GW - 28

FACILITY-WIDE GW MONITORING WORK PLAN

2020

HOLLYFRONTIER.

June 30, 2020

Mr. Kevin Pierard
Chief, Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505

Mr. Carl Chavez
New Mexico Energy, Minerals and Natural Resources Department
Oil Conservation Division
CarlJ.Chavez@state.nm.us

RE: Submittal of the *2020 Facility-Wide Groundwater Monitoring Work Plan* for the HollyFrontier Navajo Refining LLC, Artesia Refinery
RCRA Permit No. NMD048918817
Discharge Permit GW-028

Dear Mr. Pierard and Mr. Chavez:

Enclosed is the annual update to the Facility Wide Groundwater Monitoring Work Plan (FWGMWP) for the Artesia Refinery. This update has been prepared and is being submitted according to the requirements of the Post Closure Care Permit issued by the New Mexico Environment Department (NMED) Hazardous Waste Bureau. The FWGMWP also incorporates the requirements of the Discharge Permit issued by the New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division (OCD). The updated FWGMWP is being submitted in both hard copy and electronic format to NMED, electronic format only to OCD.

No substantial changes to the current facility-wide groundwater monitoring program have been proposed in the FWGMWP. If you have any questions or comments regarding this request, please feel free to contact me at 575-746-5487 or Robert Combs at 575-746-5382.

Sincerely,

Scott M. Denton
Environmental Manager
HollyFrontier Navajo Refining LLC

cc: HollyFrontier: R. Combs, J. Leik
TRC: J. Speer, D. Helbert, C. Smith

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2020 Facility-Wide Groundwater Monitoring Work Plan

June 2020

HollyFrontier Navajo Refining LLC

Artesia Refinery

NMD048918817 and DP GW-028

Prepared For:

HollyFrontier Navajo Refining LLC

501 E Main Street,

Artesia, NM 88210

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Scott Denton

Environmental Manager, HollyFrontier Navajo Refining LLC

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ABBREVIATION AND ACRONYM LIST

%	percent
AOC	Area of Concern
bgs	below ground surface
city	City of Artesia
COC	Constituent of Concern
COVID-19	Coronavirus disease of 2019
DO	Dissolved Oxygen
DRO	Diesel Range Organics
EP	Evaporation Ponds
EPA	Environmental Protection Agency
FWGMWP	Facility-Wide Groundwater Monitoring Work Plan
GRO	Gasoline Range Organics
HFNR	HollyFrontier Navajo Refining LLC
HSWA	Hazardous and Solid Waste Amendment
HWB	Hazardous Waste Bureau
IDW	Investigation-Derived Waste
mg/L	Milligrams per liter
mL	Milliliter
MTBE	Methyl Tert-Butyl Ether
MW	Monitoring Well
NCL	North Colony Landfarm
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
OCD	New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division

ORP	Oxidation-Reduction Potential
PCC Permit	Post-Closure Care Permit
PIANO	Paraffins, Isoparaffins, Aromatics, Naphthenes, and Olefins
PSH	Phase-Separated Hydrocarbons
QA/QC	Quality Assurance/Quality Control
Refinery	HollyFrontier Navajo Refining LLC Artesia Refinery
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RO	Reverse Osmosis
SVOCs	Semi-Volatile Organic Compounds
SWMU	Solid Waste Management Units
TDS	Total Dissolved Solids
TEL	Tetra Ethyl Lead
TMD	Three Mile Ditch
TOC	Top of Casing
TRC	TRC Environmental Corporation
VOCs	Volatile Organic Compounds
WQCC	Water Quality Control Commission

Executive Summary

This *2020 Facility-Wide Groundwater Monitoring Work Plan* (2020 FWGMWP) details the proposed groundwater monitoring program to be implemented at the HollyFrontier Navajo Refining LLC (HFNR) Artesia Refinery (Refinery) located at 501 East Main Street in Artesia, New Mexico.

The Refinery is subject to (1) a Post-Closure Care Permit (PCC Permit) issued by the New Mexico Environment Department (NMED) in October 2003 and later modified in December 2010; and (2) the renewed Discharge Permit GW-028 issued by New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division (OCD) on May 25, 2017 and modified on June 29, 2017 and December 2018. Both the PCC Permit and Discharge Permit require HFNR to conduct facility-wide groundwater monitoring to evaluate the presence, nature, and extent of groundwater impacts. This 2020 FWGMWP details all groundwater monitoring activities that will be conducted to satisfy both the NMED PCC Permit and the OCD Discharge Permit upon approval by NMED and OCD.

This 2020 FWGMWP serves as the annual update to the facility-wide groundwater monitoring program required by Section 4.7.6.a of the modified PCC Permit. The groundwater monitoring program covers the following Refinery areas:

- The closed Tetra Ethyl Lead (TEL) Impoundment;
- The closed North Colony Landfarm (NCL);
- The inactive Evaporation Ponds (EP);
- Three Mile Ditch (TMD); and
- The vadose zone located beneath the Refinery.

This 2020 FWGMWP describes the procedures to be followed during routine groundwater monitoring activities across the Refinery areas, including well gauging, groundwater sampling, investigation-derived waste (IDW) management, decontamination, analytical requirements, and quality assurance/quality control (QA/QC) requirements.

No substantial changes to the current facility-wide monitoring program are proposed in this 2020 FWGMWP. The sampling frequency of volatile organic compounds (VOCs) in select EP wells are proposed to be reduced from semi-annual to annual. The following wells are proposed to no longer be gauged as part of the facility-wide groundwater program: KWB-1B, MW-9, MW-19, and MW-30.

An evaluation of SVOC trends and recommendations for inclusion of SVOCs will be made in the 2021 FWGMWP update, after completion of two required SVOC sampling events, in accordance with the

SWMU/AOC Group 3 Rev 2 transmittal letter dated December 28, 2018, and NMED's subsequent response letter dated March 22, 2019.

1.0 Introduction

This *2020 Facility-Wide Groundwater Monitoring Work Plan* (2020 FWGMWP) details the proposed groundwater monitoring program to be implemented at the HollyFrontier Navajo Refining LLC (HFNR) Artesia Refinery (Refinery) located at 501 East Main Street in Artesia, New Mexico. The location of the Refinery is shown on Figure 1. The Refinery is subject to (1) a Post-Closure Care Permit (PCC Permit) issued by the New Mexico Environment Department (NMED) in October 2003 (NMED 2003) and later modified in December 2010 (NMED 2010); and (2) the renewed Discharge Permit GW-028 issued by New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division (OCD) on May 25, 2017 (OCD 2017a) and modified on June 29, 2017 (OCD 2017b) and December 14, 2018 (OCD, 2018). The PCC Permit authorizes and requires HFNR (the Permittee) to conduct facility-wide groundwater monitoring, with the purpose of evaluating the presence, nature and extent of hazardous and regulated constituents pursuant to Section 20.4.1.500 of the New Mexico Administrative Code (NMAC) and the Water Quality Control Commission (WQCC) standards included in NMAC 20.6.2. The Discharge Permit also requires facility-wide groundwater monitoring.

This 2020 FWGMWP serves as the annual update to the facility-wide groundwater monitoring program required by Section 4.7.6.a of the modified PCC Permit. The previous annual FWGMWP is the *2019 Facility-Wide Groundwater Monitoring Work Plan* which was submitted to NMED and OCD in June 2019 (TRC 2019) and approved with modifications on February 17, 2020 (NMED 2020). This 2020 FWGMWP details all groundwater monitoring activities that will be conducted to satisfy the requirements of both the NMED PCC Permit and the OCD Discharge Permit upon approval by NMED and OCD. This 2020 FWGMWP describes the procedures to be followed during routine groundwater monitoring activities, including well gauging, groundwater sampling, managing investigation-derived waste (IDW), decontamination, laboratory analysis, and quality assurance/quality control (QA/QC). The format of this 2020 FWGMWP follows the general outline specified for an investigation work plan in Appendix E.2 of the PCC Permit, while incorporating the requirements of Section 5 of the Discharge Permit.

The groundwater monitoring program covers the following Refinery areas:

- The closed Tetra Ethyl Lead (TEL) Impoundment, an approximately 0.9-acre land treatment unit located along the northern portion of the Refinery to the south and east of Eagle Creek;
- The closed North Colony Landfarm (NCL), an approximately 4.25-acre land treatment unit located near the northwestern corner of the Refinery;
- The inactive Evaporation Ponds (EP), located approximately three miles east of the active Refinery and immediately south/west of the Pecos River;

- The inactive Three Mile Ditch (TMD), an approximately 3-mile long former open wastewater conveyance ditch located between the northern portion of the active Refinery and the inactive Evaporation Ponds; and
- The vadose zone located beneath the Refinery (including the areas referred to as North Refinery, South Refinery, Field East of Refinery, North Reverse Osmosis [RO] Reject Field, South RO Reject Field, Cross-Gradient of Refinery, and Up-Gradient of Refinery).

The locations of these areas and the monitoring wells, recovery wells, and irrigation wells included in the facility-wide groundwater monitoring program are provided on Figure 2.

2.0 Site Background

HFNR owns and operates the Refinery which is an active petroleum refinery located in Artesia, New Mexico. The Refinery has been in operation since the 1920s and can process heavy, sour, light, and sweet crude oils into petroleum products for wholesale markets. The Refinery runs a predominant slate of Permian Basin crudes that are gathered in west Texas and southeast New Mexico and can also source a variety of crude oils from Cushing, Oklahoma, including Canadian crudes. The Refinery serves markets in the southwestern United States and northern Mexico. A site location map is provided as Figure 1. A facility-wide site plan is provided as Figure 2 and shows the locations of wells included in the facility-wide groundwater monitoring program.

The Refinery is regulated under the Resource Conservation and Recovery Act (RCRA) with Environmental Protection Agency (EPA) ID Number NMD 048918817. The NMED issued a Hazardous Waste Facility Permit to HFNR effective August 21, 1989 (NMED 1989), part of which included a Hazardous and Solid Waste Amendment (HSWA) Permit issued by the EPA. The HSWA permit required HFNR to identify all historical and current non-hazardous solid waste management units (SWMUs) and investigate those that had the potential to pose a threat to human health or the environment. RCRA Facility Investigations (RFIs) were conducted at the TMD and EP areas in 1990 (Mariah Associates, Inc. 1990) and from 1991 through 1993 (K.W. Brown Environmental Services 1993). Corrective actions were recommended for soil (K.W. Brown Environmental Services 1996) and groundwater (Foster Wheeler 1997) at the TMD and EP based on the RFI results. RFI activities were conducted at the NCL area from 1994 through 1997 (Covenant Technical Associates, Inc. 1997) and RFI results indicated groundwater impacts associated with historical operations were present at the NCL.

At the request of NMED, HFNR submitted a PCC Permit Application in June 1998 and revisions to the application in 2001 (Navajo 2001). The original intent of this application was to address only closure and post-closure activities at the EPs and TMD, but the application was expanded to include a complete RCRA Permit renewal application. The NMED issued a PCC Permit to HFNR effective October 5, 2003 (NMED 2003). The PCC Permit was modified in December 2010 (NMED 2010). The PCC Permit authorizes and requires the Permittee to monitor the groundwater, maintain all groundwater monitoring wells, and comply with applicable regulations of NMAC 20.4.1.500 during the post-closure period. Specific groundwater monitoring requirements are included in the PCC Permit for the areas of the TMD, NCL, EP, and other areas identified through implementation of the investigations of various SWMUs.

Historically, the Refinery has applied reject fluids from the RO system to the Refinery North and South RO Reject Fields under Discharge Permit GW-028. The OCD originally issued the Discharge Permit to HFNR on October 21, 1991, and most recently issued a renewal on May 25, 2017 (OCD 2017a) and modified on June 29, 2017 (OCD 2017b) and December 14, 2018 (OCD, 2018). The Discharge Permit requires the Permittee to conduct facility-wide groundwater monitoring. In 2018, a Class I injection well (WDW-4), was installed as an alternative disposal method for the RO reject fluids and the well became

operational in January 2019. Land application of RO reject water to the North and South RO Reject Fields ceased on January 22, 2019. HFNR submitted a *Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields* (Stage 1 Abatement Plan) on March 21, 2019, and an amendment of the Stage 1 Abatement Plan on May 24, 2019. The amended Stage 1 Abatement Plan was approved on June 7, 2019 and was implemented on July 9, 2019. The work described in the plan is anticipated to be complete by August 2020.

In 2006, HFNR submitted a Groundwater Monitoring Work Plan that combined the requirements of the two permits into a comprehensive facility-wide groundwater monitoring program (Navajo 2006). This 2020 FWGMWP comprises the annual update of the work plan, as required by Section 4.7.6.a of the PCC Permit.

3.0 Site Conditions

This section describes the current surface and subsurface conditions at the Refinery.

3.1 Surface Conditions

The surface conditions at the Refinery are described below.

3.1.1 Topography

The Refinery is located on the east side of the City of Artesia (city) in the broad Pecos River Valley of Eastern New Mexico. The topography at and surrounding the Refinery is shown on Figure 1. The average elevation of the city is 3,380 feet above mean sea level. The plain on which the city is located slopes eastward at about 30 feet per mile.

3.1.2 Surface Water Drainage

Surface drainage in the region is dominated by minor ephemeral creeks and arroyos that flow eastward to the Pecos River, located approximately three miles east of the city. The major drainage feature in the immediate area of the Refinery is Eagle Creek (or Eagle Draw), which runs southwest to northeast through the northern process area of the Refinery and then eastward to the Pecos River. Eagle Creek is an ephemeral watercourse that primarily flows only following rain events. Upstream of the Refinery, Eagle Creek functions as a major stormwater conveyance for the city. Eagle Creek also drains outlying areas west of the city and is periodically scoured by intense rain events.

Natural surface drainage at the Refinery is to the north and east. Stormwater within the process areas is captured and routed to the Refinery wastewater treatment system. Stormwater from non-process areas is contained within the Refinery property inside stormwater berms and routed to stormwater retention basins. Stormwater from within the Refinery boundary is not allowed to discharge to Eagle Creek.

The elevation of Eagle Creek is 3,360 feet at its entrance to the Refinery and decreases to approximately 3,305 feet at its confluence with the Pecos River. Eagle Creek was channelized from west of the City of Artesia to the Pecos River to help control and minimize flood events. In the vicinity of the Refinery, the Eagle Creek channel was cemented to provide further protection during flood events. A check dam was also constructed west of the City of Artesia along Eagle Creek. Federal floodplain maps indicate that most of the city and the Refinery have been effectively removed from the 100-year floodplain.

3.1.3 Area Land Uses

The areas north, south, and east of the Refinery is sparsely populated and used primarily for agricultural purposes. The primary business and residential areas of the City of Artesia are located to the west, southwest, and northwest of the Refinery. There are commercial/industrial businesses present south of

the Refinery along Highway 82, including an oil-field pipe company located at the southeast corner of the Refinery. HFNR owns a majority of the land bounded by Hermosa Drive to the south, East Richey Avenue to the north, Highway 285 (or Freeman Avenue on the south side of Highway 82) to the west, and Bolton Road to the east. A majority of the land located east of the Refinery between Bolton Road and Haldeman Road is cultivated as pecan orchards or used for other agricultural purposes.

The active Refinery and much of the surrounding property owned by HFNR is fenced and guarded with controlled entry points.

3.2 Subsurface Conditions

The subsurface conditions at the Refinery are described below.

3.2.1 Surficial Soils

Surficial soil at the Refinery is predominantly comprised of approximately 60 percent (%) Pima series and 40% Karro series. The Pima and Karro series both consist of deep, well drained soils that formed in alluvial settings. They are both calcareous and have slow to medium runoff.

3.2.2 Geology

The City of Artesia is located on the northwest shelf of the Permian Basin. In this region, the deposits comprise of approximately 250 to 300 feet of Quaternary alluvium uncomformably overlying approximately 2,000 feet of Permian clastic and carbonate rocks. These Permian deposits uncomformably overlie Precambrian syenite, gneiss, and diabase crystalline rocks.

3.2.2.1 Quaternary Alluvium

The Quaternary alluvium in the Refinery area is dominantly comprised of clays, silts, sands and gravels deposited in the Pecos River Valley. These “valley fill” deposits extend in a north-south belt approximately 20 miles wide, generally west of the Pecos River. The thickness of the valley fill varies from a thin veneer on the western margins of the Pecos River valley to a maximum of 300 feet in depressions, one of which is located beneath the Refinery. These depressions have resulted from dissolution of the underlying Permian carbonates and evaporites.

3.2.2.2 Permian Artesian Group

The Permian Artesian Group is comprised of the following five formations from shallowest to deepest: the Tansill, Yates, Seven Rivers, Queen and Grayburg Formations. The Tansill and Yates Formations outcrop at the surface east of the Pecos River and are not present in the vicinity of the Refinery. The Seven Rivers Formation is present at an approximate depth of 300 feet in the area between the Pecos River and the Refinery. However, the Seven Rivers Formation thins and pinches to the west and it is not

evident based on boring logs that this formation has been encountered beneath the Refinery process areas.

In the area of the Refinery, the Queen and Grayburg Formations have been mapped as a single unit consisting of approximately 700 feet of interbedded dolomite and calcareous dolomite, gypsum, fine-grained sandstone, carbonates, siltstone and mudstone. In locations where the Seven Rivers Formation is absent, the upper portion of the Queen Formation acts as a confining bed between the deep artesian aquifer and the valley fill aquifer.

3.2.2.3 San Andres Formation

The San Andres Formation lies beneath the Grayburg and Queen Formations and immediately above the Precambrian crystalline basement rocks. The San Andres Formation is greater than 700 feet thick and composed mainly of limestone and dolomite with irregular and erratic solution cavities ranging up to several feet in diameter. The upper portion of the formation is composed of oolitic dolomite with some anhydrite cement.

3.3 Hydrogeology

The principal aquifers in the Artesia area are within the San Andres Formation and the valley fill alluvium. There are two distinct water-bearing zones within the valley fill alluvium in the vicinity of the Refinery and 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”.

3.3.1 Shallow Saturated Zone

The shallow saturated zone occurs in fractured caliche and interbedded sand and gravel channels at 10 to 30 feet below ground surface (bgs). Groundwater in this zone is under confined conditions for some or most of the year, with static water levels measured in groundwater monitoring wells 3 to 5 feet above the shallow saturated zone. The general direction of flow in this shallow saturated zone is to the east toward the Pecos River. Groundwater flow direction and gradient in the shallow saturated zone have remained generally consistent over time, as documented in previous annual groundwater monitoring reports.

Major sources of water in the shallow saturated zone are likely to be recharge from Eagle Creek and lawn watering runoff from the grass-covered urban park that occupies the Eagle Creek Channel immediately upstream of the Refinery. The water in the shallow saturated zone is highly variable in quality, volume, areal extent, and saturated thickness. Concentrations of total dissolved solids (TDS) exceeding 4,000 milligrams per liter (mg/L) and sulfate exceeding 2,000 mg/L have been recorded in most of the wells located west and northwest (up-gradient) of the Refinery, which significantly exceed the WQCC standards of 1,000 mg/L for TDS and 600 mg/L for sulfate.

The shallow saturated zone contains phase-separated hydrocarbon (PSH) and dissolved-phase hydrocarbon constituents, as reported in the *2019 Annual Groundwater Monitoring Report* (TRC 2020). Concentrations of dissolved-phase hydrocarbon constituents in the shallow saturated zone have generally exhibited a stable or decreasing trend over time.

3.3.2 Valley Fill Zone

The valley fill zone underlies the shallow saturated zone and occurs in Quaternary alluvial deposits of sand, silt, clay and gravel. These sediments are about 300 feet thick near the Refinery.

Irrigation and water production wells completed in the valley fill zone are typically screened across one to five water-producing intervals ranging in thickness of 20 to 170 feet, with a majority of the thicknesses being closer to 20 feet. 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. Based on logs of wells located immediately to the north and east of the Refinery, the thicknesses of silt and clay deposits range from 20 to 160 feet and are interspersed with thin zones of gravels in the upper 100 feet. Wells in the valley fill zone range from 40 to 60 feet bgs and the formation yields water containing TDS ranging from 1,500 to more than 7,000 mg/L.

The valley fill zone contains dissolved-phase hydrocarbon constituents, as reported in the *2019 Annual Groundwater Monitoring Report* (TRC 2020). Concentrations of dissolved-phase hydrocarbon constituents in the valley fill zone have generally exhibited a stable or decreasing trend over time.

The valley fill zone and the underlying San Andres aquifer are hydraulically connected in some areas.

3.3.3 Deep Artesian Aquifer

The deep artesian aquifer is closely related to the Permian San Andres Limestone and generally consists of one or more water-producing intervals of variable permeability located in the upper portion of the formation. However, in the Artesia area, the water-producing interval rises stratigraphically and includes the lower sections of the overlying Grayburg and Queen formations. Near the Refinery, the depth to the top of the water-producing interval is estimated to be about 440 feet bgs. The Seven Rivers formation and the other members of the Artesia Group are generally considered confining beds although some pumpage occurs locally from fractures and secondary porosity in the lower Grayburg and Queen members.

The deep artesian aquifer has been extensively developed for industrial, municipal, and agricultural use. TDS in this aquifer ranges from 500 mg/L to more than 5,000 mg/L depending on location. In the Artesia area, water from this aquifer is generally produced from depths ranging from 850 feet to 1,250 feet below ground surface. The aquifer recharges in the Sacramento Mountains to the west of Artesia.

Extensive use of this aquifer in recent decades has lowered the potentiometric head in the aquifer in some locations from 50 to 80 feet bgs, although extensive rainfall in some years may bring the water levels in some wells close to ground surface.

Available well completion records for irrigation well RA-4798 indicate that it is screened in the deep artesian aquifer from 840 to 850 feet bgs. Analytical data from this well does not indicate the presence of hydrocarbon impacts from Refinery operations. Methyl tert-butyl ether (MTBE) has been detected in RA-4798 at levels below the WQCC standard, but these detections cannot be attributed to historical Refinery operations based on all available data as described in the report titled *Evaluation of Methyl Tert-Butyl Ether (MTBE) in Groundwater* that was submitted to NMED on September 13, 2019 (Wood 2019a).

4.0 Modifications to the Groundwater Monitoring Network

The following modifications to the facility-wide groundwater monitoring network have occurred since submittal of the 2019 FWGMWP. Well installation, repairs, and/or modifications made to the existing wells are described below.

4.1 New Monitoring Wells

One monitoring well (MW-139) was installed since submittal of the 2019 FWGMWP. Monitoring well MW-139 was installed on July 9, 2019 in the southwestern corner of the Refinery in the South Refinery Area. The well was installed in the shallow saturated zone in accordance with the Well Installation Work Plan for the Loudon Building (AOC 16) submitted to the NMED on July 30, 2018 (Wood 2018a) and the subsequent response letter to "Approval with Modifications, Well Installation Work Plan for the Loudon Building (AOC)" dated April 26, 2019 (HFNR 2019). Well installation, development, and initial sampling activities were documented in the Well Installation Report for Monitoring Well (MW-139) in Area of Concern 16 – Loudon Building (Wood 2019b) that was submitted to NMED on November 26, 2019. The MW-139 boring and well construction log was provided in the 2019 Annual Groundwater Monitoring Report (TRC 2020). The location of MW-139 is shown on Figure 2 and the well construction details are provided in Table 1.

4.2 Well Abandonment

No monitoring wells have been abandoned since submittal of the 2019 FWGMWP.

4.3 Well Repairs and Modifications

The following well maintenance and repairs were performed on existing wells since submittal of the 2019 FWGMWP:

- Locking well J-plugs and locks were replaced on various monitoring wells as required.
- PSH absorbent socks were installed and maintained in wells MW-64, MW-85, MW-86, KWB-4, KWB-8, and TEL-3.

5.0 Monitoring Program Scope of Services

The proposed groundwater monitoring program consists of semi-annual gauging of select wells; semi-annual, annual, or biennial groundwater sampling of select wells; and annual reporting. No substantial changes to the previous facility-wide monitoring program are proposed in this 2020 FWGMWP. The sampling frequency of volatile organic compounds (VOCs) in the following EP wells are proposed to be reduced from semi-annual to annual: MW-2A, MW-3, MW-4A, MW-5A, MW-10, MW-18A, MW-22A, MW-70, MW-74, MW-75, MW-76, MW-79, MW-83, MW-84, MW-87, MW-88, MW-121, MW-122, MW-123, MW-124, OCD-1R, OCD-2A, OCD-3, OCD-4, OCD-5, OCD-6, OCD-7AR, and OCD-8A. The following wells are proposed to no longer be gauged as part of facility-wide groundwater monitoring activities: KWB-1B, MW-9, MW-19, and MW-30. These proposed modifications are proposed based on the following rationale:

- Annual VOC analysis in select EP wells: VOCs historically have not been detected in groundwater beneath the EPs at concentrations above their respective CGWSLs. Additionally, target VOCs benzene, ethylbenzene, toluene, xylenes, MTBE, and naphthalene have not been detected in most of these wells over at least the six most recent semi-annual sampling events. MTBE has historically been detected in wells MW-5A, MW-7A, MW-10, MW-22A, MW-75, MW-76, MW-84, MW-87, MW-123, OD-7AR, and OCD-8A at low and stable concentrations, as shown on the time-series plots provided in Appendix D of the *2019 Annual Groundwater Monitoring Report*.

- Cessation of well gauging: None of these wells are critical for evaluating the groundwater potentiometric surface or to detect the presence and thickness of PSH, as follows:

    - KWB-1B (Field East of Refinery): Located adjacent to well KWB-1A which is gauged on semi-annual basis. Wells KWB-1A and KWB-1B are screened across the same depth interval, but the well diameter of KWB-1A is 2-inch diameter and KWB-1B is 4-inch diameter. PSH has not previously been detected in KWB-1A or KWB-1B.

    - MW-9 (TMD): Nearby wells MW-8 and MW-21 are gauged on a semi-annual basis and PSH has not been detected in any of these wells. The groundwater potentiometric surface in this area has generally been consistent over time.

    - MW-19 (NCL): Nearby well NCL-31 is gauged on a semi-annual basis and PSH has not been detected in either of these wells. The groundwater potentiometric surface in this area has generally been consistent over time.

    - MW-30 (North Refinery): Nearby well MW-56 is gauged on a semi-annual basis and PSH has not been detected in either of these wells. The groundwater potentiometric surface in this area has generally been consistent over time.

5.1 Scheduling and Notification

The schedule of the semi-annual groundwater monitoring events is dependent on the flood irrigation season of the pecan orchard located east of the Refinery, which is typically conducted between April and October. The first semi-annual event is typically conducted before the start of the flood irrigation (in March or April of each calendar year) and the second semi-annual event will be conducted after completion of the flood irrigation season (in October or November of each calendar year). Wells that will be sampled on an annual or biennial basis will be sampled during the first semi-annual monitoring event (i.e., the annual event). Biennial events will be completed during the first semi-annual event of odd-numbered calendar years. The NMED and OCD will be notified of the monitoring schedule prior to each monitoring event. The sampling frequency for each well is provided on Table 1 and Figure 3.

The first semi-annual groundwater monitoring event in 2020 was scheduled to commence the week of April 13, 2020. This event was postponed due to a public health emergency and travel restrictions associated with the coronavirus disease of 2019 (COVID-19) pandemic. HFNR requested a 60-day delay of groundwater monitoring activities, as described in an email notification on April 8, 2020, and approved by the OCD and NMED. The first semi-annual groundwater monitoring event was conducted the week of June 15, 2020. HFNR anticipates a return to the typical schedule, as detailed above, in 2021.

5.2 Gauging Requirements

Synoptic fluid level gauging will be completed semi-annually at all active and accessible monitoring and recovery wells. Wells will be gauged for depth to PSH, if present, depth to water, and total depth. Dedicated tubing and pumps (if present) will remain in the wells during gauging to minimize disturbance to the water column, if possible. All synoptic well gauging will be completed in as short a time-period as possible, typically within 48 hours. Each monitoring well will also be gauged immediately prior to commencing purging/sampling activities.

5.3 Sampling Requirements

Sampling frequency and target analytes for each well were selected based on historical data, dissolved-phase concentration trends, and well location relative to the Refinery and area boundaries. Select groundwater samples will be analyzed for VOCs, diesel range organics (DRO), gasoline range organics (GRO), total metals, dissolved metals (first semi-annual event only), cations, anions, nitrates/nitrites, cyanide, and/or TDS. Select groundwater samples will be analyzed for SVOCs, as described in the subsection below.

Wells that contain PSH at measured thicknesses of 0.03 feet or greater will not be sampled during any event. The required sample analytical parameters and sampling frequency for each well are summarized in Table 1.

5.3.1 SVOC Analysis at Select Wells

In accordance with the SWMU/AOC Group 3 Rev 2 transmittal letter dated December 28, 2018 (Wood 2018b), and NMED's subsequent response letter dated March 22, 2019, groundwater samples from select wells in the vicinity of SWMUs 20 and 22 (North Refinery and TEL wells) are required to be analyzed for SVOCs by EPA Method 8270 for two monitoring events to determine if there are significant detection of SVOCs that warrant inclusion of SVOC analysis in FWGMWP updates (NMED 2019).

The two required rounds of SVOC analysis were scheduled to be completed during the 2019 semi-annual events conducted in April and October 2019 for wells that are sampled semi-annually (MW-23, MW-43, MW-61, MW-62, MW-97, MW-137, MW-138, and TEL-4). 2019 SVOC analtyical results were presented in annual 2019 Annual Groundwater Monitoring Report, submitted to the NMED in February 2020, and are summarized in Table 4D of that report. Wells that are sampled annually (MW-93, MW-95, RW-2R) were scheduled to be sampled during the first semi-annual events of 2019 and 2020 (i.e., April 2019 and June 2020).

Due to the presence of PSH at thicknesses of 0.03 feet or greater, groundwater samples were not collected from the following wells: MW-97 in April and October 2019, MW-137 and MW-138 in October 2019, and RW-2R in April 2019. Groundwater samples will be collected for SVOC analysis from select wells MW-97, MW-137, MW-138, and RW-2R during the first semi-annual 2020 monitoring event if conditions allow sample collection (i.e. less than 0.03 feet of PSH is measured in the well) in order to satisfy the required two rounds of SVOC sample collection.

SVOC results will be evaluated after the first semi-annual 2020 monitoring event, which was postponed until June 16-18, 2020 due to COVID-19 travel and access restrictions. An evaluation of SVOC trends and recommendations for inclusion of SVOCs will be made in the 2021 FWGMWP update, after completion of two required SVOC sampling events, in accordance with the NMED's guidance, referenced above.

6.0 Groundwater Monitoring Procedures

Monitoring activities will consist of the following tasks: field documentation, well inspection, well gauging, groundwater purging and sampling, handling of samples for laboratory analysis, QA/QC sampling, and managing IDW. The procedures that will be used to complete each task are described in detail below.

6.1 Field Documentation

Documentation of field activities associated with groundwater monitoring events will be recorded each day in a bound field logbook and associated field sampling forms. Each page of the logbook and field sampling forms will be signed by the person(s) making entries on that page. The following information will be collected during groundwater sampling activities:

- Sampling and oversight personnel identification
- Instrument calibrations
- Well conditions
- Monitoring well measurements including static water level depth, total well depth, and water column height
- Depth to PSH, if present
- Weather conditions at the time of sample collection and throughout the sampling event
- Well purging procedures including: equipment, purge volume, rate, and elapsed time
- Water quality parameters recorded during purging including appearance, odor, pH, temperature, conductivity, TDS, oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity
- Sample collection dates and times
- Reasons for deviating from the sampling and analysis plan (if applicable)

6.2 Well Inspection

During each gauging and sampling event, all monitoring and recovery wells will be inspected for well integrity. The information will be recorded on the groundwater gauging form. Each inspection will include:

- Identification of the well
- Inspection of the well pad for deterioration or damage
- Inspection of the protective casing and well casing for deterioration or damage
- Inspection of the presence or absence and condition of the padlock and well J-plug
- Measurement of the total depth of the well

6.3 Well Gauging

The depth to PSH, if present, and groundwater will be gauged at each monitoring well prior to sampling. The wells that are to be gauged are presented in Table 1 and well locations are depicted on Figure 2. Prior to gauging, each well cap will be removed to allow groundwater to equilibrate with atmospheric pressure. Fluid level measurements will be collected using an oil/water interface probe to an accuracy of 0.01 feet. Measurements will be made from a marked survey datum at the top of casing (TOC). Data will

be recorded on a paper field gauging form. The oil/water interface probe will be decontaminated before use and between wells following the procedures outlined in Section 6.8.

6.3.1 Fluid Level Gauging Procedures

The following procedure will be used to measure the depths to PSH and groundwater:

- The probe will be lowered into the well slowly until the probe alarm sounds or light illuminates, then the tape will be raised and lowered again slowly until the alarm is again audible or the light again illuminates. The depth to fluid on the tape will be recorded to within 0.01 feet. To ensure accuracy, the measurement will be repeated.
- Well identification, date, time, depth to water, depth to PSH (if applicable), and other pertinent observations will be recorded on the field gauging form.

6.3.2 Total Depth Gauging

Total well depth will be measured to detect the amount of silt accumulation in a well. This measurement will be collected during sampling events and well inspections. The following procedures will be followed to determine the total depth of the well:

- The oil/water interface probe will be slowly lowered until the bottom of the well is detected.
- The total well depth will be measured when the tape becomes slack for hard bottoms.
- The point of "pick-up" (where the weight of the probe is felt when reeling up the probe) will be used to determine the total depth in the case of soft sediment bottoms.
- The hardness of the bottom of the well will be documented in the field logbook.

6.4 Groundwater Sampling

Groundwater will be purged and sampled from monitoring and recovery wells using low-flow methods in accordance with the NMED Hazardous Waste Bureau (HWB) Position Paper "Use of Low-Flow and Other Non-Traditional Sampling Techniques for Compliance Groundwater Monitoring" (NMED 2001). Groundwater will be purged and sampled from irrigation wells using standard procedures described below. Data collected during the purging and sampling of each well will be recorded on a paper groundwater sampling form.

Groundwater will be purged and sampled from monitoring and recovery wells using either a peristaltic pump (for sampling depths of approximately 25 feet bgs or less) or a dedicated, stainless steel submersible pump (for sampling depth greater than 25 feet bgs). The locations of monitoring and

recovery wells to be purged and sampled are provided on Figure 3. An oil/water interface probe will be lowered into the monitoring well to record the depth to water.

Groundwater will be purged and sampled from irrigation wells by attaching a decontaminated or dedicated hose barb to the available spigot. The spigot will be located at a point before the water supply is introduced into any storage tanks or treatment units. The groundwater will be purged from the spigot so that any stagnant water from the well casing and surface piping is removed.

A multi-parameter water quality meter with flow-through cell and hand-held turbidity meter will be used during the purging process to monitor for field water quality parameters (pH, temperature, conductivity, TDS, ORP, DO, and turbidity) and demonstrate stabilization. Water quality parameters will be recorded approximately every three minutes during purging. Water quality meters used to measure field parameters will be calibrated each day according to the manufacturer's specifications. The make, model, calibration fluids, and calibration results for the water quality meters will be recorded in the field logbook. The turbidity meter test cell will be triple rinsed with groundwater from the next sample aliquot prior to each reading. The water quality parameters and depth to water (in non-irrigation wells only) will be recorded on the Groundwater Sampling Form. A description of the water quality (e.g., turbidity, sheen, odor) will be recorded during the purging process.

The purging process will be considered complete and groundwater sampling will commence when at least four of the seven water quality parameters achieve stabilization within ten percent for three consecutive readings.

If the well goes dry during purging, a sample will be collected as soon after the water level recovers to a level from which a sample can be collected. The samples will be collected in clean, labeled laboratory-supplied containers prepared with the appropriate amount and type of preservative. The groundwater samples will be submitted for laboratory analysis following the schedule in Table 1.

Samples submitted for dissolved metals analysis will be filtered in the field using a new 0.45-micron filter. Filtering methods will be documented on the groundwater sampling form, field logbook, and chain-of-custody.

6.5 Handling of Samples for Laboratory Analysis

Neoprene or nitrile gloves will be worn during sample collection and while handling sample containers. New disposable gloves will be used to collect each sample. The sample containers will be labeled, secured with bubble wrap, placed in a resealable plastic bag, and immediately placed on ice in a cooler and stored below 4° C. The sample labels will include the Permittee name (HFNR), site name (Artesia Refinery), unique sample identification, sample collection time and date, preservatives, and the name(s) of the sampler(s). The samples will be secured with packing material and kept below 4°C with wet ice in

accordance with laboratory cooler shipping guidelines. The cooler will be secured with packing tape, and a signed and dated custody seal will be placed over the cooler lid and secured with tape. The samples and a completed chain-of-custody documentation will be shipped via priority overnight delivery to the analytical laboratory. The chain-of-custody forms are to be maintained as a record of sample collection, transfer, shipment, and receipt by the laboratory. At a minimum, all samples will be submitted to the laboratory within 48 hours after collection. The laboratory will be informed that samples are being submitted for analysis and it will be confirmed that the samples were received the following day. If samples are shipped on Friday for Saturday delivery, the receiving laboratory will be contacted so provisions can be made for laboratory sample receipt.

6.6 Quality Assurance/Quality Control Sampling

Field QA/QC samples for groundwater will be collected as follows:

- Duplicates: Collected at a frequency of ten percent at the same time and from the same location as the original sample.
- Equipment blanks: Collected from non-dedicated, decontaminated equipment at a frequency of five percent by pouring distilled water over the equipment and collecting the sample in the appropriate laboratory containers.
- Trip blanks: One included in each cooler shipped to the laboratory that contains samples for VOC analyses. The trip blank consists of two 40-milliliter (mL) vials of reagent water provided by the laboratory that were stored in the sample cooler at all times.

Laboratory QA/QC samples will be performed according to test methodologies specified for each analytical method. The laboratory QA/QC samples may include reagent or method blanks, surrogates, matrix spike/matrix spike duplicates, blank spike/blank spike duplicates and/or laboratory duplicates, as appropriate for each method. The laboratory QA/QC samples will be run at the frequency specified by each method.

6.7 PSH Sample Collection

In the event that PSH is present in any of the monitoring or recovery wells that have not historically contained PSH, samples may be collected when sufficient volume (80 mL) is present for collection and analysis. The desired analyses for evaluation of PSH include paraffins, isoparaffins, aromatics, naphthenes, and olefins (PIANO) as well as specific gravity and simulated distillation. HFNR will notify the NMED within seven calendar days if PSH is present in wells where PSH has not previously be encountered, as required by the PCC Permit.

PSH samples will be collected using a disposable, non-dedicated hand bailer. The bailer will be lowered into the well slightly into the PSH and water column. The bailer will be slowly removed and groundwater

decanted from the bottom of the bailer. The PSH remaining in the bailer will then be placed into the sample container, and the container will be sealed and properly labeled for shipment. Excess groundwater and PSH will be managed per methods discussed in Section 6.9.

6.8 Decontamination

The interface probe and other non-dedicated equipment coming into contact with groundwater will be decontaminated by the following procedures:

1. PSH, if present, will be removed with an absorbent pad.
2. Any solids will be removed to the degree possible with a brush and tap or distilled water.
3. Equipment will be washed with a brush, laboratory-grade non-phosphate detergent (e.g., Liquinox, Alconox), and potable tap water. Excess soap will be allowed to drain off the equipment when finished.
4. Equipment will be double rinsed with distilled water.

All decontamination fluids will be managed per methods discussed in Section 6.9.

6.9 Investigation-Derived Waste Disposal

The IDW (e.g., purge water, decontamination water) generated during monitoring activities will be collected and disposed of in the Refinery wastewater treatment system, upstream of the oil/water separator. Miscellaneous IDW (e.g., gloves, bailers) in contact with investigative material deemed to have no or de minimis contamination will be disposed of in a general refuse container. Any IDW deemed to have greater than de minimis contamination will be stored in labeled drums and disposed appropriately on a per case basis.

7.0 Annual Groundwater Monitoring Report

Groundwater monitoring from each calendar year will be documented in an *Annual Groundwater Monitoring Report*, in accordance with both the PCC Permit and the Discharge Permit. The *Annual Groundwater Monitoring Report* will follow the general report format provided in Appendix E of the PCC Permit and incorporate the requirements of Section 2.E of the Discharge Permit. At a minimum, the *Annual Groundwater Monitoring Report* will include the following:

- Description of groundwater monitoring and remediation activities conducted throughout the reporting period, including sample collection procedures, decontamination procedures, sample handling procedures, and management of wastes;
- Summary table of semi-annual groundwater and PSH gauging data, with corrected water table elevation for all wells containing PSH;
- Summary table of groundwater quality parameters recorded in the field (purge parameters);
- Summary of laboratory analytical data with comparison to screening levels;
- Summary of QA/QC data review and validation;
- Groundwater contour maps depicting the groundwater gradient for each semi-annual monitoring event of the reporting period, including site features and the direction and magnitude of the hydraulic gradient;
- PSH thickness isopleths maps for each semi-annual monitoring event during the reporting period;
- Isoconcentration maps for major constituents of concern (COCs);
- Plots of static water elevation versus time in key wells, specifically those that contain PSH;
- Plots of target COC groundwater concentrations versus time in wells that have historically exceeded screening levels;
- Tabulation of the monthly and cumulative volume of PSH removed from recovery wells or monitoring wells throughout the reporting period; and
- Recommendations, including any recommended changes to the groundwater monitoring program.

The *Annual Groundwater Monitoring Report* will be submitted to NMED by February 28 of the calendar year following sample collection and to OCD by June 15 of the calendar year following sample collection as part of the GW-028 Annual Discharge Report.

8.0 Schedule

The groundwater monitoring program is conducted on a semi-annual basis. The first semi-annual event is scheduled to occur no more than 30 days prior to the start of the pecan orchard flood irrigation season but no later than April 30 of each year. Typically, the first semi-annual event will occur in March or April of each calendar year. The first semi-annual groundwater monitoring event of 2020 was scheduled to commence the week of April 13, 2020. This event was postponed due to a public health emergency and travel restrictions associated with COVID-19. HFNR requested a 60-day delay of groundwater monitoring activities, as described in an email notification on April 8, 2020, and approved by the OCD and NMED. The first semi-annual groundwater monitoring event was conducted the week of June 15, 2020. HFNR anticipates a return to the typical schedule, as detailed above, in 2021.

The second semi-annual event will occur no later than 30 days after the conclusion of the pecan orchard flood irrigation season or November 15 each year. Typically, the second semi-annual event will occur in October or November of each calendar year.

The wells that are sampled on an annual basis will be sampled during the first semi-annual event of each calendar year. The wells that are sampled biennially will be sampled every other year. Biennial sampling at the Refinery began in the first semi-annual event of 2011. As such, these wells will be sampled during the first semi-annual event of each odd numbered year.

HFNR will notify both NMED and OCD prior to the initiation of each semi-annual sampling event.

The Annual Groundwater Monitoring Report will be submitted to NMED no later than February 28 of the calendar year following sample collection and to OCD no later than June 15 of the calendar year following sample collection as part of the GW-028 Annual Discharge Report.

9.0 References

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TRC 2020. 2019 Annual Groundwater Monitoring Report. February 28, 2020.

Wood 2018a. Well Installation Work Plan for the Loudon Building (AOC 16). July 30, 2018.

Wood 2018b. Submittal of the SWMU / AOC Group 3 Additional Corrective Action Investigation Report – Revision 2 and Response to Comments to the August 16, 2018 Letter of Disapproval. December 28, 2018.

Wood 2019a. Evaluation of Methyl Tert-Butyl Ether (MTBE) in Groundwater. September 13, 2019.

Wood 2019b. Well Installation Report for Monitoring Well (MW-139) in Area of Concern 16 -Loudon Building. November 26,2019.

Attachment A: Table

Table 1. 2020 Facility-Wide Groundwater Monitoring Program and Schedule

HollyFrontier Navajo Refining LLC - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Associated Area	Well Construction [a]			Historic PSH? [b]	Gauging Frequency	Analytical Suite and Frequency [c, d]									
			Well Diameter (inch)	Screen Interval (ft bgs)	Water Bearing Zone			Purge Parameters	DRO	GRO	VOCs	Metals		Cyanide	Cations/Anions	Nitrate / Nitrite as Nitrogen	Total Dissolved Solids
												As, Ba, Cr, Fe, Pb, Mn, Se	B, Cd, Co, Hg, Ni, U, Va				
KWB-13	Monitoring	Cross-gradient	2		Shallow		SA	A	A	-	A	A	A	A	A	A	A
MW-136	Monitoring	Cross-gradient	2	10 to 25	Shallow		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
NP-5	Monitoring	Cross-gradient	2	10.25 to 20	Shallow		SA	B	B	-	B	B	-	-	B	B	B
MW-1R	Monitoring	EP	2	8 to 23	Shallow		SA	A	A	-	A	A	-	-	A	A	A
MW-2A	Monitoring	EP	2		Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-2B	Monitoring	EP	2	38.5 to 48	Valley Fill		SA	No samples to be collected									
MW-3	Monitoring	EP	2		Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-4A	Monitoring	EP	4		Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-4B	Monitoring	EP	4	60.25 to 70	Valley Fill		SA	B	B	B	B	B	-	-	B	B	B
MW-5A	Monitoring	EP	2		Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-5B	Monitoring	EP	2	41.5 to 50.5	Valley Fill		SA	B	B	B	B	B	-	-	B	B	B
MW-5C	Monitoring	EP	2	59.25 to 68.75	Valley Fill		SA	B	B	B	B	B	-	-	B	B	B
MW-6A	Monitoring	EP	2		Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-6B	Monitoring	EP	2	39.5 to 49	Valley Fill		SA	B	B	B	B	B	-	-	B	B	B
MW-7A	Monitoring	EP	2		Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-7B	Monitoring	EP	4	39.5 to 49	Valley Fill		SA	B	B	B	B	B	-	-	B	B	B
MW-10	Monitoring	EP	2		Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-11A	Monitoring	EP	4	5.5 to 20	Shallow		SA	A	A	A	A	A	-	-	SA	SA	SA
MW-11B	Monitoring	EP	2	35.5 to 45	Valley Fill		SA	B	B	B	B	B	-	-	B	B	B
MW-12	Monitoring	EP	4	6.5 to 16	Shallow		SA	No samples to be collected									
MW-13	Monitoring	EP	4	9.5 to 19	Shallow		SA	No samples to be collected									
MW-14	Monitoring	EP	4	5.5 to 20	Shallow		SA	No samples to be collected									
MW-15	Monitoring	EP	4	9 to 19	Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-18A	Monitoring	EP	4	10 to 20	Shallow		SA	SA	SA	-	A	SA	SA	SA	SA	SA	SA
MW-18B	Monitoring	EP	2	37 to 47	Valley Fill		SA	B	B	B	B	B	-	-	B	B	B
MW-18T	Monitoring	EP	4	37 to 47	Valley Fill		SA	No samples to be collected									
MW-22A	Monitoring	EP	4	5.5 to 20.5	Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-22B	Monitoring	EP	2	42.3 to 52	Valley Fill		SA	B	B	B	B	B	-	-	B	B	B
MW-24	Monitoring	EP	6	15 to 20	Shallow		SA	No samples to be collected									
MW-69	Monitoring	EP	2	5 to 20	Shallow		SA	No samples to be collected									
MW-70	Monitoring	EP	4	5 to 20	Shallow		SA	SA	SA	SA	A	SA	-	-	A	A	A
MW-72	Monitoring	EP	4	2 to 12	Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-73	Monitoring	EP	4	2 to 17	Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-74	Monitoring	EP	4	2 to 17	Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-75	Monitoring	EP	4	3 to 18	Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-76	Monitoring	EP	4	3 to 18	Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-77	Monitoring	EP	4	3 to 18	Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-78	Monitoring	EP	4	2 to 17	Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-79	Monitoring	EP	4	2 to 17	Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-80	Monitoring	EP	4	2 to 17	Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-81	Monitoring	EP	4	2 to 17	Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-82	Monitoring	EP	4	2 to 17	Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-83	Monitoring	EP	4	2 to 17	Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-84	Monitoring	EP	4	2 to 17	Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-85	Monitoring	EP	4	3 to 18	Shallow	**Y**	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-86	Monitoring	EP	4	2 to 17	Shallow	**Y**	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
MW-87	Monitoring	EP	4	2 to 17	Shallow		SA	SA	SA	SA	A	SA	-	-	A	A	A
MW-88	Monitoring	EP	4	3 to 18	Shallow		SA	SA	SA	SA	A	SA	-	-	A	A	A
MW-120	Monitoring	EP	2	10 to 25	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-121	Monitoring	EP	2	10 to 25	Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-122	Monitoring	EP	2	10 to 20	Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-123	Monitoring	EP	2	10 to 25	Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
MW-124	Monitoring	EP	2	5 to 20	Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
OCD-1R	Monitoring	EP	2		Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
OCD-2A	Monitoring	EP	2	8.5 to 23.5	Shallow		SA	SA	SA	SA	A	SA	-	-	A	A	A
OCD-2B	Monitoring	EP	2	38.5 to 48	Valley Fill		SA	No samples to be collected									
OCD-3	Monitoring	EP	2	6.5 to 21.5	Shallow		SA	SA	SA	SA	A	SA	-	-	A	A	A
OCD-4	Monitoring	EP	2	6.5 to 21.5	Shallow		SA	SA	SA	SA	A	SA	-	-	A	A	A
OCD-5	Monitoring	EP	2		Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
OCD-6	Monitoring	EP	2	8 to 23	Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
OCD-7AR	Monitoring	EP	4	5.5 to 19.5	Shallow		SA	SA	SA	SA	A	SA	-	-	SA	SA	SA
OCD-7B	Monitoring	EP	2	43.5 to 52.5	Valley Fill		SA	B	B	B	B	B	-	-	B	B	B
OCD-7C	Monitoring	EP	2	60.25 to 69.75	Valley Fill		SA	No samples to be collected									
OCD-8A	Monitoring	EP	2	3 to 18	Shallow		SA	SA	SA	SA	A	SA	SA	SA	SA	SA	SA
OCD-8B	Monitoring	EP	2	43.5 to 53	Valley Fill		SA	B	B	B	B	B	-	-	B	B	B

Table 1. 2020 Facility-Wide Groundwater Monitoring Program and Schedule

HollyFrontier Navajo Refining LLC - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Associated Area	Well Construction [a]			Historic PSH? [b]	Gauging Frequency	Analytical Suite and Frequency [c, d]									
												Metals					
			Well Diameter (inch)	Screen Interval (ft bgs)	Water Bearing Zone			Purge Parameters	DRO	GRO	VOCs	As, Ba, Cr, Fe, Pb, Mn, Se	B, Cd, Co, Hg, Ni, U, Va	Cyanide	Cations/Anions	Nitrate / Nitrite as Nitrogen	Total Dissolved Solids
KWB-1A	Monitoring	Field E of Refinery	2	18 to 32	Shallow		SA	SA	SA	-	SA	SA	SA	SA	SA	SA	SA
KWB-1C	Monitoring	Field E of Refinery	4	30.5 to 49.5	Valley Fill		SA	B	B	-	B	B	-	-	B	B	B
KWB-3AR	Monitoring	Field E of Refinery	2	17 to 33	Shallow		SA [f]	SA [f]	SA [f]	-	SA [f]	SA [f]	SA [f]	SA [f]	SA [f]	SA [f]	SA [f]
KWB-5	Monitoring	Field E of Refinery	2	24.7 to 38.7	Shallow	Y	SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
KWB-6	Monitoring	Field E of Refinery	2	17.5 to 36.5	Shallow	Y	SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
KWB-7	Monitoring	Field E of Refinery	2	18 to 32	Shallow	Y	SA	SA	SA	-	SA	SA	SA	SA	SA	SA	SA
KWB-8	Monitoring	Field E of Refinery	2	15 to 34	Shallow	Y	SA	SA	SA	-	SA	SA	SA	SA	SA	SA	SA
KWB-9	Monitoring	Field E of Refinery	2	20 to 34	Shallow		SA [f]	A [f]	A [f]	-	A [f]	A [f]	A [f]	A [f]	A [f]	A [f]	A [f]
KWB-10R	Monitoring	Field E of Refinery	4	9 to 29	Shallow	Y	SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
KWB-11A	Monitoring	Field E of Refinery	4	30 to 39.5	Shallow	Y	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
KWB-11B	Monitoring	Field E of Refinery	4	50 to 69.5	Valley Fill		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
KWB-12A	Monitoring	Field E of Refinery	4	15.5 to 24.5	Shallow		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
KWB-12B	Monitoring	Field E of Refinery	4	25.5 to 39.5	Valley Fill		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
KWB-P4	Monitoring	Field E of Refinery	2		Shallow		B	B	B	-	B	-	-	-	-	-	-
MW-57	Monitoring	Field E of Refinery	2	10 to 30	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-58	Monitoring	Field E of Refinery	4	13 to 28	Shallow	Y	SA	SA	SA	-	SA	SA	SA	SA	SA	SA	SA
MW-111	Monitoring	Field E of Refinery	2	25 to 40	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-112	Monitoring	Field E of Refinery	2	25 to 35	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-113	Monitoring	Field E of Refinery	2	20 to 35	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-125	Monitoring	Field E of Refinery	2	15 to 25	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-126A	Monitoring	Field E of Refinery	2	19 to 34	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-126B	Monitoring	Field E of Refinery	2	40 to 50	Valley Fill		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-127	Monitoring	Field E of Refinery	2	20 to 50	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-128	Monitoring	Field E of Refinery	2	15 to 35	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-129	Monitoring	Field E of Refinery	2	20 to 50	Shallow	Y	SA	A	A	A	A	A	-	-	A	A	A
MW-131	Monitoring	Field E of Refinery	2	20 to 50	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-132	Monitoring	Field E of Refinery	2	15 to 40	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-133	Monitoring	Field E of Refinery	2	15 to 35	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-134	Monitoring	Field E of Refinery	2	20 to 30	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-135	Monitoring	Field E of Refinery	2	35 to 65	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
RA-1227	Irrigation	Field E of Refinery	10 / 8	194 to 246	Artesian		NA	A [f]	-	-	A [f]	-	-	-	A [f]	A [f]	A [f]
RA-3156	Irrigation	Field E of Refinery	4	182 to ?	Artesian		NA	A	-	-	A	-	-	-	A	A	A
RA-4196	Irrigation	Field E of Refinery	8	280 to 292	Artesian		NA	SA	-	-	SA	-	-	-	SA	SA	SA
RA-4798	Irrigation	Field E of Refinery	7	840 to 850	Artesian		NA	SA	-	-	SA	-	-	-	SA	SA	SA
RW-11 [e]	Recovery	Field E of Refinery	36		Shallow		SA	A	A	-	A	A	-	-	A	A	A
RW-12R [g]	Recovery	Field E of Refinery	12	15 to 35	Shallow	Y	SA	A	A	-	A	A	-	-	A	A	A
RW-13R [g]	Recovery	Field E of Refinery	12	15 to 35	Shallow	Y	SA	A	A	-	A	A	-	-	A	A	A
RW-14R [g]	Recovery	Field E of Refinery	12	15 to 35	Shallow	Y	SA	A	A	-	A	A	-	-	A	A	A
RW-18 [e]	Recovery	Field E of Refinery	36		Shallow		SA	A	-	-	A	A	-	-	A	A	A
RW-20	Recovery	Field E of Refinery	4		Shallow	Y	SA	A	A	-	A	A	-	-	A	A	A
RW-22	Recovery	Field E of Refinery	12	11.5 to 39	Shallow	Y	SA	A	A	-	A	A	-	-	A	A	A
MW-23	Monitoring	N Refinery	6	15 to 20	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-29	Monitoring	N Refinery	2	9.75 to 19.25	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-39	Monitoring	N Refinery	2	14 to 24	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-40	Monitoring	N Refinery	2		Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-41	Monitoring	N Refinery	2	14 to 19	Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-42	Monitoring	N Refinery	2		Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-43	Monitoring	N Refinery	6	15.5 to 20.5	Shallow		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
MW-59	Monitoring	N Refinery	2	15 to 30	Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-60	Monitoring	N Refinery	2	15 to 30	Shallow		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
MW-61	Monitoring	N Refinery	4	14 to 29	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-62	Monitoring	N Refinery	4	14 to 29	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-67	Monitoring	N Refinery	4	12 to 27	Shallow	Y	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
MW-90	Monitoring	N Refinery	4	5 to 20	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-91	Monitoring	N Refinery	4	7 to 22	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-92	Monitoring	N Refinery	4	5 to 20	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-93	Monitoring	N Refinery	4	5 to 20	Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-94	Monitoring	N Refinery	4	5 to 20	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-95	Monitoring	N Refinery	4	7 to 22	Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-96	Monitoring	N Refinery	4	7 to 22	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-97	Monitoring	N Refinery	4	8 to 23	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-98	Monitoring	N Refinery	4	13 to 23	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-137	Monitoring	N Refinery	2	10 to 30	Shallow	Y	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
MW-138	Monitoring	N Refinery	2	10 to 25	Shallow	Y	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
RW-1R [g]	Recovery	N Refinery	12	15 to 35	Shallow	Y	SA	A	A	A	A	A	-	-	A	A	A

Table 1. 2020 Facility-Wide Groundwater Monitoring Program and Schedule

HollyFrontier Navajo Refining LLC - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Associated Area	Well Construction [a]			Historic PSH? [b]	Gauging Frequency	Analytical Suite and Frequency [c, d]									
			Well Diameter (inch)	Screen Interval (ft bgs)	Water Bearing Zone			Purge Parameters	DRO	GRO	VOCs	Metals		Cyanide	Cations/Anions	Nitrate / Nitrite as Nitrogen	Total Dissolved Solids
												As, Ba, Cr, Fe, Pb, Mn, Se	B, Cd, Co, Hg, Ni, U, Va				
RW-2R [g]	Recovery	N Refinery	12	14.5 to 34.5	Shallow	Y	SA	A	A	A	A	A	-	-	A	A	A
RW-7R [g]	Recovery	N Refinery	12	14.5 to 34.5	Shallow	Y	SA	A	A	A	A	A	-	-	A	A	A
RW-8R [g]	Recovery	N Refinery	12	14.5 to 34.5	Shallow	Y	SA	A	A	-	A	A	-	-	A	A	A
RW-9	Recovery	N Refinery	36		Shallow		SA	A	A	A	A	A	-	-	A	A	A
RW-10	Recovery	N Refinery	36		Shallow		SA	A	A	A	A	A	-	-	A	A	A
RW-16 [e]	Recovery	N Refinery	36		Shallow		SA	A	A	-	A	A	-	-	A	A	A
RW-17 [e]	Recovery	N Refinery	36		Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-117	Monitoring	N RO Reject Field	2	10 to 25	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-118	Monitoring	N RO Reject Field	2	10 to 25	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-119	Monitoring	N RO Reject Field	2	10 to 25	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-18	Monitoring	NCL	8	15 to 19	Shallow		SA	A	A	-	A	A	A	A	A	A	A
MW-45	Monitoring	NCL	2	10.5 to 15.5	Shallow		SA	SA	SA	-	SA	SA	SA	SA	SA	SA	SA
MW-53	Monitoring	NCL	2	13.8 to 23.8	Shallow		SA	A	A	-	A	A	-	-	A	A	A
MW-54A	Monitoring	NCL	2	12.7 to 27.7	Shallow		SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
MW-54B	Monitoring	NCL	2	33.8 to 43.8	Valley Fill		SA	B	B	B	B	B	-	-	B	B	B
MW-55	Monitoring	NCL	2	13.7 to 23.7	Shallow		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
MW-56	Monitoring	NCL	2	13.4 to 23.4	Shallow		SA	A	A	-	A	A	-	-	A	A	A
MW-108	Monitoring	NCL	4	9 to 24	Shallow		SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
NCL-31	Monitoring	NCL	2	13 to 18	Shallow		SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
NCL-32	Monitoring	NCL	2	17 to 22	Shallow		SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
NCL-33	Monitoring	NCL	2	13 to 18	Shallow		SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
NCL-34	Monitoring	NCL	2	16 to 21	Shallow		SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
NCL-44	Monitoring	NCL	2		Shallow		SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
NCL-49	Monitoring	NCL	2	16.8 to 17.8	Shallow		SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
KWB-2R	Monitoring	S Refinery	2		Shallow	Y	SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
KWB-4	Monitoring	S Refinery	2	20 to 39	Shallow	Y	SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
MW-28	Monitoring	S Refinery	6	25 to 30	Shallow		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
MW-48	Monitoring	S Refinery	2	19 to 34	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-50	Monitoring	S Refinery	2	12 to 27	Shallow		SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
MW-52	Monitoring	S Refinery	2	19 to 34	Shallow		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
MW-64	Monitoring	S Refinery	4	15 to 30	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-65	Monitoring	S Refinery	4	14.5 to 29.5	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-66	Monitoring	S Refinery	4	14.6 to 29.6	Shallow		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
MW-99	Monitoring	S Refinery	4	12 to 27	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-101	Monitoring	S Refinery	4	8 to 23	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-102	Monitoring	S Refinery	4	12 to 27	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-103	Monitoring	S Refinery	4	7 to 22	Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-104	Monitoring	S Refinery	4	3 to 18	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-105	Monitoring	S Refinery	4	8 to 18	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-106	Monitoring	S Refinery	4	11 to 26	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-107	Monitoring	S Refinery	4	12 to 22	Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-109	Monitoring	S Refinery	2	15 to 29.5	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-110	Monitoring	S Refinery	2	15 to 29.5	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-130	Monitoring	S Refinery	2	30 to 45	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-139	Monitoring	S Refinery	2	10 to 30	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
RA-313	Irrigation	S Refinery	10	904 to 1157	Artesian		NA	A	-	-	A	-	-	-	A	A	A
RW-4R [g]	Recovery	S Refinery	12	14.5 to 34.5	Shallow	Y	SA	A	A	-	A	A	-	-	A	A	A
RW-5R [g]	Recovery	S Refinery	12	13 to 33	Shallow	Y	SA	A	A	-	A	A	-	-	A	A	A
RW-6R [g]	Recovery	S Refinery	12	14.5 to 34.5	Shallow	Y	SA	A	A	-	A	A	-	-	A	A	A
RW-15 [e]	Recovery	S Refinery	36		Shallow	Y	SA	A	A	-	A	A	-	-	A	A	A
RW-19	Recovery	S Refinery	12	11 to 46	Shallow	Y	SA	A	A	-	A	A	-	-	A	A	A
MW-114	Monitoring	S RO Reject Field	2	20 to 35	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-115	Monitoring	S RO Reject Field	2	10 to 25	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-116	Monitoring	S RO Reject Field	2	10 to 25	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-49	Monitoring	TEL	2	19 to 34	Shallow		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
TEL-1	Monitoring	TEL	2	13 to 23	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
TEL-2	Monitoring	TEL	2	13 to 23	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
TEL-3	Monitoring	TEL	2	13 to 23	Shallow	Y	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
TEL-4	Monitoring	TEL	2	13 to 23	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-8	Monitoring	TMD	2		Shallow		SA	A	A	A	A	A	-	-	A	A	A
MW-16	Monitoring	TMD	4	8.5 to 19	Shallow		SA	A	A	-	A	A	-	-	A	A	A
MW-20	Monitoring	TMD	4	9.5 to 23.5	Shallow		SA	A	A	-	A	A	-	-	A	A	A
MW-21	Monitoring	TMD	4	7.5 to 22	Shallow		SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-25	Monitoring	TMD	2	15.75 to 25.25	Shallow		SA	A	A	-	A	A	-	-	A	A	A
MW-26	Monitoring	TMD	2	15.25 to 24.25	Shallow		SA	A	A	-	A	A	-	-	A	A	A

Table 1. 2020 Facility-Wide Groundwater Monitoring Program and Schedule
HollyFrontier Navajo Refining LLC - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Associated Area	Well Construction [a]			Historic PSH? [b]	Gauging Frequency	Analytical Suite and Frequency [c, d]									
			Well Diameter (inch)	Screen Interval (ft bgs)	Water Bearing Zone			Purge Parameters	DRO	GRO	VOCs	Metals		Cyanide	Cations/Anions	Nitrate / Nitrite as Nitrogen	Total Dissolved Solids
												As, Ba, Cr, Fe, Pb, Mn, Se	B, Cd, Co, Hg, Ni, U, Va				
MW-27	Monitoring	TMD	2	18.25 to 27.75	Shallow		SA	A	A	-	A	A	-	-	A	A	A
MW-46R	Monitoring	TMD	2	3.5 to 18.5	Shallow		SA	SA	SA	-	SA	SA	-	-	SA	SA	SA
MW-68	Monitoring	TMD	2	14.75 to 24.5	Shallow		SA	A	A	-	A	A	-	-	A	A	A
MW-71	Monitoring	TMD	2	9.75 to 19.5	Shallow		SA	A	A	-	A	A	A	A	A	A	A
MW-89	Monitoring	TMD	4	2 to 17	Shallow		SA	A	A	-	A	A	-	-	A	A	A
NP-1	Monitoring	TMD	2	9.5 to 19	Shallow		SA	SA	-	-	SA	-	-	-	A	A	A
NP-2	Monitoring	TMD	2	9.5 to 18.5	Shallow		SA	No samples to be collected									
NP-3	Monitoring	TMD	2	9.5 to 18.5	Shallow		SA	No samples to be collected									
NP-4	Monitoring	TMD	2	24.5 to 33.5	Shallow		SA	No samples to be collected									
NP-6	Monitoring	TMD	2	8.75 to 18.75	Shallow		SA	B	-	-	B	-	-	-	-	-	-
NP-8	Monitoring	TMD	2		Shallow		SA	No samples to be collected									
NP-9	Monitoring	TMD	2		Shallow		SA	No samples to be collected									
UG-1	Monitoring	Up-gradient	4	8 to 23	Shallow		A	A	A	A	A	A	A	A	A	A	A
UG-2	Monitoring	Up-gradient	4	15 to 30	Shallow		A	A	A	A	A	A	A	A	A	A	A
UG-3R	Monitoring	Up-gradient	4	17 to 37	Shallow		A	A	A	A	A	A	A	A	A	A	A
UG-4	Monitoring	Up-gradient	2	19.5 to 39.5	Shallow		A	A	A	A	A	A	A	A	A	A	A

Note: Blank cells indicate that information is not available or applicable.

Abbreviations:

A = Annual (March/April event)
B = Biennial (March/April event in odd calendar years)
DRO = Diesal Range Organics
E = East
EP = Evaporation Ponds
ft bgs = feet below ground surface
ft btoc = feet below top of casing
ft MSL = feet Mean Sea Level
GRO = Gasoline Range Organics
N = North
NA = Not accessible
NCL = North Colony Landfarm
OCD = Oil Conservation District
S = South
SA = Semi-annual (March/April and September/October events)
TEL = Tetra Ethyl Lead Impoundment
TMD = Three Mile Ditch
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds
Y = Yes

Footnotes:

[a] Available well construction information provided.

[b] PSH was present during previous groundwater monitoring events or a recovery pump is in place. Recovery wells are gauged at least monthly.

[c] Analytical Suite to include the following:

1. Purge parameters pH, temperature, specific conductivity, dissolved oxygen, oxygen-reduction potential, and turbidity will be measured and recorded in the field.
2. Diesel Range Organics (DRO) by Method 8010Mod.
3. Gasoline Range Organics (GRO) by Method 8010Mod.
4. Volatile organic compounds (VOCs) by Method 8260, to include methyl tert butyl ether (MTBE) and naphthalene.
5. Total metals by Method 6010/6020 and/or 7470. Specific metals shown in table heading (symbols from periodic chart).
6. Dissolved metals - same list as total metals, but only analyzed during March/April event.
7. Cyanide by Method SM4500.
8. Cations/anions to include Calcium, Potassium, and Sodium by Method 6010 or 6020 and Chloride, Fluoride, and Sulfate by Method 300 or 9056.
9. Nitrates/Nitrites as Nitrogen by Method 300.
10. Total Dissolved Solids by Method 2540C.

"-" indicates parameter not required.

Note - *samples will not be collected from any well where PSH is measured to be 0.03 feet thick or greater.*

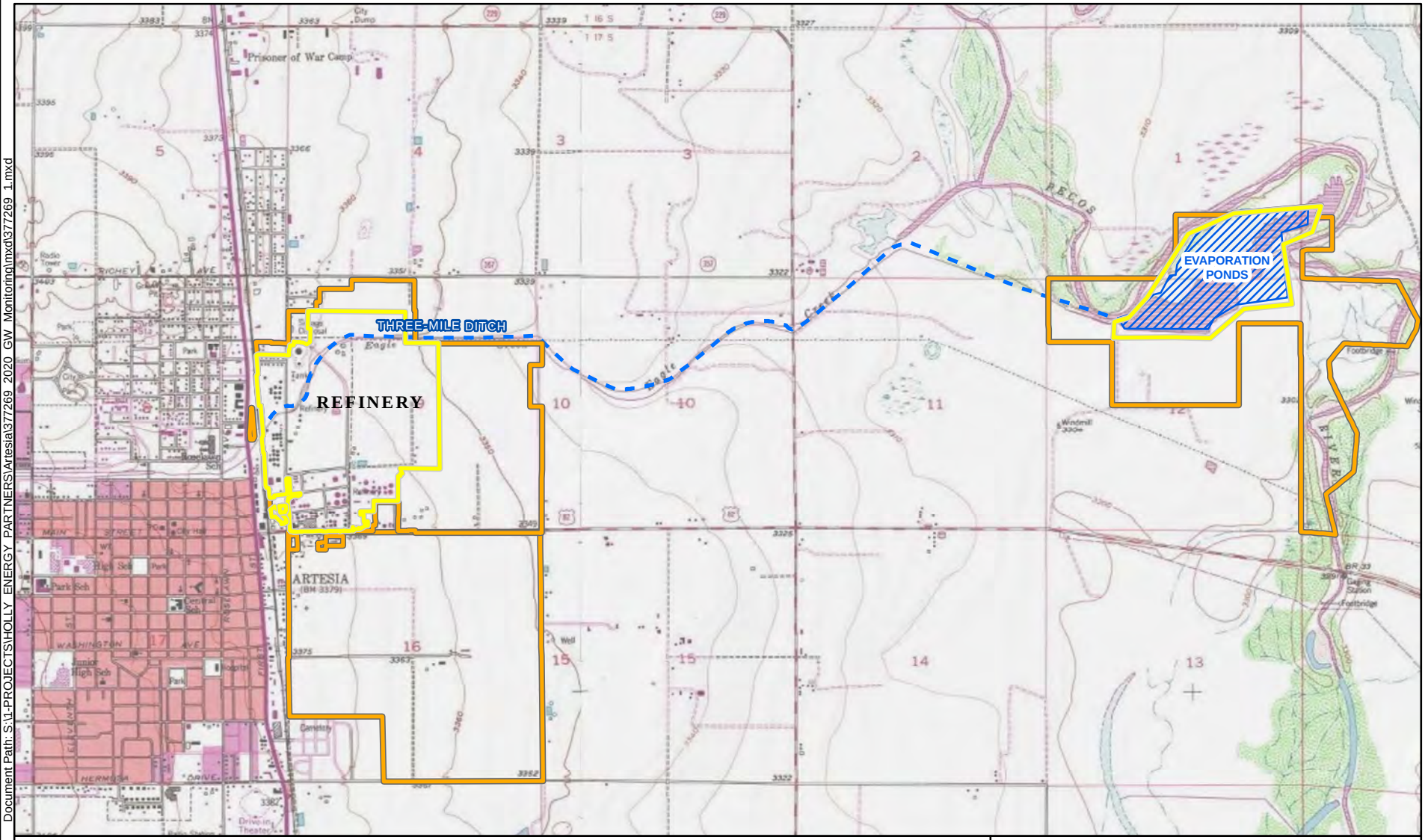
[d] Groundwater will be purged and sampled from wells as indicated using either a peristaltic pump (for sampling depths of approximately 25 feet bgs or less) or a dedicated, stainless steel submersible pump (for sampling depth greater than 25 feet bgs).

[e] Recovery trenches 11, 15, 16, 17, and 18 have multiple "wells". Gauging and sampling points are as follows: RW #11-0, RW #15C, RW #16B, RW #17A, and RW #18A.

[f] Wells will be gauged and/or sampled only if the landowner grants access.

[g] Recovery well RW-1, RW-2, RW-4, RW-5, RW-6, RW-7, RW-8, RW-12, RW-13, and RW-14 will be sampled instead if a recovery pump is installed in associated recovery well RW-1R, RW-2R, RW-4R, RW-5R, RW-6R, RW-7R, RW-8R, RW-12R, RW-13R, and RW-14R.

Attachment B: Figures



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LEGEND

- FENCELINE
- NAVAJO PROPERTY BOUNDARY (FENCELINE SHOWN WHERE COINCIDENT)
- THREE-MILE DITCH
- EVAPORATION PONDS

SOURCE: BASE MAP USGS 7.5 MINUTE SERIES QUADS, ARTESIA AND SPRINGLAKE QUADRANGLES, 1955, PHOTOREVISED 1983.

N

0 1,600 3,200
Feet

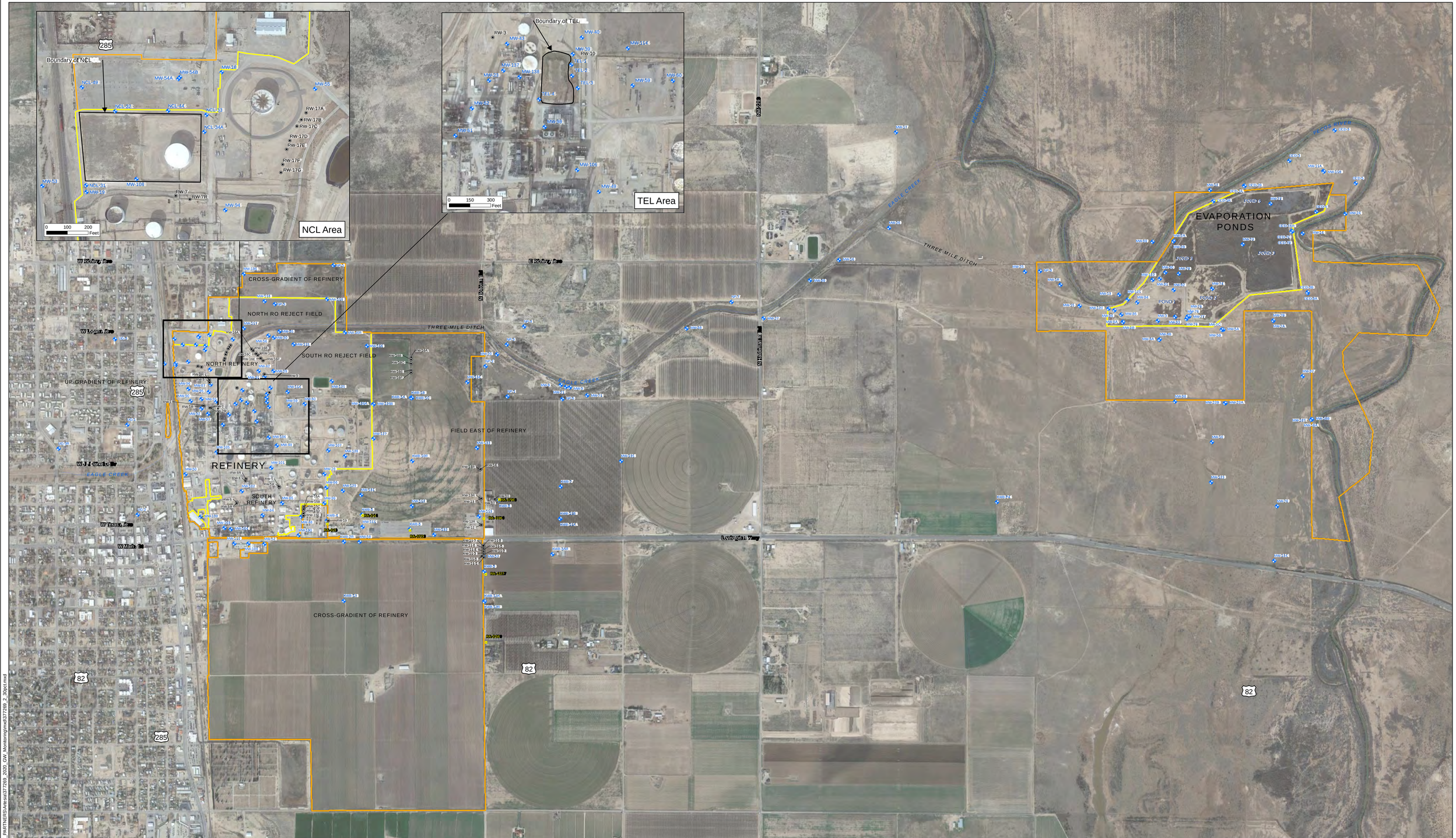
SITE LOCATION MAP

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA REFINERY, EDDY COUNTY, NEW MEXICO

PROJECT NUMBER: 377269	FILE NAME: 377269_1
AUTHOR: SRAY	DATE: 6/1/2020

TRC
505 E. HUNTLAND DR.
SUITE 250
AUSTIN, TX 78752
PH:512-329-6080

FIGURE
1



LEGEND

- IRRIGATION WELL
- MONITORING WELL
- RECOVERY WELL
- FENCELINE
- PROPERTY BOUNDARY (FENCELINE SHOWN WHERE COINCIDENT)

N W E S

0 800 1,600 Feet

1 IN = 800 FT

NOTE:
1.MONITORING WELL MW-139 INSTALLED IN JULY 2019

NEW MEXICO

AERIAL IMAGERY SOURCE: GOOGLE AND THEIR DATA PARTNERS.

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WELL LOCATION MAP

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA REFINERY, EDDY COUNTY, NEW MEXICO

AUTHOR: MJAGOE	SAVED: 6/26/2020	MXD: 377269_2_30pct

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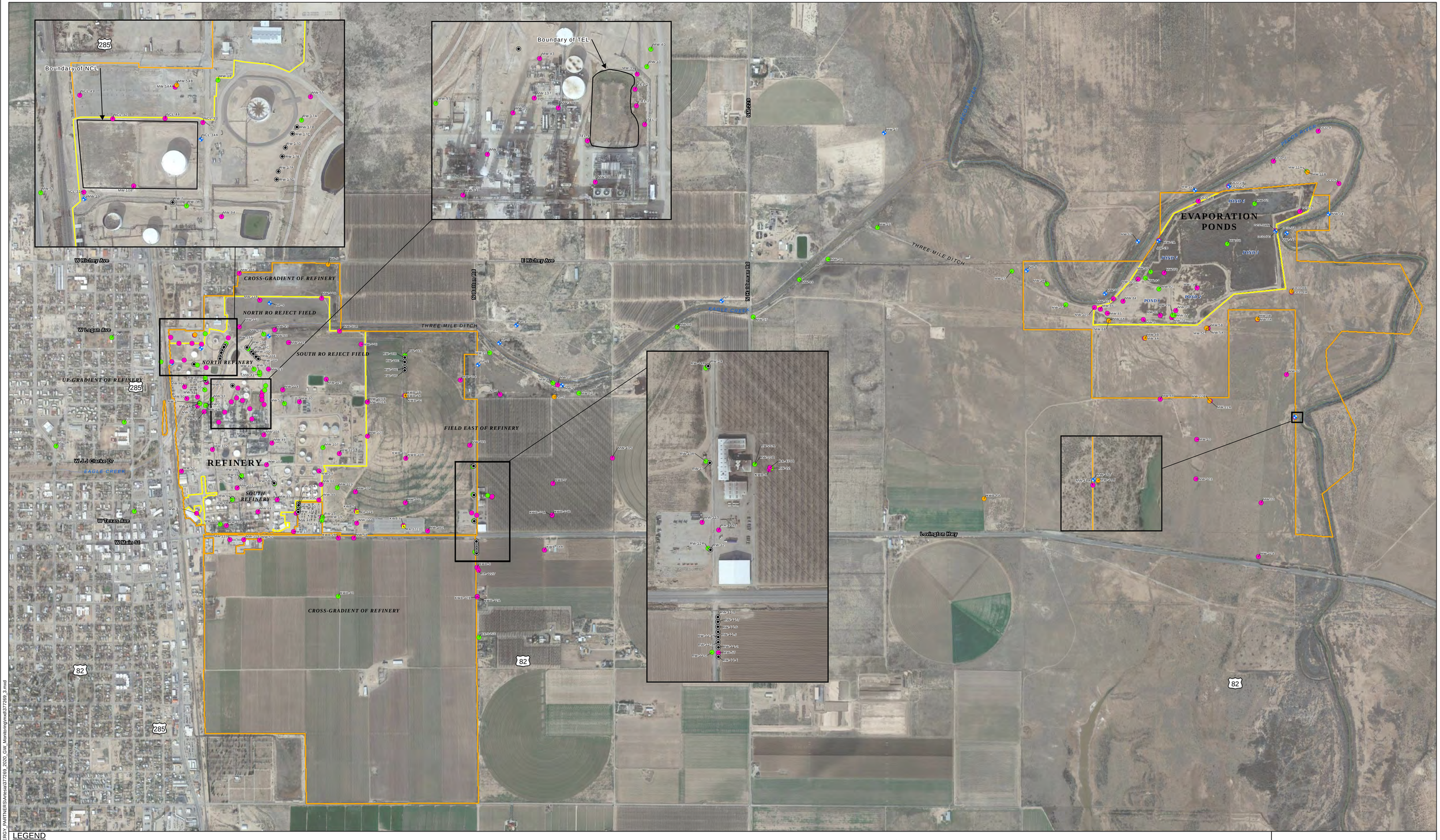
AUSTIN, TX 78752
PH:512-329-6080

FIGURE 2



LEGEND

- IRRIGATION WELL NOT INCLUDED IN SAMPLING PLAN
- MONITORING WELL NOT INCLUDED IN SAMPLING PLAN
- RECOVERY WELL NOT INCLUDED IN SAMPLING PLAN
- WELL TO BE SAMPLED ON A SEMI-ANNUAL BASIS
- WELL TO BE SAMPLED ON AN ANNUAL BASIS
- WELL TO BE SAMPLED ON A BIENNIAL BASIS
- PROPERTY BOUNDARY (FENCELINE SHOWN WHERE COINCIDENT)
- FENCELINE

N W E S

0 800 1,600
Feet

1 IN = 800 FT

NEW MEXICO

AERIAL IMAGERY SOURCE: GOOGLE AND THEIR DATA PARTNERS.

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FACILITY-WIDE GROUNDWATER SAMPLING PLAN

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA REFINERY, EDDY COUNTY, NEW MEXICO

AUTHOR: MJAGOE	SAVED: 6/26/2020	MXD: 377269_3

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FIGURE 3