0.188		< 0.188		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.940	
1,2,4-Trimethylbenzene	95-63-6	< 0.373		< 0.322		< 0.322		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.322		< 1.61	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.381		< 0.126		< 0.126		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.126		< 0.630	
1,2-Dichloroethane	107-06-2	< 0.361		< 0.0819		< 0.0819		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819		< 0.409	
1,2-Dichloropropane	78-87-5	< 0.306		< 0.149		< 0.149		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.745	
1,3,5-Trimethylbenzene	108-67-8	< 0.387		< 0.104		< 0.104		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.104		< 0.520	
2-Butanone (MEK)	78-93-3	< 3.93		< 1.19		< 1.19		< 3.93		< 3.93	J3	< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 1.19		< 5.95	
2-Hexanone	591-78-6	< 3.82		< 0.787		< 0.787		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787		< 3.94	
4-Isopropyltoluene	99-87-6	< 0.350		< 0.120		< 0.120		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.120		< 0.600	
4-Methyl-2-pentanone	108-10-1	< 2.14		< 0.478		< 0.478		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478		< 2.39	
Acetone	67-64-1	< 10.0		< 11.3		< 11.3		< 10.0		< 10.0	J3	< 10.0		< 10.0		< 10.0		< 10.0		< 10.0		< 10.0		< 11.3		< 56.5	
Benzene	71-43-2	< 0.331		< 0.0941		< 0.0941		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.0941		< 0.471	
Bromodichloromethane	75-27-4	< 0.380		< 0.136		< 0.136		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.680	
Bromoform	75-25-2	< 0.469		< 0.129		< 0.129		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.645	
Bromomethane	74-83-9	< 0.866		< 0.605		< 0.605		< 0.866		< 0.866	J3	< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.605		< 3.03	
Carbon disulfide	75-15-0	< 0.275		< 0.0962		< 0.0962		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.0962		< 0.481	
Carbon tetrachloride	56-23-5	< 0.379		< 0.128		< 0.128		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.640	
Chlorobenzene	108-90-7	< 0.348		< 0.116		< 0.116		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116		< 0.580	
Chloroethane	75-00-3	< 0.453		< 0.192		< 0.192		< 0.453		< 0.453	J3	< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.192		< 0.960	
Chloroform	67-66-3	< 0.324		< 0.111		< 0.111		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.111		< 0.555	
Chloromethane	74-87-3	< 0.276		< 0.960		< 0.960		< 0.276		1.06	JB	< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960		< 4.80	
cis-1,2-Dichloroethene	156-59-2	< 0.260		< 0.126		< 0.126		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.630	
cis-1,3-Dichloropropene	10061-01-5	< 0.418		< 0.111		< 0.111		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111		< 0.555	
Cyanide	57-12-5																										
Dibromochloromethane	124-48-1	< 0.327		< 0.140		< 0.140		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.140		< 0.700	
Ethylbenzene	100-41-4	< 0.384		< 0.137		< 0.137		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137		< 0.685	
Isopropylbenzene	98-82-8	< 0.326		< 0.105		< 0.105		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.105		< 0.525	
m,p-Xylene	179601-23-1	< 0.719		< 0.430		< 0.430		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430		< 2.15	
Mercury	7439-97-6																										
Methyl tert-butyl ether	1634-04-4	< 0.367		< 0.101		< 0.101		10.1		11.2		14.9		18.0		38.2		69.5		101		217		128		243	
Methylene chloride	75-09-2	< 1.00		< 0.430		< 0.430		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 2.15	
Naphthalene	91-20-3	< 1.00	J3J4	< 1.00	J4	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	J3J4	< 1.00		< 1.00	J4	< 5.00	
n-Butylbenzene	104-51-8	< 0.361		< 0.157		< 0.157		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.157		< 0.785	
n-Propylbenzene	103-65-1	< 0.349		< 0.0993		< 0.0993		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993		< 0.497	
o-Xylene	95-47-6	< 0.341		< 0.174		< 0.174		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.174		< 0.870	
sec-Butylbenzene	135-98-8	< 0.365		< 0.125		< 0.125		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.125		< 0.625	
Styrene	100-42-5	< 0.307		< 0.118		< 0.118		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.590	
Tetrachloroethene	127-18-4	< 0.372		< 0.300		< 0.300		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300		< 1.50	
Toluene	108-88-3	< 0.412		< 0.278		< 0.278		< 0.780		< 0.780		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.278		< 1.39	
trans-1,2-Dichloroethene	156-60-5	< 0.396		< 0.149		< 0.149		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.745	
trans-1,3-Dichloropropene	10061-02-6	< 0.419		< 0.118		< 0.118		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.590	
Trichloroethene	79-01-6	< 0.398		< 0.190		< 0.190		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190		< 0.950	
Vinyl chloride	75-01-4	< 0.259		< 0.234		< 0.234		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.234		< 1.17	
Xylenes, total	1330-20-7	< 1.06		< 0.174		< 0.174		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174		< 0.870	

Table 4
Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

Samp Field D		MW-21 4/14/2021		MW-48 4/27/2016		MW-48 10/5/2016		MW-48 4/26/2017		MW-48 10/4/2017		MW-48 4/5/2018		MW-48 10/3/2018		MW-48 4/3/2019		MW-48 10/22/2019		MW-48 11/19/2020		MW-52 4/29/2016		MW-52 10/5/2016		MW-52 4/27/2017	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.147		< 7.70		< 1.92		< 19.2		< 0.385		< 96.2		< 96.2		< 96.2		< 96.3				< 0.385		< 0.385		< 0.385	
1,1,1-Trichloroethane	71-55-6	< 0.149		< 6.38		< 1.60		< 16.0		< 0.319		< 79.8		< 79.8		< 79.8		< 79.8				< 0.319		< 0.319		< 0.319	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.133		< 2.60		< 0.650		< 6.50		< 0.130		< 32.5		< 32.5		< 32.5		< 32.5				< 0.130		< 0.130		< 0.130	
1,1,2-Trichloroethane	79-00-5	< 0.158		< 7.66		< 1.92		< 19.2		< 0.383		< 95.8		< 95.8		< 95.8		< 95.8				< 0.383		< 0.383		< 0.383	
1,1-Dichloroethane	75-34-3	< 0.100		< 5.18		< 1.30		< 13.0		< 0.259		< 64.8		< 64.8		< 64.8		< 64.8				< 0.259		< 0.259		< 0.259	
1,1-Dichloroethene	75-35-4	< 0.188		< 7.96		< 1.99		< 19.9		< 0.398		< 99.5		< 99.5		< 99.5		< 99.5				< 0.398		< 0.398		< 0.398	
1,2,4-Trimethylbenzene	95-63-6	< 0.322		310		323		482		368		381		377		564		240	J	115	J6	< 0.373		< 0.373		< 0.373	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.126		< 7.62		< 1.90		< 19.0		< 0.381		< 95.2		< 95.2		< 95.2		< 95.3				< 0.381		< 0.381		< 0.381	
1,2-Dichloroethane	107-06-2	< 0.0819		< 7.22		< 1.80		< 18.0		< 0.361		< 90.2		< 90.2		< 90.2		< 90.3				< 0.361		< 0.361		< 0.361	
1,2-Dichloropropane	78-87-5	< 0.149		< 6.12		< 1.53		< 15.3		< 0.306		< 76.5		< 76.5		< 76.5		< 76.5				< 0.306		< 0.306		< 0.306	
1,3,5-Trimethylbenzene	108-67-8	< 0.104		22.3		28.4		57.7		46.5		< 96.8		< 96.8		< 96.8		< 96.7		10.1		< 0.387		< 0.387		< 0.387	
2-Butanone (MEK)	78-93-3	< 1.19		< 78.6		< 19.6		< 196		< 3.93		< 982		< 982	J3J4	< 982		< 983				< 3.93		< 3.93		< 3.93	
2-Hexanone	591-78-6	< 0.787		< 76.4		< 19.1		< 191		< 3.82		< 955		< 955		< 955		< 955				< 3.82		< 3.82		< 3.82	
4-Isopropyltoluene	99-87-6	< 0.120		< 7.00		5.20		< 17.5		6.78		< 87.5		< 87.5		< 87.5		< 87.5				< 0.350		< 0.350		< 0.350	
4-Methyl-2-pentanone	108-10-1	< 0.478		< 42.8		< 10.7		< 107		< 2.14		< 535		< 535		< 535		< 535				< 2.14		< 2.14		< 2.14	
Acetone	67-64-1	< 11.3	J3J4	< 200		< 50.0		< 500		< 10.0		< 2500		< 2500	J3	< 2500		< 2500				< 10.0		< 10.0		< 10.0	
Benzene	71-43-2	< 0.0941		7170		5120		11700		11000		14900		7970		4870		5040		946	V	< 0.331		< 0.331		< 0.331	
Bromodichloromethane	75-27-4	< 0.136		< 7.60		< 1.90		< 19.0		< 0.380		< 95.0		< 95.0		< 95.0		< 95.0				< 0.380		< 0.380		< 0.380	
Bromoform	75-25-2	< 0.129		< 9.38		< 2.34		< 23.4		< 0.469		< 117		< 117		< 117		< 117				< 0.469		< 0.469		< 0.469	
Bromomethane	74-83-9	< 0.605		< 17.3		< 4.33		< 43.3		< 0.866		< 216		< 216		< 216	J3	< 217				< 0.866		< 0.866		< 0.866	
Carbon disulfide	75-15-0	< 0.0962		< 5.50		< 1.38		< 13.8		< 0.275		< 68.8		< 68.8		< 68.8		< 68.8				< 0.275		< 0.275		< 0.275	
Carbon tetrachloride	56-23-5	< 0.128		< 7.58		< 1.90		< 19.0		< 0.379		< 94.8		< 94.8		< 94.8		< 94.8				< 0.379		< 0.379		< 0.379	
Chlorobenzene	108-90-7	< 0.116		< 6.96		< 1.74		< 17.4		< 0.348		< 87.0		< 87.0		< 87.0		< 87.0				< 0.348		< 0.348		< 0.348	
Chloroethane	75-00-3	< 0.192		< 9.06		< 2.26		< 22.6		< 0.453		< 113		< 113		< 113		< 113				< 0.453		< 0.453		< 0.453	
Chloroform	67-66-3	< 0.111		< 6.48		< 1.62		< 16.2		< 0.324		< 81.0		< 81.0		< 81.0		< 81.0				< 0.324		< 0.324		< 0.324	
Chloromethane	74-87-3	< 0.960		< 5.52		< 1.38		< 13.8		< 0.276		< 69.0		< 69.0		< 69.0		< 69.0				< 0.276		< 0.276		< 0.276	
cis-1,2-Dichloroethene	156-59-2	< 0.126		< 5.20		< 1.30		< 13.0		< 0.260		< 65.0		< 65.0		< 65.0		< 65.0				< 0.260		< 0.260		< 0.260	
cis-1,3-Dichloropropene	10061-01-5	< 0.111		< 8.36		< 2.09		< 20.9		< 0.418		< 104		< 104		< 104		< 105				< 0.418		< 0.418		< 0.418	
Cyanide	57-12-5																					< 1.20		1.82	J	< 1.80	
Dibromochloromethane	124-48-1	< 0.140		< 6.54		< 1.64		< 16.4		< 0.327		< 81.8		< 81.8		< 81.8		< 81.7				< 0.327		< 0.327		< 0.327	
Ethylbenzene	100-41-4	< 0.137		790		448		1270		917		1360		479		603		118	J	131	J6	< 0.384		< 0.384		< 0.384	
Isopropylbenzene	98-82-8	< 0.105		67.0		68.9		82.8		88.4		< 81.5		96.2	J	122	J	< 81.5				< 0.326		< 0.326		< 0.326	
m,p-Xylene	179601-23-1	< 0.430		671		502		1040		705		954		358	J	498	J	290	J	115		< 0.719		< 0.719		< 0.719	
Mercury	7439-97-6																					< 0.0490		< 0.0490	J3	< 0.0490	
Methyl tert-butyl ether	1634-04-4	94.8		326		851		214		263		171	J	611		372		517		441	V	< 0.367		< 0.367		< 0.367	
Methylene chloride	75-09-2	< 0.430		< 20.0		< 5.00		< 50.0		< 1.00		< 250		< 250		< 250		< 250				< 1.00		< 1.00		< 1.00	
Naphthalene	91-20-3	< 1.00		101		83.2		224	J	138		< 250		< 250		1200	JJ4	< 250		33.2	J	< 1.00		< 1.00		< 1.00	
n-Butylbenzene	104-51-8	< 0.157		< 7.22		8.27		< 18.0		10.2		< 90.2		< 90.2		< 90.2		< 90.3				< 0.361		< 0.361		< 0.361	
n-Propylbenzene	103-65-1	< 0.0993		98.3		111		144		137		118	J	145	J	177	J	90.8	J			< 0.349		< 0.349		< 0.349	
o-Xylene	95-47-6	< 0.174		78.8		35.6		115		92.4		< 85.2		< 85.2		< 85.2		< 85.2		7.48	J	< 0.341		< 0.341		< 0.341	
sec-Butylbenzene	135-98-8	< 0.125		9.87	J	11.4		< 18.2		< 0.365		< 91.2		< 91.2		< 91.2		< 91.3				< 0.365		< 0.365		< 0.365	
Styrene	100-42-5	< 0.118		< 6.14		< 1.54		< 15.4		< 0.307		< 76.8		< 76.8		< 76.8		< 76.8				< 0.307		< 0.307		< 0.307	
Tetrachloroethene	127-18-4	< 0.300		< 7.44		< 1.86		< 18.6		< 0.372		< 93.0		< 93.0		< 93.0		< 93.0				< 0.372		< 0.372		< 0.372	
Toluene	108-88-3	< 0.278		214		214		667		722		1020		< 103		152	J	138	J	54.4		< 0.780		< 0.780		< 0.412	
trans-1,2-Dichloroethene	156-60-5	< 0.149		< 7.92		< 1.98		< 19.8		< 0.396		< 99.0		< 99.0		< 99.0		< 99.0				< 0.396		< 0.396		< 0.396	
trans-1,3-Dichloropropene	10061-02-6	< 0.118		< 8.38		< 2.10		< 21.0		< 0.419		< 105		< 105		< 105		< 105				< 0.419		< 0.419		< 0.419	
Trichloroethene	79-01-6	< 0.190		< 7.96		< 1.99		< 19.9		< 0.398		< 99.5		< 99.5		< 99.5		< 99.5				< 0.398		< 0.398		< 0.398	
Vinyl chloride	75-01-4	< 0.234		< 5.18		< 1.30		< 13.0		< 0.259		< 64.8		< 64.8	J3	< 64.8		< 64.8				< 0.259		< 0.259		< 0.259	
Xylenes, total	1330-20-7	< 0.174		750		538		1160		797		955		358	J	498	J	290	J	122		< 1.06		< 1.06		< 1.06	

Table 4
Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

Samp Field D		MW-52 10/4/2017		MW-52 4/5/2018		MW-52 10/3/2018		MW-52 4/3/2019		MW-52 10/23/2019		MW-52 6/17/2020		MW-52 10/7/2020		MW-52 4/14/2021	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147		< 0.147		< 0.147	
1,1,1-Trichloroethane	71-55-6	< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.149		< 0.149	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.133		< 0.133	
1,1,2-Trichloroethane	79-00-5	< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.158		< 0.158		< 0.158	
1,1-Dichloroethane	75-34-3	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.100		< 0.100	
1,1-Dichloroethene	75-35-4	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.188		< 0.188	
1,2,4-Trimethylbenzene	95-63-6	< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.322		< 0.322		< 0.322	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.126		< 0.126		< 0.126	
1,2-Dichloroethane	107-06-2	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819		< 0.0819		< 0.0819	
1,2-Dichloropropane	78-87-5	< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.149		< 0.149	
1,3,5-Trimethylbenzene	108-67-8	< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.104		< 0.104		< 0.104	
2-Butanone (MEK)	78-93-3	< 3.93		< 3.93		< 3.93	J3J4	< 3.93		< 3.93		< 1.19		< 1.19		< 1.19	
2-Hexanone	591-78-6	< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787		< 0.787		< 0.787	
4-Isopropyltoluene	99-87-6	< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.120		< 0.120		< 0.120	
4-Methyl-2-pentanone	108-10-1	< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478		< 0.478		< 0.478	
Acetone	67-64-1	< 10.0		< 10.0		< 10.0	J3	< 10.0		< 10.0		< 11.3		< 11.3		< 11.3	
Benzene	71-43-2	< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.0941		< 0.0941		< 0.0941	
Bromodichloromethane	75-27-4	< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.136		< 0.136	
Bromoform	75-25-2	< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.129		< 0.129	
Bromomethane	74-83-9	< 0.866		< 0.866		< 0.866		< 0.866	J3	< 0.866		< 0.605		< 0.605		< 0.605	
Carbon disulfide	75-15-0	< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		0.318	JB	< 0.0962		< 0.0962	
Carbon tetrachloride	56-23-5	< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.128		< 0.128	
Chlorobenzene	108-90-7	< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116		< 0.116		< 0.116	
Chloroethane	75-00-3	< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.192		< 0.192		< 0.192	
Chloroform	67-66-3	< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.111		< 0.111		< 0.111	
Chloromethane	74-87-3	< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960		< 0.960		< 0.960	
cis-1,2-Dichloroethene	156-59-2	< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.126		< 0.126	
cis-1,3-Dichloropropene	10061-01-5	< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111		< 0.111		< 0.111	
Cyanide	57-12-5	< 1.80	J5	< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80	
Dibromochloromethane	124-48-1	< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.140		< 0.140		< 0.140	
Ethylbenzene	100-41-4	< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137		< 0.137		< 0.137	
Isopropylbenzene	98-82-8	< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.105		< 0.105		< 0.105	
m,p-Xylene	179601-23-1	< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430		< 0.430		< 0.430	
Mercury	7439-97-6	< 0.0490		< 0.0490		< 0.0490		< 0.0490		0.0644	JB	< 0.100		< 0.100		< 0.100	
Methyl tert-butyl ether	1634-04-4	< 0.367		< 0.367		< 0.367		< 0.367		< 0.367		< 0.101		< 0.101		< 0.101	
Methylene chloride	75-09-2	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 0.430		< 0.430	
Naphthalene	91-20-3	< 1.00		< 1.00		< 1.00		< 1.00	J4	< 1.00		< 1.00		< 1.00		< 1.00	
n-Butylbenzene	104-51-8	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.157		< 0.157		< 0.157	
n-Propylbenzene	103-65-1	< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993		< 0.0993	
o-Xylene	95-47-6	< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.174		< 0.174		< 0.174	
sec-Butylbenzene	135-98-8	< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.125		< 0.125		< 0.125	
Styrene	100-42-5	< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.118		< 0.118	
Tetrachloroethene	127-18-4	< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300		< 0.300		< 0.300	
Toluene	108-88-3	< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.278		< 0.278		< 0.278	
trans-1,2-Dichloroethene	156-60-5	< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.149		< 0.149	
trans-1,3-Dichloropropene	10061-02-6	< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.118	J4	< 0.118	
Trichloroethene	79-01-6	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190		< 0.190		< 0.190	
Vinyl chloride	75-01-4	< 0.259		< 0.259		< 0.259	J3	< 0.259		< 0.259		< 0.234		< 0.234		< 0.234	
Xylenes, total	1330-20-7	< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174		< 0.174		< 0.174	

Samp Field D		MW-53 4/26/2016		MW-53 4/25/2017		MW-53 4/3/2018		MW-53 4/2/2019		MW-57 4/27/2016	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.385		< 0.385		< 0.385		< 0.385		< 0.385	
1,1,1-Trichloroethane	71-55-6	< 0.319		< 0.319		< 0.319		< 0.319		< 0.319	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.130	J4	< 0.130		< 0.130		< 0.130		< 0.130	
1,1,2-Trichloroethane	79-00-5	< 0.383		< 0.383		< 0.383		< 0.383		< 0.383	
1,1-Dichloroethane	75-34-3	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	
1,1-Dichloroethene	75-35-4	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398	
1,2,4-Trimethylbenzene	95-63-6	< 0.373		< 0.373		< 0.373		< 0.373		< 0.373	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.381		< 0.381		< 0.381		< 0.381		< 0.381	
1,2-Dichloroethane	107-06-2	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361	
1,2-Dichloropropane	78-87-5	< 0.306		< 0.306		< 0.306		< 0.306		< 0.306	
1,3,5-Trimethylbenzene	108-67-8	< 0.387		< 0.387		< 0.387		< 0.387		< 0.387	
2-Butanone (MEK)	78-93-3	< 3.93		< 3.93		< 3.93		< 3.93		< 3.93	
2-Hexanone	591-78-6	< 3.82		< 3.82		< 3.82		< 3.82		< 3.82	
4-Isopropyltoluene	99-87-6	< 0.350		< 0.350		< 0.350		< 0.350		< 0.350	
4-Methyl-2-pentanone	108-10-1	< 2.14		< 2.14		< 2.14		< 2.14		< 2.14	
Acetone	67-64-1	< 10.0		< 10.0	J4	< 10.0		< 10.0		< 10.0	
Benzene	71-43-2	< 0.331		< 0.331		< 0.331		< 0.331		< 0.331	
Bromodichloromethane	75-27-4	< 0.380		< 0.380		< 0.380		< 0.380		< 0.380	
Bromoform	75-25-2	< 0.469		< 0.469		< 0.469		< 0.469		< 0.469	
Bromomethane	74-83-9	< 0.866		< 0.866		< 0.866		< 0.866		< 0.866	
Carbon disulfide	75-15-0	< 0.275		< 0.275		< 0.275		< 0.275		< 0.275	
Carbon tetrachloride	56-23-5	< 0.379		< 0.379		< 0.379		< 0.379		< 0.379	
Chlorobenzene	108-90-7	< 0.348		< 0.348		< 0.348		< 0.348		< 0.348	
Chloroethane	75-00-3	< 0.453		< 0.453		< 0.453		< 0.453		< 0.453	
Chloroform	67-66-3	< 0.324		< 0.324		< 0.324		< 0.324		< 0.324	
Chloromethane	74-87-3	< 0.276		< 0.276		< 0.276		< 0.276		< 0.276	
cis-1,2-Dichloroethene	156-59-2	< 0.260		0.391	J	< 0.260		< 0.260		< 0.260	
cis-1,3-Dichloropropene	10061-01-5	< 0.418		< 0.418		< 0.418		< 0.418		< 0.418	
Cyanide	57-12-5										
Dibromochloromethane	124-48-1	< 0.327		< 0.327		< 0.327		< 0.327		< 0.327	
Ethylbenzene	100-41-4	< 0.384		< 0.384		< 0.384		< 0.384		< 0.384	
Isopropylbenzene	98-82-8	< 0.326		< 0.326		< 0.326		< 0.326		< 0.326	
m,p-Xylene	179601-23-1	< 0.719		< 0.719		< 0.719		< 0.719		< 0.719	
Mercury	7439-97-6										
Methyl tert-butyl ether	1634-04-4	< 0.367		< 0.367		< 0.367		< 0.367		< 0.367	
Methylene chloride	75-09-2	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	
Naphthalene	91-20-3	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	
n-Butylbenzene	104-51-8	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361	
n-Propylbenzene	103-65-1	< 0.349		< 0.349		< 0.349		< 0.349		< 0.349	
o-Xylene	95-47-6	< 0.341		< 0.341		< 0.341		< 0.341		< 0.341	
sec-Butylbenzene	135-98-8	< 0.365		< 0.365		< 0.365		< 0.365		< 0.365	
Styrene	100-42-5	< 0.307		< 0.307		< 0.307		< 0.307		< 0.307	
Tetrachloroethene	127-18-4	< 0.372		< 0.372		< 0.372		< 0.372		< 0.372	
Toluene	108-88-3	< 0.780		< 0.412		< 0.412		< 0.412		< 0.780	
trans-1,2-Dichloroethene	156-60-5	< 0.396		< 0.396		< 0.396		< 0.396		< 0.396	
trans-1,3-Dichloropropene	10061-02-6	< 0.419		< 0.419		< 0.419		< 0.419		< 0.419	
Trichloroethene	79-01-6	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398	
Vinyl chloride	75-01-4	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	
Xylenes, total	1330-20-7	< 1.06		< 1.06		< 1.06		< 1.06		< 1.06	

Table 4
Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

Samp	Field D	MW-57 10/5/2016		MW-57 4/26/2017		MW-57 10/3/2017		MW-57 4/4/2018		MW-57 10/3/2018		MW-57 4/2/2019		MW-57 10/22/2019		MW-57 6/16/2020		MW-57 10/6/2020		MW-57 4/13/2021		MW-58 4/28/2016		MW-58 10/5/2016		MW-58 4/25/2017	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147		< 0.147		< 0.147		< 3.85		< 0.385		< 38.5	
1,1,1-Trichloroethane	71-55-6	< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.149		< 0.149		< 3.19		< 0.319		< 31.9	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.133		< 0.133		< 1.30		< 0.130		< 13.0	
1,1,2-Trichloroethane	79-00-5	< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.158		< 0.158		< 0.158		< 3.83		< 0.383		< 38.3	
1,1-Dichloroethane	75-34-3	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.100		< 0.100		< 2.59		< 0.259		< 25.9	
1,1-Dichloroethene	75-35-4	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.188		< 0.188		< 3.98		< 0.398		< 39.8	
1,2,4-Trimethylbenzene	95-63-6	< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.322		< 0.322		< 0.322		753		387		517	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.126		< 0.126		< 0.126		< 3.81		< 0.381		< 38.1	
1,2-Dichloroethane	107-06-2	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819		< 0.0819		< 0.0819		< 3.61		< 0.361		< 36.1	
1,2-Dichloropropane	78-87-5	< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.149		< 0.149		< 3.06		< 0.306		< 30.6	
1,3,5-Trimethylbenzene	108-67-8	< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.104		< 0.104		< 0.104		17.9		3.21		< 38.7	
2-Butanone (MEK)	78-93-3	< 3.93		< 3.93		< 3.93		< 3.93		< 3.93	J3J4	< 3.93		< 3.93		< 1.19		< 1.19		< 1.19		< 39.3		< 3.93		< 393	
2-Hexanone	591-78-6	< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787		< 0.787		< 0.787		< 38.2		< 3.82		< 382	
4-Isopropyltoluene	99-87-6	< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.120		< 0.120		< 0.120		8.13	J	5.72		< 35.0	
4-Methyl-2-pentanone	108-10-1	< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478		< 0.478		< 0.478		< 21.4		< 2.14		< 214	
Acetone	67-64-1	< 10.0		< 10.0		< 10.0		< 10.0		< 10.0	J3	< 10.0		< 10.0		< 11.3		< 11.3		< 11.3		< 100		< 10.0		< 1000	
Benzene	71-43-2	0.681	J	< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.0941		< 0.0941		< 0.0941		4120		5920		3000	
Bromodichloromethane	75-27-4	< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.136		< 0.136		< 3.80		< 0.380		< 38.0	
Bromoform	75-25-2	< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.129		< 0.129		< 4.69		< 0.469		< 46.9	
Bromomethane	74-83-9	< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.605		< 0.605	J4	< 0.605		< 8.66		< 0.866		< 86.6	
Carbon disulfide	75-15-0	< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.0962		< 0.0962		< 0.0962		< 2.75		0.345	JV3	< 27.5	
Carbon tetrachloride	56-23-5	< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.128		< 0.128		< 3.79		< 0.379		< 37.9	
Chlorobenzene	108-90-7	< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116	J4	< 0.116		< 0.116		< 3.48		< 0.348		< 34.8	
Chloroethane	75-00-3	< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.192		< 0.192		< 0.192		< 4.53		< 0.453		< 45.3	
Chloroform	67-66-3	< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.111		< 0.111		< 0.111		< 3.24		< 0.324		< 32.4	
Chloromethane	74-87-3	< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960		< 0.960		< 0.960		< 2.76		< 0.276		< 27.6	
cis-1,2-Dichloroethene	156-59-2	< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.126		< 0.126		< 2.60		< 0.260		< 26.0	
cis-1,3-Dichloropropene	10061-01-5	< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111	J4	< 0.111		< 0.111	J4	< 4.18		< 0.418		< 41.8	
Cyanide	57-12-5																					< 1.20		< 1.80		< 1.80	
Dibromochloromethane	124-48-1	< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.140		< 0.140		< 0.140		< 3.27		< 0.327		< 32.7	
Ethylbenzene	100-41-4	< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137		< 0.137		< 0.137		1110		1100		720	
Isopropylbenzene	98-82-8	< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.105		< 0.105		< 0.105		59.4		53.0		51.1	J
m,p-Xylene	179601-23-1	< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430		< 0.430		< 0.430		830		873		533	
Mercury	7439-97-6																					< 0.0490		< 0.0490	J3	< 0.0490	
Methyl tert-butyl ether	1634-04-4	< 0.367		< 0.367		< 0.367		< 0.367		< 0.367		< 0.367		< 0.367		< 0.101		< 0.101		< 0.101		200		46.8	V3	< 36.7	
Methylene chloride	75-09-2	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 0.430		< 0.430		< 10.0		< 1.00		< 100	
Naphthalene	91-20-3	< 1.00	J4	< 1.00		2.73	J	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		257		86.7		191	J
n-Butylbenzene	104-51-8	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.157		< 0.157		< 0.157		9.44	J	5.17		< 36.1	
n-Propylbenzene	103-65-1	< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993		< 0.0993		105		93.0		91.0	J
o-Xylene	95-47-6	< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.174		< 0.174		< 0.174		18.3		20.1		< 34.1	
sec-Butylbenzene	135-98-8	< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.125		< 0.125		< 0.125		11.2		8.11		< 36.5	
Styrene	100-42-5	< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.118		< 0.118		< 3.07		< 0.307		< 30.7	
Tetrachloroethene	127-18-4	< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300		< 0.300		< 0.300		< 3.72		< 0.372		< 37.2	
Toluene	108-88-3	< 0.780		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.278		< 0.278		< 0.278		8.06	J	15.9		< 41.2	
trans-1,2-Dichloroethene	156-60-5	< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.149		< 0.149		< 3.96		< 0.396		< 39.6	
trans-1,3-Dichloropropene	10061-02-6	< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.118		< 0.118		< 4.19		< 0.419		< 41.9	
Trichloroethene	79-01-6	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190	J4	< 0.190	J4	< 0.190		< 3.98		< 0.398		< 39.8	
Vinyl chloride	75-01-4	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	J3	< 0.259		< 0.259		< 0.234		< 0.234		< 0.234		< 2.59		< 0.259		< 25.9	
Xylenes, total	1330-20-7	< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174		< 0.174		< 0.174		848		893		533	

Table 4

Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

	Samp	MW-58		MW-58		MW-58		MW-58		MW-68		MW-68		MW-68		MW-68		MW-68		MW-68		MW-71		MW-71		MW-71	
	Field D	10/4/2017		4/3/2018		10/3/2018		10/22/2019		4/28/2016		4/26/2017		4/3/2018		4/3/2019		6/17/2020		4/14/2021		4/28/2016		4/26/2017		4/4/2018	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.385		< 19.2		< 19.2		< 3.85		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147		< 0.147		< 0.385		< 0.385		< 0.385	
1,1,1-Trichloroethane	71-55-6	< 0.319		< 16.0		< 16.0		< 3.19		< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.149		< 0.319		< 0.319		< 0.319	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.130		< 6.50		< 6.50		< 1.30		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.133		< 0.130		< 0.130		< 0.130	
1,1,2-Trichloroethane	79-00-5	< 0.383		< 19.2		< 19.2		< 3.83	J4	< 0.383		< 0.383		< 0.383		< 0.383	J4	< 0.158		< 0.158		< 0.383		< 0.383		< 0.383	
1,1-Dichloroethane	75-34-3	< 0.259		< 13.0		< 13.0		< 2.59		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.100		< 0.259		< 0.259		< 0.259	
1,1-Dichloroethene	75-35-4	< 0.398		< 19.9		< 19.9		< 3.98		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.188		< 0.398		< 0.398		< 0.398	
1,2,4-Trimethylbenzene	95-63-6	166		574		23.5	J	272		< 0.373		< 0.373		< 0.373		< 0.373		< 0.322		< 0.322		< 0.373		< 0.373		< 0.373	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.381		< 19.0		< 19.0		< 3.81	J4	< 0.381		< 0.381		< 0.381		< 0.381		< 0.126		< 0.126		< 0.381		< 0.381		< 0.381	
1,2-Dichloroethane	107-06-2	< 0.361		< 18.0		< 18.0		< 3.61		< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819		< 0.0819		< 0.361		< 0.361		< 0.361	
1,2-Dichloropropane	78-87-5	< 0.306		< 15.3		< 15.3		< 3.06		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.149		< 0.306		< 0.306		< 0.306	
1,3,5-Trimethylbenzene	108-67-8	1.30		< 19.4		< 19.4		12.3		< 0.387		< 0.387		< 0.387		< 0.387		< 0.104		< 0.104		< 0.387		< 0.387		< 0.387	
2-Butanone (MEK)	78-93-3	< 3.93		< 196		< 196	J3J4	< 39.3		< 3.93		< 3.93		< 3.93		< 3.93		< 1.19		< 1.19		< 3.93		< 3.93		< 3.93	
2-Hexanone	591-78-6	< 3.82		< 191		< 191		< 38.2		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787		< 0.787		< 3.82		< 3.82		< 3.82	
4-Isopropyltoluene	99-87-6	3.99		< 17.5		< 17.5		4.66	J	< 0.350		< 0.350		< 0.350		< 0.350		< 0.120		< 0.120		< 0.350		< 0.350		< 0.350	
4-Methyl-2-pentanone	108-10-1	< 2.14		< 107		< 107		< 21.4		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478		< 0.478		< 2.14		< 2.14		< 2.14	
Acetone	67-64-1	< 10.0		< 500		< 500	J3	< 100		< 10.0		< 10.0		< 10.0		< 10.0	J4	< 11.3		< 11.3	J3J4	< 10.0		< 10.0		< 10.0	
Benzene	71-43-2	4080		4120		7110		3780		< 0.331		< 0.331		< 0.331		< 0.331		< 0.0941		< 0.0941		< 0.331		< 0.331		< 0.331	
Bromodichloromethane	75-27-4	< 0.380		< 19.0		< 19.0		< 3.80		< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.136		< 0.380		< 0.380		< 0.380	
Bromoform	75-25-2	< 0.469		< 23.4		< 23.4		< 4.69		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.129		< 0.469		< 0.469		< 0.469	
Bromomethane	74-83-9	< 0.866		< 43.3		< 43.3		< 8.66		< 0.866		< 0.866		< 0.866		< 0.866		< 0.605		< 0.605		< 0.866		< 0.866		< 0.866	
Carbon disulfide	75-15-0	< 0.275		< 13.8		< 13.8		< 2.75		< 0.275		< 0.275		< 0.275		< 0.275		< 0.0962		< 0.0962		< 0.275		< 0.275		< 0.275	
Carbon tetrachloride	56-23-5	< 0.379		< 19.0		< 19.0		< 3.79		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.128		< 0.379		< 0.379		< 0.379	
Chlorobenzene	108-90-7	< 0.348		< 17.4		< 17.4		< 3.48		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116		< 0.116		< 0.348		< 0.348		< 0.348	
Chloroethane	75-00-3	< 0.453		< 22.6		< 22.6		< 4.53		< 0.453		< 0.453		< 0.453		< 0.453		< 0.192		< 0.192		< 0.453		< 0.453		< 0.453	
Chloroform	67-66-3	< 0.324		< 16.2		< 16.2		< 3.24		< 0.324		< 0.324		< 0.324		< 0.324		< 0.111		< 0.111		< 0.324		< 0.324		< 0.324	
Chloromethane	74-87-3	< 0.276		< 13.8		< 13.8		< 2.76		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960		< 0.960		< 0.276		< 0.276		< 0.276	
cis-1,2-Dichloroethene	156-59-2	< 0.260		< 13.0		< 13.0		< 2.60		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.126		< 0.260		< 0.260		< 0.260	
cis-1,3-Dichloropropene	10061-01-5	< 0.418		< 20.9		< 20.9		< 4.18		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111		< 0.111		< 0.418		< 0.418		< 0.418	
Cyanide	57-12-5	< 1.80		< 1.80		< 1.80	J3J6	< 1.80														< 1.80		< 1.80		< 1.80	
Dibromochloromethane	124-48-1	< 0.327		< 16.4		< 16.4		< 3.27	J4	< 0.327		< 0.327		< 0.327		< 0.327		< 0.140		< 0.140		< 0.327		< 0.327		< 0.327	
Ethylbenzene	100-41-4	96.5		946		35.1	J	634		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137		< 0.137		< 0.384		< 0.384		< 0.384	
Isopropylbenzene	98-82-8	45.6		52.1		46.1	J	37.0		< 0.326		< 0.326		< 0.326		< 0.326		< 0.105		< 0.105		< 0.326		< 0.326		< 0.326	
m,p-Xylene	179601-23-1	220		268		< 36.0		395		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430		< 0.430		< 0.719		< 0.719		< 0.719	
Mercury	7439-97-6	< 0.0490		< 0.0490		< 0.0490		0.0567	JB													< 0.0490		< 0.0490		< 0.0490	
Methyl tert-butyl ether	1634-04-4	98.7		30.3	J	62.4		< 3.67		< 0.367		< 0.367		< 0.367		< 0.367		< 0.101		< 0.101		< 0.367		< 0.367		< 0.367	
Methylene chloride	75-09-2	< 1.00		< 50.0		< 50.0		< 10.0		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 0.430		< 1.00		< 1.00		< 1.00	
Naphthalene	91-20-3	46.9		267		< 50.0		91.7		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	J4	< 1.00		< 1.00		< 1.00		< 1.00	
n-Butylbenzene	104-51-8	5.29		< 18.0		< 18.0		8.04	J	< 0.361		< 0.361		< 0.361		< 0.361		< 0.157		< 0.157		< 0.361		< 0.361		< 0.361	
n-Propylbenzene	103-65-1	84.2		96.5		90.0		67.6		< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993		< 0.349		< 0.349		< 0.349	
o-Xylene	95-47-6	1.79		< 17.0		< 17.0		11.9		< 0.341		< 0.341		< 0.341		< 0.341		< 0.174		< 0.174		< 0.341		< 0.341		< 0.341	
sec-Butylbenzene	135-98-8	8.72		< 18.2		< 18.2		10.5		< 0.365		< 0.365		< 0.365		< 0.365		< 0.125		< 0.125		< 0.365		< 0.365		< 0.365	
Styrene	100-42-5	< 0.307		< 15.4		< 15.4		< 3.07		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.118		< 0.307		< 0.307		< 0.307	
Tetrachloroethene	127-18-4	< 0.372		< 18.6		< 18.6		< 3.72		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300		< 0.300		< 0.372		< 0.372		< 0.372	
Toluene	108-88-3	10.1		< 20.6		< 20.6		14.1	J4	< 0.780		< 0.412		< 0.412		< 0.412		< 0.278		< 0.278		< 0.780		< 0.412		< 0.412	
trans-1,2-Dichloroethene	156-60-5	< 0.396		< 19.8		< 19.8		< 3.96		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.149		< 0.396		< 0.396		< 0.396	
trans-1,3-Dichloropropene	10061-02-6	< 0.419		< 21.0		< 21.0		< 4.19		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.118		< 0.419		< 0.419		< 0.419	
Trichloroethene	79-01-6	< 0.398		< 19.9		< 19.9		< 3.98		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190		< 0.190		< 0.398		< 0.398		< 0.398	
Vinyl chloride	75-01-4	< 0.259		< 13.0		< 13.0	J3	< 2.59		< 0.259		< 0.259		< 0.259		< 0.259		< 0.234		< 0.234		< 0.259		< 0.259		< 0.259	
Xylenes, total	1330-20-7	222		268		< 53.0		407		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174		< 0.174		< 1.06		< 1.06		< 1.06	

Table 4
Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

Samp		MW-71		MW-71		MW-71		MW-113		MW-113		MW-113		MW-113		MW-113		MW-113		MW-113		MW-113		MW-113		MW-113	
Field D		4/3/2019		6/17/2020		4/14/2021		4/28/2016 FD		4/28/2016		10/5/2016 FD		10/5/2016		4/27/2017 FD		4/27/2017		10/4/2017 FD		10/4/2017		4/4/2018 FD		4/4/2018	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.385		< 0.147		< 0.147		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385	
1,1,1-Trichloroethane	71-55-6	< 0.319		< 0.149		< 0.149		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.130		< 0.133		< 0.133		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130	
1,1,2-Trichloroethane	79-00-5	< 0.383	J4	< 0.158		< 0.158		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383	
1,1-Dichloroethane	75-34-3	< 0.259		< 0.100		< 0.100		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	
1,1-Dichloroethene	75-35-4	< 0.398		< 0.188		< 0.188		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398	
1,2,4-Trimethylbenzene	95-63-6	< 0.373		< 0.322		< 0.322		0.813	J	0.753	J	9.33		9.77		4.48		3.89		21.2		22.9		2.74		2.40	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.381		< 0.126		< 0.126		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381	
1,2-Dichloroethane	107-06-2	< 0.361		0.171	J	0.156	J	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361	
1,2-Dichloropropane	78-87-5	< 0.306		< 0.149		< 0.149		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306	
1,3,5-Trimethylbenzene	108-67-8	< 0.387		< 0.104		< 0.104		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		0.442	J	< 0.387		< 0.387	
2-Butanone (MEK)	78-93-3	< 3.93		< 1.19		< 1.19		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93	
2-Hexanone	591-78-6	< 3.82		< 0.787		< 0.787		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82	
4-Isopropyltoluene	99-87-6	< 0.350		< 0.120		< 0.120		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350	
4-Methyl-2-pentanone	108-10-1	< 2.14		< 0.478		< 0.478		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14	
Acetone	67-64-1	< 10.0	J4	< 11.3		< 11.3	J3J4	< 10.0		< 10.0		< 10.0		< 10.0		< 10.0		42.4	J	< 10.0		< 10.0		< 10.0		30.7	J
Benzene	71-43-2	< 0.331		< 0.0941		< 0.0941		14.8		13.6		5.88		6.60		14.5		13.6		13.8		13.2		9.96		9.08	
Bromodichloromethane	75-27-4	< 0.380		< 0.136		< 0.136		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380	
Bromoform	75-25-2	< 0.469		< 0.129		< 0.129		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469	
Bromomethane	74-83-9	< 0.866		< 0.605		< 0.605		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866	
Carbon disulfide	75-15-0	< 0.275		< 0.0962		< 0.0962		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		0.571	J
Carbon tetrachloride	56-23-5	< 0.379		< 0.128		< 0.128		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379	
Chlorobenzene	108-90-7	< 0.348		< 0.116		< 0.116		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348	
Chloroethane	75-00-3	< 0.453		< 0.192		< 0.192		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453	J4	< 0.453	
Chloroform	67-66-3	< 0.324		< 0.111		< 0.111		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324	
Chloromethane	74-87-3	< 0.276		< 0.960		< 0.960		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276	
cis-1,2-Dichloroethene	156-59-2	< 0.260		< 0.126		< 0.126		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260	
cis-1,3-Dichloropropene	10061-01-5	< 0.418		< 0.111		< 0.111		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418	
Cyanide	57-12-5	< 1.80		< 1.80		< 45.0																					
Dibromochloromethane	124-48-1	< 0.327		< 0.140		< 0.140		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327	
Ethylbenzene	100-41-4	< 0.384		< 0.137		< 0.137		3.64		3.54		17.5		19.9		9.37		8.40		21.5		26.9		6.67		6.04	
Isopropylbenzene	98-82-8	< 0.326		< 0.105		< 0.105		< 0.326		< 0.326		1.37		1.40		0.513	J	0.441	J	5.46		5.65		0.449	J	0.518	J
m,p-Xylene	179601-23-1	< 0.719		< 0.430		< 0.430		5.31		5.18		12.7		14.3		14.8		13.3		23.4		27.9		9.01		8.49	
Mercury	7439-97-6	< 0.0490		< 0.100		0.261																					
Methyl tert-butyl ether	1634-04-4	< 0.367		1.52		7.06		14.3		14.3		14.3		13.7		14.0		14.7		11.7		12.3		12.0		11.4	
Methylene chloride	75-09-2	< 1.00		< 0.430		< 0.430		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	
Naphthalene	91-20-3	< 1.00		< 1.00	J4	< 1.00		< 1.00		< 1.00		2.00	JJ4	2.08	JJ4	1.76	J	1.57	J	3.99	J	4.20	J	< 1.00		< 1.00	
n-Butylbenzene	104-51-8	< 0.361		< 0.157		< 0.157		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361	
n-Propylbenzene	103-65-1	< 0.349		< 0.0993		< 0.0993		< 0.349		< 0.349		1.63		1.81		0.359	J	0.359	J	4.44		4.56		0.439	J	0.598	J
o-Xylene	95-47-6	< 0.341		< 0.174		< 0.174		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341	
sec-Butylbenzene	135-98-8	< 0.365		< 0.125		< 0.125		< 0.365		< 0.365		0.379	J	0.418	J	0.417	J	0.379	J	0.880	J	0.988	J	< 0.365		< 0.365	
Styrene	100-42-5	< 0.307		< 0.118		< 0.118		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307	
Tetrachloroethene	127-18-4	< 0.372		< 0.300		< 0.300		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372	
Toluene	108-88-3	< 0.412		< 0.278		< 0.278		< 0.780		< 0.780		< 0.780		< 0.780		< 0.412		< 0.412		0.660	J	0.501	J	< 0.412		< 0.412	
trans-1,2-Dichloroethene	156-60-5	< 0.396		< 0.149		< 0.149		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396	
trans-1,3-Dichloropropene	10061-02-6	< 0.419		< 0.118		< 0.118		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419	
Trichloroethene	79-01-6	< 0.398		< 0.190		< 0.190		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398	
Vinyl chloride	75-01-4	< 0.259		< 0.234		< 0.234		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	
Xylenes, total	1330-20-7	< 1.06		< 0.174		< 0.174		5.31		5.18		12.7		14.3		14.8		13.3		23.4		27.9		9.01		8.49	

Table 4

Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

	Samp	MW-113 10/2/2018		MW-113 10/2/2018		MW-113 4/2/2019		MW-113 4/2/2019		MW-113 10/23/2019		MW-113 10/23/2019		MW-113 6/17/2020		MW-113 6/17/2020		MW-113 10/7/2020		MW-113 10/7/2020		MW-113 4/14/2021		MW-113 4/14/2021		MW-130 4/27/2016	
	Field D	FD				FD						FD		FD				FD				FD					
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147		< 0.735		< 0.147		< 0.735		< 0.147	J4	< 0.735		< 0.385	
1,1,1-Trichloroethane	71-55-6	< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.745		0.154	J	< 0.745		< 0.149		< 0.745		< 0.319	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.665		< 0.133		< 0.665		< 0.133		< 0.665		< 0.130	
1,1,2-Trichloroethane	79-00-5	< 0.383		< 0.383		< 0.383		< 0.383	J4	< 0.383		< 0.383		< 0.158		< 0.790		< 0.158		< 0.790		< 0.158		< 0.790		< 0.383	
1,1-Dichloroethane	75-34-3	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.500		< 0.100		< 0.500		< 0.100		< 0.500		< 0.259	
1,1-Dichloroethene	75-35-4	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.940		< 0.188		< 0.940		< 0.188		< 0.940		< 0.398	
1,2,4-Trimethylbenzene	95-63-6	3.88		3.93		5.23		4.68		223		240		27.8		35.7		114		102		51.9		41.0		< 0.373	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.381		< 0.381		< 0.00240		< 0.00240		< 0.381		< 0.381		< 0.126		< 0.630		< 0.126		< 0.630		< 0.126		< 0.630		< 0.381	
1,2-Dichloroethane	107-06-2	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		0.410	J	< 0.409		< 0.0819		< 0.409		< 0.0819		< 0.409		< 0.361	
1,2-Dichloropropane	78-87-5	< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.745		< 0.149		< 0.745		< 0.149		< 0.745		< 0.306	
1,3,5-Trimethylbenzene	108-67-8	< 0.387		< 0.387		3.55		< 0.387		< 0.387		1.70		0.589	J	< 0.520		< 0.104		1.18	J	3.45		2.73	J	< 0.387	
2-Butanone (MEK)	78-93-3	< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 1.19		< 5.95		< 1.19		< 5.95		< 1.19		< 5.95		< 3.93	
2-Hexanone	591-78-6	< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787		< 3.94		< 0.787		< 3.94		< 0.787	J4	< 3.94		< 3.82	
4-Isopropyltoluene	99-87-6	< 0.350		< 0.350		< 0.350		< 0.350		3.13		2.92		1.57		1.38	J	1.91		1.47	J	3.82		1.20	J	< 0.350	
4-Methyl-2-pentanone	108-10-1	< 2.14		< 2.14		< 2.14		< 2.14		4.08	J	5.87	J	0.770	J	< 2.39		< 0.478		< 2.39		< 0.478		< 2.39		< 2.14	
Acetone	67-64-1	< 10.0		< 10.0		< 10.0		< 10.0	J4	< 10.0		< 10.0		39.6	J	< 56.5		< 11.3		< 56.5		< 11.3		< 56.5		< 10.0	
Benzene	71-43-2	1.30		1.82		13.9		15.4		547	J4	546		24.8		30.6		428		368		41.7		27.2		< 0.331	
Bromodichloromethane	75-27-4	< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.680		< 0.136		< 0.680		< 0.136		< 0.680		< 0.380	
Bromoform	75-25-2	< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.645		< 0.129		< 0.645		< 0.129	J4	< 0.645		< 0.469	
Bromomethane	74-83-9	< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.605		< 3.03		< 0.605		< 3.03		< 0.605		< 3.03		< 0.866	
Carbon disulfide	75-15-0	< 0.275		< 0.275		0.317	J	1.71		< 0.275		< 0.275		0.181	J	2.81	JB	0.234	JB	1.85	JB	0.140	J	< 0.481		< 0.275	
Carbon tetrachloride	56-23-5	< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.640		< 0.128		< 0.640		< 0.128		< 0.640		< 0.379	
Chlorobenzene	108-90-7	< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116	J4	< 0.580		< 0.116		< 0.580		< 0.116		< 0.580		< 0.348	
Chloroethane	75-00-3	< 0.453		< 0.453	J4	< 0.453		< 0.453		< 0.453		< 0.453		< 0.192		< 0.960		< 0.192		< 0.960		< 0.192	J4	< 0.960		< 0.453	
Chloroform	67-66-3	< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		4.90	J	< 0.555		< 0.111		< 0.555		< 0.111		< 0.555		< 0.324	
Chloromethane	74-87-3	< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960		< 4.80		< 0.960		< 4.80		< 0.960		< 4.80		< 0.276	
cis-1,2-Dichloroethene	156-59-2	< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.630		< 0.126		< 0.630		< 0.126		< 0.630		< 0.260	
cis-1,3-Dichloropropene	10061-01-5	< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111		< 0.555		< 0.111		< 0.555		< 0.111		< 0.555		< 0.418	
Cyanide	57-12-5																										
Dibromochloromethane	124-48-1	< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.140		< 0.700		< 0.140		< 0.700		< 0.140		< 0.700		< 0.327	
Ethylbenzene	100-41-4	9.92		8.85		8.09		7.03		248		270		4.48		3.55	J	137		129		18.3		12.6		< 0.384	
Isopropylbenzene	98-82-8	0.612	J	0.671	J	< 0.326		0.860	J	54.9		60.1		0.915	J	1.58	J	22.6		20.8		2.31		1.61	J	< 0.326	
m,p-Xylene	179601-23-1	9.38		8.67		12.8		11.3		307		284		47.0		36.3		165		154		56.9		39.5		< 0.719	
Mercury	7439-97-6																										
Methyl tert-butyl ether	1634-04-4	10.0		12.8		9.73		11.2		8.23		8.09		10.4		12.9		11.8		11.7		8.23		8.05		0.538	J
Methylene chloride	75-09-2	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 2.15		< 0.430		< 2.15		< 0.430		< 2.15		< 1.00	
Naphthalene	91-20-3	1.17	J	< 1.00		1.10	J	1.08	J	128		98.6		1.95	J	< 5.00		10.4		10.1	J	5.07		< 5.00		< 1.00	
n-Butylbenzene	104-51-8	< 0.361		< 0.361		< 0.361		< 0.361		4.51		3.77		< 0.157		< 0.785		1.12		0.994	J	< 0.157		< 0.785		< 0.361	
n-Propylbenzene	103-65-1	0.794	J	0.882	J	0.651	J	0.730	J	52.1		45.2		0.600	J	1.99	J	29.5		26.5		2.73		1.98	J	< 0.349	
o-Xylene	95-47-6	< 0.341		< 0.341		< 0.341		< 0.341		1.94		2.33		0.359	J	< 0.870		0.755	J	< 0.870		2.22		1.72	J	< 0.341	
sec-Butylbenzene	135-98-8	< 0.365		< 0.365		< 0.365		< 0.365		7.93		7.73		0.611	J	< 0.625		3.32		2.71	J	1.48		0.965	J	< 0.365	
Styrene	100-42-5	< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.590		< 0.118		< 0.590		< 0.118		< 0.590		< 0.307	
Tetrachloroethene	127-18-4	< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		0.582	JJ4	< 1.50		< 0.300		< 1.50		< 0.300		< 1.50		< 0.372	
Toluene	108-88-3	< 0.412		< 0.412		< 0.412		< 0.412		6.09		6.57		0.490	J	< 1.39		4.03		4.46	J	1.20		< 1.39		< 0.780	
trans-1,2-Dichloroethene	156-60-5	< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.745		< 0.149		< 0.745		< 0.149		< 0.745		< 0.396	
trans-1,3-Dichloropropene	10061-02-6	< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.590		< 0.118		< 0.590		< 0.118		< 0.590		< 0.419	
Trichloroethene	79-01-6	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190		< 0.950		< 0.190		< 0.950		< 0.190		< 0.950		< 0.398	
Vinyl chloride	75-01-4	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.234		< 1.17		< 0.234		< 1.17		< 0.234		< 1.17		< 0.259	
Xylenes, total	1330-20-7	9.39		8.67		12.8		11.3		309		286		47.4		36.3		166		154		59.1		41.2		< 1.06	

Table 4

Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

Samp Field D		MW-130 10/5/2016		MW-130 4/26/2017		MW-130 10/4/2017		MW-130 4/5/2018		MW-130 10/3/2018		MW-130 4/3/2019		MW-130 10/22/2019		MW-130 6/17/2020		MW-130 10/7/2020		MW-130 4/14/2021		MW-135 4/29/2016		MW-135 10/5/2016		MW-135 4/26/2017	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147		< 0.147		< 0.147		< 0.385		< 0.385		< 0.385	
1,1,1-Trichloroethane	71-55-6	< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.149		< 0.149		< 0.319		< 0.319		< 0.319	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.133		< 0.133		< 0.130		< 0.130		< 0.130	
1,1,2-Trichloroethane	79-00-5	< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.158		< 0.158		< 0.158		< 0.383		< 0.383		< 0.383	
1,1-Dichloroethane	75-34-3	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.100		< 0.100		< 0.259		< 0.259		< 0.259	
1,1-Dichloroethene	75-35-4	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.188		< 0.188		< 0.398		< 0.398		< 0.398	
1,2,4-Trimethylbenzene	95-63-6	< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.322		< 0.322		< 0.322		< 0.373		< 0.373		< 0.373	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.126		< 0.126		< 0.126		< 0.381		< 0.381		< 0.381	
1,2-Dichloroethane	107-06-2	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819		< 0.0819		< 0.0819		< 0.361		< 0.361		< 0.361	
1,2-Dichloropropane	78-87-5	< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.149		< 0.149		< 0.306		< 0.306		< 0.306	
1,3,5-Trimethylbenzene	108-67-8	< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.104		< 0.104		< 0.104		< 0.387		< 0.387		< 0.387	
2-Butanone (MEK)	78-93-3	< 3.93		< 3.93		< 3.93		< 3.93		< 3.93	J3J4	< 3.93		< 3.93		< 1.19		< 1.19		< 1.19		< 3.93		< 3.93		< 3.93	
2-Hexanone	591-78-6	< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787		< 0.787		< 0.787		< 3.82		< 3.82		< 3.82	
4-Isopropyltoluene	99-87-6	< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.120		< 0.120		< 0.120		< 0.350		< 0.350		< 0.350	
4-Methyl-2-pentanone	108-10-1	< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478		< 0.478		< 0.478		< 2.14		< 2.14		< 2.14	
Acetone	67-64-1	< 10.0		< 10.0		< 10.0		< 10.0		< 10.0	J3	11.6	J	< 10.0		< 11.3		< 11.3		< 11.3		< 10.0		< 10.0		< 10.0	
Benzene	71-43-2	< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		0.351	J	< 0.331		< 0.0941		< 0.0941		< 0.0941		< 0.331		< 0.331		< 0.331	
Bromodichloromethane	75-27-4	< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.136		< 0.136		< 0.380		< 0.380		< 0.380	
Bromoform	75-25-2	< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.129		< 0.129		< 0.469		< 0.469		< 0.469	
Bromomethane	74-83-9	< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866	J3	< 0.866		< 0.605		< 0.605		< 0.605		< 0.866		< 0.866		< 0.866	
Carbon disulfide	75-15-0	< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		0.332	JB	< 0.0962		< 0.0962		< 0.275		< 0.275		< 0.275	
Carbon tetrachloride	56-23-5	< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.128		< 0.128		< 0.379		< 0.379		< 0.379	
Chlorobenzene	108-90-7	< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116		< 0.116		< 0.116		< 0.348		< 0.348		< 0.348	
Chloroethane	75-00-3	< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.192		< 0.192		< 0.192		< 0.453		< 0.453		< 0.453	
Chloroform	67-66-3	< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.111		< 0.111		< 0.111		< 0.324		< 0.324		< 0.324	
Chloromethane	74-87-3	< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960		< 0.960		< 0.960		< 0.276		< 0.276		< 0.276	
cis-1,2-Dichloroethene	156-59-2	< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.126		< 0.126		< 0.260		< 0.260		< 0.260	
cis-1,3-Dichloropropene	10061-01-5	< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111		< 0.111		< 0.111		< 0.418		< 0.418		< 0.418	
Cyanide	57-12-5																										
Dibromochloromethane	124-48-1	< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.140		< 0.140		< 0.140		< 0.327		< 0.327		< 0.327	
Ethylbenzene	100-41-4	< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137		< 0.137		< 0.137		< 0.384		< 0.384		< 0.384	
Isopropylbenzene	98-82-8	< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.105		< 0.105		< 0.105		< 0.326		< 0.326		< 0.326	
m,p-Xylene	179601-23-1	< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430		< 0.430		< 0.430		< 0.719		< 0.719		< 0.719	
Mercury	7439-97-6																										
Methyl tert-butyl ether	1634-04-4	1.30		1.30		1.36		1.34		0.976	J	1.31		2.95		4.24		3.28		2.30		1.97		0.685	J	< 0.367	
Methylene chloride	75-09-2	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 0.430		< 0.430		< 1.00		< 1.00		< 1.00	
Naphthalene	91-20-3	1.12	J	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	J4	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	J4	< 1.00	
n-Butylbenzene	104-51-8	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.157		< 0.157		< 0.157		< 0.361		< 0.361		< 0.361	
n-Propylbenzene	103-65-1	< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993		< 0.0993		< 0.349		< 0.349		< 0.349	
o-Xylene	95-47-6	< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.174		< 0.174		< 0.174		< 0.341		< 0.341		< 0.341	
sec-Butylbenzene	135-98-8	< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.125		< 0.125		< 0.125		< 0.365		< 0.365		< 0.365	
Styrene	100-42-5	< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.118		< 0.118		< 0.307		< 0.307		< 0.307	
Tetrachloroethene	127-18-4	< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300		< 0.300		< 0.300		< 0.372		< 0.372		< 0.372	
Toluene	108-88-3	< 0.780		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.278		< 0.278		< 0.278		< 0.780		< 0.780		< 0.412	
trans-1,2-Dichloroethene	156-60-5	< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.149		< 0.149		< 0.396		< 0.396		< 0.396	
trans-1,3-Dichloropropene	10061-02-6	< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.118	J4	< 0.118		< 0.419		< 0.419		< 0.419	
Trichloroethene	79-01-6	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190		< 0.190		< 0.190		< 0.398		< 0.398		< 0.398	
Vinyl chloride	75-01-4	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	J3	< 0.259		< 0.259		< 0.234		< 0.234		< 0.234		< 0.259		< 0.259		< 0.259	
Xylenes, total	1330-20-7	< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174		< 0.174		< 0.174		< 1.06		< 1.06		< 1.06	

Table 4

Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

	Samp Field D	MW-135 10/3/2017		MW-135 4/3/2018		MW-135 10/2/2018		MW-135 4/3/2019		MW-135 10/23/2019		MW-135 6/17/2020		MW-135 10/7/2020		MW-135 4/13/2021		NP-01 4/28/2016		NP-01 10/4/2016		NP-01 4/26/2017		NP-01 10/4/2017		NP-01 4/4/2018	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147		< 0.147		< 0.147		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385	
1,1,1-Trichloroethane	71-55-6	< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.149		< 0.149		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.133		< 0.133		< 0.130		< 0.130	J4	< 0.130		< 0.130		< 0.130	
1,1,2-Trichloroethane	79-00-5	< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.158		< 0.158		< 0.158		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383	
1,1-Dichloroethane	75-34-3	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.100		< 0.100		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	
1,1-Dichloroethene	75-35-4	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.188		< 0.188		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398	
1,2,4-Trimethylbenzene	95-63-6	< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.322		< 0.322		< 0.322		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.126		< 0.126		< 0.126		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381	
1,2-Dichloroethane	107-06-2	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819		< 0.0819		< 0.0819		0.526	J	0.446	J	0.408	J	0.465	J	< 0.361	
1,2-Dichloropropane	78-87-5	< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.149		< 0.149		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306	
1,3,5-Trimethylbenzene	108-67-8	< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.104		< 0.104		< 0.104		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387	
2-Butanone (MEK)	78-93-3	< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 1.19		< 1.19		< 1.19		< 3.93	J4	< 3.93	J3	< 3.93		< 3.93		< 3.93	
2-Hexanone	591-78-6	< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787		< 0.787		< 0.787		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82	
4-Isopropyltoluene	99-87-6	< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.120		< 0.120		< 0.120		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350	
4-Methyl-2-pentanone	108-10-1	< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478		< 0.478		< 0.478		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14	
Acetone	67-64-1	< 10.0		< 10.0		< 10.0		< 10.0		< 10.0		< 11.3		< 11.3		< 11.3		< 10.0		< 10.0	J3	< 10.0		< 10.0		< 10.0	
Benzene	71-43-2	< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.0941		2.50		< 0.0941		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331	
Bromodichloromethane	75-27-4	< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.136		< 0.136		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380	
Bromoform	75-25-2	< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.129		< 0.129		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469	
Bromomethane	74-83-9	< 0.866		< 0.866		< 0.866		< 0.866	J3	< 0.866		< 0.605		< 0.605		< 0.605		< 0.866		< 0.866	J3	< 0.866		< 0.866		< 0.866	
Carbon disulfide	75-15-0	< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		0.301	JB	0.188	JB	< 0.0962		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275	
Carbon tetrachloride	56-23-5	< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.128		< 0.128		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379	
Chlorobenzene	108-90-7	< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116		< 0.116		< 0.116		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348	
Chloroethane	75-00-3	< 0.453		< 0.453		< 0.453	J4	< 0.453		< 0.453		< 0.192		< 0.192		< 0.192		< 0.453		< 0.453	J3	< 0.453		< 0.453		< 0.453	
Chloroform	67-66-3	< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.111		< 0.111		< 0.111		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324	
Chloromethane	74-87-3	< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960		< 0.960		< 0.960		< 0.276		1.03	JB	< 0.276		< 0.276		< 0.276	
cis-1,2-Dichloroethene	156-59-2	< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.126		< 0.126		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260	
cis-1,3-Dichloropropene	10061-01-5	< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111		< 0.111		< 0.111		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418	
Cyanide	57-12-5																										
Dibromochloromethane	124-48-1	< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.140		< 0.140		< 0.140		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327	
Ethylbenzene	100-41-4	< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137		< 0.137		< 0.137		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384	
Isopropylbenzene	98-82-8	< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.105		< 0.105		< 0.105		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326	
m,p-Xylene	179601-23-1	< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430		< 0.430		< 0.430		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719	
Mercury	7439-97-6																										
Methyl tert-butyl ether	1634-04-4	< 0.367		< 0.367		< 0.367		< 0.367		< 0.367		< 0.101		< 0.101		< 0.101		213		283		391		407		132	
Methylene chloride	75-09-2	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 0.430		< 0.430		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	
Naphthalene	91-20-3	< 1.00		< 1.00		< 1.00		< 1.00	J4	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	
n-Butylbenzene	104-51-8	< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.157		< 0.157		< 0.157		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361	
n-Propylbenzene	103-65-1	< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993		< 0.0993		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349	
o-Xylene	95-47-6	< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.174		< 0.174		< 0.174		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341	
sec-Butylbenzene	135-98-8	< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.125		< 0.125		< 0.125		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365	
Styrene	100-42-5	< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.118		< 0.118		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307	
Tetrachloroethene	127-18-4	< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300		< 0.300		< 0.300		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372	
Toluene	108-88-3	< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.278		< 0.278		< 0.278		< 0.780		< 0.780		< 0.412		< 0.412		< 0.412	
trans-1,2-Dichloroethene	156-60-5	< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.149		< 0.149		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396	
trans-1,3-Dichloropropene	10061-02-6	< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.118		< 0.118		< 0.419	J4	< 0.419		< 0.419		< 0.419		< 0.419	
Trichloroethene	79-01-6	< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190		< 0.190		< 0.190		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398	
Vinyl chloride	75-01-4	< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.234		< 0.234		< 0.234		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	
Xylenes, total	1330-20-7	< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174		< 0.174		< 0.174		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06	

Table 4
Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

Samp	Field D	NP-1 10/2/2018		NP-1 4/3/2019		NP-1 10/23/2019		NP-1 6/17/2020		NP-1 10/6/2020		NP-1 4/14/2021		NP-6 4/26/2017		NP-6 4/3/2019		NP-6 4/14/2021		RA-313 4/27/2016		RA-313 4/27/2017		RA-313 4/4/2018		RA-313 4/3/2019	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.385		< 0.385		< 0.385		< 0.147		< 0.147		< 0.147		< 0.385		< 0.385		< 0.147		< 0.385		< 0.385		< 0.385		< 0.385	
1,1,1-Trichloroethane	71-55-6	< 0.319		< 0.319		< 0.319		< 0.149		< 0.149		< 0.149		< 0.319		< 0.319		< 0.149		< 0.319		< 0.319		< 0.319		< 0.319	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.130		< 0.130		< 0.130		< 0.133		< 0.133		< 0.133		< 0.130		< 0.130		< 0.133		< 0.130		< 0.130		< 0.130		< 0.130	
1,1,2-Trichloroethane	79-00-5	< 0.383		< 0.383		< 0.383		< 0.158		< 0.158		< 0.158		< 0.383		< 0.383		< 0.158		< 0.383		< 0.383		< 0.383		< 0.383	
1,1-Dichloroethane	75-34-3	< 0.259		< 0.259		< 0.259		< 0.100		< 0.100		< 0.100		< 0.259		< 0.259		< 0.100		< 0.259		< 0.259		< 0.259		< 0.259	
1,1-Dichloroethene	75-35-4	< 0.398		< 0.398		< 0.398		< 0.188		< 0.188		< 0.188		< 0.398		< 0.398		< 0.188		< 0.398		< 0.398		< 0.398		< 0.398	
1,2,4-Trimethylbenzene	95-63-6	< 0.373		< 0.373		< 0.373		< 0.322		0.430	J	< 0.322		< 0.373		< 0.373		< 0.322		< 0.373		< 0.373		< 0.373		< 0.373	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.381		< 0.00240		< 0.381		< 0.126		< 0.126		< 0.126		< 0.381		< 0.381		< 0.126		< 0.381		< 0.381		< 0.381		< 0.381	
1,2-Dichloroethane	107-06-2	< 0.361		< 0.361		< 0.361		0.187	J	< 0.0819		< 0.0819		< 0.361		< 0.361		< 0.0819		< 0.361		< 0.361		< 0.361		< 0.361	
1,2-Dichloropropane	78-87-5	< 0.306		< 0.306		< 0.306		< 0.149		< 0.149		< 0.149		< 0.306		< 0.306		< 0.149		< 0.306		< 0.306		< 0.306		< 0.306	
1,3,5-Trimethylbenzene	108-67-8	< 0.387		< 0.387		< 0.387		< 0.104		0.104	J	< 0.104		< 0.387		< 0.387		< 0.104		< 0.387		< 0.387		< 0.387		< 0.387	
2-Butanone (MEK)	78-93-3	< 3.93		< 3.93		< 3.93		< 1.19		< 1.19		< 1.19		< 3.93		< 3.93		< 1.19		< 3.93	J4	< 3.93		< 3.93		< 3.93	
2-Hexanone	591-78-6	< 3.82		< 3.82		< 3.82		< 0.787		< 0.787		< 0.787		< 3.82		< 3.82		< 0.787		< 3.82		< 3.82		< 3.82		< 3.82	
4-Isopropyltoluene	99-87-6	< 0.350		< 0.350		< 0.350		< 0.120		< 0.120		< 0.120		< 0.350		< 0.350		< 0.120		< 0.350		< 0.350		< 0.350		< 0.350	
4-Methyl-2-pentanone	108-10-1	< 2.14		< 2.14		< 2.14		< 0.478		< 0.478		< 0.478		< 2.14		< 2.14		< 0.478		< 2.14		< 2.14		< 2.14		< 2.14	
Acetone	67-64-1	< 10.0		< 10.0		< 10.0		< 11.3		< 11.3		< 11.3		< 10.0		< 10.0		< 11.3		< 10.0		< 10.0		< 10.0		< 10.0	
Benzene	71-43-2	< 0.331		< 0.331		< 0.331		< 0.0941		< 0.0941		< 0.0941		< 0.331		< 0.331		< 0.0941		< 0.331		< 0.331		< 0.331		< 0.331	
Bromodichloromethane	75-27-4	< 0.380		< 0.380		< 0.380		< 0.136		< 0.136		< 0.136		< 0.380		< 0.380		< 0.136		< 0.380		< 0.380		< 0.380		< 0.380	
Bromoform	75-25-2	< 0.469		< 0.469		< 0.469		< 0.129		< 0.129		< 0.129		< 0.469		< 0.469		< 0.129		< 0.469		< 0.469		< 0.469		< 0.469	
Bromomethane	74-83-9	< 0.866		< 0.866		< 0.866		< 0.605		< 0.605		< 0.605		< 0.866		< 0.866		< 0.605		< 0.866		< 0.866		< 0.866		< 0.866	J3
Carbon disulfide	75-15-0	< 0.275		< 0.275		< 0.275		< 0.0962		< 0.0962		< 0.0962		< 0.275		< 0.275		< 0.0962		< 0.275		< 0.275		< 0.275		< 0.275	
Carbon tetrachloride	56-23-5	< 0.379		< 0.379		< 0.379		< 0.128		< 0.128		< 0.128		< 0.379		< 0.379		< 0.128		< 0.379		< 0.379		< 0.379		< 0.379	
Chlorobenzene	108-90-7	< 0.348		< 0.348		< 0.348		< 0.116		< 0.116		< 0.116		< 0.348		< 0.348		< 0.116		< 0.348		< 0.348		< 0.348		< 0.348	
Chloroethane	75-00-3	< 0.453		< 0.453		< 0.453		< 0.192		< 0.192		< 0.192		< 0.453		< 0.453		< 0.192		< 0.453		< 0.453		< 0.453		< 0.453	
Chloroform	67-66-3	< 0.324		< 0.324		< 0.324		< 0.111		< 0.111		< 0.111		< 0.324		< 0.324		< 0.111		< 0.324		< 0.324		< 0.324		< 0.324	
Chloromethane	74-87-3	< 0.276		< 0.276		< 0.276		< 0.960		< 0.960		< 0.960		< 0.276		< 0.276		< 0.960		< 0.276		< 0.276		< 0.276		< 0.276	
cis-1,2-Dichloroethene	156-59-2	< 0.260		< 0.260		< 0.260		< 0.126		< 0.126		< 0.126		< 0.260		< 0.260		< 0.126		< 0.260		< 0.260		< 0.260		< 0.260	
cis-1,3-Dichloropropene	10061-01-5	< 0.418		< 0.418		< 0.418		< 0.111		< 0.111		< 0.111		< 0.418		< 0.418		< 0.111		< 0.418		< 0.418		< 0.418		< 0.418	
Cyanide	57-12-5																										
Dibromochloromethane	124-48-1	< 0.327		< 0.327		< 0.327		< 0.140		< 0.140		< 0.140		< 0.327		< 0.327		< 0.140		< 0.327		< 0.327		< 0.327		< 0.327	
Ethylbenzene	100-41-4	< 0.384		< 0.384		< 0.384		< 0.137		0.245	J	< 0.137		< 0.384		< 0.384		< 0.137		< 0.384		< 0.384		< 0.384		< 0.384	
Isopropylbenzene	98-82-8	< 0.326		< 0.326		< 0.326		< 0.105		< 0.105		< 0.105		< 0.326		< 0.326		< 0.105		< 0.326		< 0.326		< 0.326		< 0.326	
m,p-Xylene	179601-23-1	< 0.719		< 0.719		< 0.719		< 0.430		0.456	J	< 0.430		< 0.719		< 0.719		< 0.430		< 0.719		< 0.719		< 0.719		< 0.719	
Mercury	7439-97-6																										
Methyl tert-butyl ether	1634-04-4	547		48.4		149		216		217		101		35.3		72.9		40.7		< 0.367		< 0.367		< 0.367		< 0.367	
Methylene chloride	75-09-2	< 1.00		< 1.00		< 1.00		< 0.430		< 0.430		< 0.430		< 1.00		< 1.00		< 0.430		< 1.00		< 1.00		< 1.00		< 1.00	
Naphthalene	91-20-3	< 1.00		< 1.00	J3J4	< 1.00		< 1.00	J4	< 1.00		< 1.00		< 1.00		< 1.00	J3J4	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	J4
n-Butylbenzene	104-51-8	< 0.361		< 0.361		< 0.361		< 0.157		< 0.157		< 0.157		< 0.361		< 0.361		< 0.157		< 0.361		< 0.361		< 0.361		< 0.361	
n-Propylbenzene	103-65-1	< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993		< 0.0993		< 0.349		< 0.349		< 0.0993		< 0.349		< 0.349		< 0.349		< 0.349	
o-Xylene	95-47-6	< 0.341		< 0.341		< 0.341		< 0.174		< 0.174		< 0.174		< 0.341		< 0.341		< 0.174		< 0.341		< 0.341		< 0.341		< 0.341	
sec-Butylbenzene	135-98-8	< 0.365		< 0.365		< 0.365		< 0.125		< 0.125		< 0.125		< 0.365		< 0.365		< 0.125		< 0.365		< 0.365		< 0.365		< 0.365	
Styrene	100-42-5	< 0.307		< 0.307		< 0.307		< 0.118		< 0.118		< 0.118		< 0.307		< 0.307		< 0.118		< 0.307		< 0.307		< 0.307		< 0.307	
Tetrachloroethene	127-18-4	< 0.372		< 0.372		< 0.372		< 0.300		< 0.300		< 0.300		< 0.372		< 0.372		< 0.300		< 0.372		< 0.372		< 0.372		< 0.372	
Toluene	108-88-3	< 0.412		< 0.412		< 0.412		< 0.278		< 0.278		< 0.278		< 0.412		< 0.412		< 0.278		< 0.780		< 0.412		< 0.412		< 0.412	
trans-1,2-Dichloroethene	156-60-5	< 0.396		< 0.396		< 0.396		< 0.149		< 0.149		< 0.149		< 0.396		< 0.396		< 0.149		< 0.396		< 0.396		< 0.396		< 0.396	
trans-1,3-Dichloropropene	10061-02-6	< 0.419		< 0.419		< 0.419		< 0.118		< 0.118		< 0.118		< 0.419		< 0.419		< 0.118		< 0.419	J4	< 0.419		< 0.419		< 0.419	
Trichloroethene	79-01-6	< 0.398		< 0.398		< 0.398		< 0.190		< 0.950		< 0.190		< 0.398		< 0.398		< 0.190		< 0.398		< 0.398		< 0.398		< 0.398	
Vinyl chloride	75-01-4	< 0.259		< 0.259		< 0.259		< 0.234		< 0.234		< 0.234		< 0.259		< 0.259		< 0.234		< 0.259		< 0.259		< 0.259		< 0.259	
Xylenes, total	1330-20-7	< 1.06		< 1.06		< 1.06		< 0.174		0.456	J	< 0.174		< 1.06		< 1.06		< 0.174		< 1.06		< 1.06		< 1.06		< 1.06	

Table 4
Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

	Samp	RA-313		RA-313		RA-3156		RA-3156		RA-3156		RA-3156		RA-3156		RA-3156		RA-4196		RA-4196		RA-4196		RA-4196		RA-4196	
	Field D	6/17/2020		4/14/2021		4/28/2016		4/26/2017		4/4/2018		4/3/2019		6/17/2020		4/14/2021		4/27/2016		10/5/2016		4/26/2017		10/4/2017		4/3/2018	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.147		< 0.147		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147		< 0.147		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385	
1,1,1-Trichloroethane	71-55-6	< 0.149		< 0.149		< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.149		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.133		< 0.133		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.133		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130	
1,1,2-Trichloroethane	79-00-5	< 0.158		< 0.158		< 0.383		< 0.383		< 0.383		< 0.383		< 0.158		< 0.158		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383	
1,1-Dichloroethane	75-34-3	< 0.100		< 0.100		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.100		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	
1,1-Dichloroethene	75-35-4	< 0.188		< 0.188		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.188		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398	
1,2,4-Trimethylbenzene	95-63-6	< 0.322		< 0.322		< 0.373		< 0.373		< 0.373		< 0.373		< 0.322		< 0.322		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.126		< 0.126		< 0.381		< 0.381		< 0.381		< 0.381		< 0.126		< 0.126		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381	
1,2-Dichloroethane	107-06-2	< 0.0819		< 0.0819		< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819		< 0.0819		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361	
1,2-Dichloropropane	78-87-5	< 0.149		< 0.149		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.149		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306	
1,3,5-Trimethylbenzene	108-67-8	< 0.104		< 0.104		< 0.387		< 0.387		< 0.387		< 0.387		< 0.104		< 0.104		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387	
2-Butanone (MEK)	78-93-3	< 1.19		< 1.19		< 3.93		< 3.93		< 3.93		< 3.93		< 1.19		< 1.19		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93	
2-Hexanone	591-78-6	< 0.787		< 0.787		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787		< 0.787		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82	
4-Isopropyltoluene	99-87-6	< 0.120		< 0.120		< 0.350		< 0.350		< 0.350		< 0.350		< 0.120		< 0.120		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350	
4-Methyl-2-pentanone	108-10-1	< 0.478		< 0.478		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478		< 0.478		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14	
Acetone	67-64-1	< 11.3		< 11.3		< 10.0		< 10.0		< 10.0		< 10.0		< 11.3		< 11.3		< 10.0		< 10.0		< 10.0		< 10.0		< 10.0	
Benzene	71-43-2	< 0.0941		< 0.0941		< 0.331		< 0.331		< 0.331		< 0.331		< 0.0941		< 0.0941		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331	
Bromodichloromethane	75-27-4	< 0.136		< 0.136		< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.136		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380	
Bromoform	75-25-2	< 0.129		< 0.129		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.129		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469	
Bromomethane	74-83-9	< 0.605		< 0.605		< 0.866		< 0.866		< 0.866		< 0.866	J3	< 0.605		< 0.605		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866	
Carbon disulfide	75-15-0	0.433	JB	< 0.0962		< 0.275		< 0.275		< 0.275		< 0.275		0.520	JB	< 0.0962		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275	
Carbon tetrachloride	56-23-5	< 0.128		< 0.128		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.128		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379	
Chlorobenzene	108-90-7	< 0.116		< 0.116		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116		< 0.116		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348	
Chloroethane	75-00-3	< 0.192		< 0.192		< 0.453		< 0.453		< 0.453		< 0.453		< 0.192		< 0.192		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453	
Chloroform	67-66-3	< 0.111		< 0.111		< 0.324		< 0.324		< 0.324		< 0.324		< 0.111		< 0.111		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324	
Chloromethane	74-87-3	< 0.960		< 0.960		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960		< 0.960		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276	
cis-1,2-Dichloroethene	156-59-2	< 0.126		< 0.126		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.126		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260	
cis-1,3-Dichloropropene	10061-01-5	< 0.111		< 0.111		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111		< 0.111		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418	
Cyanide	57-12-5																										
Dibromochloromethane	124-48-1	< 0.140		< 0.140		< 0.327		< 0.327		< 0.327		< 0.327		< 0.140		< 0.140		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327	
Ethylbenzene	100-41-4	< 0.137		< 0.137		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137		< 0.137		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384	
Isopropylbenzene	98-82-8	< 0.105		< 0.105		< 0.326		< 0.326		< 0.326		< 0.326		< 0.105		< 0.105		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326	
m,p-Xylene	179601-23-1	< 0.430		< 0.430		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430		< 0.430		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719	
Mercury	7439-97-6																										
Methyl tert-butyl ether	1634-04-4	< 0.101		< 0.101		< 0.367		< 0.367		< 0.367		< 0.367		< 0.101		0.124	J	5.07		6.57		6.18		7.63		6.93	
Methylene chloride	75-09-2	< 0.430		< 0.430		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 0.430		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	
Naphthalene	91-20-3	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	J4	< 1.00		< 1.00		< 1.00		< 1.00	J4	< 1.00		< 1.00		< 1.00	
n-Butylbenzene	104-51-8	< 0.157		< 0.157		< 0.361		< 0.361		< 0.361		< 0.361		< 0.157		< 0.157		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361	
n-Propylbenzene	103-65-1	< 0.0993		< 0.0993		< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349	
o-Xylene	95-47-6	< 0.174		< 0.174		< 0.341		< 0.341		< 0.341		< 0.341		< 0.174		< 0.174		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341	
sec-Butylbenzene	135-98-8	< 0.125		< 0.125		< 0.365		< 0.365		< 0.365		< 0.365		< 0.125		< 0.125		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365	
Styrene	100-42-5	< 0.118		< 0.118		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.118		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307	
Tetrachloroethene	127-18-4	< 0.300		< 0.300		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300		< 0.300		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372	
Toluene	108-88-3	< 0.278		< 0.278		< 0.780		< 0.412		< 0.412		< 0.412		< 0.278		< 0.278		< 0.780		< 0.780		< 0.412		< 0.412		< 0.412	
trans-1,2-Dichloroethene	156-60-5	< 0.149		< 0.149		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.149		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396	
trans-1,3-Dichloropropene	10061-02-6	< 0.118		< 0.118		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.118		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419	
Trichloroethene	79-01-6	< 0.190		< 0.190		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190		< 0.190		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398	
Vinyl chloride	75-01-4	< 0.234		< 0.234		< 0.259		< 0.259		< 0.259		< 0.259		< 0.234		< 0.234		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	
Xylenes, total	1330-20-7	< 0.174		< 0.174		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174		< 0.174		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06	

Table 4

Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

Sample / Field D...		RA-4196 10/3/2018		RA-4196 4/2/2019		RA-4196 10/23/2019		RA-4196 6/17/2020		RA-4196 10/6/2020		RA-4798 4/27/2016		RA-4798 10/5/2016		RA-4798 4/26/2017		RA-4798 10/3/2017		RA-4798 4/3/2018		RA-4798 10/3/2018		RA-4798 4/2/2019		RA-4798 10/23/2019	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.385		< 0.385		< 0.385		< 0.147		< 0.147		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385		< 0.385	
1,1,1-Trichloroethane	71-55-6	< 0.319		< 0.319		< 0.319		< 0.149		< 0.149		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319		< 0.319	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.130		< 0.130		< 0.130		< 0.133		< 0.133		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130		< 0.130	
1,1,2-Trichloroethane	79-00-5	< 0.383		< 0.383		< 0.383		< 0.158		< 0.158		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383		< 0.383	
1,1-Dichloroethane	75-34-3	< 0.259		< 0.259		< 0.259		< 0.100		< 0.100		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	
1,1-Dichloroethene	75-35-4	< 0.398		< 0.398		< 0.398		< 0.188		< 0.188		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398	
1,2,4-Trimethylbenzene	95-63-6	< 0.373		< 0.373		< 0.373		< 0.322		< 0.322		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373		< 0.373	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.381		< 0.381		< 0.381		< 0.126		< 0.126		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.381		< 0.00240		< 0.381	
1,2-Dichloroethane	107-06-2	< 0.361		< 0.361		< 0.361		< 0.0819		0.876	J	2.21		2.32		0.793	J	1.41		< 0.361		0.981	J	< 0.361		1.11	
1,2-Dichloropropane	78-87-5	< 0.306		< 0.306		< 0.306		< 0.149		< 0.149		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306		< 0.306	
1,3,5-Trimethylbenzene	108-67-8	< 0.387		< 0.387		< 0.387		< 0.104		< 0.104		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387		< 0.387	
2-Butanone (MEK)	78-93-3	< 3.93	J3J4	< 3.93		< 3.93		< 1.19		< 1.19		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93		< 3.93	J3J4	< 3.93		< 3.93	
2-Hexanone	591-78-6	< 3.82		< 3.82		< 3.82		< 0.787		< 0.787		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82		< 3.82	
4-Isopropyltoluene	99-87-6	< 0.350		< 0.350		< 0.350		< 0.120		< 0.120		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350		< 0.350	
4-Methyl-2-pentanone	108-10-1	< 2.14		< 2.14		< 2.14		< 0.478		< 0.478		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14		< 2.14	
Acetone	67-64-1	< 10.0	J3	< 10.0		< 10.0		< 11.3		< 11.3		< 10.0		< 10.0		< 10.0		< 10.0		< 10.0		< 10.0	J3	< 10.0		< 10.0	
Benzene	71-43-2	< 0.331		< 0.331		< 0.331		< 0.0941		< 0.0941	Q	< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331		< 0.331	
Bromodichloromethane	75-27-4	< 0.380		< 0.380		< 0.380		< 0.136		< 0.136		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380		< 0.380	
Bromoform	75-25-2	< 0.469		< 0.469		< 0.469		< 0.129		< 0.129		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469		< 0.469	
Bromomethane	74-83-9	< 0.866		< 0.866		< 0.866		< 0.605		< 0.605		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866		< 0.866	
Carbon disulfide	75-15-0	< 0.275		< 0.275		< 0.275		0.840	JB	0.179	JB	< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275		< 0.275	
Carbon tetrachloride	56-23-5	< 0.379		< 0.379		< 0.379		< 0.128		< 0.128		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379		< 0.379	
Chlorobenzene	108-90-7	< 0.348		< 0.348		< 0.348		< 0.116		< 0.116		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348		< 0.348	
Chloroethane	75-00-3	< 0.453		< 0.453		< 0.453		< 0.192		< 0.192		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453		< 0.453	
Chloroform	67-66-3	< 0.324		< 0.324		< 0.324		< 0.111		< 0.111		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324		< 0.324	
Chloromethane	74-87-3	< 0.276		< 0.276		< 0.276		< 0.960		< 0.960		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276		< 0.276	
cis-1,2-Dichloroethene	156-59-2	< 0.260		< 0.260		< 0.260		< 0.126		< 0.126		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260		< 0.260	
cis-1,3-Dichloropropene	10061-01-5	< 0.418		< 0.418		< 0.418		< 0.111		< 0.111		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418		< 0.418	
Cyanide	57-12-5																										
Dibromochloromethane	124-48-1	< 0.327		< 0.327		< 0.327		< 0.140		< 0.140		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327		< 0.327	
Ethylbenzene	100-41-4	< 0.384		< 0.384		< 0.384		< 0.137		< 0.137		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384		< 0.384	
Isopropylbenzene	98-82-8	< 0.326		< 0.326		< 0.326		< 0.105		< 0.105		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326		< 0.326	
m,p-Xylene	179601-23-1	< 0.719		< 0.719		< 0.719		< 0.430		< 0.430		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719		< 0.719	
Mercury	7439-97-6																										
Methyl tert-butyl ether	1634-04-4	7.53		5.94		7.09		9.48		7.98		12.1		12.4		3.60		8.89		< 0.367		7.88		< 0.367		9.43	
Methylene chloride	75-09-2	< 1.00		< 1.00		< 1.00		< 0.430		< 0.430		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	
Naphthalene	91-20-3	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	J4	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	
n-Butylbenzene	104-51-8	< 0.361		< 0.361		< 0.361		< 0.157		< 0.157		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361		< 0.361	
n-Propylbenzene	103-65-1	< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349		< 0.349	
o-Xylene	95-47-6	< 0.341		< 0.341		< 0.341		< 0.174		< 0.174		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341		< 0.341	
sec-Butylbenzene	135-98-8	< 0.365		< 0.365		< 0.365		< 0.125		< 0.125		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365		< 0.365	
Styrene	100-42-5	< 0.307		< 0.307		< 0.307		< 0.118		< 0.118		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307		< 0.307	
Tetrachloroethene	127-18-4	< 0.372		< 0.372		< 0.372		< 0.300		< 0.300		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372		< 0.372	
Toluene	108-88-3	< 0.412		< 0.412		< 0.412		< 0.278		< 0.278		< 0.780		< 0.780		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412		< 0.412	
trans-1,2-Dichloroethene	156-60-5	< 0.396		< 0.396		< 0.396		< 0.149		< 0.149		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396		< 0.396	
trans-1,3-Dichloropropene	10061-02-6	< 0.419		< 0.419		< 0.419		< 0.118		< 0.118		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419		< 0.419	
Trichloroethene	79-01-6	< 0.398		< 0.398		< 0.398		< 0.190		< 0.190		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398		< 0.398	
Vinyl chloride	75-01-4	< 0.259	J3	< 0.259		< 0.259		< 0.234		< 0.234		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259		< 0.259	J3	< 0.259		< 0.259	
Xylenes, total	1330-20-7	< 1.06		< 1.06		< 1.06		< 0.174		< 0.174		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06		< 1.06	

Table 4

Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

Samp	Field D	RA-4798 6/17/2020		RA-4798 10/6/2020		RA-4798 4/14/2021		RW-12R 4/28/2016		RW-12R 4/27/2017		RW-12R 4/4/2018		RW-12R 4/2/2019		RW-12R 6/17/2020		RW-13R 4/27/2016		RW-13R 4/4/2018		RW-15C 4/26/2017		RW-15C 4/5/2018		RW-15C 4/3/2019	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.147		< 0.147		< 0.147		< 1.92		< 1.92		< 0.385		< 0.385		< 0.147		< 0.385		< 0.385		< 9.62		< 0.385		< 3.85	
1,1,1-Trichloroethane	71-55-6	< 0.149		< 0.149		< 0.149		< 1.60		< 1.60		< 0.319		< 0.319		< 0.149		< 0.319		< 0.319		< 7.98		< 0.319		< 3.19	
1,1,2,2-Tetrachloroethane	79-34-5	< 0.133		< 0.133		< 0.133		< 0.650		< 0.650		< 0.130		< 0.130		< 0.133		< 0.130		< 0.130		< 3.25		< 0.130		< 1.30	
1,1,2-Trichloroethane	79-00-5	< 0.158		< 0.158		< 0.158		< 1.92		< 1.92		< 0.383		< 0.383	J4	< 0.158		< 0.383		< 0.383		< 9.58		< 0.383		< 3.83	
1,1-Dichloroethane	75-34-3	< 0.100		< 0.100		< 0.100		< 1.30		< 1.30		< 0.259		< 0.259		< 0.100		< 0.259		< 0.259		< 6.48		< 0.259		< 2.59	
1,1-Dichloroethene	75-35-4	< 0.188		< 0.188		< 0.188		< 1.99		< 1.99		< 0.398		< 0.398		< 0.188		< 0.398		< 0.398		< 9.95		< 0.398		< 3.98	
1,2,4-Trimethylbenzene	95-63-6	< 0.322		< 0.322		< 0.322		14.5		33.8		4.48		10.2		4.94		44.3		44.3		1460		1060		728	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.126		< 0.126		< 0.126		< 1.90		< 1.90		< 0.381		< 0.381		< 0.126		< 0.381		< 0.381		< 9.52		< 0.381		< 3.81	
1,2-Dichloroethane	107-06-2	2.28		0.877	J	1.28		< 1.80		< 1.80		< 0.361		< 0.361		< 0.0819		0.758	J	0.655	J	< 9.02		< 0.361		< 3.61	
1,2-Dichloropropane	78-87-5	< 0.149		< 0.149		< 0.149		< 1.53		< 1.53		< 0.306		< 0.306		< 0.149		< 0.306		< 0.306		< 7.65		< 0.306		< 3.06	
1,3,5-Trimethylbenzene	108-67-8	< 0.104		< 0.104		< 0.104		< 1.94		< 1.94		< 0.387		< 0.387		< 0.104		5.39		0.443	J	231		138		47.6	
2-Butanone (MEK)	78-93-3	< 1.19		< 1.19		< 1.19		< 19.6		< 19.6		< 3.93		< 3.93		< 1.19		< 3.93		< 3.93		< 98.2		< 3.93		< 39.3	
2-Hexanone	591-78-6	< 0.787		< 0.787		< 0.787		< 19.1		< 19.1		< 3.82		< 3.82		< 0.787		< 3.82		< 3.82		< 95.5		< 3.82		< 38.2	
4-Isopropyltoluene	99-87-6	< 0.120		< 0.120		< 0.120		< 1.75		2.14	J	0.372	J	< 0.350		0.352	J	0.561	J	1.34		< 8.75		5.45		7.22	J
4-Methyl-2-pentanone	108-10-1	< 0.478		< 0.478		< 0.478		< 10.7		< 10.7		< 2.14		< 2.14		5.67	J	< 2.14		< 2.14		< 53.5		< 2.14		< 21.4	
Acetone	67-64-1	< 11.3		< 11.3		< 11.3		< 50.0		< 50.0		35.2	J	< 10.0	J4	< 11.3		< 10.0		28.1	J	< 250		< 10.0		< 100	
Benzene	71-43-2	< 0.0941		< 0.0941	Q	< 0.0941		424		335		35.8		76.4		154		878		77.0		19100		21900		< 3.31	
Bromodichloromethane	75-27-4	< 0.136		< 0.136		< 0.136		< 1.90		< 1.90		< 0.380		< 0.380		< 0.136		< 0.380		< 0.380		< 9.50		< 0.380		< 3.80	
Bromoform	75-25-2	< 0.129		< 0.129		< 0.129		< 2.34		< 2.34		< 0.469		< 0.469		< 0.129		< 0.469		< 0.469		< 11.7		< 0.469		< 4.69	
Bromomethane	74-83-9	< 0.605		< 0.605		< 0.605		< 4.33		< 4.33		< 0.866		< 0.866		< 0.605		< 0.866		< 0.866		< 21.6		< 0.866		< 8.66	J3
Carbon disulfide	75-15-0	0.356	JB	0.185	JB	< 0.0962		1.86	J	1.42	J	1.04		1.55		1.18	B	< 0.275		0.455	J	< 6.88		0.650	JV3	< 2.75	
Carbon tetrachloride	56-23-5	< 0.128		< 0.128		< 0.128		< 1.90		< 1.90		< 0.379		< 0.379		< 0.128		< 0.379		< 0.379		< 9.48		< 0.379		< 3.79	
Chlorobenzene	108-90-7	< 0.116		< 0.116		< 0.116		< 1.74		< 1.74		< 0.348		< 0.348		< 0.116		< 0.348		< 0.348		< 8.70		< 0.348		< 3.48	
Chloroethane	75-00-3	< 0.192		< 0.192		< 0.192		< 2.26		< 2.26		< 0.453		< 0.453		< 0.192		< 0.453		< 0.453		< 11.3		< 0.453		< 4.53	
Chloroform	67-66-3	< 0.111		< 0.111		< 0.111		< 1.62		< 1.62		< 0.324		< 0.324		< 0.111		< 0.324		< 0.324		< 8.10		< 0.324		< 3.24	
Chloromethane	74-87-3	< 0.960		< 0.960		< 0.960		< 1.38		< 1.38		< 0.276		< 0.276		< 0.960		< 0.276		< 0.276		< 6.90		< 0.276		< 2.76	
cis-1,2-Dichloroethene	156-59-2	< 0.126		< 0.126		< 0.126		< 1.30		< 1.30		< 0.260		< 0.260		< 0.126		< 0.260		< 0.260		< 6.50		< 0.260		< 2.60	
cis-1,3-Dichloropropene	10061-01-5	< 0.111		< 0.111		< 0.111		< 2.09		< 2.09		< 0.418		< 0.418		< 0.111		< 0.418		< 0.418		< 10.4		< 0.418		< 4.18	
Cyanide	57-12-5																										
Dibromochloromethane	124-48-1	< 0.140		< 0.140		< 0.140		< 1.64		< 1.64		< 0.327		< 0.327		< 0.140		< 0.327		< 0.327		< 8.18		< 0.327		< 3.27	
Ethylbenzene	100-41-4	< 0.137		< 0.137		< 0.137		6.06		8.23		2.69		1.42		2.23		69.1		8.55		4190		3930		3030	
Isopropylbenzene	98-82-8	< 0.105		< 0.105		< 0.105		35.9		59.1		45.9		31.6		30.3		11.7		17.7		143		114		134	
m,p-Xylene	179601-23-1	< 0.430		< 0.430		< 0.430		14.0		23.9		6.48		5.95		5.53		93.9		28.3		4920		2980		1040	
Mercury	7439-97-6																										
Methyl tert-butyl ether	1634-04-4	17.0		6.54		13.6		5.68		2.10	J	3.15		3.41		2.25		77.9		55.9		4250		3020		3660	
Methylene chloride	75-09-2	< 0.430		< 0.430		< 0.430		< 5.00		< 5.00		< 1.00		< 1.00		< 0.430		< 1.00		< 1.00		< 25.0		< 1.00		< 10.0	
Naphthalene	91-20-3	< 1.00		< 1.00		< 1.00		< 5.00		8.77	J	1.30	J	< 1.00		< 1.00		14.8		1.14	J	383		< 500		173	J4
n-Butylbenzene	104-51-8	< 0.157		< 0.157		< 0.157		< 1.80		< 1.80		1.25		0.615	J	< 0.157		1.24		1.93		16.8	J	6.83		13.4	
n-Propylbenzene	103-65-1	< 0.0993		< 0.0993		< 0.0993		48.2		80.9		63.4		27.9		30.4		18.3		31.9		296		190		215	
o-Xylene	95-47-6	< 0.174		< 0.174		< 0.174		< 1.70		1.77	J	< 0.341		0.476	J	0.522	J	13.9		1.59		472		28.5		8.12	J
sec-Butylbenzene	135-98-8	< 0.125		< 0.125		< 0.125		4.71	J	10.4		5.64		3.60		4.14		2.70		3.78		19.4	J	11.4		14.8	
Styrene	100-42-5	< 0.118		< 0.118		< 0.118		< 1.54		< 1.54		< 0.307		< 0.307		< 0.118		< 0.307		< 0.307		< 7.68		< 0.307		< 3.07	
Tetrachloroethene	127-18-4	< 0.300		< 0.300		< 0.300		< 1.86		< 1.86		< 0.372		< 0.372		< 0.300		< 0.372		< 0.372		< 9.30		< 0.372		< 3.72	
Toluene	108-88-3	< 0.278		< 0.278		< 0.278		< 3.90		3.54	J	1.57		0.866	J	0.997	J	17.5		3.22		172		111		87.1	
trans-1,2-Dichloroethene	156-60-5	< 0.149		< 0.149		< 0.149		< 1.98		< 1.98		< 0.396		< 0.396		< 0.149		< 0.396		< 0.396		< 9.90		< 0.396		< 3.96	
trans-1,3-Dichloropropene	10061-02-6	< 0.118		< 0.118		< 0.118		< 2.10		< 2.10		< 0.419		< 0.419		< 0.118		< 0.419		< 0.419		< 10.5		< 0.419		< 4.19	
Trichloroethene	79-01-6	< 0.190		< 0.190		< 0.190		< 1.99		< 1.99		< 0.398		< 0.398		< 0.190		< 0.398		< 0.398		< 9.95		< 0.398		< 3.98	
Vinyl chloride	75-01-4	< 0.234		< 0.234		< 0.234		< 1.30		< 1.30		< 0.259		< 0.259		< 0.234		< 0.259		< 0.259		< 6.48		< 0.259		< 2.59	
Xylenes, total	1330-20-7	< 0.174		< 0.174		< 0.174		14.0	J	25.7		6.48		6.43		6.05		108		29.9		5390		3010		1050	

Table 4
Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

	Samp Field D	RW-19[(a)] 12/14/2020		RW-19[(a)] 12/14/2020 FD		UG-1 4/27/2016		UG-1 4/25/2017		UG-1 4/2/2018		UG-1 4/1/2019		UG-1 6/15/2020		UG-1 4/12/2021		UG-2 4/27/2016		UG-2 4/25/2017		UG-2 4/3/2018		UG-2 4/1/2019		UG-2 6/15/2020	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6					< 0.385		< 0.385		< 0.385		< 0.385		< 0.147		< 0.147		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147	
1,1,1-Trichloroethane	71-55-6					< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.149	J4	< 0.319		< 0.319		< 0.319		< 0.319		< 0.149	
1,1,2,2-Tetrachloroethane	79-34-5					< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.133		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133	
1,1,2-Trichloroethane	79-00-5					< 0.383		< 0.383		< 0.383		< 0.383		< 0.158		< 0.158		< 0.383		< 0.383		< 0.383		< 0.383		< 0.158	
1,1-Dichloroethane	75-34-3					< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.100		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100	
1,1-Dichloroethene	75-35-4					< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.188		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188	
1,2,4-Trimethylbenzene	95-63-6	568		622		< 0.373		< 0.373		< 0.373		< 0.373		< 0.322		< 0.322		< 0.373		< 0.373		< 0.373		< 0.373		< 0.322	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4					< 0.381		< 0.381		< 0.381		< 0.381		< 0.126		< 0.126		< 0.381		< 0.381		< 0.381		< 0.381		< 0.126	
1,2-Dichloroethane	107-06-2					< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819		< 0.0819		< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819	
1,2-Dichloropropane	78-87-5					< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.149		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149	
1,3,5-Trimethylbenzene	108-67-8	29.6	J	35.4	J	< 0.387		< 0.387		< 0.387		< 0.387		< 0.104		< 0.104		< 0.387		< 0.387		< 0.387		< 0.387		< 0.104	
2-Butanone (MEK)	78-93-3					< 3.93		< 3.93		< 3.93		< 3.93		< 1.19		< 1.19		< 3.93		< 3.93		< 3.93		< 3.93		< 1.19	
2-Hexanone	591-78-6					< 3.82		< 3.82		< 3.82		< 3.82		< 0.787		< 0.787		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787	
4-Isopropyltoluene	99-87-6					< 0.350		< 0.350		< 0.350		< 0.350		< 0.120		< 0.120		< 0.350		< 0.350		< 0.350		< 0.350		< 0.120	
4-Methyl-2-pentanone	108-10-1					< 2.14		< 2.14		< 2.14		< 2.14		< 0.478		< 0.478		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478	
Acetone	67-64-1					< 10.0		< 10.0		< 10.0		< 10.0		< 11.3		< 11.3		< 10.0		< 10.0		< 10.0		< 10.0		< 11.3	
Benzene	71-43-2	2060		2220		< 0.331		< 0.331		< 0.331		< 0.331		< 0.0941		< 0.0941		< 0.331		< 0.331		< 0.331		< 0.331		< 0.0941	
Bromodichloromethane	75-27-4					< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.136	J4	< 0.380		< 0.380		< 0.380		< 0.380		< 0.136	
Bromoform	75-25-2					< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.129		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129	
Bromomethane	74-83-9					< 0.866		< 0.866		< 0.866		< 0.866		< 0.605		< 0.605		< 0.866		< 0.866		< 0.866		< 0.866		< 0.605	
Carbon disulfide	75-15-0					< 0.275		< 0.275		< 0.275		< 0.275		< 0.0962		< 0.0962		< 0.275		< 0.275		< 0.275		< 0.275		< 0.0962	
Carbon tetrachloride	56-23-5					< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.128		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128	
Chlorobenzene	108-90-7					< 0.348		< 0.348		< 0.348		< 0.348		< 0.116	J4	< 0.116		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116	J4
Chloroethane	75-00-3					< 0.453		< 0.453		< 0.453		< 0.453		< 0.192		< 0.192		< 0.453		< 0.453		< 0.453		< 0.453		< 0.192	
Chloroform	67-66-3					< 0.324		< 0.324		0.367	J	< 0.324		< 0.111		< 0.111	J4	< 0.324		< 0.324		< 0.324		< 0.324		< 0.111	
Chloromethane	74-87-3					< 0.276		< 0.276		< 0.276		< 0.276		< 0.960		< 0.960		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960	
cis-1,2-Dichloroethene	156-59-2					< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.126		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126	
cis-1,3-Dichloropropene	10061-01-5					< 0.418		< 0.418		< 0.418		< 0.418		< 0.111	J4	< 0.111		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111	J4
Cyanide	57-12-5					4.32	J	< 1.80		2.24	JB	< 1.80		< 1.80		< 1.80		5.11		< 1.80		< 1.80		< 1.80		< 1.80	
Dibromochloromethane	124-48-1					< 0.327		< 0.327		< 0.327		< 0.327		< 0.140		< 0.140		< 0.327		< 0.327		< 0.327		< 0.327		< 0.140	
Ethylbenzene	100-41-4	801		862		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137		< 0.137		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137	
Isopropylbenzene	98-82-8					< 0.326		< 0.326		< 0.326		< 0.326		< 0.105		< 0.105		< 0.326		< 0.326		< 0.326		< 0.326		< 0.105	
m,p-Xylene	179601-23-1	594		647		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430		< 0.430		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430	
Mercury	7439-97-6					< 0.0490		< 0.0490		0.0552	JB	< 0.0490		< 0.100		< 0.100		< 0.0490		< 0.0490		0.0684	JB	< 0.0490		< 0.100	
Methyl tert-butyl ether	1634-04-4	4580		5020		< 0.367		< 0.367		< 0.367		< 0.367		< 0.101		< 0.101		< 0.367		< 0.367		< 0.367		< 0.367		< 0.101	
Methylene chloride	75-09-2					< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 0.430		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430	
Naphthalene	91-20-3	193	J	215	J	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	
n-Butylbenzene	104-51-8					< 0.361		< 0.361		< 0.361		< 0.361		< 0.157		< 0.157		< 0.361		< 0.361		< 0.361		< 0.361		< 0.157	
n-Propylbenzene	103-65-1					< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993		< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993	
o-Xylene	95-47-6	36.2	J	32.9	J	< 0.341		< 0.341		< 0.341		< 0.341		< 0.174		< 0.174		< 0.341		< 0.341		< 0.341		< 0.341		< 0.174	
sec-Butylbenzene	135-98-8					< 0.365		< 0.365		< 0.365		< 0.365		< 0.125		< 0.125		< 0.365		< 0.365		< 0.365		< 0.365		< 0.125	
Styrene	100-42-5					< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.118		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118	
Tetrachloroethene	127-18-4					< 0.372		< 0.372		< 0.372		< 0.372		< 0.300		< 0.300		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300	
Toluene	108-88-3	45.7	J	50.5	J	< 0.780		< 0.412		< 0.412		< 0.412		< 0.278		< 0.278		< 0.780		< 0.412		< 0.412		< 0.412		< 0.278	
trans-1,2-Dichloroethene	156-60-5					< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.149		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149	
trans-1,3-Dichloropropene	10061-02-6					< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.118		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118	
Trichloroethene	79-01-6					< 0.398		< 0.398		< 0.398		< 0.398		< 0.190	J4	< 0.190		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190	J4
Vinyl chloride	75-01-4					< 0.259		< 0.259		< 0.259		< 0.259		< 0.234		< 0.234		< 0.259		< 0.259		< 0.259		< 0.259		< 0.234	
Xylenes, total	1330-20-7	630		680		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174		< 0.174		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174	

Table 4
Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

Samp	Field D	UG-2 4/12/2021		UG-3R 4/27/2016		UG-3R 4/25/2017		UG-3R 4/2/2018		UG-3R 4/1/2019		UG-3R 6/16/2020		UG-3R 4/12/2021		UG-4 4/27/2016		UG-4 4/25/2017		UG-4 4/2/2018		UG-4 4/1/2019		UG-4 6/15/2020		UG-4 4/12/2021	
Chemical Name	**CAS**	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
1,1,1,2-Tetrachloroethane	630-20-6	< 0.147		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147		< 0.147		< 0.385		< 0.385		< 0.385		< 0.385		< 0.147		< 0.147	
1,1,1-Trichloroethane	71-55-6	< 0.149	J4	< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.149	J4	< 0.319		< 0.319		< 0.319		< 0.319		< 0.149		< 0.149	J4
1,1,2,2-Tetrachloroethane	79-34-5	< 0.133		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.133		< 0.130		< 0.130		< 0.130		< 0.130		< 0.133		< 0.133	
1,1,2-Trichloroethane	79-00-5	< 0.158		< 0.383		< 0.383		< 0.383		< 0.383		< 0.158		< 0.158		< 0.383		< 0.383		< 0.383		< 0.383		< 0.158		< 0.158	
1,1-Dichloroethane	75-34-3	< 0.100		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.100		< 0.259		< 0.259		< 0.259		< 0.259		< 0.100		< 0.100	
1,1-Dichloroethene	75-35-4	< 0.188		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.188		< 0.398		< 0.398		< 0.398		< 0.398		< 0.188		< 0.188	
1,2,4-Trimethylbenzene	95-63-6	< 0.322		< 0.373		< 0.373		< 0.373		< 0.373		< 0.322		< 0.322		< 0.373		< 0.373		< 0.373		< 0.373		< 0.322		< 0.322	
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	< 0.126		< 0.381		< 0.381		< 0.381		< 0.381		< 0.126		< 0.126		< 0.381		< 0.381		< 0.381		< 0.381		< 0.126		< 0.126	
1,2-Dichloroethane	107-06-2	< 0.0819		< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819		< 0.0819		< 0.361		< 0.361		< 0.361		< 0.361		< 0.0819		< 0.0819	
1,2-Dichloropropane	78-87-5	< 0.149		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.149		< 0.306		< 0.306		< 0.306		< 0.306		< 0.149		< 0.149	
1,3,5-Trimethylbenzene	108-67-8	< 0.104		< 0.387		< 0.387		< 0.387		< 0.387		< 0.104		< 0.104		< 0.387		< 0.387		< 0.387		< 0.387		< 0.104		< 0.104	
2-Butanone (MEK)	78-93-3	< 1.19		< 3.93		< 3.93		< 3.93		< 3.93		< 1.19		< 1.19		< 3.93		< 3.93		< 3.93		< 3.93		< 1.19		< 1.19	
2-Hexanone	591-78-6	< 0.787		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787		< 0.787		< 3.82		< 3.82		< 3.82		< 3.82		< 0.787		< 0.787	
4-Isopropyltoluene	99-87-6	< 0.120		< 0.350		< 0.350		< 0.350		< 0.350		< 0.120		< 0.120		< 0.350		< 0.350		< 0.350		< 0.350		< 0.120		< 0.120	
4-Methyl-2-pentanone	108-10-1	< 0.478		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478		< 0.478		< 2.14		< 2.14		< 2.14		< 2.14		< 0.478		< 0.478	
Acetone	67-64-1	< 11.3		< 10.0		< 10.0		< 10.0		< 10.0		< 11.3		< 11.3		< 10.0		< 10.0		< 10.0		< 10.0		< 11.3		< 11.3	
Benzene	71-43-2	< 0.0941		< 0.331		< 0.331		< 0.331		< 0.331		< 0.0941		< 0.0941		< 0.331		< 0.331		< 0.331		< 0.331		< 0.0941		< 0.0941	
Bromodichloromethane	75-27-4	< 0.136	J4	< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.136	J4	< 0.380		< 0.380		< 0.380		< 0.380		< 0.136		< 0.136	J4
Bromoform	75-25-2	< 0.129		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.129		< 0.469		< 0.469		< 0.469		< 0.469		< 0.129		< 0.129	
Bromomethane	74-83-9	< 0.605		< 0.866		< 0.866		< 0.866		< 0.866		< 0.605		< 0.605		< 0.866		< 0.866		< 0.866		< 0.866		< 0.605		< 0.605	
Carbon disulfide	75-15-0	< 0.0962		< 0.275		< 0.275		< 0.275		< 0.275		< 0.0962		< 0.0962		< 0.275		< 0.275		< 0.275		< 0.275		< 0.0962		< 0.0962	
Carbon tetrachloride	56-23-5	< 0.128		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.128		< 0.379		< 0.379		< 0.379		< 0.379		< 0.128		< 0.128	
Chlorobenzene	108-90-7	< 0.116		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116	J4	< 0.116		< 0.348		< 0.348		< 0.348		< 0.348		< 0.116	J4	< 0.116	
Chloroethane	75-00-3	< 0.192		< 0.453		< 0.453		< 0.453		< 0.453		< 0.192		< 0.192		< 0.453		< 0.453		< 0.453		< 0.453		< 0.192		< 0.192	
Chloroform	67-66-3	< 0.111	J4	< 0.324		< 0.324		< 0.324		< 0.324		< 0.111		< 0.111	J4	< 0.324		< 0.324		< 0.324		< 0.324		< 0.111		< 0.111	J4
Chloromethane	74-87-3	< 0.960		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960		< 0.960		< 0.276		< 0.276		< 0.276		< 0.276		< 0.960		< 0.960	
cis-1,2-Dichloroethene	156-59-2	< 0.126		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.126		< 0.260		< 0.260		< 0.260		< 0.260		< 0.126		< 0.126	
cis-1,3-Dichloropropene	10061-01-5	< 0.111		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111	J4	< 0.111		< 0.418		< 0.418		< 0.418		< 0.418		< 0.111	J4	< 0.111	
Cyanide	57-12-5	3.21	J	< 1.80		< 1.80	J5	< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80		< 1.80	
Dibromochloromethane	124-48-1	< 0.140		< 0.327		< 0.327		< 0.327		< 0.327		< 0.140		< 0.140		< 0.327		< 0.327		< 0.327		< 0.327		< 0.140		< 0.140	
Ethylbenzene	100-41-4	< 0.137		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137		< 0.137		< 0.384		< 0.384		< 0.384		< 0.384		< 0.137		< 0.137	
Isopropylbenzene	98-82-8	< 0.105		< 0.326		< 0.326		< 0.326		< 0.326		< 0.105		< 0.105		< 0.326		< 0.326		< 0.326		< 0.326		< 0.105		< 0.105	
m,p-Xylene	179601-23-1	< 0.430		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430		< 0.430		< 0.719		< 0.719		< 0.719		< 0.719		< 0.430		< 0.430	
Mercury	7439-97-6	< 0.100		< 0.0490		< 0.0490		< 0.0490		< 0.0490		< 0.100		< 0.100		< 0.0490		< 0.0490		0.0571	JB	< 0.0490		< 0.100		< 0.100	
Methyl tert-butyl ether	1634-04-4	< 0.101		< 0.367		< 0.367		< 0.367		< 0.367		< 0.101		< 0.101		< 0.367		< 0.367		< 0.367		< 0.367		< 0.101		< 0.101	
Methylene chloride	75-09-2	< 0.430		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 0.430		< 1.00		< 1.00		< 1.00		< 1.00		< 0.430		< 0.430	
Naphthalene	91-20-3	< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00		< 1.00	
n-Butylbenzene	104-51-8	< 0.157		< 0.361		< 0.361		< 0.361		< 0.361		< 0.157		< 0.157		< 0.361		< 0.361		< 0.361		< 0.361		< 0.157		< 0.157	
n-Propylbenzene	103-65-1	< 0.0993		< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993		< 0.349		< 0.349		< 0.349		< 0.349		< 0.0993		< 0.0993	
o-Xylene	95-47-6	< 0.174		< 0.341		< 0.341		< 0.341		< 0.341		< 0.174		< 0.174		< 0.341		< 0.341		< 0.341		< 0.341		< 0.174		< 0.174	
sec-Butylbenzene	135-98-8	< 0.125		< 0.365		< 0.365		< 0.365		< 0.365		< 0.125		< 0.125		< 0.365		< 0.365		< 0.365		< 0.365		< 0.125		< 0.125	
Styrene	100-42-5	< 0.118		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.118		< 0.307		< 0.307		< 0.307		< 0.307		< 0.118		< 0.118	
Tetrachloroethene	127-18-4	< 0.300		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300		< 0.300		< 0.372		< 0.372		< 0.372		< 0.372		< 0.300		< 0.300	
Toluene	108-88-3	< 0.278		< 0.780		< 0.412		< 0.412		< 0.412		< 0.278		< 0.278		< 0.780		< 0.412		< 0.412		< 0.412		< 0.278		< 0.278	
trans-1,2-Dichloroethene	156-60-5	< 0.149		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.149		< 0.396		< 0.396		< 0.396		< 0.396		< 0.149		< 0.149	
trans-1,3-Dichloropropene	10061-02-6	< 0.118		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.118		< 0.419		< 0.419		< 0.419		< 0.419		< 0.118		< 0.118	
Trichloroethene	79-01-6	< 0.190		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190	J4	< 0.190		< 0.398		< 0.398		< 0.398		< 0.398		< 0.190	J4	< 0.190	
Vinyl chloride	75-01-4	< 0.234		< 0.259		< 0.259		< 0.259		< 0.259		< 0.234		< 0.234		< 0.259		< 0.259		< 0.259		< 0.259		< 0.234		< 0.234	
Xylenes, total	1330-20-7	< 0.174		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174		< 0.174		< 1.06		< 1.06		< 1.06		< 1.06		< 0.174		< 0.174	

Table 4
Groundwater Analytical Data Used in Off-Site Vapor Intrusion Evaluation

Notes:

[a] Sample collected from well with >0.03 feet of PSH as part of Groundwater Reinjection Pilot Test Baseline Monitoring

- = not analyzed

< not detected above MDL

B = Analyte also detected in the associated method blank.

J = Concentration qualified as an estimated value.

J3 = Associated batch QC was outside the established quality control range for precision.

J4 = Associated batch QC was outside the established quality control range for accuracy.

J5 = Sample matrix interfered with the ability to make any accurate determination; spike value is high.

J6 = Sample matrix interfered with the ability to make any accurate determination; spike value is low.

O1 = Analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference.

P1 = Relative percent difference value not applicable for sample concentrations less than 5 times the reporting limit.

Q = Sample was prepared and/or analyzed past recommended holding time.

V = Sample concentration is too high to evaluate accurate spike recoveries.

V3 = Internal standard exhibited poor recovery due to sample matrix interference; analytical result biased high.

FD = Field Duplicate

MDL = method detection limit

µg/L = micrograms per liter

Table 5
Groundwater Vapor Intrusion Screening Levels

Analyte	CAS Number	Volatile?[a]	Inhalation Toxicity Info?	Residential VISL (µg/L)			
				USEPA	NMED	Basis	Final Residential GW VISL
1,1,1,2-Tetrachloroethane	630-20-6	Yes	Yes	3.71E+01	3.70E+01	c	3.70E+01
1,1,1-Trichloroethane	71-55-6	Yes	Yes	7.42E+03	7.39E+03	n	7.39E+03
1,1,2,2-Tetrachloroethane	79-34-5	Yes	Yes	3.23E+01	3.22E+01	c	3.22E+01
1,1,2-Trichloroethane	79-00-5	Yes	Yes	6.19E+00	6.17E+00	n	6.17E+00
1,1-Dichloroethane	75-34-3	Yes	Yes	7.64E+01	7.62E+01	c	7.62E+01
1,1-Dichloroethene	75-35-4	Yes	Yes	1.95E+02	1.95E+02	n	1.95E+02
1,2,4-Trimethylbenzene	95-63-6	Yes	Yes	2.48E+02	-	-	2.48E+02
1,2-Dibromoethane	106-93-4	Yes	Yes	1.76E+00	1.76E+00	c	1.76E+00
1,2-Dichloroethane	107-06-2	Yes	Yes	2.24E+01	2.23E+01	c	2.23E+01
1,2-Dichloropropane	78-87-5	Yes	Yes	3.62E+01	2.43E+01	c	2.43E+01
1,3,5-Trimethylbenzene	108-67-8	Yes	Yes	1.75E+02	-	-	1.75E+02
2-Butanone (MEK)	78-93-3	Yes	Yes	2.24E+06	2.24E+06	n	2.24E+06
2-Hexanone	591-78-6	Yes	Yes	8.21E+03	-	-	8.21E+03
4-Bromofluorobenzene	460-00-4	Yes	No	-	-	-	-
4-Methyl-2-pentanone (MIBK)	108-10-1	Yes	Yes	5.55E+05	5.53E+05	n	5.53E+05
Acetone	67-64-1	Yes	Yes	-	2.25E+07	n	2.25E+07
Benzene	71-43-2	Yes	Yes	1.59E+01	1.58E+01	c	1.58E+01
Bromodichloromethane	75-27-4	Yes	Yes	8.76E+00	8.73E+00	c	8.73E+00
Bromoform	75-25-2	Yes	Yes	1.17E+03	1.16E+03	c	1.16E+03
Bromomethane	74-83-9	Yes	Yes	1.74E+01	1.73E+01	n	1.73E+01
Carbon disulfide	75-15-0	Yes	Yes	1.24E+03	1.24E+03	n	1.24E+03
Carbon tetrachloride	56-23-5	Yes	Yes	4.15E+00	4.14E+00	c	4.14E+00
Chlorobenzene	108-90-7	Yes	Yes	4.10E+02	4.09E+02	n	4.09E+02
Chlorodibromomethane	124-48-1	Yes	No	-	-	-	-
Chloroethane	75-00-3	Yes	Yes	9.19E+03	2.29E+04	n	2.29E+04
Chloroform	67-66-3	Yes	Yes	8.14E+00	8.11E+00	c	8.11E+00
Chloromethane	74-87-3	Yes	Yes	2.60E+02	4.31E+01	c	4.31E+01
cis-1,2-Dichloroethene	156-59-2	Yes	No	-	-	-	-
cis-1,3-Dichloropropene	10061-01-5	Yes	No	-	4.82E+01	c	4.82E+01
Cyanide	57-12-5	Yes	Yes	2.01E+02	1.53E+02	n	1.53E+02
Ethylbenzene	100-41-4	Yes	Yes	3.49E+01	3.48E+01	c	3.48E+01
Isopropylbenzene	98-82-8	Yes	Yes	8.87E+02	8.85E+02	n	8.85E+02
Mercury (elemental)	7439-97-6	Yes	Yes	8.89E-01	6.69E-01	n	6.69E-01
Mercury, Dissolved	7439-97-6	Yes	Yes	8.89E-01	6.69E-01	n	6.69E-01
Methyl tert-butyl ether	1634-04-4	Yes	Yes	4.50E+03	4.49E+03	c	4.49E+03
Methylene Chloride	75-09-2	Yes	Yes	4.71E+03	4.70E+03	n	4.70E+03
Naphthalene	91-20-3	Yes	Yes	4.59E+01	4.58E+01	c	4.58E+01
n-Butylbenzene	104-51-8	Yes	No	-	-	-	-
n-Propylbenzene	103-65-1	Yes	Yes	2.43E+03	-	-	2.43E+03
p-Isopropyltoluene	99-87-6	Yes	No	-	-	-	-
sec-Butylbenzene	135-98-8	Yes	No	-	-	-	-
Styrene	100-42-5	Yes	Yes	9.28E+03	9.25E+03	n	9.25E+03
Tetrachloroethene	127-18-4	Yes	Yes	5.76E+01	5.75E+01	n	5.75E+01
Toluene	108-88-3	Yes	Yes	1.92E+04	1.92E+04	n	1.92E+04
trans-1,2-Dichloroethene	156-60-5	Yes	No	1.09E+02	3.74E+02	n	3.74E+02
trans-1,3-Dichloropropene	10061-02-6	Yes	No	-	4.82E+01	c	4.82E+01
Trichloroethene	79-01-6	Yes	Yes	5.18E+00	5.16E+00	n	5.16E+00
Vinyl chloride	75-01-4	Yes	Yes	1.47E+00	1.47E+00	c	1.47E+00
Xylenes, total	1330-20-7	Yes	Yes	3.85E+02	4.91E+02	n	4.91E+02

Notes:
[a] Volatile analyte defined as one with a Henry's Law Constant >1E-05 atm/m^3-mol and Vapor Pressure >1 mm Hg
- = not applicable
c = carcinogen
GW VISL = groundwater vapor intrusion screening level
n = noncarcinogen
NMED = New Mexico Environment Department
USEPA = United States Environmental Protection Agency
µg/L = micrograms per liter
VISLs based on cancer target risk level (TRL) of 1E-05 and noncancer Hazard Quotient (HQ) of 1 per NMED guidance (NMED 2019).

References:
NMED 2019. Risk Assessment Guidance for Site Investigations and Remediation. Volume 1. Soil Screening Guidance for Human Health Risk Assessments. February 2019, Revision 2, June 19. Table A-4.
Available online at: https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-

Table 6

Selection of Off-Site Residential Groundwater Vapor Intrusion COCs

Analyte	CAS Number	Number of Samples	Number of Detections	Detection Frequency	MDC (µg/L)	Final Residential GW VISL (µg/L)	Noncancer HQ	Cancer Risk	COC Determination
1,2,4-Trimethylbenzene	95-63-6	273	81	30%	1.46E+03	2.48E+02	Further evaluation in Tables 7 and 8		COC - MDC Exceeds SL
1,3,5-Trimethylbenzene	108-67-8	273	38	14%	2.31E+02	1.75E+02			COC - MDC Exceeds SL
Benzene	71-43-2	275	83	30%	2.19E+04	1.58E+01			COC - MDC Exceeds SL
Ethylbenzene	100-41-4	273	71	26%	4.19E+03	3.48E+01			COC - MDC Exceeds SL
Methyl tert-butyl ether	1634-04-4	273	147	54%	5.27E+03	4.49E+03			COC - MDC Exceeds SL
Naphthalene	91-20-3	273	60	22%	1.20E+03	4.58E+01			COC - MDC Exceeds SL
Xylenes, total	1330-20-7	273	70	26%	5.39E+03	4.91E+02			COC - MDC Exceeds SL
1,1,1,2-Tetrachloroethane	630-20-6	269	0	0%	--	3.70E+01	Nondetect		COC - ND and 1/2 MRL > SL
1,1,2-Trichloroethane	79-00-5	269	0	0%	--	6.17E+00	Nondetect		COC - ND and 1/2 MRL > SL
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	274	0	0%	--	1.76E+00	Nondetect		COC - ND and 1/2 MRL > SL
1,2-Dichloropropane	78-87-5	269	0	0%	--	2.43E+01	Nondetect		COC - ND and 1/2 MRL > SL
Bromodichloromethane	75-27-4	269	0	0%	--	8.73E+00	Nondetect		COC - ND and 1/2 MRL > SL
Bromomethane	74-83-9	269	0	0%	--	1.73E+01	Nondetect		COC - ND and 1/2 MRL > SL
Carbon tetrachloride	56-23-5	269	0	0%	--	4.14E+00	Nondetect		COC - ND and 1/2 MRL > SL
cis-1,3-Dichloropropene	10061-01-5	269	0	0%	--	4.82E+01	Nondetect		COC - ND and 1/2 MRL > SL
trans-1,3-Dichloropropene	10061-02-6	269	0	0%	--	4.82E+01	Nondetect		COC - ND and 1/2 MRL > SL
Trichloroethene	79-01-6	269	0	0%	--	5.16E+00	Nondetect		COC - ND and 1/2 MRL > SL
Vinyl chloride	75-01-4	269	0	0%	--	1.47E+00	Nondetect		COC - ND and 1/2 MRL > SL
1,1-Dichloroethane	75-34-3	269	0	0%	--	7.62E+01	Nondetect		Not a COC - 1/2 RL does not exceed SL
1,1-Dichloroethene	75-35-4	269	0	0%	--	1.95E+02	Nondetect		Not a COC - 1/2 RL does not exceed SL
Bromoform	75-25-2	269	0	0%	--	1.16E+03	Nondetect		Not a COC - 1/2 RL does not exceed SL
Chlorobenzene	108-90-7	269	0	0%	--	4.09E+02	Nondetect		Not a COC - 1/2 RL does not exceed SL
Chloroethane	75-00-3	269	0	0%	--	2.29E+04	Nondetect		Not a COC - 1/2 RL does not exceed SL
Methylene chloride	75-09-2	269	0	0%	--	4.70E+03	Nondetect		Not a COC - 1/2 RL does not exceed SL
trans-1,2-Dichloroethene	156-60-5	269	0	0%	--	3.74E+02	Nondetect		Not a COC - 1/2 RL does not exceed SL
1,1,1-Trichloroethane	71-55-6	269	1	0%	1.54E-01	7.39E+03	Negligible detection (<5%)		Not a COC - MDC Does Not Exceed SL
1,1,2,2-Tetrachloroethane	79-34-5	269	1	0%	1.60E-01	3.22E+01	Negligible detection (<5%)		Not a COC - MDC Does Not Exceed SL
1,2-Dichloroethane	107-06-2	269	22	8%	2.32E+00	2.23E+01	--	1.04E-06	Not a COC - MDC Does Not Exceed SL
2-Butanone (MEK)	78-93-3	269	4	1%	1.60E+02	2.24E+06	Negligible detection (<5%)		Not a COC - MDC Does Not Exceed SL
2-Hexanone	591-78-6	269	1	0%	5.15E+00	8.21E+03	Negligible detection (<5%)		Not a COC - MDC Does Not Exceed SL
4-Methyl-2-pentanone	108-10-1	269	4	1%	5.87E+00	5.53E+05	Negligible detection (<5%)		Not a COC - MDC Does Not Exceed SL
Acetone	67-64-1	269	7	3%	8.01E+01	2.25E+07	Negligible detection (<5%)		Not a COC - MDC Does Not Exceed SL
Carbon disulfide	75-15-0	269	38	14%	6.64E+01	1.24E+03	0.05	--	Not a COC - MDC Does Not Exceed SL
Chloroform	67-66-3	269	3	1%	4.90E+00	8.11E+00	Negligible detection (<5%)		Not a COC - MDC Does Not Exceed SL
Chloromethane	74-87-3	269	2	1%	1.06E+00	4.31E+01	Negligible detection (<5%)		Not a COC - MDC Does Not Exceed SL
Cyanide	57-12-5	110	9	8%	5.65E+01	1.53E+02	0.37	--	Not a COC - MDC Does Not Exceed SL
Isopropylbenzene	98-82-8	269	68	25%	1.43E+02	8.85E+02	0.16	--	Not a COC - MDC Does Not Exceed SL
Mercury	7439-97-6	220	32	15%	2.61E-01	6.69E-01	0.39	--	Not a COC - MDC Does Not Exceed SL
n-Propylbenzene	103-65-1	269	65	24%	2.96E+02	2.43E+03	0.12	--	Not a COC - MDC Does Not Exceed SL
Styrene	100-42-5	269	2	1%	3.48E+00	9.25E+03	Negligible detection (<5%)		Not a COC - MDC Does Not Exceed SL
Tetrachloroethene	127-18-4	269	1	0%	5.82E-01	5.75E+01	Negligible detection (<5%)		Not a COC - MDC Does Not Exceed SL
Toluene	108-88-3	273	44	16%	1.48E+03	1.92E+04	0.08	--	Not a COC - MDC Does Not Exceed SL
4-Isopropyltoluene	99-87-6	269	34	13%	8.13E+00	--	Cannot calculate HQ or risk		SLNA, no toxicity value available
cis-1,2-Dichloroethene	156-59-2	269	1	0%	3.91E-01	--	Cannot calculate HQ or risk		SLNA, no toxicity value available
Dibromochloromethane	124-48-1	269	0	0%	--	--	Cannot calculate HQ or risk		SLNA, no toxicity value available
m,p-Xylene	179601-23-1	273	71	26%	4.92E+03	--	Cannot calculate HQ or risk		SLNA, no toxicity value available
n-Butylbenzene	104-51-8	269	33	12%	1.68E+01	--	Cannot calculate HQ or risk		SLNA, no toxicity value available
o-Xylene	95-47-6	273	44	16%	4.72E+02	--	Cannot calculate HQ or risk		SLNA, no toxicity value available
sec-Butylbenzene	135-98-8	269	52	19%	1.94E+01	--	Cannot calculate HQ or risk		SLNA, no toxicity value available
Worst-Case (MDC) Cumulative Noncancer HI / Cancer Risk							**1**	**1E-06**	

Notes:

Yellow highlighting indicates MDC exceeds VISL.

- = not detected or not applicable

COC = chemical of concern

GW VISL = groundwater vapor intrusion screening level

HI = hazard index (cumulative HQ)

HQ = hazard quotient (individual analyte)

MDC = maximum detected concentration

ND = Not detected above method detection limit

SL = screening level

SLNA = screening level not available

µg/L = micrograms per liter

Table 7
Specific Residential Groundwater VISL Exceedances for Off-Site VI Evaluation

Well ID	Sample Date	FD	COC	CAS Number	Concentration (µg/L)	Residential GW VISL (µg/L)
KWB-2R	4/28/2016		Benzene	71-43-2	55.8	15.8
KWB-2R	10/5/2016		Benzene	71-43-2	398	15.8
KWB-2R	4/25/2017		Benzene	71-43-2	26	15.8
KWB-2R	10/4/2017		Benzene	71-43-2	1,120	15.8
KWB-2R	4/3/2019		Benzene	71-43-2	177	15.8
KWB-2R	10/22/2019		Benzene	71-43-2	920	15.8
KWB-2R	4/28/2016		Ethylbenzene	100-41-4	48.3	34.8
KWB-2R	10/4/2017		Ethylbenzene	100-41-4	325	34.8
KWB-2R	4/3/2019		Ethylbenzene	100-41-4	686	34.8
KWB-2R	10/22/2019		Ethylbenzene	100-41-4	264	34.8
KWB-2R	10/4/2017		Naphthalene	91-20-3	67.5	45.8
KWB-4	11/20/2020		1,2,4-Trimethylbenzene	95-63-6	254	248
KWB-4	11/20/2020		Benzene	71-43-2	2,060	15.8
KWB-4	11/20/2020		Ethylbenzene	100-41-4	632	34.8
KWB-4	11/20/2020		Methyl tert-butyl ether	1634-04-4	5,270	4,487
KWB-4	11/20/2020		Naphthalene	91-20-3	120	45.8
KWB-7	4/27/2016		Benzene	71-43-2	36.5	15.8
KWB-7	10/5/2016		Benzene	71-43-2	36.4	15.8
KWB-7	10/3/2017		Benzene	71-43-2	36.3	15.8
KWB-7	10/2/2018		Benzene	71-43-2	24.7	15.8
KWB-7	6/16/2020		Benzene	71-43-2	54.5	15.8
KWB-7	4/14/2021		Benzene	71-43-2	1,010	15.8
KWB-7	4/14/2021		Ethylbenzene	100-41-4	459	34.8
KWB-8	4/25/2017		1,2,4-Trimethylbenzene	95-63-6	380	248
KWB-8	10/6/2020		1,2,4-Trimethylbenzene	95-63-6	833	248
KWB-8	10/6/2020		1,3,5-Trimethylbenzene	108-67-8	191	175
KWB-8	10/5/2016		Benzene	71-43-2	11,500	15.8
KWB-8	4/25/2017		Benzene	71-43-2	5,620	15.8
KWB-8	10/3/2017		Benzene	71-43-2	12,500	15.8
KWB-8	10/6/2020		Benzene	71-43-2	17,800	15.8
KWB-8	10/5/2016		Ethylbenzene	100-41-4	828	34.8
KWB-8	4/25/2017		Ethylbenzene	100-41-4	1,240	34.8
KWB-8	10/3/2017		Ethylbenzene	100-41-4	617	34.8
KWB-8	10/6/2020		Ethylbenzene	100-41-4	2,890	34.8
KWB-8	4/25/2017		Naphthalene	91-20-3	141	45.8
KWB-8	10/3/2017		Naphthalene	91-20-3	51.9	45.8
KWB-8	10/6/2020		Naphthalene	91-20-3	539	45.8
KWB-8	10/5/2016		Xylenes, total	1330-20-7	1,160	491
KWB-8	4/25/2017		Xylenes, total	1330-20-7	2,070	491
KWB-8	10/3/2017		Xylenes, total	1330-20-7	795	491
KWB-8	10/6/2020		Xylenes, total	1330-20-7	4,190	491

Table 7
Specific Residential Groundwater VISL Exceedances for Off-Site VI Evaluation

Well ID	Sample Date	FD	COC	CAS Number	Concentration (µg/L)	Residential GW VISL (µg/L)
MW-48	4/27/2016		1,2,4-Trimethylbenzene	95-63-6	310	248
MW-48	10/5/2016		1,2,4-Trimethylbenzene	95-63-6	323	248
MW-48	4/26/2017		1,2,4-Trimethylbenzene	95-63-6	482	248
MW-48	10/4/2017		1,2,4-Trimethylbenzene	95-63-6	368	248
MW-48	4/5/2018		1,2,4-Trimethylbenzene	95-63-6	381	248
MW-48	10/3/2018		1,2,4-Trimethylbenzene	95-63-6	377	248
MW-48	4/3/2019		1,2,4-Trimethylbenzene	95-63-6	564	248
MW-48	4/27/2016		Benzene	71-43-2	7,170	15.8
MW-48	10/5/2016		Benzene	71-43-2	5,120	15.8
MW-48	10/4/2017		Benzene	71-43-2	11,000	15.8
MW-48	4/26/2017		Benzene	71-43-2	11,700	15.8
MW-48	4/5/2018		Benzene	71-43-2	14,900	15.8
MW-48	10/3/2018		Benzene	71-43-2	7,970	15.8
MW-48	4/3/2019		Benzene	71-43-2	4,870	15.8
MW-48	10/22/2019		Benzene	71-43-2	5,040	15.8
MW-48	11/19/2020		Benzene	71-43-2	946	15.8
MW-48	4/27/2016		Ethylbenzene	100-41-4	790	34.8
MW-48	10/5/2016		Ethylbenzene	100-41-4	448	34.8
MW-48	4/26/2017		Ethylbenzene	100-41-4	1,270	34.8
MW-48	10/4/2017		Ethylbenzene	100-41-4	917	34.8
MW-48	4/5/2018		Ethylbenzene	100-41-4	1,360	34.8
MW-48	10/3/2018		Ethylbenzene	100-41-4	479	34.8
MW-48	4/3/2019		Ethylbenzene	100-41-4	603	34.8
MW-48	10/22/2019		Ethylbenzene	100-41-4	118	34.8
MW-48	11/19/2020		Ethylbenzene	100-41-4	131	34.8
MW-48	4/27/2016		Naphthalene	91-20-3	101	45.8
MW-48	10/5/2016		Naphthalene	91-20-3	83.2	45.8
MW-48	4/26/2017		Naphthalene	91-20-3	224	45.8
MW-48	10/4/2017		Naphthalene	91-20-3	138	45.8
MW-48	4/3/2019		Naphthalene	91-20-3	1,200	45.8
MW-48	4/27/2016		Xylenes, total	1330-20-7	750	491
MW-48	10/5/2016		Xylenes, total	1330-20-7	538	491
MW-48	4/26/2017		Xylenes, total	1330-20-7	1,160	491
MW-48	10/4/2017		Xylenes, total	1330-20-7	797	491
MW-48	4/5/2018		Xylenes, total	1330-20-7	955	491
MW-48	4/3/2019		Xylenes, total	1330-20-7	498	491

Table 7
Specific Residential Groundwater VISL Exceedances for Off-Site VI Evaluation

Well ID	Sample Date	FD	COC	CAS Number	Concentration (µg/L)	Residential GW VISL (µg/L)
MW-58	4/28/2016		1,2,4-Trimethylbenzene	95-63-6	753	248
MW-58	10/5/2016		1,2,4-Trimethylbenzene	95-63-6	387	248
MW-58	4/25/2017		1,2,4-Trimethylbenzene	95-63-6	517	248
MW-58	4/3/2018		1,2,4-Trimethylbenzene	95-63-6	574	248
MW-58	10/22/2019		1,2,4-Trimethylbenzene	95-63-6	272	248
MW-58	4/28/2016		Benzene	71-43-2	4,120	15.8
MW-58	10/5/2016		Benzene	71-43-2	5,920	15.8
MW-58	4/25/2017		Benzene	71-43-2	3,000	15.8
MW-58	10/4/2017		Benzene	71-43-2	4,080	15.8
MW-58	4/3/2018		Benzene	71-43-2	4,120	15.8
MW-58	10/3/2018		Benzene	71-43-2	7,110	15.8
MW-58	10/22/2019		Benzene	71-43-2	3,780	15.8
MW-58	4/28/2016		Ethylbenzene	100-41-4	1,110	34.8
MW-58	10/5/2016		Ethylbenzene	100-41-4	1,100	34.8
MW-58	4/25/2017		Ethylbenzene	100-41-4	720	34.8
MW-58	10/4/2017		Ethylbenzene	100-41-4	96.5	34.8
MW-58	4/3/2018		Ethylbenzene	100-41-4	946	34.8
MW-58	10/3/2018		Ethylbenzene	100-41-4	35.1	34.8
MW-58	10/22/2019		Ethylbenzene	100-41-4	634	34.8
MW-58	10/5/2016		Naphthalene	91-20-3	86.7	45.8
MW-58	4/28/2016		Naphthalene	91-20-3	257	45.8
MW-58	4/25/2017		Naphthalene	91-20-3	191	45.8
MW-58	10/4/2017		Naphthalene	91-20-3	46.9	45.8
MW-58	4/3/2018		Naphthalene	91-20-3	267	45.8
MW-58	10/22/2019		Naphthalene	91-20-3	91.7	45.8
MW-58	10/5/2016		Xylenes, total	1330-20-7	893	491
MW-58	4/28/2016		Xylenes, total	1330-20-7	848	491
MW-58	4/25/2017		Xylenes, total	1330-20-7	533	491
MW-113	10/23/2019		Benzene	71-43-2	547	15.8
MW-113	10/23/2019	FD	Benzene	71-43-2	546	15.8
MW-113	6/17/2020		Benzene	71-43-2	30.6	15.8
MW-113	6/17/2020	FD	Benzene	71-43-2	24.8	15.8
MW-113	10/7/2020		Benzene	71-43-2	368	15.8
MW-113	10/7/2020	FD	Benzene	71-43-2	428	15.8
MW-113	4/14/2021		Benzene	71-43-2	27.2	15.8
MW-113	4/14/2021	FD	Benzene	71-43-2	41.7	15.8
MW-113	10/23/2019		Ethylbenzene	100-41-4	248	34.8
MW-113	10/23/2019	FD	Ethylbenzene	100-41-4	270	34.8
MW-113	10/7/2020		Ethylbenzene	100-41-4	129	34.8
MW-113	10/7/2020	FD	Ethylbenzene	100-41-4	137	34.8
MW-113	10/23/2019		Naphthalene	91-20-3	128	45.8
MW-113	10/23/2019	FD	Naphthalene	91-20-3	98.6	45.8
RW-12R	4/28/2016		Benzene	71-43-2	424	15.8
RW-12R	4/27/2017		Benzene	71-43-2	335	15.8
RW-12R	4/4/2018		Benzene	71-43-2	35.8	15.8
RW-12R	4/2/2019		Benzene	71-43-2	76.4	15.8
RW-12R	6/17/2020		Benzene	71-43-2	154	15.8
RW-13R	4/27/2016		Benzene	71-43-2	878	15.8
RW-13R	4/4/2018		Benzene	71-43-2	77	15.8
RW-13R	4/27/2016		Ethylbenzene	100-41-4	69.1	34.8

Table 7
Specific Residential Groundwater VISL Exceedances for Off-Site VI Evaluation

Well ID	Sample Date	FD	COC	CAS Number	Concentration (µg/L)	Residential GW VISL (µg/L)
RW-15C	4/26/2017		1,2,4-Trimethylbenzene	95-63-6	1,460	248
RW-15C	4/5/2018		1,2,4-Trimethylbenzene	95-63-6	1,060	248
RW-15C	4/3/2019		1,2,4-Trimethylbenzene	95-63-6	728	248
RW-15C	4/26/2017		1,3,5-Trimethylbenzene	108-67-8	231	175
RW-15C	4/26/2017		Benzene	71-43-2	19,100	15.8
RW-15C	4/5/2018		Benzene	71-43-2	21,900	15.8
RW-15C	4/26/2017		Ethylbenzene	100-41-4	4,190	34.8
RW-15C	4/5/2018		Ethylbenzene	100-41-4	3,930	34.8
RW-15C	4/3/2019		Ethylbenzene	100-41-4	3,030	34.8
RW-15C	4/26/2017		Naphthalene	91-20-3	383	45.8
RW-15C	4/3/2019		Naphthalene	91-20-3	173	45.8
RW-15C	4/26/2017		Xylenes, total	1330-20-7	5,390	491
RW-15C	4/5/2018		Xylenes, total	1330-20-7	3,010	491
RW-15C	4/3/2019		Xylenes, total	1330-20-7	1,050	491
RW-19[a]	12/14/2020		1,2,4-Trimethylbenzene	95-63-6	568	248
RW-19[a]	12/14/2020	FD	1,2,4-Trimethylbenzene	95-63-6	622	248
RW-19[a]	12/14/2020		Benzene	71-43-2	2,060	15.8
RW-19[a]	12/14/2020	FD	Benzene	71-43-2	2,220	15.8
RW-19[a]	12/14/2020		Ethylbenzene	100-41-4	801	34.8
RW-19[a]	12/14/2020	FD	Ethylbenzene	100-41-4	862	34.8
RW-19[a]	12/14/2020		Methyl tert-butyl ether	1634-04-4	4,580	4,487
RW-19[a]	12/14/2020	FD	Methyl tert-butyl ether	1634-04-4	5,020	4,487
RW-19[a]	12/14/2020		Naphthalene	91-20-3	193	45.8
RW-19[a]	12/14/2020	FD	Naphthalene	91-20-3	215	45.8
RW-19[a]	12/14/2020		Xylenes, total	1330-20-7	630	491
RW-19[a]	12/14/2020	FD	Xylenes, total	1330-20-7	680	491

Notes:

[a] Sample collected from well with >0.03 feet of PSH as part of Groundwater Reinjection Pilot Test Baseline Monitoring

COC = chemical of concern

FD = Field Duplicate

GW VISL = groundwater vapor intrusion screening level

PSH = phase-separated hydrocarbon

µg/L = micrograms per liter

Table 8
Refined Vapor Intrusion Evaluation for Off-Site Receptors

Well Location	Minimum Depth to GW since 2016 (ft bgs)	PSH Present in April 2021?	Depth to PSH, April 2021 (ft bgs)	Location	Distance to Nearest Occupied Buildings?	Type of Nearest Building	Depth to GW (Separation Distance) > 5 ft bgs? [(a)]	Depth to PSH (Separation Distance) > 18 ft bgs [(b)]	Distance to Nearest Residence > 100 ft	Recommendation
KWB-2R	19.04	YES	26.60	South of Refinery	380 ft to west (Figure 1)	C/I Oilfield Services and Machine Shop	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	YES	No further action based on following: (1) Sample is located >100 feet from nearest building, therefore, VI pathway is not a concern. (2) Both groundwater and PSH are located further away than the required vertical separation distance for VI to occur.
KWB-4	19.20	YES	25.95	South of Refinery	210 ft to southwest (Figure 1)	C/I Oilfield Services and Machine Shop	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	YES	No further action based on following: (1) Sample is located >100 feet from nearest building, therefore, VI pathway is not a concern. (2) Both groundwater and PSH are located further away than the required vertical separation distance for VI to occur.
KWB-7	13.43	NO [(c)]	--	In the Pecan Orchard	1,324 ft to west (Figure 1)	Commercial Warehouse (Pecan Orchard Plant)	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	PSH not present	YES	No further action based on following: (1) Sample is located >100 feet from nearest building, therefore, VI pathway is not a concern. (2) Both groundwater and PSH are located further away than the required vertical separation distance for VI to occur.
KWB-8	13.49	YES	24.42	Near the Pecan Orchard Plant	101 ft to west (Figure 1)	Commercial Warehouse (Pecan Orchard Plant)	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	Slightly greater 100 ft (101 ft)	Although PSH is present > 18 ft bgs, sample is located at approximately 100 feet from the **Pecan Orchard Plant, North Building**. Therefore, conduct VI modeling using existing groundwater and soil gas data.
MW-48	15.26	NA [(c, d)]	--	South of Refinery	245 ft to southeast (Figure 1)	C/I Oilfield Services and Machine Shop	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	NA [(d)]	YES	No further action based on following: (1) Sample is located >100 feet from nearest building, therefore, VI pathway is not a concern. (2) Both groundwater and PSH are located further away than the required vertical separation distance for VI to occur.
MW-58	18.01	YES	25.42	South of Refinery	731 ft to west (Figure 1)	C/I Oilfield Services and Machine Shop	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	YES	No further action based on following: (1) Sample is located >100 feet from nearest building, therefore, VI pathway is not a concern. (2) Both groundwater and PSH are located further away than the required vertical separation distance for VI to occur.
MW-113	14.71	NO	--	Near the Pecan Orchard Plant	182 ft to northeast (Figure 1)	Commercial Warehouse (Pecan Orchard Plant)	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	PSH not present	YES	No further action based on following: (1) Sample is located >100 feet from nearest building, therefore, VI pathway is not a concern. (2) Both groundwater and PSH are located further away than the required vertical separation distance for VI to occur.
RW-12R	17.83	YES	27.10	Near the Pecan Orchard Plant	70 ft to southeast (Figure 1)	Commercial Warehouse (Pecan Orchard Plant)	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	NO	Although PSH is present > 18 ft bgs, sample is located at <100 feet from the **Pecan Orchard Plant, South Building**. Therefore, conduct VI modeling using existing groundwater data. If the predicted indoor air risk based on VI modeling is unacceptable, then collect soil gas data to better characterize VI concerns at the Pecan Orchard Plant, South Building.
RW-13R	14.61	YES	24.04	Near the Pecan Orchard Plant	65 ft to east (Figure 1)	Commercial Warehouse (Pecan Orchard Plant)	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	NO	Although PSH is present > 18 ft bgs, sample is located <100 feet from the **Pecan Orchard Plant, North Building**. Therefore, conduct VI modeling using existing groundwater and soil gas data.
RW-15C	13.98	YES	21.69	South of Refinery	363 ft to south (Figure 1)	C/I Oilfield Services and Machine Shop	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	YES	No further action based on following: (1) Sample is located >100 feet from nearest building, therefore, VI pathway is not a concern. (2) Both groundwater and PSH are located further away than the required vertical separation distance for VI to occur.
RW-19[(e)]	19.34	YES	26.73	South of Refinery	203 ft to southwest (Figure 1)	C/I Oilfield Services and Machine Shop	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	YES - adequate vertical distance for bioattenuation; therefore, VI not a concern	YES	No further action based on following: (1) Sample is located >100 feet from nearest building, therefore, VI pathway is not a concern. (2) Both groundwater and PSH are located further away than the required vertical separation distance for VI to occur.

Notes:
A previous version of this Report included Table 9, "Off-Site Monitoring or Recovery Wells with PSH Present, 2016 to 2018." That information is now included above on Table 8 and Table 9 has been omitted from the Revised Report.
Highlighting indicates well requires further evaluation.
[(a)] Separation distance criteria for dissolved-phase petroleum hydrocarbons identified as 5 feet between top of groundwater table and bottom of building foundation (ITRC, 2014).
[(b)] Refinery-specific, separation distance criteria for PSH identified as 18 feet between top of PSH and bottom of building foundation (ITRC, 2014).
[(c)] PSH was not measured during the semiannual groundwater monitoring event in April 2021, but was measured during at least one monitoring event between 2016 and 2020, as shown on Figure 5A or 5B.
[(d)] Well destroyed during construction
[(e)] Sample collected from well with >0.03 feet of PSH as part of Groundwater Reinjection Pilot Test Baseline Monitoring

C/ I = commercial/industrial
ft bgs = feet below ground surface
GW = Groundwater
NA = not available
PSH = phase-separated hydrocarbon
VI = vapor intrusion

Reference:
ITRC. 2014. Petroleum Vapor Intrusion (PVI) Technical and Regulatory Guidance. Available online at: ITRC. (2014). Petroleum Vapor Intrusion (PVI) Technical and Regulatory Guidance. Available online at: https://projects.itrcweb.org/PetroleumVI-Guidance/Content/Resources/PVIPDF.pdf. October.

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CONDITIONS

Action 70633

CONDITIONS

Operator:	
HF Sinclair Navajo Refining LLC ATTN: GENERAL COUNSEL Dallas, TX 75201	OGRID: 15694
	Action Number: 70633
	Action Type: [UF-GWA] Ground Water Abatement (GROUND WATER ABATEMENT)

CONDITIONS

Created By	Condition	Condition Date
michael.buchanan	Memos and Attachments accepted for the record, HF Sinclair Navajo Refinery	8/5/2024