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Facility Wide GW Monitoring Work Plan- Updates

2017

Facility Wide Ground Water Monitoring Work Plan – Updates for 2017

Western Refining Company
Gallup Refinery
92 Giant Crossing Road
Gallup, New Mexico 87301
505-722-3833

Submitted: March 29, 2017

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.

Daniel J. Statile
VP Refining

4/3/17
Date

Reviewed by:

William Bailey
Environmental Supervisor

Submitted by:

Cheryl Johnson
Environmental Specialist

Executive Summary

Western Refining conducts quarterly, semi-annual and annual ground water monitoring at its Gallup facility on a site wide basis. The Ground Water Monitoring Work Plan (Plan) documents any additions or revisions in ground water monitoring and also details the sampling procedures used.

This Plan divides the facility into five monitoring groups. Group A consists of the boundary wells situated along the northwest corner of the refinery property and monitoring wells around the land treatment area (LTU). Group B consists of a cluster of wells at the aeration basin and at the sanitary treatment pond 1 (STP-1) near the Waste Water Treatment Unit. Group C consists of the observation wells on the northeast section of the refinery including four product recovery wells. In 2016, six new wells were installed resulting from the North Drainage Ditch and OW-14 Site Investigation. Group D includes the process/production wells and the four observation wells located on the south-southwest section of the property. Group E includes 44 permanent monitoring wells installed to delineate the extent of a hydrocarbon plume associated with a seep discovered in 2013 directly west of the crude tanks (T-101, 102); included in this group is a pre-existing well located directly west of the truck loading terminal. No visible markings or drill logs were available to identify this well and Western has labeled this well as MKTF-45 as this well is located in the vicinity of the seep investigation. Not included in the grouping are sampling requirements for the evaporation ponds and effluent from the sanitary treatment pond (STP-1).

Gallup Refinery will periodically review facility-wide monitoring data, and assess the monitoring program presented in this Plan. Revisions to the Plan, as necessary, will then be presented annually for agency review and approval. These revisions may include, but not be limited to a reduction or change in monitoring locations, monitoring frequency, and/or target chemicals to be analyzed.

Gallup follows the most current approved sampling/monitoring schedule from NMED; "Approval With Modifications – Facility Wide Ground Water Monitoring Report, Gallup Refinery, HWB-WRG-14-006, dated May 18, 2016; NMED revised Facility Wide Ground Water Monitoring Work Plan = 2012 updates, 2013 updates, 2014 updates for 2015 dated March 11, 2016; and NMED Approval with Modification – Facility Wide Ground Water Monitoring Work Plan 2014 updates for 2015 dated August 14, 2016.

We have created a monitoring work plan with quality assurance practices and controls as well as standard procedures for sampling, and a schedule of activities to monitor ground water and surface water at select locations of the Gallup Refinery. The persons responsible for the implementation and oversight of this plan are:

Vice President Refining

- Daniel J. Statile

Environmental Supervisor

- William Bailey

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List of Acronyms

AL	Aeration Lagoon
API	American Petroleum Institute
BMP	Best Management Practices
BS	Blank Spike
BSD	Blank Spike Duplicate
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CFR	Code of Federal Regulations
DQO	Data Quality Objective
DRO	Diesel Range Organics
DTB	Depth to Bottom
DTW	Depth to Water
EP	Evaporation Pond
EPA	Environmental Protection Agency
FT.	Foot
FWGWMP	Facility Wide Ground Water Monitoring Plan
GPM	Gallons per minute
GRO	Gasoline Range Organics
HNO3	Nitric Acid
HWB	Hazardous Waste Bureau
IDW	Investigation Derived Waste
LDU	Leak Detection Unit
LTU	Land Treatment Unit
ML	Milliliter
MCL	Maximum Contaminant Level
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MTBE	Methyl Tert Butyl Ether
NAICS	North American Industry Classification System

List of Acronyms – Continued

NAPIS	New American Petroleum Institute Separator
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NOI	Notice of Intent
OAPIS	Old American Petroleum Institute Separator
OW	Observation Well
OCD	Oil Conservation Division
PPE	Personal Protective Equipment
PPM	Parts per million
PSTB	Petroleum Storage Tank Bureau
PVC	Polyvinyl Chloride
PW	Process Well
QA	Quality Assurance
QC	Quality Control
RW	Recovery Well
RCRA	Resource Conservation and Recovery Act
SIC	Standard Industrial Classification
SOP	Standard Operating Procedure
SPH	Separate Phase Hydrocarbon
STP	Sanitary Treatment Pond
SVOC	Semi-volatile Organic Compound
SWMU	Solid Waste Management Unit
SWPP	Storm Water Pollution Prevention Program
TOC	Total Organic Content
VOC	Volatile Organic Compound
WQCC	Water Quality Control Commission
WWTP	Waste water treatment plant

1.0 Introduction

This Facility-Wide Ground Water Monitoring Work Plan (Plan) has been prepared for the implementation of a ground water monitoring program at the Gallup Refinery owned by Western Refining ("Gallup Refinery" or "Facility").

1.1 Scope of Activities

This Plan has been prepared to collect data that will be used to characterize the nature and extent of potential impacts to ground water at the Gallup Refinery. The monitoring plan is designed to assist the facility in evaluating any levels of contaminants that exceed compliance standards. This Plan divides the facility into five groups for periodic monitoring:

GROUP A	GROUP B	GROUP C	GROUP D	GROUP E
BW-1A, B, C	GWM-1, 2, 3	OW-13, 14, 29, 30	PW-2, 3, 4	MKTF- 1 thru 45
BW-2A, B, C	NAPIS 1, 2, 3, KA-3	OW-50, 52	OW-1, 10	
BW-3A, B, C	OAPIS-1	RW-1, 2, 5, 6	OW-11, 12	
MW-1, 2, 4, 5	LDU (3)			
SMW-2, 4	STP1-NW, SW			

Group A consists of the boundary wells situated along the northwest corner of the refinery property and the monitoring wells around the LTU. Group B consists of a cluster of monitoring wells and leak detection units for the NAPIS at the aeration basin and at the sanitary treatment pond. Group C includes the observation wells located on the northeast section of the plant and includes recovery wells from which small quantities of free product has been continually removed. Group D includes the process/production wells and four observation wells located on the south, southwest section of the refinery property. Group E includes a total of 44 new monitoring wells installed to delineate a hydrocarbon plume associated with a seep discovered west of the crude tank (Tank 101); included in this group is a pre-existing well located directly west of the truck loading terminal. This well has been labeled as MKTF-45 as no markings or boring logs have been located to identify when this well was installed. This plan also includes sampling requirements for the evaporation ponds and for the effluent from the sanitary treatment pond. Designated wells and sample points identified are monitored on a quarterly, semi-annual and annual basis following the procedures presented in this Plan.

Gallup Refinery periodically reviews facility-wide monitoring data and evaluates the monitoring program presented in this Plan. Annual revisions to the Plan will be presented for agency review and approval. These revisions may include, but not be limited to, a reduction or change in monitoring locations, monitoring frequency, and/or target chemicals to be analyzed.

1.2 Facility Ownership and Operation

This Plan pertains to the Western Refining Southwest Inc., Gallup Refinery located at Exit 39 on Interstate I-40. This refinery is known as the Gallup Refinery and is located at Jamestown, New Mexico, approximately 17 miles east of Gallup. Figure 1 shows the regional location of the Gallup Refinery.

The owner is:

	Western Refining 123 W. Mills Avenue El Paso, TX 79901	(Parent Corporation)
Operator:	Western Refining Southwest Inc. Gallup Refinery 92 Giant Crossing Road Gallup, New Mexico 87301	(Postal Address)
	Western Refining Southwest Inc. Gallup Refinery I-40, Exit 39 (17 Miles East of Gallup, NM) Jamestown, New Mexico 87347	(physical address)

The following regulatory identification and permit governs the Gallup Refinery:

- SIC code 2911 (petroleum refining) applies to the Gallup Refinery
- U.S. EPA ID Number NMD000333211
- OCD Discharge Case Number AP-111.
- 2015 NPDES MSGP, ID #NMR053168

The facility status is corrective action/compliance. Quarterly, semi-annual and annual ground water sampling is conducted at the facility to evaluate present contamination.

The refinery is situated on an 810 acre irregular shaped tract of land that is largely located within the lower one quarter of Section 28 and throughout Section 33 of Township 15 North, Range 15 West of the New Mexico Prime Meridian. A small component of the property lies within the northeastern one quarter of Section 4 of Township 14 North, Range 15 West. Figure 2 is a topographic map showing the general layout of the refinery in comparison to the local topography.

2.0 Background Information

2.1 Historical and Current Site Use

Built in the 1950's, the Gallup Refinery is located within a rural and sparsely populated section of McKinley County in Jamestown, New Mexico, 17 miles east of Gallup, New Mexico. The setting is a high desert plain on the western slope of the Continental Divide. The nearest population centers are the Flying J Travel Center (Travel Center) refueling plaza, the Interstate 40 highway corridor, and a small cluster of residential homes located on the south side of Interstate 40 approximately 2 miles southwest of the refinery (Jamestown). The surrounding land is comprised primarily of public lands and is used for cattle and sheep grazing.

The refinery primarily receives crude oil via two 6-inch diameter pipelines; two pipelines from the Four Corners Area enter the refinery property from the north. In addition, the refinery also receives natural gasoline feed stock via a 4-inch diameter pipeline that comes in from the west along the Interstate 40 corridor from the Western Refining - Wingate Facility (formerly Conoco gas plant). Crude oil and other products also arrive at the site via railroad cars. These feed stocks are then stored in tanks until refined into products.

The Gallup Refinery is a crude oil refining and petroleum products manufacturing facility. The Standard Industrial Classification (SIC) code is 2911 and the North American Industry Classification System Code (NAICS) is 32411. There are no organic chemicals, plastics, or synthetic fibers manufactured that contribute to our process flow of waste water. We do not manufacture lubricating oils.

The refinery incorporates various processing units that convert crude oil and natural gasoline into finished products. These units are briefly described as follows.

- Crude Distillation Unit - separates crude oil into various fractions; including gas, naphtha, light oil, heavy oil, and residuum.

- Fluidized Catalytic Cracking Unit (FCCU) - dissociates long-chain hydrocarbon molecules into smaller molecules, and essentially converts heavier oils into naphtha and lighter oils.

- Alkylation Unit - combines specific types of hydrocarbon molecules into a high octane gasoline blending component.

- Reforming Unit - breaks up and reforms low octane naphtha molecules to form high octane naphtha.

- Hydro-Treating Unit - removes undesirable sulfur and nitrogen compounds from intermediate feed stocks, and also saturates these feed stocks with hydrogen to make diesel fuel.

- Treater Unit - remove impurities from various intermediate and blending feed stocks to produce finished products that comply with sales specifications.

- Ammonium Thiosulfate Unit - accepts high H2S and ammonia containing gas streams from the Amine and the Sour Water Stripper units, and converts these into a useful fertilizer product, ammonium thiosulfate.

- Sulfur Recovery Unit - converts and recovers various sulfur compounds from the gases and liquids produced in other processing units to create a solid elemental sulfur byproduct.

- Waste Water Treatment Plant - process and treat refinery waste and storm water before releasing to treatment ponds.

As a result of these processing steps, the refinery produces a wide range of petroleum products including propane, butane, unleaded gasoline, diesel, and residual fuel. In addition to the afore-mentioned processing units, various other equipment and systems support the operation of the refinery and are briefly described as follows.

Storage tanks are used throughout the refinery to hold and store crude oil, natural gasoline, intermediate feed stocks, finished products, chemicals, and water and are all located above ground. Capacity of these tanks range in size from 80,000 barrels to less than 1,000 barrels.

Pumps, valves, and piping systems are used throughout the refinery to transfer various liquids among storage tanks and processing units. A railroad spur track and a railcar loading rack are used to transfer feed stocks and products from refinery storage tanks into and out of railcars.

Several tank truck loading racks are used at the refinery to load out finished products and also receive crude oil, other feed stocks, additives, and chemicals.

Gasoline is delivered to the Travel Center via tanker truck. An underground diesel pipeline exists between the refinery and the Travel Center. In 2013 the underground diesel line from Gallup Refinery to the Travel Center was replaced and put back in service on February 3, 2014... The replaced line runs above ground from the marketing area of the refinery for approximately 150 feet and continues underground to the Travel Center.

A firefighting training facility is used to conduct employee training. Waste water from the facility, when training is conducted, is pumped into a tank which is then pumped out by a vacuum truck. The vacuum truck pumps the oily water into a process sewer upstream of the New API Separator (NAPIS).

The process waste water system is a network of curbing, paving, catch basins, and underground piping used to collect waste water from various processing areas within the refinery. The waste water effluent then flows into the equalization tanks and the NAPIS where the oil is separated from water based on the principle that, given a quiet surface, oil will float to the water surface where it can be skimmed off. The skimmed slop is passed to a collection chamber where it is pumped back into the refinery process. The clarified water is routed to a waste water treatment plant (WWTP) where benzene is removed and the treated water flows into pond STP-1. STP-1 consists of two bays, north and south and each bay is equipped with five aerators per bay. Effluent from STP-1 then flows into Evaporation Pond 2 and gravitated to the rest of the ponds.

During episodes of unit upsets or major storm events, the waste water is held in one of the three equalization tanks, T-35, T-27 and T-28 which are used to handle large process and storm water flows allowing the flow to the NAPIS to be controlled. These tanks are also used to store waste water if problems are encountered with the downstream equipment, i.e., NAPIS and the WWTP.
The storm water system is a network of valves, gates, berms, embankments, culverts, trenches, ditches, natural arroyos, and retention ponds that collect, convey, control, and release storm

water that falls within or passes through refinery property. Storm water that falls within the processing areas is considered equivalent to process waste water and is sent to tanks T-35, T-27 and T-28 when needed before it reaches the NAPIS, WWTP, STP-1 and into Evaporation Pond 2 where flow is gravitated to the rest of the ponds. Storm water discharge from the refinery is very infrequent due to the arid desert-like nature of the surrounding geographical areas.

At the evaporation ponds, waste water is converted into vapor via solar and mechanical wind-effect evaporation via two 80 gallons per minute electrically driven evaporation pond spraying snow machines located between ponds 4 and 5. Two additional 66 GPM (gallons per minute) evaporation pond sprayers were installed in October 2014 between ponds 3 and 4 for a total of four evaporators. No waste water is discharged from the refinery to surface waters of the state. In September 2015. Gallup Refinery submitted a Notice of Intent requesting continued coverage under the 2015 NPDES Multi-Sector General Permit which was approved on October 8, 2015 (NMR0531685). The refinery maintains a Storm Water Pollution Prevention Plan (SWPPP) that includes Best Management Practices (BMPs) for effective storm water pollution prevention (updated September 2015). The refinery has constructed several new berms in various areas and improved outfalls (installed barrier dams equipped with gate valves) to minimize the possibility of potentially impacted runoff leaving the refinery property and also to minimize the stormwater run-on from the I-40 interchange and the Travel Center onto refinery property

2.2 Potential Receptors

Potential receptors at the facility also include those that may arise from future land uses. Currently, these include on-site workers, nearby residents, wildlife, and livestock.[1] The major route to exposure of humans would be from contaminants reaching a drinking water well. Other routes could be from showering, cooking, etc. with contaminated ground water, raising crops and vegetables with contaminated ground water, or getting exposed to or fishing in surface water that has commingled with shallow ground water. Exposure can also occur through contact with soils and/or plants that have become contaminated themselves through contact with

[1] Note: There is extensive and regular patrolling by security personnel of the facility which operates 24-hours – therefore, we can discount the possibility of an inadvertent or deliberate intruder becoming exposed to contamination in groundwater that has reached the surface in some form.

contaminated ground water. However, drinking water wells remain the primary route of possible exposure.

At this time, the nearest drinking water wells are located on-site at the southwest areas of the facility, at depths of approximately 3000 feet which are identified as process or production (PW) wells. These wells are designated as PW-2, PW-3 and PW-4 (See Figure 4 for location). These wells are operated by the facility to provide the refinery's process water and drinking water to nearby refinery-owned houses, to the refinery itself, and to the Travel Center. Currently, PW-2 is sampled every three years, PW-4 is sampled semi-annually and PW-3 is sampled on an annual basis. Annual sampling results from 2009 through 2016 have indicated no detection levels of volatile organic compounds (VOCs) or semi-volatile organic compounds (SVOCs).

Other than the on-site wells, there is no known drinking water wells located within a 4-mile radius of the site. The nearest drinking water wells that could be used by off-site residents are located to the northwest of the site at a distance slightly greater than 4-miles located within the Navajo community of Iyanbito (shown on the USGS Topographical Map - Gallup Quadrangle (Revised 1980)). These wells are northwest of the South Fork of the Puerco River which heads towards the southwest from immediately north of the facility. As the shallowest ground water will generally flow in the direction of surface water flow, any possible shallow ground water contamination that left the facility either now or in the future would flow towards the southwest after leaving the facility and away from the community of Iyanbito. The Cibola National Forest lies in the south-east direction and there are no wells or residents in this protected area. Boundary monitoring wells along the southwest to northwest perimeter of the facility have not shown any evidence of contaminants except for low concentrations of bis(2-ethylhexyl)phthalate detected in the following wells: BW-3B in 2009, BW-3C in 2011 and BW-1C in 2013. The contaminant detected is suspected to be a laboratory contaminant or possibly from the PVC pipe materials used as casing for these wells. No detection of bis(2-ethylhexyl)phthalate was detected in any of the boundary wells in 2016.

Artesian conditions at some locations of the site lead to the possibility of ground water emerging onto the surface and thus being able to affect wildlife. No surface water on the site is used for human consumption or primary contact, such as immersion, or secondary contact, such as recreation. The man-made ponds on the site are routinely monitored and are a part of this Plan. Therefore, if they are in contact with shallow ground water that has exhibited elevated levels of contaminants, the Plan will detect any commingling of ground water and surface waters.

Fluctuating ground water elevations can smear contaminants into subsurface soil and rocks, and there is a possibility that plant roots could reach such contaminated soils and bio-concentrate contaminants creating another route of exposure to potential receptors, such as birds and animals that eat the plants. No food crops are currently grown on the site.

2.3 Type and characteristics of the waste and contaminants and any known and possible sources

The types of waste likely include – volatile and semi-volatile organic compounds, primarily hydrocarbons, but could include various other industrial chemicals such as solvents, acids, spent caustic solutions, and heavy metals present in spent chemicals and waste water. These wastes could be in the form of waste water, spent chemicals destined for off-site shipping and disposal packed in drums, sludge, and dry solids. Dry wastes could stem from wind-blown metallic powders used as catalysts, and regular municipal solid wastes stored in covered containers destined for municipal landfills.

Most of the wastes and contaminants that could possibly reach ground water have the characteristic that they would biodegrade and naturally attenuate. However, any heavy metals present in dirt and sludge could possibly leach into ground water and would not biodegrade. There is a possibility also that certain long-lived chemicals would not biodegrade, or, if they did, it would be at a very slow rate. Possible sources include leaks from buried pipes, tanks, surface spills, and historical dumping of wastes in remote areas of the site.

All above-ground large tanks have leak detection or equivalent systems, such as radar gauges. Pumps that could leak hydrocarbons are within containment areas, and all tanks are located inside earthen bermed areas to contain spills. The NAPIS has double walls and a leak detection system installed.

Similarly, surface impoundments can serve as a source of possible ground water contamination. In the past, waste water from the railroad loading rack flowed to a settling and separation lagoon north of the rack and flow exited at the north end where water leaving the lagoon was distributed across a flat open site known as the fan-out area. The free flow of liquids led to subsurface soil contamination. This area is identified as SWMU No. 8 and has been cleaned up for a corrective action complete with controls status. Disposal of waste water into open fields is not practiced at the Gallup Refinery.

There are fourteen Solid Waste Management Units (SWMU) identified at the Gallup Refinery, and one closed land treatment Area. On December 31, 2013, the RCRA Post Closure Care Permit became effective under §20.4.1.901A (10) NMAC which identified an additional 20 Areas of Concern (AOCs) requiring corrective action and are listed below.

RCRA (Resource Conservation and Recovery Act) Regulated Units

- Land Treatment Unit (LTU)

SWMUs (Solid Waste Management Units)

- SWMU 1 – Aeration Basin
- SWMU 2 – Evaporation Ponds
- SWMU 3 – Empty Container Storage Area
- SWMU 4 – Old Burn Pit
- SWMU 5 – Landfill Areas
- SWMU 6 – Tank Farm
- SWMU 7 – Fire Training Area
- SWMU 8 – Railroad Rack Lagoon
- SWMU 9 – Drainage Ditch and the Inactive Land farm
- SWMU 10 – Sludge Pits
- SWMU 11 – Secondary Oil Skimmer
- SWMU 12 – Contact Wastewater Collection System

- SWMU 13 – Drainage Ditch between North and South Evaporation Ponds
- SWMU 14 – API Separator

AOCs (Areas of Concern)

- AOC 15 – New API Separator
- AOC 16 – New API Separator Overflow Tanks
- AOC 17 – Railroad Loading/Unloading Facility
- AOC 18 – Asphalt Tank Farm (tanks 701-709, 713, 714)
- AOC 19 – East Fuel Oil Loading Rack
- AOC 20 – Crude Slop and Ethanol Unloading Facility
- AOC 21 – Main Loading Racks
- AOC 22 – Loading Rack Additive Tank Farm
- AOC 23 – Retail Fuel Tank Farm (tanks 1-7, 912, 913, 1001, 1002)
- AOC 24 – Crude Oil Tank Farm (tanks 101 and 102)
- AOC 25 – Tank 573 (Kerosene Tank)
- AOC 26 – Process Units
- AOC 27 – Boiler and Cooling Unit Area
- AOC 28 – Warehouse and Maintenance Shop Area
- AOC 29 – Equipment Yard and Drum Storage Area
- AOC 30 – Laboratory
- AOC 31 – Tanks 27 and 28
- AOC 32 – Flare and Ancillary Tanks (tanks Z85V2, Z85V3, Z84-T105)
- AOC 33 – Storm Water Collection System
- AOC 34 – Scrap Yard

Existing ground water monitoring wells effectively surround all of the above listed SWMUs and AOCs.

2.4 Summary of contaminant releases that could contribute to possible ground water contamination.

Spills and leaks are known to have occurred on the site in various locations. Although most hydrocarbons are immediately picked up for recovery and contaminated soil is removed, some of the liquids present in a spill may enter the subsurface. With precipitation, there is the possibility that some of the contaminants could leach and reach ground water.

2.4.1 Separate Phase Hydrocarbons (SPH)

Separate-Phase Hydrocarbons (SPH) floating on shallow ground water has been found at the northeast end of the facility. A series of recovery wells were installed and SPH has been pumped out for several years. Recovery through hand-bailing continues on a quarterly basis indicating that the volume of SPH has continued to drop substantially from year to year in several of these recovery wells. In 2015, only Recovery Well (RW-1) had measureable levels of hydrocarbons. Elevated levels of benzene have also been found in the wells in this area possibly linked to past spills. Recovery wells are listed as follows:

RECOVERY WELLS			
RW-1	RW-2	RW-5	RW-6

2.4.1.1 Hydrocarbon Seep

In June of 2013 during a routine inspection, a hydrocarbon seep was discovered in an isolated area approximately 100 yards west of Tank 101/102. A series of excavations were completed in the area of the seep including installation of six (6) temporary sumps for bi-weekly hydrocarbon recovery. Through 2016 a total of 918,981 gallons of liquid (hydrocarbon and ground water) have been recovered from the site. To date a total of 44 permanent monitoring wells have been installed with an addition of one pre-existing well, which has been labeled as MKTF-45, and is located in the vicinity of the site investigation. Western continues to further characterize potential source areas, recovery of liquids from the temporary sumps, and continued sampling of the monitoring wells for characterization and delineation purposes. All 45 wells have been added to the 2016 Ground Water Monitoring Schedule (see Appendix B).

Additional soil staining was observed north, northwest of the sumps and sites were excavated of approximately 38.26 tons of soil which was sent to the Painted Desert Landfill for disposal. Temporary retention ditches were installed to recover liquids from this area. From April 1, 2016 through December 31, 2016, approximately 340,200 gallons of liquid (hydrocarbon and ground water) have been recovered from this area via vacuum truck. Additional sumps are planned for installation in this area similar to the original six sumps installed for recovery of liquids.

MARKETING WELLS
MKTF-1 THRU MKTF-45

2.4.2 Methyl Tert Butyl Ether (MTBE)

Methyl Tert Butyl Ether (MTBE) has not been used at the refinery since April 2006. Several monitoring wells were installed at various depths to monitor SPH and MTBE contaminant plumes from historical contamination. Historical analytical data for the observation wells (OW-14, 29 and 30) indicate the contaminant, MTBE has slowly been increasing over the years in these wells. Based on this information, New Mexico Environmental Department – Hazardous Waste Bureau (NMED-HWB) has requested two Work Plans to further investigate the known MTBE plume at the Facility and investigate a suspected plume north of the tank farm (SWMU 6). These observation wells (OW) are located downstream on the northeast section of the plant and are designated as follows.

OBSERVATION WELLS					
OW-13	OW-14	OW-29	OW-30	OW-50	OW-52

As requested by NMED in their letter dated May 11, 2015, HWB-WRG-MISC. “Requirement to Submit Work Plan Regarding Ground water Monitoring OW Series Wells and Contaminant Plume”, work plans were submitted and approved by NMED for the following:

1. Installation of additional monitoring wells to define the extent of MTBE and other hydrocarbons down-gradient and the north, northwest of existing ground water monitoring wells OW-29/30;
2. Investigation of the source of contamination in ground water in monitoring well OW-14.

Five monitoring wells (OW-53, OW-54, OW-55, OW-57 and OW-58) were installed in third quarter 2016. A request will be made to include these wells in the Facility Wide Ground Water Monitoring Work Plan and also listed on Appendix B, Table 2 for inclusion into the Monitoring Plan.

2.4.3 NAPIS UNIT

A unit at the southwest end of the facility that is used to recover and recycle oil back into the process has also – through leakage and spills – caused some MTBE and hydrocarbon contamination in shallow ground water. This unit is known as the NAPIS and was put into service in October 2004. The NAPIS has one up-gradient well NAPIS-1, located on the east side and three down-gradient shallow monitoring wells, NAPIS-2, NAPIS-3 and KA-3, which are located along the west side. The NAPIS unit is also equipped with three leak detection units on the east and west bays and also at the oil sump section on the east bay and are designated as follows:

NAPIS WELLS				LEAK DETECTION UNITS		
NAPIS-1	NAPIS-2	NAPIS-3	KA-3	EAST LDU	WEST LDU	OIL SUMP LDU

2.4.4 Aeration Basin

The Aeration Basin, which is designated as SWMU No. 1 in the facility's RCRA Post-Closure Care Permit includes three cells, known as AL-1, AL-2 (lagoons) and holding pond 1 which is currently referred to as EP-1, although it is not an evaporation pond and is not part of the area covered by SWMU No. 2 – Evaporation Ponds. All three of these cells are no longer in service since the startup of the Waste Water Treatment Plant in 2012. All refinery waste water flow was diverted to the WWTP bypassing the lagoons and pond 1. Western has experienced intermittent discharges of oil and oily water into the lagoons and spills to ground surface while it was in operation. Most of these occurrences were the result of unit upsets and or large storm events affecting the old API Separator.

Two ground water monitoring wells (GWM-1, GWM-2) were installed immediately down gradient of the aeration lagoons in 2004 and 2005 in order to detect potential leakage from the aeration basin. GWM-3 was installed in 2005 on the northwest corner of pond 1 (EP-1).

Analysis of ground water samples collected at GWM-1 and GWM-2 have indicated several organic constituents at concentrations above the screening levels in ground water, which would indicate a potential for historical releases from the lagoons. In the third quarter of 2015, quarterly inspection of GWM-1 indicated the presence of an oily substance during gauging activities. NMED was notified of this finding and Gallup was instructed to collect an oil sample for fingerprint analysis (DRO/GRO and MRO). Gallup was also instructed to purge and gauge the well on a weekly basis to check the recharge rate. The initial measurement was made without the use of an oil/interface probe and the thickness of the hydrocarbon layer in the well was not immediately known. Measured separate phase hydrocarbon (SPH) thickness ranged from 0.35 to 0.45 feet in September, October and November 2015. Weekly gauging/purging of GWM-1 has recorded no measureable hydrocarbon layer since the end of November through December 2015 although an odor and sheen has been observed on the water purged. Depth to water has remained around 21 feet and Western continues to observe a hydrocarbon layer of 0.02 to 0.04 feet in the first, third and fourth quarters 2016. On December 10, 2015, Gallup sent a response to NMED–HWB concurring that the source of the hydrocarbons observed in GWM-1 is from the adjacent aeration lagoon.

GWM-2 and 3 upon installation in 2005 were found to be dry. Water was first detected in GWM-2 in the first quarter of 2008 and in GWM-3 in the third quarter of 2010. 24-hour notification of the finding was given to NMED and OCD respectively. Analyses of ground water samples collected from GWM-2 and GWM-3 have detected the presence of several constituents at concentration levels above applicable water quality standards such as fluoride, chloride, nitrates, and sulfates. No VOCs have been detected in GWM-2 or GWM-3.

Quarterly inspections in 2011 and 2012 continued to indicate an increase in measurable water levels in GWM-2 and GWM-3, which was consistent with the increased levels in the lagoons and pond 1. In the second half of 2012 through early 2013 the levels in the lagoons and pond 1 began to decrease with cessation of gravitational flow between lagoons to pond 1 due in part to the start-up of the WWTP. Continued quarterly inspections indicated no water present in GWM-2 and GWM-3 in 2013 through 2016.

Both GWM-2 and GWM-3 have been included in the Aeration Basin Corrective Action Work Plan which began investigative soil and water sampling near the aeration basin in the third quarter of 2012 to support selection of a remedy for SWMU NO. 1 and determine the source of water detected in GWM-2 and GWM-3. Figure 4 shows the location of all of the active monitoring wells on the facility.

In February of 2012, Western submitted a "Revised Investigation Work Plan Solid Waste Management Unit (SWMU) No. 1 Aeration Basin" to include sampling of soils and ground water surrounding the Aeration Basin to determine if there has been a release to the environment and to delineate any such release. In addition, information was collected to help determine the source of ground water that had been observed in monitoring wells GWM-2 and GWM-3. The work plan also included SWMU No. 14 Old API Separator soil and ground water sampling. A new well OAPIS-1 (SWMU 14-2) was installed on the northwest corner where the benzene strippers were located on July 17, 2012 by Enviro-Drill Inc. A revised investigation Report for SWMU 1 and SWMU 14 was submitted to NMED in June 2014. OAPIS-1 (SWMU 14-2) was added to the 2014 Monitoring Schedule.

In February of 2013, the influent to the aeration lagoons was routed to the new Waste Water Treatment Plant (WWTP) and rerouting of the Travel Center sanitary effluent was completed in June of 2013. The aeration lagoons and pond 1 (EP-1), are no longer in service.

WELLS AT THE AERATION BASIN			
GWM-1	GWM-2	GWM-3	OAPIS-1

2.4.5 North Drainage Ditch On April 22, 2015, Gallup notified NMED-HWB of the discovery of hydrocarbons in a drainage ditch in the northern portion of the refinery property. Surface water samples were collected from the standing water in the drainage ditch and concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) were detected as well as methyl tert-butyl ether (MTBE), gasoline range organics (GRO) and diesel range organics (DRO). An investigation work plan was submitted to NMED for review on August 13, 2015 and was subsequently implemented in May 2016 with installation of well OW-56. A request to add this well to the

Facility Wide Ground Water Monitoring Work Plan has been added in Section 6 and added to Appendix B, Table 2.

3.0 Site Conditions

The Gallup Refinery is located within a rural and sparsely populated section of McKinley County. It is situated in the high desert plain on the western flank of the Continental Divide approximately 17 miles east of Gallup. The surrounding land is comprised primarily of public and private lands used for cattle and sheep grazing.[2]

3.1 Current site topography and location of natural and manmade structures

Local topography consists of a gradually inclined down-slope from high ground in the southeast to a lowland fluvial plain in the northwest. The highest point on refinery property is located at the southeast corner boundary (elevation approximately 7,040 feet) and the lowest point is located at the northwest corner boundary (elevation approximately 6,860 feet). The refinery processing facility is located on a flat man-made terrace at an elevation of approximately 6,950 feet.

3.2 Drainages

Surface water in this region consists of the man-made evaporation ponds and aeration basins located within the refinery, a livestock watering pond (Jon Myer's Pond) located east of the refinery, two small unnamed spring fed ponds located south of the refinery, and the South Fork of the Puerco River and its tributary arroyos. The various ponds and basins typically contain water consistently throughout the year. The South Fork of the Puerco River and its tributaries are intermittent and generally contain water only during, and immediately after, the occurrence of precipitation.

There are several stormwater conveyance ditches located throughout the refinery which are directed to discharge into contained basins where it is collected and recycled for use as process water; collected and allowed to evaporate; divert around regulated industrial activity or into two designated outfalls located on the east and west section of the property, identified as Outfall 001 and Outfall 002. Outfall 001 is located directly south of evaporation pond 8 on the western edge

[2] See, for example, the web site of McKinley County at http://www.co.mckinley.nm.us/

of the refinery's property boundary and equipped with four separate small diameter overflow pipelines, each with a manual flow valve for independent control. Outfall 002 is located north of the rail road loading rack on the eastern section of the facility. This outfall consists of a concrete barrier with a valve to control discharges from a deep ditch that collects/ponds the runoff from the rail rack loading area.

Directly west of the crude tank area, there is also a concrete barrier with a valve to control discharges from a culvert that carries stormwater flow from the truck loading rack area. This concrete barrier is located downstream of the "hydrocarbon seep area". The flow from this concrete barrier continues in a north-northwest direction alongside the southern bermed areas of evaporation ponds 3, 4, 5 and 6 and outward towards the Outfall 001 area. At the new waste water treatment plant, there are three storm drains located on the south, southwest and west side of the waste water treatment plant which is connected to an underground storm culvert that exits on the northwest section of STP-1 into a conveyance ditch along the northern edge of pond 2 into a holding pond equipped with manual flow valves, located north of evaporation pond 3. The discharge from this holding pond then flows north-northwest towards the Outfall 001 area.

3.3 Vegetation types

Surface vegetation consists of native xerophytic vegetation including grasses, shrubs, small junipers, and some prickly pear cacti. Average rainfall at the refinery is less than 7 inches per year, although it can vary to slightly higher levels elsewhere in the county depending on elevation.

On alluvial fans on valley sides and drainage ways, the existing vegetation is usually alkali sacaton, western wheatgrass, Indian rice grass, blue grama, bottlebrush squirreltail, broom snakeweed, fourwing saltbush, threeawn, winterfat, mat muhly and spike muhly. On fan remnants on valley sides we usually find blue grama, western wheatgrass, Indian ricegrass, big sagebrush, galleta, bottlebrush squirreltail, fourwing saltbrush, needleandthread, oneseed juniper, sand dropseed, spineless horsebrush, rabbitbrush, and twoneedle pinyon.

3.4 Erosion features

The impacts of historic overgrazing are visible at the north-side of the facility, in the form of arroyos that formed when surface run-off cut through the ground and washed away soils that were not able to hold water with their ground cover lost to overgrazing. Now that the facility is fenced and no livestock grazing occurs on the site, vegetation has recovered in these areas. With the facility helping to bring back vegetation in its undeveloped areas the formation and deepening of erosion features on its land has decreased.

3.5 Subsurface conditions

3.5.1 Soil types and associations

Most of the soils found at the surface in the locations where wells are located consist of the Gish-Mentmore complex.[3] These soils occur in alluvial fans on valley sides and fan remnants on valley sides. The parent material for these soils is slope and fan alluvium derived from sandstone and shale. These are well drained soils with moderately slow (0.2 in/hr) to slow permeability (0.06 in/hr). In this association, the Gish and similar soils make up about 45 percent, the Mentmore and similar soils 35 percent, and minor components 20 percent. These minor components are - Berryhill and similar soils 10 percent, and Anodize and similar soils 10 percent. The typical profile for these soils is – 0 to 2 inches fine sandy loam, 2 to 72 inches of various kinds of clay loam.

Drill logs for various wells have been provided electronically to the NMED-HWB. From these well logs we can infer that the soils in the subsurface are generally composed of clays starting at the immediate subsurface, interbedded with narrow sand and silt layers. At about 100 to 150 feet, layers of mudstone, sandstone (from the Chinle Group, Petrified Forest Formation) and siltstone start to appear. Figure 3 shows a generalized relationship of soils in and around the Gallup Refinery.

[3] Soil Survey of McKinley County Area, New Mexico, McKinley County and Parts of Cibola and San Juan Counties, Natural Resources Conservation Service (NRCS), US Department of Agriculture, available at - http://soildatamart.nrcs.usda.gov/Manuscripts/NM692/0/McKinley.Area%20NM.pdf

3.5.2 Stratigraphy

The 810-acre refinery property site is located on a layered geologic formation. Surface soils generally consist of fluvial and alluvial deposits; primarily clay and silt with minor inter-bedded sand layers. Below this surface layer is the Chinle Group, which consists of low permeability clay stones and siltstones. As such, the Chinle Group (Petrified Forest Formation) effectively serves as an aquiclude. Inter-bedded within the Chinle Group is the Sonsela Sandstone bed, which represents the uppermost potential aquifer in the region.

The Sonsela Sandstone bed lies within and parallels the dip of the Chinle Group. As such, its high point is located southeast of the refinery and it slopes downward to the northwest as it passes under the refinery. Due to the confinement of the Petrified Forest Formation aquitard, the Sonsela Sandstone bed acts as a water-bearing reservoir and is artesian at its lower extremis. Artesian conditions exist through much of the central and western portions of the refinery property.

3.5.3 Presence and flow direction of ground water

Ground water flow within the Petrified Forest Formation is extremely slow and typically averages less than 10^{-10} centimeters per second (less than 0.01 feet per year). Ground water flow within the surface soil layer above the Petrified Forest Formation is highly variable due to the presence of complex and irregular stratigraphy; including sand stringers, cobble beds, and dense clay layers. As such, hydraulic conductivity may range from less than 10^{-2} centimeters per second in the gravelly sands immediately overlying the Petrified Forest Formation up to 10^{-8} centimeters per second in the clay soil layers located near the surface.

Shallow ground water located under refinery property generally flows along the upper contact of the Petrified Forest Formation. The prevailing flow direction is from the southeast and toward the northwest. In the past, a subsurface ridge has been identified that was thought to deflect some flow in a northeast direction in the vicinity of the refinery tank farm. This is not clear from the present data.

4.0 Investigation Methods

The purpose of this section is to describe the types of activities that will be conducted and the methods that will be used as part of this Plan. Appendix A provides a thorough discussion on actual sampling methods that will be used.

4.1 Ground Water Sampling Methodology

All monitoring wells scheduled for sampling during a ground water sampling event will be sampled within 15 working days of the start of the monitoring and sampling event, weather permitting.

Appendix C contains the well data summary tables for 2016 which includes the annual and quarterly depth to water (DTW) and depth to bottom (DTB) measurements as well as corrected water table elevation with respect to wells that have SPH levels. Appendix C-1 and C-1.1 provides the corrected well elevation summary table for 2016 which includes date of establishment, ground elevation, top of casing elevation, well casing stick-up length, well depth, screening intervals, and stratigraphic units in which the wells are located. Appendix C-2 includes well elevation summary for all the Marketing (MKTF) wells which includes date of establishment, ground elevation, top of casing elevation, well casing stick-up length, well depth, screening intervals and stratigraphic units in which the wells are located. Appendix C-3 includes well elevations for the artesian wells also known as Process or Production wells (PW). Information provided for the artesian wells was gathered from well boring logs. These wells are encased and therefore measurement for depth to bottom was not field verified. No changes were made to Tables in C-1, C-1.1 and C-2 for 2016 as there were no new monitoring wells added to the list.

4.1.1 Well Gauging

At the beginning of each quarterly, semi-annual, or annual sampling event, all monitoring and recovery wells listed in Appendix B, Ground Water Monitoring Schedule, will be gauged to record the depth to SPH, if present, the DTW and the DTB of the well. The gauging will be performed using an oil/water interface probe attached to a measuring tape capable of recording measurements to the nearest 0.01 foot. Each monitoring well is field verified with the well number on the well casing or adjacent to the well to ensure that samples are collected at the correct well location. Wells also have a permanent marked reference point on the well casing from which ground water levels and well depths are measured.

Gauging measurements will be recorded on a field gauging form. Data obtained from the gauging will be reported in the annual ground water monitoring report. The data will be used to develop groundwater contour maps and SPH thickness isopleths which will also be included in the annual report.

4.1.2 Well Purging

Each monitoring well will be purged by removing ground water prior to sampling in order to ensure that formation water is being sampled. Generally, at least three well volumes (or a minimum of two if the well has low recharge rate) will be purged from each well prior to sampling. Field water quality measurements must stabilize for a minimum of three consecutive readings before purging will be discontinued. Field water quality measurements will include pH, electrical conductivity, temperature, and dissolved oxygen (DO) %. Field water quality measurement stability will be determined when field parameter readings stabilize to within ten percent between readings for three consecutive measurements. Once the readings are within ten percent, purging will stop and the well is ready for sample collection. The volume of ground water purged, the instruments used, and the readings obtained at each interval will be recorded on the field-monitoring log. Well purging and sampling will be performed using 1.5 inch x 3 foot and/or 3 inch x 3 foot disposable polyethylene bailers for ground water sampling and/or appropriately decontaminated portable sampling pumps.

4.2 Ground water Sample Collection

Ground water samples will be obtained from each well within 24 hours of the completion of well purging. Sample collection methods will be documented in the field monitoring reports. The samples will be transferred to the appropriate, clean, laboratory-prepared containers provided by the analytical laboratory. Sample handling and chain-of-custody (COC) procedures are described in more detail in Appendix A as well as decontamination procedures for reusable water sampling equipment.

All purged ground water and decontamination water from monitoring wells will be drained into the refinery waste water treatment system upstream of the NAPIS. The procedures for disposing materials are described in Appendix A.

Ground water samples are collected and analyzed for both total and dissolved. Ground water samples obtained for dissolved metals analysis will be filtered through disposable filters with a 0.45 micrometers mesh size.

4.2.1 Sample Handling

All sample containers are supplied by the contracted analytical laboratory and shipped to Western in sealed coolers. Chemical preservation is also provided by the laboratory through pre-preserved bottle ware. Collection of containerized ground water samples are in the order of most volatile to least volatile, such as: VOCs, SVOCs, metals, phenols, cyanide, sulfate, chloride, and nitrates. Immediately after the samples are collected, they will be stored in a cooler with ice or other appropriate storage method until they are delivered to the analytical laboratory. Standard COC procedures as detailed in Appendix A will be followed for all samples collected. All samples will be submitted to the laboratory as soon as possible to allow the laboratory to conduct the analyses within the specified method holding times. Details of the general sample handling procedures are provided in Appendix A.

The following shipping procedures will be performed during each sampling event:

- Individual sample containers will be packed to prevent breakage and transported in a sealed cooler with ice or other suitable coolant or other EPA or industry-wide accepted method. The drainage hole at the bottom of the cooler will be sealed and secured in case of sample container leakage.

- Each cooler or other container will be delivered directly to the analytical laboratory.

- Glass bottles will be separated in the shipping container by cushioning material to prevent breakage.

- Plastic containers will be protected from possible puncture during shipping using cushioning material.

- The COC form and sample request form will be shipped inside the sealed storage container to be delivered to the laboratory.

- Signed and dated COC seals will be applied to each cooler prior to transport of samples from the site.

4.3 Analytical Methods

Ground water and surface water samples collected during the monitoring events will be analyzed using the specified analytical methods and for the constituents listed in Appendix B.

4.4 Quality Assurance Procedures

Contract analytical laboratories will maintain internal quality assurance programs in accordance with EPA and industry accepted practices and procedures. At a minimum, the laboratories will use a combination of standards, blanks, surrogates, duplicates, matrix spike/matrix spike duplicates (MS/MSD), blank spike/blank spike duplicates (BS/BSD), and laboratory control samples to demonstrate analytical Quality Assurance/Quality Control (QA/QC). The laboratories will establish control limits for individual chemicals or groups of chemicals based on the long-term performance of the test methods. In addition, the laboratories will establish internal QA/QC that meets EPA's laboratory certification requirements. The specific procedures to be completed are identified in the following sections.

4.4.1 Equipment Calibration Procedures and Frequency

The laboratory's equipment calibration procedures, calibration frequency, and calibration standards will be in accordance with the EPA test methodology requirements and documented in the laboratory’s quality assurance (QA) and Standard Operating Procedures (SOP) manuals. All instruments and equipment used by the laboratory will be operated, calibrated, and maintained according to the manufacturers' guidelines and recommendations. Operation, calibration, and maintenance will be performed by personnel who have been properly trained in these procedures. A routine schedule and record of instrument calibration and maintenance will be kept on file at the laboratory.

4.4.2 Field QA/QC Samples

Field duplicates and trip blanks may be obtained for quality assurance during sampling activities. The samples will be handled as described in Section 4.4.3.

Trip blanks will accompany laboratory sample bottles and shipping and storage containers intended for VOC analyses. Trip blanks will consist of a sample of analyte free de-ionized water placed in an appropriate sample container. Trip blanks will be analyzed at a frequency of one for each shipping event involving twenty or more samples. Generally, a trip blank will only be placed in one of the containers, if more than one container is used to ship the set of samples.

4.4.3 Laboratory QA/QC Samples

Analytical procedures will be evaluated by analyzing reagent or method blanks, surrogates, MS/MSDs, BS/BSDs and/or laboratory duplicates, as appropriate for each method. The laboratory QA/QC samples and frequency of analysis to be completed will be documented in the cited EPA or other test methodologies. At a minimum, the laboratory will analyze laboratory blanks, MS/MSDs, BS/BSDs and laboratory duplicates at a frequency of one in twenty for all batch runs requiring EPA test methods and a frequency of one in ten for non-EPA test methods. Laboratory batch QA/QC samples will be project specific.

4.4.4 Laboratory Deliverables

The analytical data package will be prepared in accordance with EPA-established Level II analytical support protocol which will include:

- Transmittal letter, including information about the receipt of samples, the testing methodology performed, any deviations from the required procedures, any problems encountered in the analysis of the samples, any data quality exceptions, and any corrective actions taken by the laboratory relative to the quality of the data contained in the report;

- Sample analytical results, including sampling date; date of sample extraction or preparation; date of sample analysis; dilution factors and test method identification; water sample results in consistent units (milligrams per liter or micrograms per liter (µg/L)); and detection limits for undetected analytes. Results will be reported for all field samples, including field duplicates and blanks, submitted for analysis;
- Method blank results, including reporting limits for undetected analytes;
- Surrogate recovery results and corresponding control limits for samples and method blanks (organic analyses only);
- Laboratory duplicate results for inorganic analyses, including relative percent differences and corresponding control limits;
- Sample COC documentation;
- Holding times and conditions;
- Conformance with required analytical protocol(s);
- Instrument calibration;
- Blanks;
- Detection/quantitative limits;
- Recoveries of surrogates and/or matrix spikes (MS/MSDs);
- Variability for duplicate analyses;
- Completeness;
- Data report formats;

Data deliverables provided by the laboratory that include analysis of organic compounds will also include the following:

- A cover letter referencing the procedure used and discussing any analytical problems, deviations, and modifications, including signature from authority representative certifying to the quality and authenticity of data as reported;

- A report of sample collection, extraction, and analysis dates, including sample holding conditions,

- Tabulated results for samples in units as specified, including data qualification in conformance with EPA protocol, and definition of data descriptor codes;

- Final extract volumes (and dilutions required), sample size, wet-to-dry weight ratios, and instrument practical detection/quantitative limit for each analyte,

- Analyte concentrations with reporting units identified, including data qualification and a description of the qualifiers,
- Quantification of analytes in all blank analyses, as well as identification of method blank associated with each sample,

- Recovery assessments and a replicate sample summary, including all surrogate spike recovery data with spike levels/concentrations for each sample and all MS/MSD results (recoveries and spike amounts).

4.4.5 Review of Field and Laboratory QA/QC Data

The sample data, field, and laboratory QA/QC results will be evaluated for acceptability with respect to the data quality objectives (DQOs). Each group of samples will be compared with the DQOs and evaluated using data validation guidelines contained in EPA guidance documents: Guidance Document for the Assessment of RCRA Environmental Data Quality, National Functional Guidelines for Organic Data Review, and Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses, and the most recent version of SW-846, and industry-accepted QA/QC methods and procedures.

The laboratory will notify the Gallup Refinery Project Manager of data quality exceptions within one business day of identifying the data quality exception in order to allow for sample re-analysis, if possible. The Gallup Refinery Project Manager will contact NMED within one business day of receipt of laboratory notification of data quality exceptions in order to discuss the implementations and determine whether the data will still be considered acceptable, or if sample re-analysis or re-sampling is necessary.

4.4.6 Blanks, Field Duplicates, Reporting Limits and Holding Times

4.4.6.1 Blanks

The analytical results of field blanks and field rinsate blanks will be reviewed to evaluate the adequacy of the equipment decontamination procedures and the possibility of cross-contamination caused by decontamination of sampling equipment. The analytical results of trip blanks will be reviewed to evaluate the possibility for contamination resulting from the laboratory-prepared sample containers or the sample transport containers. The analytical results of laboratory blanks will be reviewed to evaluate the possibility of contamination caused by the analytical procedures. If contaminants are detected in field or laboratory blanks, the sample data will be qualified, as appropriate.

4.4.6.2 Field Duplicates

Field duplicates will consist of two samples either split from the same sample device or collected sequentially. Field duplicate ground water samples will be collected at a frequency of one per ten regular samples and will be analyzed for the full set of analyses used for the regular sample collected. At a minimum, one duplicate sample per sampling day must always be obtained.

4.4.6.3 Method Reporting Limits

Method reporting limits for sample analyses will be established at the lowest level practicable for the method and analyte concentrations and will not exceed ground water or surface water cleanup standards and screening levels. Detection limits that exceed established standards or screening levels and are reported as “not detected” will be considered data quality exceptions and an explanation for its acceptability for use will be provided.

4.4.6.4 Holding Times

Per EPA protocol the sampling, extraction, and analysis dates will be reviewed to confirm that extraction and analyses were completed within the recommended holding times. Appropriate data qualifiers will be noted if holding times are exceeded.

4.4.7 Representativeness and Comparability

4.4.7.1 Representativeness

Representativeness is a qualitative parameter related to the degree to which the sample data represent the relevant specific characteristics of the media sampled. Procedures will be implemented to assure representative samples are collected and analyzed, such as repeated measurements of the same parameter at the same location over several distinct sampling events. Any procedures or variations that may affect the collection or analysis of representative samples will be noted and the data will be qualified.

4.4.7.2 Comparability

Comparability is a qualitative parameter related to whether similar sample data can be compared. To assure comparability, analytical results will be reported in appropriate units for comparison with other data (past studies, comparable sites, screening levels, and cleanup standards), and standard collection and analytical procedures will be implemented. Any procedure or variation that may affect comparability will be noted and the data will be qualified.

4.4.8 Laboratory Reporting, Documentation, Data Reduction, and Corrective Action

Upon receipt of each laboratory data package, data will be evaluated against the criteria outlined in the previous sections. Any deviation from the established criteria will be noted and the data will be qualified. A full review and discussion of analytical data QA/QC and all data qualifiers will be submitted as appendices or attachments to the ground water monitoring reports. Data validation procedures for all samples will include checking the following, when appropriate:

- Holding times
- Detection limits
- Field equipment rinsate blanks
- Field blanks
- Field Duplicates
- Trip blanks
- Reagent blanks
- Laboratory duplicates
- Laboratory blanks
- Laboratory matrix spikes

- Laboratory matrix spike duplicates
- Laboratory blank spikes
- Laboratory blank spike duplicates
- Surrogate recoveries

If significant quality assurance problems are encountered, appropriate corrective action will be implemented. All corrective action will be reported and the corrected data will be qualified.

5.0 Monitoring and Sampling Program

The primary objective of ground water monitoring is to provide data which will be used to assess ground water quality at and near the facility. Ground water elevation data will also be collected to evaluate ground water flow conditions. The ground water monitoring program for the facility will consist of sample collection and analysis from a series of monitoring wells, recovery wells, outfalls, and evaporation pond locations.

The monitoring network is divided into six investigation areas (Group A, B, C, D and E) and including outfalls and evaporation pond locations. The sampling frequency, analyses and target analytes will vary for each investigation area and the combined data from these investigation areas will be used to assess ground water quality beneath and immediately down-gradient of the facility, and evaluate local ground water flow conditions.

Samples will not be collected from monitoring wells that have measurable SPH. For wells that are purged dry, samples will be collected if recharge volume is sufficient for sample collection within 24 hours. Wells not sampled due to insufficient recharge will be documented in the field log.

The following sections outline the monitoring program for each investigation area.

5.1 Group A Through Group E

5.1.1 Sampling Locations

The location of the monitoring, recovery wells and leak detection units are shown in Figure 4. The following wells will be sampled (as described in Appendix B):

GROUP A	GROUP B	GROUP C	GROUP D	GROUP E
BW-1A, B, C	GWM-1, 2, 3	OW-13, 14, 29, 30	PW-2, 3, 4	MKTF- 1 thru 45
BW-2A, B, C	NAPIS 1, 2, 3, KA-3	OW-50, 52	OW-1, 10	
BW-3A, B, C	OAPIS-1	RW-1, 2, 5, 6	OW-11, 12	
MW-1, 2, 4, 5	LDU (3)			
SMW-2, 4	STP1-NW, SW			

5.2 Evaporation Ponds, Outfalls

5.2.1 Sampling Locations

The following outfalls and ponds will be sampled (as described in Appendix B, Table 1). (Note: these outfalls are from one section of the waste water treatment system to another – they do not discharge to any location outside the facility).

OUTFALLS
STP-1 to EP-2

EVAPORATION PONDS		
Pond 1 – No longer in service	EP-5	EP-9
EP-2	EP-6	EP-11
EP-3	EP-7	EP-12A
EP-4	EP-8	EP-12B

6.0 Monitoring Program Revisions

Upon review of the analytical results from the monitoring events under this Plan, historic facility-wide monitoring data, available soil boring data, and other related information Western Refining will assess the monitoring program presented in this Plan. Revisions to the Plan, as necessary, will then be presented for agency review and approval on an annual basis. These revisions may include, but not be limited to, a reduction or change in monitoring locations, monitoring frequency, and/or target analytes listed in Appendix B, Table 1.

6.1 Modifications to Sampling Plan

1. The following are required changes to the Facility Wide Ground Water Monitoring Work Plan taken from NMED correspondence (HWB-WRG-14-006), Approval with Modifications Annual Facility Wide Ground Water Monitoring Report: Gallup Refinery 2013, dated May 18, 2006:

- Comment 1: Permittee may discontinue the analysis of uranium in ground water samples.
- Comment 3: Permittee must sample PW-4 during the next scheduled sampling event and then semi-annually thereafter in order to collect additional data.
- Comment 4: Permittee must add analysis for 1,2-Dibromoethane (EDB) in all monitoring wells where EDC has been detected. Analytical method used must be capable of detecting EDB at concentrations less than 0.004 micrograms per liter (e.g., EPA Method 8011).
- Comment 6: Permittee must sample the EP-2 inlet on a quarterly basis to monitor the level of benzene being discharged from STP-1 to EP-2.
- Comment 13: Remove statement in Section 10, Table 1 where last row reads "[a]ll wells including recovery wells,"

2. Request to add six new monitoring wells (OW-53, OW-54, OW-55, OW-56, OW-57, OW-58) installed in the third quarter of 2016 to Facility Wide Ground Water Monitoring Work Plan. All six of the wells will be added to "Group C" upon approval.

Appendix A

Gallup Field Sampling Collection and Handling Standard Procedures

Field Data Collection: Elevation and Purging

All facility monitoring wells and recovery wells are gauged as required throughout the year. Gallup does not have any recovery well pumps that need to be shut off and removed prior to water elevation measurements.

Each monitoring well is field verified with the well number on the well casing or adjacent to the well to ensure that samples are collected from the correct well location. Wells also have a permanent marked reference point on the well casing from which ground water levels and well depths are measured. The portable pump intake is lowered to the midpoint of the listed screened interval for each specific well using the markings identified on the pump hose which are set every ten feet. In wells with dedicated pumps, the pumps have been installed at the midpoint of the screened interval.

All water/product levels are measured to an accuracy of the nearest 0.01 foot using an electrical conductivity based meter, the Heron Instruments 100 ft. DipperT electric water depth tape complying with US GGG-T-106E, EEC Class II and a WaterMark Oil Water Interface Meter (100 ft.), Model 101L/SMOIL. After determining water levels, well volumes are calculated using the appropriate conversion factors for a given well based on its internal diameter. Volume is equal to the height of the liquid column times the internal cross-sectional area of the well.

Generally, at least three well volumes (or a minimum of two if the well has low recharge) are purged from each well prior to sampling. Field water quality parameters measured during purging (pH, electrical conductivity, temperature, and dissolved oxygen), must stabilize to within 10% for a minimum of three consecutive measurements before collection of ground water samples from each well.

Before sample collection can begin, the water collected from each monitoring well must be fresh aquifer water. Well evacuation replaces stagnant well water with fresh aquifer water. The water level in the well, total depth of well and thickness of floating product (if any) will be measured using the WaterMark Oil Water Interface Meter depth tape. If product is present, a ground water sample is not obtained.

If a well is pumped or bailed dry before two or three well volumes can be evacuated, it requires only that sufficient time elapse for an adequate volume of water to accumulate for the sampling event. The first sample will be tested for pH, temperature, specific conductivity and dissolved oxygen (%). The well will be retested for pH, temperature, specific conductivity and dissolved oxygen (%) after sampling as a measure of purging efficiency and as a check on the stability of the water samples over time. All well evacuation information will be recorded in a log book.

Wells MW-1, MW-2, MW-4, MW-5, BW-1C, BW-2A, BW-2B, BW-3B, SMW-4, OW-1, OW-10, OW-13, OW-14, OW-29 and OW-30 are each equipped with a dedicated electrical pump. The remaining wells are purged using a portable Grundfos pump. Recovery wells, NAPIS-1, NAPIS-2, NAPIS-3 and KA-3 are hand-bailed as well as GWM-1, GWM-2, GWM-3 and OAPIS-1 is hand-bailed if the presence of water is detected.

New wells MKTF 1 thru 45 and STP1-NW and STP1-SW are all hand-bailed if the presence of water is detected. If SPH is detected in any of these wells, no samples are collected.

Purged well water from wells is collected in fifty-five gallon drums or totes and drained to the process sewer upstream of the NAPIS. The water is treated in the refinery's waste water treatment system.

Sampling Equipment at Gallup

The following sampling equipment is maintained at Gallup and used by the sampling personnel:

- Heron Instruments 100 ft. DipperT electric water depth tape complying with US GGG-T-106E, EEC Class II.

- Pall Corporation Acro 50A 0.45 micron disposable filter used with 60 ml. disposable syringes for filtering water in the field.

- YSI pH/Conductivity meter Model 63, calibrated with a one-point, two-point, or three-point calibration procedure using pH standards of 7, 4 and 10.

- IQ Scientific Instruments, pH/Temperature/Conductivity/ Dissolved Oxygen meter, Model IQ1806LP.

- Grundfos 2-inch pumps with Grundfos 115-volt AC–to-DC converter.

- WaterMark Oil Water Interface Meter (100 ft.), Model 101L/SMOIL, S/N 01-5509

Calibration and maintenance procedures will be performed according to the manufacturer's specifications.

Order of Collection

Samples will be collected in the order listed below:

Parameter	**Bottle Type**
VOC, SVOC	40 ml VOA vials, (H_2SO_4)
TOC	1 liter glass jar, H_2SO_4
Extractable Organics	1 liter glass jar with Teflon™ cap
Metals* Total and Dissolved	500 ml, 125 ml plastic, HNO_3
Phenols, Cyanide	1 liter glass jar
Chloride, Sulfate, Nitrates	1 liter plastic, no preservative

*Pre-filtration bottle for dissolved metals which is subsequently filtered in the field and transferred to a pint plastic bottle with HNO_3 preservative.

Filtration

Ground water samples are filtered prior to dissolve metals analysis. For dissolved metals, sample water is poured into a jar and then extracted with a syringe. The syringe is then used to force the sample water through a 0.45 micron pore filter paper filter into the proper sample bottle to collect dissolved metals samples. Filtration must be performed within two hours of sample collection. Pour the filtrate into a sample bottle containing HNO3 preservative.

For samples destined for total metals analysis, do not filter the sample, and preserve with HNO3 to pH <2 in the field.

Gallup sampling personnel carry a cell phone when gathering ground water and other water samples. While sampling procedures are generally well known and the appropriate sample bottles are ordered to match each sampling event, occasional questions do arise from unforeseen circumstances which may develop during sampling. At such times, sampling personnel contact Hall Environmental Analytical Laboratory to verify that sampling is correctly performed.

Sample Handling Procedures

At a minimum, the following procedures will be used when collecting samples:

- Neoprene, nitrile, or other protective gloves will be worn when collecting samples. New disposable gloves will be used to collect each sample.
- All samples collected for chemical analysis will be transferred into clean sample containers supplied by the analytical laboratory. The sample container will be clearly marked. Sample container volumes and preservation methods will be in accordance with the most recent standard EPA and industry accepted practices for use by accredited analytical laboratories. Sufficient sample volume will be obtained for the laboratory to complete the method-specific QC analyses on a laboratory-batch basis.
- Sample labels and documentation will be completed for each sample.

Immediately after the samples are collected, they will be stored in a cooler with ice or other appropriate storage method until they are delivered to the analytical laboratory. Standard chain-of-custody procedures, as described in Section 4.2.1 of this Plan, will be followed for all samples collected. All samples will be submitted to the laboratory to allow the laboratory to conduct the analyses within the method holding times.

General Well Sampling Procedures

For safety protection and sampling purity, rubber gloves or disposable nitrile gloves are worn and changed between each activity.

Prepare for sampling event by making out sample bottle labels and have bottles separated into plastic bags for each well to be sampled and placed in an ice chest ready to take into the field. Bring along a note book and sample log. Document weather conditions, sample date and time. Fill in label with location, date, time, analysis, preservative, and your name. Start sampling by adjusting converter speed for each well. Affix sample label and fill bottle according to lab instructions. For samples intended for VOC analysis, use bottles with septa lids, fill bottle to neck and add final amount of water with cap to form meniscus. Turn bottles upside down to examine for bubbles, if bubbles are detected in the vial, repeat collection procedure. If no bubbles show, secure lids and pack in bubble wrap and place in cooler until sampling is completed.

Decontaminate equipment that is not dedicated for use in a particular well. Refrigerate completed samples until shipping to lab. Be sure to check holding times and arrange for appropriate shipping method. Be sure that the field effort is adequately staffed and equipped. Check QC requirements before departing—QC samples require additional equipment and supplies.

Surface Water Sample Collection

At the evaporation ponds, samples will be collected as a grab sample at the pond edge near the inlets. This location will be noted in the field notebooks. The sampler will avoid disturbing sediment and gently allow the sample container to fill making sure that undue disturbance does not allow volatile contaminants to be lost. The sample bottle will be used for the sample collection in a shallow location near the bank. If a separate bottle and/or bailer are used to refill the sample container, this will be duly noted in the field log books. The decision to use a separate bottle/bailer will be made, if at all, by the sampler and the reasons for doing so will be noted in the field log book.

Upon arrival at the field site, the sampler will set out safety equipment such as traffic cones and signs (if required). The vehicle will be parked a sufficient distance away so as to prevent sample contamination from emissions. Appropriate sample containers and gloves must be used for the type of analyses to be performed.

Decontamination Procedures

The objective of the decontamination procedures is to minimize the potential for cross-contamination

The majority of field equipment used for ground water sampling will be disposable and, therefore, not require decontamination. In order to prevent cross-contamination, field equipment that comes into contact with water or soil will be decontaminated between each sampling location. The decontamination procedure will consist of washing the equipment with a non-phosphate detergent solution (examples include Fantastik™, Liqui-Nox®), followed by two rinses of distilled water and air dried.

Decontamination water and rinsate will be contained and disposed of the same way as purge water, as described in Section 4.2. Decontamination procedures and the cleaning agents used will be documented in the daily field log.

Field Equipment Calibration Procedures

Field equipment requiring calibration will be calibrated to known standards, in accordance with the manufacturers' recommended schedules and procedures. Calibration checks will be conducted daily and the instruments will be recalibrated if necessary. Calibration measurements will be recorded in the daily field logs.

If field equipment becomes inoperable, its use will be discontinued until the necessary repairs are made. A properly calibrated replacement instrument will be used in the interim. Instrumentation used during sampling events will be recorded in the daily field logs.

Collection and Management of Investigation Derived Waste

Investigation derived waste (IDW) generated during each groundwater sampling event may include purge water, decontamination water, excess sample material, and disposable sampling equipment. All water from all wells generated during sampling and decontamination activities will be temporarily stored in labeled 55-gallon drums until placed in the refinery wastewater treatment system upstream of the API separator. All other solid waste generated during sampling activities (including sampling gloves, tubing, etc) will be disposed of with the Refinery's general municipal waste.

Documentation of Field Activities

Daily field activities, including observations and field procedures, will be recorded using indelible ink on field sampling forms. The original field forms will be maintained at Gallup Refinery. Completed forms will be maintained in a bound and sequentially numbered field file for reference during field activities. The daily record of field activities will include the following information:

- Well ID/ Evaporation pond location/ Outfall
- Date
- Start and finish sampling time
- Field team members, including visitors
- Weather conditions
- Daily activities and times conducted
- Observations
- Record of samples collected with sample designations
- Photo log (if needed)
- Field monitoring data, including health and safety monitoring (if needed)
- Equipment used and calibration records, if appropriate
- List of additional data sheets and maps completed
- An inventory of the waste generated and the method of storage or disposal
- Signature of personnel completing the field record

Sample Custody

All samples collected for analysis will be recorded in the field report or data sheets. Chain-of-custody forms will be completed at the end of each sampling day, prior to the transfer of samples off site, and will accompany the samples during shipment to the laboratory. A signed and dated custody seal will be affixed to the lid of the shipping container. Upon receipt of the samples at the laboratory, the custody seals will be broken, the chain-of-custody form will be signed as received by the laboratory, and the conditions of the samples will be recorded on the form. The original chain-of-custody form will remain with the laboratory. Gallup Refinery will maintain copies of all chain-of-custody forms generated as part of sampling activities. Copies of the chain-of-custody records will be included with all draft and final laboratory reports submitted to NMED and OCD.

APPENDIX B

APPENDIX B - TABLE 1 – Revised 4-2016

Table 1: Gallup Refinery - Ground Water Monitoring Schedule

Sampling Location ID	Sampling Frequency Q-Quarterly SA-Semi-Annual A – Annual	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite [7]
NAPI Secondary Containment (3 units)	Q	NA	NA	BTEX+MTBE, GRO/DRO extended, WQCC Metals or check for fluids
RW-1	Q	X	NA	Measure DTW, DTP (Hydrocarbon recovery). Sample for BTEX, MTBE, GRO/DRO extended if no SPH is detected.
RW-2	Q	X	NA	Same as RW-1
RW-5	Q	X	NA	Same as RW-1
RW-6	Q	X	NA	Same as RW-1
OW-1	Q –Check for artesian flow conditions	X	pH , EC, DO, ORP, Temp, TDS	Visual check for artesian flow conditions: Sample for major cations/anions, WQCC Metals, VOCS, GRO/DRO extended, with addition of EPA Method 8011 for 1,2-Dibromethane
OW-10	Q – Check for artesian flow conditions	X	pH , EC, DO, ORP, Temp, TDS	Same as OW-1
OW-13	Q	X	pH , EC, DO, ORP, Temp, TDS	VOCS, WQCC Metals, GRO/DRO extended
OW-14 [5]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as OW-13, with addition of EPA Method 8011 for 1,2-dibromethane
OW-29 [5]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as OW-13, with addition of EPA Method 8011 for 1,2-dibromethane
OW-30 [5]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as OW-13, with addition of EPA Method 8011 for 1,2-dibromethane
GWM-1	Q	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, GRO/DRO extended, WQCC Metals
GWM-2	Q – Check for Water	X	NA	Check for Water - if water is detected report to OCD & NMED within 24 hours. Sample for GRO/DRO extended, major cations/anions, VOCS.
GWM-3	Q – Check for Water	X	NA	Check for Water - if water is detected report to OCD & NMED within 24 hours. Sample for GRO/DRO extended, major cations/anions, VOCS.
NAPIS-1 [1]	Q	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, BTEX+MTBE, SVOCS, GRO/DRO EXTENDED. WQCC Metals
NAPIS-2 [1]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as Napis-1
NAPIS-3 [1]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as Napis-1
KA- 3 [1]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as Napis-1
OAPIS-1	Q	X	pH , EC, DO, ORP, Temp, TDS	VOCS, SVOCS, GRO/DRO EXTENDED, WQCC Metals, Major cations/anions, Cyanide
STP1-NW	Q	X	NA	Major cations/anions, VOCS, GRO/DRO extended, WQCC Metals
STP1-SW	Q	X	NA	Major cations/anions, VOCS, GRO/DRO extended, WQCC Metals
STP-1 TO EP-2 (EP-2 INLET) [3]	Q	NA	NA	VOCS, GRO/DRO extended, BOD, COD, TDS
Boiler Water & Cooling Tower Blow down inlet to EP-2	SA		pH , EC, DO, ORP, Temp, TDS	Major Cations/Anions – NO LONGER IN SERVICE
PW-4 [4]	SA	NA		VOCS, SVOCS, WQCC Metals, Cyanide, Nitrates
Pond 1 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	NO LONGER IN SERVICE
Evaporation Pond 2 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	General Chemistry, VOCS, SVOCS, BOD, COD, E-Coli Bacteria, WQCC Metals
Evaporation Pond 3 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 4 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 5 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 6 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2

APPENDIX B - TABLE 1 (Continued)

Sampling Location ID	Sampling Frequency Q-Quarterly SA-Semi-Annual A – Annual	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite
Evaporation Pond 7 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 8 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 9 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 11 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 12A [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 12B [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Any temporary Pond containing fluid	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
BW-1A	A	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, WQCC METALS, GRO/DRO extended
BW-1B	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-1C	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-2A	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-2B	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-2C	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-3A	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-3B	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-3C	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
MW-1	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS,SVOCS, GRO/DRO extended, WQCC Metals, Cyanide
MW-2	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH , EC, DO, ORP, Temp, TDS	Same as MW-1
MW-4	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH , EC, DO, ORP, Temp, TDS	Same as MW-1
MW-5	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH , EC, DO, ORP, Temp, TDS	Same as MW-1
OW-11	A	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, WQCC Metals, GRO/DRO extended
OW-12	A	X	pH , EC, DO, ORP, Temp, TDS	VOCS, WQCC Metals, GRO/DRO extended
OW-50	A	X	pH , EC, DO, ORP, Temp, TDS	VOCS, GRO/DRO Extended, WQCC METALS, GEN CHEM
OW-52	A	X	pH , EC, DO, ORP, Temp, TDS	VOCS, GRO/DRO Extended, WQCC METALS, GEN CHEM
SMW-2	A	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, GRO/DRO extended, WQCC Metals, Cyanide, SVOCS
SMW-4	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, SVOCS, GRO/DRO extended, WQCC Metals, Cyanide
PW-3	A	X	pH , EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, Cyanide, Nitrates
PW-2	Every 3 years beginning 2008	X	pH , EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, Cyanide, Nitrates
MKTF-01	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	VOC, SVOCS, WQCC Metals, GRO/DRO extended, Major cations/anions. Ground water samples will not be collected if SPH is present in any of these wells.
MKTF-02 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-03	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-04	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-05	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-06	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01

APPENDIX B - TABLE 1 (Continued)

Sampling Location ID	Sampling Frequency Q-Quarterly SA-Semi-Annual A – Annual	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite
MKTF-07	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-08	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-09	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-10	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-11	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-12	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-13	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-14	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-15	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-16	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-17	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-18	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-19	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-20	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-21	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-22	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-23	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-24 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-25 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-26 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-27	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-28	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-29	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-30 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-31 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-32 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-33	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-34	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-35 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-36 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-37 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-38	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-39	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-40	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-41 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-42	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-43	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-44	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-45	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01

APPENDIX B - TABLE 1 (Continued)

DEFINITIONS:

DO – Dissolved Oxygen	DTW – Depth to Water	MW – Monitor Well	VOCS – Volatile Organic Compounds – EPA Method 8260 (include MTBE)	BTEX – Benzene, Toluene, Ethylbenzene, Xylene, plus Methyl Tert Butyl Ether (MTBE) Method 8012 plus MTBE
ORP – Oxygen Reduction Potential	DTP – Depth to Product	OW – Observation Well	SVOCS – Semi-Volatile Organic Compounds – EPA Method 8270, (include phenol)	General Chemistry – pH, Specific Conductance, Cations, Anions
TEMP – Temperature	DTB – Depth to Bottom	RW – Recovery Well	DRO – Diesel Range Organics – EPA Method 8015D or as modified	WQCC Metals – includes RCRA 8 Metals (must include total and dissolved)
EC – Electrical or Specific Conductivity	EP – Evaporation Pond	PW – Raw Water Production Well	GRO – Gasoline Range Organics – EPA Method 8015D or as modified	NA – Not Applicable
TDS – Total Dissolved Solids	BW – Boundary Well	MKTF – Marketing Tank Farm Well	MRO – Motor Oil Range Organics – EPA Method 8015D or as modified	

NOTES:

1	NAPIS 1, NAPIS 2, NAPIS 3: Detection of product during quarterly monitoring must comply with Section II.F.2 (twenty-four hour reporting) of NMED Post-Closure Care Permit
2	Sample using the State of New Mexico approved analytical methods as required by 20.6.4.14 NMAC, as amended through February 16, 2006 (use methods 9221-E and 9221-F, until EPA approves 40 CFR 136 Methods, (Colilert, Colilert – 18, m-Coliblue24, membrane filter method)). Parameters are subject to change. Evaporation Pond samples must be collected at the inlet where waste water flows into the evaporation ponds
3	STP-1 to EP-2: Changed to quarterly per NMED correspondence dated 5/18/16 (HWB-WRG-14-006)
4	PW-4: Changed sampling frequency to semi-annual per NMED correspondence.
5	Addition of EPA Method 8011 for 1,2-dibromethane analysis per NMED correspondence dated 5/18/16 (HWB-WRG-14-006) in all wells where EDC was detected. Method capable of detecting EDB at concentrations less than 0.004 micrograms Per liter (Method 8011).
6	Included water quality parameters for MKTF wells.
7	Discontinue analysis for Uranium - NMED correspondence dated 5/18/16 (HWB-WRG-006).

APPENDIX B - Table 2

Table 2: Requested/Approved Changes to the Ground Water Monitoring Schedule

Sampling Location ID	Sampling Frequency (Q - Quarterly, A - Annual SA - Semi-Annual)	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite [4]	2016 Requested Changes	NMED Response
NAPI Secondary Containment (3 units)	Q	NA	NA	BTEX+MTBE, GRO/DRO extended, WQCC Metals or check for fluids	[4] Discontinue analysis for uranium in all wells	NMED Directive 5/18/2016
RW-1	Q	X	NA	Measure DTW, DTP (Hydrocarbon recovery) Sample if no SPH is detected for BTEX + MTBE, DRO/GRO.	None	
RW-2	Q	X	NA	Same as RW-1	None	
RW-5	Q	X	NA	Same as RW-1	None	
RW-6	Q	X	NA	Same as RW-1	None	
OW-1	Q – Check for artesian flow conditions	X	pH , EC, DO, ORP, Temp, TDS	Visual check for artesian flow conditions: Sample for major cations/anions, WQCC Metals, VOC, SVOC, GRO/DRO/MRO, TDS	Add EPA Method 8011 [3]	NMED Directive 5/18/2016
OW-10	Q – Check for artesian flow conditions	X	pH , EC, DO, ORP, Temp, TDS	Same as OW-1	Add EPA Method 8011 [3]	NMED Directive 5/18/2016
OW-13	Q	X	pH , EC, DO, ORP, Temp, TDS	VOC, WQCC Metals, GRO/DRO/MRO	None	None
OW-14	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as OW-13	Add EPA Method 8011 [3]	NMED Directive 5/18/2016
OW-29	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as OW-13	Add EPA Method 8011 [3]	NMED Directive 5/18/2016
OW-30	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as OW-13	Add EPA Method 8011 [3]	NMED Directive 5/18/2016
GWM-1	Q	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOC, GRO/DRO/MRO, WQCC Metals	None	
GWM-2	Q – Check for Water	X	NA	Check for Water - if water is detected report to OCD & NMED within 24 hours. Sample for GRO/DRO/MRO, major cations/anions, 8260B	None	
GWM-3	Q – Check for Water	X	NA	Same as GWM-2	None	
NAPIS-1 [1]	Q	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, BTEX+MTBE, SVOC, GRO/DRO/MRO, WQCC Metals	None	
NAPIS-2 [1]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as Napis-1	None	
NAPIS-3 [1]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as Napis-1	None	
KA-3 [1]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as Napis-1	None	
OAPIS-1	Q	X	pH , EC, DO, ORP, Temp, TDS	Major Cations/anions, VOC, SVOC, GRO/DRO/MRO, WQCC Metals, Cyanide	None	
STP1-NW	Q	X	NA	Major cations/anions, VOCS, SVOCS, GRO/DRO/MRO, WQCC Metals	None	
STP1-SW	Q	X	NA	Same as STP1-NW	None	
Boiler Water & Cooling Tower Blow down inlet to EP-2	SA	NA	pH , EC, DO, ORP, Temp, TDS	Major Cations/Anions	NO LONGER IN SERVICE	
Pond 1 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	NO LONGER IN SERVICE	NO LONGER IN SERVICE	
Evaporation Pond 2 - 9 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	General Chemistry, VOC, SVOC, BOD, COD, E-Coli Bacteria, WQCC Metals	None	
Evaporation Pond 11 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2	None	
Evaporation Pond 12a [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2	None	
Evaporation Pond 12b [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2	None	
Any temporary Pond containing fluid	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2	None	
STP-1 TO EP-2 (EP-2 Inlet)	A	NA	NA	VOC, GRO/DRO/MRO, BOD, COD, TDS	Changed to Quarterly	NMED Directive 5/18/2016
BW-1A	A	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOC, WQCC METALS, GRO/DRO/MRO	None	
BW-1B	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A	None	

APPENDIX B - Table 2 (Continued)

Sampling Location ID	Sampling Frequency (Q - Quarterly A - Annual SA - Semi-Annual)	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite [4]	2016 Requested Changes	NMED Response
BW-1C	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-2A	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-2B	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-2C	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-3A	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-3B	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-3C	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
MW-1	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOC, SVOCs, GRO/DRO/MRO, WQCC Metals, Cyanide	None	
MW-2	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH , EC, DO, ORP, Temp, TDS	Same as MW-1	None	
MW-4	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH , EC, DO, ORP, Temp, TDS	Same as MW-1	None	
MW-5	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH , EC, DO, ORP, Temp, TDS	Same as MW-1	None	
OW-11	A	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, WQCC Metals, GRO/DRO/MRO	None	
OW-12	A	X	pH , EC, DO, ORP, Temp, TDS	VOCS, GEN CHEM, WQCC METALS, GRO/DRO/MRO	None	
OW-50	A	X	pH , EC, DO, ORP, Temp, TDS	VOCS, GRO/DRO EXTENDED, WQCC METALS, GEN CHEM	None	
OW-52	A	X	pH , EC, DO, ORP, Temp, TDS	Same as OW-50	None	
SMW-2	A	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, SVOCS, GRO/DRO extended, WQCC Metals,	None	
SMW-4	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, SVOCS, GRO/DRO extended, WQCC Metals, Cyanide	None	
PW-3	A	X	pH , EC, DO, ORP, Temp, TDS	VOC, SVOC, WQCC Metals, Cyanide, Nitrates	None	
PW-2	Every 3 years starting in 2008	X	pH , EC, DO, ORP, Temp, TDS	VOC, SVOC, WQCC Metals, Cyanide, Nitrates	None	None
PW-4	Every 3 years starting in 2007	X	pH , EC, DO, ORP, Temp, TDS	VOC, SVOC, WQCC Metals, Cyanide, Nitrates	Changed to Semi-Annual	NMED directive 5/18/2016
MKTF-01	Q	X	pH , EC, DO, ORP, Temp, TDS	Major Cations/anions, VOC, SVOC, WQCC Metals, GRO/DRO extended. Ground water samples will not be collected if SPH is present in any of these wells.	None	
MKTF-02	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane	Add EPA Method 8011 [3]	NMED directive 4/26/16
MKTF-03	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-04	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-05	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-06	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01 [2]	None	
MKTF-07	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-08	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-09	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-10	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-11	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-12	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-13	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-14	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-15	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-16	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	

APPENDIX B - Table 2 (Continued)

Sampling Location ID	Sampling Frequency (Q - Quarterly A - Annual SA - Semi-Annual)	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite [4]	2016 Requested Changes	NMED Response
MKTF-17	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-18	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-19	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-20	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-21	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-22	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-23	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-24	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-02	Add EPA Method 8011 [3]	NMED directive 4/26/16
MKTF-25	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-02	Add EPA Method 8011 [3]	NMED directive 4/26/16
MKTF-26	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-02	Add EPA Method 8011 [3]	NMED directive 4/26/16
MKTF-27	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-28	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-29	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-30	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-02	Add EPA Method 8011 [3]	NMED directive 4/26/16
MKTF-31	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-02	Add EPA Method 8011 [3]	NMED directive 4/26/16
MKTF-32	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-02	Add EPA Method 8011 [3]	NMED directive 4/26/16
MKTF-33	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-34	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-35	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-02	Add EPA Method 8011 [3]	NMED directive 4/26/16
MKTF-36	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-02	Add EPA Method 8011 [3]	NMED directive 4/26/16
MKTF-37	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-02	Add EPA Method 8011 [3]	NMED directive 4/26/16
MKTF-38	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-39	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-40	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-41	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-02	Add EPA Method 8011 [3]	NMED directive 4/26/16
MKTF-42	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-43	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-44	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-45	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
OW-53	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCs, SVOCs, DRO/GRO extended, WQCC Metals, Anions	Add to monitoring schedule	Investigation Work Plan OW-29/30
OW-54	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-53	Add to monitoring schedule	Investigation Work Plan OW-29/30
OW-55	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-53	Add to monitoring schedule	Investigation Work Plan OW-29/30
OW-56	SA	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-53	Add to monitoring schedule	Investigation Work Plan North Drainage Ditch
OW-57	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-53	Add to monitoring schedule	Investigation Work Plan OW-29/30
OW-58	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-53	Add to monitoring schedule	Investigation Work Plan OW-29/30

DEFINITIONS:

DO – Dissolved Oxygen	DTW – Depth to Water	MW – Monitor Well	VOCS – Volatile Organic Compounds – EPA Method 8260 (include MTBE)	BTEX – Benzene, Toluene, Ethylbenzene, Xylene, plus Methyl Tert Butyl Ether (MTBE) Method 8012 plus MTBE
ORP – Oxygen Reduction Potential	DTP – Depth to Product	OW – Observation Well	SVOCS – Semi-Volatile Organic Compounds – EPA Method 8270, (include phenol)	General Chemistry – pH, Specific Conductance, Cations, Anions
TEMP – Temperature	DTB – Depth to Bottom	RW – Recovery Well	DRO – Diesel Range Organics – EPA Method 8015D or as modified	WQCC Metals – includes RCRA 8 Metals (must include total and dissolved)
EC – Electrical or Specific Conductivity	EP – Evaporation Pond	PW – Raw Water Production Well	GRO – Gasoline Range Organics – EPA Method 8015D or as modified	NA – Not Applicable [3]
TDS – Total Dissolved Solids	BW – Boundary Well	MKTF – Marketing Tank Farm Well	MRO – Motor Oil Range Organics – EPA Method 8015D or as modified	

NOTES:

1	NAPIS 1, NAPIS 2, NAPIS 3: Detection of product during quarterly monitoring must comply with Section II.F.2 (twenty-four hour reporting) of NMED Post-Closure Care Permit
2	Sample using the State of New Mexico approved analytical methods as required by 20.6.4.14 NMAC, as amended through February 16, 2006 (use methods 9221-E and 9221-F, until EPA approves 40 CFR 136 Methods, (Colilert, Colilert – 18, m-Coliblue24, membrane filter method)). Parameters are subject to change. Evaporation Pond samples must be collected at the inlet where waste water flows into the evaporation ponds
3	Addition of EPA Method 8011 for 1,2-dibromethane analysis per NMED correspondence dated 5/18/16 (HWB-WRG-14-006) in all wells where EDC was detected. Method capable of detecting EDB at concentrations less than 0.004 micrograms Per liter (Method 8011).
4	Discontinue analysis for uranium - NMED correspondence dated 5/18/16 (HWB-WRG-006).

APPENDIX C

APPENDIX C-1 - Ground Water Measurements

WELL DATA 2016 ANNUAL/QUARTERLY SAMPLING
DTB/DTW MEASUREMENTS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Survey [1] Ground Level Elevations (ft)	Survey [1] Well Casing Rim Elevations (ft)	Survey [1] Ground Elevation Inside Steel Sleeve (ft)	Stick-up length (ft)	Survey [1] Well Casing Bottom Elevations (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH [2] Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation [3] (ft)	Corrected Water Table [4] Elevation (factor 0.8) (ft)	Screened Interval Depth Top to Bottom (ft)	2012 Stratigraphic unit in which screen exists
11/10/2003	BW-1A [5]	9/8/2016	2.00	6,883.17	6,885.12	6,884.93	1.95	6,847.50	37.62	N/A	N/A	DRY	DRY	N/A	30 - 35	Upper Sand
10/28/2003	BW-1B [5]	9/8/2016	2.00	6,883.17	6,885.78	6,885.72	2.61	6,818.33	67.45	N/A	N/A	DRY	DRY	N/A	54.6 - 64.6	Chinle/Alluvium Interface
11/10/2003	BW-1C [5]	9/8/2016	2.00	6,883.17	6,885.68	6,885.64	2.51	6,749.29	136.39	N/A	N/A	12.55	6,873.13	N/A	125 -135	Sonsela
11/10/2003	BW-2A	9/8/2016	2.00	6,871.88	6,874.69	6,870.45	2.81	6,807.12	67.57	N/A	N/A	32.29	6,842.40	N/A	55 - 65	Upper Sand
10/28/2003	BW-2B	9/8/2016	2.00	6,871.66	6,874.50	6,870.06	2.84	6,782.24	92.26	N/A	N/A	27.84	6,846.66	N/A	80 - 90	Chinle/Alluvium Interface
10/28/2003	BW-2C	9/8/2016	2.00	6,872.90	6,875.30	6,872.02	2.40	6,722.46	152.84	N/A	N/A	20.63	6,854.67	N/A	139.5 - 149.5	Sonsela
6/15/2004	BW-3A	9/8/2016	2.00	6,875.94	6,878.39	6,875.08	2.45	6,826.04	52.35	N/A	N/A	DRY	DRY	N/A	39.5 - 49.5	Upper Sand
10/15/2003	BW-3B	9/8/2016	2.00	6,876.16	6,878.59	6,875.41	2.43	6,809.19	69.40	N/A	N/A	33.42	6,845.17	N/A	63 - 73	Chinle/Alluvium Interface
7/20/2004	BW-3C	9/8/2016	2.00	6,875.72	6,877.95	6,875.27	2.23	6,723.40	154.55	N/A	N/A	8.30	6,869.65	N/A	144.5 - 154.5	Sonsela
9/25/1981	OW-11	9/9/2016	4.00	6,922.05	6,923.51	6,921.80	1.46	6,857.72	65.79	N/A	N/A	18.79	6,904.72	N/A	43 - 65	Sonsela
12/15/1980	OW-12	9/8/2016	4.00	6,939.57	6,940.69	6,939.04	1.12	6,811.84	128.85	N/A	N/A	47.23	6,893.46	N/A	117.8 - 137.8	Sonsela
10/14/1981	MW-1	9/7/2016	5.00	6,876.63	6,878.12	6,876.79	1.49	6,747.29	130.83	N/A	N/A	7.01	6,871.11	N/A	117.72 - 127.72	Sonsela
10/15/1981	MW-2	9/7/2016	5.00	6,878.39	6,880.30	6,878.41	1.91	6,742.82	137.48	N/A	N/A	14.10	6,866.20	N/A	112 - 122	Sonsela
10/16/1981	MW-4	9/7/2016	5.00	6,879.89	6,881.63	6,879.34	1.74	6,759.91	121.72	N/A	N/A	7.38	6,874.25	N/A	101 - 121	Sonsela
7/21/1986	MW-5	9/7/2016	4.00	6,880.20	6,882.83	6,881.77	2.63	6,752.00	130.83	N/A	N/A	13.50	6,869.33	N/A	115 - 125	Sonsela
9/26/1985	SMW-2	9/9/2016	2.00	6,881.63	6,883.97	6,879.07	2.34	6,831.17	52.80	N/A	N/A	24.84	6,859.13	N/A	34.31 - 54.31	Chinle/Alluvium and Upper Sand
9/25/1985	SMW-4	9/6/2016	2.00	6,877.63	6,879.52	6,875.72	1.89	6,809.84	69.68	N/A	N/A	29.00	6,850.52	N/A	51.7 - 71.7	Chinle/Alluvium Interface
10/5/2009	OW-50	9/9/2016	2.00	6,912.63	6,914.21	6,911.46	1.58	6,850.21	64.00	N/A	N/A	16.19	6,898.02	N/A	48 - 63	Chinle/Alluvium Interface
10/5/2009	OW-52	9/9/2016	2.00	6,906.53	6,907.68	6,905.31	1.15	6,829.94	77.74	N/A	N/A	15.28	6,892.40	N/A	64 - 79	Chinle/Alluvium Interface
1/5/1981	OW-1*	3/3/2016	4.00	6,866.32	6,866.62	6,866.44	0.30	6,772.07	94.55	N/A	N/A	0.00	6,866.62	N/A	89.3 - 99.3	Sonsela
		6/6/2016	4.00	6,866.32	6,866.62	6,866.44	0.30	6,772.07	94.55	N/A	N/A	0.00	6,866.62	N/A	89.3 - 99.3	Sonsela
		9/6/2016	4.00	6,866.32	6,866.62	6,866.44	0.30	6,772.07	94.55	N/A	N/A	0.00	6,866.62	N/A	89.3 - 99.3	Sonsela
		11/15/2016	4.00	6,866.32	6,866.62	6,866.44	0.30	6,772.07	94.55	N/A	N/A	1.72	6,864.90	N/A	89.3 - 99.3	Sonsela
11/25/1980	OW-10*	3/3/2016	4.00	6,873.67	6,874.91	6,872.59	1.24	6,814.58	60.33	N/A	N/A	1.42	6,873.49	N/A	40 - 60	Sonslea
		6/6/2016	4.00	6,873.67	6,874.91	6,872.59	1.24	6,814.58	60.33	N/A	N/A	1.22	6,873.69	N/A	40 - 60	Sonsela
		9/6/2016	4.00	6,873.67	6,874.91	6,872.59	1.24	6,814.58	60.33	N/A	N/A	1.70	6,873.21	N/A	40 - 60	Sonsela
		11/15/2016	4.00	6,873.67	6,874.91	6,872.59	1.24	6,814.58	60.33	N/A	N/A	0.54	6,874.37	N/A	40 - 60	Sonsela
12/10/1980	OW-13	3/4/2016	4.00	6,918.95	6,920.07	6,915.33	1.12	6,820.92	99.15	N/A	N/A	21.43	6,898.64	N/A	78.2 - 98.2	Sonsela
		6/6/2016	4.00	6,918.95	6,920.07	6,915.33	1.12	6,820.92	99.15	N/A	N/A	21.45	6,898.62	N/A	78.2 - 98.2	Sonsela
		8/31/2016	4.00	6,918.95	6,920.07	6,915.33	1.12	6,820.92	99.15	N/A	N/A	21.94	6,898.13	N/A	78.2 - 98.2	Sonsela
		11/15/2016	4.00	6,918.95	6,920.07	6,915.33	1.12	6,820.92	99.15	N/A	N/A	21.68	6,898.39	N/A	78.2 - 98.2	Sonsela
12/17/1980	OW-14	3/4/2016	4.00	6,924.55	6,926.65	6,924.40	2.10	6,880.13	46.52	N/A	N/A	23.20	6,903.45	N/A	35 - 45	Chinle/Alluvium Interface
		6/6/2016	4.00	6,924.55	6,926.65	6,924.40	2.10	6,880.13	46.52	N/A	N/A	23.18	6,903.47	N/A	35 - 45	Chinle/Alluvium Interface
		8/31/2016	4.00	6,924.55	6,926.65	6,924.40	2.10	6,880.13	46.52	N/A	N/A	23.50	6,903.15	N/A	35 - 45	Chinle/Alluvium Interface
		11/15/2016	4.00	6,924.55	6,926.65	6,924.40	2.10	6,880.13	46.52	N/A	N/A	23.28	6,903.37	N/A	35 - 45	Chinle/Alluvium Interface

APPENDIX C-1 - Ground Water Measurements

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Survey [1] Ground Level Elevations (ft)	Survey [1] Well Casing Rim Elevations (ft)	Survey [1] Ground Elevation Inside Steel Sleeve (ft)	Stick-up length (ft)	Survey [1] Well Casing Bottom Elevations (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH [2] Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation [3] (ft)	Corrected Water Table [4] Elevation (factor 0.8) (ft)	Screened Interval Depth Top to Bottom (ft)	2012 Stratigraphic unit in which screen exists
8/23/1996	OW-29	3/4/2016	4.00	6,913.89	6,917.00	6,912.09	3.11	6,865.92	51.08	N/A	N/A	18.15	6,898.85	N/A	37.5 - 47.5	Chinle/Alluvium Interface
		6/6/2016	4.00	6,913.89	6,917.00	6,912.09	3.11	6,865.92	51.08	N/A	N/A	18.16	6,898.84	N/A	37.5 - 47.5	Chinle/Alluvium Interface
		8/31/2016	4.00	6,913.89	6,917.00	6,912.09	3.11	6,865.92	51.08	N/A	N/A	18.60	6,898.40	N/A	37.5 - 47.5	Chinle/Alluvium Interface
		11/15/2016	4.00	6,913.89	6,917.00	6,912.09	3.11	6,865.92	51.08	N/A	N/A	18.23	6,898.77	N/A	37.5 - 47.5	Chinle/Alluvium Interface
8/28/1996	OW-30	3/8/2016	4.00	6,921.81	6,924.69	6,919.84	2.88	6,874.79	49.90	N/A	N/A	22.55	6,902.14	N/A	37.9 - 47.9	Chinle/Alluvium Interface
		6/6/2016	4.00	6,921.81	6,924.69	6,919.84	2.88	6,874.79	49.90	N/A	N/A	22.64	6,902.05	N/A	37.9 - 47.9	Chinle/Alluvium Interface
		8/31/2016	4.00	6,921.81	6,924.69	6,919.84	2.88	6,874.79	49.90	N/A	N/A	23.30	6,901.39	N/A	37.9 - 47.9	Chinle/Alluvium Interface
		11/14/2016	4.00	6,921.81	6,924.69	6,919.84	2.88	6,874.79	49.90	N/A	N/A	22.75	6,901.94	N/A	37.9 - 47.9	Chinle/Alluvium Interface
7/8/2004	GWM-1	3/1/2016	2.00	6,910.22	6,912.61	6,908.36	2.39	6,886.41	26.20	22.84	0.04	22.88	6,889.73	6889.762	17.5 - 23.5	Chinle/Alluvium Interface
		6/7/2016	2.00	6,910.22	6,912.61	6,908.36	2.39	6,886.41	26.20	21.36	0.03	21.39	6,891.22	6891.244	17.5 - 23.5	Chinle/Alluvium Interface
		9/13/2016	2.00	6,910.22	6,912.61	6,908.36	2.39	6,886.41	26.20	21.29	N/A	N/A	N/A	N/A	17.5 - 23.5	Chinle/Alluvium Interface
		11/14/2016	2.00	6,910.22	6,912.61	6,908.36	2.39	6,886.41	26.20	21.50	0.02	21.52	6,891.09	6891.106	17.5 - 23.5	Chinle/Alluvium Interface
9/25/2005	GWM-2	3/1/2016	2.00	6,910.32	6,913.09	6,908.05	2.77	6,894.28	18.81	N/A	N/A	DRY	DRY	N/A	3.2 - 16.2	Chinle/Alluvium Interface
		6/7/2016	2.00	6,910.32	6,913.09	6,908.05	2.77	6,894.28	18.81	N/A	N/A	DRY	DRY	N/A	3.2 - 16.2	Chinle/Alluvium Interface
		9/13/2016	2.00	6,910.32	6,913.09	6,908.05	2.77	6,894.28	18.81	N/A	N/A	DRY	DRY	N/A	3.2 - 16.2	Chinle/Alluvium Interface
		11/14/2016	2.00	6,910.32	6,913.09	6,908.05	2.77	6,894.28	18.81	N/A	N/A	DRY	DRY	N/A	3.2 - 16.2	Chinle/Alluvium Interface
9/25/2005	GWM-3	3/1/2016	2.00	6,907.35	6,910.25	6,905.48	2.90	6,892.45	17.80	N/A	N/A	DRY	DRY	N/A	3 - 15	Chinle/Alluvium Interface
		6/7/2016	2.00	6,907.35	6,910.25	6,905.48	2.90	6,892.45	17.80	N/A	N/A	DRY	DRY	N/A	3 - 15	Chinle/Alluvium Interface
		9/13/2016	2.00	6,907.35	6,910.25	6,905.48	2.90	6,892.45	17.80	N/A	N/A	DRY	DRY	N/A	3 - 15	Chinle/Alluvium Interface
		11/14/2016	2.00	6,907.35	6,910.25	6,905.48	2.90	6,892.45	17.80	N/A	N/A	DRY	DRY	N/A	3 - 15	Chinle/Alluvium Interface
3/14/2008	NAPIS-1	3/1/2016	2.00	6,913.62	6,913.86	6,913.56	0.24	6,900.33	13.53	N/A	N/A	6.65	6,907.21	N/A	3.7 - 13.7	Chinle/Alluvium Interface
		6/7/2016	2.00	6,913.62	6,913.86	6,913.56	0.24	6,900.33	13.53	N/A	N/A	6.64	6,907.22	N/A	3.7 - 13.7	Chinle/Alluvium Interface
		9/1/2016	2.00	6,913.62	6,913.86	6,913.56	0.24	6,900.33	13.53	N/A	N/A	6.99	6,906.87	N/A	3.7 - 13.7	Chinle/Alluvium Interface
		11/14/2016	2.00	6,913.62	6,913.86	6,913.56	0.24	6,900.33	13.53	N/A	N/A	6.82	6,907.04	N/A	3.7 - 13.7	Chinle/Alluvium Interface
3/14/2008	NAPIS-2 [6]	3/1/2016	2.00	6,913.40	6,912.65	6,912.54	-0.75	6,899.04	13.61	N/A	N/A	7.65	6,905.00	N/A	4.2 - 14.2	Chinle/Alluvium Interface
		6/7/2016	2.00	6,913.40	6,912.65	6,912.54	-0.75	6,899.04	13.61	N/A	N/A	6.40	6,906.25	N/A	4.2 - 14.2	Chinle/Alluvium Interface
		9/1/2016	2.00	6,913.40	6,912.65	6,912.54	-0.75	6,899.04	13.61	N/A	N/A	8.84	6,903.81	N/A	4.2 - 14.2	Chinle/Alluvium Interface
		11/14/2016	2.00	6,918.29	6,917.87	6,912.54	-0.42	6,899.04	14.33	N/A	N/A	8.20	6,909.67	N/A	4.2 - 14.2	Chinle/Alluvium Interface
3/14/2008	NAPIS-3 [6]	3/1/2016	2.00	6,913.38	6,912.76	6,912.53	-0.62	6,882.34	30.42	N/A	N/A	8.55	6,904.21	N/A	25.4 - 30-4	Chinle/Alluvium Interface
		6/7/2016	2.00	6,913.38	6,912.76	6,912.53	-0.62	6,882.34	30.42	N/A	N/A	7.72	6,905.04	N/A	25.4 - 30-4	Chinle/Alluvium Interface
		9/1/2016	2.00	6,913.38	6,912.76	6,912.53	-0.62	6,882.34	30.42	N/A	N/A	9.10	6,903.66	N/A	25.4 - 30-4	Chinle/Alluvium Interface
		11/14/2016	2.00	6,918.30	6,918.07	6,912.53	-0.23	6,882.34	31.12	N/A	N/A	9.11	6,908.96	N/A	25.4 - 30-4	Chinle/Alluvium Interface
6/11/2007	KA-3 [6]	3/3/2016	2.00	6,913.29	6,912.52	6,912.20	-0.77	6,889.32	23.20	N/A	N/A	7.68	6,904.84	N/A	15 - 25	Chinle/Alluvium Interface
		6/6/2016	2.00	6,913.29	6,912.52	6,912.20	-0.77	6,889.32	23.20	N/A	N/A	7.42	6,905.10	N/A	15 - 25	Chinle/Alluvium Interface
		9/1/2016	2.00	6,913.29	6,912.52	6,912.20	-0.77	6,889.32	23.20	N/A	N/A	8.13	6,904.39	N/A	15 - 25	Chinle/Alluvium Interface
		11/14/2016	2.00	6,918.20	6,917.61	6,912.20	-0.59	6,889.32	24.10	N/A	N/A	8.28	6,909.33	N/A	15 - 25	Chinle/Alluvium Interface
7/17/2012	OAPIS-1	3/1/2016	2.00	6,914.37	6,916.73	6,916.50	2.36	6,888.37	28.36	N/A	N/A	11.86	6,904.87	N/A	16 - 26	Chinle/Alluvium Interface
		6/7/2016	2.00	6,914.37	6,916.73	6,916.50	2.36	6,888.37	28.36	N/A	N/A	11.50	6,905.23	N/A	17 - 26	Chinle/Alluvium Interface
		9/1/2016	2.00	6,914.37	6,916.73	6,916.50	2.36	6,888.37	28.36	N/A	N/A	11.32	6,905.41	N/A	18 - 26	Chinle/Alluvium Interface
		11/14/2016	2.00	6,914.37	6,916.73	6,916.50	2.36	6,888.37	28.36	N/A	N/A	11.44	6,905.29	N/A	19 - 26	Chinle/Alluvium Interface

APPENDIX C-1 - Ground Water Measurements

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Survey [1] Ground Level Elevations (ft)	Survey [1] Well Casing Rim Elevations (ft)	Survey [1] Ground Elevation Inside Steel Sleeve (ft)	Stick-up length (ft)	Survey [1] Well Casing Bottom Elevations (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH [2] Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation [3] (ft)	Corrected Water Table [4] Elevation (factor 0.8) (ft)	Screened Interval Depth Top to Bottom (ft)	2012 Stratigraphic unit in which screen exists
3/28/1995	RW-1	3/4/2016	4.00	6,942.86	6,946.06	6,941.25	3.20	6,903.02	43.04	28.05	2.50	30.55	6,915.51	6917.51	25 - 40	Chinle/Alluvium Interface
		6/8/2016	4.00	6,942.86	6,946.06	6,941.25	3.20	6,903.02	43.04	27.98	3.82	31.80	6,914.26	6917.316	25 - 40	Chinle/Alluvium Interface
		9/13/2016	4.00	6,942.86	6,946.06	6,941.25	3.20	6,903.02	43.04	27.90	4.14	32.04	6,914.02	6917.332	25 - 40	Chinle/Alluvium Interface
		11/16/2016	4.00	6,942.86	6,946.06	6,941.25	3.20	6,903.02	43.04	27.80	3.10	30.90	6,915.16	6917.64	25 - 40	Chinle/Alluvium Interface
3/29/1995	RW-2	3/4/2016	4.00	6,926.40	6,928.53	6,925.02	2.13	6,888.73	39.80	0.00	0.00	22.45	6,906.08	6906.08	26.1 - 36.1	Chinle/Alluvium Interface
		6/8/2016	4.00	6,926.40	6,928.53	6,925.02	2.13	6,888.73	39.80	0.00	0.00	22.31	6,906.22	6906.22	26.1 - 36.1	Chinle/Alluvium Interface
		9/13/2016	4.00	6,926.40	6,928.53	6,925.02	2.13	6,888.73	39.80	0.00	0.00	22.47	6,906.06	6906.06	26.1 - 36.1	Chinle/Alluvium Interface
		11/16/2016	4.00	6,926.40	6,928.53	6,925.02	2.13	6,888.73	39.80	0.00	0.00	22.22	6,906.31	6906.31	26.1 - 36.1	Chinle/Alluvium Interface
8/27/1997	RW-5	3/4/2016	4.00	6,941.53	6,943.57	6,940.82	2.04	6,903.98	39.59	0.00	0.00	28.22	6,915.35	6915.35	29.5 - 39.5	Chinle/Alluvium Interface
		6/7/2016	4.00	6,941.53	6,943.57	6,940.82	2.04	6,903.98	39.59	0.00	0.00	28.22	6,915.35	6915.35	29.5 - 39.5	Chinle/Alluvium Interface
		9/13/2016	4.00	6,941.53	6,943.57	6,940.82	2.04	6,903.98	39.59	0.00	0.00	27.70	6,915.87	6915.87	29.5 - 39.5	Chinle/Alluvium Interface
		11/16/2016	4.00	6,941.53	6,943.57	6,940.82	2.04	6,903.98	39.59	0.00	0.00	27.40	6,916.17	6916.17	29.5 - 39.5	Chinle/Alluvium Interface
8/27/1997	RW-6	3/4/2016	4.00	6,941.96	6,944.01	6,941.49	2.05	6,903.11	40.90	0.00	0.00	28.25	6,915.76	6915.76	28.5 - 38.5	Chinle/Alluvium Interface
		6/7/2016	4.00	6,941.96	6,944.01	6,941.49	2.05	6,903.11	40.90	0.00	0.00	28.24	6,915.77	6915.77	28.5 - 38.5	Chinle/Alluvium Interface
		9/13/2016	4.00	6,941.96	6,944.01	6,941.49	2.05	6,903.11	40.90	0.00	0.00	27.99	6,916.02	6916.02	28.5 - 38.5	Chinle/Alluvium Interface
		11/16/2016	4.00	6,941.96	6,944.01	6,941.49	2.05	6,903.11	40.90	0.00	0.00	27.72	6,916.29	6916.29	28.5 - 38.5	Chinle/Alluvium Interface
5/6/2014	STP1-NW	3/1/2016	2.00	6,904.50	6,904.47	6,903.95	-0.03	6,854.47	50.00	N/A	N/A	20.55	6,883.92	N/A	20 - 50	Chinle/Alluvium Interface
		6/7/2016	2.00	6,904.50	6,904.47	6,903.95	-0.03	6,854.47	50.00	N/A	N/A	20.89	6,883.58	N/A	20 - 50	Chinle/Alluvium Interface
		9/9/2016	2.00	6,904.50	6,904.47	6,903.95	-0.03	6,854.47	50.00	N/A	N/A	21.20	6,883.27	N/A	20 - 50	Chinle/Alluvium Interface
		11/14/2016	2.00	6,904.50	6,904.47	6,903.95	-0.03	6,854.47	50.00	N/A	N/A	21.02	6,883.45	N/A	20 - 50	Chinle/Alluvium Interface
5/6/2014	STP1-SW	3/8/2016	2.00	6,912.40	6,912.38	6,911.95	-0.02	6,880.38	32.00	N/A	N/A	DRY	N/A	N/A	15 - 30	Chinle/Alluvium Interface
		6/7/2016	2.00	6,912.40	6,912.38	6,911.95	-0.02	6,880.38	29.10	N/A	N/A	DRY	N/A	N/A	15 - 30	Chinle/Alluvium Interface
		9/9/2016	2.00	6,912.40	6,912.38	6,911.95	-0.02	6,880.38	29.10	N/A	N/A	DRY	N/A	N/A	15 - 30	Chinle/Alluvium Interface
		11/14/2016	2.00	6,912.40	6,912.38	6,911.95	-0.02	6,880.38	29.10	N/A	N/A	DRY	N/A	N/A	15 - 30	Chinle/Alluvium Interface

DEFINITIONS:

DTB - Depth to Bottom

DTW - Depth to Water

SPH = Separate Phase Hydrocarbons

* Wells also checked for Artesian flow conditions.

N/A = Not Available

Negative number in Stick up Length column indicates well is flushmount and located at or below ground level.

Depth to Water Column - if 0.00 is indicated - means water is at top of casing (full) under artesian flow conditions.

Dry indicates no water was detected.

NOTES:

1. Elevation data from NMED's "Approval with Modifications, Requirement to Resurvey Ground water Monitoring Wells and Recovery Wells", dated 9/26/12.

APPENDIX C-1.1 - Marketing Wells

WELL DATA 2016 ANNUAL/QUARTERLY SAMPLING
DTB/DTW MEASUREMENTS FOR MKTF 1 - MKTF 45 WELLS

Date of Installation	Date of Survey [1]	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevations (ft)	Well Casing Rim Elevations (ft)	Ground Elevation Inside Steel Sleeve (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to [2] SPH (ft)	SPH [3] Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation (ft)	Corrected [4] Water Table Elevation (Factor 0.8) (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
11/14/2013	1/21/2014	MKTF-01	2/24/2016	4.00	6,918.28	6,920.67	6,920.67	2.39	6,903.25	17.42	N/A	N/A	5.84	6,914.83	N/A	5 - 15	Chinle/Alluvium Interface
			6/10/2016	4.00	6,918.28	6,920.67	6,920.67	2.39	6,903.25	17.42	N/A	N/A	7.02	6,913.65	N/A	5 - 15	Chinle/Alluvium Interface
			9/7/2016	4.00	6,918.28	6,920.67	6,920.67	2.39	6,903.25	17.42	7.12	1.50	8.62	6,912.05	6913.25	5 - 15	Chinle/Alluvium Interface
			10/28/2016	4.00	6,918.28	6,920.67	6,920.67	2.39	6,903.25	17.42	7.53	1.35	8.88	6,911.79	6912.87	5 - 15	Chinle/Alluvium Interface
11/14/2013	1/21/2014	MKTF-02	2/24/2016	4.00	6,915.00	6,917.45	6,917.18	2.45	6,896.97	20.48	N/A	N/A	7.22	6,910.23	N/A	7 - 17	Chinle/Alluvium Interface
			6/10/2016	4.00	6,915.00	6,917.45	6,917.18	2.45	6,896.97	20.48	N/A	N/A	8.09	6,909.36	N/A	7 - 17	Chinle/Alluvium Interface
			9/7/2016	4.00	6,915.00	6,917.45	6,917.18	2.45	6,896.97	20.48	N/A	N/A	8.28	6,909.17	N/A	7 - 17	Chinle/Alluvium Interface
			10/28/2016	4.00	6,915.00	6,917.45	6,917.18	2.45	6,896.97	20.48	N/A	N/A	8.55	6,908.90	N/A	7 - 17	Chinle/Alluvium Interface
11/7/2013	1/21/2014	MKTF-03	3/17/2015	4.00	6,931.73	6,931.69	6,930.85	-0.04	6,913.24	18.45	8.46	0.80	9.26	6,922.43	6923.07	3 - 18	Chinle/Alluvium Interface
			6/9/2016	4.00	6,931.73	6,931.69	6,930.85	-0.04	6,913.24	18.45	7.55	4.28	11.83	6,919.86	6923.28	3 - 18	Chinle/Alluvium Interface
			9/12/2016	4.00	6,931.73	6,931.69	6,930.85	-0.04	6,913.24	18.45	7.92	2.40	10.32	6,921.37	6923.29	3 - 18	Chinle/Alluvium Interface
			11/3/2015	4.00	6,931.73	6,931.69	6,930.85	-0.04	6,913.24	18.45	8.30	1.10	9.40	6922.29	6923.17	3 - 18	Chinle/Alluvium Interface
11/12/2013	1/21/2014	MKTF-04	2/29/2016	4.00	6,933.90	6,933.57	6,933.24	-0.33	6,911.42	22.15	N/A	N/A	10.68	6,922.89	N/A	10 - 22	Chinle/Alluvium Interface
			6/9/2016	4.00	6,933.90	6,933.57	6,933.24	-0.33	6,911.42	22.15	N/A	N/A	10.30	6,923.27	N/A	10 - 22	Chinle/Alluvium Interface
			9/11/2016	4.00	6,933.90	6,933.57	6,933.24	-0.33	6,911.42	22.15	N/A	N/A	10.23	6,923.34	N/A	10 - 22	Chinle/Alluvium Interface
			11/2/2016	4.00	6,933.90	6,933.57	6,933.24	-0.33	6,911.42	22.15	N/A	N/A	10.40	6,923.17	N/A	10 - 22	Chinle/Alluvium Interface
11/12/2013	1/21/2014	MKTF-05	3/16/2015	4.00	6,939.49	6,942.22	6,941.95	2.73	6,924.47	17.75	15.72	0.36	16.08	6,926.14	6926.43	4 - 14	Chinle/Alluvium Interface
			6/9/2016	4.00	6,939.49	6,942.22	6,941.95	2.73	6,924.47	17.75	15.34	0.53	15.87	6,926.35	6926.77	4 - 14	Chinle/Alluvium Interface
			9/11/2016	4.00	6,939.49	6,942.22	6,941.95	2.73	6,924.47	17.75	14.74	3.04	17.78	6,924.44	6926.87	4 - 14	Chinle/Alluvium Interface
			11/3/2015	4.00	6,939.49	6,942.22	6,941.95	2.73	6,924.47	17.75	15.47	0.84	16.31	6,925.91	6926.58	4 - 14	Chinle/Alluvium Interface
11/11/2013	1/21/2014	MKTF-06	3/16/2015	4.00	6,944.24	6,946.81	6,946.63	2.57	6,923.04	23.77	18.24	1.70	19.94	6,926.87	6928.23	8 - 20	Chinle/Alluvium Interface
			6/9/2016	4.00	6,944.24	6,946.81	6,946.63	2.57	6,923.04	23.77	18.02	0.94	18.96	6,927.85	6928.60	8 - 20	Chinle/Alluvium Interface
			9/11/2016	4.00	6,944.24	6,946.81	6,946.63	2.57	6,923.04	23.77	17.40	1.08	18.48	6,928.33	6929.19	8 - 20	Chinle/Alluvium Interface
			11/3/2015	4.00	6,944.24	6,946.81	6,946.63	2.57	6,923.04	23.77	18.04	0.74	18.78	6,928.03	6928.62	8 - 20	Chinle/Alluvium Interface
11/11/2013	1/21/2014	MKTF-07	3/16/2015	4.00	6,944.40	6,947.18	6,947.06	2.78	6,929.56	17.62	13.10	1.13	14.23	6,932.95	6933.85	4 - 14	Chinle/Alluvium Interface
			6/9/2016	4.00	6,944.40	6,947.18	6,947.06	2.78	6,929.56	17.62	12.01	2.59	14.60	6,932.58	6934.65	4 - 14	Chinle/Alluvium Interface
			9/11/2016	4.00	6,944.40	6,947.18	6,947.06	2.78	6,929.56	17.62	12.20	2.41	14.61	6,932.57	6934.50	4 - 14	Chinle/Alluvium Interface
			11/3/2015	4.00	6,944.40	6,947.18	6,947.06	2.78	6,929.56	17.62	12.90	1.98	14.88	6,932.30	6933.88	4 - 14	Chinle/Alluvium Interface
11/11/2013	1/21/2014	MKTF-08	3/16/2015	4.00	6,944.02	6,947.09	6,942.67	3.07	6,925.11	21.98	14.25	0.25	14.50	6,932.59	6932.79	8 - 18	Chinle/Alluvium Interface
			6/9/2016	4.00	6,944.02	6,947.09	6,942.67	3.07	6,925.11	21.98	13.48	0.70	14.18	6,932.91	6933.47	8 - 18	Chinle/Alluvium Interface
			9/11/2016	4.00	6,944.02	6,947.09	6,942.67	3.07	6,925.11	21.98	13.63	0.66	14.29	6,932.80	6933.33	8 - 18	Chinle/Alluvium Interface
			11/8/2015	4.00	6,944.02	6,947.09	6,942.67	3.07	6,925.11	21.98	13.84	1.48	15.32	6,931.77	6932.95	8 - 18	Chinle/Alluvium Interface
11/11/2013	1/21/2014	MKTF-09	2/29/2016	4.00	6,943.57	6,946.50	6,945.90	2.93	6,923.80	22.70	N/A	N/A	14.15	6,932.35	N/A	7 - 19	Chinle/Alluvium Interface
			6/9/2016	4.00	6,943.57	6,946.50	6,945.90	2.93	6,923.80	22.70	N/A	N/A	13.92	6,932.58	N/A	7 - 19	Chinle/Alluvium Interface
			9/11/2016	4.00	6,943.57	6,946.50	6,945.90	2.93	6,923.80	22.70	N/A	N/A	14.20	6,932.30	N/A	7 - 19	Chinle/Alluvium Interface
			11/2/2016	4.00	6,943.57	6,946.50	6,945.90	2.93	6,923.80	22.70	N/A	N/A	14.10	6,932.40	N/A	7 - 19	Chinle/Alluvium Interface
10/31/2013	1/21/2014	MKTF-10	2/29/2016	4.00	6,937.51	6,937.16	6,936.63	-0.35	6,921.17	15.99	N/A	N/A	8.60	6,928.56	N/A	7 - 17	Chinle/Alluvium Interface
			6/9/2016	4.00	6,937.51	6,937.16	6,936.63	-0.35	6,921.17	15.99	N/A	N/A	8.20	6,928.96	N/A	7 - 17	Chinle/Alluvium Interface
			9/11/2016	4.00	6,937.51	6,937.16	6,936.63	-0.35	6,921.17	15.99	N/A	N/A	8.45	6,928.71	N/A	7 - 17	Chinle/Alluvium Interface
			11/2/2016	4.00	6,937.51	6,937.16	6,936.63	-0.35	6,921.17	15.99	N/A	N/A	8.25	6,928.91	N/A	7 - 17	Chinle/Alluvium Interface

APPENDIX C-1.1 - Marketing Wells

Date of Installation	Date of Survey [1]	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevations (ft)	Well Casing Rim Elevations (ft)	Ground Elevation Inside Steel Sleeve (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to [2] SPH (ft)	SPH [3] Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation (ft)	Corrected [4] Water Table Elevation (Factor 0.8) (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
10/31/2013	1/21/2014	MKTF-11	2/29/2016	4.00	6,931.61	6,931.34	6,930.86	-0.27	6,913.20	18.14	N/A	N/A	8.80	6,922.54	N/A	8 - 18	Chinle/Alluvium Interface
			6/9/2016	4.00	6,931.61	6,931.34	6,930.86	-0.27	6,913.20	18.14	N/A	N/A	8.66	6,922.68	N/A	8 - 18	Chinle/Alluvium Interface
			9/11/2016	4.00	6,931.61	6,931.34	6,930.86	-0.27	6,913.20	18.14	N/A	N/A	8.70	6,922.64	N/A	8 - 18	Chinle/Alluvium Interface
			11/2/2016	4.00	6,931.61	6,931.34	6,930.86	-0.27	6,913.20	18.14	N/A	N/A	8.65	6,922.69	N/A	8 - 18	Chinle/Alluvium Interface
11/7/2013	1/21/2014	MKTF-12	3/12/2016	4.00	6,939.70	6,942.11	6,941.88	2.41	6,916.51	25.60	19.13	1.81	20.94	6,921.17	6922.62	12 - 22	Chinle/Alluvium Interface
			6/10/2016	4.00	6,939.70	6,942.11	6,941.88	2.41	6,916.51	25.60	18.23	1.32	19.55	6,922.56	6923.62	12 - 22	Chinle/Alluvium Interface
			9/10/2016	4.00	6,939.70	6,942.11	6,941.88	2.41	6,916.51	25.60	19.23	0.32	19.55	6,922.56	6922.82	12 - 22	Chinle/Alluvium Interface
			11/1/2016	4.00	6,939.70	6,942.11	6,941.88	2.41	6,916.51	25.60	19.33	0.29	19.62	6,922.49	6922.72	12 - 22	Chinle/Alluvium Interface
11/12/2013	1/21/2014	MKTF-13	3/12/2015	4.00	6,933.67	6,935.18	6,934.83	1.51	6,913.93	21.25	13.75	2.07	15.82	6,919.36	6921.02	8 - 18	Chinle/Alluvium Interface
			6/10/2016	4.00	6,933.67	6,935.18	6,934.83	1.51	6,913.93	21.25	12.99	1.20	14.19	6,920.99	6921.95	8 - 18	Chinle/Alluvium Interface
			9/10/2016	4.00	6,933.67	6,935.18	6,934.83	1.51	6,913.93	21.25	13.88	0.98	14.86	6,920.32	6921.10	8 - 18	Chinle/Alluvium Interface
			11/1/2016	4.00	6,933.67	6,935.18	6,934.83	1.51	6,913.93	21.25	14.01	0.96	14.97	6,920.21	6920.98	8 - 18	Chinle/Alluvium Interface
11/12/2013	1/21/2014	MKTF-14	3/12/2016	4.00	6,925.65	6,928.02	6,927.80	2.37	6,910.56	17.46	7.60	0.55	8.15	6,919.87	6920.31	4 - 14	Chinle/Alluvium Interface
			6/10/2016	4.00	6,925.65	6,928.02	6,927.80	2.37	6,910.56	17.46	7.13	2.33	9.46	6,918.56	6920.42	4 - 14	Chinle/Alluvium Interface
			9/10/2016	4.00	6,925.65	6,928.02	6,927.80	2.37	6,910.56	17.46	7.31	1.69	9.00	6,919.02	6920.37	4 - 14	Chinle/Alluvium Interface
			11/1/2016	4.00	6,925.65	6,928.02	6,927.80	2.37	6,910.56	17.46	7.45	1.10	8.55	6,919.47	6920.35	4 - 14	Chinle/Alluvium Interface
10/29/2013	1/21/2014	MKTF-15	3/16/2016	2.00	6,943.74	6,943.48	6,943.19	-0.26	6,924.00	19.48	13.17	0.00	13.92	6,929.56	6929.56	9 - 19	Chinle/Alluvium Interface
			6/9/2016	2.00	6,943.74	6,943.48	6,943.19	-0.26	6,924.00	19.48	12.60	0.22	12.82	6,930.66	6930.84	9 - 19	Chinle/Alluvium Interface
			9/11/2016	2.00	6,943.74	6,943.48	6,943.19	-0.26	6,924.00	19.48	N/A	0.00	13.00	6,930.48	6930.48	9 - 19	Chinle/Alluvium Interface
			11/2/2016	2.00	6,943.74	6,943.48	6,943.19	-0.26	6,924.00	19.48	N/A	0.00	12.90	6,930.58	6930.58	9 - 19	Chinle/Alluvium Interface
11/7/2013	1/21/2014	MKTF-16	2/29/2016	2.00	6,951.00	6,950.58	6,950.58	-0.42	6,936.48	14.10	N/A	N/A	9.90	6,940.68	N/A	4 - 14	Chinle/Alluvium Interface
			6/8/2016	2.00	6,951.00	6,950.58	6,950.58	-0.42	6,936.48	14.10	N/A	N/A	9.58	6,941.00	N/A	4 - 14	Chinle/Alluvium Interface
			9/11/2016	2.00	6,951.00	6,950.58	6,950.58	-0.42	6,936.48	14.10	N/A	N/A	9.65	6,940.93	N/A	4 - 14	Chinle/Alluvium Interface
			11/2/2016	2.00	6,951.00	6,950.58	6,950.58	-0.42	6,936.48	14.10	N/A	N/A	9.28	6,941.30	N/A	4 - 14	Chinle/Alluvium Interface
11/14/2013	1/21/2014	MKTF-17	2/25/2016	2.00	6,945.79	6,945.76	6,945.64	-0.03	6,921.65	24.11	N/A	N/A	11.82	6,933.94	N/A	14 - 24	Chinle/Alluvium Interface
			6/10/2016	2.00	6,945.79	6,945.76	6,945.64	-0.03	6,921.65	24.11	N/A	N/A	11.30	6,934.46	N/A	14 - 24	Chinle/Alluvium Interface
			9/12/2016	2.00	6,945.79	6,945.76	6,945.64	-0.03	6,921.65	24.11	N/A	N/A	12.40	6,933.36	N/A	14 - 24	Chinle/Alluvium Interface
			11/7/2016	2.00	6,945.79	6,945.76	6,945.64	-0.03	6,921.65	24.11	N/A	N/A	8.95	6,936.81	N/A	14 - 24	Chinle/Alluvium Interface
11/15/2013	1/21/2014	MKTF-18	2/26/2016	2.00	6,950.97	6,950.65	6,950.17	-0.32	6,925.27	25.38	N/A	N/A	8.34	6,942.31	N/A	17 - 27	Chinle/Alluvium Interface
			6/10/2016	2.00	6,950.97	6,950.65	6,950.17	-0.32	6,925.27	25.38	N/A	N/A	11.85	6,938.80	N/A	17 - 27	Chinle/Alluvium Interface
			9/12/2016	2.00	6,950.97	6,950.65	6,950.17	-0.32	6,925.27	25.38	N/A	N/A	7.75	6,942.90	N/A	17 - 27	Chinle/Alluvium Interface
			11/7/2016	2.00	6,950.97	6,950.65	6,950.17	-0.32	6,925.27	25.38	N/A	N/A	7.50	6,943.15	N/A	17 - 27	Chinle/Alluvium Interface
11/5/2013	4/30/2014	MKTF-19	2/25/2016	2.00	6,944.89	6,944.67	6,944.34	-0.22	6,927.20	17.47	N/A	N/A	12.62	6,932.05	N/A	10 - 20	Chinle/Alluvium Interface
			6/10/2016	2.00	6,944.89	6,944.67	6,944.34	-0.22	6,927.20	17.47	N/A	N/A	11.90	6,932.77	N/A	10 - 20	Chinle/Alluvium Interface
			9/12/2016	2.00	6,944.89	6,944.67	6,944.34	-0.22	6,927.20	17.47	N/A	N/A	11.25	6,933.42	N/A	10 - 20	Chinle/Alluvium Interface
			11/7/2016	2.00	6,944.89	6,944.67	6,944.34	-0.22	6,927.20	17.47	N/A	N/A	11.00	6,933.67	N/A	10 - 20	Chinle/Alluvium Interface
2/10/2014	4/30/2014	MKTF-20	2/29/2016	4.00	6,951.89	6,951.78	6,951.17	-0.11	6,941.89	9.89	N/A	N/A	7.81	6,943.97	N/A	2 - 10	Chinle/Alluvium Interface
			6/8/2016	4.00	6,951.89	6,951.78	6,951.17	-0.11	6,941.89	9.89	N/A	N/A	7.23	6,944.55	N/A	2 - 10	Chinle/Alluvium Interface
			9/11/2016	4.00	6,951.89	6,951.78	6,951.17	-0.11	6,941.89	9.89	N/A	N/A	7.65	6,944.13	N/A	2 - 10	Chinle/Alluvium Interface
			11/2/2016	4.00	6,951.89	6,951.78	6,951.17	-0.11	6,941.89	9.89	N/A	N/A	7.10	6,944.68	N/A	2 - 10	Chinle/Alluvium Interface
2/10/2014	4/30/2014	MKTF-21	2/29/2016	4.00	6,952.68	6,952.57	6,952.00	-0.11	6,942.68	9.89	N/A	N/A	7.24	6,945.33	N/A	2 - 10	Chinle/Alluvium Interface
			6/8/2016	4.00	6,952.68	6,952.57	6,952.00	-0.11	6,942.68	9.89	N/A	N/A	6.98	6,945.59	N/A	2 - 10	Chinle/Alluvium Interface
			9/11/2016	4.00	6,952.68	6,952.57	6,952.00	-0.11	6,942.68	9.89	N/A	N/A	7.62	6,944.95	N/A	2 - 10	Chinle/Alluvium Interface
			11/2/2016	4.00	6,952.68	6,952.57	6,952.00	-0.11	6,942.68	9.89	N/A	N/A	6.30	6,946.27	N/A	2 - 10	Chinle/Alluvium Interface

APPENDIX C-1.1 - Marketing Wells

Date of Installation	Date of Survey [1]	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevations (ft)	Well Casing Rim Elevations (ft)	Ground Elevation Inside Steel Sleeve (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to [2] SPH (ft)	SPH [3] Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation (ft)	Corrected [4] Water Table Elevation (Factor 0.8) (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
11/8/2013	4/30/2014	MKTF-22	2/25/2016	2.00	6,939.76	6,942.31	6,938.57	2.55	6,907.06	35.25	N/A	N/A	26.13	6,916.18	N/A	22 - 32	Chinle/Alluvium Interface
			6/10/2016	2.00	6,939.76	6,942.31	6,938.57	2.55	6,907.06	35.25	N/A	N/A	26.06	6,916.25	N/A	22 - 32	Chinle/Alluvium Interface
			9/10/2016	2.00	6,939.76	6,942.31	6,938.57	2.55	6,907.06	35.25	N/A	N/A	26.13	6,916.18	N/A	22 - 32	Chinle/Alluvium Interface
			11/1/2016	2.00	6,939.76	6,942.31	6,938.57	2.55	6,907.06	35.25	N/A	N/A	26.05	6,916.26	N/A	22 - 32	Chinle/Alluvium Interface
11/4/2013	4/30/2014	MKTF-23	2/25/2016	2.00	6,927.23	6,929.98	6,925.79	2.75	6,909.62	20.36	N/A	N/A	14.67	6,915.31	N/A	7 - 17	Chinle/Alluvium Interface
			6/10/2016	2.00	6,927.23	6,929.98	6,925.79	2.75	6,909.62	20.36	N/A	N/A	14.64	6,915.34	N/A	7 - 17	Chinle/Alluvium Interface
			9/10/2016	2.00	6,927.23	6,929.98	6,925.79	2.75	6,909.62	20.36	15.04	0.11	15.15	6,914.83	6914.92	7 - 17	Chinle/Alluvium Interface
			11/1/2016	2.00	6,927.23	6,929.98	6,925.79	2.75	6,909.62	20.36	14.80	0.12	14.92	6,915.06	6915.16	7 - 17	Chinle/Alluvium Interface
10/29/2013	4/30/2014	MKTF-24	2/22/2016	2.00	6,926.07	6,928.72	6,924.62	2.65	6,898.25	30.47	N/A	N/A	21.34	6,907.38	N/A	18 - 28	Chinle/Alluvium Interface
			6/8/2016	2.00	6,926.07	6,928.72	6,924.62	2.65	6,898.25	30.47	N/A	N/A	21.23	6,907.49	N/A	18 - 28	Chinle/Alluvium Interface
			9/7/2016	2.00	6,926.07	6,928.72	6,924.62	2.65	6,898.25	30.47	N/A	N/A	22.69	6,906.03	N/A	18 - 28	Chinle/Alluvium Interface
			10/28/2016	2.00	6,926.07	6,928.72	6,924.62	2.65	6,898.25	30.47	N/A	N/A	22.34	6,906.38	N/A	18 - 28	Chinle/Alluvium Interface
10/30/2013	4/30/2014	MKTF-25	2/23/2016	2.00	6,913.35	6,916.19	6,911.79	2.84	6,896.76	19.43	N/A	N/A	10.83	6,905.36	N/A	6 - 16	Chinle/Alluvium Interface
			6/9/2016	2.00	6,913.35	6,916.19	6,911.79	2.84	6,896.76	19.43	N/A	N/A	11.22	6,904.97	N/A	6 - 16	Chinle/Alluvium Interface
			9/8/2016	2.00	6,913.35	6,916.19	6,911.79	2.84	6,896.76	19.43	N/A	N/A	12.17	6,904.02	N/A	6 - 16	Chinle/Alluvium Interface
			10/31/2016	2.00	6,913.35	6,916.19	6,911.79	2.84	6,896.76	19.43	N/A	N/A	11.45	6,904.74	N/A	6 - 16	Chinle/Alluvium Interface
10/30/2013	4/30/2014	MKTF-26	2/22/2016	2.00	6,912.55	6,915.31	6,911.35	2.76	6,898.16	17.15	N/A	N/A	8.17	6,907.14	N/A	4 - 14	Chinle/Alluvium Interface
			6/9/2016	2.00	6,912.55	6,915.31	6,911.35	2.76	6,898.16	17.15	N/A	N/A	9.60	6,905.71	N/A	4 - 14	Chinle/Alluvium Interface
			9/7/2016	2.00	6,912.55	6,915.31	6,911.35	2.76	6,898.16	17.15	9.44	1.37	10.81	6,904.50	35934.50	4 - 14	Chinle/Alluvium Interface
			10/28/2016	2.00	6,912.55	6,915.31	6,911.35	2.76	6,898.16	17.15	9.36	1.39	10.75	6,904.56	35934.44	4 - 14	Chinle/Alluvium Interface
10/30/2013	4/30/2014	MKTF-27	2/22/2016	2.00	6,915.36	6,917.90	6,914.18	2.54	6,903.18	14.72	N/A	N/A	7.20	6,910.70	N/A	1 - 12	Chinle/Alluvium Interface
			6/8/2016	2.00	6,915.36	6,917.90	6,914.18	2.54	6,903.18	14.72	N/A	N/A	7.51	6,910.39	N/A	1 - 12	Chinle/Alluvium Interface
			9/7/2016	2.00	6,915.36	6,917.90	6,914.18	2.54	6,903.18	14.72	N/A	N/A	8.06	6,909.84	N/A	1 - 12	Chinle/Alluvium Interface
			10/28/2016	2.00	6,915.36	6,917.90	6,914.18	2.54	6,903.18	14.72	N/A	N/A	8.10	6,909.80	N/A	1 - 12	Chinle/Alluvium Interface
4/2/2014	4/30/2014	MKTF-28	2/23/2016	2.00	6,918.67	6,921.52	6,917.51	2.85	6,905.36	16.16	N/A	N/A	5.32	6,916.20	N/A	3 - 13	Chinle/Alluvium Interface
			6/8/2016	2.00	6,918.67	6,921.52	6,917.51	2.85	6,905.36	16.16	N/A	N/A	5.28	6,916.24	N/A	3 - 13	Chinle/Alluvium Interface
			9/8/2016	2.00	6,918.67	6,921.52	6,917.51	2.85	6,905.36	16.16	N/A	N/A	6.40	6,915.12	N/A	3 - 13	Chinle/Alluvium Interface
			10/28/2016	2.00	6,918.67	6,921.52	6,917.51	2.85	6,905.36	16.16	N/A	N/A	9.26	6,912.26	N/A	3 - 13	Chinle/Alluvium Interface
4/2/2014	4/30/2014	MKTF-29	2/23/2016	2.00	6,898.83	6,901.62	6,897.67	2.79	6,878.78	22.84	N/A	N/A	1.92	6,899.70	N/A	10 - 20	Chinle/Alluvium Interface
			6/9/2016	2.00	6,898.83	6,901.62	6,897.67	2.79	6,878.78	22.84	N/A	N/A	2.69	6,898.93	N/A	10 - 20	Chinle/Alluvium Interface
			9/7/2016	2.00	6,898.83	6,901.62	6,897.67	2.79	6,878.78	22.84	N/A	N/A	4.52	6,897.10	N/A	10 - 20	Chinle/Alluvium Interface
			10/28/2016	2.00	6,898.83	6,901.62	6,897.67	2.79	6,878.78	22.84	N/A	N/A	3.10	6,898.52	N/A	10 - 20	Chinle/Alluvium Interface
4/1/2014	4/30/2014	MKTF-30	2/23/2016	2.00	6,898.10	6,900.80	6,896.68	2.70	6,877.60	23.20	N/A	N/A	14.40	6,886.40	N/A	10 - 20	Chinle/Alluvium Interface
			6/9/2016	2.00	6,898.10	6,900.80	6,896.68	2.70	6,877.60	23.20	N/A	N/A	14.01	6,886.79	N/A	10 - 20	Chinle/Alluvium Interface
			9/7/2016	2.00	6,898.10	6,900.80	6,896.68	2.70	6,877.60	23.20	N/A	N/A	15.48	6,885.32	N/A	10 - 20	Chinle/Alluvium Interface
			10/28/2016	2.00	6,898.10	6,900.80	6,896.68	2.70	6,877.60	23.20	N/A	N/A	15.70	6,885.10	N/A	10 - 20	Chinle/Alluvium Interface
4/1/2014	4/30/2014	MKTF-31	2/23/2016	2.00	6,904.26	6,906.87	6,903.11	2.61	6,884.06	22.81	N/A	N/A	7.95	6,898.92	N/A	6 - 21	Chinle/Alluvium Interface
			6/9/2016	2.00	6,904.26	6,906.87	6,903.11	2.61	6,884.06	22.81	N/A	N/A	7.75	6,899.12	N/A	6 - 21	Chinle/Alluvium Interface
			9/8/2016	2.00	6,904.26	6,906.87	6,903.11	2.61	6,883.06	23.81	N/A	N/A	8.48	6,898.39	N/A	6 - 21	Chinle/Alluvium Interface
			10/31/2016	2.00	6,904.26	6,906.87	6,903.11	2.61	6,884.06	22.81	N/A	N/A	8.45	6,898.42	N/A	6 - 21	Chinle/Alluvium Interface
3/31/2014	4/30/2014	MKTF-32	2/24/2016	2.00	6,908.44	6,911.11	6,907.16	2.67	6,883.36	27.75	N/A	N/A	14.53	6,896.58	N/A	9 - 24	Chinle/Alluvium Interface
			6/9/2016	2.00	6,908.44	6,911.11	6,907.16	2.67	6,883.36	27.75	N/A	N/A	14.31	6,896.80	N/A	9 - 24	Chinle/Alluvium Interface
			9/9/2016	2.00	6,908.44	6,911.11	6,907.16	2.67	6,882.36	28.75	N/A	N/A	14.40	6,896.71	N/A	9- 24	Chinle/Alluvium Interface
			10/31/2016	2.00	6,908.44	6,911.11	6,907.16	2.67	6,883.36	27.75	N/A	N/A	14.16	6,896.95	N/A	9 - 24	Chinle/Alluvium Interface

APPENDIX C-1.1 - Marketing Wells

Date of Installation	Date of Survey [1]	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevations (ft)	Well Casing Rim Elevations (ft)	Ground Elevation Inside Steel Sleeve (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to [2] SPH (ft)	SPH [3] Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation (ft)	Corrected [4] Water Table Elevation (Factor 0.8) (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
4/3/2014	4/30/2014	MKTF-33	2/25/2016	2.00	6,936.59	6,939.75	6,936.59	3.16	6,906.55	33.20	N/A	N/A	23.20	6,916.55	N/A	20 - 30	Chinle/Alluvium Interface
			6/10/2016	2.00	6,936.59	6,939.75	6,936.59	3.16	6,906.55	33.20	N/A	N/A	23.29	6,916.46	N/A	20 - 30	Chinle/Alluvium Interface
			9/10/2016	2.00	6,936.59	6,939.75	6,936.59	3.16	6,906.55	33.20	N/A	N/A	23.20	6,916.55	N/A	20 - 30	Chinle/Alluvium Interface
			11/1/2016	2.00	6,936.59	6,939.75	6,936.59	3.16	6,906.55	33.20	N/A	N/A	22.95	6,916.80	N/A	20 - 30	Chinle/Alluvium Interface
3/31/2014	4/30/2014	MKTF-34	2/25/2016	2.00	6,942.42	6,945.35	3,943.52	2.93	6,917.67	27.68	N/A	N/A	19.20	6,926.15	N/A	9 - 24	Chinle/Alluvium Interface
			6/10/2016	2.00	6,942.42	6,945.35	3,943.52	2.93	6,917.67	27.68	N/A	N/A	18.60	6,926.75	N/A	9 - 24	Chinle/Alluvium Interface
			9/12/2016	2.00	6,942.42	6,945.35	3,943.52	2.93	6,917.67	27.68	N/A	N/A	18.03	6,927.32	N/A	9 - 24	Chinle/Alluvium Interface
			11/7/2016	2.00	6,942.42	6,945.35	3,943.52	2.93	6,917.67	27.68	N/A	N/A	17.50	6,927.85	N/A	9 - 24	Chinle/Alluvium Interface
11/19/2014	12/16/2014	MKTF-35	2/26/2016	2.00	6,951.90	6,951.65	6,951.25	-0.25	6,935.20	16.45	N/A	N/A	8.40	6,943.25	N/A	6 - 16	Chinle/Alluvium Interface
			6/10/2016	2.00	6,951.90	6,951.65	6,951.25	-0.25	6,935.20	16.45	N/A	N/A	7.37	6,944.28	N/A	6 - 16	Chinle/Alluvium Interface
			9/12/2016	2.00	6,951.90	6,951.65	6,951.25	-0.25	6,935.20	16.45	N/A	N/A	6.65	6,945.00	N/A	6 - 16	Chinle/Alluvium Interface
			11/3/2016	2.00	6,951.90	6,951.65	6,951.25	-0.25	6,935.20	16.45	N/A	N/A	6.00	6,945.65	N/A	6 - 16	Chinle/Alluvium Interface
11/19/2014	12/16/2014	MKTF-36	3/17/2015	2.00	6,950.67	6,950.12	6,949.87	-0.55	6,934.67	15.45	N/A	N/A	7.71	6,942.41	N/A	5 15	Chinle/Alluvium Interface
			6/10/2016	2.00	6,950.67	6,950.12	6,949.87	-0.55	6,934.67	15.45	6.78	0.02	6.80	6,943.32	12.22	5 15	Chinle/Alluvium Interface
			9/13/2016	2.00	6,950.67	6,950.12	6,949.87	-0.55	6,934.67	15.45	6.54	0.01	6.55	6,943.57	11.78	5 15	Chinle/Alluvium Interface
			11/7/2016	2.00	6,950.67	6,950.12	6,949.87	-0.55	6,934.67	15.45	N/A	N/A	6.30	6,943.82	N/A	5 15	Chinle/Alluvium Interface
11/18/2014	12/16/2014	MKTF-37	3/17/2015	2.00	6,959.07	6,958.87	6,958.62	-0.20	6,934.27	24.60	N/A	N/A	9.21	6,949.66	N/A	4 - 24	Chinle/Alluvium Interface
			6/10/2016	2.00	6,959.07	6,958.87	6,958.62	-0.20	6,934.27	24.60	8.21	0.02	8.23	6,950.64	14.80	4 - 24	Chinle/Alluvium Interface
			9/12/2016	2.00	6,959.07	6,958.87	6,958.62	-0.20	6,934.27	24.60	N/A	N/A	7.65	6,951.22	N/A	4 - 24	Chinle/Alluvium Interface
			11/3/2016	2.00	6,959.07	6,958.87	6,958.62	-0.20	6,934.27	24.60	N/A	N/A	7.09	6,951.78	NA	4 - 24	Chinle/Alluvium Interface
11/20/2014	12/16/2014	MKTF-38	2/29/2016	2.00	6,955.17	6,954.89	6,954.54	-0.28	6,934.60	20.29	N/A	N/A	8.63	6,946.26	N/A	5 - 20	Chinle/Alluvium Interface
			6/8/2016	2.00	6,955.17	6,954.89	6,954.54	-0.28	6,934.60	20.29	N/A	N/A	8.43	6,946.46	N/A	5 - 20	Chinle/Alluvium Interface
			9/13/2016	2.00	6,955.17	6,954.89	6,954.54	-0.28	6,934.60	20.29	N/A	N/A	8.00	6,946.89	N/A	5 - 20	Chinle/Alluvium Interface
			11/1/2016	2.00	6,955.17	6,954.89	6,954.54	-0.28	6,934.60	20.29	N/A	N/A	7.50	6,947.39	N/A	5 - 20	Chinle/Alluvium Interface
11/14/2014	12/16/2014	MKTF-39	3/3/2016	2.00	6,953.97	6,953.75	6,953.12	-0.22	6,938.55	15.20	N/A	N/A	8.50	6,945.25	N/A	5 - 15	Chinle/Alluvium Interface
			6/8/2016	2.00	6,953.97	6,953.75	6,953.12	-0.22	6,938.55	15.20	N/A	N/A	8.33	6,945.42	N/A	5 - 15	Chinle/Alluvium Interface
			9/13/2016	2.00	6,953.97	6,953.75	6,953.12	-0.22	6,938.55	15.20	N/A	N/A	8.40	6,945.35	N/A	5 - 15	Chinle/Alluvium Interface
			11/1/2016	2.00	6,953.97	6,953.75	6,953.12	-0.22	6,938.55	15.20	N/A	N/A	7.80	6,945.95	N/A	5 - 15	Chinle/Alluvium Interface
11/13/2014	12/16/2014	MKTF-40	2/23/2016	2.00	6,891.35	6,894.33	6,890.48	2.98	6,870.69	23.64	N/A	N/A	13.88	6,880.45	N/A	5 - 20	Chinle/Alluvium Interface
			6/9/2016	2.00	6,891.35	6,894.33	6,890.48	2.98	6,870.69	23.64	N/A	N/A	13.31	6,881.02	N/A	5 - 20	Chinle/Alluvium Interface
			9/8/2016	2.00	6,891.35	6,894.33	6,890.48	2.98	6,870.69	23.64	N/A	N/A	13.52	6,880.81	N/A	5 - 20	Chinle/Alluvium Interface
			10/31/2016	2.00	6,891.35	6,894.33	6,890.48	2.98	6,870.69	23.64	N/A	N/A	13.76	6,880.57	N/A	5 - 20	Chinle/Alluvium Interface
11/14/2014	12/16/2014	MKTF-41	2/24/2016	2.00	6,891.11	6,893.64	6,889.80	2.53	6,853.54	40.10	N/A	N/A	19.90	6,873.74	N/A	22 - 37	Chinle/Alluvium Interface
			6/9/2016	2.00	6,891.11	6,893.64	6,889.80	2.53	6,853.54	40.10	N/A	N/A	19.65	6,873.99	N/A	22 - 37	Chinle/Alluvium Interface
			9/9/2016	2.00	6,891.11	6,893.64	6,889.80	2.53	6,853.54	40.10	N/A	N/A	20.11	6,873.53	N/A	22 - 37	Chinle/Alluvium Interface
			10/31/2016	2.00	6,891.11	6,893.64	6,889.80	2.53	6,853.54	40.10	N/A	N/A	20.00	6,873.64	N/A	22 - 37	Chinle/Alluvium Interface
11/12/2014	12/16/2014	MKTF-42	2/24/2016	2.00	6,890.42	6,892.95	6,888.75	2.53	6,859.80	33.15	N/A	N/A	17.69	6,875.26	N/A	10 - 30	Chinle/Alluvium Interface
			6/9/2016	2.00	6,890.42	6,892.95	6,888.75	2.53	6,859.80	33.15	N/A	N/A	17.30	6,875.65	N/A	10 - 30	Chinle/Alluvium Interface
			9/9/2016	2.00	6,890.42	6,892.95	6,888.75	2.53	6,859.80	33.15	N/A	N/A	17.30	6,875.65	N/A	10 - 30	Chinle/Alluvium Interface
			10/31/2016	2.00	6,890.42	6,892.95	6,888.75	2.53	6,859.80	33.15	N/A	N/A	17.25	6,875.70	N/A	10 - 30	Chinle/Alluvium Interface
11/11/2014	12/16/2014	MKTF-43	2/24/2016	2.00	6,874.12	6,876.90	6,873.22	2.78	6,861.47	15.43	N/A	N/A	5.00	6,871.90	N/A	2 - 12	Chinle/Alluvium Interface
			6/9/2016	2.00	6,874.12	6,876.90	6,873.22	2.78	6,861.47	15.43	N/A	N/A	3.67	6,873.23	N/A	2 - 12	Chinle/Alluvium Interface
			9/9/2016	2.00	6,874.12	6,876.90	6,873.22	2.78	6,861.47	15.43	N/A	N/A	3.98	6,872.92	N/A	2 - 12	Chinle/Alluvium Interface
			10/31/2016	2.00	6,874.12	6,876.90	6,873.22	2.78	6,861.47	15.43	N/A	N/A	5.12	6,871.78	N/A	2 - 12	Chinle/Alluvium Interface

APPENDIX C-1.1 - Marketing Wells

Date of Installation	Date of Survey [1]	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevations (ft)	Well Casing Rim Elevations (ft)	Ground Elevation Inside Steel Sleeve (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to [2] SPH (ft)	SPH [3] Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation (ft)	Corrected [4] Water Table Elevation (Factor 0.8) (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
11/11/2014	12/16/2014	MKTF-44	2/24/2016	2.00	6,867.41	6,869.95	6,866.06	2.54	6,818.80	51.15	N/A	N/A	28.74	6,841.21	N/A	38 - 48	Chinle/Alluvium Interface
			6/9/2016	2.00	6,867.41	6,869.95	6,866.06	2.54	6,818.80	51.15	N/A	N/A	27.83	6,842.12	N/A	38 - 48	Chinle/Alluvium Interface
			9/8/2016	2.00	6,867.41	6,869.95	6,866.06	2.54	6,818.80	51.15	N/A	N/A	31.34	6,838.61	N/A	38 - 48	Chinle/Alluvium Interface
			10/31/2016	2.00	6,867.41	6,869.95	6,866.06	2.54	6,818.80	51.15	N/A	N/A	40.70	6,829.25	N/A	38 - 48	Chinle/Alluvium Interface
Pre-existing	12/16/2014	MKTF-45	3/17/2016	4.00	6,948.63	6,949.59	6,948.27	0.96	6,919.35	30.24	13.14	1.80	14.94	6,934.65	6936.09	Unknown	Chinle/Alluvium Interface
			6/10/2016	4.00	6,948.63	6,949.59	6,948.27	0.96	6,919.35	30.24	12.48	0.32	12.80	6,936.79	6937.05	Unknown	Chinle/Alluvium Interface
			9/13/2016	4.00	6,948.63	6,949.59	6,948.27	0.96	6,919.35	30.24	11.95	0.45	12.40	6,937.19	6937.55	Unknown	Chinle/Alluvium Interface
			11/7/2016	4.00	6,948.63	6,949.59	6,948.27	0.96	6,919.35	30.24	11.46	0.43	11.89	6,937.70	6938.04	Unknown	Chinle/Alluvium Interface

DEFINITIONS:

DTB - Depth to Bottom
DTW - Depth to Water
N/A - Not Applicable
SPH - Separate Phase Hydrocarbons

Negative number in Stick up Length column indicates well is flush mount and located at or below ground level
Depth to Water Column - if a measurement of 0.00 is indicated - means water level is at top of casing - Full.
Dry indicates no water was detected in the well.

NOTES:

1) Wells surveyed by a licensed professional surveyor-Hammon Enterprises, Inc. (HEI)
2) "0" indicates no SPH level.
3) Depth to SPH - Depth to Water Measurement = SPH Column Thickness.
4) Corrected Water Table Elevaton applies only if SPH thickness column measurement exists. (0.8 X SPH thickness + Ground Water Elevation)

APPENDIX C-2 - Well Elevation Summary Table

2016 WELL ELEVATION SUMMARY TABLE
Revision 7 - October 2016

Date of Installation	Well ID Number	Survey Measurement date	Verified Casing Diameter (Inch)	Survey Ground Level Elevation (feet)	Survey Well Casing Rim Elevation (feet)	Measuring Point Description	Survey Stick up Length (feet)	Survey Well Casing Bottom Elevation (feet)	Survey Total Well Depth (feet)	Screened Interval Depth Top to Bottom (feet)	Stratigraphic unit in which screen exists
11/10/2003	BW-1A [2]	9/15/2014	2.00	6,883.17	6,885.12	North edge PVC casing	1.95	6,839.06	46.06	38 - 43	Upper Sand
10/28/2003	BW-1B [2]	9/15/2014	2.00	6,883.17	6,885.78	North edge PVC casing	2.61	6,809.49	76.29	63.4 - 73.4	Chinle/Alluvium Interface
11/10/2003	BW-1C [2]	9/15/2014	2.00	6,883.17	6,885.68	North edge PVC casing	2.51	6,740.39	145.29	133.9 - 143.9	Sonsela
11/10/2003	BW-2A	6/7/2011	2.00	6,871.88	6,874.69	North edge PVC casing	2.81	6,807.12	67.57	55 - 65	Upper Sand
10/28/2003	BW-2B	6/7/2011	2.00	6,871.66	6,874.50	North edge PVC casing	2.84	6,782.24	92.26	80 - 90	Chinle/Alluvium Interface
10/28/2003	BW-2C	6/7/2011	2.00	6,872.90	6,875.30	North edge PVC casing	2.40	6,722.46	152.84	139.5 - 149.5	Sonsela
6/15/2004	BW-3A	6/7/2011	2.00	6,875.94	6,878.39	North edge PVC casing	2.45	6,826.04	52.35	39.5 - 49.5	Upper Sand
10/15/2003	BW-3B	6/7/2011	2.00	6,876.16	6,878.59	North edge PVC casing	2.43	6,809.19	69.40	63 - 73	Chinle/Alluvium Interface
7/20/2004	BW-3C	6/7/2011	2.00	6,875.72	6,877.95	North edge PVC casing	2.23	6,723.40	154.55	144.5 - 154.5	Sonsela
1/5/1981	OW-1 [1]	6/7/2011	4.00	6,866.32	6,866.62	North edge PVC casing	0.30	6,772.07	94.55	89.3 - 99.3	Sonsela
11/25/1980	OW-10	6/7/2011	4.00	6,873.67	6,874.91	North edge PVC casing	1.24	6,814.58	60.33	40 - 60	Sonsela
9/25/1981	OW-11	6/7/2011	4.00	6,922.05	6,923.51	North edge PVC casing	1.46	6,857.72	65.79	43 - 65	Sonsela
12/15/1980	OW-12	6/7/2011	4.00	6,939.57	6,940.69	North edge PVC casing	1.12	6,811.84	128.85	117.8 - 137.8	Sonsela
12/10/1980	OW-13	6/7/2011	4.00	6,918.95	6,920.07	North edge PVC casing	1.12	6,820.92	99.15	78.2 - 98.2	Sonsela
12/17/1980	OW-14	6/7/2011	4.00	6,924.55	6,926.65	North edge PVC casing	2.10	6,880.13	46.52	35 - 45	Chinle/Alluvium Interface
8/23/1996	OW-29	6/7/2011	4.00	6,913.89	6,917.00	North edge PVC casing	3.11	6,865.92	51.08	37.5 - 47.5	Chinle/Alluvium Interface
8/28/1996	OW-30	6/7/2011	4.00	6,921.81	6,924.69	North edge PVC casing	2.88	6,874.79	49.90	37.9 - 47.9	Chinle/Alluvium Interface
10/5/2009	OW-50	6/7/2011	2.00	6,912.63	6,914.21	North edge PVC casing	1.58	6,850.21	64.00	48 - 63	Chinle/Alluvium Interface
10/5/2009	OW-52	6/7/2011	2.00	6,906.53	6,907.68	North edge PVC casing	1.15	6,829.94	77.74	64 - 79	Chinle/Alluvium Interface
10/14/1981	MW-1	6/7/2011	5.00	6,876.63	6,878.12	North edge PVC casing	1.49	6,747.29	130.83	117.72 - 127.72	Sonsela
10/15/1981	MW-2	6/7/2011	5.00	6,878.39	6,880.30	North edge PVC casing	1.91	6,742.82	137.48	112 - 122	Sonsela
10/16/1981	MW-4	6/7/2011	5.00	6,879.89	6,881.63	North edge PVC casing	1.74	6,759.91	121.72	101 - 121	Sonsela
7/21/1986	MW-5	6/7/2011	4.00	6,880.20	6,882.83	North edge aluminum casing	2.63	6,752.00	130.83	115 - 125	Sonsela
3/28/1995	RW-1	6/7/2011	4.00	6,942.86	6,946.06	North edge PVC casing	3.20	6,903.02	43.04	25 - 40	Chinle/Alluvium Interface
3/29/1995	RW-2	6/7/2011	4.00	6,926.40	6,928.53	North edge PVC casing	2.13	6,888.73	39.80	26.1 - 36.1	Chinle/Alluvium Interface
8/27/1997	RW-5	6/7/2011	4.00	6,941.53	6,943.57	West Edge PVC Casing (Existing Mark)	2.04	6,903.98	39.59	29.5 - 39.5	Chinle/Alluvium Interface
8/27/1997	RW-6	6/7/2011	4.00	6,941.96	6,944.01	North edge PVC casing	2.05	6,903.11	40.90	28.5 - 38.5	Chinle/Alluvium Interface
9/26/1985	SMW-2	6/7/2011	2.00	6,881.63	6,883.97	North edge aluminum casing	2.34	6,831.17	52.80	34.31 - 54.31	Chinle/Alluvium Interface and Upper Sand
9/25/1985	SMW-4	6/7/2011	2.00	6,877.63	6,879.52	North edge aluminum casing	1.89	6,809.84	69.68	51.7 - 71.7	Chinle/Alluvium Interface
7/8/2004	GWM-1	6/7/2011	2.00	6,910.22	6,912.61	North edge PVC casing	2.39	6,886.41	26.20	17.5 - 23.5	Chinle/Alluvium Interface
9/25/2005	GWM-2	6/7/2011	2.00	6,910.32	6,913.09	North edge PVC casing	2.77	6,894.28	18.81	3.2 - 16.2	Chinle/Alluvium Interface
9/25/2005	GWM-3	6/7/2011	2.00	6,907.35	6,910.25	North edge PVC casing	2.90	6,892.45	17.80	3 - 15	Chinle/Alluvium Interface
3/14/2008	NAPIS-1	6/7/2011	2.00	6,913.62	6,913.86	North edge PVC casing	0.24	6,900.33	13.53	3.7 - 13.7	Chinle/Alluvium Interface
3/14/2008	NAPIS-2 [4]	6/7/2011	2.00	6,913.40	6,912.65	North edge PVC casing	-0.75	6,899.04	13.61	4.2 - 14.2	Chinle/Alluvium Interface
3/14/2008	NAPIS-3 [4]	6/7/2011	2.00	6,913.38	6,912.76	North edge PVC casing	-0.62	6,882.34	30.42	25.4 - 30.4	Chinle/Alluvium Interface
6/11/2007	KA-3 [4]	6/7/2011	2.00	6,913.29	6,912.52	North edge PVC casing	-0.77	6,889.32	23.20	15 - 25	Chinle/Alluvium Interface

APPENDIX C-2 - Well Elevation Summary
(Continued)

Date of Installation	Well ID Number	Survey Measurement date	Verified Casing Diameter (Inch)	Survey Ground Level Elevation (feet)	Survey Well Casing Rim Elevation (feet)	Measuring Point Description	Survey Stick up Length (feet)	Survey Well Casing Bottom Elevation (feet)	Survey Total Well Depth (feet)	Screened Interval Depth Top to Bottom (feet)	Stratigraphic unit in which screen exists
7/17/2012	OAPIS-1	4/2/2013	2.00	6,916.50	6,916.73	Northwest edge PVC casing	0.23	6,890.73	26.00	14 - 26	Chinle/Alluvium Interface
5/6/2014	STP1-NW [3]	9/15/2014	2.00	6,904.50	6,904.47	North edge top of PVC	-0.03	6,854.47	50.00	20 - 50	Chinle/Alluvium Interface
5/6/2014	STP1-SW [3]	9/15/2014	2.00	6,912.40	6,912.38	North edge top of PVC	-0.02	6,880.38	32.00	15 - 30	Chinle/Alluvium Interface
2016 REVISIONS/ADDITIONS TO SUMMARY TABLE											
3/14/2008	NAPIS-2 [4]	10/17/2016	2.00	6,918.29	6,917.87	North edge PVC casing	-0.42	6,903.54	14.33	4.2 - 14.2	Chinle/Alluvium Interface
3/14/2008	NAPIS-3 [4]	10/17/2016	2.00	6,918.30	6,918.07	North edge PVC casing	-0.23	6,886.95	31.12	25.4 - 30.4	Chinle/Alluvium Interface
6/11/2007	KA-3 [4]	10/17/2016	2.00	6,918.20	6,917.61	North edge PVC casing	-0.59	6,893.51	24.10	15 - 25	Chinle/Alluvium Interface

DEFINITIONS:

NA = Not applicable

Survey of all wells conducted in June 2011.

Stick up length is determined by subtracting 2011 Survey Ground Level Elevation from 2011 Survey Well Casing Rim Elevation. Negative values indicate well is a flush mount.

2011 Survey Well Casing Bottom Elevation is determined by subtracting the 2011 Survey Well Casing Rim Elevation from the 2011 Survey Total Well Depth Measurement.

Total well depth was determined using a bottom sensing meter, Testwell Water level meter with bottom sensing indicator.

Screened interval for each well was verfied to the well boring logs. Settlement may have occurred since installation of well which is why total well depth is higher or equal to the screened interval levels.

NOTES:

1) OW-1 original stick up length was measured to the top of the pvc casing which is connected to the well shroud with a rubber coupling.
2011 survey measurement was taken to the top segment of pvc casing not connected to the rubber coupling. (Coupling is where elevation is referenced)

2) BW-1A, B, C: Height of berm was increased where these wells are located and casings had to be extended.
Berm work at all evaporation ponds from April through August to increase outside slope and height. Three wells were resurveyed by HEI (Hammon Enterprises Inc) upon completion.

3) New wells installed on the west end of the north and south bays of the sanitary treatment pond (STP-1)

4) NAPIS-2, NAPIS-3 and KA-3 all had vaults re-installed - increased height to limit water seepage. Wells were surveyed upon completion on October 17, 2016 by HEI Professional Surveyors.

2014 WELL ELEVATION SUMMARY TABLE - No Changes for 2016

MKTF-01 through MKTF-45

Date of Installation	Well ID Number	Survey Measurement Date [1]	Casing Diameter (Inch)	Ground Level Elevations (ft)	Well Casing Rim Elevations (ft)	Ground Elevation Inside Steel Sleeve (ft)	Measuring Point Description	Stick-up length (ft)	Well Casing Bottom Elevations (ft)	Total Well Depth [2] (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
11/14/2013	MKTF-01	1/21/2014	4.00	6,918.28	6,920.67	6,920.67	North edge PVC Casing	2.39	6,903.25	17.42	5 - 15	Chinle/Alluvium Interface
11/14/2013	MKTF-02	1/21/2014	4.00	6,915.00	6,917.45	6,917.18	North edge PVC Casing	2.45	6,896.97	20.48	7 - 17	Chinle/Alluvium Interface
11/7/2013	MKTF-03	1/21/2014	4.00	6,931.73	6,931.69	6,930.85	North edge PVC Casing	-0.04	6,913.24	18.45	3 - 18	Chinle/Alluvium Interface
11/12/2013	MKTF-04	1/21/2014	4.00	6,933.90	6,933.57	6,933.24	North edge PVC Casing	-0.33	6,911.42	22.15	10 - 22	Chinle/Alluvium Interface
11/20/2013	MKTF-05	1/21/2014	4.00	6,939.49	6,942.22	6,941.95	North edge PVC Casing	2.73	6,924.47	17.75	4 - 14	Chinle/Alluvium Interface
11/11/2013	MKTF-06	1/21/2014	4.00	6,944.24	6,946.81	6,946.63	North edge PVC Casing	2.57	6,923.04	23.77	8 - 20	Chinle/Alluvium Interface
11/11/2013	MKTF-07	1/21/2014	4.00	6,944.40	6,947.18	6,947.06	North edge PVC Casing	2.78	6,929.56	17.62	4 - 14	Chinle/Alluvium Interface
11/11/2013	MKTF-08	1/21/2014	4.00	6,944.02	6,947.09	6,942.67	North edge PVC Casing	3.07	6,925.11	21.98	8 - 18	Chinle/Alluvium Interface
11/11/2013	MKTF-09	1/21/2014	4.00	6,943.57	6,946.50	6,945.90	North edge PVC Casing	2.93	6,923.80	22.70	7 - 19	Chinle/Alluvium Interface
10/31/2013	MKTF-10	1/21/2014	4.00	6,937.51	6,937.16	6,936.63	North edge PVC Casing	-0.35	6,921.17	15.99	7 - 17	Chinle/Alluvium Interface
10/31/2013	MKTF-11	1/21/2014	4.00	6,931.61	6,931.34	6,930.86	South edge PVC Casing	-0.27	6,913.20	18.14	8 - 18	Chinle/Alluvium Interface
11/7/2013	MKTF-12	1/21/2014	4.00	6,939.70	6,942.11	6,941.88	North edge PVC Casing	2.41	6,916.51	25.60	12 - 22	Chinle/Alluvium Interface
11/12/2013	MKTF-13	1/21/2014	4.00	6,933.67	6,935.18	6,934.83	North edge PVC Casing	1.51	6,913.93	21.25	8 - 18	Chinle/Alluvium Interface
11/12/2013	MKTF-14	1/21/2014	4.00	6,925.65	6,928.02	6,927.80	North edge PVC Casing	2.37	6,910.56	17.46	4 - 14	Chinle/Alluvium Interface
10/29/2013	MKTF-15	1/21/2014	2.00	6,943.74	6,943.48	6,943.19	North edge PVC Casing	-0.26	6,924.00	19.48	9 - 19	Chinle/Alluvium Interface
11/7/2013	MKTF-16	1/21/2014	2.00	6,951.00	6,950.58	6,950.58	North edge PVC Casing	-0.42	6,936.48	14.10	4 - 14	Chinle/Alluvium Interface
11/14/2013	MKTF-17	1/21/2014	2.00	6,945.79	6,945.76	6,945.64	North edge PVC Casing	-0.03	6,921.65	24.11	14 - 24	Chinle/Alluvium Interface
11/15/2013	MKTF-18	1/13/2014	2.00	6,950.97	6,950.65	6,950.17	North edge PVC Casing	-0.32	6,925.27	25.38	17 - 27	Chinle/Alluvium Interface
11/5/2013	MKTF-19	4/30/2014	2.00	6,944.89	6,944.67	6,944.34	North edge PVC Casing	-0.22	6,927.20	17.47	10 - 20	Chinle/Alluvium Interface
2/10/2014	MKTF-20	4/30/2014	4.00	6,951.89	6,951.78	6,951.17	North edge PVC Casing	-0.11	6,941.89	9.89	2 - 10	Chinle/Alluvium Interface
2/10/2014	MKTF-21	4/30/2014	4.00	6,952.68	6,952.57	6,952.00	North edge PVC Casing	-0.11	6,942.68	9.89	2 - 10	Chinle/Alluvium Interface
4/30/2014	MKTF-22	4/30/2014	2.00	6,939.76	6,942.31	6,938.57	North edge PVC Casing	2.55	6,907.06	35.25	22 - 32	Chinle/Alluvium Interface
4/30/2014	MKTF-23	4/30/2014	2.00	6,927.23	6,929.98	6,925.79	North edge PVC Casing	2.75	6,909.62	20.36	7 - 17	Chinle/Alluvium Interface
4/30/2014	MKTF-24	4/30/2014	2.00	6,926.07	6,928.72	6,924.62	North edge PVC Casing	2.65	6,898.25	30.47	18 - 28	Chinle/Alluvium Interface
4/30/2014	MKTF-25	4/30/2014	2.00	6,913.35	6,916.19	6,911.79	North edge PVC Casing	2.84	6,896.76	19.43	6 - 16	Chinle/Alluvium Interface

APPENDIX C-2.1 - (Continued)

Date of Installation	Well ID Number	Survey Measurement Date [1]	Casing Diameter (Inch)	Ground Level Elevations (ft)	Well Casing Rim Elevations (ft)	Ground Elevation Inside Steel Sleeve (ft)	Measuring Point Description	Stick-up length (ft)	Well Casing Bottom Elevations (ft)	Total Well Depth [2] (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
4/30/2014	MKTF-26	4/30/2014	2.00	6,912.55	6,915.31	6,911.35	North edge PVC Casing	2.76	6,898.16	17.15	4 - 14	Chinle/Alluvium Interface
4/30/2014	MKTF-27	4/30/2014	2.00	6,915.36	6,917.90	6,914.18	North edge PVC Casing	2.54	6,903.18	14.72	2 - 12	Chinle/Alluvium Interface
4/30/2014	MKTF-28	4/30/2014	2.00	6,918.67	6,921.52	6,917.51	North edge PVC Casing	2.85	6,905.36	16.16	3 - 13	Chinle/Alluvium Interface
4/30/2014	MKTF-29	4/30/2014	2.00	6,898.83	6,901.62	6,897.67	North edge PVC Casing	2.79	6,878.78	22.84	10 - 20	Chinle/Alluvium Interface
4/30/2014	MKTF-30	4/30/2014	2.00	6,898.10	6,900.80	6,896.68	North edge PVC Casing	2.70	6,877.60	23.20	10 - 20	Chinle/Alluvium Interface
4/30/2014	MKTF-31	4/30/2014	2.00	6,904.26	6,906.87	6,903.11	North edge PVC Casing	2.61	6,884.06	22.81	6 - 21	Chinle/Alluvium Interface
4/30/2014	MKTF-32	4/30/2014	2.00	6,908.44	6,911.11	6,907.16	North edge PVC Casing	2.67	6,883.36	27.75	9.5 - 24.5	Chinle/Alluvium Interface
4/30/2014	MKTF-33	4/30/2014	2.00	6,936.59	6,939.75	6,936.59	North edge PVC Casing	3.16	6,906.55	33.20	20 - 30	Chinle/Alluvium Interface
4/30/2014	MKTF-34	4/30/2014	2.00	6,942.42	6,945.35	6,943.52	North edge PVC Casing	2.93	6,917.67	27.68	9.5 - 24.5	Chinle/Alluvium Interface
11/19/2014	MKTF-35	12/16/2014	2.00	6,951.90	6,951.65	6,951.25	North edge PVC Casing	-0.25	6,935.20	16.45	6 - 16	Chinle/Alluvium Interface
11/19/2014	MKTF-36	12/16/2014	2.00	6,950.67	6,950.12	6,949.87	North edge PVC Casing	-0.55	6,934.67	15.45	5 - 15	Chinle/Alluvium Interface
11/18/2014	MKTF-37	12/16/2014	2.00	6,959.07	6,958.87	6,958.62	North edge PVC Casing	-0.20	6,934.27	24.60	4 - 24	Chinle/Alluvium Interface
11/20/2014	MKTF-38	12/16/2014	2.00	6,955.17	6,954.89	6,954.54	North edge PVC Casing	-0.28	6,934.60	20.29	5 - 20	Chinle/Alluvium Interface
11/14/2014	MKTF-39	12/16/2014	2.00	6,953.97	6,953.75	6,953.12	North edge PVC Casing	-0.22	6,938.55	15.20	5 - 15	Chinle/Alluvium Interface
11/13/2014	MKTF-40	12/16/2014	2.00	6,891.35	6,894.73	6,890.48	North edge PVC Casing	3.38	6,871.09	23.64	5 - 20	Chinle/Alluvium Interface
11/14/2014	MKTF-41	12/16/2014	2.00	6,891.11	6,893.64	6,889.80	North edge PVC Casing	2.53	6,853.54	40.10	22 - 37	Chinle/Alluvium Interface
11/12/2014	MKTF-42	12/16/2014	2.00	6,890.42	6,892.95	6,888.75	North edge PVC Casing	2.53	6,859.80	33.15	10 - 30	Chinle/Alluvium Interface
11/11/2014	MKTF-43	12/16/2014	2.00	6,874.12	6,876.90	6,873.22	North edge PVC Casing	2.78	6,861.47	15.43	2 - 12	Chinle/Alluvium Interface
11/11/2014	MKTF-44	12/16/2014	2.00	6,867.41	6,869.95	6,866.06	North edge PVC Casing	2.54	6,818.80	51.15	38 - 48	Chinle/Alluvium Interface
Unknown [3]	MKTF-45	1/12/2015	4.00	6,948.63	6,949.59	6,948.27	North edge PVC Casing	0.96	6,919.35	30.24	20 - 30	Chinle/Alluvium Interface

DEFINITIONS:

NA = Not applicable

Stick up length is determined by subtracting 2011 Survey Ground Level Elevation from 2011 Survey Well Casing Rim Elevation.

2011 Survey Well Casing Bottom Elevation is determined by subtracting the 2011 Survey Well Casing Rim Elevation from the 2011 Survey Total Well Depth Measurement.

Total well depth was determined using a bottom sensing meter, Testwell Water level meter with bottom sensing indicator.

Screened interval for each well was verfied to the well boring logs. Settlement may have occurred since installation of well which is why total well depth is higher or equal to the screened interval levels.

NOTES:

1) 1/21/14 AND 4/30/14 - Survey conducted by DePauli Engineering. 12/16/14 and 1/2/15 - Survey conducted by HEI - Hammon Enterprises, Inc. Professional licensed surveyors.

2) Depth to bottom field verified 2/4/2015 using a bottom sensing meter, Testwell Water Level Meter with bottom sensing indicator.

3) Pre-existing well - Well logs, survey data unavailable for well identification. Re-labeled as MKTF-45.

APPENDIX C-3 - Well Elevation Summary Table - Artesian Water Wells

2011 WELL ELEVATION SUMMARY TABLE FOR ARTESIAN WATER WELLS

Revision #2 - March 21, 2012

Date of Installation	Well ID Number	Submersible pump depth (feet)	Casing Diameter (Inch)	Well Head Elevation Mark* (North) (feet)	Well Head Elevation Mark* (West) (feet)	Well Head Elevation Mark* (Z) (feet)	Measuring Point Description	Total Well Depth (feet)	Well Casing Bottom Elevation[1] (feet)	Stratigraphic unit	Aquifer
9/24/1956	PW-2	800	16.0	3,300.40	4,694.28	162.78	1st Discharge tee or elbow	1,075.00	2,225.40	Chinle	San Andreas/Yeso Aquifer
April 1979	PW-3	900	14.0	2,932.83	1,387.79	248.00	1st Discharge tee or elbow	1,030.00	1,902.83	Chinle	San Andreas/Yeso Aquifer
11/12/1999	PW-4	750	12.0[2]	1,895.73	2,979.78	178.51	1st Discharge tee or elbow	1,020.00[3]	819.73	Chinle	San Andreas/Yeso Aquifer

NOTES:

** Basis of survey Refinery Control Point at 1000W, 2575N, plant elevation = 254.87 feet and MSL elevation = 6959.41 feet.*

1) Well casing bottom elevation using Well Head Elevation Mark (North) as reference point.
2) Actual well casing diameter is 12 inches. The 176 feet of 24 inch steel casing is the actual cemented support for development of the well.
3) The actual total well depth is 1020 feet with additional 56 feet x 7-7/8 inch diameter open exploratory hole which was accounted for as total well depth of 1076 feet.

At the time of the survey by DePauli Engineering the artesian wells were not included as these wells have never been listed on the summary table or had questionable elevations.
These wells are sampled annually, semi-annual and every three years and not required to be gauged when sampling. A copy of an original survey dated February 13, 2003 conducted by DePauli Engineering attached for reference.

No changes for 2016.

APPENDIX C-3 - Well Elevation Table - Artesian Water Wells

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FIGURES

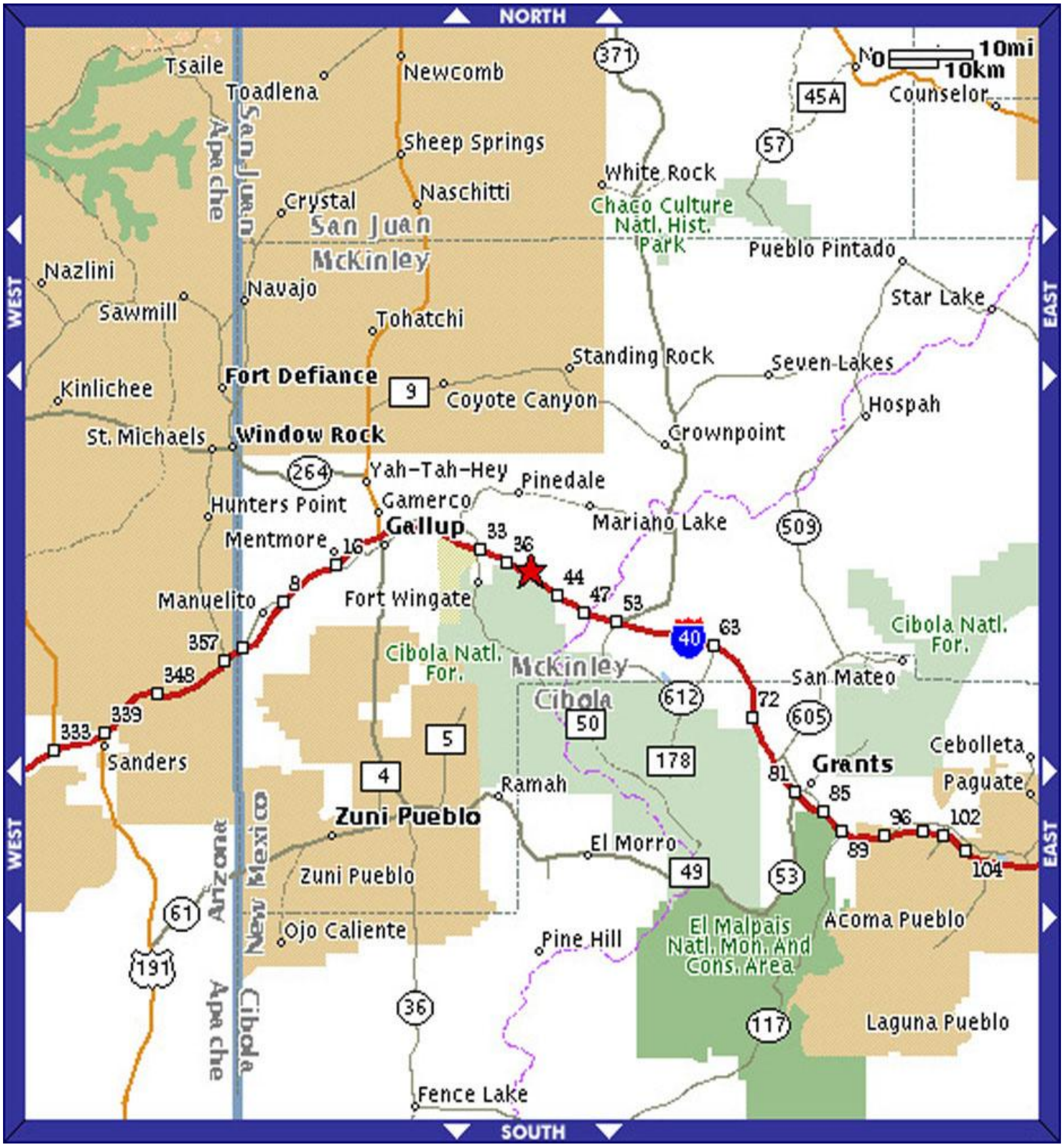


Figure 1: Regional map showing the location of the Gallup Refinery (red star along Interstate-40, 20 miles east of the City of Gallup).

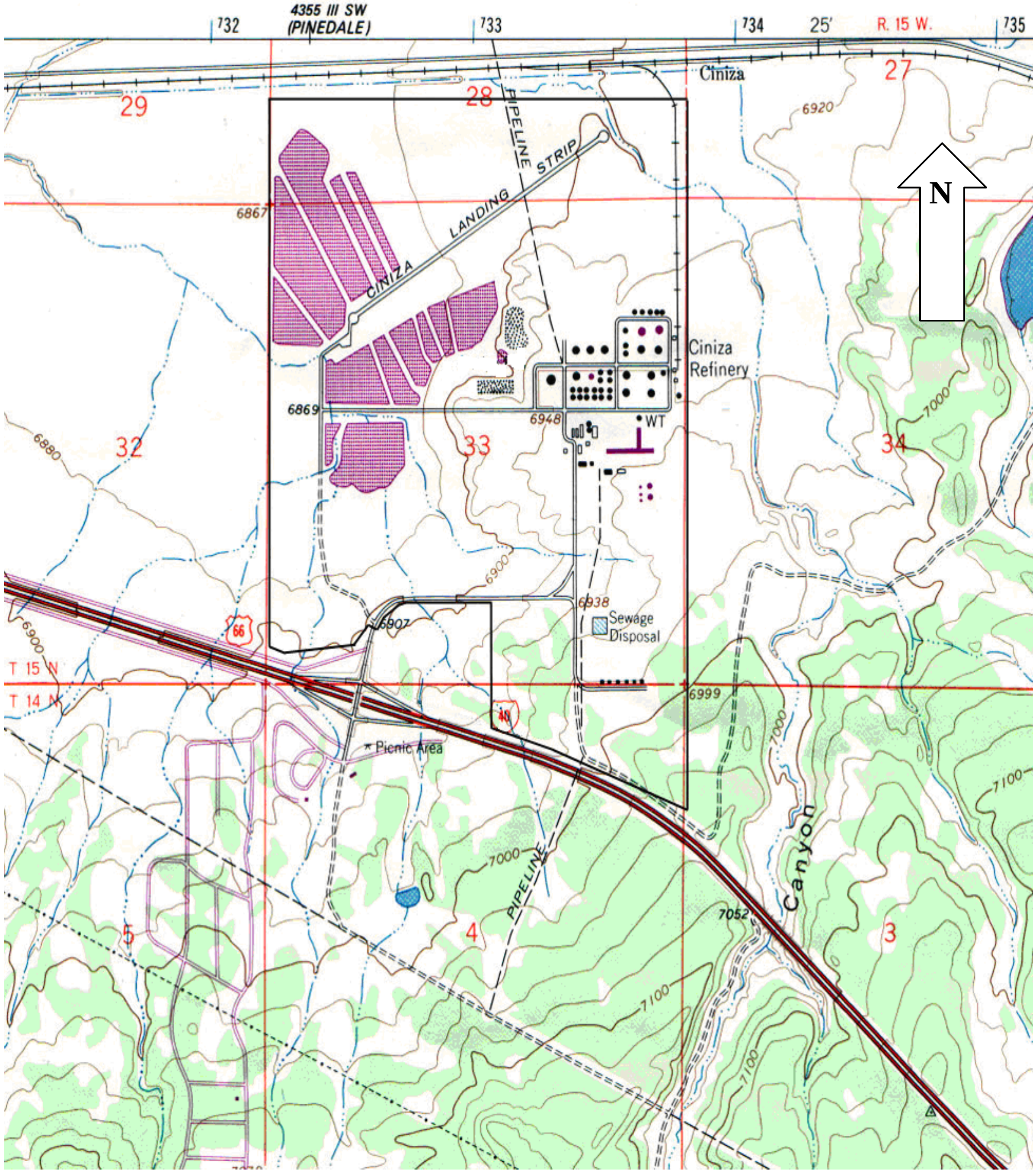


Figure 2: Topographic Map of the Gallup Refinery Site - USGS Topographical Map - Gallup Quadrangle (Revised 1980)

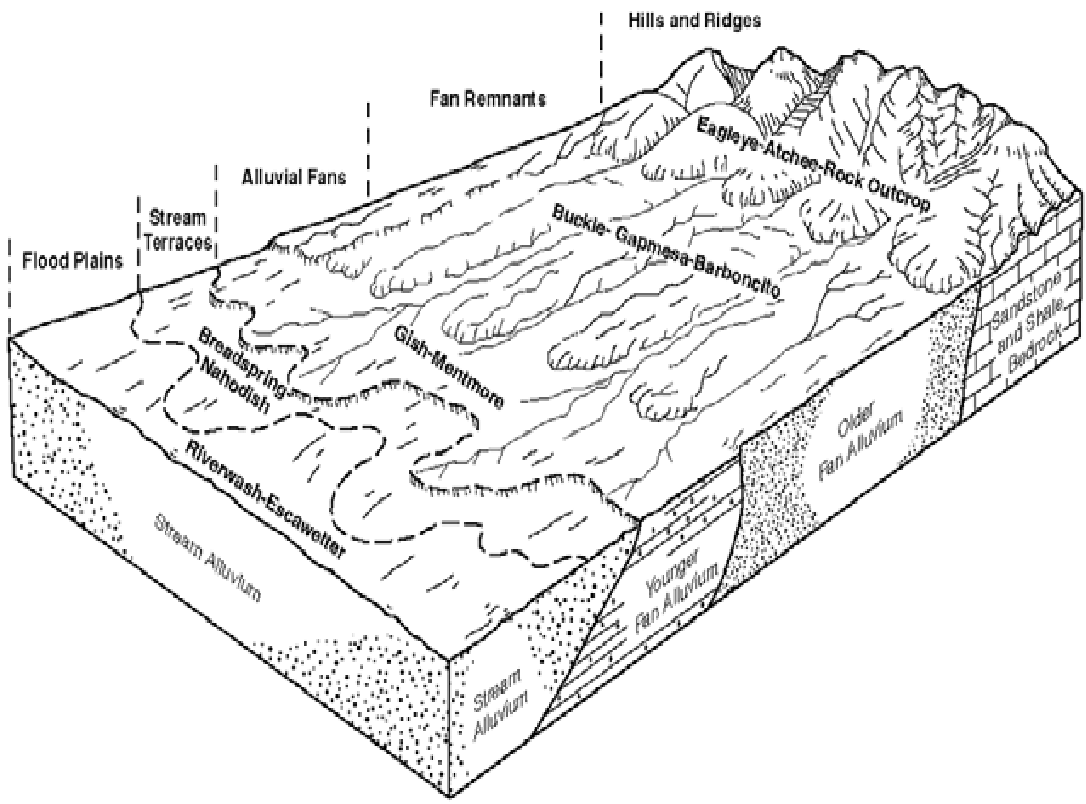
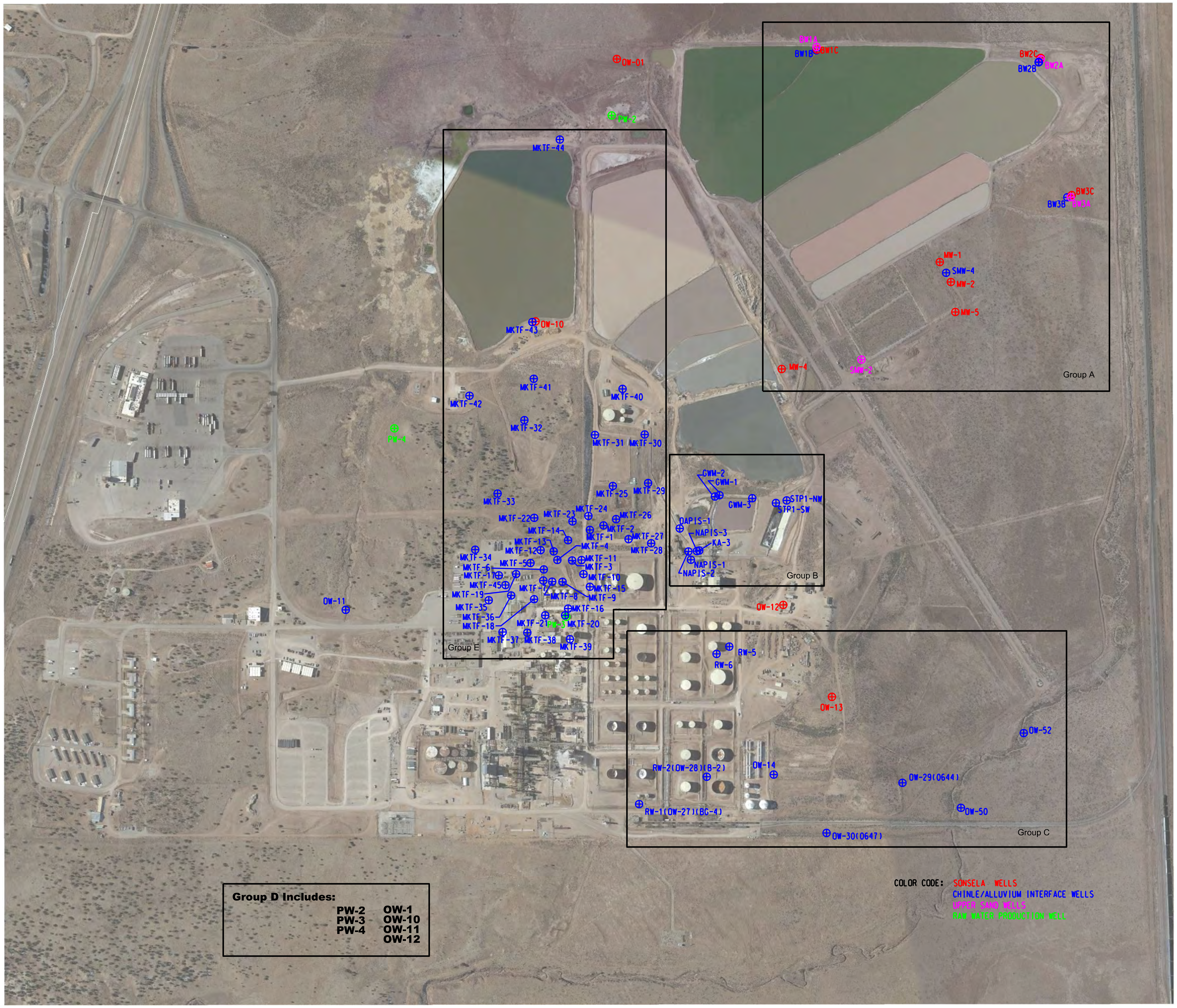


Figure 3: Generalized relationship of soils in the Gallup Refinery area: from NRCS/USDA Soil Survey of McKinley County.



4601 Ripley
El Paso, Texas
79922
915-584-1317

1"=500'

Project #: 0625859

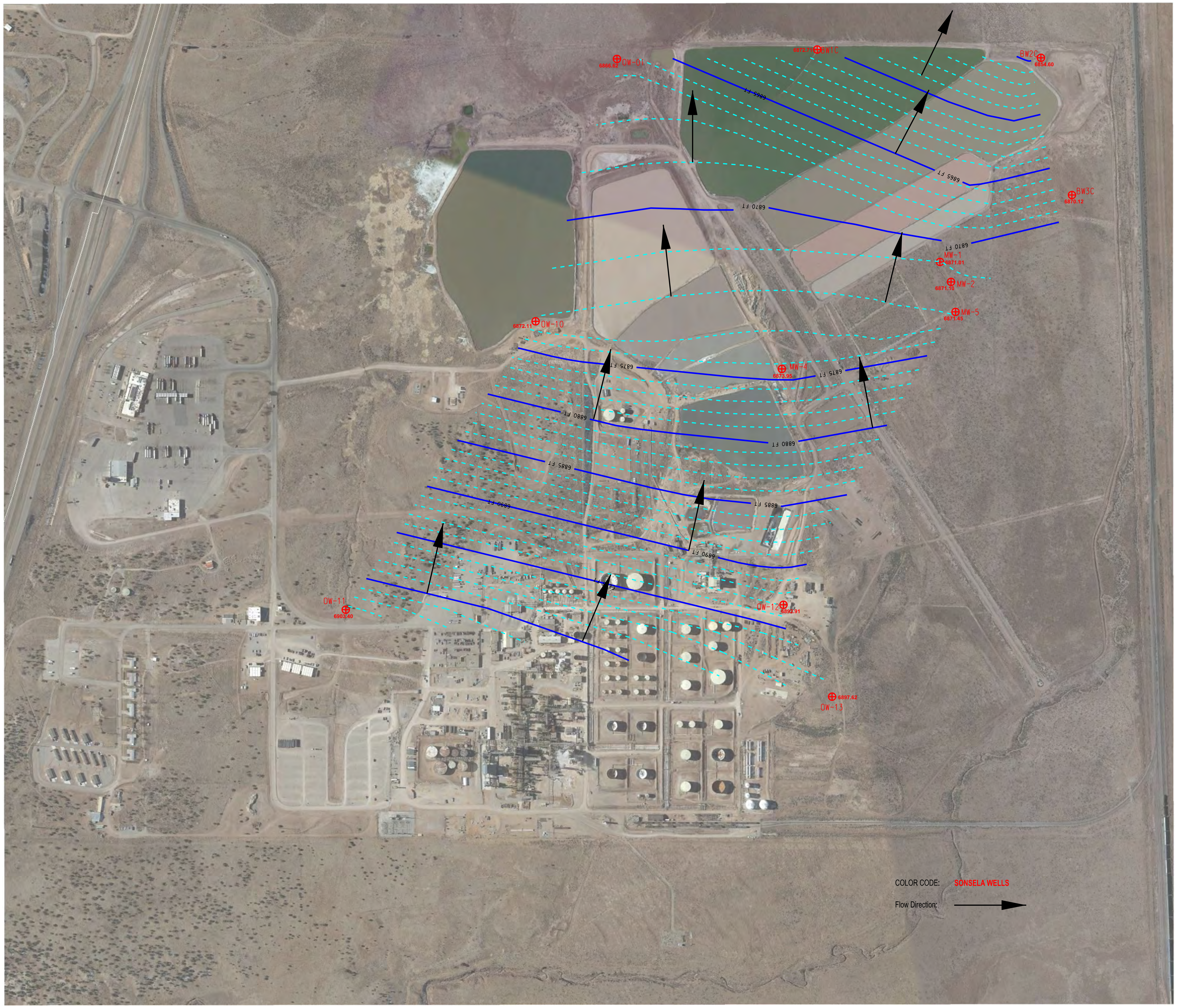
Figure 4

FACILITIES AND WELL GROUPS

WESTERN REFINING - GALLUP REFINERY

Western Refining - Gallup Refinery
92 Giant Crossing Road
Gallup, New Mexico 87347

Date: February 26, 2015



psi

4601 Ripley
El Paso, Texas
79922
915-584-1317

1"=500'

Project #: 0625859

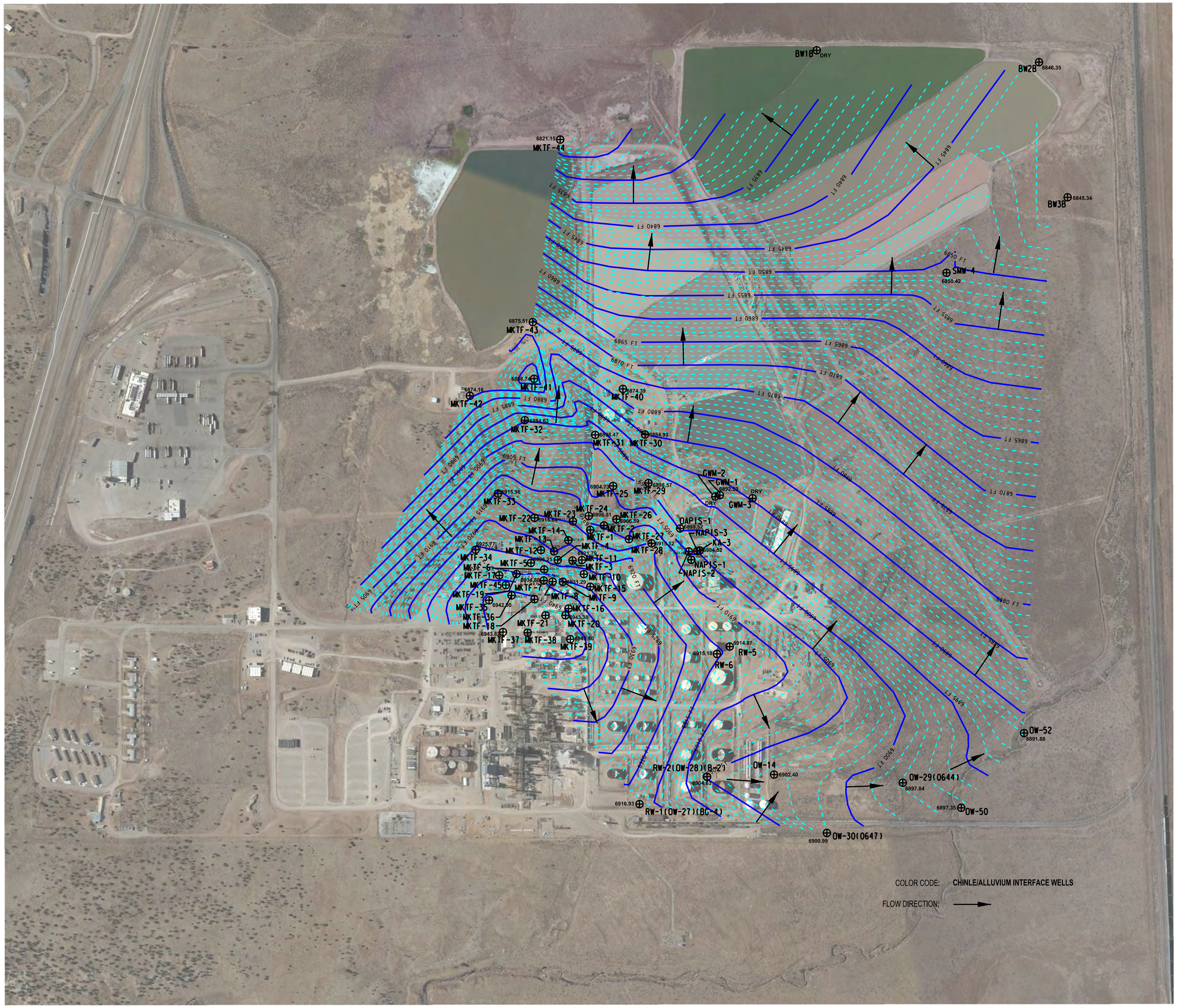
Figure 5

Sonsela Water Elevation Map 2014

WESTERN REFINING - GALLUP REFINERY

Western Refining - Gallup Refinery
92 Giant Crossing Road
Gallup, New Mexico 87347

Date: February 26, 2015



psi

4601 Ripley
El Paso, Texas
79922
915-584-1317

1"=500'

Project #: 0625859

Figure 6

Alluvium/Chinle Gp Interface Water Elevation Map

WESTERN REFINING - GALLUP REFINERY

Western Refining - Gallup Refinery
92 Giant Crossing Road
Gallup, New Mexico 87347

Date: February 26, 2015

Facility Wide Ground Water
Monitoring Work Plan – Updates for 2017


MONTANA
NORTH DAKOTA
SOUTH DAKOTA
IDAHO
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
Western
Refining
Fueling Our Lives

Western Refining Company
Gallup Refinery
92 Giant Crossing Road
Gallup, New Mexico 87301
505-722-3833

Submitted: March 22 ~~31~~, 2017

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.

______________________________________ ________________________________

Daniel J. Statile ______Date
VP Refining

Reviewed by: Submitted by:

_________________________ _________________________________

Ed Riege, M.P.H.
Remediation Manager

Cheryl Johnson
Environmental Specialist

Executive Summary

Western Refining conducts quarterly, semi-annual and annual ground water monitoring at its Gallup facility on a site wide basis. The Ground Water Monitoring Work Plan (Plan) documents any additions or revisions in ground water monitoring and also details the sampling procedures used.

This Plan divides the facility into five monitoring groups. Group A consists of the boundary wells situated along the northwest corner of the refinery property and monitoring wells around the land treatment area (LTU). Group B consists of a cluster of wells at the aeration basin and at the sanitary treatment pond 1 (STP-1) near the Waste Water Treatment Unit. Group C consists of the observation wells on the northeast section of the refinery including four product recovery wells. In 2016, six new wells were installed resulting from the North Drainage Ditch and OW-14 Site Investigation. Group D includes the process/production wells and the four observation wells located on the south-southwest section of the property. Group E includes 44 permanent monitoring wells installed to delineate the extent of a hydrocarbon plume associated with a seep discovered in 2013 directly west of the crude tanks (T-101, 102); ~~. Also~~ included in this group is a pre-existing well located directly west of the truck loading terminal~~rack~~. No visible markings or drill logs were available to identify this well and Western has labeled this well as MKTF-45 as this well is located in the vicinity of the seep investigation. Not included in the grouping are sampling requirements for the evaporation ponds and effluent from the sanitary treatment pond (STP-1).

Gallup Refinery will periodically review facility-wide monitoring data, and assess the monitoring program presented in this Plan. Revisions to the Plan, as necessary, will then be presented annually for agency review and approval. These revisions may include, but not be limited to~~,~~ a reduction or change in monitoring locations, monitoring frequency, and/or target chemicals to be analyzed.

Gallup follows the most current approved sampling/monitoring schedule from NMED; "Approval With Modifications – Facility Wide Ground Water Monitoring Report, Gallup Refinery, HWB-WRG-14-006, dated May 18, 2016Work Plan 2012 Updates; 2013 Updates; 2014 Updates for 2015", dated July 24, 2015; NMED revised Facility Wide Ground Water Monitoring Work Plan = 2012 updates, 2013 updates, 2014 updates for 2015 dated March 11, 2016; and NMED Approval with Modification – Facility Wide Ground Water Monitoring Work Plan 2014 updates for 2015 dated August 14, 2016. .

We have created a monitoring work plan with quality assurance practices and controls as well as standard procedures for sampling, and a schedule of activities to monitor ground water and surface water at select locations of the Gallup Refinery. The persons responsible for the implementation and oversight of this plan are:

Vice President Refining

- Daniel J. Statile

Remediation Manager

- Ed Riege

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List of Acronyms

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AL	Aeration Lagoon
API	American Petroleum Institute
BMP	Best Management Practices
BS	Blank Spike
BSD	Blank Spike Duplicate
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CFR	Code of Federal Regulations
DQO	Data Quality Objective
DRO	Diesel Range Organics
DTB	Depth to Bottom
DTW	Depth to Water
EP	Evaporation Pond
EPA	Environmental Protection Agency
FT.	Foot
FWGWMP	Facility Wide Ground Water Monitoring Plan
GPM	Gallons per minute
GRO	Gasoline Range Organics
HNO3	Nitric Acid
HWB	Hazardous Waste Bureau
IDW	Investigation Derived Waste
LDU	Leak Detection Unit
LTU	Land Treatment Unit
ML	Milliliter
MCL	Maximum Contaminant Level
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MTBE	Methyl Tert Butyl Ether
NAICS	North American Industry Classification System

List of Acronyms – Continued

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NAPIS	New American Petroleum Institute Separator
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NOI	Notice of Intent
OAPIS	Old American Petroleum Institute Separator
OW	Observation Well
OCD	Oil Conservation Division
PPE	Personal Protective Equipment
PPM	Parts per million
PSTB	Petroleum Storage Tank Bureau
PVC	Polyvinyl Chloride
PW	Process Well
QA	Quality Assurance
QC	Quality Control
RW	Recovery Well
RCRA	Resource Conservation and Recovery Act
SIC	Standard Industrial Classification
SOP	Standard Operating Procedure
SPH	Separate Phase Hydrocarbon
STP	Sanitary Treatment Pond
SVOC	Semi-volatile Organic Compound
SWMU	Solid Waste Management Unit
SWPP	Storm Water Pollution Prevention Program
TOC	Total Organic Content
VOC	Volatile Organic Compound
WQCC	Water Quality Control Commission
WWTP	Waste water treatment plant

1.0 Introduction

This Facility-Wide Ground Water Monitoring Work Plan (Plan) has been prepared for the implementation of a ground water monitoring program at the Gallup Refinery owned by Western Refining ("Gallup Refinery" or "Facility").

1.1 Scope of Activities

This Plan has been prepared to collect data that will be used to characterize the nature and extent of potential impacts to ground water at the Gallup Refinery. The monitoring plan is designed to assist the facility in evaluating any levels of contaminants that exceed compliance standards. This Plan divides the facility into five groups for periodic monitoring:

GROUP A	GROUP B	GROUP C	GROUP D	GROUP E
BW-1A, B, C	GWM-1, 2, 3	OW-13, 14, 29, 30	PW-2, 3, 4	MKTF- 1 thru 45
BW-2A, B, C	NAPIS 1, 2, 3, KA-3	OW-50, 52	OW-1, 10	
BW-3A, B, C	OAPIS-1	RW-1, 2, 5, 6	OW-11, 12	
MW-1, 2, 4, 5	LDU (3)			
SMW-2, 4	STP1-NW, SW			

Group A consists of the boundary wells situated along the northwest corner of the refinery property and the monitoring wells around the LTU. Group B consists of a cluster of monitoring wells and leak detection units for the NAPIS at the aeration basin and at the sanitary treatment pond. Group C includes the observation wells located on the northeast section of the plant and includes recovery wells from which small quantities of free product has been continually removed. Group D includes the process/production wells and four observation wells located on the south, southwest section of the refinery property. Group E includes a total of 44 new monitoring wells installed to delineate a hydrocarbon plume associated with a seep discovered west of the crude tank (Tank 101); ~~. Also~~ included in this group is a pre-existing well located directly west of the truck loading terminal~~rack~~. This well has been labeled as MKTF-45 as no markings or boring logs have been located to identify when this well was installed. This plan also includes sampling requirements for the evaporation ponds and for the effluent from the sanitary treatment pond. Designated wells and sample points identified are monitored on a quarterly, semi-annual and annual basis following the procedures presented in this Plan.

Gallup Refinery ~~–~~periodically reviews facility-wide monitoring data and ~~assess~~ evaluates the monitoring program presented in this Plan. Annual revisions to the Plan will be presented for agency review and approval. These revisions may include, but not be limited to, a reduction or change in monitoring locations, monitoring frequency, and/or target chemicals to be analyzed.

1.2 Facility Ownership and Operation

This Plan pertains to the Western Refining Southwest Inc., Gallup Refinery located at Exit 39 on Interstate I-40. This refinery is known as the Gallup Refinery and is located at Jamestown, New Mexico, approximately 17 miles east of Gallup. Figure 1 shows the regional location of the Gallup Refinery.

The owner is:

	Western Refining 123 W. Mills Avenue El Paso, TX 79901	(Parent Corporation)
Operator:	Western Refining Southwest Inc. Gallup Refinery 92 Giant Crossing Road Gallup, New Mexico 87301	(Postal Address)
	Western Refining Southwest Inc. Gallup Refinery I-40, Exit 39 (17 Miles East of Gallup, NM) Jamestown, New Mexico 87347	(physical address)

The following regulatory identification and permit governs the Gallup Refinery:

- SIC code 2911 (petroleum refining) applies to the Gallup Refinery
- U.S. EPA ID Number NMD000333211
- OCD Discharge Case Number AP-111.
- 2015 NPDES MSGP, ID #NMR053168

The facility status is corrective action/compliance. Quarterly, semi-annual and annual ground water sampling is conducted at the facility to evaluate present contamination.

The refinery is situated on an 810 acre irregular shaped tract of land that is ~~substantially~~ largely located within the lower one quarter of Section 28 and throughout Section 33 of Township 15 North, Range 15 West of the New Mexico Prime Meridian. A small component of the property lies within the northeastern one quarter of Section 4 of Township 14 North, Range 15 West. Figure 2 is a topographic map showing the general layout of the refinery in comparison to the local topography.

2.0 Background Information

2.1 Historical and Current Site Use

Built in the 1950's, the Gallup Refinery is located within a rural and sparsely populated section of McKinley County in Jamestown, New Mexico, 17 miles east of Gallup, New Mexico. The setting is a high desert plain on the western slope of the Continental Divide. The nearest population centers are the Flying J ~~Pilot (formerly Giant)~~ Travel Center (Travel Center) refueling plaza, the Interstate 40 highway corridor, and a small cluster of residential homes located on the south side of Interstate 40 approximately 2 miles southwest of the refinery (Jamestown). The surrounding land is comprised primarily of public lands and is used for cattle and sheep grazing.

The refinery primarily receives crude oil via two 6-inch diameter pipelines; two pipelines from the Four Corners Area enter the refinery property from the north. In addition, the refinery also receives natural gasoline feed stock via a 4-inch diameter pipeline that comes in from the west along the Interstate 40 corridor from the Western Refining - Wingate Facility (formerly Conoco gas plant). Crude oil and other products also arrive at the site via railroad cars. These feed stocks are then stored in tanks until refined into products.

The Gallup Refinery is a crude oil refining and petroleum products manufacturing facility. The Standard Industrial Classification (SIC) code is 2911 and the North American Industry Classification System Code (NAICS) is 32411. There are no organic chemicals, plastics, or synthetic fibers manufactured that contribute to our process flow of waste water. We do not manufacture lubricating oils.

The refinery incorporates various processing units that convert crude oil and natural gasoline into finished products. These units are briefly described as follows.

- Crude Distillation Unit - separates crude oil into various fractions; including gas, naphtha, light oil, heavy oil, and residuum.

- Fluidized Catalytic Cracking Unit (FCCU) - dissociates long-chain hydrocarbon molecules into smaller molecules, and essentially converts heavier oils into naphtha and lighter oils.

- Alkylation Unit - combines specific types of hydrocarbon molecules into a high octane gasoline blending component.

- Reforming Unit - breaks up and reforms low octane naphtha molecules to form high octane naphtha.

- Hydro-Treating Unit - removes undesirable sulfur and nitrogen compounds from intermediate feed stocks, and also saturates these feed stocks with hydrogen to make diesel fuel.

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- Treater Unit - remove impurities from various intermediate and blending feed stocks to produce finished products that comply with sales specifications.

- Ammonium Thiosulfate Unit - accepts high H2S and ammonia containing gas streams from the Amine and the Sour Water Stripper units, and converts these into a useful fertilizer product, ammonium thiosulfate.

- Sulfur Recovery Unit - converts and recovers various sulfur compounds from the gases and liquids produced in other processing units to create a solid elemental sulfur byproduct.

- Waste Water Treatment Plant - -process and treat refinery waste and storm water before releasing to treatment ponds.

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As a result of these processing steps, the refinery produces a wide range of petroleum products including propane, butane, unleaded gasoline, diesel, and residual fuel. In addition to the afore-mentioned processing units, various other equipment and systems support the operation of the refinery and are briefly described as follows.

Storage tanks are used throughout the refinery to hold and store crude oil, natural gasoline, intermediate feed stocks, finished products, chemicals, and water and are all located above ground. Capacity of these tanks range in size from 80,000 barrels to less than 1,000 barrels.

Pumps, valves, and piping systems are used throughout the refinery to transfer various liquids among storage tanks and processing units. A railroad spur track and a railcar loading rack are used to transfer feed stocks and products from refinery storage tanks into and out of railcars.

Several tank truck loading racks are used at the refinery to load out finished products and also receive crude oil, other feed stocks, additives, and chemicals.

Gasoline is delivered to the Pilot Travel Center via tanker truck. An underground diesel pipeline exists between the refinery and the Pilot Travel Center. . As a result of an off-refinery release, the pipeline was purged of product, filled with nitrogen and temporarily placed out of service. Gallup Refinery worked with the New Mexico Environment Department (NMED) Petroleum Storage Tank Bureau (PSTB) and the New Mexico Oil Conservation Division (NMED-OCD) to place this line back in service. In 2013 the underground diesel line from Gallup Refinery to the Pilot Travel Center was replaced and put back in service on February 3, 2014.... The replaced line runs above ground from the marketing area of the refinery for approximately 150 feet and continues underground to the Pilot Travel Center. The diesel line was commissioned. and put back in service on February 3, 2014.

A firefighting training facility is used to conduct employee firefighting training. Waste water from the facility, when training is conducted, is pumped into a tank which is then pumped out by a vacuum truck. The vacuum truck pumps the oily water into a process sewer upstream of the New API Separator (NAPIS).

The process waste water system is a network of curbing, paving, catch basins, and underground piping used to collect waste water from various processing areas within the refinery. The waste water effluent then flows into the equalization tanks and the NAPIS where the oil is separated from water based on the principle that, given a quiet surface, oil will float to the water surface where it can be skimmed off. The skimmed slop is passed to a collection chamber where it is pumped back into the refinery process. The clarified water is routed to athe new waste water treatment plant (WWTP) where benzene is removed and the treated water flows into the new pond STP-1. STP-1 consists of two bays, north and south and each bay is equipped with five aerators per bay. Effluent from STP-1 then flows into Evaporation Pond 2 and gravitated to the rest of the ponds. The new WWTP was completed and put online in May of 2012.

During episodes of unit upsets or major storm events, the waste water is held in one of the three equalization tanks, T-35, T-27 and T-28 which are used to handle large process and storm water flows allowing the flow to the NAPIS to be controlled. These tanks are also used to store waste water if problems are encountered with the downstream equipment, i.e., NAPIS and the WWTP.
The storm water system is a network of valves, gates, berms, embankments, culverts, trenches, ditches, natural arroyos, and retention ponds that collect, convey, control, and release storm water that falls within or passes through refinery property. Storm water that falls within the processing areas is considered equivalent to process waste water and is sent to tanks T-35, T-27 and T-28 when needed before it reaches the NAPIS, WWTP, STP-1 and into Evaporation Pond 2 where flow is gravitated to the rest of the ponds. Storm water discharge from the refinery is very infrequent due to the arid desert-like nature of the surrounding geographical areas,.

At the evaporation ponds, waste water is converted into vapor via solar and mechanical wind-effect evaporation via two 80 gallons per minute electrically driven evaporation pond spraying snow machines located between ponds 4 and 5. Two additional 66 GPM (gallons per minute) evaporation pond sprayers were installed in October 2014 between ponds 3 and 4 for a total of four evaporators. No waste water is discharged from the refinery to surface waters of the state. In September 2015. Gallup Refinery submitted a Notice of Intent requesting continued coverage under— the 2015 NPDES Multi-Sector General Permit which was approved on October 8, 2015 (NMR0531685)-. -The refinery maintains a Storm Water Pollution Prevention Plan (SWPPP) that includes Best Management Practices (BMPs) for effective storm water pollution prevention (updated September 2015). The refinery has constructed several new berms in various areas and improved outfalls (installed barrier dams equipped with gate valves) to minimize the possibility of potentially impacted runoff leaving the refinery property and also to minimize the stormwater run-on from the I-40 interchange and the Pilot Travel Center onto refinery property

2.2 Potential Receptors

Potential receptors at the facility also include those that may arise from future land uses. Currently, these include on-site workers, nearby residents, wildlife, and livestock.[1] The major route to exposure of humans would be from contaminants reaching a drinking water well. Other routes could be from showering, cooking, etc. with contaminated ground water, raising crops and vegetables with contaminated ground water, or getting exposed to or fishing in surface water that has commingled with shallow ground water. Exposure can also occur through contact with soils and/or plants that have become contaminated themselves through contact with contaminated ground water. However, drinking water wells remain the primary route of possible exposure.

At this time, the nearest drinking water wells are located on-site at the southwest areas of the facility, at depths of approximately 3000 feet which are identified as process or production (PW) wells. These wells are designated as PW-2, PW-3 and PW-4 (See Figure 4 for location). These wells are operated by the facility to provide the refinery's process water and drinking water to nearby refinery-owned houses, to the refinery itself, and to the ~~Pilot~~ Travel Center. Currently, PW-2 ~~and PW-4 ar~~is~~e~~ sampled every three years, PW-4 is sampled semi-annually ~~-~~and PW-3 is sampled on an annual~~ly.~~ basis. ~~—~~Annual sampling results from 2009 through 201~~5~~6 have indicated no detection levels of volatile organic compounds (VOCs) or semi-volatile organic compounds (SVOCs).

Other than the on-site wells, there is no known drinking water wells located within a 4-mile radius of the site. The nearest drinking water wells that could be used by off-site residents are located to the northwest of the site at a distance slightly greater than 4-miles located within the Navajo community of Iyanbito (shown on the USGS Topographical Map - Gallup Quadrangle (Revised 1980)). These wells are northwest of the South Fork of the Puerco River which heads towards the southwest from immediately north of the facility. As the shallowest ground water will generally flow in the direction of surface water flow, any possible shallow ground water contamination that left the facility either now or in the future would flow towards the southwest

[1] Note: There is extensive and regular patrolling by security personnel of the facility which operates 24-hours – therefore, we can discount the possibility of an inadvertent or deliberate intruder becoming exposed to contamination in groundwater that has reached the surface in some form.

after leaving the facility and away from the community of Iyanbito. The Cibola National Forest lies in the south-east direction and there are no wells or residents in this protected area. Boundary monitoring wells along the southwest to northwest perimeter of the facility have not shown any evidence of contaminants except for low concentrations of bis(2-ethylhexyl)phthalate detected in the following wells: BW-3B in 2009, BW-3C in 2011 and BW-1C in 2013. The contaminant detected is suspected to be a laboratory contaminant or possibly from the PVC pipe materials used as casing for these wells. No detection of bis(2-ethylhexyl)phthalate was detected in any of the boundary wells in 201~~5~~6.

Artesian conditions at some locations of the site lead to the possibility of ground water emerging onto the surface and thus being able to affect wildlife. No surface water on the site is used for human consumption or primary contact, such as immersion, or secondary contact, such as recreation. The man-made ponds on the site are routinely monitored and are a part of this Plan. Therefore, if they are in contact with shallow ground water that has exhibited elevated levels of contaminants, the Plan will detect any commingling of ground water and surface waters.

Fluctuating ground water elevations can smear contaminants into subsurface soil and rocks, and there is a possibility that plant roots could reach such contaminated soils and bio-concentrate contaminants creating another route of exposure to potential receptors, such as birds and animals that eat the plants. No food crops are currently grown on the site.

2.3 Type and characteristics of the waste and contaminants and any known and possible sources

The types of waste likely include – volatile and semi-volatile organic compounds, primarily hydrocarbons, but could include various other industrial chemicals such as solvents,~~;~~ acids,~~;~~ spent caustic solutions,~~;~~ and heavy metals present in spent chemicals and waste water. These wastes could be in the form of waste water, spent chemicals destined for off-site shipping and disposal packed in drums, sludge, and dry solids. Dry wastes could stem from wind-blown metallic powders used as catalysts, and regular municipal solid wastes stored in covered containers destined for municipal landfills.

Most of the wastes and contaminants that could possibly reach ground water have the characteristic that they would biodegrade and naturally attenuate. However, any heavy metals present in dirt and sludge could possibly leach into ground water and would not biodegrade. There is a possibility also that certain long-lived chemicals would not biodegrade, or, if they did, it would be at a very slow rate. Possible sources include leaks from buried pipes, tanks, surface spills, and historical dumping of wastes in remote areas of the site.

All above-ground large tanks have leak detection or equivalent systems, such as radar gauges. Pumps that could leak hydrocarbons are within containment areas, and all tanks are located inside earthen bermed areas to contain spills. The NAPIS has double walls and a leak detection system installed.

Similarly, surface impoundments can serve as a source of possible ground water contamination. In the past, waste water from the railroad loading rack flowed to a settling and separation lagoon north of the rack and flow exited at the north end where water leaving the lagoon was distributed across a flat open site known as the fan-out area. The free flow of liquids led to subsurface soil contamination. This area is identified as SWMU No. 8 and has been cleaned up for a corrective action complete with controls status. Disposal of waste water into open fields is not practiced at the Gallup Refinery.

There are fourteen Solid Waste Management Units (SWMU) identified at the Gallup Refinery, and one closed land treatment Area. On December 31, 2013, the RCRA Post Closure Care Permit became effective under §~~20.4.1.901A(~~20.4.1.901A (10) NMAC which identified an additional 20 Areas of Concern (AOCs) requiring corrective action and are listed below.

RCRA (Resource Conservation and Recovery Act) Regulated Units

- Land Treatment Unit (LTU)

SWMUs (Solid Waste Management Units)

- SWMU 1 – Aeration Basin
- SWMU 2 – Evaporation Ponds
- SWMU 3 – Empty Container Storage Area
- SWMU 4 – Old Burn Pit
- SWMU 5 – Landfill Areas
- SWMU 6 – Tank Farm
- SWMU 7 – Fire Training Area
- SWMU 8 – Railroad Rack Lagoon
- SWMU 9 – Drainage Ditch and the Inactive Land farm
- SWMU 10 – Sludge Pits
- SWMU 11 – Secondary Oil Skimmer
- SWMU 12 – Contact Wastewater Collection System
- SWMU 13 – Drainage Ditch between North and South Evaporation Ponds
- SWMU 14 – API Separator

AOCs (Areas of Concern)

- AOC 15 – New API Separator
- AOC 16 – New API Separator Overflow Tanks
- AOC 17 – Railroad Loading/Unloading Facility
- AOC 18 – Asphalt Tank Farm (tanks 701-709, 713, 714)
- AOC 19 – East Fuel Oil Loading Rack
- AOC 20 – Crude Slop and Ethanol Unloading Facility
- AOC 21 – Main Loading Racks
- AOC 22 – Loading Rack Additive Tank Farm
- AOC 23 – Retail Fuel Tank Farm (tanks 1-7, 912, 913, 1001, 1002)
- AOC 24 – Crude Oil Tank Farm (tanks 101 and 102)
- AOC 25 – Tank 573 (Kerosene Tank)
- AOC 26 – Process Units
- AOC 27 – Boiler and Cooling Unit Area
- AOC 28 – Warehouse and Maintenance Shop Area
- AOC 29 – Equipment Yard and Drum Storage Area
- AOC 30 – Laboratory
- AOC 31 – Tanks 27 and 28
- AOC 32 – Flare and Ancillary Tanks (tanks Z85V2, Z85V3, Z84-T105)
- AOC 33 – Storm Water Collection System
- AOC 34 – Scrap Yard

Existing ground water monitoring wells effectively surround all of the above listed SWMUs and AOCs.

2.4 Summary of contaminant releases that could contribute to possible ground water contamination.

Spills and leaks are known to have occurred on the site in various locations. Although most hydrocarbons are immediately picked up for recovery and contaminated soil is removed, some of the liquids present in a spill may enter the subsurface. With precipitation, there is the possibility that some of the contaminants could leach and reach ground water.

2.4.12.4.1 Separate Phase Hydrocarbons (SPH)

Separate-Phase Hydrocarbons (SPH) floating on shallow ground water has been found at the northeast end of the facility. A series of recovery wells were installed and SPH has been pumped out for several years. Recovery through hand-bailing continues on a quarterly basis indicating that the volume of SPH has continued to drop substantially from year to year in several of these recovery wells. – IIn 2015, only Recovery Well (RW-1) had measureable levels of hydrocarbons. Elevated levels of benzene have also been found in the wells in this area possibly linked to past spills. Recovery wells are listed as follows:

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RECOVERY WELLS			
RW-1	RW-2	RW-5	RW-6

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2.4.1.1 Hydrocarbon Seep

In June of 2013 during a routine inspection, a hydrocarbon seep was discovered in an isolated area approximately 100 yards west of Tank 101/102. A series of excavations were completed in the area of the seep including installation of six (6) temporary sumps for bi-weekly hydrocarbon recovery. Through 2016 a total of 918,981 gallons of liquid (hydrocarbon and ground water) have been recovered from the site. To date a total of 44 permanent monitoring wells have been installed with an addition of one pre-existing well, which has been labeled as MKTF-45, and is located in the vicinity of the site investigation. Western continues to further characterize potential source areas, recovery of liquids from the temporary sumps, and continued sampling of the monitoring wells for characterization and delineation purposes. All 45 wells have been added to the 2016 Ground Water Monitoring Schedule (see Appendix B).

Additional soil staining was observed north, northwest of the sumps and sites were excavated of approximately 38.26 tons of soil which was sent to the Painted Desert Landfill for disposal. Temporary retention ditches were installed to recover liquids from this area. From April 1, 2016 through December 31, 2016, approximately 340,200 gallons of liquid (hydrocarbon and ground water) have been recovered from this area via vacuum truck. Additional sumps are planned for installation in this area similar to the original six sumps installed for recovery of liquids.

MARKETING WELLS
MKTF-1 THRU MKTF-45

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2.4.2 Methyl Tert Butyl Ether (MTBE)

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Methyl Tert Butyl Ether (MTBE) has not been used at the refinery since April 2006. Several monitoring wells were installed at various depths to monitor SPH and MTBE contaminant plumes from historical contamination. Historical analytical data for the observations wells (OW-14, 29 and 30) indicates that the contaminant, MTBE has slowly been increasing over the years in these wells. Based on this information, New Mexico Environmental Department – Hazardous Waste Bureau (NMED-HWB) has requested two Work Plans to further investigate the known MTBE plume at the Facility and investigate a suspected plume north of the tank farm (SWMU 6). These observation wells (OW) are located downstream on the northeast section of the plant and are designated as follows.

OBSERVATION WELLS					
OW-13	OW-14	OW-29	OW-30	OW-50	OW-52

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As requested by NMED in their letter dated May 11, 2015, HWB-WRG-MISC. "Requirement to Submit Work Plan Regarding Ground water Monitoring OW Series Wells and Contaminant Plume", work plans were submitted and approved by NMED for the following:

1. Installation of additional monitoring wells to define the extent of MTBE and other hydrocarbons down-gradient and the north, northwest of existing ground water monitoring wells OW-29/30;
2. Investigation of the source of contamination in ground water in monitoring well OW-14.

Five monitoring wells (OW-53, OW-54, OW-55, OW-57 and OW-58) were installed in third quarter 2016. A request will be made to include these wells in the Facility Wide Ground Water Monitoring Work Plan and also listed on Appendix B, Table 2 for inclusion into the Monitoring Plan.

2.4.3 NAPIS UNIT

-A unit at the southwest end of the facility that is used to recover and recycle oil back into the process has also – through leakage and spills – caused some MTBE and hydrocarbon contamination in shallow ground water. This unit is known as the NAPIS and was put into service in October 2004. The NAPIS has one up-gradient well NAPIS-1, located on the east side and three down-gradient shallow monitoring wells, NAPIS-2, NAPIS-3 and KA-3, which are located along the west side. The NAPIS unit is also equipped with three leak detection units on the east and west bays and also at the oil sump section on the east bay and are designated as follows:

NAPIS WELLS				LEAK DETECTION UNITS		
NAPIS-1	NAPIS-2	NAPIS-3	KA-3	EAST LDU	WEST LDU	OIL SUMP LDU

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2.4.42.4.4 -Aeration Basin

The Aeration Basin, which is designated as SWMU No. 1 in the facility's RCRA Post-Closure Care Permit includes three cells, known as AL-1, AL-2 (lagoons) and holding pond 1 which is currently

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referred to as EP-1, although it is not an evaporation pond and is not part of the area covered by SWMU No. 2 – Evaporation Ponds. All three of these cells are no longer in service ~~-~~since the startup of the ~~-~~Waste Water Treatment Plant in 201~~3~~2. Al~~l~~l refinery waste water flow was diverted to the WWTP bypassing ~~-~~the lagoons and pond 1. Western has experienced intermittent discharges of oil and oily water into the lagoons and spills to ground surface while it was in operation. Most of these occurrences were the result of unit upsets and or large storm events affecting the old API Separator.

Two ground water monitoring wells (GWM-1, GWM-2) were installed immediately down gradient of the aeration lagoons in 2004 and 2005 in order to detect potential leakage from the aeration basin. GWM-3 was ~~-~~installed in 2005 on the northwest corner of pond 1 (EP-1).

Analysis of ground water samples collected at GWM-1 and GWM-2 have indicated several organic constituents at concentrations above the screening levels in ground water, which would indicate a potential for historical releases from the lagoons. In the third quarter of 2015, quarterly inspection of GWM-1 indicated the presence of an oily substance during gauging activities. NMED was notified of this finding and Gallup was instructed to collect an oil sample for fingerprint analysis (DRO/GRO and MRO). Gallup was also instructed to purge and gauge the well on a weekly basis to check the recharge rate. The initial measurement was made without the use of an oil/interface probe and the thickness of the hydrocarbon layer in the well was not immediately known. Measured separate phase hydrocarbon (SPH) thickness ranged from 0.35 to 0.45 feet in September, October and November 2015. Weekly gauging/purging of GWM-1 has recorded no measureable hydrocarbon layer since the end of November through December 2015 although an odor and sheen has been observed on the water purged. Depth to water has remained around 21 feet and Western continues to observe a hydrocarbon layer of 0.02 to 0.04 feet in the first, third and fourth quarters 2016. ~~purge and gauge on a weekly basis.~~ O~~O~~n December 10, 2015, Gallup sent a response to NMED~~-~~–HWB concurring that the source of the hydrocarbons observed in GWM-1 is from the adjacent aeration lagoon.

GWM-2 and 3 upon installation in 2005 were found to be dry. Water was first detected in GWM-2 in the first quarter of 2008 and in GWM-3 in the third quarter of 2010. 24-hour notification of the finding was given to NMED and OCD respectively. Analyses of ground water samples collected from GWM-2 and GWM-3 have detected the presence of several -constituents at concentration levels above applicable water quality standards such as fluoride, chloride, nitrates, and sulfates. No VOCs have been detected in GWM-2 or GWM-3.

Quarterly inspections in 2011 and 2012 continued to indicate an increase in measurable water levels in GWM-2 and GWM-3, which was consistent with the increased levels in the lagoons and pond 1. In the second half of 2012 through early 2013 the levels in the lagoons and pond 1 began to decrease with cessation of gravitational flow between lagoons to pond 1 due in part to the start--up of the WWTP. Continued quarterly inspections indicated no water present in GWM-2 and GWM-3 in 2013 through -20156.

Both GWM-2 and GWM-3 have been included in the Aeration Basin Corrective Action Work Plan which began investigative soil and water sampling near the aeration basin in the third quarter of 2012 to support selection of a remedy for SWMU NO. 1 and determine the source of water detected in GWM-2 and GWM-3. Figure 4 shows the location of all of the active monitoring wells on the facility.

In February of 2012, Western submitted a "Revised Investigation Work Plan Solid Waste Management Unit (SWMU) No. 1 Aeration Basin" to include sampling of soils and ground water surrounding the Aeration Basin to determine if there has been a release to the environment and to delineate any such release. In addition, information was collected to help determine the source of ground water that had been observed in monitoring wells GWM-2 and GWM-3. The work plan also included SWMU No. 14 Old API Separator soil and ground water sampling. A new well OAPIS-1 (SWMU 14-2) was installed on the northwest corner where the benzene strippers were located on July 17, 2012 by Enviro-Drill Inc. A revised investigation Report for SWMU 1 and SWMU 14 was submitted to NMED in June 2014. OAPIS-1 (SWMU 14-2) was -added to the 2014 Monitoring Schedule.

In February of 2013, the influent to the aeration lagoons was routed to the new Waste Water Treatment Plant (WWTP) and rerouting of the Travel CenterPilot sanitary effluent was completed in June of 2013. The aeration lagoons and pond 1 (EP-1), are no longer in service.

WELLS AT THE AERATION BASIN			
GWM-1	GWM-2	GWM-3	OAPIS-1

2.4.5 In June of 2013 during a routine inspection a hydrocarbon seep was discovered in an isolated area approximately 100 yards west of Tank 101/102. A series of excavations were completed in the area of the seep including installation of six (6) temporary sumps for bi-weekly hydrocarbon recovery. Through 2015 a total of 552,694 gallons of liquid (hydrocarbon and ground water) have been recovered from the site. To date a total of 44 permanent monitoring wells have been installed with an addition of one pre-existing well, which has been labeled as MKTF-45, and is located in the vicinity of the site investigation. Western continues to further characterize potential source areas, recovery of liquids from the temporary sumps, and continued sampling of the monitoring wells for characterization and delineation purposes. All I 45 wells have been added to the 2015 Ground Water Monitoring Schedule (see Appendix B).

2.4.62.4.5 North Drainage Ditch On April 22, 2015, Gallup notified NMED-HWB of the discovery of hydrocarbons in a drainage ditch in the northern portion of the refinery property. Surface water samples were collected from the standing water in the drainage ditch and concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) were detected as well as methyl tert-butyl ether (MTBE), gasoline range organics (GRO) and diesel range organics (DRO). An investigation work plan was submitted to NMED for review on August 13, 2015 and was subsequently implemented in May 2016 with installation of well OW-56. A request to add this well to the Facility Wide Ground Water Monitoring Work Plan has been added in Section 6 and added to Appendix B, Table 2.

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3.0 Site Conditions

The Gallup Refinery is located within a rural and sparsely populated section of McKinley County. It is situated in the high desert plain on the western flank of the Continental Divide approximately 17 miles east of Gallup. The surrounding land is comprised primarily of public and private lands used for cattle and sheep grazing.[2]

3.1 Current site topography and location of natural and manmade structures

Local topography consists of a gradually inclined down-slope from high ground in the southeast to a lowland fluvial plain in the northwest. The highest point on refinery property is located at the southeast corner boundary (elevation approximately 7,040 feet) and the lowest point is located at the northwest corner boundary (elevation approximately 6,860 feet). The refinery processing facility is located on a flat man-made terrace at an elevation of approximately 6,950 feet.

3.2 Drainages

Surface water in this region consists of the man-made evaporation ponds and aeration basins located within the refinery, a livestock watering pond (Jon Myer's Pond) located east of the refinery, two small unnamed spring fed ponds located south of the refinery, and the South Fork of the Puerco River and its tributary arroyos. The various ponds and basins typically contain water consistently throughout the year. The South Fork of the Puerco River and its tributaries are intermittent and generally contain water only during, and immediately after, the occurrence of precipitation.

There are several stormwater conveyance ditches located throughout the refinery which are directed to discharge into contained basins where it is collected and recycled for use as process water; collected and allowed to evaporate; divert around regulated industrial activity or into two designated outfalls located on the east and west section of the property, identified as Outfall 001 and Outfall 002. Outfall 001 is located directly south of evaporation pond 8 on the western edge

[2] See, for example, the web site of McKinley County at http://www.co.mckinley.nm.us/

of the refinery's property boundary and equipped with four separate small diameter overflow pipelines, each with a manual flow valve for independent control. Outfall 002 is located north of the rail road loading rack on the eastern section of the facility. This outfall consists of a concrete barrier with a valve -to control discharges from a deep ditch that collects/ponds the runoff from the rail rack loading area.

Directly west of the crude tank area, there is also a concrete barrier with a valve to control discharges from a culvert that carries stormwater flow from the truck loading rack area. This concrete barrier is located downstream of the "hydrocarbon seep area". The flow from this concrete barrier continues in a north-northwest direction alongside the sou~~r~~thern bermed areas of ~~the~~ evaporation ponds 3, 4, 5 and 6 and outward towards the Outfall 001 area. At the new waste water treatment plant, there are three storm drains located on the south, southwest and west side of the waste water treatment plant which is connected to an underground storm culvert that exits on the northwest section of STP-1 into a -conveyance ditch along the northern edge of pond 2 into a holding pond equipped with manual flow valves, located north of evaporation pond 3. The discharge from this holding pond then flows north-northwest towards the Outfall 001 area.

3.3 Vegetation types

Surface vegetation consists of native xerophytic vegetation including grasses, shrubs, small junipers, and some prickly pear cacti. Average rainfall at the refinery is less than 7 inches per year, although it can vary to slightly higher levels elsewhere in the county depending on elevation.

On alluvial fans on valley sides and drainage ways, the existing vegetation is usually alkali sacaton, western wheatgrass, Indian rice grass, blue grama, bottlebrush squirreltail, broom snakeweed, fourwing saltbush, threeawn, winterfat, mat muhly and spike muhly. On fan remnants on valley sides we usually find blue grama, western wheatgrass, Indian ricegrass, big sagebrush, galleta, bottlebrush squirreltail, fourwing saltbrush, needleandthread, oneseed juniper, sand dropseed, spineless horsebrush, rabbitbrush, and twoneedle pinyon.

3.4 Erosion features

The impacts of historic overgrazing are visible at the north-side of the facility, in the form of arroyos that formed when surface run-off cut through the ground and washed away soils that were not able to hold water with their ground cover lost to overgrazing. Now that the facility is fenced and no livestock grazing occurs on the site, vegetation has recovered in these areas. With the facility helping to bring back vegetation in its undeveloped areas the formation and deepening of erosion features on its land has decreased.

3.5 Subsurface conditions

3.5.1 Soil types and associations

Most of the soils found at the surface in the locations where wells are located consist of the Gish-Mentmore complex.[3] These soils occur in alluvial fans on valley sides and fan remnants on valley sides. The parent material for these soils is slope and fan alluvium derived from sandstone and shale. These are well drained soils with moderately slow (0.2 in/hr) to slow permeability (0.06 in/hr). In this association, the Gish and similar soils make up about 45 percent, the Mentmore and similar soils 35 percent, and minor components 20 percent. These minor components are - Berryhill and similar soils 10 percent, and Anodize and similar soils 10 percent. The typical profile for these soils is – 0 to 2 inches fine sandy loam, 2 to 72 inches of various kinds of clay loam.

Drill logs for various wells have been provided electronically to the NMED-HWB. From these well logs we can infer that the soils in the subsurface are generally composed of clays starting at the immediate subsurface, interbedded with narrow sand and silt layers. At about 100 to 150 feet, layers of mudstone, sandstone (from the Chinle Group, Petrified Forest Formation) and siltstone start to appear. Figure 3 shows a generalized relationship of soils in and around the Gallup Refinery.

[3] Soil Survey of McKinley County Area, New Mexico, McKinley County and Parts of Cibola and San Juan Counties, Natural Resources Conservation Service (NRCS), US Department of Agriculture, available at - http://soildatamart.nrcs.usda.gov/Manuscripts/NM692/0/McKinley.Area%20NM.pdf

3.5.2 Stratigraphy

The 810-acre refinery property site is located on a layered geologic formation. Surface soils generally consist of fluvial and alluvial deposits; primarily clay and silt with minor inter-bedded sand layers. Below this surface layer is the Chinle Group, which consists of low permeability clay stones and siltstones. As such, the Chinle Group (Petrified Forest Formation) effectively serves as an aquiclude. Inter-bedded within the Chinle Group is the Sonsela Sandstone bed, which represents the uppermost potential aquifer in the region.

The Sonsela Sandstone bed lies within and parallels the dip of the Chinle Group. As such, its high point is located southeast of the refinery and it slopes downward to the northwest as it passes under the refinery. Due to the confinement of the Petrified Forest Formation aquitard, the Sonsela Sandstone bed acts as a water-bearing reservoir and is artesian at its lower extremis. Artesian conditions exist through much of the central and western portions of the refinery property.

3.5.3 Presence and flow direction of ground water

Ground water flow within the Petrified Forest Formation is extremely slow and typically averages less than 10^{-10} centimeters per second (less than 0.01 feet per year). Ground water flow within the surface soil layer above the Petrified Forest Formation is highly variable due to the presence of complex and irregular stratigraphy; including sand stringers, cobble beds, and dense clay layers. As such, hydraulic conductivity may range from less than 10^{-2} centimeters per second in the gravelly sands immediately overlying the Petrified Forest Formation up to 10^{-8} centimeters per second in the clay soil layers located near the surface.

Shallow ground water located under refinery property generally flows along the upper contact of the Petrified Forest Formation. The prevailing flow direction is from the southeast and toward the northwest. In the past, a subsurface ridge has been identified that was thought to deflect some flow in a northeast direction in the vicinity of the refinery tank farm. This is not clear from the present data.

4.0 Investigation Methods

The purpose of this section is to describe the types of activities that will be conducted and the methods that will be used as part of this Plan. Appendix A provides a thorough discussion on actual sampling methods- that will be used.

4.1 Ground Water Sampling Methodology

All monitoring wells scheduled for sampling during a ground water sampling event will be sampled within 15 working days of the start of the monitoring and sampling event, weather permitting.

Appendix C contains the well data summary tables for 20156 which includes the annual and quarterly depth to water (DTW) and depth to bottom (DTB) measurements as well as corrected water table elevation with respect to wells that have SPH levels. Appendix C-12 and C-12.1 provides the corrected well elevation summary table for 20165 which includes date of establishment, ground elevation, top of casing elevation, well casing stick-up length, well depth, screening intervals, and stratigraphic units in which the wells are located. Appendix C-2 includes well elevation summary for all the Marketing (MKTF) wells which includes date of establishment, ground elevation, top of casing elevation, well casing stick-up length, well depth, screening intervals and stratigraphic units in which the wells are located. —AAppendix C-3 includes well elevations for the artesian wells also known as Process or Production wells (PW). Information provided for the artesian wells was gathered from well boring logs. These wells are encased and therefore measurement for depth to bottom was not field verified. No changes were made to Tables in C-21, -and C-21.1 and C-2 for 20165 as there were no new monitoring wells added to the list.

4.1.1 Well Gauging

At the beginning of each quarterly, semi-annual, or annual sampling event, all monitoring and recovery wells listed in Appendix B, Ground Water Monitoring Schedule, will be gauged to record the depth to SPH, if present, the DTW and the DTB of the well. The gauging will be performed using an_ -oil/water interface probe attached to a measuring tape capable of recording measurements to the nearest 0.01 foot. Each monitoring well is field verified with the well number on the well casing or adjacent to the well to ensure that samples are collected at the correct well location. Wells also have a permanent marked reference point on the well casing from which ground water levels and well depths are measured.

Gauging measurements will be recorded on a field gauging form. Data obtained from the gauging will be reported in the annual ground water monitoring report. The data will be used to develop groundwater contour maps and SPH thickness isopleths which will also be included in the annual report.

4.1.2 Well Purging

Each monitoring well will be purged by removing ground water prior to sampling in order to ensure that formation water is being sampled. Generally, at least three well volumes (or a minimum of two if the well has low recharge rate) will be purged from each well prior to sampling. Field water quality measurements must stabilize for a minimum of three consecutive readings before purging will be discontinued. Field water quality measurements will include pH, electrical conductivity, temperature, and dissolved oxygen (DO) %. Field water quality measurement stability will be determined when field parameter readings stabilize to within ten percent between readings for three consecutive measurements. Once the readings are within ten percent, purging will stop and the well is ready for sample collection. The volume of ground water purged, the instruments used, and the readings obtained at each interval will be recorded on the field-monitoring log. Well purging and sampling will be performed using 1.5 inch x 3 foot and/or 3 inch x 3 foot disposable polyethylene bailers for ground water sampling and/or appropriately decontaminated portable sampling pumps.

4.2 Ground water Sample Collection

Ground water samples will be obtained from each well within 24 hours of the completion of well purging. Sample collection methods will be documented in the field monitoring reports. The samples will be transferred to the appropriate, clean, laboratory-prepared containers provided by the analytical laboratory. Sample handling and chain-of-custody (COC) procedures are described in more detail in Appendix A as well as decontamination procedures for reusable water sampling equipment.

All purged ground water and decontamination water from monitoring wells will be drained into the refinery waste water treatment system upstream of the NAPIS. The procedures for disposing materials are described in Appendix A.

Ground water samples are collected and analyzed for both total and dissolved. Ground water samples obtained for dissolved metals analysis will be filtered through disposable filters with a 0.45 micrometers mesh size.

4.2.1 Sample Handling

All sample containers are supplied by the contracted analytical laboratory and shipped to Western in sealed coolers. Chemical preservation is also provided by the laboratory through pre-preserved bottle ware. Collection of containerized ground water samples are in the order of most volatile to least volatile, such as: VOCs, SVOCs, metals, phenols, cyanide, sulfate, chloride, and nitrates. Immediately after the samples are collected, they will be stored in a cooler with ice or other appropriate storage method until they are delivered to the analytical laboratory. Standard COC procedures as detailed in Appendix A will be followed for all samples collected. All samples will be submitted to the laboratory as soon as possible to allow the laboratory to conduct the analyses within the specified method holding times. Details of the general sample handling procedures are provided in Appendix A.

The following shipping procedures will be performed during each sampling event:

- Individual sample containers will be packed to prevent breakage and transported in a sealed cooler with ice or other suitable coolant or other EPA or industry-wide accepted method. The drainage hole at the bottom of the cooler will be sealed and secured in case of sample container leakage.

- Each cooler or other container will be delivered directly to the analytical laboratory.

- Glass bottles will be separated in the shipping container by cushioning material to prevent breakage.
- Plastic containers will be protected from possible puncture during shipping using cushioning material.
- The COC form and sample request form will be shipped inside the sealed storage container to be delivered to the laboratory.
- Signed and dated COC seals will be applied to each cooler prior to transport of samples from the site.

4.3 Analytical Methods

Ground water and surface water samples collected during the monitoring events will be analyzed using the specified analytical methods and for the constituents listed in Appendix B.

4.4 Quality Assurance Procedures

Contract analytical laboratories will maintain internal quality assurance programs in accordance with EPA and industry accepted practices and procedures. At a minimum, the laboratories will use a combination of standards, blanks, surrogates, duplicates, matrix spike/matrix spike duplicates (MS/MSD), blank spike/blank spike duplicates (BS/BSD), and laboratory control samples to demonstrate analytical Quality Assurance/Quality Control (QA/QC). The laboratories will establish control limits for individual chemicals or groups of chemicals based on the long-term performance of the test methods. In addition, the laboratories will establish internal QA/QC that meets EPA's laboratory certification requirements. The specific procedures to be completed are identified in the following sections.

4.4.1 Equipment Calibration Procedures and Frequency

The laboratory's equipment calibration procedures, calibration frequency, and calibration standards will be in accordance with the EPA test methodology requirements and documented in the laboratory's quality assurance (QA) and Standard Operating Procedures (SOP) manuals. All instruments and equipment used by the laboratory will be operated, calibrated, and maintained according to the manufacturers' guidelines and recommendations. Operation, calibration, and maintenance will be performed by personnel who have been properly trained in these procedures. A routine schedule and record of instrument calibration and maintenance will be kept on file at the laboratory.

4.4.2 Field QA/QC Samples

Field duplicates and trip blanks may be obtained for quality assurance during sampling activities. The samples will be handled as described in Section 4.4.3.

Trip blanks will accompany laboratory sample bottles and shipping and storage containers intended for VOC analyses. Trip blanks will consist of a sample of analyte free de-ionized water placed in an appropriate sample container. Trip blanks will be analyzed at a frequency of one for each shipping event involving twenty or more samples. Generally, a trip blank will only be placed in one of the containers, if more than one container is used to ship the set of samples.

4.4.3 Laboratory QA/QC Samples

Analytical procedures will be evaluated by analyzing reagent or method blanks, surrogates, MS/MSDs, BS/BSDs and/or laboratory duplicates, as appropriate for each method. The laboratory QA/QC samples and frequency of analysis to be completed will be documented in the cited EPA or other test methodologies. At a minimum, the laboratory will analyze laboratory blanks, MS/MSDs, BS/BSDs and laboratory duplicates at a frequency of one in twenty for all batch runs requiring EPA test methods and a frequency of one in ten for non-EPA test methods. Laboratory batch QA/QC samples will be project specific.

4.4.4 Laboratory Deliverables

The analytical data package will be prepared in accordance with EPA-established Level II analytical support protocol which will include:

- Transmittal letter, including information about the receipt of samples, the testing methodology performed, any deviations from the required procedures, any problems encountered in the analysis of the samples, any data quality exceptions, and any corrective actions taken by the laboratory relative to the quality of the data contained in the report;

- Sample analytical results, including sampling date; date of sample extraction or preparation; date of sample analysis; dilution factors and test method identification; water sample results in consistent units (milligrams per liter or micrograms per liter (µg/L)); and detection limits for undetected analytes. Results will be reported for all field samples, including field duplicates and blanks, submitted for analysis;
- Method blank results, including reporting limits for undetected analytes;
- Surrogate recovery results and corresponding control limits for samples and method blanks (organic analyses only);
- Laboratory duplicate results for inorganic analyses, including relative percent differences and corresponding control limits;
- Sample COC documentation;
- Holding times and conditions;
- Conformance with required analytical protocol(s);
- Instrument calibration;
- Blanks;
- Detection/quantitative limits;
- Recoveries of surrogates and/or matrix spikes (MS/MSDs);
- Variability for duplicate analyses;
- Completeness;
- Data report formats;

Data deliverables provided by the laboratory that include analysis of organic compounds will also include the following:

- A cover letter referencing the procedure used and discussing any analytical problems, deviations, and modifications, including signature from authority representative certifying to the quality and authenticity of data as reported;

- A report of sample collection, extraction, and analysis dates, including sample holding conditions,

- Tabulated results for samples in units as specified, including data qualification in conformance with EPA protocol, and definition of data descriptor codes;

- Final extract volumes (and dilutions required), sample size, wet-to-dry weight ratios, and instrument practical detection/quantitative limit for each analyte,

- Analyte concentrations with reporting units identified, including data qualification and a description of the qualifiers,
- Quantification of analytes in all blank analyses, as well as identification of method blank associated with each sample,

- Recovery assessments and a replicate sample summary, including all surrogate spike recovery data with spike levels/concentrations for each sample and all MS/MSD results (recoveries and spike amounts).

4.4.5 Review of Field and Laboratory QA/QC Data

The sample data, field, and laboratory QA/QC results will be evaluated for acceptability with respect to the data quality objectives (DQOs). Each group of samples will be compared with the DQOs and evaluated using data validation guidelines contained in EPA guidance documents: Guidance Document for the Assessment of RCRA Environmental Data Quality, National Functional Guidelines for Organic Data Review, and Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses, and the most recent version of SW-846, and industry-accepted QA/QC methods and procedures.

The laboratory will notify the Gallup Refinery Project Manager of data quality exceptions within one business day of identifying the data quality exception in order to allow for sample re-analysis, if possible. The Gallup Refinery Project Manager will contact NMED within one business day of receipt of laboratory notification of data quality exceptions in order to discuss the implementations and determine whether the data will still be considered acceptable, or if sample re-analysis or re-sampling is necessary.

4.4.6 Blanks, Field Duplicates, Reporting Limits and Holding Times

4.4.6.1 Blanks

The analytical results of field blanks and field rinsate blanks will be reviewed to evaluate the adequacy of the equipment decontamination procedures and the possibility of cross-contamination caused by decontamination of sampling equipment. The analytical results of trip blanks will be reviewed to evaluate the possibility for contamination resulting from the laboratory-prepared sample containers or the sample transport containers. The analytical results of laboratory blanks will be reviewed to evaluate the possibility of contamination caused by the analytical procedures. If contaminants are detected in field or laboratory blanks, the sample data will be qualified, as appropriate.

4.4.6.2 Field Duplicates

Field duplicates will consist of two samples either split from the same sample device or collected sequentially. Field duplicate ground water samples will be collected at a frequency of one per ten regular samples and will be analyzed for the full set of analyses used for the regular sample collected. At a minimum, one duplicate sample per sampling day must always be obtained.

4.4.6.3 Method Reporting Limits

Method reporting limits for sample analyses will be established at the lowest level practicable for the method and analyte concentrations and will not exceed ground water or surface water cleanup standards and screening levels. Detection limits that exceed established standards or screening levels and are reported as “not detected” will be considered data quality exceptions and an explanation for its acceptability for use will be provided.

4.4.6.4 Holding Times

Per EPA protocol the sampling, extraction, and analysis dates will be reviewed to confirm that extraction and analyses were completed within the recommended holding times. Appropriate data qualifiers will be noted if holding times are exceeded.

4.4.7 Representativeness and Comparability

4.4.7.1 Representativeness

Representativeness is a qualitative parameter related to the degree to which the sample data represent the relevant specific characteristics of the media sampled. Procedures will be implemented to assure representative samples are collected and analyzed, such as repeated measurements of the same parameter at the same location over several distinct sampling events. Any procedures or variations that may affect the collection or analysis of representative samples will be noted and the data will be qualified.

4.4.7.2 Comparability

Comparability is a qualitative parameter related to whether similar sample data can be compared. To assure comparability, analytical results will be reported in appropriate units for comparison with other data (past studies, comparable sites, screening levels, and cleanup standards), and standard collection and analytical procedures will be implemented. Any procedure or variation that may affect comparability will be noted and the data will be qualified.

4.4.8 Laboratory Reporting, Documentation, Data Reduction, and Corrective Action

Upon receipt of each laboratory data package, data will be evaluated against the criteria outlined in the previous sections. Any deviation from the established criteria will be noted and the data will be qualified. A full review and discussion of analytical data QA/QC and all data qualifiers will be submitted as appendices or attachments to the ground water monitoring reports. Data validation procedures for all samples will include checking the following, when appropriate:

- Holding times
- Detection limits
- Field equipment rinsate blanks
- Field blanks
- Field Duplicates
- Trip blanks
- Reagent blanks
- Laboratory duplicates
- Laboratory blanks
- Laboratory matrix spikes

- Laboratory matrix spike duplicates
- Laboratory blank spikes
- Laboratory blank spike duplicates
- Surrogate recoveries

If significant quality assurance problems are encountered, appropriate corrective action will be implemented. All corrective action will be reported and the corrected data will be qualified.

5.0 Monitoring and Sampling Program

The primary objective of ground water monitoring is to provide data which will be used to assess ground water quality at and near the facility. Ground water elevation data will also be collected to evaluate ground water flow conditions. The ground water monitoring program for the facility will consist of sample collection and analysis from a series of monitoring wells, recovery wells, outfalls, and evaporation pond locations.

The monitoring network is divided into six –investigation areas (Group A, B, C, D and E) and including outfalls and evaporation pond locations. The sampling frequency, analyses and target analytes will vary for each investigation area and the combined data from these investigation areas will be used to assess ground water quality beneath and immediately down-gradient of the facility, and evaluate local ground water flow conditions.

Samples will not be collected from monitoring wells that have measurable SPH. For wells that are purged dry, samples will be collected if recharge volume is sufficient for sample collection within 24 hours. Wells not sampled due to insufficient recharge will be documented in the field log.

The following sections outline the monitoring program for each investigation area.

5.1 Group A Through Group E

5.1.1 Sampling Locations

The location of the monitoring, recovery wells and leak detection units are shown in Figure 4. The following wells will be sampled (as described in Appendix B):

GROUP A	GROUP B	GROUP C	GROUP D	GROUP E
BW-1A, B, C	GWM-1, 2, 3	OW-13, 14, 29, 30	PW-2, 3, 4	MKTF- 1 thru 45
BW-2A, B, C	NAPIS 1, 2, 3, KA-3	OW-50, 52	OW-1, 10	
BW-3A, B, C	OAPIS-1	RW-1, 2, 5, 6	OW-11, 12	
MW-1, 2, 4, 5	LDU (3)			
SMW-2, 4	STP1-NW, SW			

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5.2 Evaporation Ponds, Outfalls

5.2.1 Sampling Locations

The following outfalls and ponds will be sampled (as described in Appendix B, Table 1). (Note: these outfalls are from one section of the waste water treatment system to another – they do not discharge to any location outside the facility).

OUTFALLS
STP-1 to EP-2
~~Boiler Water Inlet to EP-2~~

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EVAPORATION PONDS		
Pond 1 – No longer in service	EP-5	EP-9
EP-2	EP-6	EP-11
EP-3	EP-7	EP-12A
EP-4	EP-8	EP-12B

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6.0 Monitoring Program Revisions

Upon review of the analytical results from the monitoring events under this Plan, historic facility-wide monitoring data, available soil boring data, and other related information Western Refining will assess the monitoring program presented in this Plan. Revisions to the Plan, as necessary, will then be presented for agency review and approval on an annual basis. These revisions may include, but not be limited to, a reduction or change in monitoring locations, monitoring frequency, and/or target analytes listed in Appendix B, Table 1.

6.1 ~~Requests for~~ Modifications to Sampling Plan

1. The following are required changes to the Facility Wide Ground Water Monitoring Work Plan taken from NMED correspondence (HWB-WRG-14-006), Approval with Modifications Annual Facility Wide Ground Water Monitoring Report: Gallup Refinery 2013, dated May 18, 2006:

- Comment 1: Permittee may discontinue the analysis of uranium in ground water samples.
- Comment 3: Permittee must sample PW-4 during the next scheduled sampling event and then semi-annually thereafter in order to collect additional data.
- Comment 4: Permittee must add analysis for 1,2-Dibromoethane (EDB) in all monitoring wells where EDC has been detected. Analytical method used must be capable of detecting EDB at concentrations less than 0.004 micrograms per liter (e.g., EPA Method 8011).
- Comment 6: Permittee must sample the EP-2 inlet on a quarterly basis to monitor the level of benzene being discharged from STP-1 to EP-2.
- Comment 13: Remove statement in Section 10, Table 1 where last row reads "[a]ll wells including recovery wells,"

2. Request to add six new monitoring wells (OW-53, OW-54, OW-55, OW-56, OW-57, OW-58) installed in the third quarter of 2016 to Facility Wide Ground Water Monitoring Work Plan. All six of the wells will be added to "Group C" upon approval.

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A. Forty-five (45) permanent monitoring wells from the hydrocarbon seep investigation have been added to the 2015 sampling plan.

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SEEP AREA (GROUP E)

Samples will be analyzed for VOCs, SVOCs, Water Quality Control Commission (WQCC) metals (total and dissolved), gasoline range organics (GRO), diesel range organics (DRO) and motor oil range organics (MRO), and major cations and anions. **Pursuant to directive by NMED dated April 26, 2016, MKTF wells with historic detections of 1,2-dichloroethane will also be analyzed for 1,2-dibromomethane by EPA Method 8011.** Pursuant to earlier discussions with NMED, the groundwater samples will be collected and analyzed on a quarterly basis in 2016 and 2017 with plans to move to annual sampling pending future review of sample results. Samples will not be collected from monitoring wells that have a measureable separate phase hydrocarbon (SPH) level..

Remove statement "All wells including the recovery wells containing separate phase hydrocarbons" from Table 1 in Appendix B, Gallup Refinery Ground Water Monitoring Schedule. Table 1 defines the list of approved analytical suite for each sample location. This requested revision is listed in Table 2: Ground Water Monitoring Schedule in Appendix B pending approval from NMED and OCD. Western complieswith the most current monitoring schedule approved by NMED, which is the July 24, 2015 "Approval With Modifications Facility Wide Ground Water Monitoring Work Plan – 2012 Updates; 2013 Updates; 2014 Updates for 2015.

Appendix A:

-Gallup Field Sampling Collection and Handling Standard Procedures

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Field Data Collection: Elevation and Purging

All facility monitoring wells and recovery wells are gauged as required throughout the year. Gallup does not have any recovery well pumps that need to be shut off and removed prior to water elevation measurements.

Each monitoring well is field verified with the well number on the well casing or adjacent to the well to ensure that samples are collected from_ at the correct well location. Wells also have a permanent marked reference point on the well casing from which ground water levels and well depths are measured. The portable pump intake is lowered to the midpoint of the listed screened interval for each specific well using the markings identified on the pump hose which are set every ten feet. In wells with dedicated pumps, the pumps have been installed at the midpoint of the screened interval.

All water/product levels are measured to an accuracy of the nearest 0.01 foot using an electrical conductivity based meter, the Heron Instruments 100 ft. DipperT electric water depth tape complying with US GGG-T-106E, EEC Class II and a WaterMark Oil Water Interface Meter (100 ftft.), Model 101L/SMOIL. After determining water levels, well volumes are calculated using the appropriate conversion factors for a given well based on its internal diameter. Volume is equal to the height of the liquid column times the internal cross-sectional area of the well.

Generally, at least three well volumes (or a minimum of two if the well has low recharge) are purged from each well prior to sampling. Field water quality parameters measured during purging (pH, electrical conductivity, temperature, and dissolved oxygen), must stabilize to within 10% for a minimum of three consecutive measurements before collection of ground water samples from each well.

Before sample collection can begin, the water collected from each monitoring well must be fresh aquifer water. Well evacuation replaces stagnant well water with fresh aquifer water. The water level in the well, total depth of well and thickness of floating product (if any) will be measured using the WaterMark Oil Water Interface Meter depth tape. If product is present, a ground water sample is- not obtained.

If a well is pumped or bailed dry before two or three well volumes can be evacuated, it requires only that sufficient time elapse for an adequate volume of water to accumulate for the sampling event. The first sample will be tested for pH, temperature, specific conductivity and dissolved oxygen (%). The well will be retested for pH, temperature, specific conductivity and dissolved oxygen (%) after sampling as a measure of purging efficiency and as a check on the stability of the water samples over time. All well evacuation information will be recorded in a log book.

Wells MW-1, MW-2, MW-4, MW-5, BW-1C, BW-2A, BW-2B, BW-3B, SMW-4, OW-1, OW-10, OW-13, OW-14, OW-29 and OW-30 are each equipped with a dedicated electrical pump. The remaining wells are purged using a portable Grundfos pump. Recovery wells, ~~and~~ NAPIS-1, NAPIS-2, NAPIS-3 and KA-3 are hand-bailed as well as GWM-1, GWM-2, GWM-3 and OAPIS-1 is hand-bailed if the presence of water is detected.

New wells MKTF 1 thru 45 and STP1-NW and STP1-SW are all hand-bailed if the presence of water is detected. If SPH is detected in any of these wells, no samples are collected.

Purged well water from wells is collected in fifty-five gallon drums or totes and drained to the process sewer upstream of the NAPIS. The water is treated in the refinery's waste water treatment system.

Sampling Equipment at Gallup

The following sampling equipment is maintained at Gallup and used by the sampling personnel:

- Heron Instruments 100 ft. DipperT electric water depth tape complying with US GGG-T-106E, EEC Class II.

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- Pall Corporation Acro 50A 0.45 micron disposable filter used with 60 ml. disposable syringes for filtering water in the field.

- YSI pH/Conductivity meter Model 63, calibrated with a one-point, two-point, or three-point calibration procedure using pH standards of 7, 4 and 10.

- IQ Scientific Instruments, pH/Temperature/Conductivity/ Dissolved Oxygen meter, Model IQ1806LP.

- Grundfos 2-inch pumps with Grundfos 115-volt AC–to-DC converter.

- WaterMark Oil Water Interface Meter (100 ~~ft~~ft.), Model 101L/SMOIL, S/N 01-5509

Calibration and maintenance procedures will be performed according to the manufacturer's specifications.

Order of Collection

Samples will be collected in the order listed below:

Parameter	Bottle Type
VOC, SVOC	40 ml VOA vials, (H_2SO_4)
TOC	1 liter glass jar, H_2SO_4
Extractable Organics	1 liter glass jar with Teflon™ cap
Metals* Total and Dissolved	500 ml, 125 ml plastic, HNO_3
Phenols, Cyanide	1 liter glass jar
Chloride, Sulfate, Nitrates	1 liter plastic, no preservative

*–Pre-filtration bottle for dissolved metals which is subsequently filtered in the field and transferred to a pint plastic bottle with HNO_3 preservative.

Filtration

Ground water samples are filtered prior to dissolve metals analysis. For dissolved metals, sample water is poured into a jar and then extracted with a syringe. The syringe is then used to force the sample water through a 0.45 micron pore filter paper filter into the proper sample bottle to collect dissolved metals samples. Filtration must be performed within two hours of sample collection. Pour the filtrate into a sample bottle containing HNO3 preservative.

For samples destined for total metals analysis, do not filter the sample, and preserve with HNO3 to pH <2 in the field.

Gallup sampling personnel carry a cell phone when gathering ground water and other water samples. While sampling procedures are generally well known and the appropriate sample bottles are ordered to match each sampling event, occasional questions do arise from unforeseen circumstances which may develop during sampling. At such times, sampling personnel contact Hall Environmental Analytical Laboratory to verify that sampling is correctly performed.

Sample Handling Procedures

At a minimum, the following procedures will be used when collecting samples:

- Neoprene, nitrile, or other protective gloves will be worn when collecting samples. New disposable gloves will be used to collect each sample.
- All samples collected for chemical analysis will be transferred into clean sample containers supplied by the analytical laboratory. The sample container will be clearly marked. Sample container volumes and preservation methods will be in accordance with the most recent standard EPA and industry accepted practices for use by accredited analytical laboratories. Sufficient sample volume will be obtained for the laboratory to complete the method-specific QC analyses on a laboratory-batch basis.
- Sample labels and documentation will be completed for each sample.

Immediately after the samples are collected, they will be stored in a cooler with ice or other appropriate storage method until they are delivered to the analytical laboratory. Standard chain-of-custody procedures, as described in Section 4.2.1 of this Plan, will be followed for all samples collected. All samples will be submitted to the laboratory to allow the laboratory to conduct the analyses within the method holding times.

General Well Sampling Procedures

For safety protection and sampling purity, rubber gloves or disposable nitrile gloves are worn and changed between each activity.

Prepare for sampling event by making out sample bottle labels and have bottles separated into plastic bags for each well to be sampled and placed in an ice chest ready to take into the field. Bring along a note book and sample log. Document weather conditions, sample date and time. Fill in label with location, date, time, analysis, preservative, and your name. Start sampling by adjusting converter speed for each well. Affix sample label and fill bottle according to lab instructions. For samples intended for VOC analysis, use bottles with septa lids, fill bottle to neck and add final amount of water with cap to form meniscus. Turn bottles upside down to examine for bubbles, if bubbles are detected in the vial, repeat collection procedure. If no bubbles show, secure lids and pack in bubble wrap and place in cooler until sampling is completed.

Decontaminate equipment that is not dedicated for use in a particular well. Refrigerate completed samples until shipping to lab. Be sure to check holding times and arrange for appropriate shipping method. Be sure that the field effort is adequately staffed and equipped. Check QC requirements before departing—QC samples require additional equipment and supplies.

Surface Water Sample Collection

At the evaporation ponds, samples will be collected as a grab sample at the pond edge near the inlets. This location will be noted in the field notebooks. The sampler will avoid disturbing sediment and gently allow the sample container to fill making sure that undue disturbance does not allow volatile contaminants to be lost. The sample bottle will be used for the sample collection in a shallow location near the bank. If a separate bottle and/or bailer are used to refill the sample container, this will be duly noted in the field log books. The decision to use a separate bottle/bailer will be made, if at all, by the sampler and the reasons for doing so will be noted in the field log book.

Upon arrival at the field site, the sampler will set out safety equipment such as traffic cones and signs (if required). The vehicle will be parked a sufficient distance away so as to prevent sample contamination from emissions. Appropriate sample containers and gloves must be used for the type of analyses to be performed.

Decontamination Procedures

The objective of the decontamination procedures is to minimize the potential for cross-contamination

The majority of field equipment used for ground water sampling will be disposable and, therefore, not require decontamination. In order to prevent cross-contamination, field equipment that comes into contact with water or soil will be decontaminated between each sampling location. The decontamination procedure will consist of washing the equipment with a non-phosphate detergent solution (examples include Fantastik™, Liqui-Nox®), followed by two rinses of distilled water and air dried.

Decontamination water and rinsate will be contained and disposed of the same way as purge water, as described in Section 4.2. Decontamination procedures and the cleaning agents used will be documented in the daily field log.

Field Equipment Calibration Procedures

Field equipment requiring calibration will be calibrated to known standards, in accordance with the manufacturers' recommended schedules and procedures. Calibration checks will be conducted daily and the instruments will be recalibrated if necessary. Calibration measurements will be recorded in the daily field logs.

If field equipment becomes inoperable, its use will be discontinued until the necessary repairs are made. A properly calibrated replacement instrument will be used in the interim. Instrumentation used during sampling events will be recorded in the daily field logs.

Collection and Management of Investigation Derived Waste

Investigation derived waste (IDW) generated during each groundwater sampling event may include purge water, decontamination water, excess sample material, and disposable sampling equipment. All water from all wells generated during sampling and decontamination activities will be temporarily stored in labeled 55-gallon drums until placed in the refinery wastewater treatment system upstream of the API separator. All other solid waste generated during sampling activities (including sampling gloves, tubing, etc) will be disposed of with the Refinery's general municipal waste.

Documentation of Field Activities

Daily field activities, including observations and field procedures, will be recorded using indelible ink on field sampling forms. The original field forms will be maintained at Gallup Refinery. Completed forms will be maintained in a bound and sequentially numbered field file for reference during field activities. The daily record of field activities will include the following information:

- Well ID/ Evaporation pond location/ Outfall
- Date
- Start and finish sampling time
- Field team members, including visitors
- Weather conditions
- Daily activities and times conducted
- Observations
- Record of samples collected with sample designations
- Photo log (if needed)
- Field monitoring data, including health and safety monitoring (if needed)
- Equipment used and calibration records, if appropriate
- List of additional data sheets and maps completed
- An inventory of the waste generated and the method of storage or disposal
- Signature of personnel completing the field record

Sample Custody

All samples collected for analysis will be recorded in the field report or data sheets. Chain-of-custody forms will be completed at the end of each sampling day, prior to the transfer of samples off site, and will accompany the samples during shipment to the laboratory. A signed and dated custody seal will be affixed to the lid of the shipping container. Upon receipt of the samples at the laboratory, the custody seals will be broken, the chain-of-custody form will be signed as received by the laboratory, and the conditions of the samples will be recorded on the form. The original chain-of-custody form will remain with the laboratory. Gallup Refinery will maintain copies of all chain-of-custody forms generated as part of sampling activities. Copies of the chain-of-custody records will be included with all draft and final laboratory reports submitted to NMED and OCD.

APPENDIX B - TABLE 1 – Revised 4-2016

Table 1: Gallup Refinery - Ground Water Monitoring Schedule ~~– Approved July 24-2015~~

Sampling Location ID	Sampling Frequency Q-Quarterly SA-Semi-Annual A – Annual ~~Sampling Frequency~~	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite [7]
NAPI Secondary Containment (3 units)	Q	NA	NA	BTEX+MTBE, GRO/DRO extended, WQCC Metals or check for fluids
RW-1	Q	X	NA	Measure DTW, DTP (Hydrocarbon recovery). Sample for BTEX, MTBE, GRO/DRO extended if no SPH is detected
RW-2	Q	X	NA	Same as RW-1
RW-5	Q	X	NA	Same as RW-1
RW-6	Q	X	NA	Same as RW-1
OW-1 [5]	Q	X	pH , EC, DO, ORP, Temp, TDS	Visual check for artesian flow conditions: Sample for major cations/anions, WQCC Metals, VOCS, GRO/DRO~~/M~~ EPA Method 8011 for 1,2-Dibromethane
OW-10 [5]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as OW-1
OW-13	Q	X	pH , EC, DO, ORP, Temp, TDS	VOCS, WQCC Metals, GRO/DRO~~/MRO~~ extended
OW-14 [5]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as OW-13, with addition of EPA Method 8011 for 1,2-dibromethane
OW-29 [5]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as OW-13, with addition of EPA Method 8011 for 1,2-dibromethane
OW-30 [5]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as OW-13, with addition of EPA Method 8011 for 1,2-dibromethane
GWM-1	Q	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, GRO/DRO extended, WQCC Metals
GWM-2	Q	X	NA	Check for Water - if water is detected report to OCD & NMED within 24 hours. Sample for GRO/DRO extended VOCS.
GWM-3	Q	X	NA	Check for Water - if water is detected report to OCD & NMED within 24 hours. Sample for GRO/DRO extended VOCS.
NAPIS-1 [1]	Q	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, BTEX+MTBE, SVOCS, GRO/DRO EXTENDED. WQCC Metals
NAPIS-2 [1]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as Napis-1
NAPIS-3 [1]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as Napis-1
KA- 3 [1]	Q	X	pH , EC, DO, ORP, Temp, TDS	Same as Napis-1
OAPIS-1	Q	X	pH , EC, DO, ORP, Temp, TDS	VOCS, SVOCS, GRO/DRO EXTENDED, WQCC Metals, Major cations/anions, Cyanide
STP1-NW	Q	X	NA	Major cations/anions, VOCS, GRO/DRO extended, WQCC Metals
STP1-SW	Q	X	NA	Major cations/anions, VOCS, GRO/DRO extended, WQCC Metals
STP-1 TO EP-2 (EP-2 INLET) [3]	Q	NA	NA	VOCS, GRO/DRO extended, BOD, COD, TDS
Boiler Water & Cooling Tower Blow down inlet to EP-2	~~Semi Annual (SA)~~SA		pH , EC, DO, ORP, Temp, TDS	Major Cations/Anions – NO LONGER IN SERVICE
PW-4 [4]	SA	NA		VOCS, SVOCS, WQCC Metals, Cyanide, Nitrates
Pond 1 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	NO LONGER IN SERVICE
Evaporation Pond 2 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	General Chemistry, VOCS, SVOCS, BOD, COD, E-Coli Bacteria, WQCC Metals
Evaporation Pond 3 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 4 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2

APPENDIX B - TABLE 1 – Revised 4-2016

Evaporation Pond 5 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 6 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2

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APPENDIX B - TABLE 1 (Continued)

Sampling Location ID	Sampling Frequency	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite
Pond 1 [2]	SA		pH , EC, DO, ORP, Temp, TDS	NO LONGER IN SERVICE
Evaporation Pond 2 [2]	SA		pH , EC, DO, ORP, Temp, TDS	General Chemistry, VOC, SVOC, BOD, COD, E-Coli Bacteria, WQCC Metals
Evaporation Pond 3 [2]	SA		pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 4 [2]	SA		pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 5 [2]	SA		pH , EC, DO, ORP, Temp, TDS	Same as EP-2

Sampling Location ID	Sampling Frequency Q-Quarterly SA-Semi-Annual A – Annual	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite
Evaporation Pond 6 [2]	SA		pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 7 [2]	SA		pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 7 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 8 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 9 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 11 [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 12A [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 12B [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
Any temporary Pond containing fluid	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2
STP-1 TO EP-2 (EP-2 Inlet)	A		NA	VOC, GRO/DRO extended, BOD, COD, TDS
BW-1A	Annual (A)	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, WQCC METALS, GRO/DRO/MRO extended
BW-1B	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-1C	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-2A	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-2B	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-2C	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-3A	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-3B	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-3C	A	X	pH , EC, DO, ORP, Temp, TDS	Same as BW-1A
MW-1	A	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS,SVOCS, GRO/DRO extended, WQCC Metals, Cyanide
MW-2	A	X	pH , EC, DO, ORP, Temp, TDS	Same as MW-1
MW-4	A	X	pH , EC, DO, ORP, Temp, TDS	Same as MW-1
MW-5	A	X	pH , EC, DO, ORP, Temp, TDS	Same as MW-1
OW-11	A	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, WQCC Metals, GRO/DRO extended
OW-12	A	X	pH , EC, DO, ORP, Temp, TDS	VOCS, WQCC Metals, GRO/DRO extended

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APPENDIX B - TABLE 1 (Continued)

OW-50	A	X	pH , EC, DO, ORP, Temp, TDS	VOCS, GRO/DRO Extended, WQCC METALS, GEN CHEM
OW-52	A	X	pH , EC, DO, ORP, Temp, TDS	VOCS, GRO/DRO Extended, WQCC METALS, GEN CHEM
SMW-2	A	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, GRO/DRO extended, WQCC Metals, Cyanide, SVOCS
SMW-4	A	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, SVOCS, GRO/DRO extended, WQCC Metals, Cyanide
PW-3	A	X	pH , EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, Cyanide, Nitrates
PW-2	Every 3 years beginning 2008	X	pH , EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, Cyanide, Nitrates
MKTF-01	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	VOC, SVOCS, WQCC Metals, GRO/DRO extended, Major cations/anions. Ground water samples will not be collected if SPH is present in any of these wells.
MKTF-02 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-03	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-04	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-05	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-06	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01

APPENDIX B - TABLE 1 (Continued)

Sampling Location ID	Sampling Frequency Q-Quarterly; SA-Semi-Annual A – Annual	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite
OW-11	A	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, WQCC Metals, GRO/DRO/MRO
OW-12	A	X	pH , EC, DO, ORP, Temp, TDS	VOCS, WQCC METALS, GRO/DRO/MRO
OW-50	A	X	pH , EC, DO, ORP, Temp, TDS	VOCS, GRO/DRO EXTENDED, WQCC METALS, GEN CHEM
OW-52	A	X	pH , EC, DO, ORP, Temp, TDS	VOCS, GRO/DRO EXTENDED, WQCC METALS, GEN CHEM
SMW-2	A	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, GRO/DRO extended, WQCC Metals, Cyanide
SMW-4	A	X	pH , EC, DO, ORP, Temp, TDS	Major cations/anions, VOCS, SVOCS, GRO/DRO extended, WQCC Metals, Cyanide
All wells including the recovery wells containing separate phase hydrocarbons.	Annual Event	X		Major Cations/Anions, VOC, SVOC, WQCC 20.6.2.3103 Constituents.
PW-3	A	X	pH , EC, DO, ORP, Temp, TDS	VOC, SVOC, WQCC Metals, Cyanide, Nitrates
PW-2	Every 3 years. Starting in 2008	X	pH , EC, DO, ORP, Temp, TDS	VOC, SVOC, WQCC Metals, Cyanide, Nitrates
PW-4	Every 3 years. Starting in 2007	X	pH , EC, DO, ORP, Temp, TDS	VOC, SVOC, WQCC Metals, Cyanide, Nitrates
MKTF-01 TO MKTF-45	Q	X	NA	VOC, SVOC, WQCC Metals, GRO/DRO extended, Major cations/anions. Ground water samples will not be collected if SPH is present in any of these wells.
MKTF-07	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-08	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-09	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-10	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-11	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-12	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-13	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-14	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-15	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-16	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-17	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-18	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-19	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-20	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-21	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-22	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-23	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-24 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-25 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-26 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-27	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01

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APPENDIX B - TABLE 1 (Continued)

Sampling Location ID	Sampling Frequency Q-Quarterly; SA-Semi-Annual A – Annual	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite
MKTF-28	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-29	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-30 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-31 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-32 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-33	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-34	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-35 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-36 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-37 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
MKTF-38	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-39	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-40	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-41 [5]	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01 with addition of EPA Method 8011 for 1,2-dibromethane
Sampling Location ID	**Sampling Frequency Q-Quarterly; SA-Semi-Annual A – Annual**	**Collect GW Elevation, DTW, DTP**	**Water Quality Parameters**	**Analytical Suite**
MKTF-42	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-43	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-44	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01
MKTF-45	Q	X	pH, EC, DO, ORP, Temp, TDS [6]	Same as MKTF-01

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DEFINITIONS:

OW-1 and OW-10 – Check for artesian flow conditions.

STP-1 TO EP-2 - Sample collected at the inlet to Evaporation Pond 2 from STP-1

NAPIS 1 = (KA-1R); NAPIS-2 = (KA-2R), NAPIS-3 = KA-3R) - monitor wells positioned around NAPIS to detect leakage

DO- Dissolved Oxygen; ORP - Oxygen Reduction Potential; Temp - Temperature; EC - Electrical or Specific Conductivity

TDS - Total Dissolved Solids; -VOCS - Volatile Organic Compounds-EPA Method 8260, must include MTBE

SVOCS - Semi-Volatile Organic Compounds - EPA Method 8270, must include phenol

DRO - Diesel Range Organics, GRO - Gasoline Range Organics, MRO - Motor oil range organics = EPA Method 8015D (or as modified)

BTEX - Benzene, Toluene, Ethylbenzene, Xylene, plus Methyl Tert-Butyl Ether (MTBE) - EPA Method 8021+MTBE

General Chemistry - pH, specific conductance, cations, Aanions; WQCC metals include the RCRA 8 metals, must be analyzed as totals and dissolved

DTW - Depth to Water;- DTP - Depth to Product; EP - Evaporation Pond; BW - Boundary Wells

MW - Monitor Well; OW - Observation Well; RW - Recovery Well; PW - Raw Water Production Well

~~WQCC metals include the RCRA 8 metals, must be analyzed as totals and dissolved~~

NA - Not Applicable

NOTES:

1) NAPIS 1, NAPIS 2, NAPIS 3: Detection of product during quarterly monitoring must comply with Section II.F.2 (twenty-four hour reporting) of NMED Post-Closure Care Permit

2) Sample using the State of New Mexico approved analytical methods as required by 20.6.4.14 NMAC, as amended through February 16, 2006 (use methods 9221-E and 9221-F, until EPA approves 40 CFR 136 Methods, (Colilert, Colilert – 18, ~~methods. (Colilert, Colilert - 18,~~ m-Coliblue24, membrane filter method)). Parameters are subject to change. Evaporation Pond samples must be collected at the inlet where waste water flows into the evaporation ponds.

3) STP-1 to EP-2: Changed to quarterly per NMED correspondence dated 5/18/16 (HWB-WRG-14-006)

4) PW-4: Changed sampling frequency to semi-annual per NMED correspondence.

5) Addition of EPA Method 8011 for 1,2-dibromethane analysis per NMED correspondence dated 5/18/16 (HWB-WRG-14-006) in all wells where EDC was detected. Method capable of detecting EDB at concentrations less than 0.004 micrograms

APPENDIX B - TABLE 1 (Continued)

Per liter (Method 8011).

6) Included water quality parameters for MKTF wells.

7. Discontinue analysis for Uranium - NMED correspondence dated 5/18/16 (HWB-WRG-006).