AP - 111

Facility-Wide GW Monitoring Plan (FWGWMP) 2

2012

NEW MEXICO
ENVIRONMENT DEPARTMENT

SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.nmenv.state.nm.us

RYAN FLYNN
Secretary

BUTCH TONGATE
Deputy Secretary

TOM BLAINE, P.E.
Director
Environmental Health Division

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

May 12, 2014

Mr. Ed Riege
Environmental Superintendent
Western Refining, Southwest Inc.,
Gallup Refinery
92 Giant Crossing Road
Jamestown, New Mexico 87347

RE: DISAPPROVAL
2011 FACILITY-WIDE GROUNDWATER MONITORING REPORT
AND
2012 FACILITY-WIDE GROUNDWATER MONITORING REPORT
WESTERN REFINING, SOUTHWEST INC., GALLUP REFINERY
EPA ID# NM000333211
WRG-12-003
WRG-13-003

Dear Mr. Riege:

The New Mexico Environment Department (NMED) has reviewed Western Refining, Southwest Inc., Gallup Refinery's (the Permittee) *2011 Facility-Wide Groundwater Monitoring Report* (2011 Report), dated August 2012 and the *2012 Facility-Wide Groundwater Monitoring Report* (2012 Report), dated April 2012. The Permittee's Post-Closure Care RCRA Permit, Section IV.C.3, requires the Permittee to submit a Facility-Wide Groundwater Monitoring Report describing all groundwater monitoring activities by September 1st of each year. NMED hereby issues this Disapproval for both Reports.

Many of the comments in this Disapproval have been the subject of NMED comments in past Reports. NMED acknowledges that the turnaround time from submittal to response to the Reports has caused some issues regarding response to comments. The Disapproval and then the Approval with Modifications for the 2010 Facility-Wide Groundwater Monitoring Report (2010 Report) were not sent until December 2012; thus, the 2011 and 2012 Report submittals did not address NMED comments.

Therefore, the Permittee is required to re-submit only the 2012 Report. The analytical data and summary tables for the 2011 Report must be included as an appendix on the disc submitted with the revised 2012 Report. The comments in this Disapproval focus primarily on the 2012 Report; however, the 2011 Report was reviewed concurrently and many, if not all, of the comments regarding the 2012 Report are relevant to the 2011 Report as well. The Permittee must incorporate and address the following comments in the revised 2012 Report and in all future Reports.

Comment 1

Ensure that the data presented in the Report tables are consistent with the results presented in the text of the Report. There are inconsistencies regarding the discussion of data results and the accurate reporting of information.

Comment 2

In the Executive Summary, page 1, under the Groundwater Monitoring heading, the Permittee states, "[t]here are forty monitoring wells distributed within the boundaries of the refinery of which, seventeen monitoring wells are located along the perimeter of the aeration lagoons and evaporation ponds." The Permittee does not describe the location(s) of the other groundwater monitoring wells. In the revised Report provide a full description of the groundwater monitoring network at the refinery.

Comment 3

In the Executive Summary, page 3, under the West Side Ground Water heading, paragraph 4, the Permittee states, "[l]ocated down gradient of the NAPIS on the west side, are three wells (NAPIS-2, NAPIS-3, KA-3). Of the three wells, NAPIS-2 and KA-3 had detectable concentration levels of organic constituents (benzene, ethyl benzene, MTBE, 1-Methylnaphthalene, naphthalene, and phenol). Five metal constituents were also detected in this well, (arsenic, barium, iron, manganese, and uranium)." It is not clear in which well the metals were detected. Revise the description to include the groundwater monitoring well designation.

Comment 4

In Section 2 (Scope of Activities 2012) revise the language to reflect that the work has been conducted rather than using present perfect tense such as "is collected," "will be," "is gauged," and "are obtained." Revise the Report to use the proper tense to indicate that the work was completed.

Comment 5
NMED's Approval with Modifications for the 2010 Report, dated December 12, 2012, Comment 10, stated, "[i]n Section 6.0 (Ground Water Monitoring Results), pages 29 through 48, the Permittee discusses the analytical results from the 2012 [note: this was a typo] groundwater monitoring events in three sections, Sections 6.1 (Wells with Constituent Levels Above Standards), 6.2 (Wells with Constituent Levels below Standards), and 6.3 (Evaporation Ponds, Influents, Effluents, Boiler Water to EP-2 and Leak Detection Units – Constituent Levels). However, the Permittee does not consistently discuss exceedences of and detections below, the screening levels in their appropriate sections." This is also an issue in the 2011 and 2012 Reports, making the analytical results discussion difficult to interpret.

Be clear and consistent regarding descriptions of analytical results. The Report divides analytical results into two sections: analytes detected above screening levels and analytes detected below screening levels; however, the Permittee is not consistent in reporting results in the correct section. For example, in Section 6.1.10 (SWM-2, SMW-4), page 38, paragraph 3, the Permittee states, "SMW-2 annual sampling analytical results indicated the detection of chloride (2400 mg/L) and sulfate (1600 mg/L) at concentration levels above the WQCC standard. Fluoride and bromide were also detected at concentration levels below the applicable standards. Gasoline Range Organics (GRO) was also detected at concentrations level of 0.28 mg/L. Total metals analysis indicated detectable concentration levels of the following metals: Arsenic at 0.005 mg/L, chromium at 0.17 mg/L, iron at 1.5 mg/L, manganese at 0.25 mg/L and uranium at 0.11 mg/L. Barium, selenium and zinc were also detected at concentration levels below the applicable standards." The language in this paragraph is confusing and it is difficult to parse which analytes were above or below standards. Modify the text to clarify which analytes were detected and which were above or below standards. To avoid repetition and avoid omission of groundwater monitoring wells (see Comment 10), revise the Report to organize the discussion of the analytical results by monitoring well collection (i.e., group together the discussion of the analytical results for the boundary wells (BW), the recovery wells (RW), the observation wells (OW), the NAPIS wells, the aeration basin wells, etc.). Then, discuss the analytical results and provide separate paragraphs for discussion of analytes detected above and below cleanup levels. For each constituent, present the applicable screening level (see Comment 6) for comparison to the results. In addition, revise the Report to provide references to the data tables in Section 8 so that the discussion can be cross-refrenced with the data provided in the summary tables.

Comment 6
In Section 6.1.1, the Permittee states, "[a]nalytical results indicated concentration levels of fluoride were above the current WQCC and Environmental Protection Agency Regional Screening Level (EPA RSL) standards of 1.6 mg/L and 0.93 mg/L in all of the above listed BW wells for the annual sampling conducted in 2012." Further in the section, the Permittee states, "[t]otal metals detected above the WQCC and/or EPA RSL standards included the following metals; chromium at 0.22 mg/L in BW1-C." The Permittee must follow the groundwater cleanup requirements in Permit Section IV.D.1 which requires:

> "The cleanup levels for all contaminants in groundwater shall be the WQCC groundwater quality standards, 20.6.2.3103 NMAC, the cleanup levels for toxic pollutants calculated in accordance with 20.6.2.7.WW NMAC, and the drinking water maximum contaminant levels (MCLs) adopted by EPA under the federal Safe Drinking Water Act (42 U.S.C. §§ 300f to 300j-26) or the New Mexico Environmental Improvement Board (EIB), 20.7.10 NMAC. If both a WQCC water quality standard and an MCL have been established for an individual substance, then the lower of the levels shall be the cleanup level for that substance.
>
> The most recent version of NMED's Tap Water Screening Levels listed in Table A-1 of *Technical Background Document for Development of Soil Screening Levels* (as updated) shall be used to establish the cleanup level if either a WQCC standard or an MCL has not been established for a specific substance. In the absence of an NMED tap water screening level then the EPA *Regional Screening Levels for Chemical Contaminants at Superfund Sites* (RSLs) for tap water shall be used."

Throughout the Report, the Permittee uses incorrect standards for comparison. Revise the Report to reflect the appropriate groundwater standards. For example, for fluoride the WQCC standard is 1.6 mg/L and the EPA MCL is 4.0 mg/L; therefore, the cleanup level for fluoride will be based on the most conservative of the standards, the WQCC standard. If neither the WQCC nor the EPA MCL had provided a standard for fluoride, then the Permittee would be required to use the NMED "Tap Water Screening Levels" or the EPA RSLs. Revise the Report to present the appropriate screening levels based on the guidance in Permit Section IV.D.1 for all of the constituents in groundwater.

<u>Comment 7</u>

In the analytical results tables, the Permittee provides three groundwater screening levels for comparison. Revise the table to indicate which screening level is used for each analyte based on the guidance in Permit Section IV.D.1 (Groundwater Cleanup Levels) (see also Comment 6 and Comment 13).

<u>Comment 8</u>

Comment 12 of NMED's December 12, 2012 Approval with Modifications required that the Permittee "sample wells up gradient from NAPIS-1, NAPIS-2, NAPIS-3, KA-3, OW-1, OW-10, and OW-11 and review the groundwater analytical results to determine if uranium detections are similar to concentrations in unaffected wells. The Permittee must discuss the results in either the 2011 Annual Groundwater Monitoring Report." There is no discussion of uranium results in the 2011 or 2012 Reports. Revise the 2012 Report to discuss the presence of uranium in groundwater at the facility.

Comment 9
In Section 6.1.5 (NAPIS-1, NAPIS-2, NAPIS-3, KA-3), page 32, paragraph 5, the Permittee states, "[i]n NAPIS-3, BTEX and MTBE were at non-detectable levels from 2008 through 2009 and fourth quarter 2010 through 2012." This statement is not clear. Clarify whether BTEX and MTBE were not detected from 2008 through 2012 or if the constituents were detected in the first three quarters of 2010, 2011, and 2012 and not the fourth quarter.

Comment 10
In Section 6.1.8 (OW-13, OW-14, OW-29, OW-30) the Permittee does not discuss OW-13 nor is it discussed in Section 6.2 (Wells with Constituent Levels Below Standards). Revise the Report to ensure that analytical results from OW-13 are discussed.

Comment 11
In Section 6.2.7 (OW-11, OW-12), page 48, the Permittee states, "BTEX plus MTBE concentration levels indicated non-detect for all four quarters for both wells." The sampling frequency for OW-11 and OW-12 is annual. The sample date listed in this section and Table 1 in Section 10 is 8/22/12. Revise the Report to state the proper sampling frequency.

Comment 12
In Section 7.1 (East Side Ground Water), page 62, third paragraph, the Permittee states, "[u]p-gradient of the OW wells, directly north of OW-14, are four shallow recovery wells (RW-1, RW-2, RW-5, and RW-6) from which SPH has been recovered and continues to be recovered." Revise the Report to present the correct cardinal direction of the RW wells from well OW-14 which are located south/south-east of well OW-14.

Comment 13
Table 8.4.4 (Volatile Organic Compound Analytical Result Summary) lists the volatile organic compound (VOC) results for well OW-10. In addition to listing too many screening levels (see also Comments 6 and 7), the Permittee lists the wrong values for the constituents. The screening levels listed in the table for 1,1-Dichloroethane (mg/L) for WQCC is 0.025 mg/L, 40 CFR 141.62 is NE [not established], and EPA RSL Tapwater is 2.4E-03 mg/L. The WQCC standard for 1,1-dichloroethane is 0.025 mg/L, a EPA MCL has not been established; therefore, the Permittee must use the WQCC standard. Additionally, use the same units for reporting the analytical results as the screening levels. Using the same unit makes the review easier, and fewer conversion factor errors may be made. For example even though using the EPA RSL was inappropriate in this case, the EPA RSL for 1,2-Dichloroethane is listed as 1.5E-01 ug/L in the EPA RSL table; however, the Permittee lists it as 1.5E-03 mg/L, which is off by a factor of 10. Revise the tables to present the proper screening level units for each constituent.

Comment 14
Section 6.3.4 (Leak Detection Units (LDU): East LDU, West LDU, Oil Sump LDU). In Section 7.2 (West Side Ground Water Monitoring) the Permittee states, "[a]lso located at the NAPIS are

three leak detection units which are inspected and if fluids are detected, samples are collected on a quarterly basis. All three leak detection units continue to have a fluid level." The paragraph goes on, "[q]uarterly analyses of fluid collected from these units and the continued presence of fluid indicate the potential that the fluid may be coming from the NAPIS." The Permittee addressed this issue in a letter to NMED dated August 5, 2013 and are using a vacuum truck to remove water which is still present in the LDUs. The Permittee must repair the leaks in the NAPIS unit within 90 days of receipt of this letter.

Comment 15
Section 6.4 (OCD Groundwater Discharge Permit GW-032AP-111) contains more than just the discussion of the change in permitting from OCD. Revise the section title to reflect the actual contents of the section.

Comment 16
In Section 7.1 (East Side Ground Water), page 61, the Permittee states, "[t]he stratigraphic units in which these wells exist are in what is known as the Chinle/Alluvium Interface." Well OW-13 is screened in the Sonsela aquifer. Revise the Report to present the correct information regarding well OW-13. See also Comment 27.

Comment 17
In Section 7.1, the Permittee states that "2007 results indicated 1.3E-03 mg/L was detected and fourth quarter 2012 analytical results were detected at 0.011 mg/L indicating that the MTBE plume is slowly migrating in a north-west direction downgradient from OW-14. The stratigraphic units in which these wells exist are in what is known as the Chinle/Alluvium Interface." The Permittee may be required to install additional groundwater monitoring wells to define the extent of the MTBE plume.

Comment 18
In Section 7.4 (Recommendations) the second bulleted item reads, "[s]ubmit the 2012 Annual Ground Water Monitoring Report on or before September 1, 2012." The next submittal will be the 2013 groundwater monitoring report. Revise the Report to reflect the proper dates.

Comment 19
Table 8.2 (Influents (Infl to AL-1, Infl to AL-2, Infl to EP-1) BTEX Analytical Results Summary) lists benzene results for the Influent to AL-1. The analytical result for the sample collected on 6/14/2012 indicate that benzene was present at 0.67 mg/L. However, the analytical laboratory report from the June 2012 sample collected indicates that the sample collection date was 6/12/12 and that the benzene was non-detect with a RL <1.0 ug/L. Revise the summary table to state the correct analytical results with dates of collection. Review all of the analytical summary tables to verify that they report the correct dates for sample collection, the correct analytical results, and the correct screening level comparisons.

Comment 20
In Table 8.2 (Influents (Infl to AL-1, Infl to AL-2, Infl to EP-1) BTEX Analytical Result Summary), the footnote for the "Infl to AL-1(5)" cell reads "[b]eginning third quarter 2012 no samples were collected. Influent going to new WWTP." In Section 6.3.2 (Influents: Infl to AL-1; Infl to AL-2; Infl to EP-1), the Permittee states, "[b]eginning the third quarter of 2012, Influent to AL-1 was no longer in operation due to the start up of the new WWTP. All waste water is now routed to the WWTP via Tank 35 and the NAPIS. Samples are no longer collected from the location known as Infl to AL-1." However, this statement is incorrect, because the benzene strippers were still in operation through November 10, 2012. The analytical reports in Appendix K include data collected from 8/21/2012 and 12/5/2012 (with only SVOC analysis performed). Revise the Report to reflect the correct information or explain why samples were collected beyond the third quarter of 2012.

Comment 21
In Table 8.7.3 (GWM-1, GWM-2, GWM-3 Dissolved Metals Analysis Result Summary) the footnote numbers do not correlate to the footnote. Revise the table to present the corrected footnotes. Throughout the tables, ensure that the footnotes correspond correctly to the numbers in all tables.

Comment 22
In Table 8.8 (NAPIS-1, NAPIS-2, NAPIS-3, KA-3 BTEX Analytical Result Summary), groundwater monitoring well NAPIS-3 has a footnote from the 10/2/2012 sampling date which states that it "[w]as not sampled in September due to low recharge rate." However, analytical results are presented with a September sampling date. Table 8.8.1 and the other tables which depict the analytical data results for the NAPIS groundwater monitoring wells also present analytical results from the September sampling date. Revise the table to present the correct information. In Section 10, Table 1 (Monitoring Schedule 2012), the footnote for the NAPIS-3 sampling date states "[o]n 8/21/12 well purged dry – slow recharge rate. Samples taken on 10/2/12." Low-flow sampling methods may need to be employed if NAPIS-3 continues to have a low recharge rate. The Permittee and NMED may discuss this issue and revise the Facility-Wide Groundwater Monitoring Work Plan if needed. Revise the Report to discuss the groundwater sampling issues at NAPIS-3. Revise the text of the Report to correct the above – the Report presents groundwater analytical data for the third quarter (September) in the text. If groundwater samples were not collected, explain why groundwater samples were not collected from well NAPIS-3 in September. Ensure that the summary tables correlate to the laboratory analytical reports and that the text presents the same information as displayed in the summary tables and vice versa.

Comment 23
In Section 9 (Well Data Summary Table) there are still artifacts from previously submitted tables that include errors. The table must be based on the most recent survey data. The column "Stick-up Length (ft)" does not present the most current 2011 survey datums.

Comment 24
In Section 10, Table 1, ensure that the correct information is presented. Table 1 is based on Work Plan Table 1. Ensure that all analytes sampled are listed in the table. If changes are made to the analytical parameters for any groundwater monitoring well, the Permittee must discuss the change in the text of the Report and propose to change Table 1 in the next update of the Facility-Wide Groundwater Monitoring Work Plan.

Comment 25
In Section 12, graphs are presented which show trend lines for various contaminants in groundwater monitoring wells. Include an additional line graph for the relevant groundwater standard or criteria for comparison. For example: on the Graph 1 (GWM-1 Benzene (2006-2012)) add a line at 0.0039 mg/L to show the benzene water quality standard. Additionally, in the text of the Report explain the reasons only certain groundwater monitoring wells and contaminants were chosen to be represented in the graphs.

Comment 26
In the revised Report include isoconcentration maps of the contaminants of concern (superimposed onto a potentiometric surface map).

Comment 27
Figure 10 (Chinle GP/Alluvium Interface Water Elev.) includes well OW-11, which is now considered to be screened in the Sonsela aquifer (the re-evaluation of the stratigraphic zones). Remove well OW-11 from Figure 10 and include it on the Sonsela figure. Ensure that all of the figures with associated monitor wells have been revised to show the most recent stratigraphic interpretation.

Comment 28
In Appendix C (Well and Field Logs) logs from the 3/20/2012 sampling date indicate that "[p]urge water disposed of in EP-1." The groundwater wells which have this note include: NAPIS-1, NAPIS-2, NAPIS-3, KA-3, GWM-1, GWM-2, and GWM-3. It is the Permittee's responsibility to make sure that any workers collecting environmental samples are aware of the requirements in the Work Plan and are aware of the facility's investigation derived waste disposal practices. Another note in the field notes for Infl to EP-1 indicates that the discharge to EP-1 was under water for the 3/20/2012 and 6/12/12 sample collection dates and that a grab sample was collected from the sluiceway between AL-2 and EP-1. Discuss this in the text of the Report. The note for the 12/5/2012 sampling event for the Pilot Effluent indicates that the effluent was not sampled during the original sampling date of 11/28/2012, because there was no flow; thus, the effluent was diverted directly to Pond 9. Discuss this deviation in the text of the Report. The Report must include discussion of all deviations from the Facility-Wide Groundwater Monitoring Work Plan.

The revised 2012 Report must be accompanied with a response letter that details where all revisions have been made, cross-referencing NMED's numbered comments. A red-line strikeout version of the Report also must be submitted in electronic format that shows where all changes have been made. Include the environmental laboratory analytical data results on a disc with the electronic copy of the revised Report rather than submitting another paper copy of the analytical data results. Ensure that the files are organized either by sampling frequency/date or monitoring well. In addition, include corrected analytical and data summary tables from the 2011 Report in a separate appendix on the disc. The Permittee must submit two paper copies and an electronic version of the revised 2012 Report to NMED no later than **August 28, 2014**.

If you have any questions regarding this letter, please contact Kristen Van Horn at (505) 476-6046.

Sincerely,

John E. Kieling
Chief
Hazardous Waste Bureau

cc: D. Cobrain, NMED HWB
N. Dhawan, NMED HWB
K. Van Horn, NMED HWB
C. Chavez, EMNRD OCD
T. Larsen, WRG
C. Johnson, WRG
A. Haines, WRG
L. King, EPA Region 6

File: WSMR 2014 and Reading
WSMR 12-003
WSMR-13-003

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2012 NOV -2 P 12: 45

Certified Return Receipt: #7011 2970 0003 9281 8022

October 29, 2012

Mr. John E. Kieling
NMED - Hazardous Waste Bureau
2905 Rodeo Park Drive East, Bldg 1
Santa Fe, NM 87505-6303

Re: Disapproval – Facility Wide Ground Water Monitoring Work Plan, 2011 Updates
Western Refining Company Southwest Inc., Gallup Refinery
EPA ID #NMD000333211
HWB-WRG-12-002

Dear Mr. Kieling:

Western Refining Southwest, Gallup Refinery has prepared the following responses to the comments listed regarding the above referenced matter dated September 24, 2012. Appendix A, B, C and D are attached with the Revised Report as well as Figures 3, 5 and 6. A red-line strike-out version will also be sent electronically as requested.

Comment 1

There are several issues regarding the figures included in the Work Plan. Figure 3, Figure 5 and Figure 5b are difficult to read. Remove the hatching over the SWMUs in Figure 3. Increase the font size or do not bold the ground water monitoring well labels so that they are legible. On Figure 5 remove the closed (abandoned) wells. The NAPIS wells are mislabeled as KA-wells on all three figures; re-label them appropriately. Ensure that the figures include all of the ground water monitoring and recovery wells. Use the same base map showing all ground water and recovery wells for all of the figures. On Figures 5 and 5b, include the ground water elevations along with the ground water monitoring well designation labels so that the elevations and ground water contours can be verified. Report the dates that the ground water data were collected in the map legend. Revise the figures as needed.

Response: *All the figures have been revised as requested. Figure 5b has been relabeled as Figure 6.*

Comment 2

The page numbering in the Table of Contents is incorrect. Appendix E is listed as page 50 and Appendix F and the figures are listed as having page numbers in the 500s. Adjust the page numbers and revise the Table of Contents to reflect the correct numbering.

Response: *Appendix E contained the Hall Laboratory Analysis for wells OW-50, OW-52 and OW-1 for 2011 which had 503 pages total. There was no error in page numbering. The Table of Contents has been revised and updated by removing the page numbers from the Appendix and Figures List.*

Comment 3

Do not include the February 9, 2009 letter *Facility Wide Ground water Monitoring Work Plan (Appendix A: Letter from NMED/HWB February 9)*. Remove Appendix A from the revised Work Plan. Delete all associated references in the text and, if the Appendix designations are changed, correct the text reference to other appendices and the Table of Contents, as necessary.

Response: *February 9, 2009 letter listed as Appendix A has been removed as requested and replaced with the following: "Approval with Modifications, Requirement to Resurvey Ground Water Monitoring Wells and Recovery Wells, September 26, 2012."*

Comment 4

Appendix F contains a document titled Stratigraphic Interpretation Report from Peregrine GeoConnect dated March 2012. It is not clear why the report was included in the Work Plan. Remove Appendix F from the Work Plan and submit the stratigraphic report separately, if appropriate.

Response: *Appendix F has been removed.*

Comment 5

The Permittee proposes to change the sampling frequency and analytes for OW-1; checking only for artesian conditions quarterly. The purpose of OW-1 is to act as an observation well to evaluate whether or not any constituents from the refinery are migrating from the refinery property. The Permittee must continue to check OW-1 for artesian flow conditions and sample for major cations, major anions, VOCs, DRO extended, WQCC metals, pH, EC, DO, ORP, temperature and TDS on quarterly basis. OW-1 is listed twice in Table 1 (Appendix D). Revise the table to delete the duplicate listing.

Response: *Table 1 in Appendix D has been revised.*

I-40 Exit 39, Jamestown, New Mexico 87347 • 505 722-3833 • www.wnr.com

Mail: Route 3 Box 7, Gallup, New Mexico 87301

Comment 6

The Permittee proposes to change the sampling frequency of OW-50 and OW-52 from quarterly monitoring to annual monitoring. NMED Concurs. Continue to sample for water quality parameters and the analytical suites listed in Table 1 (Appendix D). Modify Table 1 as necessary.

Response: *Table 1 in Appendix D has been revised to reflect sampling frequency changes for OW-50 and OW-52 and annual monitoring will commence in 2013.*

Comment 7

In Section 2.0 (Background Information), page 9, paragraph 3, the Permittee states, "Western is working with OCD and PTSB to place this line back in service." As noted in Comment 4 of NMED's September 2011 *Notice of Disapproval Facility Wide Ground water Monitoring Work Plan*, Comment 4, OCD has determined that the pipe is not within its jurisdiction. Remove the reference to OCD from the revised Work Plan.

Response: *Section 2.0, page 9 has been revised.*

Comment 8

NMED's Comments 4 and 5 from the February 16, 2012 Second Notice of Disapproval Requirement to Resurvey Ground water Monitoring Wells and Recovery Wells as well as Comment 2 from the May 18, 2012 Third Disapproval Requirement to Resurvey Groundwater Monitoring Wells and Recovery Wells required further edits to the Permittee's Well Elevation Summary Table. The Permittee included an unapproved Well Elevation Table as Appendix C in the Work Plan. Once the Well Elevation Summary Table has been approved, include it in the revised Work Plan. In addition, include the updated and corrected version of the Artesian Water Well Table. NMED will not approve the Work Plan until the corrected tables have been approved and are included in the revised Work Plan. Additionally, base the ground water elevation maps off of the correct ground water elevation data in the revised Work Plan. Update Section 4.1 (Ground Water Sampling Methodology), which references the tables, in the revised Work Plan.

Response: *The approved elevation summary tables are included as Appendix C-2, 2011 Corrected Well Elevation Summary Table – Revision 4 and Appendix C-3, 2011 Corrected Well Elevation Summary Table – Artesian Wells, Rev 2.*

Comment 9

Section 2.4 (Summary of contaminant releases that could contribute to possible ground water contamination), page 14, paragraph 3 contains a typographical error citing the year 2021, instead of 2012. Revise the Work Plan to reflect the correct date.

Response: *Date has been corrected.*

Comment 10

In Section 2.4 (Summary of contaminant releases that could contribute to possible ground water contamination), page 15, paragraph 1, the Permittee states, "[t]he continued presence of water in GWM-2 and GWM-3 may be attributed to the fluctuation of ground water levels due to the increase in moisture this year." GWM-2 and GWM-3 were installed in fall 2005; the wells were deliberately installed as dry wells to observe whether or not the aeration basin leaks. Water was detected during the first quarter of ground water sampling in 2008; water has been detected continuously since 2010. The past two years have experienced below normal precipitation. Either the ground water levels have not been measured and recorded properly, or there is an increase in the elevation of the water table, or the aeration basin is leaking. The Permittee must base statements made in work plans and reports on data that can be substantiated, not based on conjecture. The Permittee is required to investigate the source of water for GWM-2 and GWM-3 as part of the Aeration Basin corrective action work plan.

Response: *Revisions have been made to include that GWM-2 and GWM-3 will be included as part of the Aeration Basin corrective action work plan to investigate the continued presence of water in both of these wells.*

Comment 11

There seems to be an issue between previously reported ground water elevation data and the data presented in the Work Plan. For example, the Permittee previously reported the ground water level for GWM-2 on 2/16/2011 (reported in an email on 2/17/2011) as having a total well depth of 18.97 feet and 17.94 feet as the depth of water. In Appendix C-1, page 41, table entitled "Well Data 2011 Annual/Quarterly Sampling 2011 DTB/DTW Measurements", for 2/16/2011, GWM-2 is recorded as total depth of 18.81 feet with depth to ground water 15.08 feet. The listed measurements do not correspond; if the measurements were corrected to account for the new survey data, the water column height should be the same. Ensure that the ground water level measurements are accurate; revise the table as necessary. Include a footnote to the table stating that the depth to ground water was adjusted using the new survey data.

Response: *The referenced measurement of 17.94 feet is the depth to water measurement for GWM-3 not GWM-2 as indicated on e-mail referenced. DTW measurement of 15.08* *feet as listed in Appendix C-1 for GWM-2 was recorded in error from the weekly checks taken on 2/24/11. Correct depth to water measurement should read 17.48 feet. Appendix C-1 has been revised to reflect approved survey measurements.*

Comment 12

In Section 4.4.6.2 (Field Duplicates), the Permittee states, "[f]ield duplicates will not be collected on a routine basis, as there is sufficient data to establish outliers or suspect results through a trend analysis." Field duplicate ground water samples must be obtained at a frequency of ten percent. At a minimum, one duplicate sample per sampling day must always be obtained. Revise the Work Plan accordingly.

Response: *Section 4.4.6.2 language has been revised to reflect changes in field duplicate collection.*

Comment 13

In Appendix B (Gallup Field Sampling Collection and Handling Standard Procedures), describe the location along the well where the measurements will be taken. Revise the Work Plan to include this detail.

Response: *A paragraph has been added that describes where the measurements are taken.*

If you have any questions regarding Western's responses, please do not hesitate to contact Cheryl Johnson of my staff at (505) 722-0231.

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 that 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.

Sincerely,

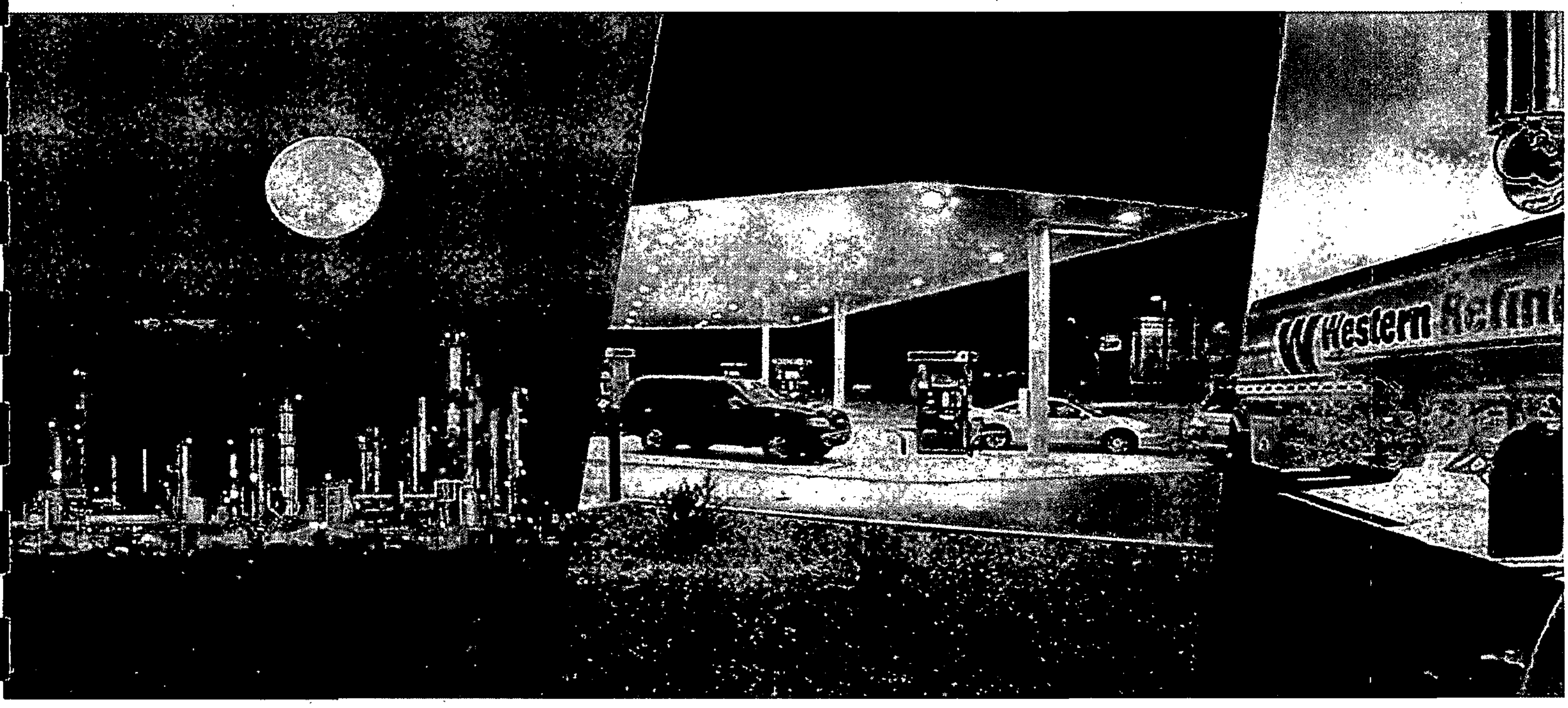
Ed Riege
Environmental Manager

cc: K. Van Horn, NMED HWB
C. Chavez, OCD
C. Johnson, WNR-Gallup

Facility-Wide Ground Water Monitoring Work Plan

Gallup Refinery - 2011 Updates

Submitted: October 30, 2012



Submitted by: Western Refining Company
Route 3 Box 7
Gallup, New Mexico 87301

Facility-Wide Ground Water Monitoring Work Plan
Gallup Refinery – 2011 Updates

Western Refining
Gallup, New Mexico

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.

Prepared by:

Cheryl Johnson
Environmental Specialist

Reviewed by:

Ed Riege, M.P.H.
Environmental Manager

Executive Summary

This Site-Wide Ground Water Monitoring Work Plan (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 owned by Western Refining ("Gallup Refinery" or "Facility"). The monitoring work plan is also designed to make the Facility quickly aware of any levels of contaminants that exceed compliance standards.

This Plan divides the Facility into two areas for periodic monitoring: the East Side and the West Side. The East Side includes the Refinery complex, recovery wells from which small quantities of free product has been continuously removed, and the northeast set of observation wells and monitoring wells. The West Side includes a cluster of wells in and around the waste water treatment system, boundary wells, shallow monitoring wells in and around land treatment areas, and produced/production water wells. This plan also includes sampling requirements for aeration lagoons, influents, and evaporation ponds located in the West Side. Designated wells and sample points in these two areas will be monitored on an annual, semi-annual, quarterly, monthly, and weekly basis following the procedures presented in this Plan.

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.

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 at select locations of the Gallup Refinery. The persons responsible for the implementation and oversight of this plan are:

Refinery Manager
- Mark B. Turri

Environmental Manager
- Ed Riege

Environmental Specialist
- Cheryl Johnson
- Alvin Dorsey

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LIST OF ACRONYMS

BMP	Best Management Practices
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
EPA	Environmental Protection Agency
GPM	Gallons per minute
HWB	Hazardous Waste Bureau
MTBE	Methyl Tert Butyl Ether
NAPIS	New American Petroleum Institute Separator
NMED	New Mexico Environment Department
OCD	Oil Conservation Division
PPE	Personal protective equipment
PSTB	Petroleum Storage Tank Bureau
VOC	Volatile Organic Compounds
SVOC	Semi-volatile Organic Compounds
SWMU	Solid Waste Management Unit
SWPP	Storm Water Pollution Prevention program
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 also designed to make the facility quickly aware of any levels of contaminants that exceed compliance standards.

This Plan divides the Facility into two areas for periodic monitoring: the East Side and the West Side. The East Side includes the Refinery complex, recovery wells from which small quantities of free products have been continually removed, and the northeast set of observation wells and monitoring wells. The West Side includes a cluster of wells in and around the waste water treatment system, boundary wells, shallow monitoring wells in and around land treatment areas, and produced/production water wells. This plan also includes sampling requirements for aeration lagoons, influents, and evaporation ponds located in the West Side. Designated wells and sample points in these two areas will be monitored on an annual, semi-annual, quarterly, monthly, and weekly basis following the procedures presented in this Plan.

Gallup Refinery will periodically review facility-wide monitoring data, and assess the monitoring program presented in this Plan. Annual revisions to the Plan, as necessary, will then 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 Route 3, Box 7 Gallup, New Mexico 87301	(postal address)

Western Refining Southwest Inc (physical address)
I-40, Exit 39
Jamestown, New Mexico 87347

SIC code 2911 (petroleum refining) applies to the Gallup Refinery.

The following regulatory identification and permit governs the Gallup Refinery:

U.S. EPA ID Number NMD000333211
OCD Discharge Permit No. GW-032

The facility status is corrective action/compliance. Annual and quarterly 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 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 Pilot (formerly Giant) 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 at a density of less than six cattle or 30 sheep per section.

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 stocks via a 4-inch diameter pipeline that comes in from the west along the Interstate 40 corridor from the 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 NAIC 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.

- The crude distillation unit separates crude oil into various fractions; including gas, naphtha, light oil, heavy oil, and residuum.

- The fluidized catalytic cracking unit (FCCU) dissociates long-chain hydrocarbon molecules into smaller molecules, and essentially converts heavier oils into naphtha and lighter oils.

- The alkylation unit combines specific types of hydrocarbon molecules into a high octane gasoline blending component.

- The reforming unit breaks up and reforms low octane naphtha molecules to form high octane naphtha.

- The 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.

- The isomerization unit converts low octane hydrocarbon molecules into high octane molecules.

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

- The 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.

- The 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. This unit only operates when the ammonium thiosulfate unit is inoperable or cannot handle incoming loads.

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 aforementioned 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. These tanks are all located above ground and 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 may receive crude oil, other feed stocks, additives, and chemicals.

Gasoline and diesel is delivered to the Pilot Travel Center via tanker truck. An underground diesel pipeline exits 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. Western is working with the New Mexico Environment Department Petroleum Storage Tank Bureau (PSTB) to place this line back into service.

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 leading to the New API Separator (NAPIS).

The process wastewater system is a network of curbing, paving, catch basins, and underground piping that collects waste water effluent from various processing areas within the refinery and then conveys this wastewater to Tank 35 (T-35) and then to the NAPIS.

T-35 is an equalization tank which handles large process and storm water flows allowing the flow to the NAPIS to be controlled during process and storm water events. The equalization tank is also used to store the waste water for a couple of days if problems are encountered with the downstream equipment, i.e., NAPIS and the benzene strippers and in the future the new DAF and MPPE units. The NAPIS is a two compartment oil water separator. 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 oil is passed to a collection chamber where it is pumped back into the refinery process. The clarified water is piped to three benzene strippers where benzene is removed. The stripped water flows into the first aeration lagoon. Sludge sinks to the bottom of the NAPIS which is periodically vacuumed out by a vacuum truck and disposed as hazardous waste at an approved landfill or recycled and reused in refineries that have this allowable exemption under RCRA.

At the benzene strippers, ambient air is blown upwards through the falling cascade of clarified waste water as it passes through distillation column packing. Countercurrent desorption of benzene from the water occurs due to the high volume of air passing over the relatively large surface area provided by the packing. The desorbed benzene is absorbed into the air stream and vented to the atmosphere. Effluent from the stripper columns gravity flows through piping into the first aeration lagoon.

At the aeration basins, the treated waste water is mixed with air in order to oxidize any remaining organic constituents and increase the dissolved oxygen concentration available in the water for growth of bacteria and other microbial organisms. The microbes degrade hydrocarbons into carbon dioxide and water. Three 15-hp mechanical aerators provide aeration in the first aeration lagoon with two 15-hp aerators providing aeration in the second lagoon. Effluent from the second aeration lagoon flows onward into the first of several evaporation ponds of various sizes.

At the evaporation ponds, waste water is converted into vapor via solar and mechanical wind-effect evaporation. No waste water is discharged from the refinery to surface waters of the state because all the waste water evaporates.

The storm water system is a network of valves, gates, berms, embankments, culverts, trenches, ditches, natural arroyos, and retention ponds that collect, convey, control, treat, 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 T-35, T-27 and T-28 when needed before it reaches the NAPIS, benzene strippers and waste water treatment system for retention in evaporation ponds. Storm water discharge from the refinery is very infrequent due to the arid desert-like nature of the surrounding geographical area.

The Gallup Refinery currently operates under the Multi-Sector Permit 2008 (MSGP-2008). Gallup Refinery submitted a new NOI for coverage under the new MSGP. The refinery maintains a Storm Water Pollution Prevention Plan (SWPPP) that includes Best Management Practices (BMPs) for effective storm water pollution prevention. 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.

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. These wells are designated PW-2, PW-3 and PW-4. Figure 3 shows the locations of these wells. These wells are operated by the facility to provide the refinery's process water, drinking water to nearby refinery-owned houses, to the refinery itself, and to the Pilot Travel Center. These wells are monitored and

[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.

no contaminants have been detected in the deep aquifer that these wells are screened within.

Other than the on-site wells, there are 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 having left the facility in shallow ground water.

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 attenuate. There is a possibility also that certain long-lived chemicals would not biodegrade, or, if they did, it would be at a very slow pace.

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 also within berms to contain spills. The NAPIS has double walls and a leak detection system. This situation did not exist in the past. So, past spills and leaks could be a source of ground water contamination.

Similarly, surface impoundments can serve as a source of possible ground water contamination. In the past, liquids from the railroad rack lagoon in the northeast end of the Facility discharged into a field and drain onto the ground and evaporate – this led to subsurface soil contamination and has recently 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 Sold Waste Management Units (SWMU) identified at the Gallup Refinery, and one closed Land Treatment Area.

<u>RCRA Regulated Units</u>

- Land Treatment Unit

<u>SWMUs</u>

- 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 Landfarm
- 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

Existing ground water monitoring wells effectively surround all these SWMUs.

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 rapidly picked up for recovery, some of the liquids present in a spill enter the subsurface. With precipitation, there is a possibility that some of the contaminants could leach out and reach ground water.

Separate Phase Hydrocarbons (SPH) floating on shallow ground water has been found at the northeast end of the facility. A system of recovery wells has been created and SPH has been pumped out for several years. Recovery through hand-bailing continues on a quarterly basis with the volumes recovered, dropping substantially every year. Trace levels of Benzene have also been found in wells in this area possibly linked to this spilled material.

Recovery Wells

- RW-1
- RW-2
- RW-5
- RW-6

A small tank that held Methyl Tert Butyl Ether (MTBE) has leaked and created a plume of MTBE in the shallow ground water at the northeast end of the refinery. This tank is no longer in service and has been removed. MTBE has not been used at the refinery since April 2006.

A series of monitoring wells at various depths are in place to monitor contaminant plumes from this northeast area that has SPH and MTBE releases. These monitoring wells are designated as follows.

Monitoring Wells

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

A unit at the southwest end of the Facility that is used to recover oil and recycle this 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 New American Petroleum Institute Separator (NAPIS) which was put into service in October 2004. The NAPIS has one up-gradient well – NAPIS-1 and three down-gradient shallow monitoring wells, NAPIS-2, NAPIS-3 and KA-3.

There has always been the possibility that the waste water treatment system of the Facility based at the aeration lagoons (AL-1 and AL-2) and evaporation pond 1 (EP-1) may have leaked contaminants into shallow ground water. The first aeration lagoon, known as AL-1, has received waste water with benzene at levels greater than 0.5 ppm – either through ineffective treatment farther upstream in the process, or through overflows – making these liquids a hazardous waste; however the aeration process and biological action within this lagoon has brought the benzene levels to well below 0.5 ppm and of the order of 0.1 ppm and less. Equalization tanks (Tank 35, Tank 27 and Tank 28) were put in service in 2011 for collection of excess waste water effluent from various processing areas within the refinery. The equalization tanks are used to divert excess waste water overflow to the NAPIS caused by unit shutdowns or rain storms. The waste water flow can then be controlled to the NAPIS.

Monitoring well GWM-1 was installed in July 2004 down gradient of the aeration basins in order to detect potential leakage from the aeration basins, however analyses of ground water samples collected at GWM-1 have indicated only very low concentrations of constituents such as BTEX and methyl tertiary butyl ether (MTBE) that would indicate a potential for historical releases in the area. GWM-1 has shown benzene levels ranging from 0.012 ppm in 2006 to 0.0096 ppm in 2011. Ethyl benzene was detected in July 2008 at 0.0039 ppm to 0.0042 ppm in December of 2012. MTBE was also detected in 2006 at 0.16 ppm with a slight decrease in December of 2011 at 0.054 ppm. The location of this well was determined in the field after mutual consultation by representatives of the refinery, OCD and the drilling contractor.

Two new shallow ground water monitoring wells were installed in the early fall of 2005 near GWM-1 which is located at the southwest corner of EP-1. GWM-2 was placed at the NW corner of EP-2 and GWM-3 was placed at the NW corner of EP-1. GWM-1, 2 and 3 were placed to determine whether any leakage from the lagoons and or evaporation pond is occurring. GWM-2 and GWM-3 are considered dry wells since its installation in 2005. Water was detected in the first quarter of 2008 in GWM-2 and notification was given to NMED and OCD respectively. In 2010 during the second quarter inspections, GWM-2 and GWM-3 were found to have a water level of 1.5 feet in GWM-2 and 0.88 feet in GWM-3. Weekly inspections were done to monitor recharge rate. Quarterly inspections in 2011 have indicated the continued presence of water in both GWM-2 and GWM-3 wells. GWM-2 and GWM-3 have shown non-detectable (<0.001 ppm) levels of BTEX constituents and MTBE has been detected in GWM-2 at levels ranging from 0.011 ppm in September 2010 to 0.0027 ppm in December 2011, which are below the EPA RSL standard of 0.012 ppm. GWM-3 has also indicated the presence of MTBE at levels ranging from 0.009 ppm in September 2010 to non-detectable levels of <0.0025 ppm in September and December 2011. GWM-2 and GWM-3 have also shown high levels of fluoride, chloride and sulfate which are above the WQCC and EPA MCL standards. GWM-3 also had detection levels of DRO ranging from 3.7 ppm in September 2010 to 1.3 ppm in December 2011. The continued presence of water in both GWM-2 and GWM-3 will be investigated as part of the Aeration Basin corrective action work plan. Figure 3 shows the location of all of the active monitoring wells on the Facility.

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 lands and is used for cattle and sheep grazing at low densities[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.

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 ricegrass, 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.

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

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 Mentmore-Gish 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, 2-72 inches 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 formation, Petrified Forest group) and siltstone start to appear. Figure 4 shows a generalized relationship of soils in and around the Gallup Refinery.

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 Formation, which consists of low permeability clay stones and siltstones that comprise the shale of this formation. As such, the Chinle Formation effectively serves as an aquiclude. Inter-bedded within the Chinle Formation is the Sonsela Sandstone bed, which represents the uppermost potential aquifer in the region.

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[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

The Sonsela Sandstone bed lies within and parallels the dip of the Chinle Formation. 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 Chinle Formation aquiclude, 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 Chinle 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 Chinle 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 Chinle 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 Chinle 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 northeasterly 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 B provides more detailed information on actual sampling procedures 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.

Included in Appendix C are the following well data summary tables for 2011: C-1 provides the annual and quarterly DTW (depth to water) and DTB (depth to bottom) measurements for 2011 as well as corrected water table elevation with respect to wells that have separate phase hydrocarbon levels; C-2 provides the corrected well elevation summary table for 2011 which includes date of establishment, ground elevation, top of casing elevation, well casing stick-up length, well depth, screening levels, and stratigraphic units in which the wells are located. Western received the "Approval with Modifications, Requirement to Resurvey Ground Water Monitoring Wells and Recovery Wells", from NMED HWB on September 24, 2012 and is incorporated into this Report (Appendix A). C-2.1 provides corrected well elevations for the artesian wells otherwise known as process or production wells. 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.

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 D, Ground Water Monitoring Schedule, will be gauged to record the depth to SPH (if present), the depth to water, and the total depth 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. All measurements will be made relative to the same datum for all wells.

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 (%). 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 disposable bailers and/or appropriately decontaminated 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 procedures are described in more detail in Appendix B. Decontamination procedures for reusable water sampling equipment are described in Appendix B.

All purged ground water and decontamination water from monitoring wells will be disposed of in the refinery waste water treatment system upstream of the NAPI Separator. The procedures for disposing materials are described in Appendix B.

Ground water samples intended for metals analysis will be submitted to the laboratory as total metals samples. Ground water samples obtained for dissolved metals analysis will be filtered using 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 chain-of-custody procedures, as described in Appendix B of this Plan, 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 method holding times. Details of the general sample handling procedures are provided in Appendix B.

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 chain-of-custody form and sample request form will be shipped inside the sealed storage container to be delivered to the laboratory.
- Signed and dated chain-of-custody 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 for the constituents listed in Appendix D. In addition, for various locations the list of metals is modified to either be the Skinner list of the NM Water Quality Control Commission list or RCRA 8 metals list. Appendix D provides a summary of target analytes for each EPA analytical method.

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 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 and 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, matrix spike/matrix spike duplicates (MS/MSDs), blank spike/blank spike duplicates (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 chain-of-custody 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), and

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 two investigation areas (East Side and West Side). The sampling frequency, analyses and target analytes will vary for each investigation area and well/outfall/evaporation pond location. 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 East Side

5.1.1 Sampling Locations

The location of the East Side monitoring and recovery wells are shown in Figure 3. The following wells will be sampled (as described in Appendix D) within the East Side area:

Recovery wells

- RW-1
- RW-2
- RW-5
- RW-6

Monitoring wells

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

5.2 West Side

5.2.1 Sampling Locations

The locations of wells on the West Side are shown in Figure 3.

The following wells, outfalls, and ponds will be sampled (as described in Appendix D, Table 1) within the West Side area:

(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.)

Monitoring wells

- NAPIS 1
- NAPIS 2
- NAPIS 3
- KA-3
- GWM-1
- GWM-2
- GWM-3
- SMW-2
- SMW-4
- MW-1
- MW-2
- MW-4
- MW-5
- OW-1
- OW-10

- OW-11
- OW-12
- BW-1A
- BW-1B
- BW-1C
- BW-2A
- BW-2B
- BW-2C
- BW-3A
- BW-3B
- BW-3C
- PW-2
- PW-3
- PW-4

<u>Outfalls</u>

- Influent to AL-1
- Influent to AL-2
- Influent to EP-2
- AL2 to EP-1
- Pilot Effluent (Travel Center)
- NAPIS Effluent
- Boiler Water Inlet to EP-2

<u>Ponds</u>

- EP-1
- EP-2
- EP-3
- EP-4
- EP-5
- EP-6
- EP-7
- EP-8
- EP-9
- EP-11
- EP-12A
- EP-12B
- Any temporary pond containing liquid

Containment

- NAPIS secondary containment (Leak Detection Units -LDU)

- East LDU
- West LDU
- Oil Sump LDU

5.3 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.

5.3.1 Request for Modifications to Sampling Plan

Gallup Refinery requests a change to the monitoring frequency for the following wells; OW-50, OW-52 and OW-1. OW-50 and OW-52 were installed in October 2009 to monitor the possible migration of MTBE from up-gradient wells OW-14, OW-29 and OW-30. Since its installation, quarterly sampling analytical lab data has indicated non-detect for BTEX constituents as well as MTBE and VOCs for 2010 and 2011. Based on the analytical data Gallup requests to change the monitoring/sampling frequency to an annual basis.

OW-1 inspection was changed in the Facility Wide Monitoring Work Plan approved August 25, 2010 to quarterly sampling. In the past this well was only required to be visually checked and water level measurement recorded on a quarterly basis. Based on the 2010 and 2011 quarterly sampling results, lab analysis data indicates non-detectable levels for BTEX plus MTBE constituents as well as VOCs for 2010 and 2011. Gallup proposes to change the sampling frequency to an annual basis and continue to monitor this well on a quarterly basis for water level measurement.

Based on these proposals, Gallup has made changes to Appendix D to reflect requested changes. Hall Environmental Lab Data is also included for OW-50, OW-52, and OW-1 in Appendix E as supporting documents.

APPENDIX A: Approval with Modifications, dated 9-24-12, from NMED – HWB.

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.nmenv.state.nm.us

SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

DAVE MARTIN
Secretary

BUTCH TONGATE
Deputy Secretary

JAMES H. DAVIS, Ph.D.
Director
Resource Protection Division

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

September 24, 2012

Mr. Ed Riege
Environmental Superintendent
Western Refining, Southwest Inc., Gallup Refinery
Route 3, Box 7
Gallup, New Mexico 87301

**RE: APPROVAL WITH MODIFICATIONS
REQUIREMENT TO RESURVEY GROUNDWATER MONITORING WELLS AND RECOVERY WELLS
WESTERN REFINING COMPANY, SOUTHWEST, INC., GALLUP REFINERY
EPA ID # NMD000333211
HWB-WRG-11-003**

Dear Mr. Riege:

The New Mexico Environment Department (NMED) has received Western Refining Company, Southwest Inc., Gallup Refinery's (Permittee) submittal titled, *Requirement to Resurvey Ground Water Monitoring Wells and Recovery Wells* (Report), dated June 12, 2012. NMED has reviewed the Report and hereby issues this Approval with the following modifications.

<u>Comment 1</u>

In Comment 3 of NMED's May 18, 2012 Third Notice of Disapproval (NOD), the Permittee was required to verify that all horizontal data from the June 2011 survey was correct and represented the actual locations of the monitoring wells surveyed. The Permittee cross referenced survey data from Sterling & Mataya Engineers collected on May 13, 1991 (May 1991) and data acquired by Lynn Engineering and Surveying collected on June 21, 2007 (June 2007) to verify the monitoring well locations. Survey data from the May 1991 survey was converted from NAD27 to NAD83; however, the Permittee did not provide conversions for all of the May 1991 survey data. Provide revised coordinate verification worksheets that include all monitoring wells from the May 1991 survey. In addition, there is a typographical error in the reported elevation for the OW-11 monitoring well conversion. The Permittee reports an elevation of 6923.59 feet and the May 1991 reports it as 6923.89 feet. Correct the typographical errors in revised coordinate verification worksheets.

Comment 2

In the *2011 Corrected Well Elevation Summary Table – Revision 3 (June 12, 2012)*, the Permittee did not report a stick-up length measurement for BW-1B in the "2011 Survey Stick-up Length (feet)" column. In addition, the Permittee did not define the asterisk from the OW-1 "2011 Measuring Point Description" column. Define the symbol in the "Notes" section or remove it from the revised data table. The Permittee is reminded that all data tables must be reviewed and corrected for errors prior to submission. Correct the typographical errors and provide a revised data table.

Comment 3

Comments 8 and 11 of NMED's September 24, 2012 Disapproval letter for the *Facility-Wide Ground Water Monitoring Work Plan - 2011 Updates* requires the Permittee to resubmit the tables in Appendix C with the approved survey data in the revised Work Plan. The Permittee must review these tables and ensure the correct information from this Report is incorporated into the final version of the tables in the revised Work Plan.

The Permittee must submit the revised data tables, replacement pages, and response letter with the required information addressing all the comments from this Approval with modifications to NMED by **October 9, 2012.**

If you have questions regarding this letter please contact Leona Tsinnajinnie of my staff at (505) 476-6057.

Sincerely,

John E. Kieling
Chief
Hazardous Waste Bureau

cc: D. Cobrain, NMED HWB
K. Van Horn, NMED HWB
L. Tsinnajinnie, NMED HWB
C. Chavez, OCD
T. Larson, Western Refining Company, Gallup Refinery
C. Johnson, Western Refining Company, Gallup Refinery
A. Haines, Western Refining Company, El Paso, Texas

File: Reading File and WRG 2012 File
HWB-WRG-11-003

APPENDIX B: 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 through 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 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. 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 DipperT electric water depth tape. If product is present, a ground water sample is typically 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, OW13, OW14, OW29 and OW30 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 GWM1 and GWM2 and GWM3 are hand-bailed if the presence of water is detected.

Purged well water from wells is collected in fifty five gallon drums and disposed of 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 syringe 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.

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, (H2SO4)
TOC	1 liter glass jar, H2SO4
Extractable Organics	1 liter glass jar with Teflon™ cap
Metals* Total and Dissolved	500 ml, 125 ml plastic, HNO3
Phenols, Cyanide	1 liter glass jar
Chloride, Sulfate, Nitrates	1 liter plastic, no preservative

* Prefiltration bottle for dissolved metals which is subsequently filtered and transferred to a pint plastic bottle with HNO3.

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 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/ bailer is 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 disposed 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.

WELL DATA 2011 ANNUAL/QUARTERLY SAMPLING
2011 DTB/DTW MEASUREMENTS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	A Ground Level Elevations (ft)	Well Casing Rim Elevations (ft)	Stick-up length (ft)	Well Casing Bottom Elevations (ft)	Total Well Depth (ft)	Depth to SPH (ft)	B SPH Thickness (ft)	C Depth to Water (ft)	D = A-C Ground water Elevation (ft)	= 0.8 B + D Corrected Water Table Elevation	Screened Interval Depth Top to Bottom (ft)	2012 Re-Evaluated Stratigraphic unit in which screen exists[1]	Purge Volume = 3 Well Vol (gal)
11/10/2003	BW-1A	10/28/2011	2.00	6,874.10	6,876.68	2.58	6,839.06	37.62	N/A	N/A	0.00	DRY	N/A	30 - 35	Upper Sand	N/A
10/28/2003	BW-1B	10/28/2011	2.00	6,874.13	6,876.94	2.81	6,809.49	67.45	N/A	N/A	0.00	DRY	N/A	54.6 - 64.6	Chinle/Alluvium Interface	N/A
11/10/2003	BW-1C	10/28/2011	2.00	6,873.95	6,876.78	2.83	6,740.39	136.39	N/A	N/A	6.11	6,867.84	N/A	125 -135	Sonsela	63.66
11/10/2003	BW-2A	10/28/2011	2.00	6,871.88	6,874.69	2.81	6,807.12	67.57	N/A	N/A	32.16	6,839.72	N/A	55 - 65	Upper Sand	17.32
10/28/2003	BW-2B	10/28/2011	2.00	6,871.66	6,874.50	2.84	6,782.24	92.26	N/A	N/A	27.56	6,844.10	N/A	80 - 90	Chinle/Alluvium Interface	31.64
10/28/2003	BW-2C	10/28/2011	2.00	6,872.90	6,875.30	2.40	6,722.46	152.84	N/A	N/A	20.18	6,852.72	N/A	139.5 - 149.5	Sonsela	64.87
6/15/2004	BW-3A	10/28/2011	2.00	6,875.94	6,878.39	2.45	6,826.04	52.35	N/A	N/A	0.00	DRY	N/A	39.5 - 49.5	Upper Sand	N/A
10/15/2003	BW-3B	10/28/2011	2.00	6,876.16	6,878.59	2.43	6,809.19	69.40	N/A	N/A	32.10	6,844.06	N/A	63 - 73	Chinle/Alluvium Interface	18.24
7/20/2004	BW-3C	10/28/2011	2.00	6,875.72	6,877.95	2.23	6,723.40	154.55	N/A	N/A	7.62	6,868.10	N/A	144.5 - 154.5	Sonsela	71.8
9/25/1981	OW-11	10/26/2011	4.00	6,922.05	6,923.51	1.46	6,857.72	65.79	N/A	N/A	20.83	6,901.22	N/A	43 - 65	Sonsela	99.81
12/15/1980	OW-12	10/26/2011	4.00	6,939.57	6,940.69	1.12	6,811.84	128.85	N/A	N/A	48.00	6,891.57	N/A	117.8 - 137.8	Sonsela	179.49
10/14/1981	MW-1	10/6/2011	5.00	6,876.63	6,878.12	1.49	6,747.29	130.83	N/A	N/A	6.79	6,869.84	N/A	117.72 - 127.72	Sonsela	379.56
10/15/1981	MW-2	10/10/2011	5.00	6,878.39	6,880.30	1.91	6,742.82	137.48	N/A	N/A	8.80	6,869.59	N/A	112 - 122	Sonsela	393.76
10/16/1981	MW-4	10/12/2011	5.00	6,879.89	6,881.63	1.74	6,759.91	121.72	N/A	N/A	7.72	6,872.17	N/A	101 - 121	Sonsela	348.84
7/21/1986	MW-5	10/10/2011	4.00	6,880.20	6,882.83	2.63	6,752.00	130.83	N/A	N/A	14.52	6,865.68	N/A	115 - 125	Sonsela	258.21
9/26/1985	SMW-2	10/12/2011	2.00	6,881.63	6,883.97	2.34	6,831.17	52.80	N/A	N/A	25.58	6,856.05	N/A	34.31 - 54.31	Chinle/Alluvium and Upper Sand	13.31
9/25/1985	SMW-4	10/10/2011	2.00	6,877.63	6,879.52	1.89	6,809.84	69.68	N/A	N/A	29.33	6,848.30	N/A	51.7 - 71.7	Chinle/Alluvium Interface	19.73
1/5/1981	OW-1	12/15/2011	4.00	6,866.32	6,866.62	0.30	6,772.07	94.55	N/A	N/A	3.48	6,862.84	N/A	89.3 - 99.3	Sonsela	178
		10/13/2011	4.00	6,866.32	6,866.62	0.30	6,772.07	94.55	N/A	N/A	0.00	6,866.32	N/A	89.3 - 99.3	Sonsela	209.52
		10/26/2011	4.00	6,866.32	6,866.62	0.30	6,772.07	94.55	N/A	N/A	0.17	6,866.15	N/A	89.3 - 99.3	Sonsela	209.52
		6/20/2011	4.00	6,866.32	6,866.62	0.30	6,772.07	94.55	N/A	N/A	1.90	6,864.42	N/A	89.3 - 99.3	Sonsela	204.55
		2/28/2011	4.00	6,866.32	6,866.62	0.30	6,772.07	94.55	N/A	N/A	1.84	6,864.48	N/A	89.3 - 99.3	Sonsela	204.68

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Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	A Ground Level Elevations (ft)	Well Casing Rim Elevations (ft)	Stick-up length (ft)	Well Casing Bottom Elevations (ft)	Total Well Depth (ft)	Depth to SPH (ft)	B SPH Thickness (ft)	C Depth to Water (ft)	D = A-C Ground water Elevation (ft)	= 0.8 B + D Corrected Water Table Elevation	Screened Interval Depth Top to Bottom (ft)	2012 Re-Evaluated Stratigraphic unit in which screen exists[1]	Purge Volume = 3 Well Vol (gal)
11/25/1980	OW-10	12/15/2011	4.00	6,873.67	6,874.91	1.24	6,814.58	60.33	N/A	N/A	0.78	6,872.89	N/A	40 - 60	Sonslea	116
		10/13/2011	4.00	6,873.67	6,874.91	1.24	6,814.58	60.33	N/A	N/A	0.19	6,873.48	N/A	40 - 60	Sonsela	133.51
		10/26/2011	4.00	6,873.67	6,874.91	1.24	6,814.58	60.33	N/A	N/A	0.42	6,873.25	N/A	40 - 60	Sonsela	133
		6/20/2011	4.00	6,873.67	6,874.91	1.24	6,814.58	60.33	N/A	N/A	1.40	6,872.27	N/A	40 - 60	Sonsela	147.85
		2/28/2011	4.00	6,873.67	6,874.91	1.24	6,814.58	60.33	N/A	N/A	0.35	6,873.32	N/A	40 - 60	Sonsela	150.18
12/10/1980	OW-13	12/13/2011	4.00	6,918.95	6,920.07	1.12	6,820.92	99.15	N/A	N/A	23.00	6,895.95	N/A	78.2 - 98.2	Sonsela	150
		10/25/2011	4.00	6,918.95	6,920.07	1.12	6,820.92	99.15	N/A	N/A	23.14	6,895.81	N/A	78.2 - 98.2	Sonsela	168.74
		6/20/2011	4.00	6,918.95	6,920.07	1.12	6,820.92	99.15	N/A	N/A	23.19	6,895.76	N/A	78.2 - 98.2	Sonsela	170.52
		2/24/2011	4.00	6,918.95	6,920.07	1.12	6,820.92	99.15	N/A	N/A	23.32	6,895.63	N/A	78.2 - 98.2	Sonsela	170.23
12/17/1980	OW-14	12/13/2011	4.00	6,924.55	6,926.65	2.10	6,880.13	46.52	N/A	N/A	25.19	6,899.36	N/A	35 - 45	Chinle/Alluvium Interface	42
		10/24/2011	4.00	6,924.55	6,926.65	2.10	6,880.13	46.52	N/A	N/A	25.38	6,899.17	N/A	35 - 45	Chinle/Alluvium Interface	46.93
		6/20/2011	4.00	6,924.55	6,926.65	2.10	6,880.13	46.52	N/A	N/A	25.45	6,899.10	N/A	35 - 45	Chinle/Alluvium Interface	43.4
		2/24/2011	4.00	6,924.55	6,926.65	2.10	6,880.13	46.52	N/A	N/A	25.69	6,898.86	N/A	35 - 45	Chinle/Alluvium Interface	42.87
8/23/1996	OW-29	12/13/2011	4.00	6,913.89	6,917.00	3.11	6,865.92	51.08	N/A	N/A	20.00	6,893.89	N/A	37.5 - 47.5	Chinle/Alluvium Interface	61
		10/24/2011	4.00	6,913.89	6,917.00	3.11	6,865.92	51.08	N/A	N/A	20.06	6,893.83	N/A	37.5 - 47.5	Chinle/Alluvium Interface	68.4
		6/20/2011	4.00	6,913.89	6,917.00	3.11	6,865.92	51.08	N/A	N/A	20.44	6,893.45	N/A	37.5 - 47.5	Chinle/Alluvium Interface	63.4
		2/24/2011	4.00	6,913.89	6,917.00	3.11	6,865.92	51.08	N/A	N/A	20.49	6,893.40	N/A	37.5 - 47.5	Chinle/Alluvium Interface	69.95
8/28/1996	OW-30	12/15/2011	4.00	6,921.81	6,924.69	2.88	6,874.79	49.90	N/A	N/A	24.64	6,897.17	N/A	37.9 - 47.9	Chinle/Alluvium Interface	50
		10/24/2011	4.00	6,921.81	6,924.69	2.88	6,874.79	49.90	N/A	N/A	24.70	6,897.11	N/A	37.9 - 47.9	Chinle/Alluvium Interface	55.94
		6/20/2011	4.00	6,921.81	6,924.69	2.88	6,874.79	49.90	N/A	N/A	24.80	6,897.01	N/A	37.9 - 47.9	Chinle/Alluvium Interface	52.39
		2/24/2011	4.00	6,921.81	6,924.69	2.88	6,874.79	49.90	N/A	N/A	24.91	6,896.90	N/A	37.9 - 47.9	Chinle/Alluvium Interface	52.15
10/5/2009	OW-50[3]	12/15/2011	2.00	6,912.63	6,914.21	1.58	6,850.21	64.00	N/A	N/A	17.30	6,895.33	N/A	48 - 63	Chinle/Alluvium Interface	23

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Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	A Ground Level Elevations (ft)	Well Casing Rim Elevations (ft)	Stick-up length (ft)	Well Casing Bottom Elevations (ft)	Total Well Depth (ft)	Depth to SPH (ft)	B SPH Thickness (ft)	C Depth to Water (ft)	D = A-C Ground water Elevation (ft)	= 0.8 B + D Corrected Water Table Elevation	Screened Interval Depth Top to Bottom (ft)	2012 Re-Evaluated Stratigraphic unit in which screen exists[1]	Purge Volume = 3 Well Vol (gal)
	OW-50[3]	10/25/2011	2.00	6,912.63	6,914.21	1.58	6,850.21	64.00	N/A	N/A	17.51	6,895.12	N/A	48 - 63	Chinle/Alluvium Interface	22.73
		6/20/2011	2.00	6,912.63	6,914.21	1.58	6,850.21	64.00	N/A	N/A	17.61	6,895.02	N/A	48 - 63	Chinle/Alluvium Interface	22.2
		3/1/2011	2.00	6,912.63	6,914.21	1.58	6,850.21	64.00	N/A	N/A	17.61	6,895.02	N/A	48 - 63	Chinle/Alluvium Interface	22.2
10/5/2009	OW-52[3]	12/13/2011	2.00	6,906.53	6,907.68	1.15	6,829.94	77.74	N/A	N/A	15.90	6,890.63	N/A	64 - 79	Chinle/Alluvium Interface	30
		10/25/2011	2.00	6,906.53	6,907.68	1.15	6,829.94	77.74	N/A	N/A	16.14	6,890.39	N/A	64 - 79	Chinle/Alluvium Interface	30.12
		6/20/2011	2.00	6,906.53	6,907.68	1.15	6,829.94	77.74	N/A	N/A	16.09	6,890.44	N/A	64 - 79	Chinle/Alluvium Interface	30.76
		3/1/2011	2.00	6,906.53	6,907.68	1.15	6,829.94	77.74	N/A	N/A	16.18	6,890.35	N/A	64 - 79	Chinle/Alluvium Interface	30.72
7/8/2004	GWM-1	12/14/2011	2.00	6,910.22	6,912.61	2.39	6,886.41	26.20	N/A	N/A	16.08	6,894.14	N/A	17.5 - 23.5	Chinle/Alluvium Interface	4.9
		9/26/2011	2.00	6,910.22	6,912.61	2.39	6,886.41	26.20	N/A	N/A	16.42	6,893.80	N/A	17.5 - 23.5	Chinle/Alluvium Interface	4.78
		6/15/2011	2.00	6,910.22	6,912.61	2.39	6,886.41	26.20	N/A	N/A	15.82	6,894.40	N/A	17.5 - 23.5	Chinle/Alluvium Interface	3.84
		2/16/2011	2.00	6,910.22	6,912.61	2.39	6,886.41	26.20	N/A	N/A	15.99	6,894.23	N/A	17.5 - 23.5	Chinle/Alluvium Interface	3.16
9/25/2005	GWM-2	12/14/2011	2.00	6,910.32	6,913.09	2.77	6,894.28	18.81	N/A	N/A	15.40	6,894.92	N/A	3.2 - 16.2	Chinle/Alluvium Interface	1.6
		9/26/2011	2.00	6,910.32	6,913.09	2.77	6,894.28	18.81	N/A	N/A	15.89	6,894.43	N/A	3.2 - 16.2	Chinle/Alluvium Interface	1.51
		6/15/2011	2.00	6,910.32	6,913.09	2.77	6,894.28	18.81	N/A	N/A	15.02	6,895.30	N/A	3.2 - 16.2	Chinle/Alluvium Interface	1.93
		2/16/2011	2.00	6,910.32	6,913.09	2.77	6,894.28	18.81	N/A	N/A	15.08	6,895.24	N/A	3.2 - 16.2	Chinle/Alluvium Interface	0.7
9/25/2005	GWM-3	12/14/2011	2.00	6,907.35	6,910.25	2.90	6,892.45	17.80	N/A	N/A	14.35	6,893.00	N/A	3 - 15	Chinle/Alluvium Interface	1.7
		9/26/2011	2.00	6,907.35	6,910.25	2.90	6,892.45	17.80	N/A	N/A	15.64	6,891.71	N/A	3 - 15	Chinle/Alluvium Interface	3.94
		6/15/2011	2.00	6,907.35	6,910.25	2.90	6,892.45	17.80	N/A	N/A	14.20	6,893.15	N/A	3 - 15	Chinle/Alluvium Interface	1.82
		2/16/2011	2.00	6,907.35	6,910.25	2.90	6,892.45	17.80	N/A	N/A	12.84	6,894.51	N/A	3 - 15	Chinle/Alluvium Interface	0.46
3/14/2008	NAPIS-1	12/14/2011	2.00	6,913.62	6,913.86	0.24	6,900.33	13.53	N/A	N/A	7.45	6,906.17	N/A	3.7 - 13.7	Chinle/Alluvium Interface	3
		9/27/2011	2.00	6,913.62	6,913.86	0.24	6,900.33	13.53	N/A	N/A	7.30	6,906.32	N/A	3.7 - 13.7	Chinle/Alluvium Interface	3.05
		6/15/2011	2.00	6,913.62	6,913.86	0.24	6,900.33	13.53	N/A	N/A	7.96	6,905.66	N/A	3.7 - 13.7	Chinle/Alluvium Interface	2.95

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	NAPIS-1	3/2/2011	2.00	6,913.62	6,913.86	0.24	6,900.33	13.53	N/A	N/A	7.47	6,906.15	N/A	3.7 - 13.7	Chinle/Alluvium Interface	3.19
3/14/2008	NAPIS-2	12/14/2011	2.00	6,913.40	6,912.65	-0.75	6,899.04	13.61	N/A	N/A	8.20	6,905.20	N/A	4.2 - 14.2	Chinle/Alluvium Interface	2.6
		9/27/2011	2.00	6,913.40	6,912.65	-0.75	6,899.04	13.61	N/A	N/A	8.18	6,905.22	N/A	4.2 - 14.2	Chinle/Alluvium Interface	2.66
		6/15/2011	2.00	6,913.40	6,912.65	-0.75	6,899.04	13.61	N/A	N/A	8.67	6,904.73	N/A	4.2 - 14.2	Chinle/Alluvium Interface	2.85
		3/2/2011	2.00	6,913.40	6,912.65	-0.75	6,899.04	13.61	N/A	N/A	9.14	6,904.26	N/A	4.2 - 14.2	Chinle/Alluvium Interface	2.62
3/14/2008	NAPIS-3	12/14/2011	2.00	6,913.38	6,912.76	-0.62	6,882.34	30.42	N/A	N/A	8.30	6,905.08	N/A	25.4 - 30-4	Chinle/Alluvium Interface	11
		9/27/2011	2.00	6,913.38	6,912.76	-0.62	6,882.34	30.42	N/A	N/A	7.74	6,905.64	N/A	25.4 - 30-4	Chinle/Alluvium Interface	11.09
		6/15/2011	2.00	6,913.38	6,912.76	-0.62	6,882.34	30.42	N/A	N/A	7.89	6,905.49	N/A	25.4 - 30-4	Chinle/Alluvium Interface	11.15
		3/2/2011	2.00	6,913.38	6,912.76	-0.62	6,882.34	30.42	N/A	N/A	8.11	6,905.27	N/A	25.4 - 30-4	Chinle/Alluvium Interface	11.05
6/11/2007	KA-3	12/14/2011	2.00	6,913.29	6,912.52	-0.77	6,889.32	23.20	N/A	N/A	8.08	6,905.21	N/A	15 - 25	Chinle/Alluvium Interface	7.25
		9/27/2011	2.00	6,913.29	6,912.52	-0.77	6,889.32	23.20	N/A	N/A	8.11	6,905.18	N/A	15 - 25	Chinle/Alluvium Interface	7.38
		6/15/2011	2.00	6,913.29	6,912.52	-0.77	6,889.32	23.20	N/A	N/A	8.44	6,904.85	N/A	15 - 25	Chinle/Alluvium Interface	8.1
		3/2/2011	2.00	6,913.29	6,912.52	-0.77	6,889.32	23.20	N/A	N/A	8.51	6,904.78	N/A	15 - 25	Chinle/Alluvium Interface	8.06
3/28/1995	RW-1	11/28/2011	4.00	6,942.86	6,946.06	3.20	6,903.02	43.04	30.77	0.08	30.85	6,912.01	6912.074	25 - 40	Chinle/Alluvium Interface	NA
		10/3/2011	4.00	6,942.86	6,946.06	3.20	6,903.02	43.04	30.81	0.09	30.90	6,911.96	6912.032	25 - 40	Chinle/Alluvium Interface	NA
		6/27/2011	4.00	6,942.86	6,946.06	3.20	6,903.02	43.04	30.52	0.11	30.63	6,912.23	6912.318	25 - 40	Chinle/Alluvium Interface	NA
		3/9/2011	4.00	6,942.86	6,946.06	3.20	6,903.02	43.04	30.04	0.11	30.15	6,912.71	6912.798	25 - 40	Chinle/Alluvium Interface	NA
3/29/1995	RW-2	11/28/2011	4.00	6,926.40	6,928.53	2.13	6,888.73	39.80	0.00	0.00	31.65	6,894.75	6894.75	26.1 - 36.1	Chinle/Alluvium Interface	NA
		10/3/2011	4.00	6,926.40	6,928.53	2.13	6,888.73	39.80	0.00	0.00	25.36	6,901.04	6901.04	26.1 - 36.1	Chinle/Alluvium Interface	NA
		6/27/2011	4.00	6,926.40	6,928.53	2.13	6,888.73	39.80	0.00	0.00	26.71	6,899.69	6899.69	26.1 - 36.1	Chinle/Alluvium Interface	NA
		3/9/2011	4.00	6,926.40	6,928.53	2.13	6,888.73	39.80	0.00	0.00	25.68	6,900.72	6900.72	26.1 - 36.1	Chinle/Alluvium Interface	NA
8/27/1997	RW-5	11/28/2011	4.00	6,941.53	6,943.57	2.04	6,903.98	39.59	0.00	29.85	29.85	6,911.68	6935.56	29.5 - 39.5	Chinle/Alluvium Interface	NA

WELL DATA 2011 ANNUAL/QUARTERLY SAMPLING
2011 DTB/DTW MEASUREMENTS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	A Ground Level Elevations (ft)	Well Casing Rim Elevations (ft)	Stick-up length (ft)	Well Casing Bottom Elevations (ft)	Total Well Depth (ft)	Depth to SPH (ft)	B SPH Thickness (ft)	C Depth to Water (ft)	D = A-C Ground water Elevation (ft)	= 0.8 B + D Corrected Water Table Elevation	Screened Interval Depth Top to Bottom (ft)	2012 Re-Evaluated Stratigraphic unit in which screen exists[1]	Purge Volume = 3 Well Vol (gal)
	RW-5	10/3/2011	4.00	6,941.53	6,943.57	2.04	6,903.98	39.59	0.00	0.00	29.89	6,911.64	6911.64	29.5 - 39.5	Chinle/Alluvium Interface	NA
		6/27/2011	4.00	6,941.53	6,943.57	2.04	6,903.98	39.59	0.00	30.11	30.11	6,911.42	6935.508	29.5 - 39.5	Chinle/Alluvium Interface	NA
		3/9/2011	4.00	6,941.53	6,943.57	2.04	6,903.98	39.59	0.00	0.00	30.05	6,911.48	6911.48	29.5 - 39.5	Chinle/Alluvium Interface	NA
8/27/1997	RW-6	11/28/2011	4.00	6,941.96	6,944.01	2.05	6,903.11	40.90	29.90	0.03	29.93	6,912.03	6912.054	28.5 - 38.5	Chinle/Alluvium Interface	NA
		10/4/2011	4.00	6,941.96	6,944.01	2.05	6,903.11	40.90	29.91	0.03	29.94	6,912.02	6912.044	28.5 - 38.5	Chinle/Alluvium Interface	NA
		6/27/2011	4.00	6,941.96	6,944.01	2.05	6,903.11	40.90	30.11	0.04	30.15	6,911.81	6911.842	28.5 - 38.5	Chinle/Alluvium Interface	NA
		3/9/2011	4.00	6,941.96	6,944.01	2.05	6,903.11	40.90	30.24	0.02	30.26	6,911.70	6911.716	28.5 - 38.5	Chinle/Alluvium Interface	NA

NOTES:
DTB - Depth to Bottom
DTW - Depth to Water
SPH = Separate Phase Hydrocarbons
Corrected water table elevations are only provided if SPH was detected.
Total well depth re-measured on 9-19-11.
Stick up length is determined by substracting Well Casing Rim Elevation from Ground Level Elevation.
[1] Stratigraphic interpretation conducted by Peregrine GeoConnect to re-evaluate the named zones they produce water from. Tables were updated to reflect correct units.

APPENDIX C-2

2011 CORRECTED WELL ELEVATION SUMMARY TABLE

Revision 4 - September 26, 2012

Date of Installation	Well ID Number	2011 Survey Measurement date[1]	Previous Casing Diameter (Inch)	2011 Verified Casing Diameter[2] (Inch)	Previous Ground Level Elevation (feet)	2011 Survey Ground Level Elevation[1] (feet)	Previous Well Casing Rim Elevation (feet)	2011 Survey Well Casing Rim Elevation[1] (feet)	2011 Measuring Point Description[1]	Previous Stick-up length[3] (feet)	2011 Survey Stick up Length[4] (feet)	Previous Well Casing Bottom Elevation (feet)	2011 Survey Well Casing Bottom Elevation[5] (feet)	Previous Total Well Depth (feet)	2011 Survey Total Well Depth[6] (feet)	Screened Interval Depth Top to Bottom[7] (feet)	Previous Stratigraphic unit in which screen exists	2012 Re-Evaluated Stratigraphic unit in which screen exists[8]
11/10/2003	BW-1A	6/7/2011	2.00	2.00	6,876.73	6,874.10	6,876.73	6,876.68	North edge PVC casing	4.38	2.58	6,836.73	6,839.06	40.00	37.62	30 - 35	Chinle/Alluvium	Upper Sand
10/28/2003	BW-1B	6/7/2011	2.00	2.00	6,876.91	6874.13[9]	6,876.91	6,876.94	North edge PVC casing	2.39	2.81	6,811.71	6,809.49	67.55	67.45	54.6 - 64.6	Chinle/Alluvium	Chinle/Alluvium Interface
11/10/2003	BW-1C	6/7/2011	2.00	2.00	6,876.75	6,873.95	6,876.75	6,876.78	North edge PVC casing	4.52	2.83	6,719.75	6,740.39	157.00	136.39	125 -135	Sonsela Sandstone	Sonsela
11/10/2003	BW-2A	6/7/2011	2.00	2.00	6,874.72	6,871.88	6,874.72	6,874.69	North edge PVC casing	4.27	2.81	6,809.22	6,807.12	65.50	67.57	55 - 65	Chinle/Alluvium	Upper Sand
10/28/2003	BW-2B	6/7/2011	2.00	2.00	6,874.58	6,871.66	6,874.58	6,874.50	North edge PVC casing	4.50	2.84	6,784.08	6,782.24	90.50	92.26	80 - 90	Sonsela sandstone	Chinle/Alluvium Interface
10/28/2003	BW-2C	6/7/2011	2.00	2.00	6,875.40	6,872.90	6,875.40	6,875.30	North edge PVC casing	2.98	2.40	6,724.40	6,722.46	151.00	152.84	139.5 - 149.5	Sonsela sandstone	Sonsela
6/15/2004	BW-3A	6/7/2011	2.00	2.00	6,878.22	6,875.94	6,878.22	6,878.39	North edge PVC casing	3.00	2.45	6,828.22	6,826.04	52.60	52.35	39.5 - 49.5	Chinle/alluvium	Upper Sand
10/15/2003	BW-3B	6/7/2011	2.00	2.00	6,878.79	6,876.16	6,878.79	6,878.59	North edge PVC casing	3.15	2.43	6,803.79	6,809.19	75.00	69.40	63 - 73	Chinle/alluvium	Chinle/Alluvium Interface
7/20/2004	BW-3C	6/7/2011	2.00	2.00	6,878.08	6,875.72	6,878.08	6,877.95	North edge PVC casing	2.69	2.23	6,723.08	6,723.40	155.00	154.55	144.5 - 154.5	Sonsela sandstone	Sonsela
1/5/1981	OW-1	6/7/2011	4.00	4.00	6,868.00	6,866.32	6,868.45	6866.62[10]	North edge PVC casing	1.92	0.30[10]	6,773.96	6,772.07	94.04	94.55	89.3 - 99.3	Sonsela sandstone	Sonsela
11/25/1980	OW-10	6/7/2011	4.00	4.00	6,872.00	6,873.67	6,875.12	6,874.91	North edge PVC casing	1.59	1.24	6,804.00	6,814.58	68.00	60.33	40 - 60	Chinle/alluvium	Sonsela
9/25/1981	OW-11	6/7/2011	4.00	4.00	6,923.89	6,922.05	6,923.51	6,923.51	North edge PVC casing	2.08	1.46	6,857.27	6,857.72	66.62	65.79	43 - 65	Chinle/alluvium	Sonsela
12/15/1980	OW-12	6/7/2011	4.00	4.00	6,940.43	6,939.57	6,940.43	6,940.69	North edge PVC casing	1.88	1.12	6,795.43	6,811.84	145.00	128.85	117.8 - 137.8	Sonsela sandstone	Sonsela
12/10/1980	OW-13	6/7/2011	4.00	4.00	6,920.12	6,918.95	6,920.12	6,920.07	North edge PVC casing	4.79	1.12	6,820.12	6,820.92	100.00	99.15	78.2 - 98.2	Sonsela sandstone	Sonsela
12/17/1980	OW-14	6/7/2011	4.00	4.00	6,926.64	6,924.55	6,926.64	6,926.65	North edge PVC casing	2.25	2.10	6,881.64	6,880.13	45.00	46.52	35 - 45	Chinle/alluvium	Chinle/Alluvium Interface
8/23/1996	OW-29	6/7/2011	4.00	4.00	6,913.50	6,913.89	6,913.50	6,917.00	North edge PVC casing	3.88	3.11	6,864.50	6,865.92	49.00	51.08	37.5 - 47.5	Chinle/alluvium	Chinle/Alluvium Interface
8/28/1996	OW-30	6/7/2011	4.00	4.00	6,921.60	6,921.81	6,921.60	6,924.69	North edge PVC casing	4.85	2.88	6,873.20	6,874.79	48.40	49.90	37.9 - 47.9	Chinle/alluvium	Chinle/Alluvium Interface
10/5/2009	OW-50	6/7/2011	2.00	2.00	6,914.37	6,912.63	6,914.37	6,914.21	North edge PVC casing	2.71	1.58	6,977.37	6,850.21	63.00	64.00	48 - 63	Chinle/alluvium	Chinle/Alluvium Interface
10/5/2009	OW-52	6/7/2011	2.00	2.00	6,906.26	6,906.53	6,907.68	6,907.68	North edge PVC casing	2.21	1.15	6,985.26	6,829.94	79.00	77.74	64 - 79	Chinle/alluvium	Chinle/Alluvium Interface
10/14/1981	MW-1	6/7/2011	5.00	5.00	6,878.52	6,876.63	6,878.15	6,878.12	North edge PVC casing	1.25	1.49	6,746.50	6,747.29	132.02	130.83	117.72 - 127.72	Chinle/Alluvium	Sonsela
10/15/1981	MW-2	6/7/2011	5.00	5.00	6,878.40	6,878.39	6,880.84	6,880.30	North edge PVC casing	1.88	1.91	6,741.90	6,742.82	138.94	137.48	112 - 122	Chinle/alluvium	Sonsela
10/16/1981	MW-4	6/7/2011	5.00	5.00	6,882.54	6,879.89	6,882.20	6,881.63	North edge PVC casing	2.31	1.74	6,760.40	6,759.91	122.14	121.72	101 - 121	Sonsela sandstone	Sonsela
7/21/1986	MW-5	6/7/2011	4.00	4.00	6,883.32	6,880.20	6,882.93	6,882.83	North edge aluminum casing	2.02	2.63	6,750.30	6,752.00	133.02	130.83	115 - 125	Sonsela sandstone	Sonsela
3/28/1995	RW-1	6/7/2011	4.00	4.00	6,943.50	6,942.86	6,943.50	6,946.06	North edge PVC casing	4.42	3.20	6,900.50	6,903.02	43.00	43.04	25 - 40	Chinle/alluvium	Chinle/Alluvium Interface
3/29/1995	RW-2	6/7/2011	4.00	4.00	6,927.20	6,926.40	6,927.20	6,928.53	North edge PVC casing	3.58	2.13	6,889.20	6,888.73	38.00	39.80	26.1 - 36.1	Chinle/alluvium	Chinle/Alluvium Interface
8/27/1997	RW-5	6/7/2011	4.00	4.00	6,942.50	6,941.53	6,942.50	6,943.57	West Edge PVC Casing (Existing Mark)	2.92	2.04	6,902.50	6,903.98	40.00	39.59	29.5 - 39.5	Chinle/alluvium	Chinle/Alluvium Interface
8/27/1997	RW-6	6/7/2011	4.00	4.00	6942.6[11]	6,941.96	6942.6[11]	6,944.01	North edge PVC casing	2.58	2.05	6,933.80	6,903.11	38.80	40.90	28.5 - 38.5	Chinle/alluvium	Chinle/Alluvium Interface
9/26/1985	SMW-2	6/7/2011	2.00	2.00	6,884.44	6,881.63	6,884.11	6,883.97	North edge aluminum casing	4.54	2.34	6,827.10	6,831.17	57.34	52.80	34.31 - 54.31	Chinle/alluvium	Chinle/Alluvium Interface and Upper Sand
9/25/1985	SMW-4	6/7/2011	2.00	2.00	6,882.54	6,877.63	6,882.73	6,879.52	North edge aluminum casing	3.83	1.89	6,760.40	6,809.84	122.14	69.68	51.7 - 71.7	Chinle/alluvium	Chinle/Alluvium Interface

2011 CORRECTED WELL ELEVATION SUMMARY TABLE

Revision 4 - September 26, 2012

Date of Installation	Well ID Number	2011 Survey Measurement date[1]	Previous Casing Diameter (Inch)	2011 Verified Casing Diameter[2] (Inch)	Previous Ground Level Elevation (feet)	2011 Survey Ground Level Elevation[1] (feet)	Previous Well Casing Rim Elevation (feet)	2011 Survey Well Casing Rim Elevation[1] (feet)	2011 Measuring Point Description[1]	Previous Stick-up length[3] (feet)	2011 Survey Stick-up Length[4] (feet)	Previous Well Casing Bottom Elevation (feet)	2011 Survey Well Casing Bottom Elevation[5] (feet)	Previous Total Well Depth (feet)	2011 Survey Total Well Depth[6] (feet)	Screened Interval Depth Top to Bottom[7] (feet)	Previous Stratigraphic unit in which screen exists	2012 Re-Evaluated Stratigraphic unit in which screen exists[8]
7/8/2004	GWM-1	6/7/2011	2.00	2.00	6,912.65	6,910.22	6,912.65	6,912.61	North edge PVC casing	3.88	2.39	6,888.95	6,886.41	23.70	26.20	17.5 - 23.5	Chinle/alluvium	Chinle/Alluvium Interface
9/25/2005	GWM-2	6/7/2011	2.00	2.00	6,913.17	6,910.32	6,913.17	6,913.09	North edge PVC casing	4.75	2.77	6,896.97	6,894.28	18.97	18.81	3.2 - 16.2	Chinle/alluvium	Chinle/Alluvium Interface
9/25/2005	GWM-3	6/7/2011	2.00	2.00	6,912.65	6,907.35	6,912.65	6,910.25	North edge PVC casing	4.85	2.90	6,896.15	6,892.45	17.94	17.80	3 - 15	Chinle/alluvium	Chinle/Alluvium Interface
3/14/2008	NAPIS-1	6/7/2011	2.00	2.00	6,918.43	6,913.62	6,918.43	6,913.86	North edge PVC casing	0.29	0.24	6,904.40	6,900.33	14.00	13.53	3.7 - 13.7	Chinle/alluvium	Chinle/Alluvium Interface
3/14/2008	NAPIS-2	6/7/2011	2.00	2.00	6,917.27	6,913.40	6,917.27	6,912.65	North edge PVC casing	0.10	-0.75	6,902.80	6,899.04	14.50	13.61	4.2 - 14.2	Chinle/alluvium	Chinle/Alluvium Interface
3/14/2008	NAPIS-3	6/7/2011	2.00	2.00	6,917.31	6,913.38	6,917.31	6,912.76	North edge PVC casing	0.29	-0.62	6,886.60	6,882.34	30.70	30.42	25.4 - 30.4	Chinle/alluvium	Chinle/Alluvium Interface
6/11/2007	KA-3	6/7/2011	2.00	2.00	6,917.17	6,913.29	6,917.17	6,912.52	North edge PVC casing	0.17	-0.77	6,892.40	6,889.32	25.00	23.20	15 - 25	Chinle/alluvium	Chinle/Alluvium Interface

NOTES:

1) Surveyed by DePauli Engineering & Surveying, LLC on June 7, 2011 at request of NMED due to discrepancies on well casing and ground level elevations.
2) Field verified using a tape measure by Gallup Refinery field technician.
3) Original measurements were given in inches and converted to feet by dividing by 12.
4) Stick up length is determined by subtracting 2011 Survey Ground Level Elevation from 2011 Survey Well Casing Rim Elevation.
5) 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.
6) Total well depth was determined using a bottom sensing meter, Testwell Water level meter with bottom sensing indicator.
7) 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.
8) Stratigraphic interpretation conducted by Peregrine Geoconnect to re-evaluate the named zones they produce water from. Tables were updated to reflect correct stratigraphic zone.
9) BW-1B 2011 Survey Ground Level Elevation is to the lowest concrete pad elevation surrounding the well.
10) 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)
11) RW-6 elevation data was originally entered incorrectly as 6972.6 feet. Correct elevation is 6942.6 feet.
12) NAPIS 2, 3 and 4 well shroud is located below ground level therefore values entered in "2011 Survey Stick-Up Length (feet)" indicate a negative value.
13) Previous measurements and elevations are from the Well Data Summary Table from the 2009 Annual Ground Water Monitoring Report.

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. PW-2 and PW-4 are sampled every three years and PW-3 is sampled annually and are not required to be gauged when sampling.

APPENDIX D

Table 1: Gallup Refinery - Ground Water Monitoring Schedule

Sampling Location ID	Sampling Frequency	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite
Pilot Effluent	Quarterly (Q)			VOC/ DRO extended/GRO/BOB/COD/WQCC Metals
NAPIS Effluent	Q			Gen Chem/VOC/SVOC(phenol)/DRO extended//GRO/WQCC Metals
AL2 to EP-1	Q			Major cations/major anions/VOC/SVOC (phenol)/DRO extended/GRO/WQCC Metals
Influent to AL-1	Q			VOC/BOD/COD/chlorides/DRO extended/GRO/pH/phenol
Influent to AL-2	Q			VOC/BOD/COD/chlorides/DRO extended/GRO/pH/phenol
Influent to Evaporation Pond 1	Q			Major cations/ major anions/pH/BOD/COD/chlorides/VOC/SVOC (phenol)/DRO extended/GRO/WQCC metals
NAPI 2ndary Containment	Q			BTEX/DRO extended/GRO/WQCC Metals or check for fluids
RW-1	Q	X		Measure DTW,DTP
RW-2	Q	X		Measure DTW,DTP
RW-5	Q	X		Measure DTW,DTP
RW-6	Q	X		Measure DTW,DTP
OW-1	Q	X	pH , E.C., D.O., ORP, Temp, TDS	Visual check for artesian flow conditions and sample for major cations, major anions, VOCs, DRO extended, WQCC metals.
OW-10	Q	X	pH , E.C., D.O., ORP, Temp, TDS	Water level measurement of the Sonsela Aquifer water table. Major cations/anions, VOC, DRO extended, WQCC Metals.
OW-13	Q	X	pH , E.C., D.O., ORP, Temp, TDS	VOC
OW-14	Q	X	pH , E.C., D.O., ORP, Temp, TDS	VOC
OW-29	Q	X	pH , E.C., D.O., ORP, Temp, TDS	VOC
OW-30	Q	X	pH , E.C., D.O., ORP, Temp, TDS	VOC
GWM-2	Q	X		Check for Water - if water is detected report to OCD & NMED within 24 hours. Sample for BTEX+MTBE/GRO/DRO extended/major cations/anions.
GWM-3	Q	X		Check for Water - if water is detected report to OCD & NMED within 24 hours. Sample for BTEX+MTBE/GRO/DRO extended/major cations/anions.
GWM-1	Q	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/major anions/VOC/DRO extended/GRO/WQCC Metals
NAPIS-1(a)	Q	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/major anions/ BTEX + MTBE/SVOCs/DRO/GRO/WQCC Metals
NAPIS-2 (a)	Q	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/major anions/ BTEX + MTBE/SVOCs/DRO/GRO/WQCC Metals
NAPIS-3(a)	Q	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/major anions/ BTEX + MTBE/SVOCs/DRO/GRO/WQCC Metals
KA- 3 (a)	Q	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/major anions/ BTEX + MTBE/SVOCs/DRO/GRO/WQCC Metals
Boiler Water & Cooling Tower Blow down inlet to EP-2	Semi Annual (SA)		pH , E.C., D.O., ORP, Temp, TDS	Major Cations/Anions
Evaporation Pond 1 (b)	SA		pH , E.C., D.O., ORP, Temp, TDS	General Chemistry/VOC/SVOC/WQCC 20.6.2.3103 constituents/BOD/COD/E-Coli Bacteria/RCRA 8 Metals
Evaporation Pond 2 (b)	SA		pH , E.C., D.O., ORP, Temp, TDS	Same as Evaporation Pond 1
Evaporation Pond 3 (b)	SA		pH , E.C., D.O., ORP, Temp, TDS	Same as Evaporation Pond 1

APPENDIX D

Sampling Location ID	Sampling Frequency	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite
Evaporation Pond 4 (b)	SA		pH , E.C., D.O., ORP, Temp, TDS	Same as Evaporation Pond 1
Evaporation Pond 5 (b)	SA		pH , E.C., D.O., ORP, Temp, TDS	Same as Evaporation Pond 1
Evaporation Pond 6 (b)	SA		pH , E.C., D.O., ORP, Temp, TDS	Same as Evaporation Pond 1
Evaporation Pond 7 (b)	SA		pH , E.C., D.O., ORP, Temp, TDS	Same as Evaporation Pond 1
Evaporation Pond 8 (b)	SA		pH , E.C., D.O., ORP, Temp, TDS	Same as Evaporation Pond 1
Evaporation Pond 9A (b)	SA		pH , E.C., D.O., ORP, Temp, TDS	Same as Evaporation Pond 1
Evaporation Pond 11 (b)	SA		pH , E.C., D.O., ORP, Temp, TDS	Same as Evaporation Pond 1
Evaporation Pond 12A (b)	SA		pH , E.C., D.O., ORP, Temp, TDS	Same as Evaporation Pond 1
Evaporation Pond 12B (b)	SA		pH , E.C., D.O., ORP, Temp, TDS	Same as Evaporation Pond 1
Any temporary Pond containing fluid	SA		pH , E.C., D.O., ORP, Temp, TDS	Same as Evaporation Pond 1
BW-1A	Annual (A)	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions, VOC/SVOC/WQCC Metals
BW-2A	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions, VOC/SVOC/WQCC Metals
BW-3A	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions, VOC/SVOC/WQCC Metals
BW-2A	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions, VOC/SVOC/WQCC Metals
BW-2B	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions, VOC/SVOC/WQCC Metals
BW-2C	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions, VOC/SVOC/WQCC Metals
BW-3A	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions, VOC/SVOC/WQCC Metals
BW-3B	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions, VOC/SVOC/WQCC Metals
BW-3C	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions, VOC/SVOC/WQCC Metals
Pond 2 Inlet	A			VOC/DRO extended/GRO/BOD/COD/TDS
MW-1	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions, VOC/DRO extended/GRO/WQCC Metals
MW-2	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions, VOC/DRO extended/GRO/WQCC Metals
MW-4	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions, VOC/DRO extended/GRO/WQCC Metals
MW-5	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions, VOC/DRO extended/GRO/WQCC Metals
OW-11	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions, VOC/SVOC/WQCC Metals
OW-12	A	X	pH , E.C., D.O., ORP, Temp, TDS	VOC
OW-50 (c)	A	X	pH , E.C., D.O., ORP, Temp, TDS	VOC/SVOC/WQCC Metals(Total and Dissolved), GRO/DRO/Gen Chem
OW-52 (c)	A	X	pH , E.C., D.O., ORP, Temp, TDS	VOC/SVOC/WQCC Metals(Total and Dissolved), GRO/DRO/Gen Chem
SMW-2	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions/VOC/DRO extended/GRO/WQCC Metals
SMW-4	A	X	pH , E.C., D.O., ORP, Temp, TDS	Major cations/anions/VOC/DRO extended/GRO/WQCC Metals

APPENDIX D

Sampling Location ID	Sampling Frequency	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite
PW-3	Annual beginning in 2009	X	pH , E.C., D.O., ORP, Temp, TDS	VOC/SVOC/WQCC Metals/Cyanide/Nitrates
PW-2	Every 3 years. Starting in 2008	X	pH , E.C., D.O., ORP, Temp, TDS	VOC/SVOC/WQCC Metals/Cyanide/Nitrates
PW-4	Every 3 years. Starting in 2007	X	pH , E.C., D.O., ORP, Temp, TDS	VOC/SVOC/WQCC Metals/Cyanide/Nitrates
Effluent from OLD API (storm Water Separator Effluent)	Monthly flow rate measurements to new API separator			Collect monthly flow rate readings from the Old API to the New API Separator. If Effluent is re-routed to any other location than the New API Separator, NMED/OCD must be contacted to determine whether additional sampling and analysis is required.

The Analyte list for EPA Method 8260 must include MTBE

(a.) 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

(b.) 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.

(c.) Proposed changes as requested by Gallup Refinery concurred by NMED, *Comment 6, Disapproval Facility Wide Ground Water Monitoring Work Plan, 2011 Updates, dated 9-24-12.* Annual sampling to begin in 2013.

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

Evaporation Pond samples must be collected at the inlet where waste water flows into the evaporation ponds.

NOTES:

Pilot Effluent - Effluent from the Pilot Gas Station to the Aeration Lagoon

Pond 2 Inlet - Sample collected at the inlet to Evaporation Pond 2 from Evaporation Pond 1

NAPIS Effluent - Effluent leaving the New API Separator

AL-2 to EP-1 - Sample collection at the inlet from Aeration Lagoon 2 to Evaporation Pond 1 (Influent location into EP-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; E.C. - 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 - EPA Method 8015B (or as modified); GRO - Gasoline Range Organics - EPA Method 8015B (or as modified)

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

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

GWM wells - located around the aeration lagoons to detect leakage

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